



STANDARD SPECIFICATIONS FOR PUBLIC WORKS IMPROVEMENTS

February 2026

TABLE OF CONTENTS

Part 1	General Requirements (Page 1 - 9)
Part 2	Earthwork Specifications (Page 10 – 34)
Part 3	Concrete and Concrete Structures (Page 35 – 48)
Part 4	Pavements (Page 49 - 62)
Part 5	Storm and Sanitary Sewers (Page 63 - 145)
Part 6	Water Main Specifications (Page 146 - 164)
Part 7	Standard Detail Drawings

**PART 1
GENERAL REQUIREMENTS**

SECTION	PAGE	1-9
101	PRE-CONSTRUCTION CONFERENCE.....	2
102	STANDARD SPECIFICATIONS.....	2
103	OSHA REQUIREMENTS	2
104	PROTECTING WORK AND IMPROVEMENTS.....	2
105	SALVAGED MATERIALS.....	2
106	PROTECTION OF PROPERTY IRONS.....	2
107	CONSTRUCTION STAKING.....	3
108	LOCATION OF UTILITIES	3
109	CONSTRUCTION SCHEDULE	3
110	CITY WATER.....	3
111	DISPOSAL OF EXCAVATED MATERIALS	4
112	STREET UNDERCUT	4
113	TRAFFIC CONTROL.....	4
114	STREET CLOSING NOTIFICATION.....	5
115	INCIDENTAL WORK ITEMS	5
116	NOTIFICATION FOR ENGINEERING SERVICES	5
117	EROSION CONTROL	5
118	STORAGE OF MATERIAL AND EQUIPMENT	6
119	TESTING AND SAMPLING	6
120	PROJECT COORDINATION.....	6
121	PERMITS.....	7
122	DISCOVERY OF CONTAMINATED SOIL	7
123	BORROW EXCAVATION.....	8
124	NOISE RESTRICTION	8
125	WISCONSIN'S PREVAILING WAGE RATE	8
126	SUBMITTALS	8
127	INSTALLATION	8

PART 2 EARTHWORK SPECIFICATIONS

SECTION	PAGE 10-34
201 GRADING REQUIREMENTS.....	11
201.1 GENERAL.....	11
201.2 EXCAVATION	11
201.2.1 GENERAL	11
201.2.2 EXCAVATION AROUND CONCRETE CURB, SIDEWALKS, OR DRIVEWAYS	11
201.2.3 EXCAVATION BELOW SUBGRADE	12
201.2.4 DISPOSAL OF EXCESS MATERIAL.....	12
201.2.5 MAINTAINING DRAINAGE	12
201.2.6 TOPSOIL.....	12
201.2.7 GRADING.....	13
201.2.8 EROSION CONTROL	13
201.2.9 CLEANUP.....	13
201.3 FILL.....	13
201.4 SELECT FILL	14
201.5 SALVABLE CRUSHED AGGREGATE AND GRANULAR BACKFILL	14
201.6 CLEARING AND GRUBBING	14
202 COMPACTION REQUIREMENTS	15
202.1 GENERAL.....	15
202.2 TYPE 1 COMPACTION.....	15
202.3 TYPE 2 COMPACTION.....	15
202.4 PAYMENT	16
203 PAVEMENT REMOVAL REQUIREMENTS	16
203.1 DESCRIPTION	16
203.2 CONSTRUCTION METHODS.....	16
203.3 PAYMENT	16
204 ABANDONED STRUCTURES AND PIPES	17
204.1 GENERAL.....	17
204.2 CONSTRUCTION METHODS.....	17
204.3 PAYMENT	17
205 RESTORATION REQUIREMENTS	17
205.1 TOPSOIL	17
205.1.1 General.....	17
205.1.2 Salvaged Topsoil.....	18
205.1.3 Topsoil Placement.....	18
205.2 SEED MIXTURES	19
205.2.1 General Requirements	19
205.2.2 Mixtures	19

	205.2.3	Inoculation	19
	205.2.4	Storage of Seed.....	19
	205.2.5	Seeding Rates	19
	205.2.6	Sowing.....	20
205.3	FERTILIZING.....		20
	205.3.1	Contents	20
	205.3.2	Construction Methods	20
205.4	MULCHING		21
	205.4.1	General.....	21
	205.4.2	Mulch Placement.....	21
205.5	WATERING		26
205.6	PAYMENT		26
206	SODDING		26
206.1	DESCRIPTION		26
206.2	MATERIALS.....		26
	206.2.1	Sod.....	26
	206.2.2	Fertilizer.....	27
206.3	CONSTRUCTION METHODS.....		27
	206.3.1	Preparation of Earth Bed.....	27
	206.3.2	Placing the Sod.	27
	206.3.3	Staking.....	28
	206.3.4	Fertilizing.....	28
	206.3.5	Watering	28
	206.3.6	Basis of Payment.....	28
207	CONSTRUCTION SITE EROSION CONTROL AND STORM WATER MANAGEMENT		28
207.1	AUTHORITY.....		28
207.2	PURPOSE		29
207.3	DEFINITIONS... ..		29
207.4	DESIGN CRITERIA, STANDARDS AND SPECIFICATION FOR CONTROL MEASURES		30
207.5	MAINTENANCE OF CONTROL MEASURES		30
207.6	EROSION AND OTHER POLLUTANT		30
	CONTROL REQUIREMENTS		
	207.6.1	Site Dewatering.. ..	31
	207.6.2	Waste and Material Disposal.....	31
	207.6.3	Tracking	31
	207.6.4	Drain Inlet Protection	31
	207.6.5	Site Erosion Control.....	31
	207.6.6	Other Construction Site Control Measures	32
	207.6.7	Control Methods	32
207.7	PAYMENT		33

PART 3
CONCRETE AND CONCRETE STRUCTURES

SECTION	PAGE	35-48
301	CONCRETE REQUIREMENTS	36
301.1	GENERAL.....	36
301.2	CONCRETE CHARACTERISTICS	36
301.3	WATER.....	36
301.4	ADMIXTURES	36
301.5	COLD WEATHER CONCRETE	36
301.6	STEEL REINFORCEMENTS	37
301.7	TESTING OF CONCRETE	37
301.8	MIX DESIGN	38
301.9	FLY ASH AND SLAG	38
301.10	BACKFILLING AND OPENING TO TRAFFIC.....	38
301.11	PROTECTION	39
302	CONCRETE CURB AND GUTTER REQUIREMENTS.....	39
302.1	GENERAL.....	39
302.2	CONSTRUCTION METHODS.....	39
302.2.1	Preparation of Foundation.....	39
302.2.2	Concrete Placement.....	40
302.2.3	Finishing	40
302.2.4	Contraction Joints.....	40
302.2.5	Expansion Joints	41
302.3	PROTECTION	41
302.4	CURING.....	41
302.5	REINFORCEMENT	42
302.6	BACKFILLING AND RESTORING THE SITE.....	42
302.7	METHOD OF MEASUREMENT	42
302.8	BASIS OF PAYMENT	42
303	SIDEWALK REQUIREMENTS	43
303.1	GENERAL	43
303.2	CONSTRUCTION METHODS.....	43
303.2.1	Preparation of Foundation.....	43
303.2.2	Forms	43
303.2.3	Placing and Finishing Concrete	43
303.2.4	Joints	44
303.3	REINFORCEMENT	45
303.4	PROTECTION	45
303.5	CURING.....	45
303.6	BACKFILLING AND RESTORING THE SITE.....	45
303.7	METHOD OF MEASUREMENT	46
303.8	BASIS OF PAYMENT	46

304	CONCRETE CHANNEL REQUIREMENTS	46
304.1	GENERAL	46
304.2	CONSTRUCTION METHODS.....	46
304.2.1	Base Preparation.....	46
304.2.2	Concrete Placement.....	47
304.2.3	Reinforcement.....	47
304.2.4	Jointing	47
304.3	BASIS OF PAYMENT.....	47

PART 4 PAVEMENTS

SECTION	PAGE 49-62
401	CRUSHED AGGREGATE BASE COURSE..... 50
401.1	DESCRIPTION
401.2	MATERIALS
401.3	EQUIPMENT
401.4	CONSTRUCTION METHODS
401.4.1	Preparation of Subgrade.....
401.4.2	Spreading and Shaping
401.4.3	Compaction and Water Sprinkling
401.4.4	Driveways
401.5	PAYMENT
402	BITUMINOUS CONCRETE REQUIREMENTS..... 54
402.1	GENERAL
402.1.1	Density Testing.....
402.2	PRIME AND TACK COAT
402.3	ASPHALT CONCRETE PAVEMENT
402.3.1	Asphalt Concrete Placement.....
403	SEAL COAT AND SEAL COAT WITH PRE-COATED AGGREGATE
403.1.	GENERAL SPECIFICATIONS
403.1.1	Traffic Control
403.1.2	Surface Preparation
403.2	SEAL COAT
403.2.1	Bituminous Materials.....
403.2.2	Cover Aggregate.....
403.2.3	Construction Methods.....
403.2.4	Payment.....
403.3	SEAL COAT WITH PRE-COATED COVER AGGREGATE
403.3.1	Bituminous Materials.....
403.3.2	Cover Aggregate.....
403.3.3	Payment.....

404	BITUMINOUS PAVEMENT MILLING	58
404.1	WEDGE CUT MILLING	58
404.1.1	General	58
404.1.2	Construction Methods	58
404.1.3	Payment For Wedge Cut Milling	59
404.2	FULL DEPTH MILLING	59
404.2.1	General	59
404.2.2	Construction Methods	59
404.2.3	Payment	59
404.3	EQUIPMENT	59
404.4	CITY WATER	60
405	INFRARED THERMAL BOND SEAMLESS BITUMINOUS PAVEMENT PATCHING	60
405.1	GENERAL	60
405.2	EQUIPMENT	60
405.3	MATERIALS	60
405.4	CONSTRUCTION	61
405.5	METHOD OF PAYMENT	61

PART V STORM AND SANITARY SEWERS

SECTION	PAGE
501	GENERAL..... 64
501.1	DESCRIPTION 64
501.2	REGULATIONS AND PERMITS 64
501.3	ENGINEER'S ESTIMATE OF QUANTITIES 64
501.4	EQUIPMENT 64
501.5	TESTS 64
501.6	FINISHING WORK AND MAINTENANCE 66
501.7	RESPONSIBILITY FOR EXISTING UTILITIES 67
501.8	CONSTRUCTION STAKING..... 67
501.9	DOMESTIC WATER..... 67
502	MATERIALS 68
502.1	GENERAL 68
502.2	RESPONSIBILITY FOR MATERIAL FURNISHED BY OWNER..... 68
502.3	RESPONSIBILITY FOR SAFE STORAGE 68
502.4	SEWER PIPE 69
502.4.1	General 69
502.4.2	Cast Iron Soil Pipe 69
502.4.3	Ductile Iron Pipe..... 69
502.4.4	PVC Pipe 69
502.4.5	Reinforced Concrete Pipe..... 70
502.4.7	Smooth Lined Corrugated Polypropylene Pipe – Storm Sewer Use Only 70

502.5	PRECAST MANHOLES	71
502.6	INLETS	72
502.7	CASTINGS	72
502.8	GRANULAR BACKFILL.....	73
502.9	GEOTEXTILE FABRIC - RIP RAP	74
502.9.1	Permanent Erosion Control – Tied Concrete Block.....	76
503	CONSTRUCTION METHODS.....	76
503.1	EXCAVATION	76
503.2	TRENCH WIDTH.....	77
503.3	DEWATERING	77
503.4	ROCK EXCAVATION	78
503.5	PIPE INSTALLATION.....	79
503.5.1	General	79
503.5.2	Bedding and Cover	81
503.5.3	Horizontal and Vertical Alignment Requirements.....	82
503.5.4	Undercut and Special Bedding	82
503.5.5	Concrete Cradle or Encasement.....	82
503.6	BACKFILLING	82
503.7	LATERALS	83
503.7.1	SANITARY LATERALS	83
503.7.2	STORM LATERALS	84
503.8	MANHOLE CONSTRUCTION.....	85
503.8.1	General Manhole Construction.....	85
503.8.2	Sanitary Sewer Manhole Construction	85
503.8.3	Sanitary Manholes in Street Locations.....	86
503.8.4	Sanitary Manholes in Remote Locations.....	86
503.9	BORING OR JACKING	87
503.10	ABANDONED ACCESS STRUCTURES	87
503.11	EXPLORATORY EXCAVATIONS.....	88
503.12	PAVEMENT REMOVAL AND REPLACEMENT.....	88
503.13	TRAFFIC CONTROL.....	88
503.14	RESTORATION.....	89
504	MEASUREMENT AND PAYMENT	90
504.1	GENERAL	90
504.2	SANITARY SEWERS	90
504.3	SANITARY SEWER MANHOLES	90
504.4	SANITARY SEWER DROP MANHOLES.....	90
504.5	SANITARY SEWER LATERALS	91
504.6	SANITARY SEWER RISERS.....	91
504.7	STORM SEWERS AND LATERALS.....	91
504.8	STORM SEWER MANHOLES, CATCH BASINS, INLETS	92
504.9	BORING AND JACKING SEWER PIPE.....	92
504.10	CONCRETE CRADLE OR ENCASEMENT	92
504.11	ROCK EXCAVATION.....	92
504.12	ABANDONED MANHOLES, CATCHBASINS AND PIPES ..	93
504.13	EXPLORATORY EXCAVATIONS.....	93
504.14	UNDERCUT AND SPECIAL BEDDING	93

504.15	GRANULAR BACKFILL.....	93
504.16	TRAFFIC CONTROL.....	94
504.17	RESTORATION.....	94
505	FORCEMAIN	94
505.1	General	94
505.2	Abbreviations	94
505.3	Submittals.....	94
505.4	Material Handling.....	95
505.5	Products and Materials.....	95
505.5.1	Pipe.....	95
505.5.2	Fittings.....	95
505.5.3	Joints	96
505.5.4	HDPE by Mechanical Joint Adapters	96
505.5.5	Polyethylene Encasement.....	97
505.5.6	Insulation	97
505.6	Construction Methods.....	97
505.6.1	General.....	97
505.6.2	Excavation	97
505.6.3	Field Inspection of Materials.....	97
505.6.4	Direction of Laying.....	97
505.6.5	Installation	97
505.6.6	Joining of Pipe.....	98
505.6.7	Cutting of Pipe.....	98
505.6.8	Obstructions in Line or Grade	98
505.6.9	Thrust Restriant.....	98
505.6.10	Joint Deflection	99
505.6.11	Depth	99
505.6.12	Unstable Soil	99
505.6.13	Embedment.....	100
505.6.14	Setting Valves	100
505.6.15	Polyethylene Encasement.....	100
505.6.16	Testing.....	100
505.7	Measurement and Payment	101
505.7.1	General.....	101
505.7.2	Force Main.....	101
505.7.3	Appurtenances	102
505.7.4	Testing.....	102
506	SUBMERSIBLE PUMP LIFT STATION	102
506.1	General.....	102
506.1.1	Summary	102
506.1.2	Related Sections	102
506.1.3	Submittals.....	102
506.1.4	Pump Test	102
506.1.5	Manufacturer Services	103
506.1.6	Warranty	103
506.2	Products	103
506.2.1	Lift Station, General.....	103
506.2.2	Pumps	104
506.2.3	Ductile Iron Pipe	104
506.2.4	Plug Valves	104

506.2.5	Check Valves	105
506.2.6	Flanged Coupling Adapters	105
506.2.7	Sleeve Couplings	105
506.2.8	Manholes	105
506.2.9	Waterstop Seals.....	105
506.2.10	Lift Station Access Covers.....	105
506.2.11	Wet Well Vent	105
506.2.12	Painting	106
506.3	Execution	106
506.3.1	Lift Station Access Covers	106
506.3.2	Pump Installation.....	106
506.3.3	Operation of System.....	106
506.3.4	Field Performance Test.....	106
507	CONTROL SYSTEM	107
507.1	General	107
507.1.1	Summary	107
507.1.2	Related Sections	107
507.1.3	Submittals.....	107
507.1.4	Maintenance Contract	107
507.2	Products	107
507.2.1	Acceptable Manufacturers	107
507.2.2	Functional Description	107
507.2.3	Control Panel.....	108
507.2.4	Combination Starters.....	110
507.2.5	Selector Switches, Push Buttons & Pilot Lights	110
507.2.6	Ground Fault Protection System	110
507.2.7	Liquid Level Pump/Alarm Control.....	110
507.2.8	Submersible Level Transducer.....	112
507.2.9	Float Controller.....	113
507.2.10	Running Time Meters	113
507.2.11	G.F.I. Receptacle	114
507.2.12	Manual Transfer Switch.....	114
507.2.13	Panel Enclosure..	114
507.2.14	Floats.....	115
507.2.15	Painting.....	115
507.3	Execution	115
507.3.1	Installation	115
507.3.2	Testing	116
508	SUPERVISORY & ANNUNCIATION SYSTEM.....	116
508.1	General.....	116
508.1.1	Summary.....	116
508.1.2	Related Sections	116
508.1.3	Submittals.....	116
508.1.4	Spare Parts.....	116
508.1.5	Maintenance Contract	116
508.2	Products	116
508.2.1	Acceptable Manufacturers.....	116
508.2.2	Functional Description.....	116
508.2.3	Supervisory Control and Data Collection (SCADA) System.....	117

508.2.4	Remote Alarm System	117
508.2.5	Remote Alarm Light.....	118
508.2.6	External Alarm Light	118
508.2.7	Panel-Mounted Lights	118
508.3	Execution	118
508.3.1	Installation	118
508.3.2	Supervisory Control and Data Collection (SCADA) System.....	118
508.3.3	Testing	118
509	ELECTRICAL GENERAL PROVISIONS.....	118
509.1	General.....	118
509.1.1	Drawings & Specifications	118
509.1.2	Summary.....	119
509.1.3	Coordination.....	119
509.1.4	References	119
509.1.5	Submittals.....	120
509.1.6	Quality Assurance	120
509.1.7	Standards for Materials and Workmanship.....	120
509.1.8	Substitution of Materials.....	120
509.1.9	Codes, Permits and Fees.....	121
509.1.10	Project/Site Conditions.....	121
509.1.11	Warranty	121
509.2	Products	121
509.3	Execution	121
509.3.1	Electrical System Identification and Instruction	122
509.3.2	Interruption of Service.....	122
509.3.3	Test.....	122
509.3.4	Electrical Work Closeout.....	123
509.3.5	Coordination with Mechanical	123
510	CONDUITS	123
510.1	General	123
510.1.1	Summary	123
510.1.2	Submittals	123
510.2	Products 124	
510.2.1	Materials	123
510.3	Execution	124
510.3.1	Installation.....	124
511	CABLE, WIRE, AND CONNECTORS	125
511.1	General	125
511.1.1	Summary	125
511.1.2	Submittals	125
511.2	Products	126
511.2.1	Manufacturers.....	126
511.2.2	Materials	126
511.2.3	Branch Circuit Conduit Runs	126
511.3	Execution	127
511.3.1	Installation.....	127

	511.3.2 Field Quality Control	128
512	BOXES AND FITTINGS	128
512.1	General	128
512.1.1	Summary	128
512.1.2	Submittals	128
512.1.3	Quality Assurance	128
512.2	Products	128
512.2.1	Manufacturers	128
512.2.2	Materials	129
512.3	Execution	129
512.3.1	Installation	129
513	WIRING DEVICES	130
513.1	General	130
513.1.1	Summary	130
513.1.2	Description of Work	130
513.1.3	Submittals	130
513.1.4	Quality Assurance	130
513.2	Products	131
513.2.1	Manufacturers	131
513.2.2	Fabricated Devices	131
513.2.3	Wiring Device Accessories	131
513.3	Execution	131
513.3.1	Examination	131
513.3.2	Installation	132
513.3.3	Testing	132
514	DISCONNECT SWITCHES	132
514.1	General	132
514.1.1	Description	133
514.2	Products	133
514.2.1	Disconnect Switches	133
514.3	Execution	133
514.3.1	Installation	133
515	SUPPORTING DEVICES	134
515.1	General	134
515.1.1	Summary	134
515.1.2	Description of Work	134
515.2	Products	134
515.2.1	Fixtures	134
515.2.2	Fixture Supports	134
515.2.3	Structural Supports	134
515.3	Execution	134
515.3.1	Examination	134
515.3.2	Installation	135

516	SERVICES, METERING, AND GROUNDING	135
516.1	General	135
516.1.1	Summary	135
516.1.2	Description of Work	135
516.1.3	Quality Assurance	136
516.2	Products	136
516.2.1	Grounding.....	136
516.3	Execution	136
516.3.1	Examination.....	136
516.3.2	Installation	136
517	LIFT STATION SITE WORK	137
517.1	General	137
517.1.1	Summary	137
517.1.2	Sitework General.....	137
517.1.3	Asphalt Driveway.....	137
517.1.4	Measurement & Payment-Site Grading and Driveway.....	138
517.1.5	Replace Topsoil.....	138
518	SUBMITTALS	138
518.1	General	138
518.1.1	Applicable Provisions	138
518.1.2	Applicable Publications (NONE)	
518.1.3	Description of Work.....	138
518.1.4	Related Work Elsewhere (NONE)	
518.1.5	Shop Drawings.....	138
518.1.6	Operation/ Maintenance Manuals and Instructions	139
518.1.7	Permits and Approvals	140
518.1.8	Construction Schedule	140
518.1.9	Start-up Reports	140
518.1.10	Record Drawings.....	140
518.2	Products and Materials (N/A)	
518.3	Construction Methods (N/A)	
518.4	Measurement and Payment	141
518.4.1	General.....	141
518.4.2	Submittals.....	141
519	QUALITY CONTROL.....	141
519.1	General	141
519.1.1	Applicable Provisions	141
519.1.2	Applicable Publications (NONE).....	141
519.1.3	Description of Work	141
519.1.4	Related Work Elsewhere.....	141
519.1.5	Quality Assurance	141
519.1.6	Tolerances	142
519.1.7	References.....	142
519.1.8	Mock-up	142
519.1.9	Inspection and Testing Laboratory Services.....	142

519.1.10	Manufacturers' Field Services and Reports	143
519.2	Products and Materials (N/A)	
519.3	Construction Methods (N/A)	
519.4	Measurement and Payment (N/A).....	143
520	PROJECT CLOSEOUT	143
520.1	General	143
520.1.1	Applicable Provisions	143
520.1.2	Applicable Publications (NONE)	
520.1.3	Description of Work.....	144
520.1.4	Related Work Elsewhere (NONE)	
520.1.5	Tests and Adjustments	144
520.1.6	Loose and Detachable Parts	144
520.1.7	Operating and Maintenance Instructions	144
520.1.8	Guarantee Documents.....	144
520.2	Products and Materials (N/A)	
520.3	Construction Methods (N/A)	
520.4	Measurement and Payment (N/A).....	144

PART 6 SUN PRAIRIE UTILITIES WATER MAIN SPECIFICATIONS

SECTION	PAGE 146-164
601	WATER MAIN.....147
601.1	MATERIALS147
601.1.1	Pipe147
601.1.2	Fittings.....148
601.1.3	Hydrants149
601.1.4	Valves.....150
601.1.5	Valve Boxes150
601.1.6	Service Laterals.....150
601.1.7	Water Manholes151
601.2	CONSTRUCTION METHODS.....151
601.2.1	General.....151
601.2.2	Excavation.....152
601.2.3	Dewatering152
601.2.4	Pipe Laying.....153
601.2.5	Joining and Adjusting of Pipes153
601.2.6	Fittings/Hydrants154
601.2.7	Thrust Blocking.....155
601.2.8	Installation of Copper Services155
601.2.9	Services Over 2" In Size156
601.2.10	Sterilizing the Pipe.....156
601.2.11	Backfilling157
601.2.12	Miscellaneous.....157

601.3	PRESSURE AND LEAKAGE TEST	157
601.4	BACTERIAL TESTING	158
601.5	ABANDON PIPES	158
601.6	TAPPING	159
601.6.1	Materials	159
601.6.2	Design Standards	159
601.6.3	Installation	159
601.7	WATERMAIN BORING, JACKING, AND CASING	160
601.7.0	Description of Work	160
601.7.0.1	Submittals	160
601.7.1	Products and Materials	161
601.7.2	Construction Methods	162
601.7.3	Measurement and Payment	164

PART 7 STANDARD DETAIL DRAWINGS

DESCRIPTION	PAGE
CURB RAMPS - TYPE 2 AND 3.....	SDD 08D05-21b
CURB RAMPS - TYPE 4A AND 4A1.....	SDD 08D05-21c
CURB RAMPS - TYPE 4B AND 4B1.....	SDD 08D05-21d
CURB RAMPS - TYPE 5, 6, 7A, 7B & 8.....	SDD 08D05-21e
CURB RAMPS - RADIAL DETECTABLE WARNINGS.....	SDD 08D05-21f
CURB RAMPS – RECTANGULAR AND RADIAL DETECTABLE WARNINGS PLATES.....	SDD 08D05-21g
TYPICAL SIDEWALK	3-2
TYPICAL RESIDENTIAL DRIVEWAY APPROACH	3-3
STANDARD RESIDENTIAL DRIVEWAY OPENING	3-4
SIDEWALK DRAIN WAY DETAIL	3-5
CONCRETE RETAINING WALL DETAIL	3-6
CONCRETE CURB & GUTTER DETAILS.....	3-7
CURB & GUTTER - INLET DETAIL	3-8
COMMERCIAL DRIVE ENTRANCE	3-9
PAVEMENT MARKING DETAILS	3-10
ROAD SIGN DETAILS	3-11
CURB & GUTTER BUMP-IN	3-12
CONCRETE SPEED HUMP, FLOW THROUGH GUTTER	3-13
CONCRETE SPEED HUMP, RAISED GUTTER	3-14
TYPICAL ASPHALT BIKE/PEDESTRIAN PATH	4-1
STORM AND SANITARY SEWER BEDDING STANDARDS.....	5-1
SANITARY SEWER LATERALS STANDARD DETAILS	5-2
TYPICAL STORM SEWER LATERAL	5-3
STORM LATERAL CLEANOUT CONNECTION.....	5-4
PIPE INSULATION DETAIL	5-5
CONCRETE PIPE SUPPORT DETAIL	5-6
SANITARY MANHOLES IN STREET LOCATIONS.....	5-7
SANITARY MANHOLES IN REMOTE LOCATIONS	5-8
OUTSIDE SANITARY DROP REMOTE MANHOLE.....	5-8a
OUTSIDE DROP TO SANITARY SEWER MANHOLES	5-9
TYPICAL INLET DETAIL.....	5-10
STANDARD CONCRETE MASONRY ENDWALLS	5-11

STANDARD PIPE GATE FOR CONCRETE APRON ENDWALL	5-12
PANEL INSTRUMENTATION	5-13
RIP-RAP AND FABRIC DETAIL.....	5-14
CAST IN PLACE STORM STRUCTURE	5-15
CONCRETE COLLAR FOR MANHOLE CASTINGS/WATER VALVES.....	5-16
BUTTRESS FOR BENDS AND PLUGS	6-1
BUTTRESS FOR TEES AND HYDRANT DETAIL.....	6-2
PIPE INSULATION AND WATER SERVICES	6-3

PART 1

GENERAL REQUIREMENTS

PART I GENERAL REQUIREMENTS

101 PRE-CONSTRUCTION CONFERENCE

A pre-construction conference for representatives of the Contractor, City of Sun Prairie, Developer, and any Utilities shall be held before the Contractor proceeds with construction. The conference shall be held at the City Municipal Building for all parties to discuss the timeframe of the project and concerns of residents.

102 STANDARD SPECIFICATIONS

Where mentioned elsewhere in the specifications or plans, the "Standard Specifications" shall refer to the latest edition of State of Wisconsin: "Standard Specifications for Highway and Structure Construction," and the latest amendments (State Specifications) and the "City of Sun Prairie Standard Specifications" last revised in January 2026 (City Specifications). In instances where the State and City Specifications conflict, the City Specifications shall supersede.

103 OSHA REQUIREMENTS

All equipment, materials, and work under this project shall be in full accordance with the provisions of the "Occupational Safety and Hazard Act." Any item in the Contract is in addition to the OSHA requirements. In instances where the Contract conflicts with the OSHA requirements, the OSHA requirements shall supersede.

104 PROTECTING WORK AND IMPROVEMENTS

The Contractor shall protect property, existing improvements, and all new work installed by Contractor and others from damage until final payment is made. Property, improvements, and work damaged shall be repaired or replaced by the Contractor. If more than one Contractor is responsible, the costs shall be shared. The Engineer shall determine responsibility for damages. All repair and replacement methods shall be approved by the Engineer.

105 SALVAGED MATERIALS

All materials as identified as being salvaged shall become the property of the City of Sun Prairie. All other materials shall be disposed of by the Contractor.

106 PROTECTION OF PROPERTY IRONS

The Contractor and/or subcontractor shall be responsible for protecting and preserving all property irons during construction. No property iron shall be disturbed or destroyed until the Engineer has referenced the iron for perpetuation or replacement.

The Engineer shall determine those property irons which were lost due to Contractor(s) negligence, and shall, in addition to penalties under law, withhold up to \$400 for each lost or damaged property iron from the Contractor's payments as a deposit for property irons lost due to Contractor(s) negligence. Once the actual costs of the replacement are determined, the actual costs shall be deducted from the Contractor's final payment. The contractor(s) shall have the option to hire a licensed Land Surveyor to reset all lost property irons at contractor's cost in lieu of

finer imposed. The contractor shall file a map of the perpetuated property iron locations with the Dane County Surveyor's Office and provide a copy to the City of Sun Prairie.

107 CONSTRUCTION STAKING

The Contractor shall supply the Engineer with hardwood stakes and hardwood lath for construction staking. The Contractor shall supply a rod person for assisting the Engineer in construction staking. Cost for providing these materials and services shall be included in other unit prices.

The Contractor shall give the Engineer not less than 48 hours notice, not including Saturdays, Sundays or Holidays when requesting inspection or line and grade stakes.

Set and maintain construction stakes to within 0.03 feet horizontally and establish elevations to within 0.04 feet vertically for curb and gutter, pavements, storm sewer, and sanitary sewer layout. Set and maintain construction stakes to within 0.1 feet horizontally and establish elevations to within 0.1 feet vertically for water main and road subgrade layout.

For automated machine installation, string-line shall be used and set off of stakes every 25 ft. for curves, high/low points, and connections to existing concrete.

108 LOCATION OF UTILITIES

It shall be the Contractor's responsibility to verify the locations of all utilities, prior to commencing with the construction. It shall also be the Contractor's responsibility to protect all existing utilities from damage as a result of their construction operations. All utilities damaged as a result of the Contractor's equipment or methods shall be replaced at their expense.

The Contractor shall coordinate the relocating of all utilities, which are in conflict with the proposed improvements. Construction schedules should reflect any such delays.

109 CONSTRUCTION SCHEDULE

The Contractor shall, within 14 days of the date of the Notice of Award, provide a detailed construction schedule showing progress on a weekly basis to the date of completion. Construction shall not begin until the schedule has been submitted and approved by the Engineer.

All work shall be continuous from the project start up to final completion. For City projects, liquidated damages may be assessed for each workday the Contractor is not working on the site once the project commences. Inclement weather will not count towards liquidated damages. Time extensions shall be granted per WisDOT standard specification 108.10.2.2. The Contractor shall work with the City to avoid working on days of scheduled special events. Work shall not be allowed to be performed on Sunday.

110 CITY WATER

The Contractor may obtain water from City hydrants only after applying for and obtaining approval from Sun Prairie Utilities Superintendent at 125 West Main Street. 608-837-5500.

111 DISPOSAL OF EXCAVATED MATERIALS

The Contractor shall make their own arrangements for disposing of the excavated concrete and bituminous materials, as well as all undesirable surplus soil materials. The Contractor shall not be allowed to dispose of any materials on City of Sun Prairie property.

112 STREET UNDERCUT

The Street Undercut Backfill bid item shall consist of furnishing and placing material in those areas where undercut has been ordered by the Engineer upon completion of a "test roll" of the finished street subgrade. Street Undercut will not be paid where a utility trench was opened. The materials shall consist of breaker run or crusher run as it is commonly referred. This material shall consist of crushed aggregate with predominantly 6 inches or less in at least one dimension per the latest amended edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation, Section 311, Division of Highways, except as modified herein or in the Special Provisions of the Contract. This material, as with all crushed aggregate, shall be subject to the Engineer's approval. The Contractor shall be responsible for undercutting areas that previously passed a proof-roll and subsequently failed due to Contractor neglect.

113 TRAFFIC CONTROL

This item of work shall include all materials, labor, equipment, signs, barricades, flashers, posts and other items required to provide and install a complete construction traffic control system as required herein.

The work shall be performed at the various locations specified or as necessary to provide a safe and effective traffic control system during any and all time construction of the improvements is incomplete, unless otherwise specified. Traffic through the site must be maintained at all times. Traffic may be limited to one lane travel only during work hours, and only if a flag person is provided. During non-working hours two travel lanes must be provided.

Once traffic control is established for the construction site, the Contractor shall remove the existing street signs and store/protect for reinstallation, post construction. If the Contractor damages the street sign and/or the post, the contractor shall replace the sign, at the cost of the contractor, with new signs approved by the Director of Public Works. It will be the contractors' responsibility for maintaining traffic while the street signs are removed. If the project calls for new street signs, the contractor shall provide and install per the bid item in the contract.

a. MUTCD

All work shall be in conformance with the Manual of Uniform Traffic Control Devices (MUTCD), and the appropriate supplements for its use in the State of Wisconsin and these specifications.

All barricades and channelization devices utilized during periods of darkness shall be equipped with reflectorized surfaces and self-contained electric flashers. Where external supplemental illumination is sufficient, the requirement for flashers may be waived with the permission of the Engineer. Cost for supplying Traffic Control shall be included in other unit prices unless a special Bid Item is included in the Bid Form.

Road closure signs shall read "Road Closed to Thru Traffic."

The Contractor shall notify the Sun Prairie Police Department (837-7336) 72 hours in advance of detour. The Contractor shall cooperate in notifying the affected businesses and residents. The Contractor shall provide 24-hour contact information for traffic control services.

114 STREET CLOSING NOTIFICATION

All Contractors on City Contracts shall give the City Engineer notice of their intent to begin work on any street at least forty-eight (48) hours in advance. If it is necessary that a detour be used during the life of the project, then the City Engineer shall have at least seventy-two (72) hours notice. Saturdays, Sundays, and legal holidays shall not be included in the measuring of notice time. Further notice shall be given of any change in project scheduling following the original notification.

The Contractor shall remove, salvage and protect all existing traffic control or street name signs. The contractor shall deliver signs to City Street Department. The contractor shall notify City Street Department when site is ready for signs to be reinstalled.

Prior to all street closings, the Contractor shall notify individually, the Police Department, Fire Department, and City Engineer.

The Contractor shall not in any manner unnecessarily obstruct the streets or pedestrian crossings, and shall at all times and under all circumstances provide safe and sufficient means of travel for pedestrians and vehicles.

115 INCIDENTAL WORK ITEMS

Work required as part of the plans or specifications, but not included in the Bid Form, shall be considered as incidental work items, and all costs for providing such items of work shall be included in other unit prices of the Contract.

116 NOTIFICATION FOR ENGINEERING SERVICES

The Contractor shall give two (2) working days notification when requesting staking. Costs for restaking due to the Contractor's negligence shall be deducted from the Contract.

The Contractor shall give two (2) working days notice prior to working on a weekend or holiday. Failure to offer said notice may result in the Contractor not being able to work on these days.

117 EROSION CONTROL

It shall be the Contractor's responsibility to properly control erosion on the job site. All erosion control measures must be in place before any construction may begin on the project. Any siltation of inlets or ditches shall be cleaned and maintained until permanent seeding has taken hold. Inlets within the site and immediately downstream of the site must be protected by in-frame inlet protection. The in-frame inlet protection must meet the following requirements:

1. All ASTM standard D8057-17 requirements, including:
 - a. Bypass overflow that meets or exceeds inlet design flow.
 - b. In-frame structure and bag shall be strong enough to handle full sediment load.
2. No part of the inlet protection projecting above the grate.

3. For combination inlets, the device shall capture the runoff entering both grate and curb opening.
4. The filter bag shall be "Dual Fabric", with nonwoven bottom and woven top.

The Contractor shall be responsible for complying with the City of Sun Prairie Erosion Control and Stormwater Management Ordinance, and the requirements of the Wisconsin Department of Natural Resources Technical Standards.

118 STORAGE OF MATERIAL AND EQUIPMENT

All equipment and materials shall be stored and maintained in accordance with manufacturer's recommendations. All stored materials and equipment shall be clearly tagged or labeled indicating directions for use and storage where appropriate.

The Contractor shall confine their apparatus, materials, equipment, and operations within the limits indicated by law, ordinance, permits or directions by the Engineer. The Contractor shall make their own provisions for storage areas. At no time shall any storage take place on public streets open to all traffic. At no time shall storage be allowed to interfere with traffic, motorist safety, motorist visibility, or worker's visibility. All stored materials must be marked with flashing barricades or other method as approved by Engineer.

All materials, which may be damaged by weather and all equipment, shall be stored in watertight sheds or trailers with floors at least 6 inches above the ground. All storage areas shall be kept orderly and shall be protected from Contractor's operation barriers. The City assumes no responsibility for stored materials or equipment.

Where agreed to in writing by the Engineer, the City will provide for partial payment of materials stored in the vicinity for use on the project. Payment is usually reserved for sensitive or bulky items that in the Engineer's opinion would not be practical to store on the job site. Payment will be limited to 75% of the invoiced value of the materials less Contract retainage. Payment will only be made if original invoices for the materials are supplied to the Engineer. Such payments will be deducted from payments for work performed under the Contract.

119 TESTING AND SAMPLING

All materials shall be subject to testing, and shall be tested if so ordered by the Engineer. The Contractor shall furnish without charge all samples and such facilities necessary for the collecting and forwarding of such samples. Unless otherwise specified elsewhere, all testing shall be done at the expense of the City.

120 PROJECT COORDINATION

The Contractor shall coordinate work with the Director of Public Works in restricting of parking and refuse and recycling collection in the construction area. The Contractor shall notify the Director 48 hours in advance of the need for posting "No Parking" signs. The Contractor shall provide temporary "No Parking" signs. Arrangements for refuse and recycling collection shall be coordinated with the Director. In extreme cases, it may be necessary for the Contractor to transport refuse and/or recyclables to the nearest accessible intersection. The coordination and associated work will be incidental to the various pay items.

121 PERMITS

No permits, unless specifically mentioned will be obtained by the City. The Contractor shall be responsible for obtaining all other permits.

The Contractor shall be required to obtain a permit if dewatering operations exceed 70 GPM in either single or aggregate capacity.

Private Water Systems Section
<http://dnr.wi.gov/org/water/dwg/Forms/3300258.pdf>
P.O. Box 7921
Madison, Wisconsin 53707

The Contractor shall apply as required with the Department of Natural Resources when discharging effluent from a construction excavation pit. Information and applications for these permits may be obtained at the following address:

Southern District
DNR, Southern District Headquarters
3911 Fish Hatchery Road
Fitchburg, Wisconsin 53711
(608) 275-3266

122 DISCOVERY OF CONTAMINATED SOIL

Several Leaking Underground Storage Tank (LUST) sites have been identified by the Wisconsin Department of Natural Resources (WDNR) at various properties throughout the City of Sun Prairie. There is a possibility that contamination from these LUST sites and other undiscovered LUST sites may have migrated into the City right-of-way, and could be encountered during routine construction.

If, during the progress of the work, the Contractor discovers potentially contaminated subsurface conditions, that differ from those conditions that are shown on the plans or indicated in the contract documents, the CONTRACTOR shall immediately notify the Engineer of the conditions and shall suspend work in that area. The Engineer will promptly investigate the conditions and make changes as deemed necessary to complete the work. Potentially contaminated soil impacts include, but are not limited to petroleum products (gasoline, diesel fuel, fuel oil, etc.) and/or their vapors, which may endanger the health and safety of the workers or the public. The Contractor remains solely responsible for the safety and welfare of their employees.

123 BORROW EXCAVATION

Borrow excavation shall consist of satisfactory soil or a mixture of satisfactory soil, stone, gravel or other acceptable materials which is of a character and quality satisfactory for the purpose intended. The material shall be free from sod, stumps, logs and other perishable and deleterious matter. All borrow material shall be subject to approval by the Engineer.

The borrow pit shall not be located within ten (10) feet of either a proposed building footprint or right-of-way. The pit shall have safety fences properly installed on all sides at the end of each workday. After borrowing operations are completed, the pit shall be brought up to original grade. The excavated area shall be brought up to finished grade with an approved fill material, and compacted to a 90% modified proctor, covered with six (6) inches minimum of topsoil, seeded and mulched.

124 NOISE RESTRICTION

In accordance with the City of Sun Prairie Code of Ordinances, 8.32.030, the operation of construction equipment shall be between the hours of 7 a.m. and 7 p.m. In addition, no work shall occur on Sundays.

125 WISCONSIN'S PREVAILING WAGE RATE

Bidding on all public and private sponsored public works projects are required to follow the prevailing wage rate laws. For more information please call the Department of Workforce Development at 608-266-6860.

126 SUBMITTALS

The contractor shall provide submittals (per section 518) for all products, materials, and equipment.

127 INSTALLATION

All products, materials, and equipment shall be installed per manufacturers' recommendations.

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PART 2

EARTHWORK SPECIFICATIONS

PART II EARTHWORK

SECTION 201: GRADING REQUIREMENTS

201.1 GENERAL

Grading shall consist of the loosening, loading, hauling, and disposal of all materials of every description encountered in the performance of the work other than specific materials, which have been classified and bid upon. It shall consist of furnishing and placing materials in accordance with these specifications and as shown on the accompanying cross sections and plans. The work shall be done to the line and grade established by the Engineer.

201.2 EXCAVATION

201.2.1 GENERAL

All excavation as shown on the accompanying cross-sections and plans shall be done by the Contractor to the line and grade established by the Engineer. All topsoil and organic materials shall be stripped from the project as shown on the cross-sections, and as directed by the Engineer.

The Contractor shall make all major excavations of existing material in the area between the curb line and the property line before curb and gutter is installed.

201.2.2 EXCAVATION AROUND CONCRETE CURB, SIDEWALK, OR DRIVEWAYS

No mechanical equipment or vehicles will be allowed over or on concrete curb and gutter, concrete sidewalk and concrete driveway aprons for at least seven (7) days after pouring of said structures or until the concrete has attained a compressive strength of 3000 psi. No mechanical equipment shall be allowed to work within ten (10) feet for a minimum of three (3) days after pouring of said structures or until the concrete has attained a compressive strength of 3000 psi. Any damage caused by the Contractor shall be removed and replaced at the Contractor's expense. No material either from or for the area back of the curb line shall be dumped or shoved onto new bituminous pavement for rehandling by mechanical equipment.

Concrete curb and gutter, concrete sidewalk, concrete driveway aprons and pavements damaged or dislocated in line or elevation by the Contractor in the operations of excavating, filling, rolling, and grading shall be replaced by the Contractor immediately at the Contractor's expense. The Contractor shall operate all equipment in such a manner that equipment tires or tracks do not discolor, mark or damage existing curb and gutter, sidewalk or pavements. The Contractor shall take all necessary precautions to protect existing trees in the terrace. When the trees are to be removed, they shall be so identified by the Engineer and payment made as described under Clearing and Grubbing, or Tree Removal.

201.2.3 EXCAVATION BELOW SUBGRADE

The Engineer reserves the right to order additional excavation, when conditions of the subsoil require such extra work. The additional excavations shall be measured in the field and calculated from those measurements. Payment for additional excavation shall be made on the basis of the Contract unit price or by dividing the total bid price by the Engineer's estimated cubic yard quantity. If the sub base has been undercut by the Contractor, except when ordered by the Engineer, then the Contractor shall, at no expense to the City, return the sub base under the roadway, curb and gutter, and sidewalk to the correct grade with crushed aggregate base course, as directed by the Engineer.

If undercutting or additional undercutting is necessary after the CABC has been placed, payment for such undercutting shall be calculated from top of stone to bottom of undercut. Undercutting will not be paid where a utility trench was opened. Payment shall be at the same unit price as the Excavation below Subgrade, and at the quantity as measured in the field.

201.2.4 DISPOSAL OF EXCESS MATERIAL

Unless otherwise specified, the Contractor shall dispose of all excess excavated material at a site provided by the Contractor at no additional cost to the City. Disposal of excess or undesirable materials shall be subject to approval by the Engineer.

201.2.5 MAINTAINING DRAINAGE

During construction, the roadway, ditches and channels shall be maintained in a well drained condition at all times by keeping the excavation areas and embankments sloped to the approximate section of the ultimate earth grade. Blading or leveling operations will be required when placing embankments and during the process of excavation except when such excavation is in ledge rock or areas where leveling is not practical or necessary. If it is necessary in the prosecution of the work, to interrupt existing surface drainage, sewers, or under drainage, temporary drainage, approved by the Engineer, shall be provided until permanent drainage work is completed. The construction of all temporary drainage installations shall be considered as incidental to the construction of the work.

The Contractor shall be responsible for and shall take all reasonable and necessary precautions to preserve and protect all existing tile drains, sewers and other sub-surface drains, or parts thereof, which in the judgment of the Engineer may be continued in service without change. The Contractor shall repair at their own expense any and all damage to such facilities.

201.2.6 TOPSOIL

All suitable material removed from excavation may be used in the construction of the terraces and at such other places as shown on the plans. All excavated slopes or areas and all embankment slopes or areas, designated to be covered with topsoil, shall be undercut or underfilled to the necessary depth to provide for the specified amount of topsoil. This work shall be performed as to avoid removing or loosening any material outside the required slopes. Any such material which may be removed or loosened shall be replaced and thoroughly compacted to the required cross section.

201.2.7 GRADING

All intersecting roads, approaches, entrances and driveways shall be graded as shown on the plans or as laid out in the field by the Engineer. The work of constructing intersections and private entrances, trimming shoulders and slopes, finishing and blading the earth subgrade and completing the ditches to proper alignment, grade and cross section shall follow the rough grading closely. Grading operations shall not be performed to the detriment of the work of trimming and finishing the roadway and blading and maintaining the roadbed and earth subgrade.

The grading, trimming and finishing shall be completed prior to construction of the base course. Adjustment in slopes, to avoid injury to standing trees or to harmonize with existing landscape features especially at the intersection of cuts and fills, shall be made and the transition to such adjusted slopes shall be gradual. The crests of earth cut banks shall be rounded as indicated on the plans or directed by the Engineer. All earth slopes shall be constructed to a surface that will merge with adjacent terrain and be in substantial accordance with the cross section. The horizontal serrated condition of slopes ordinarily left by excavating equipment shall be partially smoothed by means of blading or other operations so the slopes will have a general contour of the required slope but may be slightly rough or irregular.

During grading operations and pending placement of base course, the contractor shall provide continuous maintenance of the entire road bed and perform all blading and repair work necessary to keep the grade smooth and to the required grade and cross section. Washouts caused by erosion shall be refilled with acceptable material and properly compacted.

201.2.8 EROSION CONTROL

The area of erosive land exposed to the elements by the grading operations at any one time shall be subject to the approval of the Engineer and the duration of such exposure prior to the final trimming and finishing of the area shall be as short as practicable. Construction in and adjacent to storm sewers, rivers, streams, lakes, or other waterways shall be performed in such a manner as to avoid washing, sloughing, or depositing of materials into such waterways. The Engineer shall have full authority to order the suspension of grading and other operations pending the adequate and proper performance of the trimming, finishing and maintenance work or to restrict the area of erosive land exposed to the elements.

201.2.9 CLEANUP

No project shall be accepted until all excess mud, terrace dirt, bituminous material, rocks and crushed stone have been removed from the sidewalk, terrace, curb heads, gutter, pavement, and storm structures cleaned out. Workdays shall be charged against the Contractor until all cleanup is complete and to the satisfaction of the Engineer.

201.3 FILL

Additional fill material, when brought from off-site or from on-site borrow pits, and if ordered by the Engineer, shall be paid for at the unit price bid.

Fill material shall be deposited, spread and leveled in layers before compacting. Each layer shall be compacted to the degree as called for in the Special Provisions. The required compaction shall be attained for each layer before any material for a succeeding layer is placed thereon.

Hauling and leveling equipment shall be routed and distributed over each layer of fill in such a manner as to make use of the compaction afforded thereby.

The compaction shall be performed by means of tamping rollers, pneumatic rollers, vibratory rollers, or other types of equipment, which will produce the required results in the materials, encountered and be subject to the approval of the Engineer.

Tandem or three-wheel rollers, if used on the project, must weigh at least ten (10) tons. Material used and degree of compaction as approved by the Engineer.

The compaction shall not be performed when the moisture content of the materials is such as to cause excessive displacement or distortion under the compacting equipment. Where such conditions exist, the Contractor shall be required to add moisture or remove moisture by aeration to produce the moisture content necessary for the required compaction of the materials.

Crushed stone screenings shall not be used as backfill material.

201.4 SELECT FILL

Select fill material, if ordered by the Engineer, shall be hauled in, spread and leveled, then compacted to not less than 95% of its maximum density, as determined by the Modified Proctor Test (ASTM D1557), or as specified in the Special Provisions.

Select fill where ordered shall be paid for by the unit price bid and shall conform to the requirements of Granular Backfill.

201.5 SALVAGABLE CRUSHED AGGREGATE BASE COURSE AND GRANULAR BACKFILL

Whenever instructed by the Engineer, the Contractor shall salvage by segregating crushed aggregate and granular backfill materials. The salvaged material shall be free of earth and debris. This material shall be reused as Granular Backfill or as directed by the Engineer, at no additional cost to the City.

201.6 CLEARING AND GRUBBING

Clearing and grubbing shall consist of cutting and disposing of trees, shrubs, stumps, and boulders of all sizes. The Engineer may order that specific trees or shrubs be saved. Trimming of limbs from trees or trimming of shrubs shall not be done without permission of the Engineer.

All stumps shall be completely removed by excavation under proposed concrete sidewalk, concrete curb and gutter, all types of pavement, permanent structures, and at such other places as directed by the Engineer. Tree stumps under other areas in the right-of-way may be removed with stump cutting machinery to a depth of at least twelve (12) inches below the original ground area in fill areas, and at least twelve (12) inches below the subgrade in cut areas.

The Contractor shall provide a disposal area for all trees, stumps, limbs, brush and vegetation from the project at no additional cost to the City.

Stumps, roots, brush, logs, limbs, and other debris resulting from clearing and grubbing shall not be burned on or near City property without the written permission of the Engineer, and the securing of permits for burning from the property authorities.

The Contract lump sum price for Clearing and Grubbing shall be payment in full for furnishing all labor and equipment for performing the required work, and for the handling and disposal of all debris resulting from the Clearing and Grubbing. Whenever the Contract does not include a bid item for clearing and grubbing this work shall be considered incidental and costs shall be included in other unit prices.

SECTION 202: COMPACTION REQUIREMENTS

202.1 GENERAL

This work shall consist of the consolidation and compaction of all materials of every description encountered in the performance of the work in accordance with the Contract Documents.

202.2 TYPE 1 COMPACTION

In general, Type 1 Compaction will be required in areas where additional construction above the material to be compacted will not take place within a one-year period. Unless otherwise required on the plans or in the Special Provisions, existing materials shall be used in Type 1 Compaction conditions.

Where Type 1 Compaction is called for, it may be accomplished by track, rubber tire equipment, or compaction equipment. This equipment shall be routed and distributed over each backfill lift so that the track (or tire) contacts all areas of the surface of the lift. The maximum depth of lift shall be 2' 0". Type 1 compaction shall be compaction of the backfill material to 90% of its maximum density, as determined by the Modified Proctor Test (ASTM D1557).

202.3 TYPE 2 COMPACTION

Where Type 2 Compaction is called for, it shall consist of compaction of the backfill material to 95% of its maximum density. Unless otherwise noted, material placed as fill which is at a depth of three (3) feet or greater below the finished subgrade, shall be compacted to not less than 90% of its maximum density. Materials placed as fills in Type 2 Compaction zones shall consist of a granular content unless otherwise approved by the Engineer.

The maximum density shall be determined in accordance with the Method of Test for the Mixture-Density Relations of Soils, AASHTO Designation: D1557, Method D, with the replacement of the fraction of material retained on the 3/4-inch sieve with No. 4 to 3/4- inch material. The density of compacted material shall be determined in accordance with the Method of Test for density of Soil-In-Place by the Sand-Cone Method, AASHTO Designation: D1556 the test for Density of Soil and Soil Aggregate in Place By Nuclear Methods, ASTM Designation; D2922, or other approved methods.

The maximum compaction lift for backfill material shall be 12 inches unless the Contractor can support to the satisfaction of the Engineer that the compaction of deeper lifts than this can meet the above requirements.

Compaction around structures (sanitary and storm sewer manholes, inlets, water valve manholes, valve boxes, etc.) shall be accomplished by means of a hoe pack.

Unless otherwise called for in the Contract Documents all compaction of fill material shall be Type 2 Compaction.

202.4 PAYMENT

The cost of providing the compaction as called for in the Contract Documents shall be included by the Contractor in their various unit prices and, therefore, they shall not be paid separately. When original material is not acceptable, and other backfill material is required by the Engineer, this material shall be paid for at the unit price bid and shall include Type 2 Compaction.

SECTION 203 - PAVEMENT REMOVAL REQUIREMENTS

203.1 DESCRIPTION

Removal of existing pavement, sidewalk and curb and gutter shall include the removal and disposal of all types of roadway surfacing including concrete pavement, brick pavement, bituminous surfacing, existing stone or gravel base regardless of the depth or type; removal and disposal of curb and gutter and the removal and disposal of sidewalk as called for in the Contract documents.

203.2 CONSTRUCTION METHODS

In removing existing pavement the pavement shall be saw cut to a true line with a face perpendicular to the surface of the existing structure at the locations called for on the plans. Existing sidewalk and existing curb and gutter shall be removed to an existing joint or saw cut as specified by the Engineer.

The Contractor shall not use a frost ball or similar type of equipment to break up the existing pavement, sidewalk, and curb and gutter. The type of equipment used to break up the existing sidewalk, pavement, and curb and gutter shall be of a type that will not damage the existing underground utilities and shall be subject to the approval of the Engineer.

All removed pavement, sidewalk, curb and gutter, and other demolition material shall be removed, transported, and disposed of by the Contractor at a suitable site at their cost.

203.3 PAYMENT

Pavement removal shall be measured and paid for as specified in the contract documents. Curb and gutter removal may be classed as removing pavement and be included and measured as such, or it may be measured and paid under a separate bid item, depending on how the Contract Bid Proposal reads.

Sidewalk removal shall be measured as specified in the contract documents irrespective of the depth of the walk.

The Contract unit price for pavement removal (including curb and gutter) and sidewalk removal measured as provided for above shall be payment in full for breaking down, removing and

disposal of the removed material and for the furnishing of all labor, tools, equipment and incidentals necessary to complete the item of work in accordance with the Contract documents.

SECTION 204: ABANDONED STRUCTURES AND PIPES

204.1 GENERAL

This work shall consist of removing, wholly or in part, manholes, catch basins, inlets or other structures; the removal of base course and pavement as necessary in the removal; the salvaging and/or disposing of the resulting materials and backfilling the resulting excavation; bulkheading and abandoning lines in the structure, all as called for on the plans or as directed by the Engineer.

204.2 CONSTRUCTION METHODS

Abandoned structures shall be removed to a depth of three (3) feet below the proposed or existing street grade, whichever is lower and filled with sand compacted to a Type 2 compaction, unless noted.

All inlets to and outlets from existing structures shall be permanently bulkheaded or as otherwise called for in the Contract documents.

Pipes that are specified to be abandoned shall be filled completely with a flowable fill, unless otherwise specified by the City Engineer.

Service shall be maintained in such sewers until the Engineer orders the bulkheads placed and the manholes and catch basins abandoned.

204.3 PAYMENT

Abandoned structures shall be measured as units. Abandoned pipe shall be measured as specified in the contract documents. The Contract unit price for abandoning structures and pipes shall be payment in full for breaking down, removing, or sealing; for disposal of materials; for backfilling, for furnishing any required concrete masonry; and for furnishing all labor, tools, equipment and incidentals necessary to complete the item of work in accordance with the requirements of the Contract documents.

SECTION 205: RESTORATION REQUIREMENTS

205.1 TOPSOIL

205.1.1 GENERAL

This work shall consist of the furnishing of humus-bearing soil, commonly known as topsoil, placing, spreading and finishing to the approval of the Engineer.

Topsoil shall consist of the natural loam, sandy loam, silt loam, silty clay loam or clay loam humus-bearing soils adapted to the sustenance of plant life, and such topsoil shall be neither excessively acid nor excessively alkaline.

All areas designated to be covered with topsoil shall be undercut or underfilled to such a degree so that when covered to the required depth with topsoil the finished work will be in accordance with the required lines, grades, slopes, and cross sections.

Topsoil Subgrade preparation should include the removal of all gravel, aggregate base rock material (except 1' behind the curb and gutter and 6" on either side of the sidewalk), asphalt, concrete, and all other construction debris to a minimum depth of 12" below finish grade. Replace with clean earth fill to get to the correct subgrade if necessary.

Topsoil shall not be placed until all private and public utilities are installed.

205.1.2 SALVAGED TOPSOIL

This soil shall consist of suitable soils, approved by the Engineer, and salvaged from an approved site within the project limits. When done as part of a City contract, said material shall remain the property of the City, unless otherwise noted or approved by the Engineer.

The available humus-bearing soil shall be stripped off to such depth as available, or as necessary to produce sufficient volumes to cover the designated areas to the required depths, taking all practicable care to avoid incorporation of any of the underlying sterile soil there within.

The topsoil thus stripped from these areas may be stockpiled on an approved place on the right-of-way so that it can be reclaimed and spread on the areas provided they have been prepared to receive the same.

All areas from which topsoil is procured shall be cleared, if necessary, by means of mowing weeds or other vegetation to a height of approximately six (6) inches. The bottom 4 inches of topsoil shall be free from any litter such as brush, rock, or foreign material of objectionable size or quantity. The top 2" shall consist of pulverized topsoil.

205.1.3 TOPSOIL PLACEMENT

After the areas upon which the topsoil is to be placed have been prepared and finished to the required lines, grades, slopes, and cross section, the topsoil shall be placed and spread thereon to a uniform depth as shown on the plans or required in the Contract, or if none is so shown to a depth of six (6) inches, with the top 2" being a pulverized topsoil or such greater depth as designated by the Engineer.

Prior to the end of each working day, topsoil shall be cleaned off the adjacent sidewalk, bike paths, curb heads, gutters and roadways. Adjacent stormwater structures and waterways shall be protected during the placement of topsoil. The Engineer may order the installation of curb and field inlet sediment barriers constructed of a combination of hay bales, stone, block, silt fence and sand bags. The sediment barriers shall be constructed in accordance with the State of Wisconsin Department of Transportation Facilities Development Manual, Procedure 10-15-5. The sediment barriers shall be maintained until such time the disturbed areas are restored and stabilized.

Rocks, twigs, large clods that will not break down, and other foreign material shall be removed and the entire surface shall be dressed to present a uniform appearance. Rolling may be required.

205.2 SEED MIXTURES

205.2.1 GENERAL REQUIREMENTS

All seed shall conform to the requirements of the Wisconsin Statutes and the Wisconsin Administrative Code Chapter Agriculture 20 regarding noxious weed seed content and labeling.

Seed shall not be used on the work later than one (1) year after the test date, which appears on the label.

205.2.2 MIXTURES

Seed mixtures for use on City projects, unless otherwise provided or approved, shall be Madison Parks by Earth Carpet.

Madison Parks seed shall have an additional ½ pound annual rye per 1000 square feet.

For stormwater detention facilities and infiltration basins, the seed shall be native ecotypes from southeast Minnesota, eastern Iowa, northern Illinois, or southern Wisconsin. The seed mix shall be suitable for the type of soil and environment.

205.2.3 INOCULATION

White Clover, Alsike Clover, Empire Birdsfoot Trefoil and Crown Vetch species shall be inoculated. In the performance of such inoculation care shall be exercised to follow the instructions, which ordinarily accompany such culture purchases. When the seed is applied according to Method B, seeds requiring inoculation shall be treated with five times the amount of inoculate recommended in the instructions.

Particular care shall be exercised to avoid exposure of the culture or inoculated seed to the sunlight, and in no case shall such exposure exceed 1/2 hour. The Contractor may purchase the culture for inoculation from the Department of Bacteriology, College of Agriculture, University of Wisconsin, Madison, Wisconsin 53706

205.2.4 STORAGE OF SEED

Any seed delivered prior to use shall be used in such manner that it will be protected from damage by heat, moisture, rodents or other causes. Any previously tested and accepted seed that has become damaged shall be discarded and replaced by the Contractor.

205.2.5 SEEDING RATES

Madison Parks seed mix shall be placed at a rate of 4 pounds per 1,000 square feet.

At least 50% of seed used must be sown into shredded topsoil prior to hydro-mulch.

205.2.6 SOWING

Sowing shall not take place until the seedbed has been approved by the Engineer. Unless otherwise specified, seeds may be sown at the option of the Contractor, by either Method A or Method B described below:

METHOD A

The selected seed mixture shall be sown by means of equipment adapted to the purpose, or it may be scattered uniformly over the areas to be seeded, and lightly raked or dragged to cover the seed with approximately one-fourth inch of soil. After seeding, the areas shall be lightly rolled or compacted by means of suitable equipment, preferably of the cultipacker type when such equipment can be operated, or by means of light hand tampers.

METHOD B - Refer to 205.4 Mulching, Method D, Hydraulic Seeding: Hydraulic Mulch – Blend with Tackifier

Upon the prepared seedbed, a mixture of seed, mulch (wood or paper fiber), and fertilizer shall be sown or spread by means of a stream or spray of water under pressure operated from an approved type of machine designed for that purpose. The seed, mulch, fertilizer, and water shall be placed into a tank, provided within the machine, in sufficient quantities that when the contents of the tank are sprayed on a given area the seed will be uniformly spread at the required rate of application. During the process the contents of the tank shall be kept stirred or agitated to provide uniform distribution of the seed.

Seeding shall be limited to a period from April 15 to first frost, or as approved by the Engineer.

205.3 FERTILIZING

205.3.1 CONTENTS

Fertilizers, intended for use in connection with seeding, sodding or other planting, should be standard commercial products conforming to the requirements of the Wisconsin Statutes. Each package of fertilizer shall be plainly marked with the analysis of the contents showing minimum percentages of total nitrogen, available phosphoric acid and soluble potash.

Fertilizers shall meet the following minimum requirements:

Nitrogen, not less than	10%
Phosphoric Acid, not less than ..	10%
Potash, not less than	10%

Sum of nitrogen, phosphoric acid and potash, shall not be less than 32 percent.

Testing of fertilizers shall be in accordance with Fertilizer-Methods of Analysis by the Association of Official Agricultural Chemist (AOAC) in its latest revision.

205.3.2 CONSTRUCTION METHODS

The fertilizer selected for the seeding areas shall be uniformly spread thereon and incorporated into the soil by light discing and harrowing. The fertilizer shall be well pulverized and free from lumps when applied.

Fertilizer shall be applied at the rate of 7 pounds per 1,000 square feet of area, unless otherwise specified in the Contract.

In the event fertilizer is incorporated with topsoil areas, the fertilizer may be applied just prior to and in conjunction with the final discing or harrowing to a depth of several inches and the fertilizer then incorporated as set forth above.

In the event fertilizer is to be placed on seeding areas where the seed is to be sown by means of a spray or stream of water under pressure, the required amount of fertilizer may be placed in the tank, mixed together with the water and the seed, and applied in the seeding operation. Fertilizer applied by this method will not require discing and harrowing after being placed.

When the fertilizing of sod or sodded areas is required, the fertilizer shall be spread uniformly over the sod or sodded areas at the rate specified above after which the area plus fertilizer shall be moistened by sprinkling sufficiently to allow the fertilizer to soak into the sod. The rate of sprinkling shall be slow enough to permit the sod to absorb the water, and shall not cause any appreciable runoff from the areas sprinkled.

205.4 MULCHING

205.4.1 GENERAL

Mulching materials consists of straw or hay in an air-dry condition, or other suitable material of a similar nature that the engineer approves, and is free of noxious weed seeds and objectionable foreign matter.

Mulch shall be placed immediately on all areas that are seeded, unless otherwise specified or approved, after seeding has been completed. Mulching operations shall not take place during periods of high winds, as determined by the Engineer.

The placed mulch shall be loose enough to allow some sunlight to penetrate and air to slowly circulate, but thick enough to shade the ground, conserve soil moisture, and prevent or reduce erosion.

The Contractor shall maintain the mulched areas and shall repair any areas damaged by wind, erosion, traffic, fire, or other causes prior to acceptance of the work.

205.4.2 MULCH PLACEMENT

The Contractor shall perform the work by either Method "A", Method "B," Method "C", or Method "D" or a combination thereof, unless a specific method is specified in the contract.

New Subdivisions: Class 1 Urban, Type "A" Erosion mat or Hydro-Mulch must be used in the terrace as well as 5' behind the sidewalk.

METHOD A, Netting

The mulching material shall be uniformly spread over the designated areas to a loose depth of ½" to 1", using seventy (70) to ninety (90) pounds of mulch per 1,000 square feet. The mulch material from compacted bales shall be well loosened or made fluffy before being spread in place. Unless otherwise directed, mulching operations shall begin at the top of the slopes and proceed downward.

The mulch cover, except when composed of wood excelsior fiber, shall be securely anchored in place by means of heavy twine fastened by pegs or staples to form a grid of from six (6) to ten (10) feet spacing.

METHOD B, Tackifier

Treat straw or hay with a tackifier, blown from a machine and uniformly deposited over designated areas in one operation. Mix and place tackifier according to the WisDOT PAL.

The mulch shall be placed uniformly over the area to a loose depth of $\frac{1}{2}$ " to 1", using one and one-half to two tons of mulch per acre. Within the above-designated limits, the Engineer will determine, on the job, the rate of application of the mulch and tackifier, and the right is reserved for the Engineer to vary the rates during mulching operations to produce the desired results.

The machine for placing the mulch shall be of an approved type, which will blow or eject by constant air stream a controlled amount of mulch.

METHOD C, Crimping

The mulching material shall be uniformly spread over the designated areas to a loose depth of $\frac{1}{2}$ " to 1", using one and one half to two tons of mulch per acre, by blowing from a machine, as described in Method "B," or by other approved methods.

Immediately after spreading, the mulch shall be anchored in the soil by the use of a mulch tiller consisting of a series of dull, flat discs with notched edges. The discs shall be approximately 20 inches in diameter and shall be spaced at about 8-inch centers. The tiller shall be equipped with a ballast compartment to permit adjustment of the mass for depth control.

The mulch shall be impressed into the soil to a depth of approximately one and one half to two and one half inches in one pass of the tiller traveling longitudinally. Mulch tillers shall not be operated on slopes so steep that damage to the mulch, seedbed or soil occurs. Either Method "A" or Method "B" shall anchor the mulch on such areas. Tractors shall be equipped and operated to minimize the disturbance or displacement of the soil. More than one pass of the tiller may be required to assure adequate anchoring of the mulch.

Method "C" shall not be used if the mulch cannot be impressed into the soil a minimum of one and one half inches.

Throughout the process, the mulch material shall be fed into the blowing machine to produce a constant and uniform ejection from the discharge spout, operated in a position to produce a mulch of uniform depth and coverage.

The mulch material shall not contain moisture in excess of that which will permit uniform feeding through the machine.

All areas within twenty (20) feet of the curb and all areas exceeding a 12% slope shall require double mulch to prevent sediment from leaving the lot.

Method D, Hydraulic Seeding: Hydraulic Mulch – Blend with Tackifier

GENERAL

SUMMARY

- A. This section specifies a hydraulically-applied, erosion control product category of Hydraulic Mulch (HM) – Blend with Tackifier. The Blend with Tackifier HM shall be 100% biodegradable, made in the United States and composed of 100% recycled thermally refined (within a pressure vessel) virgin wood fibers, cellulose fibers and wetting agents (including high-viscosity colloidal polysaccharides). The HM shall be phytosanitized, free from plastic netting, and upon application form an intimate bond with the soil surface to create a continuous, porous, absorbent and flexible erosion resistant blanket that allows for rapid germination and accelerated plant growth.
- B. I
- C.

SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions. Include required substrate preparation, list of materials and application rate.
- B. Certifications: Manufacturer shall submit a letter of certification that the product meets or exceeds all technical and packaging requirements and is made in the U.S.A.

DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in UV and weather-resistant factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures and construction operations.

COMPOSITION

- A. All components of the HM shall be pre-packaged by the Manufacturer to assure both material performance and compliance with the following values. No chemical additives with the exception of fertilizer, liming and bio stimulant materials should be added to this product.
 - 1. Thermally Processed* (within a pressure vessel) Virgin Wood Fibers (minimum) – 67%
 - *Heated to a temperature greater than 380 degrees Fahrenheit (193 degrees Celsius) for 5 minutes at a pressure greater than 50 psi (345 kPa)
 - 2. Cellulose Fibers (maximum) – 30%
 - 3. Wetting Agent – Including high-viscosity colloidal polysaccharides – 3%

PACKAGING

- A. Bags: Net Weight – 50 lb (22.7 kg), UV and weather-resistant plastic film
Pallets: Weatherproof, stretch-wrapped with UV resistant pallet cover
Pallet Quantity: 40 bags/pallet or 1 ton (909 kg)/pallet

EXECUTION

VEGETATION SPECIES SELECTION

- A. Once soils have been analyzed for agronomic potential and amendment recommendations, selection of suitable plant species for achieving sustainable growth and effective erosion

control shall be determined by a qualified seed supplier, consulting professional and/or regulatory agency.

B. Site and project specific information considered for species selection shall include:

1. Project Location and Planning
 - i. Climate
 - ii. Elevation
 - iii. Aspect
 - iv. Slope/Gradient
 - v. Permanent or Temporary Planting
 - vi. Installation Date(s)
2. Soil Conditions
 - i. Soil Texture
 - ii. Soil pH
 - iii. Toxicities/Deficiencies noted in the previous section.
3. Site Maintenance Requirements
 - i. Mowing
 - ii. Irrigation
 - iii. Animal grazing preference
4. Preferred Vegetation
 - i. Drought Tolerant
 - ii. Native Vegetation
 - iii. Shrub Species
 - iv. Turf Grasses
 - v. Cool Season
 - vi. Warm Season
 - vii. Blend of Cool and Warm Season
 - viii. Legume Species
 - ix. Cover Crops

SUBSTRATE AND SEEDBED PREPARATION

- A. Examine substrates and conditions where materials will be applied. Apply product to geotechnically stable slopes that have been designed and constructed to divert runoff away from the face of the slope. Do not proceed with installation until satisfactory conditions are established.
- B. Depending upon project sequencing and intended application, prepare seedbed in compliance with other specifications under Section 205.1 and 205.2.

INSTALLATION

- A. Strictly comply with equipment manufacturer's installation instructions and recommendations. Use approved hydro-spraying machines with fan-type nozzle (50-degree tip). To achieve optimum soil surface coverage, apply HM from opposing directions to soil surface. Rough surfaces (rocky terrain, cat tracks and ripped soils) may require higher application rates to achieve 75% cover. Slope interruption devices or water diversion techniques are recommended when slope lengths exceed 20 feet (6 m). For application on slopes steeper than 4H:1V, slope interruption lengths may need to be decreased based on actual site conditions. Not recommended for channels or areas with concentrated water flow. No

chemical additives with the exception of fertilizer, liming and bio stimulant materials should be added to this product.

- B. For Erosion Control and Revegetation: To ensure proper application rates, measure and stake area.

1. *Apply fertilizer with specified prescriptive agronomic formulations, seed and HM at a rate of 50 lb per 100 gallons (23 kg / 380 liters) of water over properly prepared surfaces. Confirm loading rates with equipment manufacturer.*

Do not apply on saturated soils or substrates. Do not apply if precipitation is anticipated within 24-48 hours.

- C. Mixing: A mechanically agitated hydraulic-application machine is recommended:

1. *Fill 1/3 of mechanically agitated hydro seeder with water. Turn pump on for 15 seconds and purge and pre-wet lines. Turn pump off.*
2. *Turn agitator on and load low-density materials first (i.e. seed).*
3. *Continue slowly filling tank with water while loading fiber matrix into tank.*
4. *Consult application and loading charts to determine number of bags to be added for desired area and application rate. Mix at a rate of 50 lb of HM per 100 gallons (23 kg/380 liters). Contact Equipment manufacturer to confirm optimum mixing rates.*
5. *All HM should be completely loaded before water level reaches 75% of the top of tank.*
6. *Top off with water and mix until all fiber is fully broken apart and hydrated (minimum of 10 minutes — increase mixing time when applying in cold conditions). This is very important to fully activate the bonding additives and to obtain proper viscosity.*
7. *Add fertilizer*
8. *Shut off recirculation valve to minimize potential for air entrainment within the slurry.*
9. *Slow down agitator and start applying with a 50-degree fan tip nozzle.*
10. *Spray in opposing directions for maximum soil coverage.*

- D. Application Rates: These application rates are for standard conditions. Designers may need to increase application rates on rough surfaces. Consult application and loading charts to determine number of bags to be added for desired area and application rate.

Slope Gradient / Condition	English	SI
$\leq 4H$ to 1V	2,000 lb/ac	2,250 kg/ha
$> 4H$ to 1V and $\leq 3H$ to 1V	2,500 lb/ac	2,800 kg/ha

CLEANING AND PROTECTION

- A. After application, thoroughly flush the tank, pumps and hoses to remove all material. Wash all material from the exterior of the machine and remove any slurry spills. Once dry, material will be more difficult to remove.
- B. Clean spills promptly. Advise owner of methods for protection of treated areas. Do not allow treated areas to be trafficked or subjected to grazing.

INSPECTION AND MAINTENANCE

- A. All inspections and maintenance recommendations shall be conducted by qualified professionals consistent with the owner, engineer/specifier and regulatory entity(s) expectations.
- B. Initial inspections shall insure installations are in accordance with the project plans and specifications with material quantities and activities fully documented.
- C. Subsequent inspections shall be conducted at pre-determined time intervals and corrective maintenance activities directed after each significant precipitation or other potentially damaging weather or site event.

205.5 WATERING

All seeded areas shall be watered immediately after seeding and shall be kept moist by watering or sprinkling by the Contractor until the perennial grass seed has germinated and grown to a height of two (2) inches.

205.6 PAYMENT

The pay item for "Restoration," when paid for as a bid item, shall be paid for by lump sum price, unless specified otherwise in the Special Provisions.

This pay item will be paid at the Contract price, which price shall be full compensation for preparing the earth bed; furnishing, storing, handling and placing all topsoil, seed, fertilizer, and mulch; labor and all other items required to complete this pay item as called for in the Contract documents.

SECTION 206: SODDING

206.1 DESCRIPTION

This work shall consist of preparing sod beds, furnishing and laying of live sod on the shoulders, slopes, ditches, or other locations as designated by the Engineer, the construction of sod ditch checks or similar appurtenances, furnishing and applying the required fertilizer, all in accordance with these Specifications.

206.2 MATERIALS

206.2.1 SOD

The sod shall consist of a dense, well-rooted growth of permanent and desirable grasses, indigenous to the general locality where it is to be used, and shall be practically free from weeds or undesirable grasses. At the time the sod is cut, the grass on the sod shall have a length of approximately two inches (if longer, the grass shall be cut to approximately this length) and the sod shall have been raked free from debris.

The sod shall be cut in uniform strips approximately 18"x 72," but no longer than what can be easily handled. The sod strips shall be uniform in thickness; shall have no holes in them; shall be free of weeds, insects and diseases; shall be uniformly green and not discolored due to drying or heating; and shall be moist.

The thickness of the sod shall be uniform, approximately 3/4 inch or more, depending on the nature of the sod, so that practically all of the dense root system of the grasses will be retained, but exposed, in the sod strip and so that the sod can be handled without undue tearing or breaking up.

In the event the sod which is to be cut is in a dry conditions as to cause crumbling or breaking during cutting operations, at least twelve (12) hours before cutting the sod, the Contractor, at no additional cost to the City, shall apply water to the sod in sufficient quantities to provide a well moistened condition of the sod to the depth to which it is to be cut.

206.2.2 FERTILIZER

Fertilizer shall conform to the requirements set forth in Section 205.3.

206.3 CONSTRUCTION METHODS

206.3.1 PREPARATION OF EARTH BED

The area to be sodded shall have been previously constructed to the required cross section and contour, and the tops and bottoms of the slopes shall be rounded to a minimum four (4) foot radius curve.

The areas to be sodded shall be free from stones, roots or other undesirable foreign material.

The soil on the area to be sodded shall be loosened and brought to a reasonably fine granular texture, to a depth of two (2) to three (3) inches, by means of equipment or hand methods adapted to the purpose.

206.3.2 PLACING THE SOD

The earth bed upon which the sod is to be placed shall be moistened to the loosened depth, if not naturally sufficiently moist, and the sod shall be placed thereon within approximately twenty-four (24) hours after the same has been cut.

Sod shall be laid so that the joints caused by abutting ends of sod strips are not continuous. Each sod strip shall be so laid as to abut snugly against the strip previously laid.

As the sod is being laid it shall be rolled or firmly but lightly tamped with suitable wooden or metal tampers, sufficiently only to "set" or press the sod into the underlying soil.

At points where water will flow over a sodded area, the upper edges of the sod strips shall be turned into the soil below the adjacent area and a layer of earth placed over this juncture, which earth shall be thoroughly compacted to conduct the surface water over the upper edge of the sod.

At the limits of sodded areas, wherever practical or feasible, at the end strips shall be placed to affect a broken line and ends of the strips shall be turned.

Frozen sod shall not be placed, nor shall any sod be placed upon frozen soil.

206.3.3 STAKING

On all slopes steeper than one foot vertical to four feet horizontal the sod shall be staked or pegged with pieces of plasterers' lath or stakes equivalent thereto, twelve (12) inches in length, spaced as required by the nature of the soil and steepness of slope, from 18 inches to 36 inches apart along the longitudinal axis of the sod strip. Stakes shall preferably be placed near the top edges of the sod strip and shall be driven approximately plumb through the sod to be almost flush with the sod.

All sod placed in ditches, flumes or other appurtenances, where a concentrated flow of water may be expected, shall be staked regardless of the slope.

After the staking has been completed the surface shall be cleared of loose sod, excess soil, or other foreign material and the areas shall then be thoroughly moistened by sprinkling with water.

206.3.4 FERTILIZING

When the fertilizing of areas to be sodded is required, the fertilizer shall be spread uniformly over the areas to be sodded at the rate of 17 pounds per 1,000 square feet of area unless otherwise specified in the Contract. The fertilizer shall be pulverized and free from lumps when applied. The fertilizer shall be pulverized and free from lumps when applied. The fertilizer shall be incorporated into the areas to be sodded by light discing or harrowing.

206.3.5 WATERING

All sodded areas shall be kept thoroughly moist by watering or sprinkling, when rainfall is deficient, for a period of ten (10) days.

206.3.6 BASIS OF PAYMENT

Sodding measured as provided above, will be paid for at the Contract unit price per square yard of sodding, or the trench foot of sodding, which price shall be full compensation for preparing the earth bed; for furnishing, placing, staking, top dressing and watering the sod; and for all labor, equipment, tools and incidentals necessary to complete the work in accordance with the Contract.

SECTION 207: CONSTRUCTION SITE EROSION CONTROL AND STORM WATER MANAGEMENT

207.1 AUTHORITY

These specifications are adopted under the authority granted by Sec. 62.23, Wis. Stats. and City Ordinance 15.28 and 15.30.

207.2 PURPOSE

It is the purpose of this Chapter to preserve the natural resources; to protect the quality of the waters of the State and City and to protect and promote the health, safety and welfare of the people, to the extent practicable by:

1. Minimizing the amount of sediment and other pollutants carried by runoff or discharged from construction sites to lakes, streams and wetlands;
2. Providing for the development of public storm water management facilities.
3. Minimizing the amount of pollutants and runoff from developed lands reaching lakes, streams and wetlands.

207.3 DEFINITIONS

- (a) AGRICULTURAL LAND USE means use of land for planting, growing, cultivating and harvesting of crops for human or livestock consumption and pasturing or yarding of livestock.
- (b) COMMERCIAL LAND USE means use of land for the retail or wholesale sale of goods or services.
- (c) CONSTRUCTION SITE CONTROL MEASURE means a control measure used to meet the requirements of Sec. 15.28, City Ordinances.
- (d) CONTROL MEASURE means a structural or non structural practice or combination of practices to control sediment and other pollutants; manage runoff; or maintain infiltration identified in the manual of practice such as infiltration devices, wet detention basins, grit chambers, filter fences, mulching and seeding, and minimizing the extent and duration of disturbed areas.
- (e) CONTROL PLAN means a written description of the number, locations, sizes and other pertinent information of control measures designed to meet the requirements of this ordinance submitted by the applicant for review and approval by the City.
- (f) CURVE NUMBER means values ranging from 0 to 100 which predict the amount of runoff for specified rain volumes for different land surfaces and soil hydrologic groups.
- (g) EROSION means the detachment and movement of soil, sediment or rock fragments by water, wind, ice or gravity.
- (h) INDUSTRIAL LAND USE means exterior storage areas, loading and unloading areas, equipment washing areas or other area or surface directly associated with an industrial process or a land use activity covered under the Wisconsin pollutant discharge elimination system.
- (i) LAND DEVELOPMENT ACTIVITY means any activity which changes the volume or peak flow discharge rate of rainfall runoff from the land surface, or means the construction of buildings; roads; pavement or gravel parking lots and/or storage areas; and similar facilities, excluding agricultural land use.
- (j) LAND DISTURBING ACTIVITY means any manmade change of the land surface including removing vegetative cover; excavating; filling; and grading, but not including agricultural land uses.
- (k) LANDOWNER means any person holding title to or having an interest in land.
- (l) LAND USER means any person operating, leasing, renting or having made other arrangements with the landowner by which the landowner authorizes use of their land.

- (m) **MANUAL OF PRACTICE** means The Wisconsin Construction Site Erosion and Wisconsin Storm Water Design Manual of Practice published by the Department of Natural Resources.
- (n) **RUNOFF** means the rainfall, snow melt or irrigation water flowing over the ground surface.
- (o) **SET OF ONE YEAR DESIGN STORMS** means the following rain intensities and rain volumes or corresponding values specific to the community for the storm durations of 0.5, 1, 2, 3, 6, 12 and 24 hours:

STORM DURATION (Hours)	RAIN INTENSITY (Inches/Hour)	TOTAL RAIN (Inches)
.5	1.8	0.9
1	1.1	1.1
2	0.7	1.3
3	0.5	1.5
6	0.3	1.7
12	0.2	2.0
24	0.1	2.5

- (p) **SITE** means the entire area included in the legal description of the land on which the land disturbing or land development activity is proposed in the permit application.
- (q) **SOIL HYDROLOGIC GROUP** means a classification of soils into four groups, A, B, C and D based on runoff potential.
- (r) **STORM WATER DRAINAGE SYSTEM** means channels, swales, pipes, culverts, street gutters, ditches, detention basins, retention basins, infiltration devices or similar facilities for conveying or managing runoff from a site.
- (s) **STORM WATER MANAGEMENT CONTROL MEASURE** means a control measure used to meet the requirements of Sec. 15.30 City Ordinance.

207.4 DESIGN CRITERIA, STANDARDS AND SPECIFICATIONS FOR CONTROL MEASURES

All control measures required to comply with this Chapter shall meet the design criteria, standards and specifications for the control measure identified in the manual of practice or equivalent design criteria, standards and specifications identified by the City.

207.5 MAINTENANCE OF CONTROL MEASURES

All control measures necessary to meet the requirements of this Chapter shall be maintained:

- (a) By the Contractor during the period of land disturbance and the subsequent Contract guarantee period, if a permanent control measure.
- (b) At the frequency and in the manner described in the manual of practice.

207.6 EROSION AND OTHER POLLUTANT CONTROL REQUIREMENTS

The following requirements shall be met on disturbed sites.

207.6.1 SITE DEWATERING

Water pumped from the site shall be discharged in a manner so as to minimize the discharge of sediments into drainage facilities. Water may not be discharged in a manner that causes erosion of the site or receiving channels.

207.6.2 WASTE AND MATERIAL DISPOSAL

All waste and unused construction materials shall be disposed of frequently and in licensed solid waste or wastewater facilities. No garbage, debris, cleaning wastes, toxic materials or hazardous materials shall be buried on site; dumped on the land surface or in detention basins; or discharged or otherwise allowed to be carried by runoff into a receiving channel or storm sewer system.

207.6.3 TRACKING

Each site shall provide the following to prevent sediment from being tracked onto public or private roadways:

- (a) Each site shall have designated access drives and parking areas of sufficient width, length and wearing surface.
- (b) All access roads serving more than five (5) vehicles per hour shall be graveled.
- (c) Vehicle and equipment wash water shall be discharged to an infiltration area, detention basin or equivalent control measure.
- (d) Any sediment reaching a public or private road shall be removed by scraping and sweeping before the end of each workday.

207.6.4 DRAIN INLET PROTECTION

Inlets within the site and immediately downstream of the site must be protected with in-frame inlet protection device or equivalent, per section 117, as approved by the City Engineer.

207.6.5 SITE EROSION CONTROL

- (a) Runoff from all areas upslope of the site shall be diverted around disturbed areas. Diverted runoff shall be conveyed in a manner that will not erode the receiving channels.
- (b) All activities on the site shall be conducted in a logical sequence to minimize the area of bare soil exposed at any one time.
- (c) Runoff from the entire disturbed area on the site shall be controlled by meeting either subsection 1, 2 or 3 below:
 - 1. All disturbed ground shall be stabilized within seven (7) days of initial disturbance by seeding, mulching, sodding and/or equivalent control measure.
 - 2. For sites with more than ten (10) acres disturbed at one time or if a channel originates in the disturbed area, one or more detention basins shall be constructed. Each detention basin shall have a surface area of at least one (1%) percent of the disturbed area draining to the basin and at least three (3) feet of depth. If undisturbed lands drain to a wet detention basin, the wet detention basin shall be removed to maintain a depth of three (3) feet.
 - 3. For sites with less than ten (10) acres disturbed at one time, filter fences, straw bales, berms or equivalent control measures shall be placed along all sideslope and downslope sides of the site. If a channel or area of concentrated runoff passes through the site, filter fences shall be placed along the channel edges to control sediment from reaching the channel.

- (d) All roof drainage shall discharge to vegetated, mulched, or other stable pervious surface.
- (e) All temporary roadways and parking areas shall be constructed with minimal cuts and on relatively flat grades. All disturbed side slopes shall be stabilized with mulching and seeding or equivalent control measures within seven (7) days of construction of the cuts.
- (f) Any soil or dirt piles which will be in existence for more than seven (7) days may not be located within twenty-five (25) feet of a roadway or drainage channel and shall be stabilized by mulching, vegetative cover, tarps or other means. Erosion and runoff from piles which will be in existence for less than seven (7) days shall be controlled by placing straw bales or filter fence barriers around the pile.
- (g) Surplus excavated materials, including topsoil, shall be removed from the site as part of site grading activities. Stockpiled materials to be reused on the site shall be maintained according to subsection (5)f above.

207.6.6 OTHER CONSTRUCTION SITE CONTROL MEASURES

Other control measures shall be used where necessary to prevent excessive runoff, sediment or other pollutant discharge to waters of the State and the City.

207.6.7 CONTROL METHODS

Allowable Soil Loss Standard. Construction plans will not be approved nor permits issued unless the proposed design, suggested location and phased implementation of effective, practicable erosion control measures shall prevent gully erosion and;

1. Permissible Soil Loss. Limit total off-site annual aggregate soil loss resulting from sheet and rill erosion of exposed areas, to an annual, cumulative rate not to exceed 5 tons per acre per year.
2. Calculation Method. Plan compliance under Subsection 67 shall be determined using the Soil Conservation Service Universal Soil Loss Equation (USLE), which includes the following considerations: season of year; site characteristics; soil erodibility and slope. Computer versions of USLE for Dane County (Excel or QuatroPro versions) are available from Dane County Land Conservation (www.co.dane.wi.us).

The Contractor shall agree to undertake control measures as follows:

- (1) Stripping of vegetation, grading, excavation, or other land disturbing activities shall be done in a manner that will minimize soil erosion. If possible, construction should be scheduled for times of year when erosion hazards are minimal.
- (2) No site shall be cleared of top soil, trees, and other natural features before the commencement of construction operations. Natural vegetation shall be retained and protected until the final ground cover is placed. Only those areas approved for the placement of physical improvements or earthwork may be cleared until the placement of final ground cover.
- (3) Temporary stabilization and control measures (seeding, mulching, tarping, erosion rotting, etc.) are required for protection of exposed areas which will remain unworked for a period in excess of two (2) weeks during construction or other land disturbing activities.
- (4) Drainage provisions shall contain increased runoff resulting from developments or disturbances to the soil and surface conditions, during and after development or disturbance. Drainage shall be conveyed to the nearest public drainage facility. The rate of runoff during development activities shall not exceed the rate of runoff from before development.
- (5) Water runoff shall be minimized and retained onsite whenever possible to facilitate ground water recharge.

- (6) Sediment shall be retained onsite. Vehicles shall not track dirt or debris onto adjacent roadways and sediment shall not be carried off site by surface runoff.
- (7) Any temporary or permanent diversions, sediment basins, or other such erosion and runoff control measures as required, shall be installed prior to any onsite grading or land disturbances except in the areas subject to land disturbance.
- (8) No portion of the disturbed land shall remain uncovered without either temporary or permanent cover for more than two (2) weeks after notice to the Engineer that activities are completed.
- (9) Surplus excavation materials shall be removed from the site immediately after rough grading. The disposal site for the surplus excavation is also subject to the requirements of this chapter if within the City limits.

207.7 PAYMENT

The Contractor shall consider the control of erosion, and the requirements and methods of these specifications as standard requirements for all work conducted under this Contract by their employees, their subcontractors, their suppliers, and others having purpose on the construction site.

The Contractor shall include the costs of any and all materials, methods, labor, procedures, or any other cost of controlling erosion in their consideration of the unit prices for their other items of work, and shall not be paid separately therefore, unless specifically called for in the Bid Proposal.

Where the Bid Proposal contains items of work, which are of an Erosion Control or Storm Water Management nature, and intended to be a permanent installation, the Contractor may employ these items in their control of erosion and storm water management during their construction operations. However, these items shall be fully cleaned, restored, or in every way fully functioning for its permanent use prior to acceptance by the City.

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PART 3

CONCRETE AND CONCRETE STRUCTURES

SECTION 301: CONCRETE REQUIREMENTS

301.1 GENERAL

All concrete used on City of Sun Prairie Public Works projects shall comply with the following Subsections of Section 501, "Concrete Masonry," of the latest edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation, Division of Highways, except as modified in The City Specifications, Special Provisions, or in writing by the City Engineer.

501.2	Materials
501.3	Construction

301.2 CONCRETE CHARACTERISTICS

Concrete shall have the following characteristics:

Compressive Strength	4000 psi in 28 days
Slump	Slip form, 1 1/2 Inch (Max.) Flat Work, 4 Inch (Max.)
Air-Entrapment	Slip form, 7% plus or minus 1 1/2% All other, 6% plus or minus 1 1/2%
Minimum Cement Content	6 94lbs. bags per cubic yard

The cement content shall be reduced with fly ash that conforms to ASTM C618 Class C or slag that conforms to ASTM C 989, grade 100 or 120.

301.3 WATER

Water shall conform to Section 501.2.4 of the "Standard Specifications."

No water shall be added when placing concrete unless approved by the Engineer. If water is added without consent of the Engineer, this shall be considered sufficient grounds for rejecting the concrete.

301.4 ADMIXTURES

All concrete exposed to the weather shall be air-entrained. Admixtures other than those required for air entrainment shall not be used unless approved by the City Engineer.

301.5 COLD WEATHER CONCRETE

Cold weather concrete shall conform to Sections 415.3.15 and 501.3.9 of the "Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation."

Cold weather concrete shall be protected per 415.3.13.2 of the "Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation, as follows:

Predicted or Actual Air Temperature	Minimum Equivalent Level of Protection
22 to 32 F (-6 to < 0 C)	Single layer of polyethylene
17 to 22 F (-8 to < -6 C)	Double layer of polyethylene
< 17 F (< -8 C)	6" of loose , dry straw or hay between 2 layers of polyethylene

Regardless of the precautions taken, the Contractor shall be responsible for the protection of the concrete placed, and any concrete damaged by freezing or frost action during the first seven (7) days following its placement shall be removed and replaced by the Contractor at the Contractor's expense. All methods of protection are subject to approval by the Engineer. Concrete shall not be placed when frost is present in base.

301.6 STEEL REINFORCEMENTS

Steel reinforcements shall conform to definitions provided under specific sections.

301.7 TESTING OF CONCRETE

Slump tests shall be made following the procedure in ASTM C 143. The frequency of the tests shall be within the first 25 cubic yards and within each of the subsequent 50 cubic yards thereafter, or at the Engineer's discretion. If the measured slump falls outside the limits as determined by the Engineer, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the concrete shall be considered to have failed to meet the requirements of the Specifications and shall not be used in the structure.

Concrete cylinders for strength tests shall be made in accordance with ASTM Method C 31. Concrete cylinders shall be 6 inches in diameter and 12 inches in height. Concrete cylinder forms shall be supplied by the Contractor. Concrete cylinders shall be made by the Engineer. A minimum of 3 cylinders shall be cast within the first 25 cubic yards and within each of the subsequent 50 cubic yards thereafter, or at the Engineer's discretion. The City will transport the test samples to the testing laboratory where the tests will be performed at the City's expense, unless done as part of a private development, then test will be done at the developer's expense.

Cure boxes shall be provided by the contractor 24 hours prior to the concrete pour when temperatures are expected to be below 40 degrees or above 80 degrees Fahrenheit. One cure box shall be provided for pours up to 80 cubic yards. Two cure boxes shall be provided for pours over 80 cubic yards

The cure boxes shall be constructed with 2-inch Styrofoam insulation on all sides including the bottom and the opening lid. The boxes shall be constructed to be air tight when closed. The boxes shall have minimum inside dimensions when closed of 18 inches wide, 24 inches long, by 14 inches high. . (Styrofoam coolers are not allowed).

Concrete cylinders shall be tested at seven days and at 28 days. The test results at 28 days shall be the average strength of the specimens determined in accordance with ASTM Method C 39, except that if one specimen in a test show manifest evidence of improper sampling, molding or testing, it shall be disregarded.

In the event that cylinders show the compressive strength of the concrete to be below 4000 psi, the following procedure shall be followed:

Cores shall be taken in accordance with "Standard Methods of Securing, Preparing and Testing Specimens from Hardened Concrete for Compressive and Flexural Strengths" (ASTM C-42), from the area of the pour represented by the defective cylinders. These cores shall be tested as prescribed in Section 4 of the "Standard Method of Test for Compressive Strength of Molded Concrete Cylinders (ASTM C-39) in order to verify the cylinder tests. The Contractor shall supply all cylinder molds and concrete for concrete cylinder tests.

Where the cores show the compressive strength of the concrete to equal or exceed 4000 psi, the concrete material in question shall be accepted subject to acceptance of workmanship and dimensions of the work. The costs of obtaining and testing cores shall be borne by the Contractor.

Where the concrete cores show the compressive strength of the concrete to be below 4000 psi, and equal to or greater than 3500 psi, the City may elect to deduct from any monies due or to become due the Contractor an amount equal to twenty (20) percent of the concrete price for the structure or portion thereof in which the defective concrete is incorporated. The Contractor shall also bear the cost of obtaining and testing the cores.

Where the cores show the compressive strength of the concrete to be below 3500 psi, the structure or portion thereof in which the defective concrete is incorporated shall be removed and disposed of by the Contractor. Again, the Contractor shall bear the cost of obtaining and testing the cores.

Air content tests shall be made in accordance with the "Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method" (ASTM C-231). Air content may also be checked by the use of approved Air Content Indicators. Air tests shall be conducted within the first 25 cubic yards and within each of the subsequent 50 cubic yards thereafter, or at the Engineer's discretion.

301.8 MIX DESIGN

Contractors are required to submit a mix design for concrete for review and approval by the City Engineer. Mix Designs shall be submitted whenever the supplier or aggregate source is changed. Placement of concrete will not be allowed prior to approval of the Mix Design.

301.9 FLY ASH AND SLAG

The Contractor may substitute fly ash and/or slag for cement in accordance with the specifications for concrete masonry in the latest edition of State of Wisconsin, Department of Transportation Standard Specifications for Highway and Structure Construction and supplements thereto.

301.10 BACKFILLING AND OPENING TO TRAFFIC

Backfilling may proceed after concrete reaches a minimum compressive strength of 3000 psi.

The Engineer reserves the right to determine the time when the pavement or structure shall be opened to traffic, either on the basis of test cylinders, minimum time periods, atmospheric temperatures, or mix design.

When opening of the pavement or structure to traffic is controlled by cylinder tests, the pavement may be opened, after expiration of the curing period or cold weather protection period, as the

case may be, when the tests of cylinders show a compressive strength of the concrete of not less than 3,000 pounds per square inch.

301.11 PROTECTION

The Contractor shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting.

The Contractor shall be responsible for protecting concrete from damage due to either accident or vandalism. Replacement of damaged concrete shall be at the Contractor's expense.

SECTION 302: CURB AND GUTTER REQUIREMENTS

302.1 GENERAL

A. DESCRIPTION

This work shall consist of constructing air-entrained concrete masonry curb and gutter, with or without reinforcement, of the dimensions and design as indicated, and placed in one course on the prepared foundation or base, at the locations and to the required lines and grades, all as shown on the plans and or as provided by the Contract. For City reconstruction projects, curb and gutter shall be installed prior to sidewalk installation.

B. EQUIPMENT

Equipment and tools necessary for performing all parts of the work shall be satisfactory as to design, capacity and mechanical condition for the purposes intended, and any equipment which is not maintained in full working order, or which as used by the Contractor is proven inadequate to obtain the results prescribed, shall be repaired, improved, replaced, or supplemented to obtain the progress and workmanship contemplated by the Contract.

302.2 CONSTRUCTION METHODS

302.2.1 PREPARATION OF FOUNDATION

The foundation shall be prepared by excavating to the lines, grades and cross section shown on the plans and required for placing the concrete curb and gutter. All soft or unsuitable material underlying the proposed curb and gutter shall be removed and replaced with crushed aggregate base course, gradation No. 2 or 3. The depth of crushed aggregate shall match the bottom of the aggregate beneath the pavement to allow drainage of the subgrade. The foundation shall be approved by the Engineer prior to the placement of the crushed aggregate.

A minimum of 4" of crushed aggregate base course, gradation No. 2 or 3, shall be placed under the curb and gutter to a minimum of one foot outside the form lines.

When so indicated on the plans or specifications, drainage of the curb and gutter foundation shall be provided for with pipe underdrains, constructed in accordance with the pertinent requirements of Section 612, of the "Standard Specifications," at the locations shown on the plans or as directed by the Engineer.

302.2.2 CONCRETE PLACEMENT

The concrete shall be placed either by an approved slipform/extrusion machine, by the formed method, or by a combination of these methods.

A. MACHINE PLACEMENT

The slipform/extrusion machine approved shall be so designed as to place, spread, consolidate, screed, and finish the concrete in one complete pass in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous concrete section. The machine shall shape, vibrate, and/or extrude the concrete for the full width and depth of the concrete section being placed. It shall be operated with as nearly a continuous forward movement as possible. All operations of mixing, delivery, and spreading concrete will be so coordinated as to provide uniform progress, with stopping and starting of the machine held to a minimum.

B. FORMED METHOD

The forms shall be of steel construction and shall conform to the design of the type of curb and gutter being installed. Forms shall be free of hardened concrete, mud, dirt and debris and shall be free of bends and twists. Flexible or rigid forms of proper curvature may be used for curves having a radius of 100 feet or less. Division plates shall be metal.

The front and back forms shall extend for the full depth of the concrete. All of the forms shall be braced and staked so that they remain in both horizontal and vertical alignment until their removal. They shall be cleaned and coated with an approved form-release agent before concrete is placed against them.

The concrete shall be deposited into the forms without segregation and then it shall be tamped and spaded or mechanically vibrated for thorough consolidation. Low roll or mountable curbs may be formed without the use of a face form by using a straightedge and template to form the curb face. When used, face forms shall be removed as soon as possible to permit finishing. Front and back forms shall be removed as soon as possible to permit finishing. Front and back forms shall be removed without damage to the concrete after it has set.

302.2.3 FINISHING

The plastic concrete shall be finished smooth, and then it shall be given a final surface texture using a light broom or burlap drag. Concrete that is adjacent to forms and formed joints shall be edged with a suitable edging tool to the dimensions shown on the plans. Any honeycombed areas occurring either along the front or back of curb shall be pointed with mortar conforming to the requirements set forth under Subsection 518.2.3 of the "Standard Specifications," except that the cement shall be Portland cement.

302.2.4 CONTRACTION JOINTS

Transverse weakened-plane contraction joints shall be constructed at right angles to the curb line at intervals not exceeding 10 feet. Joint depth shall average at least one-fourth of the cross section of the concrete.

Contraction joints may be sawed, hand-formed, or made by 1/8-inch-thick division plates in the formwork. Sawing shall be done early after the concrete has set to prevent the formation of uncontrolled cracking. The joints may be hand-formed either by (1) using a narrow or triangular jointing tool or a thin metal blade to impress a plane of weakness into the plastic concrete, or (2) inserting 1/8-inch-thick steel strips into the plastic concrete temporarily. Steel strips shall be

withdrawn before final finishing of the concrete. Where division plates are used to make contraction joints, the plates shall be removed after the concrete has set and while the forms are still in place.

302.2.5 EXPANSION JOINTS

Expansion joints shall be constructed at right angles to the curb line at immovable structures, excluding storm sewer inlets, and at points of curvature, at points of tangency, at intervals not exceeding 250 feet on straight sections, and between the curb and gutter and adjacent rigid structures. Filler material for expansion joints shall conform to requirements of ASTM D994, D1751, or D1752 and shall be furnished in a single half-inch thick piece for the full depth and width of the joint.

Expansion joints in a slip formed curb or curb and gutter shall be constructed with an appropriate hand tool by raking or sawing through partially set concrete for the full depth and width of the section. The cut shall be only wide enough to permit a snug fit for the joint filler. After the filler is placed, open areas adjacent to the filler shall be filled with concrete and then troweled and edged.

Alternately, an expansion joint may be installed by removing a short section of fresh extruded curb and gutter immediately, installing temporary holding forms, placing the expansion joint filler, and replacing and reconsolidating the concrete that was removed. Contaminated concrete shall be discarded.

Expansion joints shall not be placed within 15 feet from either side of a storm sewer inlet. Epoxy coated rebar must be installed at any cold joints near a storm sewer inlet. (See Detail Drawing No. 3-8.)

302.3 PROTECTION

The Contractor shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. For slipform construction, materials such as wood planks or forms to protect the edges shall also be required. The contractor shall protect freshly placed curb & gutter from damage by rain events until adequately cured and resistant to damage. Concrete showing signs of damage as a result of a rain event will be removed and replaced at the contractor's expense.

All concrete placed between October 15 and May 15 shall be covered with plastic and insulated with hay or other approved insulation for not less than 7 days or more than 14 days unless receiving prior approval from the Engineer. The Contractor must receive Engineer approval prior to placing concrete during this period.

When concrete is being placed in cold weather and the temperature may be expected to drop below 35 degrees Fahrenheit, suitable protection shall be provided to keep the concrete from freezing until it is at least 7 days old. Concrete injured by frost action shall be removed and replaced at the Contractor's expense.

302.4 CURING

Concrete shall be cured for at least 7 days after placement to protect it against loss of moisture, rapid temperature change, and mechanical injury. Moist burlap, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used as the curing material. Curing material is to be applied within 2 hours of pour and is to be

uniformly applied to all exposed faces. Membrane curing shall not be permitted in frost-affected areas when the concrete will be exposed to de-icing chemicals within 30 days after completion of the curing period. Curing compound or plastic must be used if forms are removed prior to the completion of the curing period.

302.5 REINFORCEMENT

Reinforcement shall be required in all utility trench crossings, or as directed by the Engineer. Reinforcement shall consist of two #4 epoxy coated rebars, 15 feet long, centered on each crossing.

Reinforcement shall be required in curb and gutter repairs 10 feet or less by drilling two #4 epoxy coated rebar (1' in length) into each side of existing curb and gutter.

Reinforcement shall be paid for by the Contract Unit Price Bid for No. 4 Epoxy Coated Reinforcing Bar. When the Contract does not provide this bid item, the work shall be considered as incidental to the curb and gutter bid item.

302.6 BACKFILLING AND RESTORING THE SITE

When the curb & gutter has been cured and the forms removed, the space along the back of the curb shall be backfilled with satisfactory soil and thoroughly compacted. The backfill shall conform to the section shown on the plans or as necessary to match the adjacent ground surface. The Contractor shall dispose of surplus excavation and shall restore the site of the work to a neat and workmanlike condition.

The topsoil shall be placed to a minimum depth of six (6) inches and be level with the top of curb.

302.7 METHOD OF MEASUREMENT

Curb and gutter, completed in accordance with the terms of the Contract, will be measured by length in linear feet along the base of the curb face or along the flow line of the gutter, and such measurement shall be continuous along such line where the gutter is extended across driveway and alley entrance returns. No deduction in length will be made for drainage structures installed in the curbing such as catch basins, drop inlets, etc.

All excavation required for and performed during construction of curb and gutter, when covered by a separate bid item in the Contract, will be measured for payment as provided in the specifications: However, when the Contract does not provide a separate bid item for curb and gutter excavation such work required and performed will not be measured for payment but will be considered as incidental to and a part of the item of curb and gutter as the case may be.

302.8 BASIS OF PAYMENT

The footage, measured as provided above, shall be paid for at the Contract unit price per linear foot for concrete curb and gutter (size and type), as the case may be. This price shall be full compensation for all excavation, the preparation of foundation, and crushed aggregate base, and all special construction required at driveway and alley entrances; for furnishing all materials, including concrete masonry, expansion joints, and reinforcement tie bars/ for placing, finishing, protecting, and curing; for sawing of joints when permitted by the Engineer; and for all labor, tools, equipment and incidentals necessary to complete the work; including disposal of surplus material from excavation and restoring the site of the work, provided, however, that where the

Contract provides a bid item for curb and gutter excavation, such item of work required for construction of curb, gutter, or combination curb and gutter will be paid for as provided in the Contract.

SECTION 303: SIDEWALK REQUIREMENTS

303.1 GENERAL

This work shall consist of constructing sidewalks, with or without reinforcement as the case may be, placed on the prepared foundation or base in one course of the required dimensions and design; all as shown on the plans and provided by the contract.

The contractor is responsible for constructing the sidewalk/crosswalks to be ADA compliant on all installation methods.

303.2 CONSTRUCTION METHODS

303.2.1 PREPARATION OF FOUNDATION

The foundation shall be formed by excavating or filling to the required elevation of the bottom of the subbase. The foundation shall be thoroughly tamped or otherwise compacted to 95% of its maximum density. In cuts the foundation shall be made sufficiently wide to permit placing of forms and performing the required work of placing the concrete and finishing; and on embankments the foundation shall be constructed to a width at least two feet wider than the proposed sidewalk and extending not less than one foot beyond each side of the sidewalk.

All sidewalks shall be placed on a minimum of four inches of Granular Subbase Course or Crushed Aggregate Base Course. The cost for this material shall be included in the unit bid price for new sidewalk. All material shall be subject to approval by the Engineer.

303.2.2 FORMS

Forms shall be of metal construction and shall be straight and of sufficient strength to resist springing, tipping or other displacement during the process of depositing and consolidating the concrete. An approved flexible form shall be used for all curves having a radius of 100 feet or less. Metal forms shall be of approved sections and shall have a flat surface on top. The forms shall have a depth at least equal to the depth of the sidewalk. They shall be securely staked, braced and held firmly to the required line and grade, and shall be sufficiently tight to prevent leakage of mortar. All forms shall be cleaned thoroughly and coated with an approved form-release agent before the concrete is placed against them.

303.2.3 PLACING AND FINISHING CONCRETE

Except as otherwise revised or amended herein, all the pertinent requirements of Section 501 of the "Standard Specifications" shall be applicable to the concrete masonry involved. The foundation and forms, and reinforcement when required shall be checked and approved by the Engineer before the concrete is placed. The concrete shall be placed on a moist foundation deposited to the required depth and consolidation and spaded sufficiently to bring the mortar to the surface, after which it shall be struck off and floated with a float. Before the mortar has set

the surface shall be steel troweled and brushed. Before the concrete is given the final surface finish, the surface of the walk shall be checked with a 10-foot straightedge, and any areas which show a variation or departure from the testing edge of more than 1/4 inch shall be corrected by adding or removing concrete as necessary while the concrete is still plastic.

303.2.4 JOINTS

For sidewalk of uniform width, transverse joints shall be constructed at right angles to the centerline for the sidewalk, and longitudinal joints shall be constructed parallel to the centerline of the walk, unless otherwise provided. For sidewalks of variable or tapering widths, the transverse and longitudinal joint shall be at right angles to each other insofar as feasible, and the joints shall be constructed as laid out in the field by the Engineer.

No joint shall deviate more than five degrees from a position perpendicular to the surface of the finished sidewalk, nor shall the axis of any joint deviate more than 1/2 inch either way from a straight line or from the designated alignment at any point. If the joints are constructed in sections, there shall be no offsets or concrete struts between adjacent units.

A contraction joint in sidewalk shall consist of a slot or groove, at least one inch in depth and 1/4 inch in width, formed by a hand tool, or by inserting a metal parting strip in the concrete after it has been struck off and consolidated and while the concrete is still plastic. As soon as the concrete will retain its shape, the parting strip shall be removed and the joint edge-finished.

Contraction joints in concrete bike path, 8 feet or wider, shall be saw cut in accordance to 415.3.7 of the "Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation."

Contraction joints shall be located at intervals equal to the sidewalk width, up to a width of 6 feet. Sidewalks wider than 6 feet shall have contraction joints at 10 foot intervals.

When the sidewalk is constructed in partial width slabs, transverse joints in adjacent slabs shall be placed in line with like joints in the previously constructed slabs. In the case of widening existing sidewalks, transverse joints shall be placed in line with like joints in the existing sidewalk.

Expansion joint filler shall be half-inch thick material and shall conform to the pertinent Section of the "Standard Specifications." Transverse expansion joint filler shall be placed through the sidewalk at uniform intervals of not more than 100 feet.

Expansion joint filler shall be placed between the sidewalk and back of abutting parallel curb and gutter or other concrete roadway structures and between sidewalk and buildings, retaining walls, or other rigid structures. Expansion joint filler shall be placed between handicap access ramp and the back of curb or gutter or edge of pavement.

Expansion joint filler shall extend to the full depth of the concrete, and the top shall be slightly below the finished surface of the sidewalk.

The concrete at the faces of all joints shall be thoroughly spaded and compacted to fill the voids and the surface shall be finished smooth and true to grade in a manner as herein before provided. The edges of the sidewalk along forms, joints, and metal slab division forms shall be rounded with an edger of 1/4-inch radius.

Joints shall not be sealed, unless otherwise specified.

303.3 REINFORCEMENT

Reinforcement shall be required in all utility trench crossings or as directed by the Engineer. Reinforcement shall consist of three #4 epoxy coated rebars, 15 feet long, centered on each crossing.

Reinforcement shall be required in sidewalk repairs 10 feet or less by drilling three #4 epoxy coated rebar (1' in length) into each side of existing sidewalk.

Reinforcement shall be paid for by the Contract unit price bid for No. 4 Epoxy Coated Reinforcing Bar. When the Contract does not provide this bid item, the work shall be considered incidental to the sidewalk bid item.

303.4 PROTECTION

The Contractor shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. For slipform construction, materials such as wood planks or forms to protect the edges shall also be required. The contractor shall protect freshly placed sidewalk from damage by rain events until adequately cured and resistant to damage. Concrete showing signs of damage as a result of a rain event will be removed and replaced at the contractor's expense.

All concrete placed between October 15 and May 15 shall be covered with plastic and insulated with hay or other approved insulation for not less than 7 days or more than 14 days unless receiving prior approval from the Engineer. The Contractor must receive Engineer approval prior to placing concrete during this period.

When concrete is being placed in cold weather and the temperature may be expected to drop below 35 degree Fahrenheit, suitable protection shall be provided to keep the concrete from freezing until it is at least 10 days old. Concrete injured by frost action shall be removed and replaced at the Contractor's expense.

303.5 CURING

Concrete shall be cured for at least seven days after placement to protect it against loss of moisture, rapid temperature change, and mechanical injury. Moist burlap, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used at the curing material. Curing material is to be applied within 2 hours of pour and is to be uniformly applied to all exposed faces. Membrane curing shall not be permitted in frost-affected areas when the concrete will be exposed to de-icing chemicals within 30 days after completion of the curing period. Curing compound or plastic must be used if forms are removed prior to the completion of the curing period.

303.6 BACKFILLING AND RESTORING THE SITE

Where the sidewalk does not abut curb, gutter, pavement or other structures, and when the concrete in such sidewalk has been cured and the forms removed, the spaces along the sides shall be backfilled with satisfactory soil and thoroughly compacted. The backfill shall conform to the section shown on the plans or as necessary to match the adjacent ground surface. The Contractor shall dispose of surplus excavation and shall restore the site of the work to a neat and workmanlike condition.

303.7 METHOD OF MEASUREMENT

Sidewalks shall be measured by area in square feet, and the quantity measured for payment shall be the amount actually completed and accepted in accordance with the terms of the Contract, computed from dimensions as shown on the plans, or as altered by order of the Engineer.

303.8 BASIS OF PAYMENT

The area, measured as provided above, shall be paid for at the Contract unit price for the items of Concrete Sidewalk, which price shall be full compensation for furnishing all materials, including concrete masonry, reinforcement, and expansion joints; for all excavation and preparation of foundation and sub base, backfilling, and disposal of surplus material; for saw cutting, placing, finishing, jointing, protecting, and curing; and for all labor, tools, equipment and incidentals necessary to complete the work and restore the site of the work. However, when the Contract provides a bid item for landscaping and restoration, these costs will be paid for separately as provided in the Contract.

SECTION 304: CONCRETE CHANNEL REQUIREMENTS

304.1 GENERAL

The Contractor shall furnish all work, materials, labor, equipment, and other items necessary to construct a fully functioning and operational concrete channel paving system in accordance with the Contract documents, these Specifications, and the plan sheets.

It shall be the Contractor's responsibility to schedule and prosecute their work in a timely fashion with due regard to weather and conditions encountered in the field.

The Contractor shall make all provisions for providing access to the site of the work by their workers, suppliers, subcontractors and the Engineer.

304.2 CONSTRUCTION METHODS

304.2.1 BASE PREPARATION

The Contractor shall provide all equipment and labor to excavate or fill to the required subgrade elevations. The cost for clearing and grubbing shall be considered incidental to the work unless a special bid item is included in the bid form.

The subgrade shall be thoroughly compacted to 95% of its maximum density. A minimum of 6 inches of crushed aggregate Gradation No. 2 as specified in Section 401.2, shall be placed under the concrete. If water is present, a clean stone material, Gradation No. 1, Section 503.5.2, shall be used. The cost for placing the crushed aggregate base shall be included in the unit bid price for concrete channel.

Where ordered by the Engineer, due to poor soil conditions, the Contractor shall undercut the subgrade and backfill the excavation using either a base course material or clean stone material approved by the Engineer. The undercut and undercut fill shall be paid for as specified in the bid proposal. Areas undercut when not ordered by the Engineer shall not be paid for. Areas ordered

undercut should be measured by the Engineer prior to backfilling. The width of the undercut payment will be the channel width plus two feet.

304.2.2 CONCRETE PLACEMENT

The Contractor shall construct a concrete drainage channel to the line, grade and cross section indicated in accordance with the Contract documents, these Specifications and the plan sheets.

The concrete channel shall be constructed of a minimum of six inches of concrete conforming to the CONCRETE SPECIFICATIONS, Section 301 of these specification documents, including specifications for protection, and curing and construction methods. The concrete shall have a light broom finish.

304.2.3 REINFORCEMENT

Reinforcement shall consist of a welded steel wire fabric 6x6 - W2.9 x W2.9. The fabric shall be supported on solid concrete blocks sufficiently spaced prior to concrete placements.

304.2.4 JOINTING

Transverse contraction joints shall be required at 10-foot intervals. A longitudinal joint shall be required along the center of the channel. Joints shall be tooled or saw cut. Saw cut joints must be cut prior to the development of shrinking cracks, but not before sawing can be performed without causing the concrete to ravel. Joints shall extend to a depth of at least 1/5 the thickness of the concrete.

Expansion joints shall be located at intervals not to exceed 250-foot intervals, and at all points of curvature and points of tangency. Filler material for expansion joints shall conform to requirements of ASTM D994, D1751 or D1752, and shall be furnished in a single 1-inch-thick piece for the full length and depth of the joint. In addition, 3/4-inch smooth dowel bars, 18 inches in length and greased on end, shall be installed at 1- foot intervals thru the joint.

Costs for transverse and longitudinal joints and installing expansion joints shall be included in the unit price bid for concrete channels.

304.3 BASIS OF PAYMENT

The unit price bid for concrete channels shall include the cost for excavation, subgrade preparation, stone base installation, dewatering, concrete placement, reinforcement, joint construction, connections to existing structures and erosion control.

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PART 4

PAVEMENTS

SECTION 401: CRUSHED AGGREGATE BASE COURSE

401.1 DESCRIPTION

This item shall consist of furnishing and installing materials to result in a dense compacted base course composed of two or more courses or layers of coarse crushed stone aggregate, fine aggregate, and binder or filler blended as necessary to produce an intimate mixture, of the required gradation and stability, constructed on the prepared foundation in accordance with the specifications and in conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the Engineer.

401.2 MATERIALS

The materials supplied shall comply with Section 301 of the State of Wisconsin Latest Edition for Standard Specifications for Highway and Structure Construction. The aggregates shall consist of hard, durable particles of crushed stone resulting from the artificial crushing of rock, boulder or large cobblestones substantially all faces of which have resulted from the crushing operation. The material shall be free from dirt, debris, frozen materials, vegetable matter, shale, and lumps or balls of clay.

The determination of the acceptability of the aggregates will be made by field evaluation and/or laboratory test. The Engineer reserves the right to prohibit the use of material from any source, plant, pit, quarry or deposit where the character of the material or method of operation is such as to make improbable the furnishing of aggregates conforming to the requirements of these specifications, unless satisfactory evidence is shown that material conforming to specification requirements is produced.

Unless specified in the Contract or permitted by the Engineer, crushed concrete, crushed bituminous pavements, and mixtures thereof shall not be used for constructing Crushed Aggregate Base Course.

A certified analysis of the material to be supplied shall be submitted to the Engineer ten days in advance of the furnishing of any material. The analysis shall be dated within 90 days of the delivery date, the tests and analysis shall be performed on material from the same pit/quarry from which the material will be supplied. The aggregates shall be well graded between the limits specified and shall conform to the following gradation requirements:

PERCENTAGE BY WEIGHT PASSING

SIEVE SIZE	CRUSHED BREAKER	GRADATION NO. 1	GRADATION NO. 2
	(3" MAXIMUM)	(1-1/4 MAXIMUM)	(3/4 MAXIMUM)
3"	100	--	--
2-1/2"	--	--	--
2"	--	--	--
1-1/2"	75-80	--	--
1-1/4"	--	95-100	--
1"	--	--	100
3/4"	--	70-93	90-100
1/2"	--	--	--
3/8"	--	42-80	40-75
No. 4	0-25	25-63	25-60
No. 10	--	16-48	15-45
No. 40	--	8-28	--
No. 200	0-10	2-12	3-12

Unless otherwise provided in the Contract, aggregates for the top layer of base course shall be Gradation No. 1, and the aggregates for the bottom layer shall be Crushed Breaker (3" maximum).

A minimum of 12" of Aggregate shall be used on all streets (8" Crushed Breaker and 4" Gradation No.1). A larger amount of aggregate may be used at the direction of the Engineer and/or project.

401.3 EQUIPMENT

Equipment and tools necessary for performing and maintaining all parts of the work, satisfactory as to design, capacity and mechanical condition for the purpose intended, must be on the job before the work is started. Any equipment which is not maintained in full working order or which as used by the Contractor is inadequate to obtain the results prescribed, shall be repaired, improved, replaced, or supplemented to obtain the progress and quality of work contemplated by the Contractor.

401.4 CONSTRUCTION METHODS**401.4.1 - PREPARATION OF SUBGRADE**

The foundation shall be so prepared and constructed so that it will have uniform density throughout. It shall be brought to the required alignment and cross section with equipment and methods adapted for the purpose. Upon completion of the shaping and compacting operations, the foundation shall be smooth, at required density, and at the proper elevation and contour (within 0.10 foot of proposed grade) to receive the course to be constructed on it.

The right is reserved to make such minor adjustments in the finished grade line from that shown on the plans as may be necessary or desirable to maintain the characteristics of a stabilized

foundation by minimizing the amount of cutting into or filling over such stabilized foundation, provided such adjustments do not impair the riding qualities, drainage, or appearance of the finished pavement or cause, in effect, a deviation from a grade established by appropriate municipal ordinance. Upon completion of checking the subgrade elevations, the Engineer shall order a "test roll" of the finished street subgrade. The Contractor shall cooperate in this test and furnish a loaded truck of not less than 60,000 pounds gross weight. Areas of yielding or unstable material shall be excavated and replaced with approved material as ordered by the Engineer. This work shall be measured and paid for under the appropriate Contract items, as street undercut and street undercut fill.

Base material shall not be placed on a foundation that is soft, spongy, wet, or covered by ice and snow. Base material shall not be placed on a dry or dusty foundation where the existing condition would cause rapid dissipation of moisture from the base material and hinder or preclude its proper compaction. Such dry foundations shall have water applied to them and shall be reworked or re-compacted if necessary.

Under direction of the Engineer Geogrid shall be installed on subgrade and undercut area. Geogrid shall be Tensar Biaxial BX1100 or approved equal. Install Geogrid per manufacturers' recommendations including cable ties at roll overlaps.

MEASUREMENT AND PAYMENT

GENERAL

A. Geosynthetics for earthworks shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Procedures.

B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Procedures.

GEOGRID

A. Geogrid, Square Yards. The measurement for Geogrid of the specified type shall be by the square yard of surface area upon which the Geogrid has been placed. Payment shall be made at the contract unit price bid per square yard of geogrid of the specified type installed, as measured.

401.4.2 SPREADING AND SHAPING

Equipment used for spreading and shaping the crushed aggregate base course shall be designed and operated so as to spread the material in uniform layers without undue segregation. Graders used for spreading and shaping shall have weight, rigidity and design suitable for the work. Graders shall have sufficient power to properly perform the work. Other types of equipment for spreading and shaping the material will be permitted, provided the work performed or produced by them is equivalent to or better than the work obtainable from blade machines. All equipment necessary for spreading and shaping, compaction and water sprinkling of the base material shall be on the site prior to beginning the work of installing the base material.

Sufficient amount of crushed aggregate base course (CABC) shall be placed prior to curb and gutter installation to resist rutting and/or pumping of the subgrade material. The CABC material shall be removed, disposed of and replaced in areas where evidence of rutting and/or pumping of the subgrade has occurred. City of Sun Prairie is not responsible for any undercutting due to rutting and/or pumping of the subgrade due to lack of aggregate base course placed prior to curb and gutter installation. This work will be done at the contractor's expense.

The material shall be deposited on the foundation or previously placed layer in a manner to minimize segregation and to facilitate spreading to a uniform layer of the required dimensions. Excessive manipulation which will cause segregation between the coarse and fine materials shall

be avoided. No crushed aggregate shall be placed between the curbs until the curbs have been adequately backfilled. The work shall, in general, proceed from the point on the project nearest the source of supply of the aggregate in order that the hauling equipment will travel over the previously placed material, and the hauling equipment shall be routed as uniformly as possible over all portions of the previously constructed courses or layers of the base course. Stockpiling of the aggregates shall not be allowed unless approved or ordered by the Engineer.

401.4.3 COMPACTION AND WATER SPRINKLING

Prior to and during compaction operations the material shall be shaped and maintained to proper dimensions and contour by means of blade graders or other suitable equipment. The surface of each layer shall be kept true and smooth at all times.

All crushed aggregate shall be thoroughly water sprinkled to the satisfaction of the Engineer to provide the required compaction. After leveling and water sprinkling, each layer of crushed aggregate shall be compacted to the degree that no further appreciable consolidation or movement of the base is evidenced under the action of the compaction equipment. The required compaction shall be attained for each layer before any material for a succeeding layer is placed thereon. Areas around manhole structures and water valves shall be compacted with a jumping jack or plate compactor.

The compaction shall be performed by means of tamping rollers, pneumatic rollers, vibratory rollers, or other types of equipment which will produce the required results in the materials encountered, and be subject to the approval of the Engineer. Tandem or three wheel rollers, if used on the project, shall weigh at least ten (10) tons. Hauling and leveling equipment shall be routed and distributed over each layer of crushed aggregate in such a manner as to make use of the compaction afforded thereby.

The crushed aggregate base course shall be shaped and compacted to the proper alignment and cross section. Upon completion of checking the base course elevations, (within 0.05 foot of proposed grade) the Engineer may order a "test roll" of the finished street base course if the condition of the subgrade is in question. All areas where proper compaction is not obtainable due to secretions of materials, excess fines, or their deficiencies in the crushed aggregate, shall be reworked as necessary or the material in them removed and replaced with material that will yield the required results. The complete cost of such reworking and replacement shall be at the Contractor's expense (refer to section 401.4.1).

401.4.4 DRIVEWAYS

Where shown on the plans or directed by the Engineer, the Contractor shall construct driveways of Gradation No. 1 (1-1/4" maximum size) crushed aggregate. Unless otherwise specified, driveways shall be six (6) inches in depth.

401.5 PAYMENT

The item Crushed Aggregate Base Course shall be measured by the square yard. The quantity to be measured for payment shall be the amount of material required and incorporated in the work in accordance with the Contract.

The area shall be measured from flag of curb to flag of curb. Payment shall be for the full depth of the pavement design.

The quantity of crushed aggregate measured as provided above will be paid for at the Contract unit price per square yard for Crushed Aggregate Base Course, complete in place, which price shall be full compensation for furnishing, placing, watering, drying, compacting, and maintaining the crushed aggregate base course; for preparing foundation; for stockpiling, if required; and for furnishing all labor, tools, equipment and incidentals necessary to complete the work.

SECTION 402 - BITUMINOUS CONCRETE REQUIREMENTS

402.1 GENERAL

This work shall consist of furnishing, placing, and constructing bituminous concrete surface and base courses and/or resurfacing in accordance with the Contract documents.

The preparation of mixtures for bituminous Base, Binder, and Surface courses shall comply with the requirements of the latest amended edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation, Division of Highways, except as modified herein or in the Special Provisions of the Contract.

402.1.1 DENSITY TESTING

Density shall comply with the requirements of the latest amended edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation, Division of Highways, except as modified herein or in the Special Provisions of the Contract. Density testing shall consist of two readings, the first reading within 3' of the centerline and/or joint and the other within 3' of the flag and/or opposite joint, every 200 feet or requested by the engineer. Testing will be required on each pass of the Binder and Surface course. Density Testing shall be the responsibility of the Contractor. The Contractor shall provide City staff with all testing results

402.2 PRIME AND TACK COAT

This work shall be consistent with the latest edition of the D.O.T. Standard Specifications, including the latest supplemental specifications, along with the following additions.

A. In situations where traffic must be maintained, tack coat shall not be placed on the traveled half of the street until traffic can be switched to the new pavement. The Contractor is responsible for re-applying tack coat in areas that are found to be deficient.

B. All joints in the surface layer (excluding the flag of the concrete curb and gutter) shall be tack coated by use of a hose and spray nozzle attachment to insure a tight bond and sealed joint.

C. Payment for Prime and Tack Coat shall be made at the Contract unit price. Payment will not be made if re-applications are required as ordered by the Engineer.

402.3 ASPHALT CONCRETE PAVEMENT

This work shall be consistent with the latest edition of the DOT Standard Specifications, including the latest supplemental specifications, along with the following additions:

A. Asphalt Concrete Pavement shall be Type 4 LT S for binder course and 4 LT S for surface course on all residential streets, unless otherwise noted. Asphalt Concrete Pavement shall be 3 MT S for binder course and 4 MT S for surface course on arterial and collector streets, unless otherwise noted. Type 4 LT S and/or 5 LT S shall be used in driveways, bike paths, and parking lots.

B. Asphaltic material shall be PG58-28 unless otherwise noted.

C. Trucks transporting the asphaltic material shall be covered with a tarp at all times until paving operations begin for that load. The material shall have a temperature of 270°F - 300°F at time of paving. Loads of asphalt that is less than 250°F or more than 350°F shall be rejected.

D. Upon request, the contractor shall provide samples of the asphaltic mixture being used on the project. The contractor shall provide the Resident Project Representative one bag per day up to 1000 tons, and an additional one bag per 1000 tons thereafter.

E. The Contractor shall submit to the City an asphaltic mix design as specified in Section 460.2.7. Cost for submitting said mix design should be included in other unit prices.

F. The contractor shall notify neighboring residents with a "hand delivered written notice" 48 hours prior to surface course paving operations. The contractor shall also provide temporary "No Parking" signs from the Department of Public Works and have them in place eight hours prior to surface course paving operations.

G. Payment for Asphalt Concrete Pavement shall be at the unit price bid per contract.

402.3.1 – Asphalt Concrete Placement

1. Placement of Binder Course

A. Prior to the placement of the binder course material, base course surrounding manhole/ water structures must be compacted with a jumping jack or plate compactor.

B. Binder course shall be placed so the finish rolled grade and thickness are to the required job specifications. Binder course shall be plate compacted around all rigid structures.

2. Placement of Surface Course

A. The binder surface will be swept clear of all debris and a tack coat applied immediately prior to the placement of the wearing course of asphalt.

B. The surface course shall be placed so the finish grade and thickness are to the required job specifications.

C. The finish rolled surface course must be 3/8" above all manhole castings and water valves and 1/4" above the flag of the curb. The surface course must be 3/8" above all manhole castings and water valves directly at the manhole/water valve, creating a vertical drop.

D. Place the finished longitudinal joint line of the wearing course at the pavement centerline for 2-lane roadways, or at the lane lines if the roadway has more than 2-lanes.

E. If manhole castings and/or water valves are not 3/8" below the surface course elevation, the contractor shall install a circular concrete collar to resolve the issue at any time within the 1 year warranty, determined by the Engineer. Refer to Detail 5-16.

F. For greenfield street building the surface course shall be placed the same year as the binder course. All dry utilities and restoration (terrace and 5' behind the sidewalk/multi-use path) must be complete prior to the placement of the surface course. The surface course will be inspected at the 1 year warranty and if it is determined that there is damage from the development/builders, the surface course may be milled and replaced. The limits of the milling will be determined by the City Engineer.

G. Pavement markings shall be installed the same year as the surface course. The pavement markings need be installed in weather conditions per Wisconsin DOT Specifications. The pavement markings will be inspected at the 1 year warranty and if it is determined that there is damage from the development/builders, the pavement markings need be replaced.

SECTION 403 - SEAL COAT AND SEAL COAT WITH PRE-COATED AGGREGATE

This work shall consist of two separate methods of construction, Seal Coat and Seal Coat with Precoated Cover Aggregate. This work shall be consistent with the latest edition of the DOT Standard Specifications, including the latest supplemental specifications, along with the following additions:

403.1 GENERAL SPECIFICATIONS

403.1.1 TRAFFIC CONTROL

This shall be the responsibility of the Contractor and shall be in full compliance with the Manual of Uniform Traffic Control Devices and the appropriate supplements.

The Contractor shall post temporary "No Parking" signs at the beginning, mid-point, and end of each block, with additional locations as required. The Contractor shall notify the Public Works Director 48 hours in advance of the need for posting the signs.

Because of the amount of cure time required in the seal coat process, the City shall notify all adjacent property owners a minimum of 24 hours in advance of the construction.

The Contractor shall be responsible for and maintain the work area until acceptance by the City. Maintenance shall include protection and repair of the treated surface. The Contractor shall also maintain warning signs until the excess aggregate has been removed. Removal of the excess aggregate shall be the responsibility of the Contractor, and shall occur as directed by the Director of Public Works.

403.1.2 SURFACE PREPARATION

The Contractor shall be responsible for thoroughly cleaning the surface with a power broom immediately prior to the application of the bituminous material. The City Public Works Department will remove any silt spots or vegetation prior to the street sweeping. Repairing failed

sections of pavement and sealing existing cracks will also be the responsibility of the City. Costs for the surface preparation shall be included in the Contractor's unit bid price per square yard for Bituminous Seal Coat.

403.2 SEAL COAT

403.2.1 BITUMINOUS MATERIALS

The bituminous materials to be furnished shall be either PG64-22 or PG58-28. The PG64-22 or PG58-28 shall be applied at a rate of 0.25 to 0.40 gallons per square yard. The exact rate for each street shall be determined by the Contractor to provide satisfactory performance. Cost for furnishing and applying the bituminous material shall be included in the unit bid price per square yard for Seal Coat.

Areas upon which bituminous materials have been applied shall be closed to traffic until the aggregate for seal coat cover has been applied and properly rolled. The area treated with bituminous material in any one day shall be limited to the amount that can be covered with aggregate and properly rolled during daylight hours. Bituminous material shall be re-applied at no additional costs to the City if the treated surface is damaged prior to being covered with aggregate.

403.2.2 COVER AGGREGATE

The cover aggregate shall be washed and meet the gradation requirements of Section 475.2 of the Standard Specifications.

402.2.3 CONSTRUCTION METHODS

The methods shall be consistent with Section 475.3 of the latest edition of the DOT Standard Specifications. Equipment used shall be in good operating condition and shall be subject to the approval of the City Engineer.

402.2.4 PAYMENT

Payment for Bituminous Seal Coat shall be at the unit price bid per square yard, and shall be payment in full for providing traffic control, preparing the pavement surface, collection of excess aggregate, furnishing all equipment, materials, and labor for constructing the Bituminous Seal Coat.

403.3 SEAL COAT WITH PRECOATED COVER AGGREGATE

403.3.1 BITUMINOUS MATERIALS

The bituminous materials to be furnished shall be PG64-22 or PG58-28. Oil shall be applied at a rate of 0.25 to 0.40 gallons per square yard. The rate of application for the precoated aggregate shall be sufficient to adequately cover the applied bituminous materials with a minimum of waste.

403.3.2 COVER AGGREGATE

This material for precoated seal coating shall be washed Birdseye pea gravel passing the following gradation requirements:

GRADATION REQUIREMENTS

SIEVE SIZE	#4	#8	#16	#50
PERCENTAGE OF WEIGHT PASSING	85-100%	20-55%	0-20%	0-5%

403.3.3 PAYMENT

This item shall be measured in place and paid for at a Contract unit price per square yard for Bituminous Seal Coat with Precoated Cover Aggregate. The payment shall be considered payment in full for providing traffic control, preparing the pavement surface, furnishing all equipment, materials, and labor for constructing the Bituminous Seal Coat With Precoated Cover Aggregate.

SECTION 404 - BITUMINOUS PAVEMENT MILLING

404.1 WEDGE CUT MILLING

404.1.1 GENERAL

Bituminous milling shall consist of milling the existing pavement in preparation for a bituminous overlay. All work shall be performed in full compliance with Section 490 of the State of Wisconsin Standard Specifications.

404.1.2 CONSTRUCTION METHODS

Milling along the existing concrete curb & gutter (wedge cut) shall consist of milling a minimum of four feet out from the edge of the concrete gutter. The depth of the milling shall be equal to the depth of planned over-lay below the edge of the existing concrete gutter. At the edge, four feet from the concrete gutter edge, the depth shall be cut 1/8 inch deep. The depth of cut shall be determined by measuring between the concrete and undisturbed bituminous pavement using a straight edge.

The salvaged material from the wedge cut milling shall remain the property of the City of Sun Prairie. The Contractor shall truck and stockpile the material to an Engineer- appointed location within the City limits.

Bituminous pavement overlays of existing curb and gutter pans shall not be removed by milling operations unless otherwise approved by the Engineer. An alternative means of removal shall be approved prior to proceeding with this portion of work. The bituminous material removed from the concrete pan will not be accepted by the City unless otherwise approved by the City.

404.1.3 PAYMENT FOR WEDGE CUT MILLING

Payment for wedge cut milling will be at the unit price bid as specified in the Contract Bid Proposal or Special Provisions. The bid price shall include all costs for milling, cleaning, traffic control and salvaging the asphalt material.

404.2 FULL DEPTH MILLING

404.2.1 GENERAL

This work shall consist of pulverizing the existing bituminous asphalt material for its full depth, and a portion of the base course. This shall also include the reshaping of the combined aggregate between the curb and gutter flags.

404.2.2 CONSTRUCTION METHODS

The pulverized material shall be reduced to a maximum aggregate size of 1-1/2 inch. Material larger than 2 inch shall not be allowed left on site. Excess material shall become the property of the City of Sun Prairie and shall be transported to a site designated by the City Public Works Superintendent, unless otherwise specified or agreed upon. A maximum cross slope of .035 ft/ft shall be allowed.

The Contractor shall provide adequate equipment to control the longitudinal and transverse cross slope during both pulverizing and reshaping processes. Compaction of the material shall be accomplished with pneumatic rollers followed by vibratory smooth drum equipment.

In addition to the normal amount of water used during milling, it is likely that a substantial amount will be required during, or just ahead of, the reshaping process to aid in compaction and stabilization of the milled material.

The salvaged asphalt material shall remain the property of the City of Sun Prairie. The Contractor shall truck and stockpile the material to an Engineer appointed location within the City limits.

404.2.3 PAYMENT FOR FULL DEPTH MILLING

Payment will be by the unit price bid per square yard. The bid price shall include all costs for milling, cleaning, traffic control, and supplying all necessary equipment and labor to complete the work. Payment will only be made on the specified or approved widths.

404.3 EQUIPMENT

The grinding machine shall be a power operated, self-propelled machine, having a cutting drum with lacing patterns that will attain a grooved surface and produce grinding chips of less than two (2) inches in size. The grinding machine shall be equipped with a pressurized watering system for dust control. The equipment shall be of the type that has successfully performed similar work.

The cleaning equipment shall be of the type to efficiently remove all loosened material and load into trucks for hauling and spreading. Because of the nature of the streets to be ground and the traffic restrictions, a belt loader followed by a power sweeper and manual sweeping is most desirable. Flushing into the City's storm sewer system as a means of cleanup will not be allowed.

404.4 CITY WATER

The Contractor may obtain water from City hydrants only after applying with and obtaining approval from Sun Prairie Utilities Superintendent at 125 West Main Street.

SECTION 405 – INFRARED THERMAL BOND SEAMLESS BITUMINOUS PAVEMENT PATCHING

405.1 GENERAL

Infrared Thermal Bond Seamless Bituminous Patching is a method of blending new bituminous concrete material with infrared heated existing surface material to form a joint free integral mix patch.

This specification governs repair of existing bituminous surfaces required because of settlement of rutting, alligator cracking, aggregate raveling, or repairs of this method as ordered by the Director of Public Works or City Engineer.

405.2 EQUIPMENT

Pavement Restoration Vehicle (PRV) shall be a truck or trailer-mounted, self-contained pavement maintenance heating system equipped with a fuel system and a heated chamber capable of maintaining the fresh virgin bituminous materials at a temperature of 275 degrees F or higher. Any material with a laying temperature less than 265 degrees F shall be discarded. Any material not used within 48 hours shall be discarded.

The adjustable height infrared heating unit may be truck or trailer mounted to the PRV. The heating unit shall be equipped with a heating chamber or chambers capable of heating the existing bituminous pavement to a workable condition without oxidation or burning. There shall be no flame in direct contact with the existing bituminous surface.

Compaction shall be achieved with a self-propelled vibratory roller of sufficient size to provide complete compaction to the full heated depth of the patched area. The new surface shall match the elevation of the adjacent pavement. Compaction methods shall be subject to the approval of the City Engineer.

405.3 MATERIALS

New bituminous concrete material for patching shall be equal to Wisconsin Department of Transportation specification gradation 3 or 4. PG64-22 or PG58-28 is desirable.

A minimum of 30% of new virgin material shall be added to all patched areas. Additional material shall be added as needed and as directed by the City Engineer.

405.4 CONSTRUCTION

The areas to be patched shall be marked on the pavement and measured by the City Engineer and the Contractor. The Contractor shall determine the starting point of the work and the sequence of the heater application so as to accomplish all the work as specified.

The infrared heating unit shall be lowered to within six (6) inches of the existing pavement. The heated area must extend at least six (6) inches outside the area of repair.

Apply heat continuously until the surface is heated to a depth of approximately two (2) inches. The depth of heat penetration through an existing bituminous overlay or surface coarse shall be the thickness of the surface coarse or approximately two (2) inches, whichever is less. When the surface can be worked with a rake, proper heat penetration has been achieved.

Etch an outline of the perimeter of the repair area with the rake at least three (3) inches beyond the edges of the repair area. Scarify the existing bituminous surface with the repair area to the full heated depth.

Remove enough existing bituminous material (as required by adjacent grades) to allow for the addition of 30% new virgin bituminous mix to achieve a blend of 30% new / 70% existing heated material within the area of the patch.

If the patch area is already low, less existing material need be removed prior to the addition of the new virgin mix. Remove only the old oxidized surface in low areas.

Reshape patched area by hand with rake and lute to match grade of existing adjacent pavement.

Compact patched areas with the specified roller to the full depth of the heated patch. Compacted surface shall be smooth, in texture and shall have positive drainage, matching the slope of the existing pavement.

Clean-up site after paving. Remove all debris resulting from patching operation to the satisfaction of the City Engineer.

405.5 METHOD OF PAYMENT

Payment will be by the unit price bid per square foot. The unit price shall include all equipment, materials and labor to complete the work to the satisfaction of the City Engineer.

Measurement for payment at the unit price shall be based on the number of square feet marked and measured by the City Engineer and Contractor prior to repairs. Any additional repairs must be approved by the City Engineer.

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PART 5

STORM AND SANITARY SEWER SPECIFICATIONS

SECTION 501 – GENERAL

501.1 DESCRIPTION.

This Contract shall include furnishing all labor, equipment, tools and materials (except as otherwise specified) for the complete prosecution of the work required under this Contract. The Contractor shall remove pavement as required; perform all excavation required for the work; sheet, brace and support the adjoining ground and surface water; provide barricades, flagmen and warning lights; install and test all sewer pipe and sewer appurtenances; backfill and consolidate the trenches and other excavations; restore the roadway surface unless otherwise stipulated; remove all surplus materials and clean the site; and maintain street and other surfaces over the trench as specified.

It is required that all work on any one street, alley, easement or right-of-way be entirely completed in continuous sequence. This includes main installation, lateral installation, leakage testing, resurfacing and final clean-up.

501.2 REGULATIONS AND PERMITS

The work shall be done in accordance with the requirements of the various regulatory bodies of the State, municipal ordinances, the drawings and specifications, and the City Engineer. The City may obtain certain permits for construction. These permits, if obtained, will be considered part of the Special Provisions. The Contractor shall comply with all provisions of these permits, especially concerning notification requirements.

The Contractor is to obtain all other required construction permits and licenses including street openings or street closings, and shall pay the cost of same. This shall include any permits required by the DNR for dewatering operations.

501.3 ENGINEER'S ESTIMATE OF QUANTITIES

The Engineer's estimate of quantities, as shown in the Bid, is approximate and the right is reserved by the City to increase or decrease said quantities. The estimated quantities as shown will be used as a basis for comparing Bids.

501.4 EQUIPMENT

Equipment and tools necessary for performing all parts of the work shall be satisfactory as to design, capacity, and mechanical condition for the purposes intended, and any equipment which is not maintained in full working order, or which as used by the Contractor is inadequate to obtain the results prescribed, shall be repaired, improved, replaced or supplemented to obtain the progress and workmanship contemplated by the Contract.

501.5 TESTS

All sanitary sewers shall be required to pass a water infiltration test and a low-pressure air test. Unless otherwise specified in the Contract documents, the Contractor shall perform both tests in the presence of the Engineer.

After completion of pipelines laid below the ground water level, the Engineer will test the line for water infiltration. The infiltration shall not exceed the rate of fifty (50) gallons per day per mile of line per inch diameter of pipe being tested for any section of the system. Tests will be performed for each run of pipe between manholes, after groundwater conditions have returned to normal.

Manholes shall be individually tested for infiltration when directed by the Engineer. The rate of infiltration shall not exceed fifty (50) gallons per day per mile of vertical height (wall only) per inch internal diameter (or maximum horizontal dimension of structure). Fifty (50) gallons per day per mile of vertical height per inch internal diameter equals to the following rates:

Maximum allowable manhole infiltration:

48" diameter manhole = 0.0758 gallons per vertical foot per hour

60" diameter manhole = 0.0947 gallons per vertical foot per hour

72" diameter manhole = 0.1136 gallons per vertical foot per hour

The following procedure shall be followed when conducting the low-pressure air test:

1. The sewer line to be tested shall be thoroughly cleaned prior to testing.
2. Plug pipe outlets and brace securely.
3. Air shall be added slowly to the tested portion until the internal air pressure is raised to 4.0 psig.
4. After a minimum internal pressure of 4.0 psig has been obtained, a stabilization period of two minutes shall follow in which time the 4.0 psig minimum pressure shall be maintained.
5. The test may begin when the pressure decreases to 3.5 psig, or stabilizes at a higher pressure. The test pressure shall not drop more than 0.5 psig during the required test time, which time is as recommended by the ASTM F 1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

If the section being tested is below the ground water level, the Engineer shall determine the average height above the crown of the sewer. For every foot of ground water above the crown, the pressure shall be increased by 0.43 psig.

The Contractor may, at their option, conduct the air test on lengths of the line of less than a manhole-to-manhole segment to locate leaking locations for repairs. However, the entire manhole-to-manhole segment shall be required to pass the above test prior to acceptance by the City.

The Contractor shall furnish all equipment, materials, and labor required for the testing. The testing equipment shall be approved by the Engineer prior to use. As a precaution, the pressurizing equipment should include a regulator set at 10 psig to avoid damaging an otherwise acceptable line. Costs for the air test shall be included in the price for sanitary sewer main.

In the event the water infiltration or the loss of air exceeds the rates specified, the Contractor shall locate the point or points of leakage and repair the pipeline or manhole as directed by the Engineer at the expense of the Contractor. All visible leaks in manholes shall be repaired even though the leakage test requirements are met. Acceptance and final payment for sewers

completed shall not be made until any leakage, which exceeds the rate specified, has been corrected.

In the event defects in the sewer are detected by the closed circuit television inspection, the Contractor shall correct such defects prior to acceptance and final payment for sewers completed.

The Contractor, in the presence of the Engineer, shall determine whether the vertical deflection of installed Poly (Vinyl Chloride) (PVC) sewer pipe exceeds the maximum allowable vertical deflection by a deflection testing mandrel furnished by the Contractor. The mandrel size shall not be less than 95% of the internal dimension of the tested pipe. The deflection test shall be performed without mechanical pulling devices, and shall be performed after the installation of service laterals and after completion of all backfilling and filling operations. The maximum vertical deflection of the pipe shall not exceed that which will permit the free passage of the mandrel through the pipe. All pipe that exceeds the above stated maximum deflection should be repaired by the Contractor prior to acceptance and final payment for sewers completed. The cost of this work shall be at the Contractor's expense.

All existing and new sewers, as specified by the Engineer, shall have a closed circuit television inspection performed after finished road grading but prior to the surface course of asphalt being installed. The television reports must be compatible with ITPipes software and shall be supplied to the City of Sun Prairie Waste Water Treatment Plant (WWTP) for review. The City's WWTP personnel shall have five (5) calendar days to review the report after the contractor has received confirmation of receiving the deliverables. The WWTP will notify the contractor of any defective work, damaged pipes, or debris within 5 days. Any defects, damaged pipes, and/or debris shall be replaced, repaired, and/or cleaned by the contractor prior to the surface course of asphalt being installed. Prior to acceptance of these sewers, corrections will be made to the satisfaction of the City's WWTP Director and may require an additional television inspection

501.6 FINISHING WORK AND MAINTENANCE

The Contractor shall maintain all trenches, keeping them well filled and in a safe condition for travel, and shall deliver to the City, at the time of acceptance, a finished job with all trenches in a condition satisfactory to the Engineer.

All concrete, bituminous, and gravel pavements; stone flagging or paving; sidewalks; curbs and gutters; culverts; fences; or other structures; which may have been damaged or displaced by the Contractor in constructing the sewer, shall be rebuilt or re-laid properly to the original line and grade in accordance with pertinent parts of these Specifications, or in the absence of applicable specifications, to the original condition of the structure.

The Contractor shall maintain all bituminous and gravel surfaces, restored and replaced as above, in first class condition until final acceptance of the project is made by the Common Council. Failures occurring during the required guarantee period shall be repaired by the Contractor at no additional cost to the City.

All existing or new or sewers and structures shall be cleaned of any accumulations of silt, debris, and other foreign matter, and prior to acceptance, such installations shall be tested with water or by other approved methods, and under such tests unimpeded flow shall be indicated.

The area along the whole sewer shall be left clean and graded in a condition satisfactory to the Engineer.

Unless otherwise provided, costs of the work included in this Article shall be at the expense of the Contractor, and shall be included in the unit prices bid for the Contract items with which such work is associated. Final payment will be withheld until such work is done in a manner satisfactory to the Engineer.

501.7 RESPONSIBILITY FOR EXISTING UTILITIES

The City and its agents make no guarantee as to non-indicated sizes, locations or conditions of underground and above ground utilities as shown on the drawings. Variations from the size or location as shown on the drawings, or malfunctioning of existing utilities, shall not be cause for extra payment under this Contract. The Contractor shall be responsible for notifying the various utilities involved so that all underground utilities can be located prior to construction underground.

During installation of storm and sanitary sewer and appurtenances, the Contractor shall inspect all existing underground utilities and appurtenances for condition and soundness. The condition of all existing underground utilities shall be reported to the City immediately after exposing. The Contractor shall not proceed with their work until the Owner has been notified. The City shall then be given time to inspect and correct, if required, any existing sewers, manholes, water main, or other underground utilities and appurtenances.

The Contractor shall keep an accurate and complete record of all existing underground utilities encountered and shall provide the City with a copy of this record. The record shall include a description of the item encountered, opinion as to condition, and adequate measurements and depths so that the item can be located in the future.

501.8 CONSTRUCTION STAKING

The Contractor shall furnish hardwood stakes and hardwood lath and labor, as required for construction staking. Costs for providing this material shall be included in other unit prices.

The Contractor shall give the Engineer not less than 48 hours notice, not including Saturdays, Sundays or Holidays when requesting inspection or line and grade stakes.

501.9 DOMESTIC WATER

The Contractor shall make their own arrangements for domestic water used for construction or testing purposes with Sun Prairie Utilities.

SECTION 502 - MATERIALS

502.1 GENERAL

Unless otherwise shown on the plans or specified in the Contract, the materials furnished and installed in the work shall conform to the requirements specified herein for the type and class of material named.

The Contractor shall be responsible for all materials furnished by them and shall replace, at their own expense, all such material found to be defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material found to be defective. All material rejected by the Engineer shall be promptly removed from the site of the work.

The Contractor shall furnish random lengths of pipe for each Contract as may be required for the proper placement of fittings or structures. The costs of random lengths of pipe shall be included in the Contract unit prices for the respective sizes and types of pipe.

502.2 RESPONSIBILITY FOR MATERIAL FURNISHED BY OWNER

The Contractor's responsibility for materials furnished by the City shall begin at the point of delivery thereof to the Contractor. Materials already on the site shall become the Contractor's responsibility on the date of the award of the Contract. The Contractor shall examine all material furnished by the City at the time and place of delivery to them and shall reject all defective material. Any material furnished by the City, and found to be defective, shall be set aside to be removed from site by the City. Any material furnished by the City and installed by the Contractor without discovery of such defects, will be replaced with sound material by the City. The Contractor, however, shall at their own expense, furnish all equipment, labor and facilities necessary to remove the defective material and install the sound material in a manner satisfactory to the Engineer.

502.3 RESPONSIBILITY FOR SAFE STORAGE

The Contractor for this work shall confine their operations, storage of materials, building and equipment to areas designated by the Engineer. They shall cooperate with the City and any other Contractor working in the area. Unless otherwise approved, storage outside the right-of-way will not be permitted.

Materials delivered for the Contractor are to be neatly and compactly piled along the site in such manner as to cause the least inconvenience to the property owners and the general public. They shall not be piled within 10 feet of any hydrants or public traffic crossing.

The Contractor shall be responsible for the safe storage of material furnished by or to them, and accepted by them, and intended for the work. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times.

502.4 SEWER PIPE

Sewer pipe shall conform to the following specifications and types used and shall be approved by the Engineer. All pipe installations shall meet requirements of these specifications and requirements recommended by pipe manufacturers. All pipe shall be installed with either Class "C" or Class "B" bedding. All plastic pipe shall be installed with a Class "B" bedding. All sewer joints are subject to approval by the Engineer. When circumstances call for connecting/repairing sewer pipe, connections shall be made with an approved PVC hard sleeve made of the same material as the existing pipe. For connections to non PVC pipe the contractor shall use a steel reinforced coupling. For lined sewers, a Non-Shear Mission Coupling made by LMK Technologies, or approved equal by the Engineer, shall be used.

502.4.2 CAST-IRON

The pipe and accessories shall be of extra heavy cast-iron with mechanical joints or push-on joints and shall conform to the requirements of the Specification for Cast-Iron Sewer Pipe, and Fittings, ASTM A74.

Joints for cast-iron soil pipe and fittings shall conform to the requirements of the Specification for Rubber Gaskets for Cast-Iron Soil Pipe and Fittings, ASTM C564.

502.4.3 DUCTILE-IRON PIPE

The pipe and accessories shall be of ductile-iron with mechanical joints or push-on joints and shall conform to the requirements of American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or San-lined Molds, for Water or other liquids, ASA A21.51 (AWWA C151). The pipe and accessories shall be class 52 minimum, or as otherwise noted in the plans or Special Provisions. The pipe and fittings shall be tar coated and be cement lined, in conformance with AWWA C104.

The joints shall be rubber gasket joints and shall conform to the requirements of American National Standard for Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings, ASA A21.11 (AWWA C111).

The fittings for ductile-iron pipe shall conform to the requirements of American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids, ASA A21.10 (AWWA C110).

502.4.4 POLY VINYL CHLORIDE (PVC) SEWER PIPE

Poly Vinyl Chloride (PVC) sewer pipe and fittings shall conform to the requirements of the Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings, ASTM D 3034, SDR-35.

For PVC sewers all fittings shall be furnished by the manufacturer and shall be injection molded Poly Vinyl Chloride (PVC) with the same wall thickness and joints as the pipe.

The PVC manufacturer shall be one whose pipe and joint have been accepted for use in Wisconsin by the Municipal Wastewater Section of the Department of Natural Resources.

All pipe used on a project shall be supplied by the same manufacturer and shall be the same type.

Joints shall be elastomeric and shall be made as recommended by the manufacturer.

502.4.5 REINFORCED CONCRETE PIPE

The pipe, fittings, and accessories shall be of reinforced concrete and shall conform to the requirements of the Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, ASTM C 76 or the Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe, ASTM C 507. Unless otherwise specified, all reinforced concrete culvert, storm drain, and sewer pipe shall be Class III (ASTM C 76) and reinforced concrete elliptical culvert, storm drain, and sewer pipe shall be Class HE-III (ASTM C 507).

Joints for sanitary sewer pipe shall be designed for the use of confined "O"-ring type rubber gaskets. No lift holes shall be permitted in sanitary sewer pipe.

Joints for storm sewer pipe shall be designed for the use of rubber gasket, flexible plastic gaskets, cold plastic sewer joint compound, external sealing bands, or a combination of the above. Unless otherwise specified, circular reinforced concrete pipe shall be installed with rubber gasket joints, flexible plastic gaskets, cold plastic sewer joint compound, external sealing bands, or a combination of the above, at the Contractor's option and as approved by the Engineer.

Rubber gaskets shall conform to the requirements of the Specification for joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets, ASTM C 443. Flexible plastic gaskets shall conform to the requirements of the Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets, Type B Flexible Plastic Gaskets, AASHTO M 198. Cold plastic sewer joint compound shall be Seal tight Cold Plastic Sewer Joint Compound as manufactured by W.R. Meadows, Inc. or equal. External sealing bands shall be Mac Wrap External Joint Collars as manufactured by Mar-Mac Manufacturing Company, Inc., or equal.

Concrete apron end walls for concrete pipe sewers shall be manufactured with reinforcement and concrete conforming to the pertinent requirements for Class II, Wall B, reinforced concrete pipe, ASTM C 507.

An Engineer approved joint tie shall be installed between the apron end wall and last two sections of pipe for reinforced concrete pipes.

Apron end wall joint ties shall be considered as incidental to the cost of the apron end wall.

502.4.7 SMOOTH LINED CORRUGATED POLYPROPYLENE PIPE- STORM SEWER USE ONLY

Polypropylene pipe shall only be used in the following conditions:

- The pipe required is 24-diameter or less.
- The ADT on the street is less than 7,000.
- A minimum of 2-feet of cover exists. Cover is measured from the top of pipe to the top of the finished base course.
- The trench width is no wider than the OD of the pipe plus 24-inches.
- The pipe is to be bedded per the Class B requirements as noted on Detailed Drawing No. 5-1.

Pipe and fittings shall be polypropylene compound. Pipe shall be limited to 12-24 inch diameter, smooth lined with corrugated exterior meeting AASHTO M330 S and ASTM F2736 specifications. The pipe shall have a minimum stiffness of 46 psi. The joints shall be water tight gaskets that meet or exceeds the 10.8 psi air pressure standards as outlined in ASTM D3212. Fittings other than those supplied by the manufacturer are subject to approval by the Engineer.

All polypropylene pipes shall be tested for acceptance with an Engineer-approved mandrel. The mandrel test shall not take place prior to the street subgrade test roll, but shall be tested prior to the placement of the asphalt surface material. The mandrel must pass through the entire length between structures when pulled by hand and without excess force.

The Contractor shall furnish the mandrel, all materials, equipment and labor for making this acceptance test. The mandrel shall be of a design to prevent it from tipping from side to side and to prevent debris build-up from occurring between the channels of the adjacent fins or legs during operation. Each end of the core of the mandrel shall have fasteners to which the pulling cables can be attached. The mandrel shall have nine various sized fins or legs of appropriate dimensions for various diameter pipes. Each fin or leg shall have a permanent marking that states its designated pipe size and percent deflection allowable. The diameter of the mandrel shall be equal to 92.5 percent of the base inside diameter of the pipe.

An Engineer approved joint tie shall be installed between the apron end wall and last two sections of pipe for all pipe sizes. Apron end wall joint ties shall be considered as an incidental cost.

502.5 PRECAST MANHOLES

Precast manholes shall be of reinforced concrete and shall conform to the requirements of the Specification for Precast Reinforced Concrete Manhole Section, ASTM C 478.

- a. Joints for sanitary manholes and appurtenances shall be made watertight with an all-weather pre-compressed butyl rubber sealant. (Kent Seal No.2, EZ-STIK, or equal). The sealant shall be installed on the inside and outside ring of the joints. In addition to the internal joint sealer, external joint sealer (Mac Wrap or equivalent) shall be installed on the outside of all barrel section and cone section joints. Joints for storm manholes and appurtenances shall be made watertight with an all-weather pre-compressed butyl rubber sealant. (Kent Seal No.2, EZ-STIK, or equal). The sealant shall be installed on the inside and outside ring of the joints. When a storm manhole has a depth of 10' or greater and/or there is groundwater conditions the manhole shall require an external joint sealant (Mac Wrap or equivalent) on all joints.
- b. Manhole connections for sanitary sewer pipe and laterals shall consist of flexible manhole sleeves, Kor-N-Seal or Interpace through 18 inch, or A-Lok, or equal, as approved by the Engineer in diameters greater than 18 inch. Steps shall not be located above the inlet or outlet. Steps shall be located over the manhole bench. Inverts for the inlet pipes shall be 0.05' higher than the invert of the outlet pipe, unless approved by the Engineer, or otherwise indicated on the construction drawings.
For storm manholes, pick holes and pipe connections shall be sealed with concrete mortar. The mortar shall be type S.
- c. All adjusting rings for sanitary and storm sewer manholes shall be made from Expanded Polypropylene (EPP) as manufactured by CRETEX (PRO-RING) or approved equal and meet the requirements of ASTM D3575 and ASTM D4819-13. The adjustment rings shall

be tested to assure compliance with impact and loading requirements per AASHTO M-306, H-25, and HS-25. The adjusting rings shall be sealed using M-1 Structural Adhesive/Sealant, or approved equal, meeting requirements of ASTM C-920.

Per the manufacturer's installation instructions, the contractor shall use the minimal number of grade, angle, and finish rings necessary to match manhole casting to 3/8" below road grade. Prior to the application of the adhesive/sealant, the adjustment rings shall be approved by the Engineer. Maximum height of adjusting rings shall not exceed 7.50". The inner diameter of the adjustment rings must match the inner diameter of the cone installed. The Contractor shall refer to the structure shop drawings for adjustment heights. (For existing structures where shop drawings are not required, the Contractor shall supply the adjusting rings and refer to the final Plan Set for the existing adjustment heights and proposed rim grades).

502.6 INLETS

Unless otherwise stated or shown, all inlets shall be rectangular in shape and be of precast or cast-in-place concrete construction and will conform to detail drawing 5-10.

Where called for, or approved by the Engineer due to unusual circumstances, solid concrete blocks may be used for inlet construction. Concrete blocks shall meet the requirements of ASTM C-139. The face size of stretcher units shall be 7-5/8 inches by 15-5/8 inches. Special shapes and sizes shall be furnished as required.

No masonry work shall take place when the temperature of the air is below 40 degrees Fahrenheit, unless heating and insulating means, approved by the Engineer, is provided to protect masonry work from freezing.

For storm inlets, pick holes and pipe connections shall be sealed with concrete mortar. The mortar shall be type S.

Expanded Polypropylene (EPP) adjustment rings shall be used under the following conditions. Adjusting rings for storm inlets shall be made from Expanded Polypropylene (EPP) as manufactured by CRETEX (PRO-RING) or approved equal and meet the requirements of ASTM D3575 and ASTM D4819-13. The adjusting rings shall be sealed using M-1 Structural Adhesive/Sealant, or approved equal, meeting requirements of ASTM C-920. The adjustment rings shall be tested to assure compliance with impact and loading requirements per AASHTO M-306, H-25, and HS-25. Cretex rings, or approved equal, shall come in size 46" x 30" and then cut down to fit the inlet. M-1 adhesive, or approved equal, shall be used to adhere the newly created seam.

The contractor, at their expense, shall immediately remove any crushed aggregate or other construction debris entering any structure and/or pipe.

502.7 CASTINGS

Gray iron castings used in the work shall conform to the requirements of the Specifications for Gray Iron Castings, ASTM A 48, Class 30.

The following Neenah Foundry castings, or equal castings, are standard for City construction. Other equal castings, as approved by the Engineer in writing, or when specified, may be used.

The portion of the material, which passes the No. 4 sieve, shall conform to the following requirements:

GRADATION REQUIREMENTS

SIEVE SIZE	#4	#40	#100	#200
PERCENTAGE OF WEIGHT PASSING - Grade 1	100%	Not more than 75%	Not more than 15%	Not more than 8%
PERCENTAGE OF WEIGHT PASSING - Grade 2	100%	-	Not more than 30%	Not more than 15%

The liquid limit of the material shall not be greater than 25, and the plasticity index shall not be more than 6.

Granular backfill, where ordered by the Engineer, shall be paid for at the Contract unit price per ton bid. The price bid shall be full compensation for hauling, placing and compacting the material and for disposal of undesirable material.

502.9 GEOTEXTILE FABRIC – RIP RAP

Under direction of the Engineer geotextile fabric (Type R) shall be installed underneath Rip Rap.

GENERAL

A. The geotextile fabric shall consist of either woven or nonwoven polyester, polypropylene, stabilized nylon, polyethylene or polyvinylidene chloride. All fabric shall have the minimum strength values in the weakest principal direction. Nonwoven fabric may be needle punched, heat bonded, resin bonded, or combinations thereof.

B. The geotextile fabric shall be insect, rodent, mildew, and rot resistant.

C. The geotextile fabric shall be furnished in a wrapping which will protect the fabric from ultraviolet radiation and from abrasion due to shipping and hauling. The geotextile is to be kept dry until installed.

D. The geotextile fabric rolls shall be clearly marked showing the type of fabric.

E. Samples of fabric for testing may be obtained from the job site as specified herein or as determined by the Engineer.

F. If sewn seams are used, the Contractor shall furnish a field sewn seam sample produced from the geotextile fabric and thread and with the equipment to be used on the project, prior to its incorporation into the work.

G. All numerical values specified below represent minimum/maximum average roll values (i.e., the average of minimum test results on any roll in a lot should meet or exceed the minimum specified values).

GEOTEXTILE FABRIC, TYPE R (RIPRAP)

A. The fabric shall comply with the following physical properties:

Test	Method	Value
Grab Tensile Strength, lbs	ASTM D 4632	300 min.
CBR Puncture Strength	ASTM D 6241	800 min.
Apparent Breaking Elongation, Percent	ASTM D 4632	20 min.
Apparent Opening Size, U.S. Standard Sieve	ASTM D 4751	30 max.
Permittivity, SEC-1	ASTM D 4491	0.40 min.

B. Acceptable materials are Geotex 1201, Thrace-LINQ 275EX, Mirafi 1120N, 24 Mirafi HP370, and US 300 NW, or equal.

GEOTEXTILE FABRIC, TYPE HR (HEAVY RIPRAP)

A. The fabric shall comply with the following physical properties:

Test	Method	Value
Grab Tensile Strength, lbs	ASTM D 4632	300 min.
CBR Puncture Strength	ASTM D 6241	800 min.
Apparent Breaking Elongation, Percent	ASTM D 4632	20 min.
Apparent Opening Size, U.S. Standard Sieve	ASTM D 4751	30 max.
Permittivity, SEC-1	ASTM D 4491	0.40 min.

B. Acceptable materials are Geotex 1201, Thrace-LINQ 275EX, Mirafi 1120N, Mirafi HP370, and US 300 NW, or equal.

GEOTEXTILE FABRIC, TYPE R

A. The area shall be graded smooth and all stones, roots, sticks, or other foreign material which would interfere with the fabric being completely in contact with the soil shall be removed prior to placing the fabric.

B. The fabric shall be placed loosely and laid parallel to the direction of the water movement. Pinning or stapling may be required to hold the geotextile in place. Separate pieces of fabric shall be joined by overlapping or sewing. The fabric in the overlapped joints shall be placed with a minimum overlap of 24 inches in the direction of the flow.

C. After placement, the fabric shall be exposed no longer than 48 hours prior to covering.

D. Damaged areas shall be covered with a patch of fabric using a 36 inch overlap in all directions.

E. Placement of riprap shall be from the base of the slope upward. Height of free fall of riprap shall be determined by the Engineer but in no case shall this height exceed 12 inches.

GEOTEXTILE FABRIC, TYPE HR

A. The construction methods for Type HR fabric shall conform to the requirements of Type R, except that the height of freefall of riprap shall not exceed 6 inches.

MEASUREMENT AND PAYMENT

GENERAL

GEOTEXTILE FABRIC

- A. Geotextile Fabric, Square Yards. The measurement for geotextile fabric of the specified type shall be by the square yard of surface area upon which the geotextile fabric has been placed. Payment shall be made at the contract unit price bid per square yard of geotextile fabric of the specified type installed, as measured.

502.9.1 PERMANENT EROSION CONTROL – TIED CONCRETE BLOCK MAT

Flexamat (Standard) or approved equal shall be placed at storm sewer endwalls as indicated on the project plan set and installed per the manufacturer's guidelines.

The Flexamat or approved equal area shall be seeded using DOT Seed Mix #20, unless otherwise specified on the project plan set. The seed and fertilizer shall be sown or spread as described in Method B under Section 205.2.6.

SECTION 503 - CONSTRUCTION METHODS

503.1 EXCAVATION

Unless otherwise provided in the Contract or permitted by the Engineer, the work of constructing sewers and allied works shall be done in open trenches and in a manner to protect the pipelines or sewers from unusual stresses. When provided in the Contract or permitted by the Engineer, the construction of sewers may be done by tunneling and/or jacking in lieu of open trenching; details of construction shall be indicated on the plan, specified in the Contract, or established by the Engineer prior to beginning the work of tunneling and/or jacking. All of the work of constructing sewers shall be done in accordance with the applicable provisions of the "Wisconsin Administrative Code."

The trenches shall be excavated in conformity with the required alignment and grades as shown on the plans and as laid out in the field by the Engineer. It shall be understood that the elevations for sewers, as shown on the plans, are subject to such revisions as may be necessary to fit field conditions and that the Engineer reserves the right to adjust the profile grades from those shown on the plan. No adjustment in compensation will be made for the grade adjustments up to one (1) foot above or below the elevations shown on the plans.

The Contractor shall remove all vegetation along the trench line to the width of the proposed trench before beginning excavation. Vegetation removed shall not be used as backfill in the trench, but shall be disposed of by the Contractor at no additional cost to the City. The materials excavated from the trench shall be deposited on the sides of the trenches and excavations, beyond the reach of slides, or transported to spoil banks. The material must be placed as to be as little inconvenience as practical to public travel and adjoining tenants. Fire hydrants, valve boxes, storm inlets, and manholes shall not be left obstructed.

Excavated material, determined by the Engineer to be undesirable for backfilling, shall be immediately removed by the Contractor from the site. No additional payment will be made to the Contractor for the disposal of surplus or undesirable material. Disposal sites shall be subject to the City erosion control requirements.

Unless otherwise provided, the Contractor shall provide all the sheeting or bracing needed to protect the work, existing property, utilities, pavement, etc., and to provide safe working

conditions in the trench. Such sheeting and bracing shall be according to the Contractor's design and shall comply with the "Wisconsin Administrative Code." Removal of any sheeting or bracing from the trench shall be accomplished in such a manner as to fulfill the above requirements. Sheeting and bracing shall be removed unless specific permission is given by the Engineer to leave it in place. Costs of this work shall be at the Contractor's expense.

The Engineer reserves the right to limit the extent of excavation in advance of pipe laying and backfilling depending on the nature of the soil and other conditions affecting the work. Unless written permission is granted by the Engineer, the trench shall not be excavated more than 100 feet in advance of the pipe laying. In no case shall the total length of open trench exceed 200 feet.

503.2 TRENCH WIDTH

Restrictions may be placed by the Engineer on the width of the trench at the surface of the ground. On streets opened to traffic, on narrow restricted easements, and in other such locations, the width of the trench at the surface shall be limited to street right-of-way or limits or in other locations work activities shall be limited to the construction limits shown on the plans.

The width of trench from a point one foot above the top of pipe to the bottom of the trench shall not exceed the width listed in the following table. A minimum clearance of 6 inches shall exist between the outside wall of the pipe and the trench wall, as measured at the spring line of the pipe.

MAXIMUM WIDTH OF TRENCH BELOW TOP OF PIPE	
INTERNAL PIPE DIAMETER INCHES	TRENCH WIDTH INCHES
4	30
6	30
8	36
10	36
12	36
15	39
18" and larger	O.D. of pipe plus 24 Inches

Where the width of the trench cannot be maintained within the limits shown above, the Contractor shall at their own expense provide an approved method of sheeting or bracing, a concrete cradle or encasement, stronger pipe, or any other Engineer approved method of correction. The removal of sheeting below the top of pipe shall be made only when approved by the Engineer. Sheeting shall be pulled in increments not to exceed 3 feet as the trench is being filled. The material in the 3-foot section of trench shall be thoroughly compacted before pulling the sheeting another 3-foot increment.

503.3 DEWATERING

The Contractor shall remove by pumping, bailing, or otherwise, any water which may accumulate or be found in the trenches and other excavations made under the Contract, and shall form all dams, flumes or other works necessary to keep them entirely clear of water while the sewers and their foundations, and other foundation works are being constructed, and shall conduct all water

from such excavations so as not to flow over or damage private property. Costs of this work shall be at the Contractor's expense.

When the condition exists, the Contractor shall furnish and install well points or deep wells to lower the groundwater below the bottom of the trench. Any permits required for dewatering operations shall be the responsibility of the Contractor to obtain and pay for.

No additional payment will be made for dewatering of the trench or other excavations, whether accomplished by trench sumps, pumps, well points, or deep wells.

The Contractor shall direct the discharge to the nearest existing public drainage facility. Any damages, either directly or indirectly related to the dewatering operations, including the cleaning of streets and drainage ways, shall be rectified by the Contractor. Should the dewatering operation affect a private water supply well, the Contractor shall be responsible for providing the affected parties with alternative potable and non-potable water supplies until dewatering has ceased and normal water levels have returned. If the water in the water supply well, as tested by the Engineer, is found to be contaminated, through no fault of the Contractor, after normal water levels returned, the Engineer shall make arrangements to restore water potability. The Contractor shall be held responsible only until dewatering has ended and the ground water table has reached its normal elevation.

When dewatering operations are required the Contractor shall avoid any noise disturbances to adjacent property owners in accordance with local noise ordinances 8.32. Adjacent residents may be accommodated by locating pumps or generators as remotely as possible. The use of intake and exhaust silencers may also be required.

503.4 ROCK EXCAVATION

Rock excavation shall include all hard, solid rock in ledges, bedded deposits and unstratified masses and all conglomerate deposits or any other naturally occurring material so firmly cemented as to present all the characteristics of solid rock; which material is so hard or so firmly cemented that, as determined by the Engineer, it is not practical to excavate and remove same with a power shovel except after thorough and continuous drilling and blasting.

Power shovels referred to above shall be taken to apply to a modern power shovel or backhoe of not less than one cubic yard manufacturer's rated capacity, having adequate power and being in good running condition in the hands of an experienced operator. Rock excavation shall also include all rock boulders necessary to be removed having a volume of three-quarters (3/4) cubic yard or more. Rock excavation shall not apply to concrete or bituminous bound bases or surface courses of macadam, gravel, concrete, or broken stone.

The pay limits for rock excavation shall be carried to a depth of six (6) inches below the outside of the sewer, and to a width limited to the outside diameter of the pipe plus two (2) feet. Rock excavation shall be carried to a depth of eight (8) inches below the outside of manholes for manholes up to ten (10) feet deep and twelve (12) inches below the outside of manholes for manholes over ten (10) feet deep. The horizontal limit for rock excavation shall be the outside dimensions of the manhole plus two (2) feet. Payment for rock excavation shall be made at a unit price per cubic yard within the above pay limit dimensions as measured by the Engineer.

When during the course of the work, the Contractor believes that rock has been encountered; they shall immediately notify the Engineer both verbally and in writing. The Engineer shall then make an inspection of the material and make a final decision on whether rock excavation is

required to complete the work. No payment shall be made for rock removed prior to inspection and measurement by the Engineer. The Engineer shall consider alternative measures including the adjustment of line and grade, in lieu of rock excavation.

All rock excavated from the trench shall be considered undesirable backfill and shall be disposed of as specified in Section 3.1. In the event a shortage of material occurs during backfilling due to rock excavation, the Contractor shall provide the necessary material at no additional cost to the City.

Should rock excavation be accomplished only by blasting, the Contractor must first obtain a blasting permit from the City Clerk's Office. The Contractor's method and procedure must conform to State laws, City ordinances, and be approved by the Engineer.

The following information shall be furnished to the City prior to any blasting work taking place:

1. Blasters License; must meet minimum State standards for work intended.
2. Construction Operation Insurance with blasting hazard inclusion. Minimal limits shall be:

Liability:	\$1,000,000.00 per person \$1,000,000.00 per accident
Property Damage:	\$1,000,000.00

503.5 PIPE INSTALLATION

503.5.1 GENERAL

The design and construction of sanitary sewers shall be such that no pipes are constructed under the curb & gutter in a paralleling path. The pipe shall be installed to provide adequate separation to preserve the curb & gutter should the pipe need be exposed by excavation.

Before the start of new sewer construction a sanitary manhole plug shall be installed in the outlet pipe of the downstream manhole. The plug must be installed in the presence of the Resident Project Representative (RPR) and may be removed only in the presence of the RPR. The contractor shall observe that the plug is in place throughout the duration of the project. This plug must be secured with a tie to the manhole steps. The Contractor may only remove the plug after the binder course of pavement is installed. Water that has accumulated in the downstream manhole must be pumped out prior to removal of the plug.

Prior to commencing with pipe laying, the Contractor shall notify the Engineer of the date they intend to begin work. The Contractor shall also supply the Engineer with a detailed construction schedule before pipe installation commences. The Engineer may order the removal and relaying of any pipe installed prior to notification.

The pipe, fittings and accessories shall be of the size, class, type, and design; and shall be laid at the locations and to the required lines and grades; all as shown on the plans, required by the Contract, or directed by the Engineer. Wherever the word "pipe" appears in this Article, it shall be understood to include pipe, fittings, and accessories. The proper installations of structures and fitting, whose locations are shown on the plans and laid out by the Engineer, shall be

accomplished by the use of random lengths of pipe furnished by the Contractor. All field cuts of all types of pipe shall be made with an approved mechanical pipe cutter or with a power saw in order to make a straight, true cut without chipping or cracking the pipe. In the event the Contractor is unable to obtain the pipe specified on the plans or in the Contract, the Contractor shall promptly inform the Engineer, and with the approval of the Engineer, the Contractor will be allowed to furnish and install a larger size pipe. In such case, the additional cost resulting from such substitution shall be at the Contractor's expense and no adjustment in compensation will be allowed.

The laying of pipes in finished trenches shall commence at the lowest point and shall proceed towards the upper end, and the pipe shall be laid so that the spigot or tongue ends point in the direction of flow.

Storm sewer precast manhole & inlet pipe connections shall be constructed using concrete collars with a minimum of 12" of concrete around the entire circumference of the pipe at the pipe/structure connection.

Jointing surfaces shall be carefully cleaned before pipes are lowered into trenches. The pipes shall be lowered so as to avoid unnecessary handling in the trench. Each section shall have a firm bearing throughout its length and shall be true to the line and grade required.

The method of shoving or pulling the pipes together shall be such that there will be no injury to the pipes, and the joints will be properly adjusted and will not be excessively large. The pipes shall be fitted and matched so that when set firmly to line and grade they will form a sewer with a smooth and uniform invert.

After the pipe is installed, lift holes shall be sealed with suitable concrete and mastic, or other approved plugs, as well as an external joint sealer (Mac Wrap or equivalent). External joint sealer shall extend to the spring line of the pipe. Pipes to be used for sanitary sewers shall not contain lift holes.

Sanitary sewer stubs will not be allowed unless approved by the Engineer. Sewers shall be constructed manhole to manhole.

The pipe shall not be laid within ten (10) feet of excavating or within fifty (50) feet of blasting operations. The pipe shall not be laid in water or on frozen trench bottoms, or when, in the opinion of the Engineer, the trench conditions or weather are unsuitable for the proper performance of the work.

No length of pipe shall be laid until the previously laid length of pipe has been sufficiently backfilled to hold it securely in place during the jointing operation. If, in making a joint, any previously laid pipe is disturbed, such pipe shall be removed and relaid. Adequate backfill shall be placed on the pipe to prevent floating. Any pipe that has floated shall be removed and relaid at the expense of the Contractor.

Whenever storm or sanitary sewer crosses over water mains with a resultant of less than five feet of cover in between, then 2-inch polystyrene board insulation should be laid perpendicular to the water main or service and six inches above it.

The Contractor shall furnish suitable lifting and handling devices designed to distribute the weight of the pipe over the length of the pipe and prevent high stresses over small areas.

All water shall be kept completely out of the bell of the pipe until the joint is completed and water shall not be allowed to rise in or about the pipe until the trench is filled at least one (1) foot above the top of the pipe.

Before leaving pipe in the trench unattended for any reason, care must be taken that the unfinished end of the sewer is securely closed with a watertight plug for sanitary sewers and a tightly fitting plug or bulkhead to preclude the entrance of foreign matter into storm pipes. Any earth or other materials that may find entrance into the sewer shall be removed by the Contractor at no additional cost to the City.

503.5.2 BEDDING AND COVER

Prior to lowering the pipe into the trench, the bedding shall be shaped to support and fit the entire bottom quadrant of the pipe. If the pipe is a bell and spigot type, holes shall be made for the bell to prevent the bell from supporting the weight of the pipe and backfill material. The haunches of all pipe shall be adequately supported for the thorough full length of the pipe through thorough working and compacting of the bedding materials along each side of the pipe without disturbing the line and grade of the pipe. All pipe shall be bedded on a minimum of 4 inches of granular material. Granular material, whether existing or hauled in, shall meet the requirements of the following gradations for Bedding and Cover Material and shall be subject to approval of the Engineer.

PERCENTAGE BY WEIGHT PASSING

Gradation	1	2	3	4	5
Sieve No.	Crushed Stone Aggregate	Crushed Stone Chips	Crushed Gravel Aggregate	Crushed Stone Screenings	Fine Aggregate
1"	100	-	100	-	-
3/4"	90-100	100	90-100	-	-
1/2"	-	90-10	-	100	-
3/8"	20-55	40-70	20-55	90-100	100
No. 4	0-10	0-15	0-10	-	95-100
No. 8	0-5	0-5	-	0-15	80-100
No. 16	-	-	-	-	50-85
No. 30	-	-	-	0-15	25-60
No. 50	-	-	-	-	10-30
No. 100	-	-	-	-	2-10

Bedding material of Gradation 1, 2, or 3 shall be used for all pipe sizes over ten (10) inches in diameter, and for smaller sizes when directed by the Engineer. (See Sanitary Laterals for stone size). With the approval of the Engineer, the maximum size of the washed gravel or crushed stone may be increased.

The cost of bedding, including excavation for bedding material and bedding material furnished and compacted in place, shall be included in the unit bid price for sanitary and storm sewer pipe complete, and in place and the Contractor shall not be paid separately therefore.

All flexible or semi-rigid pipe (PVC, ABS, Composite Pipe) corrugated polyethylene pipe shall be bedded according to Class "B" bedding requirements. All rigid sewer pipe (vitrified clay, concrete, ductile iron, and cast iron) shall be bedded according to Class "C" bedding

requirements, except at manhole connections and as otherwise directed in the Special Provisions or plans.

If the pipe to be installed is at or below the groundwater elevation as determined by the Engineer, Gradation number one (1), two (2), or three (3) shown above shall be used as Cover Material. In dry trench conditions, gradation number four (4) or five (5) may be used as Cover Material.

503.5.3 HORIZONTAL AND VERTICAL ALIGNMENT REQUIREMENTS

The Contractor may elect to use a laser beam for alignment and grade, subject to checking the work against grade stakes provided by the Engineer. Discrepancies from grade sheet elevations of more than 0.05 feet for storm sewer and 0.02 feet for sanitary sewer shall be corrected by removing and relaying pipe back to the point where the error first occurred. Discrepancies in alignment shall be tolerated when the total left to right error does not exceed one tenth (1/10) of the nominal internal pipe diameter. The pipe with discrepancies in excess of this shall be removed to the point where the discrepancy is within the tolerances and relaid at the Contractor's sole expense.

Whenever sewers in excess of seventy-five (75) feet are installed using laser alignment, adequate blower capacity shall be required to ventilate the pipe.

503.5.4 UNDERCUT AND SPECIAL BEDDING

The Engineer reserves the right to order additional excavation where unsuitable foundations exist. When this condition exists, the subgrade shall be undercut as directed by the Engineer. The undercut subgrade shall then be brought back up to the required grade by backfilling with bedding material approved by the Engineer. Backfill material shall meet the requirements of bedding materials for Gradation #1, 2 or 3.

The Contractor shall only be paid for undercut and special bedding if ordered by the Engineer. No payment will be made for unsuitable conditions that result from the Contractor's failure to adequately dewater or otherwise prepare the trenches.

503.5.5 CONCRETE CRADLE OR ENCASEMENT

If in the opinion of the Engineer, soil conditions warrant, concrete cradles or encasements shall be required. Excavation shall be carried below the normal grade line to allow for the required bedding material or blocking, plus a minimum of 6 inches of concrete under the pipe. In the case of a cradle, the concrete shall be placed up to the spring line of the pipe. In the case of an encasement, the concrete shall be a minimum of 6 inches all around the pipe. Concrete shall have a minimum of 3000 PSI compressive strength with the mix design approved by the Engineer prior to use.

503.6 BACKFILLING

Unless otherwise provided, all trenches and excavations shall be backfilled immediately after the sewers and appurtenances have been constructed therein. In covering the sewers and filling around structures, the backfill material shall be brought up evenly on all sides so that no unbalanced pressure is brought to bear upon the pipe and masonry.

After bedding and covering the pipe as required by the Bedding and Cover Specification the trench shall be backfilled with material approved by the Engineer. Unless otherwise specified or

directed by the Engineer, the Contractor shall backfill trenches and other excavations with materials excavated in the course of the work. Vegetation and stones or fragments of broken rock in excess of 6 inches in diameter in any dimension shall not be allowed within 36" of the top of the pipe. Frozen material shall not be used for backfilling, and shall be replaced with suitable material at no additional cost. Twelve inch in diameter or larger boulders shall not be allowed in the trench.

Whenever specified in the Contract or plans, or directed by the Engineer, the trenches and other excavations shall be backfilled with Granular Backfill. Granular backfilling shall consist of durable particles ranging from fine to coarse in a substantially uniform combination. Granular Backfill shall conform to the Gradation Specifications for Granular Backfill located in Section 502 of these specifications. Crushed stone screenings shall not be used as backfill material.

Granular Backfill when ordered by the Engineer will be paid for by unit price bid per ton. Granular Backfill will not be paid for if required due to Contractors negligence.

The Contractor shall be required to backfill all excavations to the original ground elevation unless otherwise specified in the Contract or ordered by the Engineer. In the event of a shortage of material to perform this work, including replacement as may be required by rock excavation or removal of boulders, the Contractor shall provide the necessary material at no additional cost to the City.

503.7 LATERALS

503.7.1 SANITARY LATERALS

Whenever shown on the plan, or directed by the Engineer, the Contractor shall install sanitary sewer laterals. Installation of sanitary sewer laterals shall comply with all the requirements set forth herein for the installation of the sewer main, including excavation, backfilling, laying and jointing pipe. Sanitary laterals shall be bedded with $\frac{3}{4}$ " clear stone unless otherwise approved by the City Engineer. Over-excavated areas shall be brought up to pipe subgrade with $\frac{3}{4}$ " clear, unless otherwise approved by City Engineer. The lateral type installed shall be approved by the Engineer, and as shown in drawing No. 5-2. Sanitary sewer laterals shall be laid with a maximum grade of one-half ($\frac{1}{2}$) inch per foot and a minimum grade of one-fourth ($\frac{1}{4}$) inch per foot. Unless otherwise specified, the sanitary sewer laterals shall be four (4) inches in diameter, and shall be of the same material as the sewer main pipe. Where laterals are to be connected to risers the Contractor shall furnish and install the required fittings.

Laterals shall extend from the sewer main to the property line, to the edge of the easement, to the construction limits, or as directed by the Engineer. In locations where sidewalks or walkways exist, laterals shall extend five (5) feet beyond the edge of the pavement.

All laterals shall be installed 10 feet deep at the property line, unless otherwise directed by the Engineer. If the sewer main is shallower than 10 foot deep, the lateral shall be laid at 1/4 inch per foot to achieve the maximum depth possible at the property line. Laterals shall remain exposed until witnessed by inspector.

Approved cleanouts are required in four (4) and six (6) inch laterals exceeding one hundred (100) feet.

When connecting to existing sewer laterals, the fernco shall be set on a 4" x 8" x 16" concrete block, or equivalent. Costs for blocks shall be included in the UNIT Bid Prices.

All ends of laterals or wyes shall be marked, plugged, and backfilled and compacted with granular material. All plugs shall be manufactured for the type of pipe material used, and shall be watertight. Plugs or caps must be capable of withstanding test pressures, and be properly backfilled against original ground. The ends of the lateral shall be marked with a 4-foot 2" x 4" at the trench bottom and again at the finished surface protruding 2 feet above the finished grade, and painted fluorescent green unless determined by the Engineer to be in a location unsuitable for such marking.

The top of the curb shall be stamped with an "S" stamp at the location of the sanitary lateral crossing. The City of Sun Prairie Water Pollution Control Facility will provide one stamp to each concrete contractor to perform this work. Contractors will be responsible for obtaining additional "S" stamps. The additional "S" stamp shall be the same size and shape as the stamps provided by the City and must be approved by the City. The top of the curb at the location of the stamp shall be painted green.

The Contractor shall be responsible for keeping a complete and accurate written report of the wye location, lateral location, length, size and depth. The information shall be kept on cards provided by the City, and shall remain the property of the City of Sun Prairie.

When coring lateral openings into existing concrete, clay or PVC pipe, the cored piece shall be removed from the pipe.

Lateral connections made into existing pipe shall use the following saddles:

- Concrete pipe: Kor-N-Tee Saddle – (6" S006-7B), or approved equal.
- Clay pipe: The LMK Saddle by LMK Technologies, or approved equal.
- PVC pipe: The LMK Saddle by LMK Technologies, or approved equal.
- Fold & Foam liners and pipe bursting, CIPP liners, and PVC folded Liners: The LMT Saddle by LMK Technologies, or approved equal.

All saddles shall be installed per manufacturer's specifications.

503.7.2 STORM LATERALS

Whenever shown on the plan, or directed by the Engineer, the Contractor shall install storm sewer laterals. Installation of storm sewer laterals shall comply with all the requirements set forth herein for the installation of the sewer main, including excavation, backfilling, laying and jointing pipe.

The lateral type installed shall be approved by the Engineer, and as shown in drawing No. 5-3. Storm sewer laterals shall be laid with a minimum grade of one-eighth (1/8) inch per foot. Unless otherwise specified, the storm sewer laterals shall be four (4) inches in diameter. The lateral shall remain exposed until witnessed by inspector.

The entire storm lateral shall be insulated at all locations where with less than 5 ft. of cover exists, (4'x8'x2" Insulation or box-in method allowed) as shown in drawing No. 5-3.

The lateral cleanout shall be installed 1' past the property line, or as directed by the Engineer, and as shown in drawing No. 5-3 and No. 5-4. Connection to existing sump line shall be 3' past the R.O.W.

All laterals shall be plugged, marked, backfilled and compacted with granular material. All plugs shall be manufactured for the type of pipe material used, and shall be watertight. Plugs or caps must be properly backfilled against original ground. The ends of future connected laterals shall

be marked with a 4-foot 2" x 4" at the trench bottom and again at the finished surface protruding 2 feet above the finished grade, and painted fluorescent orange or pink, unless determined by the Engineer to be in a location unsuitable for such marking.

The Contractor shall be responsible for keeping a complete and accurate written report of the wye location, lateral location, length, size and depth. The information shall be kept on cards provided by the City, and shall remain the property of the City of Sun Prairie.

503.8 MANHOLE CONSTRUCTION

503.8.1 GENERAL MANHOLE CONSTRUCTION

a) Unless otherwise approved or directed, all manholes shall be precast reinforced concrete conforming to requirements of the Specification for Precast Concrete Manhole Section, ASTM C 478.

b) Manhole connections to the sewer main shall be as specified in Section 502.5. The manhole shall be installed on a minimum of 6 inches of bedding material conforming to Gradation No. 1 or 2 as specified in Section 503.5.2. With approval from the Engineer, a larger gradation of stone bedding may be used in particular soil conditions.

c) When a field poured manhole base has been approved by the Engineer, the base shall conform to the following specifications. A minimum of 8 inches of concrete shall be poured below the bottom of the outlet sewer. The base section shall be supported by a minimum of three solid concrete blocks prior to pouring base. The concrete blocks shall be placed on a minimum of six inches of stone conforming to Gradations 1 & 2 specified in Section 503.5.2. For manhole depths exceeding 10 feet, the base thickness shall be increased to 12 inches.

d) Manholes shall be constructed to have steps placed above the bench, steps shall not be placed directly over the flow line of the manhole.

e) The contractor, at their expense, shall immediately remove any crushed aggregate or other construction debris entering any structure and/or pipe.

503.8.2 SANITARY SEWER MANHOLE CONSTRUCTION

a) Manholes shall have concrete benches poured to the top of the outlet pipe as a minimum. The bench shall slope toward the trough at a maximum slope of 1/2 inch per foot, and be of 2800 psi minimum 28-day compressive strength.

b) An outside drop in sanitary sewers shall be constructed when the difference between the incoming sewer flow line and outlet sewer spring line is greater than 24 inches. The drop shall be the same diameter as the incoming sewer, unless otherwise specified, and conform to the requirements set forth in Drawing No. 5-9 found in these specifications.

c) Manhole connections shall conform to specifications set forth in Section 502.5.

d) Manhole covers and castings shall conform to specifications set forth in Section 502.7.

e) Manholes shall have maximum chimney height of 4.5 or 7.5 inches in manholes where rings are allowed. Maximum constructed height will determine internal seal to be used. EPP adjusting rings shall be sealed per specifications in 502.5.

f) Joints for sanitary manholes and appurtenances shall be made with a butyl rubber gasket. The material to be used shall be KentSeal, ConSeal, or equal. Butyl rubber gasket shall be installed on the inside and outside ring of the cone and barrel section joints.

g) The Contractor when directed shall make all necessary openings into existing structures, including construction or reconstruction, if the existing inverts are required to serve new connections. Openings made in structures shall conform to specifications set forth in Section 502.5. Further, any sewer pipe extension from the manhole shall be plugged watertight and shall remain plugged until road binder has been installed. The plug shall be a screw plug and said plug shall be secured to manhole steps. The plug shall be installed in the presence of the Engineer and shall only be removed in the presence of the Engineer. Water that has accumulated in the downstream manhole shall be pumped out of the manhole prior to the removal of the plug.

h) Existing manholes adjusted to road grade, shall conform to specifications as set forth in 503.8.2(e).

503.8.3 SANITARY MANHOLES IN STREET LOCATIONS

a) Manholes in street locations that are not in the pavement and are within 100 feet of the paved street shall not be considered remote manholes. These manholes are intended to be included in the pavement when the future phase or subdivision is constructed. The manhole shall be constructed with a one (1) foot barrel section installed below the cone to raise the casting and cone section above grade to prevent infiltration. This one-foot barrel section will be removed when the manhole is reconstructed prior to placing the street pavement. The manhole shall be constructed to accommodate proper street grade when the one-foot barrel section is removed.

The casting shall be placed on the cone section with an all weather precompressed butyl gasket, 3/8" x 3 1/2" between the cone and casting.

503.8.4 SANITARY MANHOLES IN REMOTE LOCATIONS

a) Manhole covers and casting shall be Neenah R-1916-C as specified in Section 502.7.

b) The top of the manhole cone section shall be a minimum of 6 inches above finished grade.

c) Manhole castings shall be mounted directly to the manhole cone. Casting shall be anchored with Rawl Caulk (or equal) concrete anchors and threaded rod.

d) Precompressed E-Z Stik 3/8" x 3 1/2" or equal shall be used between manhole casting and cone section. Additionally, a butyl rubber gasket, as specified in Section 503.8.2(f), shall be installed on inside and outside ring of cone and barrel section joints.

e) Manholes shall be marked with a 2 inch diameter standard weight galvanized steel pipe. The pipe shall be mounted in concrete and shall project a minimum of 10 feet above finished grade. The pipe shall be equipped with a .080 gauge aluminum sign

12 inch by 18 inch with engineer grade reflective surface and the words "Sanitary Sewer" on the surface and two vertical strips of striped reflective tape (4 inches wide) on the back. The sign shall be installed within 4 inches of the top of the pole with two locked bolts.

503.9 BORING OR JACKING

Where required on the drawings or directed by the Engineer, sewers shall be installed by boring or jacking. All operations shall be done in full compliance with State Laws, City Ordinances and requirements of the Engineer.

Casing pipe, when required, shall be not less than 6 inches greater than the maximum outside diameter of the bell of the sewer pipe. All joints in steel casings shall have continuous circumferential welds, and be watertight. All annular spaces between carrier and casing pipes shall be backfilled with blown-in-place sand backfill. If in the opinion of the Engineer soil conditions exist where soil collapse is a possibility, the Contractor shall cement grout the space between the casing pipe and existing soil at no additional cost to the City.

Boring and jacking pits shall be sheeted and braced where required to protect workmen and existing conditions. The Contractor shall comply with all provisions of highway or railroad permits. The Contractor shall furnish all signs, barricades, or lights required by permits or the Engineer. Immediately upon completing the bore, the Contractor shall expose the casing ends and elevations shall be determined. The Engineer shall determine whether the casing elevations are permissible.

The carrier pipe shall be placed in the casing pipe on wooden blocks, or approved equal, located to prevent contact between the bell ends of the carrier pipe and the casing pipe. A minimum of two blocks in two locations on the pipe shall be provided for each length of pipe. Blocks, or approved equal, shall be banded or otherwise adequately attached to each length of pipe. After the sewer pipe has been tested, the annular space between the carrier and casing pipes shall be blown full of sand, blowing in from both ends of the casing when possible. After the Engineer has inspected the finished operation, both ends of the casing shall be bulk headed or sealed with cement grout.

In the event a casing pipe must be withdrawn for reboring, the void created shall be filled with grout prior to reboring.

Costs for hand tunneling under existing utilities such as gas, water, electric, sewers, trees, or other obstructions or improvements shall be included in the Contractor's other unit prices and shall not be paid separately therefore.

503.10 ABANDONED ACCESS STRUCTURES

Abandoned access structures shall be removed to a depth of three feet below the proposed or existing street grade, whichever is lower, or the grade called for on the plans, and filled with sand compacted to 95% maximum density. All castings on such abandoned structures are the property of the City of Sun Prairie and shall be salvaged by the Contractor and delivered to the City Garage, by the Contractor.

Abandoned access structures shall be measured as units. The Contract unit price for abandoning access structures shall be payment in full for breaking down, removing, or sealing; for disposal of materials; for backfilling; for furnishing any required concrete masonry; and for

furnishing all labor, tools, equipment and incidentals necessary to complete the item of work in accordance with the requirements of the Contract documents.

All inlets to and outlets from existing structures shall be sealed by filling them with concrete.

Service shall be maintained in such structures until the Engineer orders the bulkheads placed and the manholes and catch basins abandoned.

503.11 EXPLORATORY EXCAVATIONS

When directed by the Engineer, the Contractor shall excavate and explore underground utilities or structures well in advance of the construction. The grades of the potential conflict shall be determined by the Engineer. The Contractor shall then backfill and maintain the openings. All costs for this work shall be included in the Contract unit price for Exploratory Excavations when included in the Bid Form, and when not included, in other unit prices.

503.12 PAVEMENT REMOVAL AND REPLACEMENT

The Contractor, as part of normal trench excavation, shall remove all pavements and road surfaces as called for regardless of thickness, depth or number of courses encountered. The pavement removed shall be as minimal as possible for safe sewer and sewer appurtenance installation.

All pavements shall be saw cut prior to excavation procedures to prevent damage to the pavement outside the construction limits. Upon completion of the excavation/installation procedure, the Contractor shall saw the pavement as directed by the Engineer to neat, straight lines. Pavement damaged beyond the original pavement cut shall be saw cut, removed and replaced at the expense of the Contractor.

In locations where it is necessary to excavate through concrete pavement, the concrete shall be sawed and carefully removed to the limits specified so as not to damage or disturb the adjacent pavement. Damages to the pavement beyond this limit shall be replaced at the Contractor's expense.

Where concrete, bituminous, or base course is to be replaced, the work and materials shall be in full accordance with the Standard of the City of Sun Prairie.

The Contractor shall maintain all street surfaces until final acceptance of the work.

503.13 TRAFFIC CONTROL

The Contractor shall provide for the maintenance of traffic over or along the street while undergoing improvements or reconstruction, the street shall be kept open to all traffic and the Contractor shall keep the portions of the street being used by public traffic in such condition that traffic will be reasonably and adequately accommodated. The Contractor shall provide and maintain in safe and adequate condition temporary approaches, crossings and intersections with roads and necessary driveways. The Contractor shall bear all of the expense of maintaining traffic over the section of street undergoing improvement and the construction and maintenance of such approaches, crossings, intersections and other features as may be necessary without direct compensation except as to those features of such work which are a part of planned, completed construction work.

All Contractors on City Contracts shall give the Police and Fire Department a minimum of 48 hours notice (excluding holidays and the weekend) of their intent to begin work on any City street. The same notice shall be given to the Wisconsin Department of Transportation and Dane County when work is to be performed on their respective highways. Further notice shall be given of any major change in project scheduling following the initial notification. If approved by the Engineer, and a detour is to be used during the life of a project, then the notice shall be 72 hours.

The Contractor shall not at any time close any street to the public except by express permission of the Engineer. When closing a street is provided for in the Contract or when the character of the work as determined by the Engineer makes it necessary that a street or portion thereof be closed to traffic, the Contractor shall notify the Engineer at the earliest possible date so that arrangements may be made for closing the street and providing detours if possible.

The Contractor shall not in any manner unnecessarily obstruct the streets or crossings, and shall at all times and under all circumstances provide safe and sufficient means for foot passengers and vehicles.

The Contractor shall furnish, erect, and maintain for the life of the Contract all barricades, warning signs, and flagging, and remove them at the completion of the project. This work shall be done in accordance with the current addition of the Manual on Uniform Traffic Control Devices, and as directed by the Engineer. The Contractor will be held responsible for all damages to the work due to failure of barricades, signs, lights, flag persons and watchpersons to protect it and, whenever evidence of such damage is found prior to acceptance, the Engineer may order the damaged portion immediately removed and replaced by the Contractor at the Contractor's own cost.

The Contractor shall not open any streets or portions thereof to traffic that have been previously closed to traffic until so directed or authorized by the Engineer. Whenever all of the work or any portion thereof is in acceptable condition for travel, such sections shall be opened to traffic as may be approved by the Engineer. Such openings shall not be construed as assumption of the maintenance by the City unless otherwise specifically provided, nor as an acceptance of the roadway or any part of it, nor as a waiver of any of the provisions of the Specifications and Contract.

503.14 RESTORATION

Restoration shall proceed concurrently with the installation of sewers and appurtenances. Where trees, shrubbery, fences, mailboxes, or private properties, etc. have been removed or disturbed by the Contractor, whether intentionally as part of the work or through the Contractor's negligence, such property shall be replaced or repaired at the expense of the Contractor.

Where work is to be done on rights-of-way or easements, the Contractor shall confine their operations to those limits, unless otherwise directed by the Engineer. Restoration shall be performed in full compliance with the RESTORATION specifications of this Contract.

SECTION 504 - MEASUREMENT AND PAYMENT

504.1 GENERAL

Only that work which is completed and accepted in accordance with the Contract will be measured for payment.

The Contract prices for various items shall include all equipment, tools, labor, and incidentals necessary to complete the work as specified.

504.2 SANITARY SEWER

Sanitary sewers shall be measured by length in feet of each of the various types, classes and sizes of pipe installed at the various depths, measured along the center line of the pipe from center of manhole to center of manhole including junctions and fittings. The depths of installation shall be measured in feet from the invert of the sewer pipe to the elevation of the existing ground. There shall be no deductions from the measured lengths for wyes or other fittings.

The Contract price shall include furnishing all materials necessary to perform the work; excavation of the trench, except boring and jacking; installation and removal of sheeting and bracing; dewatering the trench; disposal of surplus material from the trench; backfilling the trench and compaction of the backfill material; embankment over the sewer using surplus material from the excavation of the trench; bedding and covering the pipe; laying the pipe and installing the fittings and accessories; jointing and sealing of joints in pipe, fittings and accessories; connections to existing structures; cleaning out the sewer; restoring the site; preparation and testing of pipe; and all other work incidental to the installation of sanitary sewers.

504.3 SANITARY SEWER MANHOLES

Sanitary sewer manholes shall be measured separately as units of each or by vertical foot of the various types and sizes of each installed at the various depths. The depths of installation shall be measured in feet from the invert of the lowest outlet pipe to the top of the cast-iron manhole frame.

The Contract price shall include furnishing all materials, including castings, necessary to perform the work; excavation; installation and removal of sheeting and bracing; the excavation; disposal of surplus material from the excavation; backfilling the excavation and compaction of the backfill material; preparation of the foundation; construction of the structure, including connections; cleaning out the structure; restoring the site; and all other work incidental to the installation of sanitary sewer manholes.

504.4 SANITARY SEWER DROP MANHOLES

Sanitary drop manholes shall be measured separately as units of each or by the vertical foot of the various sizes of each installation. The Contract price shall include furnishing all materials, labor, and equipment to perform the work; excavation; installation and removal of sheeting and bracing; dewatering the excavation; disposal of surplus material from the excavation; backfilling the excavation and compaction of the backfill material, all in accordance with Drawing No. A-3 found in these Specifications.

504.5 SANITARY SEWER LATERALS

Sanitary sewer laterals shall be measured by length in feet of each of the various types, classes and sizes of pipe installed, measured along the center line of the pipe from the center of the sewer main at the wye to the end of the lateral pipe, or from the top of the riser to the end of the lateral pipe, whichever the case may be.

The Contract price shall include furnishing all materials necessary to perform the work, including the wye and all required fittings where laterals are connected to risers; excavation of the trench; installation and removal of sheeting and bracing; dewatering, the trench; backfilling the trench; and compaction of the backfill material; bedding and covering the pipe; laying the pipe and installing the fittings; jointing and sealing of joints in pipe and fittings; encasement, where specified; cleaning out the lateral; restoring the site; and all other work incidental to the installation of sanitary sewer laterals.

Where a wye only is to be installed, the wye shall be measured separately and be paid at the unit price bid for various sized wyes.

Lots designated for a duplex building require two laterals.

504.6 SANITARY SEWER RISERS

Sanitary sewer risers shall be measured by length in vertical feet of each of the various types and sizes installed, measured from the invert of the sewer main to the top of the riser. Installation Types 2, 3, and 4 as seen on Drawing No. 5-2 are **not** considered risers.

Risers shall not be installed unless so directed by the Engineer. Installation procedures shall be subject to approval by the Engineer.

504.7 STORM SEWERS AND LATERALS

Storm sewers shall be measured by length in feet of each of the various types, classes and sizes of pipe installed, measured along the centerline of the pipe, center to center of junctions and fittings. The quantity to be paid shall include the lengths of construction through manholes, catch basins, apron end walls, inlets and other structures, unless the storm main is greater than 36 inches in diameter or when special fittings are paid for separately in the Bid Form. In such cases the measured length shall be from inside edge of structure to inside edge of structure. There shall be no deductions from the measured lengths for the installations of wyes, tees, angle-sections and special sections in storm mains required to join pipes of dissimilar sizes, shapes and types unless special fittings are paid for separately in the Bid Form. For inlet leads, the measurement shall be from centerline of wye or manhole, to the center of the inlet unless the storm main is greater than 36 inches in diameter, in which case the measurement is made to the inside wall of the structure.

Storm sewer laterals shall be measured by length in feet of each of the various types, classes and sizes of pipe installed, measured along the center line of the pipe from the center of the sewer main at the wye to the end of the lateral pipe.

The Contract price shall include all materials necessary to perform the work, including fittings and accessories, including wyes, tees, angle-sections and special precast sections required to join pipes of dissimilar sizes, shapes and types and apron end walls; excavation of the trench, except tunneling and jacking; installation and removal of sheeting and bracing; dewatering the trench;

disposal of surplus material from the trench; backfilling the trench and compaction of the backfill material; embankment over the sewer using surplus material from the excavation of the trench; bedding the pipe; laying the pipe and installing the fittings, accessories, wyes, tees, angle-sections and special sections, fittings, accessories, wyes, tees, angle-sections and special sections; encasement, where specified; connections to existing structures when not separated in the Bid form; cleaning out the sewer, restoring the site; and all other work incidental to the installation of storm sewers.

504.8 STORM SEWER MANHOLES, CATCH BASINS AND INLETS

Storm sewer manholes, catch basins and inlets shall be measured separately as units of each of the various types and sizes of each installed.

The Contract price shall include furnishing all materials, including castings and covers necessary to perform the work; excavation; installation and removal of sheeting and bracing; dewatering the excavation; disposal of surplus material from the excavation; backfilling the excavation; backfilling the excavation and compaction of the backfill material; preparation of the foundation; construction of the structure, including connections; cleaning out the structure; restoring the site; and all other work incidental to the installation of storm sewer manholes, catch basins and inlets.

Double inlets on continuous grades shall be separated by a distance of 6 to 20 feet, depending on longitudinal grade and cross-slope, to allow flow to return to the curb face.

All storm sewer inlets shall have a 13" sump. Storm sewer manholes require no sump. The structures shall be set on a minimum of 6 inches of clear stone as illustrated in detail drawing 5-10. Exits shall have all voids neatly filled with concrete to provide a smooth, gradual entrance to the pipe. All exits shall have sufficient concrete all the way around the pipe forming the shape of a funnel. (Mortar will not be allowed). Exterior openings shall be sealed with a 12" concrete collar around the entire pipe circumference.

504.9 BORING AND JACKING SEWER PIPE

Unless otherwise called for in the Special Provisions, the work shall be paid for at the unit price bid per linear foot.

The cost shall include furnishing all materials, labor, equipment and barricading necessary for completion of the work. All sheeting, bracing, casing pipe, filling the casing, and other materials required in the work, and left in place, shall be included in the unit price bid.

504.10 CONCRETE CRADLE OR ENCASEMENT

Concrete cradle or encasement shall be measured by length in feet for each of the various types and sizes of pipe, and at the unit price bid, and shall be in addition to the price bid for sewer main.

The Contract price bid shall include forming, sheeting, excavation and all materials necessary for installation for construction in accordance with specifications, and as shown on the detailed drawing for Bedding Standards.

504.11 ROCK EXCAVATION

Rock excavation shall be measured in the field and the volume in cubic yards shall be computed from those measurements. The vertical measurements shall extend from the surface of the rock

to an elevation six (6) inches below the bottom of the pipe or structure; the horizontal measurements shall be limited to the outside width of the pipe or structure plus two (2) feet. Boulders three-quarters (3/4) cubic yard or more in volume shall be measured individually and the volume of each boulder computed from average dimensions taken in three directions.

Rock excavation for manholes shall be determined by the size of the manhole to be installed. The vertical measurement shall extend from the surface of the rock to an elevation of eight (8) inches below the outside of the sewer for manholes up to ten (10) feet deep and twelve (12) inches below the outside of the sewer for manholes over ten (10) feet deep. The horizontal measurements shall be limited to the outside dimension of the manhole plus two (2) feet.

The Contract price shall include excavation of the rock; disposal of surplus material from the excavation; replacement with approved material of any shortage of backfill material resulting from rock excavation; and all other work incidental to rock excavation.

504.12 ABANDONED MANHOLES, CATCHBASINS AND PIPES

Abandoned structures shall be measured as units of each, regardless of structure size. The Contract price shall include furnishing all labor, material, excavation, backfill material, compaction, and incidental work necessary to complete the work in full compliance with Section 503.10 of these Specifications. Pipes that are specified to be abandoned shall be filled completely with a flowable fill, unless otherwise specified by the City Engineer.

504.13 EXPLORATORY EXCAVATIONS

The Contractor, when ordered by the Engineer, shall make exploratory excavations. Exploratory excavations, when included in the Bid Form, shall be measured separately as units of each opening. The Contract price shall include the excavation required to expose the utility structure, backfilling the excavation and compaction of the backfill material; permanently or temporarily restoring and maintaining the site as necessary; and all other work incidental to the excavation and backfilling of openings.

504.14 UNDERCUT AND SPECIAL BEDDING

When directed by the Engineer, additional excavation shall be made in areas where unstable or unacceptable foundations exist. This shall not include unstable conditions created by the Contractor's negligence in removing standing water or in dewatering excavations, in which no additional payment will be made. Undercut excavation shall be measured in the field and the volume in cubic yards computed. The maximum width of the additional excavation shall be the outside dimension of the pipe or structure plus two feet, plus the amount necessary should sheeting or bracing be used.

The Contract price shall include excavation; installation and removal of sheeting and bracing; dewatering the excavation; disposal of surplus material from the excavation; and furnishing, placing and compacting the specified bedding material required to replace the materials excavated.

504.15 GRANULAR BACKFILL

Granular backfill shall only be paid for when ordered by the Engineer, and shall be in accordance with Section 502.8. Granular backfill shall be paid for at the unit price per ton bid, or as directed in the contract documents.

The Contract price shall include furnishing, hauling, placing and compacting the specified material; and disposal of surplus material from the excavation displaced by the granular backfill.

504.16 TRAFFIC CONTROL

When included in the Contract as a separate item of work, traffic control shall be measured for payment as a single complete unit of work, and shall be in full accordance with the State of Wisconsin Division of Highway, Manual of Traffic Control Devices. The Contract price shall include furnishing all materials, labor, tools, equipment and incidentals necessary to perform the work; constructing, assembling, painting, hauling, erecting, re-erecting, maintaining and removing traffic signs, barricades and other control devices; furnishing, placing, maintaining and removing lights and signals, including the fuel or power therefor; supplying and performing all flagging and guidance services; furnishing, applying and removing pavement marking, unless otherwise provided; and all other work incidental to Traffic Control. The Contract lump sum shall be payable to the Contractor when so specified in the Bid Form.

When the Contract does not include a separate Contract item for Traffic Control, then all the work herein before prescribed, required and performed will not be separately measured for payment, but will be considered incidental to other items in the Contract.

504.17 RESTORATION

When included in the Contract as a separate item of work, restoration shall be measured for payment as a single complete unit of work unless otherwise labeled on the Bid Form. When the Contract does not include a separate Contract item for Restoration, all work required to be performed shall be considered incidental to other items in the Contract.

SECTION 505 – FORCEMAIN

505.1 GENERAL

Provide forcemain, appurtenances, and testing as shown and as specified for a complete, operating system.

505.2 ABBREVIATIONS

ANSI – American National Standards Institute
ASTM – American Society for Testing and Materials
AWWA – American Water Works Association

505.3 SUBMITTALS

- A. Upon request, submit three certified copies of test and inspection reports in accordance with ASTM and AWWA standards covering hydrostatic tests, physical and chemical properties, and coating analysis.
- B. Accurately record locations of fittings and field changes. Prior to substantial completion, deliver record drawings to Engineer.

505.4 MATERIAL HANDLING

Carefully unload and store pipe to prevent damage to pipe or surface coatings. Pipes shall not be skidded upon ground. Repair damage to pipe coatings to satisfaction of the engineer.

505.5 PRODUCTS AND MATERIALS

505.5.1 PIPE

Note: PVC and HDPE pipe to be considered on a case by case basis. Subject to approval by City Engineer.

- A. All force main 4 inches or larger shall meet the following minimum requirements:
 - 1. Ductile Iron Pipe. Pipe shall meet the requirements of ANSI/AWWA C151/A21.51, Class 52. Standard cement-mortar lining shall meet the requirements of ANSI/AWWA C104/A21.04.
 - 2. Polyvinyl Chloride Pipe. Pipe shall meet the requirements of ANSI/AWWA C900/A29.00, Pressure Class (PC) 150, minimum, or ASTM D2241, Pressure Rating (PR) 250, minimum; and a SDR 18 or less.
 - 3. High Density Polyethylene Pipe (HDPE) DIPS Size. Polyethylene pipe shall conform to the requirements of ASTM F714 and AWWA C906-99. Pipe shall be PE3408, HDPE Class 160, DR11, and have outside diameters similar to ANSI A-21.51 ductile iron pipe. Ends shall be plain for butt fuse joining.
 - 4. High Density Polyethylene Pipe (HDPE) IPS Size. Polyethylene pipe shall conform to the requirements of ASTM F714 and AWWA C906-99. Pipe shall be PE3408, HDPE Class 160, DR11, and have outside diameters similar to iron pipe. Ends shall be plain for butt fuse joining.
- B. All forcemain less than 4 inches in diameter shall meet the following minimum requirements.
 - 1. Polyvinyl Chloride Pipe. Pipe shall conform with ASTM D1784 and meet the requirements of PVC 12454-B, 12454-C or 14333-D. Manufacture shall conform with ASTM D2241 for SDR-21, Pressure Rating (PR) 200.
 - 2. Polyethylene Pipe. Pipe shall meet the requirements of ASTM D2239 or D3035 and shall have a minimum working pressure of 160 psi. Ends shall be plain for butt fusing.

505.5.2 FITTINGS

- A. All fittings for forcemain 4 inches in diameter or larger shall meet the following minimum requirements:
 - 1. Full body fittings shall conform to ANSI/AWWA C110/A21.10 and ANSI/ AWWA C111/A21.11 with bituminous coating. Standard cement mortar lining shall conform to ANSI/AWWA C104/A21.4. Compact fittings shall conform to ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/A21.11 with bituminous coating standard cement mortar lining shall conform to ANSI/AWWA C104/A21.4. Only ductile iron compact fittings manufactured in North America shall be allowed.
 - 2. Polyvinyl Chloride Pipe. Full body ductile iron fittings shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11 with bituminous coating. Standard cement mortar lining shall conform to ANSI/AWWA C104/A21.4. Compact fittings shall conform to ANSI/AWWA C153/A21.53 and ANSI/ AWWA C111/A21.11 with bituminous coating standard cement mortar lining

shall conform to ANSI/AWWA C104/A21.4. Only ductile iron compact fittings manufactured in North America shall be allowed. No PVC fittings will be allowed.

3. High Density Polyethylene (HDPE). Fittings may be molded or custom fabricated. Molded fittings shall be manufactured in accordance with ASTM D3261. Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, sheet stock or molded fittings. All fittings shall be tested in accordance with AWWA C906. All fittings and custom fabrications shall be pressure rated for the same internal pressure rating of the mating pipe. Fittings shall have IPS or DIPS diameter to match the mating pipe. Ends shall be plain for butt fuse joining.

- B. All fittings for forcemain less than 4 inches in diameter shall meet the following minimum requirements:
 - 1. Polyvinyl Chloride Pipe. Fittings shall conform with ASTM D2464 or ASTM D2466 or ASTM D2467.
 - 2. Polyethylene Pipe. Fittings shall conform with ASTM D2239 or D3035 and shall have a minimum working pressure of 160 psi. Ends shall be plain for butt fusing.

505.5.3 JOINTS

- A. All joints for pressure pipe 4 inches in diameter or larger shall meet the following minimum requirements:
 - 1. Ductile Iron Pipe. Joints shall be either push-on or mechanical joint conforming to ANSI/AWWA C111/A21.11 unless specified otherwise. All joints, fittings, etc., shall be equipped to provide electric continuity. The continuity must be provided through the use of a trademarked, well established method acceptable to the Engineer.
 - 2. Polyvinyl Chloride Pipe. Joints shall be push-on type employing elastomeric seals (rubber gaskets) and conform to ASTM D3139.
 - 3. High Density Polyethylene Pipe (HDPE). Joints shall be butt fusion meeting the requirements of ASTM D3261. Electro fusion meeting the requirements of ASTM F1055 shall be used where necessary for pipe coupling or where approved by the Engineer.
- B. All joints for pressure pipe less than 4 inches in diameter shall meet the following minimum requirements:
 - 1. Polyvinyl Chloride Pipe. Joints shall conform to ASTM D2855 or ASTM D3139. Solvent weld or elastomeric seals will be acceptable.
 - 2. Polyethylene Pipe. Joints shall be butt fusion meeting the requirements of ASTM D3261. Electro fusion meeting the requirements of ASTM F1055 shall be used where necessary for pipe coupling or where approved by the engineer.

505.5.4 HDPE BY MECHANICAL JOINT ADAPTERS

- A. The HDPE by MJ Adapters shall be manufactured by Central Plastics Company or equal. The adapter shall comply with AWWA C906 and be manufactured for use on pipe conforming ASTM D2513, D3035, F714. The adapter shall be molded from a PPI and NSF listed pre-blended virgin resin in accordance with the material specifications listed in ASTM D3350 with a cell classification of 34f464C and be compatible for heat fusion with any pipe manufactured from a like or similar resin.
 - 1. Adapters shall be tested according to ASTM D1599 and ASTM D1598.

2. HDPE Adapters shall match the mating pipe size.
3. Adapters shall have a pressure rating equal to that of the mating pipe.
4. Adapters shall be used for all transitions from HDPE to valves or ductile iron pipe.
5. Adapters must provide thrust restraint.

505.5.5 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be polyethylene film tube conforming to ANSI/AWWA C105/A21.5. Polyethylene film sheet conforming to ANSI/AWWA C105/A21.5 may be used at odd-shaped appurtenances where the use of tube is not practical.
- B. The polyethylene film shall be clearly marked with the information required in ANSI/AWWA C105/A21.5.

505.5.6 INSULATION

- A. Insulation shall be extruded polystyrene insulation (25 psi) conforming to ASTM C578, Type IV, in 4 foot x 8 foot sheets with minimum thickness of 2 inches.

505.6 CONSTRUCTION METHODS

505.6.1 GENERAL

- A. All construction shall be done in conformance with ANSI/AWWA C600/A26.00 and ANSI/AWWA C900/A29.00, except as modified herein.

505.6.2 EXCAVATION

- A. All excavation shall be done in conformance with Section 503.1 and 503.4

505.6.3 FIELD INSPECTION OF MATERIALS

- A. Before lowering and while suspended, the pipe or fittings shall be inspected for defects. All materials used in the work must pass field inspection.

505.6.4 DIRECTION OF LAYING

- A. Unless otherwise ordered, pipe shall be laid with the bell ends facing the direction of laying. When the grade exceeds 30 feet of rise per one hundred feet of trench, the bells shall be face upgrade.

505.6.5 INSTALLATION

- A. The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench.
- B. Extreme care shall be exercised by the Contractor in handling all pipe, fittings and special castings so as to prevent breakage. Under no circumstances shall they be dropped into the trench or so handled as to receive hard blows or jolts when being moved.

505.6.6 JOINING OF PIPE

- A. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe.
- B. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

505.6.7 CUTTING OF PIPE

- A. Pipe shall be cut at right angles to the centerline of the pipe. Cutting shall be done in a neat workmanlike manner without damage to the pipe and so as to leave a smooth end.
- B. All pipes shall be cut with an approved mechanical cutter. The cut end of a pipe to be used with rubber gasket joints shall be tapered by grinding or filing about 1/8 inch back at an angle of approximately 30 degrees with the centerline of the pipe, and any sharp or rough edges shall be removed.

505.6.8 OBSTRUCTIONS IN LINE OR GRADE

- A. Whenever it becomes necessary to lay a main over, under or around a known obstruction, the Contractor will furnish and install the required fittings. The laying of such fittings will be paid for at the unit price bid for each size of main. No additional compensation will be paid to the Contractor for any expenses incurred because of such obstruction.
- B. When an unknown underground structure interferes with the work to such an extent that an alteration of the plan is required, the Contractor shall notify the engineer immediately.

505.6.9 THRUST RESTRAINT

- A. Thrust restraint is required for all bends, caps, plugs, tees, and valves adjacent to tees. Thrust restraint shall be provided by use of concrete buttresses or joint restraint.
- B. Concrete buttresses shall be poured against firm, undisturbed ground. When concrete buttresses cannot be placed against undisturbed ground they shall be placed against fill material of composition conforming to the requirements of ASTM C12 or ASTM D2321 as applicable for rigid and flexible pipe respectively, compacted to 95 percent of the modified proctor density for the material. The buttresses shall be constructed to the minimum dimensions as shown on the contract drawings or as required by the Engineer. All buttresses shall be formed to keep the joints free of concrete.

- C. Solid precast concrete blocks may be used in lieu of the poured buttresses when approved by the Engineer. When concrete blocks are used, they shall be stepped-out to match the minimum dimensions required for poured concrete buttresses.
- D. Ductile iron or PVC pipe connecting to HDPE pipe must be restrained a sufficient distance upstream to prevent joint separation due to contraction of the HDPE pipe. The minimum length of restrained pipe required shall be as shown on the contract drawings or as specified in Special Provisions. If no minimum length for restrained joints is specified, the Contractor shall submit the restrained joint calculations to the Engineer for review prior to construction.
- E. Restrained joint fittings may be used in lieu of concrete buttresses. When restrained joint fittings are used, a sufficient length of pipe on each side of the fitting shall be restrained to resist the thrust forces. The minimum length of restrained pipe required shall be as shown on the contract drawings or as specified in Special Provisions. If no minimum length for restrained joints is specified, the Contractor shall submit the restrained joint calculations to the Engineer for review prior to construction.
- F. Thrust restraint is not required for HDPE mains with HDPE fittings except where transitioning to other pipe materials.

505.6.10 JOINT DEFLECTION

- A. The maximum allowable deflection shall conform to ANSI/AWWA C600/A26.00 for ductile iron pipe and ANSI/AWWA C900/A29.00 and ASTM D2774 for PVC pipe. If excess deflection is required, bends shall be furnished to provide angular deflections.
- B. The maximum deflection shall be as specified by manufacturer.

505.6.11 DEPTH

- A. The force main shall be placed at a depth as to prevent freezing. This depth shall provide six and one-half feet (6'-6") of cover over iron and one-half foot more for other materials unless otherwise shown on the contract drawings or required by Special Provisions of these specifications.
- B. Insulation shall be installed if bury is less than six and one-half feet (6'-6") or utility crossing effectively removes earthen freeze protection. Insulation shall be installed as shown on the contract drawings or as directed by the Engineer in the field.

505.6.12 UNSTABLE SOIL

- A. If in the opinion of the Engineer the trench bottom is of unstable material, they may direct the Contractor to excavate the unstable material and replace same with 3/4 inch washed stone. Where the condition of unstable material is unusually severe, the Engineer may order the placement of a concrete cradle. Materials used in such cases when not called for in the Contract Documents shall be paid for by Change Order at a negotiated price.

505.6.13 EMBEDMENT

- A. Class B embedment shall be used for all ductile iron or HDPE pipe installed under this contract in accordance with the contract drawings and ASTM C12, or as indicated in Special Procedures - Division 01 of these specifications.
- B. Class II embedment shall be used for all PVC pipe installed under this contract in accordance with the contract drawings and ASTM D2321, or as indicated in Special Provisions.

505.6.14 SETTING VALVES

- A. Valves in mains shall be provided and installed in locations as shown on the contract drawings. A valve box shall be provided for every valve unless otherwise specified. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve. The box cover shall be flush or up to a 1/2 inch lower than the surface of the finished grade.
- B. Valves on PVC and HDPE mains shall be anchored in concrete.

505.6.15 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be installed where shown in the contract drawings or as required in the Special Provisions. Installation of polyethylene encasement shall conform to ANSI/AWWA C105/A21.5I.
- B. The polyethylene film shall be fitted to the contour of the pipe creating a snug, but not tight, encasement. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as joints or fittings, and to prevent damage to the polyethylene caused by backfilling operations. Overlaps and ends shall be secured with adhesive tape or plastic tie straps. For installations below the water table, circumferential wraps of tape shall be placed at two foot intervals along the barrel of the pipe.
- C. All fittings and valves shall be fully wrapped with polyethylene.
- D. Exposure to sunlight of the polyethylene film shall be kept to a minimum.

505.6.16 TESTING

- A. All equipment required for hydrostatic testing shall be furnished and operated by the Contractor subject to the approval of the Engineer. This equipment shall include all sampling taps and necessary flushing appurtenances.
 - 1. Hydrostatic tests shall consist of pressure and leakage test in accordance with AWWA C600, Section 4, Hydrostatic Testing. The hydraulic test shall be conducted at 150 percent of normal operating pressure or 150 psi, whichever is greater.
 - a. Water shall not be added during the pressure test. No pipe section will be accepted if the test pressure drops more than 5 psi within the two-hour test duration.

- b. The leakage is the amount of water required to bring the pressure back up to the starting pressure once the pressure test passes.
 2. Hydrostatic tests shall be conducted on sections of main recommended as ready by the Contractor and approved by the Engineer. No section shall be less than one block of main (approximately 400 feet) unless conditions warrant such testing of smaller sections.
- B. Where ductile iron main is installed, a random section of completed main will be selected by the Engineer for a continuity test. This random section shall be subjected to 300 amps DC for 15 minutes. All equipment necessary to make the test and to establish a closed circuit with the test section of main providing one leg of the circuit shall be provided by the Contractor at no additional cost to the Owner. The Contractor shall take whatever precautions they deem necessary such as filling the main with water prior to testing to protect the gaskets and building the amperage up slowly while watching an ammeter.
 1. If the random section passes the test, the electrical continuity for the entire main installation will be considered acceptable.
 2. Should the random section fail the test, it shall be repaired by and at the expense of the Contractor until it can pass the test. Also, the remainder of the project will be divided into test sections by the Engineer and tested for compliance by and at the expense of the Contractor.
- C. All tracer wire installed shall be tested for continuity. All tracer wire must pass the continuity test. Any sections not passing the continuity test must be excavated and replaced.

505.7 MEASUREMENT AND PAYMENT

505.7.1 GENERAL

- A. Force main shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Provisions.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Provisions.

505.7.2 FORCE MAIN

- A. Forcemain, Linear Foot. Measurement for force mains shall be per lineal foot of a specific diameter force main installed. Payment shall be made at the contract unit price bid per lineal foot of the respective diameter and shall include all necessary fittings, bends, locator tape, tracer wire, polyethylene encasement, thrust restraint, restoration and all other items required, not bid as a separate item.
- B. Forcemain, Lump Sum. When so provided, payment for forcemain shall be made at the contract lump sum price bid or as specified in Special Provisions. This payment shall include all work defined.
- C. Forcemain, Inclusive. When no quantity is provided, forcemain work shall be inclusive.

505.7.3 APPURTENANCES

- A. Cleanouts, Each. Cleanouts shall be paid for at the price bid for cleanout and shall include all labor and materials required for complete installation as shown on the contract drawings.
- B. Air Release Manholes, Each. Air release manholes shall be paid for as the whole unit complete and installed, which shall include all labor and materials necessary for the complete installation as shown on the contract drawings.
- C. Insulation, Square Foot. Measurement for insulation shall be per square foot of insulation installed. Payment shall be made at the contract unit price bid per square foot of insulation installed.

505.7.4 TESTING

- A. Force mains shall be installed and pass test for pressure and leakage before any forcemain installation payments shall be made.
 - 1. The Contractor is responsible for furnishing and operating all forcemain testing equipment including taps.
 - 2. Following testing, the contractor shall remove any temporary fittings, valves and plugs.
 - 3. After removal, any temporary fittings, valves, and plugs shall become the Contractor's property.
- B. Payment for forcemain requiring tracer wire will not be issued until an accepted continuity test has been performed and approved by the Engineer.

SECTION 506 - SUBMERSIBLE PUMP LIFT STATION

506.1 GENERAL

506.1.1 Summary

Provide lift station, complete with submersible centrifugal sewage pumps, piping, and appurtenances, as shown and as specified.

506.1.2 Related Sections

Forcemain
Instrumentation and controls
Electrical.

506.1.3 Submittals

Submit shop drawings and O/M manuals in accordance with Submittal Section.

506.1.4 Pump Test

Manufacturer shall perform standard inspections and tests before shipment; submit a written report of test data to the WWTP representative.

506.1.5 Manufacturer Services

- A. Equipment manufacturer shall provide services of a factory-trained representative for a minimum of one day to review the installation, to check and adjust equipment when ready for operation, and to observe field tests of equipment. Train City operators in operation and maintenance of equipment inspect thoroughly for damage and missing items, check integral equipment supplied by other manufacturers, and make any necessary adjustments. Notify WWTP representative of schedule for performing this initial service. Notice shall be given to the City representative 7-10 days before service and confirmed with the WWTP representative 24 to 48 hours before service.
- B. Prior to start-up, service representative shall furnish a letter to a WWTP representative confirming that the installation is in accordance with manufacturer recommendations, necessary alignments and adjustments have been made, and equipment is ready for operation.
- C. In addition to initial services, manufacturer shall provide for a one-day inspection trip after six months of operation to inspect and adjust equipment.
- D. Provide O&M manual providing product literature, installation instructions, operating instructions, maintenance instructions, and wiring diagrams.

506.1.6 Warranty

- A. Pump manufacturer shall warranty pump workmanship and materials in accordance with its standard five-year limited warranty. Submit written warranty prior to or with final application for payment.

506.2 PRODUCTS

506.2.1 Lift Station, General

- A. Provide totally submersible, electric pumps with hydraulic sealing discharge connection, pump guide rails, pump mounting bracket, guide rail supports, and pump lifting chains with hooks. Provide piping, valves and accessories, as designated in the other sections of this specification, the special provisions, and the detail drawings.
- B. Design shall be such that pumps will be automatically connected to discharge piping when lowered into place. Pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastening devices to be removed, and no need of personnel to enter pump well.
- C. Pumps and motors shall be UL-Approved for use in Class 1, Div. 1, Group D hazardous location as defined by National Electrical Code.
- D. Guide rails and guide brackets shall be non-sparking type; provide stainless steel rails with brass bushings. Guide bars shall extend from the access cover to the discharge connection.
- E. Miscellaneous metals and hardware within lift station wet well shall be stainless steel.

506.2.2 Pumps

- A. Pumps motors shall be compatible with the following power supply:
 - 1. 277/480 volts, 3 phase, 4 wire, 60 hertz.
- B. Pump impeller shall be gray cast iron; factory fitted to meet service conditions.
- C. Pumps shall be heavy-duty Hydromatic, Flygt, or approved equal non-clog sewage pumps capable of passing a 3-inch sphere. Pumps shall be of cast iron construction, complete with tandem mechanical seal (two individual sealing units), stainless steel fasteners and hardware, two vane balanced impeller operating against wear plates to insure maximum life, and moisture sensing probes for indication of primary seal failure.
- D. Stator casing, oil casing and impeller shall be of gray iron construction with all parts coming into contact with sewage protected by a coat of rubber-asphalt paint.
- E. Pump volute casing shall have a machined bronze discharge flange to automatically and firmly connect with the cast iron discharge connection.
- F. Impeller shall be protected by a bronze wear ring and neoprene O-ring at inlet of pump.
- G. Pump motors shall have cooling characteristics suitable to permit continuous operation in totally, partially, and non-submerged conditions. Motors shall have integral overload element embedded in winding to protect motor against over current and overheating due to overload and failure to start. Overload element shall automatically reset when motor cools.
- H. Pump motor power and control cables shall be provided by pump supplier. Power cable shall be type SO with ground wire, size as recommended by manufacturer and as required by code. Control cables shall be type SJO, size and number of conductors as required to perform functions specified. Cables shall be potted into a steel connector with polyurethane resin, or other suitable means shall be used to provide a leak proof seal.
- I. Power cable and control wiring shall be of sufficient length to reach separate weather proof junction box without splices and shall allow complete removal of pumps from pump well without disconnection of wiring from pumps. Explosion proof seal required between junction box and control panel.
- J. The power cables shall be fastened to a hanger bar just below the wet well door to allow for easy access during pump removal and maintenance. Hanger bar shall be constructed of 304 stainless steel.

506.2.3 Ductile Iron Pipe

ANSI/AWWA C151; Class 52 unless otherwise shown. Exposed joints shall be flanged type, ANSI/AWWA C151, with required bolts and full-face gasket. Buried joints shall be mechanical type, ANSI/AWWAC111. Fittings shall conform to ANSI/AWWAC110. Pipe and fittings shall have a standard thickness cement mortar lining and interior and exterior bituminous coatings.

506.2.4 Plug Valves

Non-lubricated, eccentric plug valve with cast-iron (semi-steel) body, resilient-faced plug, corrosion-resistant seat and bearings, packing replaceable under pressure, minimum port area of

80% of full pipe area, 175 psi working pressure, totally enclosed. Plug valves shall be DeZurik, Figure 118, or equal with 2" square operating nut to be used with standard valve wrench. The bypass piping plug valve requires right angle drive.

506.2.5 Check Valves

AWWA C508 cushioned swing type, iron body, bronze mounted, bolted cover, stainless steel shafts, and double O-rings for shaft seals, 175 psi working pressure, outside lever and adjustable spring; Clow, Dresser, or approved equal. The check valve shall be designed for use with sewage. The valve will be mounted horizontally.

506.2.6 Flanged Coupling Adapters

Steel or cast iron, flexible flanged adapter; Rockwell 912/913, Dresser 127/128, or approved equal.

506.2.7 Sleeve Couplings

Steel or cast iron, sleeve coupling; Rockwell 411/413, Dresser 38, or approved equal.

506.2.8 Manholes

Wet well/valve pit unit, either separated or integral, shall be precast concrete in accordance ASTM C478 and C76. Steps shall be installed in valve pit only to allow access. Steps shall conform to City's standard specifications for manhole construction.

506.2.9 Waterstop Seals

Flexible, watertight, rubber wedge ring Boot Coupling by KOR-N-SEAL, or Interspace or equal.

506.2.10 Lift Station Access Covers

Aluminum frame and door(s), H-20 live load capacity, positive locking arm, forged brass hinges with stainless steel pins, automatic hold-open arm with release, zinc plated hardware, snap lock with outside removable handle and inside fixed handle, mill finish with bituminous coating on exterior of frame; Bilco, USEMCO, Milcor, or approved equal. The cover shall be cast into the top of the lift station. The frame shall have upper guardrail brackets and chain hooks. Sizing of the access frames and covers shall be as per contract drawings and/or pump valve suppliers recommendations, but in no case less than two feet square each.

1. Guide rails and guide brackets shall be non-sparking type; provide stainless steel rails with brass brushings. Guide bars shall extend from the access cover to the discharge connection. The guide rails shall be 2 inch Schedule 40 stainless steel pipe. Each pump shall be furnished with 1/4-inch minimum diameter stainless steel chain for lifting out the pumps. The chain shall be of sufficient length and attach to the pump so as to provide a direct pull over the center of weight.
2. Provide wet well access cover with 0.040 aluminum warning sign with baked enamel finish suitable for outdoor use. Sign shall read:

Caution: Dangerous/hazardous gases. Level 2 confined space. Do not enter without proper equipment and supervision.

506.2.11 Wet Well Vent

- A. Vent shall be steel pipe, painted with one coat of rust-inhibiting primer and two coats of exterior enamel finish. Upper end of vent shall have a code-approved vent cap with screen.

- B. Vent shall not be located on the service drive side of the lift station.

506.2.12 Painting

- A. All piping, valves and miscellaneous metal shall be painted. Factory primed and painted fixture requires field painting. Painting shall be in strict accordance with manufacturer's instructions and the painting schedule below:
1. Wet Well Interior Piping and Metals:
Koppers - Bitumastic No. 50 or equal
Prepare surface and apply two coats as per manufacturer's instructions
 2. Miscellaneous Exterior Metals:
Koppers - Glamorglaze or equal
Prepare surface, apply primer and two coats per manufacturer's instructions.

506.3 EXECUTION

506.3.1 Lift Station Access Covers

- A. Covers shall not open toward the service drive.
- B. The wet well cover shall be positioned to allow the pumps to be pulled straight up and out of the wet well.
- C. The valve pit cover shall be positioned to allow operation of the plug valves, and the riser pipe with 3-inch quick couple, and plug valve with right angle drive without entering the valve pit.

506.3.2 Pump Installation

- A. Install pumps and accessories in accordance with approved shop drawings and manufacturers recommendations.
- B. Provide pipe seals for influent sewer and effluent discharge pipe passing through walls of wet well and valve manhole.
- C. Extend piping and terminate with a suitable coupling adapter to mate with discharge forcemain.

506.3.3 Operation of System

- A. Electrical connections and controls will be provided under subsequent sections of this specification.

506.3.4 Field Performance Test

- A. Each pump shall be tested after installation to check the in-field performance. The Contractor shall furnish and install all gauges and accessories required for this test and shall run each pump in the duplex system as directed by the Engineer. The Contractor shall provide field data taken from at least three different operating points for comparison with pump curves. The Contractor shall record the individual shutoff head for each pump for comparison with pump curves. The Contractor shall also record MEG readings on

each pump motor, amp readings in each leg for each pump to check for motor imbalance and excessive amp draw by the motor. The Contractor shall be responsible for all adjustments or replacements necessary.

- C. Any defects in the equipment or failure to meet the guarantees or requirements of the specifications shall be promptly corrected by the Contractor by replacements or otherwise. The decision of the Engineer as to whether or not the Contractor has fulfilled their obligations under the contract shall be final. If the Contractor fails or refuses to make these corrections, or if the improved equipment, when tested, shall again fail to meet the guarantees of the Contractor, the Owner, notwithstanding its Ownership of work and materials which have entered into the manufacture of said equipment, shall have the option of rejecting said equipment or of accepting the same at such reduced price as may be agreed upon by the parties hereto.
- D.

SECTION 507 - CONTROL SYSTEM

507.1 General

507.1.1 Summary

Provide a complete and properly operating system to control lift station and interrelated equipment in accordance with the Functional Description and as shown and as specified in these specifications and any project specific Special Provisions.

507.1.2 Related Sections

Submersible Pump Lift Station
Equipment and Motor Wiring

507.1.3 Submittals

Submit shop drawings and O/M manuals for control equipment in accordance with Submittal Section of this specification.

507.1.4 Maintenance Contract

System manufacturer shall offer to the City for consideration, a maintenance-service contract. Only manufacturers who can provide acceptable maintenance-service contracts will be considered.

507.2 PRODUCTS

507.2.1 Acceptable Manufacturers

System shall be the responsibility of a single vendor, unless otherwise indicated, and shall be manufactured in accordance with these specifications.

507.2.2 Functional Description

A. Duplex Lift Station:

1. Pumps shall be controlled by individual hand-off-auto selector switches on control panel and a pressure transducer activated control system with redundant floats.
2. Operation of pumps shall be initiated by variations in level of wet well as detected by the pressure transducer.

3. On a rising level, lead pump shall start when level reaches pump #1 "on" level as set on the pressure transducer control bar. A continued rise in level to pump #2 "on" level as set on the pressure transducer control bar shall start lag pump. Pump(s) shall continue in operation until a falling level reaches common pump(s) "off" level on as set on the pressure transducer control bar.
4. Pumps shall be automatically alternated after each pumping cycle whether cycle utilizes lead pump only or both pumps. Provide a manual alternator selector switch to manually alternate pumps. It shall be a three position selector switch (#1, #2; AUTO; #2, #1) and shall over-ride automatic alternator.
5. Low water cut-off shall be provided to assure that pumps will be totally submerged at all times. A falling wet well level to "low water cutoff" level as set on the control bar shall shut off all pumps that are operating. A rise in level above pump(s) "off" level as set on the pressure transducer control bar shall allow pump(s) to operate utilizing their normal pump "on" set points (automatic restoration). In addition to controls provided by the pressure transducer, a redundant "low water cutoff" float shall be provided. An alarm shall not be provided for water level below "low water cut-off."
6. Pressure transducer control bar shall provide set point for "high water alarm." In addition to controls provided by the pressure transducer, a redundant "high water start" float shall be provided.
7. Provide output contacts for annunciation and alarms as required for functions specified in the Supervisory and Enunciation System Section of these specifications.
8. Interlock pumps to prevent simultaneous starting of both pumps.

B. Ground Fault Protection:

1. Each submersible pump motor and power cable shall be protected by an individual ground fault protection system that shall shut off respective pump when a ground fault is sensed.
 2. A ground fault shall be sensed by a zero sequence sensor and an adjustable range ground fault relay. A ground fault condition shall interrupt respective pump control circuit and shut off pump.
 3. Ground fault relay shall be adjusted to prevent nuisance tripping due to leakage current in motor and power cable and prevent damage to power cable on higher magnitude ground fault currents. Time delay shall be adjustable to allow circuit protective devices to interrupt large faults.
- C. Set points:** See Detail Plans for pressure transducer control bar set points and redundant float elevations.

507.2.3 Control Panel

- A. Provide factory-wired panel containing control equipment, power equipment, supervisory and annunciation, and miscellaneous equipment described herein, as referenced elsewhere in these specifications, and shown on drawings.

- B. Control panels shall bear a serialized U.L. label indicating that it is U.L. approved as an assembled unit. Panels that have individual components that are U.L. labeled, but do not have U.L. approval as an assembled unit, are not acceptable.
- C. Control, power, supervisory, and miscellaneous electrical equipment shall be housed in a single enclosure, factory assembled, wired and tested.
- D. Design, manufacture, and test panel in accordance with latest applicable standards of NEMA, IEEE and ANSI.
- E. Components shall be neatly mounted and logically arranged. In addition, all major components and subassemblies shall be identified as to function with laminated, engraved nameplates, or similar approved means.
- F. Conform to NEMA Class 2, Type B wiring Control Panel Provisions.
- G. Wiring in control panel shall be flexible stranded, 600 volt, 90°C., suitable for wet or dry locations. It shall be neatly tied and fastened to chassis. Each conductor shall be tagged and numbered in accordance with manufacturers' wiring diagram. Outgoing wires shall be connected to an outgoing terminal strip. Provide 10% spare terminals. Wires shall be fastened to electrical components by solderless mechanical connectors to facilitate replacement.
- H. Circuit breaker handles, receptacles, ground fault protection relay handles, push buttons, HOA switches, pilot lights, elapsed time meter, and similar equipment requiring access shall be mounted so that they may be viewed or operated by opening outer door (outdoor enclosures) or without opening door (indoor enclosures).
- I. Panel shall be suitable for operation at designated service voltage with bracing and components for 10,000 AIC, symmetrical (minimum). Main cabling shall be rated equal to or higher than rating of main circuit protective device trip rating or fusible switch frame rating.
- J. Panel shall contain the following:
 - 1. Incoming cable provisions with phase insulated neutral and ground lugs.
 - 2. A U. L. rated main disconnect switch, rated for 480 volt, 3-phase, 3-wire 60-Hertz power supply.
 - 3. A 480-volt/1 20-volt transformer.
 - 4. Combination starters consisting of circuit breaker, NEMA-rated contractor and overloads with reset push button for each pump, sized for motor (see below).
 - 5. Ground fault protection sensors and relays (see below).
 - 6. HOA selector switch and pilot light for each pump (see below).
 - 7. Start/run capacitors and start/run relays if motors are not equipped with integral capacitors.
 - 8. A 120-volt control circuit.

9. Intrinsically safe pressure transducer, float control and alarm circuit with power supply sufficiently large for load (see below).
10. Control circuit breakers and/or fuses.
11. Supervisory and annunciation equipment.
12. Condensation heater and thermostat protected by an individual circuit breaker.
13. Terminal boards for field connections.
14. Automatic alternator to alternate pump.
15. Manual alternator switch.
16. Running time meter for each pump (see below).
17. G. F. I. receptacle on inner door protected by individual circuit breaker.

507.2.4 Combination Starters

- A. Combination starters shall be NEMA Class, UL listed. Where motors are provided with integral thermal sensors, sensors shall be connected in series with starter overload element and magnetic contactor coil.

507.2.5 Selector Switches, Push Buttons & Pilot Lights

- A. Switches, push buttons, and lights shall be industrial grade, oil tight units.

507.2.6 Ground Fault Protection System

- A. System shall consist of a ground fault relay and a current sensor that is integral to each pump's motor starter.
- B. Ground fault relay shall be an adjustable instantaneous trip type employing reliable solid-state circuitry. It shall be self-powered by fault current. Relay shall have normally open, normally closed contacts, rated 10 amps. at service voltage. Operating mechanism shall be trip free so it cannot be reset in presence of a fault. Visual indication of operating mechanism shall be provided utilizing handle position or a green target for "normal" position and a red target for "tripped" position.
- C. Current sensor shall be a window type zero sequence current transformer with a pick-up current range sized to accommodate required functions.
- D. When a ground fault occurs which exceeds selected pick-up setting of ground fault relay, relay shall trip, open respective motor contactor and isolate ground fault from line. Reset of system shall be manual.

507.2.7 Liquid Level Pump/Alarm Control

- A. The controller shall receive the wet well level signal from the level transducer, display it on a 4-inch LED bar graph on the face of the controller, graphically display eight level adjustments for automatic pump control and abnormal level alarm in a coordinated

arrangement with the level display and provide automatic operation of the station pumps and alarms as specified herein.

- B. The pump/alarm controller shall accept a single, level-proportional analog input signal (1-5 VDC or 4-20 mADC) and provide level-differential automatic operation of the pumps and alarms.
- C. The controller shall display the sensed control level on a 40-segment LED bar graph display. The level shall be displayed in a 0-10 foot range with 3-inch resolution.
- D. The controller shall operate directly with the level sensing transducer. The controller shall include transducer excitation voltage regulation, signal spanning and offsetting and adjustable quelling (rate of change limiting).
- E. Directly aligned with the calibrated LED bar graph display shall be eight vertical receptacles with programming pins and adjacent range scales to match the calibrated bar graph giving full-range, level-differential, on/off operation of pumps and alarms from the sensed level excursion. The receptacles and programming pins shall be gold-plated to ensure reliable, long-term operation.
- F. Each of the differential pump control circuits shall be programmable with a pump-down capability. The left receptacle of each control stage shall receive the low level (turn-off) programming pin. The right receptacle shall receive the high level (turn-on) programming pin.
- G. Stages 3 and 4 of the controller shall be labeled Low Level Alarm and High Level Alarm and shall be used to provide adjustable differential level-responsive alarm outputs.
- H. The arrangement of the level and programming display with an integral wet well level scaled Mylar overlay shall allow easy setting and viewing of all control adjustments from the front of the controller mounted on the inner door of the enclosure. A front-mounted LED indicator shall be provided in conjunction with each differential control/alarm stage to show when the stage output is activated.
- I. A three-position, spring-return-to-center raise-auto-lower level simulation switch shall allow the manual creation of a simulated level signal when the switch is raised or lowered from the center auto position. By use of this switch, the effective operation of the stations pumps and alarm systems can be confirmed and the station returned to normal without danger of leaving the station in a non-automatic condition.
- J. The controller shall operate on 120 VAC power and include a rear-accessible, extractor-type input power fuse and power line transient protection. The input power and the control outputs shall be wired to screw/clamp barrier-type terminals on the back of the controller housing able to accept one or two AWG 12 or smaller conductors per terminal. The controller shall incorporate the pump control output load relays and a common abnormal level alarm output load relay with dry contacts wired to terminals rated 10 amps at 240 VAC.
- K. The controller shall include abnormal level alarm annunciation circuitry with a front accessible alarm silence push button and rear terminal block connection for an external audible alarm and silence push button.

- L. Upon power up, the controller shall go through a timing routine, which allows the analog signal and display to stabilize before any control or alarm outputs are enabled. After the stabilization period, the control circuits of the controller shall be sequentially enabled on a timed-step arrangement, providing staggered starting of the pumps.
- M. In addition to the time delay upon power up, the differential-level control circuits shall each be forced to an OFF condition upon power up so that a level excursion will need to go past their turn-on elevation for them to operate.
- N. The controller shall provide solid-state automatic pump alternation on successive starts. A front accessible three-position auto alternator override switch (1-2, Auto, 2-1) shall provide fixed pump sequence selection as well as automatic alternation.
- O. The controller front face measurements shall be approximately 8.5" high x 7.5" wide. It shall semi-flush mount on the control panel door and have a depth behind the panel of not greater than 3.5 inches.
- P. It is the specific intention of this functional requirement that a standard controller will be employed with features as herein described and that it be a fully-integrated assembly. This is the furnishing of similar functions using a multiplicity of set point modules, extensive relay/timer logic to accomplish control sequences or generic programmable logic controllers with custom software is specifically precluded by this specification and will not be acceptable. The controller shall be Consolidated Electric Model D152 or Contegra Station Master 2000.

507.2.8 Submersible Level Transducer

- A. The liquid level of the wet well shall be sensed by a Submersible Level Transducer. The transducers shall be a three-wire type to operate from a supply voltage of 10.5 to 24 VDC and produce an instrumentation signal in direct proportion to the measured level excursion over a factory-calibrated range of 0 to 10 feet of water.
- B. The transducer shall be of the solid-state head-pressure sensing type, suitable for continuous submergence and operation, and shall be installed in accordance with manufacturer's instructions. The bottom diaphragm face of the sensor shall be installed six inches above the floor elevation. The sensor shall be mounted using a stainless steel cable system in a location and as shown on the plans.
- C. The transducer housing shall be fabricated of Type 316 stainless steel with a bottom diaphragm 2-5/8" diameter of heavy-duty, limp, foul-free, molded Teflon™ bonded to a synthetic rubber back/seal.
- D. A hydraulic fill liquid behind the diaphragm shall transmit the sensed pressure to a solid-state, variable-capacitance transducer element to convert the sensed pressure to a corresponding electrical value. The sensed media shall exert its pressure against the diaphragm that flexes minutely so as to vary the proximity between an internal ceramic diaphragm and a ceramic substrate to vary the capacitance of an electrical field created between the two surfaces. A stable, hybrid, operational amplifier assembly shall be incorporated in the transducer to excite and demodulate the sensing mechanism. The transducer shall incorporate laser-trimmed; temperature compensated high quality components and construction to provide a precise, reliable, stable output signal directly proportional to the sensed pressure over a factor-calibrated range.

- E. The transducer element shall incorporate high over-pressure protection and be designed to withstand intermittent overpressures five times the full-scale range being sensed. Metallic diaphragms shall not be acceptable in that they are subject to damage or distortion. Sensing principles employing LVDT's, resistive or pneumatic elements shall not be acceptable.
- F. The transducer/transmitter shall include easily accessible offset and span adjustments in the upper assembly. Span shall be adjustable from 100% down to 15% of the sensor range. Fine and coarse adjustments for both span and offset shall be provided using 25-turn potentiometers. Offset and span adjustments shall be non-interactive, for ease of calibration.
- G. The internal pressure of the lower transducer assembly shall be relieved to atmospheric pressure through a heavy-duty urethane jacketed hose/cable assembly and a slack PVC bellows mounted in the NEMA 4X vented fiberglass upper assembly. The sealed breather system shall compensate for variations in barometric pressure and expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive elements.
- H. The transducer assembly shall be installed where directed by the Engineer and connected with other system elements and placed in successful operation. It shall be provided with input power and output signal transient protection, associated control elements as specified herein and in accordance with manufacturer's instructions. The pressure transducer shall be Consolidated Electric Model A1000.I, or Sigma Controls 6100 Sensor or Centegra Model SLX220.

507.2.9 Float Controller

- A. Provide an independent factory-wired float controller. The float controller shall be wired in parallel with the pressure transducer activated control system to provide a redundant capability.
- B. Redundant floats and control logic shall be provided for the "high water," "Pump On" control and "High Level Alarm" condition and a "low water cutoff," "Pump Off" control.
- C. Controller shall incorporate level simulation test switches and an all relay automatic alternator. Test switches shall be located behind inner enclosure door (outdoor enclosure) or enclosure door (indoor enclosure).
- D. Relay shall be plug-in type complete with sealed dust covers and plug-in base.
- E. Control circuits shall be electrically independent of each other and primary power source. Control circuits to floats shall be protected by intrinsically safe barrier relays, U.L. approved to protect non-explosion-proof devices in a Class 1, Division 1, Group D hazardous area. Load contacts of controller shall have a non-inductive rating of 10 amps. at 250 vac.
- F. Provide output contacts for annunciation and alarms as required for functions specified in these specifications.

507.2.10 Running Time Meters

- A. Meters shall be non-resettable 0-9,999.9 hours; Engler, Eagle, or approved equal.

507.2.11 G.F.I. Receptacle

- A. Duplex receptacles for ground fault interruption shall be 120 volt, three-wire grounding, rated to trip at 5 milli-amps, solid state electronic circuitry with built-in test circuit; P & S Interrupters 5, 1 591 -F, or approved equal.

507.2.12 Manual Transfer Switch

- A. Provide manual transfer switch to allow operation of control panel, pumps and appurtenances by portable emergency power generator. Transfer switch shall be lockable in either the "commercial power" or "emergency power" mode.
- B. The generator receptacle shall be compatible with local utility equipment. Provide Meltric Model 37-29043-080; D.S. 200 amp, inlet/angle/box. Area around the receptacle shall be clear for a minimum of three feet to allow easy access when connecting to emergency power.

507.2.13 Panel Enclosure

- A. Control panel enclosure shall be a stainless steel enclosed outdoor panel meeting requirements of NEMA Type 4X. It shall be a rigid, freestanding panel sized to accommodate required distribution, control, and instrumentation devices. Panel instrumentation shall be installed per Detail Drawing No. 5-13, Panel Instrumentation.
- B. Enclosure shall be fabricated of Code gauge cold rolled steel and reinforced as required. All exterior hardware such as clamps, clamp screws, hinge pins, etc. shall be stainless steel. All external hardware, except screws for securing door shall be tamperproof. Use of pop-rivets will not be permitted. Provide rain guard (drip shield) over entire upper edge of outer door. Provide external post mounting bracket of same materials as enclosure to adapt enclosure for post mounting.
- C. Provide a full-length piano-hinged, gasketed outer door with three-point latching door and padlocking provisions. Provide hinged inner door extending over both control and power section; door shall be minimum 14-gauge steel.
- D. Enclosure assembly finish shall be stainless steel, type 304, unpainted.
 - 1. Steel that is thoroughly cleaned and bonderized, coated with a rust resistant primer and finished with two coats of an exterior grade gray epoxy finish.
 - 2. Galvanized steel finished with one coat of exterior grade gray epoxy paint.
 - 3. Stainless steel, type 304, unpainted.
- E. Enclosure shall be insulated with 1/2-inch urethane sheet insulation. All joints of sheet insulation shall be filled with compatible urethane spray foamed insulation so that enclosure insulation is uniform.
- F. Enclosure shall be provided with a condensate heater controlled by a thermostat. Heater shall be suitably sized for enclosure to prevent condensation and maintain minimum temperature required for components housed in enclosure.

507.2.14 Floats

- A. Floats shall consist of a 316-type stainless steel housing, mounting clamp, a flexible three-conductor cable with a synthetic rubber jacket and a mercury switch. Inside float housing shall be a mercury switch potted in epoxy.
- B. Float switches shall be direct acting type. A liquid rise of one inch from rest position shall operate float switch and reset will occur when liquid level drops one inch. Weight and buoyancy shall be such that contaminants like a cake of grease will not result in float switch changing operating level more than one inch.
- C. Three-conductor cable shall be 14 AWG with 105 strands per conductor made for heavy flexing service and underwater use. Cable length shall be as required for installation. A green grounding wire will connect internally to float housing.
- D. Operating temperature range shall be 0 deg. to + 180 deg. F.
- E. Floats shall be fastened to a weighted 1/8-inch stainless steel cable with corrosion resistant hardware. Provide neoprene cable protection sleeves at each operating level of each float.
- F. Floats shall be Consolidated Electric Model 9G, or approved equal.
- G. Float assemblies shall be provided by same supplier as control panel to ensure compatibility of system.
- H. Floats shall be fastened to a hanger bar located just below the wet well door to allow for easy access during pump removal and maintenance. Hanger bar shall be 304 stainless steel.

507.2.15 Painting

- A. All piping, valves and miscellaneous metal shall be painted. Factory primed and painted fixture requires field painting. Painting shall be in strict accordance with manufacturer's instructions and the painting schedule below:
 - 1. Wet Well Interior Piping and Metals:
 - Koppers - Bitumastic No. 50 or equal
 - Prepare surface and apply two coats as per manufacturer's instructions
 - 2. Miscellaneous Exterior Metals:
 - Koppers - Glamorglaze or equal
- Prepare surface, apply primer and two coats per manufacturer's instructions.

507.3 EXECUTION

507.3.1 Installation

- A. Install equipment in accordance with shop drawings and manufacturer's recommendations.
- B. Conduit entrances to exterior enclosures shall be stuffed with fiberglass insulation to maintain the integrity of insulated enclosures

- C. Secure pressure transducer support and float support cable to lift station with stainless steel eyebolt. Support cable shall be accessible from lift station hatch opening.
- D. Electrical wiring shall be performed in accordance with the electrical sections of this specification.

507.3.2 Testing

- A. Provide final start-up and system testing in accordance with the ELECTRICAL section of this specification.

SECTION 508 - SUPERVISORY & ANNUNCIATION SYSTEM

508.1 GENERAL

508.1.1 Summary

- A. Provide a complete and properly operating system to supervise lift station pumps and controls in accordance with Functional Description and as shown and specified.

508.1.2 Related Sections

Control system.

508.1.3 Submittals

- A. Submit shop drawings and O/M manuals of supervisory and annunciation system.

508.1.4 Spare Parts

- A. Furnish five spare pilot light lamps.

508.1.5 Maintenance Contract

- A. System manufacturer shall offer to Owner for consideration a maintenance-service contract in accordance with Section 13301. Only manufacturers who can provide acceptable maintenance-service contracts will be considered.

508.2 PRODUCTS

508.2.1 Acceptable Manufacturers

- A. System shall be the responsibility of a single vendor, unless otherwise indicated, and shall be manufactured in accordance with these specifications.

508.2.2 Functional Description

- A. Seal Chamber Alarm: Entrance of moisture into pump seal chamber shall be sensed by an electrode-type moisture probe. A moisture condition within chamber shall light respective pump alarm light on door of control panel and activate a remote alarm station. Light shall remain lit until condition is corrected.
- B. High Water Alarm: High water alarm condition shall be sensed by the pressure transducer activated control system. A redundant high water alarm cutoff float shall also indicate alarm condition. A high wet well condition shall light an alarm light on door of control panel and activate a remote alarm station. Light shall remain lit until condition is corrected.

- C. Supervisory Control and Data Collection (SCADA) System: Alarm conditions shall be transmitted to the City of Sun Prairie's existing SCADA central terminal unit.
- D. Remote Alarm Station & Alarm Light:
 - 1. Remote alarm station shall be activated by alarm conditions sensed in pump control panel.
 - 2. Alarm station shall contain a seal chamber alarm light and a separate alarm light for high water alarm.
 - 3. An alarm condition shall simultaneously cause respective alarm light to flash, sound a common audible alarm, and cause a remote alarm light to flash. Depression of alarm silencing switch shall silence audible alarm; local and remote alarm light shall remain lit until trouble is corrected. Succeeding alarm conditions originated when an alarm condition already exists shall reactivate audible alarm and cause remote light to flash.
 - 4. A toggle switch shall be installed to deactivate audible alarm and remote light alarm.

508.2.3 Supervisory Control and Data Collection (SCADA) System

- A. Provide remote terminal unit (RTU) at lift station and upgrade existing central terminal unit (CTU) to accommodate new RTU.
- B. RTU shall be capable of sending/receiving digital input signals to/from the CTU. RTU shall be of same or newer generation as existing RTU's used by the City of Sun Prairie.
- C. SCADA system shall transmit data regarding the following conditions from RTU to CTU:
 - 4. Pump No. 1 on, Pump No. 1 off
 - 2. Pump No. 2 on, Pump No. 2 off
 - 3. Pump No. 1 fail
 - 4. Pump No. 2 fail
 - 5. High wet well
 - 6. Station data failure
 - 7. 120-volt failure
 - 8. 12-volt battery failure
 - 9. Power failure
- D. Provide SCADA system with battery backup and battery charger.
- E. SCADA system shall be Altronex.

508.2.4 Remote Alarm Station

- A. Remote alarm station shall be flush-mounted unit with stainless steel faceplate, alarm lights, audible alarm, silencing switch, flasher, relays and necessary accessories to provide supervision specified under Functional Description.
- B. Panel-mounted alarm lights shall be as specified below.
- C. Audible alarm shall be a solid state Sonalert, 1VA at 120 volt; P.R. Mallory & Co., or approved equal.

508.2.5 Remote Alarm Light

- A. P & S #2152 pilot light, #406 Red, complete with type 430 stainless steel engraved nameplate.

508.2.6 External Alarm Light

- A. 100 watt, A-lamp, 130 v, weatherproof with red polycarbonate globe.

508.2.7 Panel-Mounted Lights

- A. One-inch diameter, dim-glow type with adjustable resistor. Running lights shall be green; alarm lights shall be red.

508.3 EXECUTION

508.3.1 Installation

- A. Mount pilot and alarm lights and silencing switch on door of control panel or remote alarm panel; other components shall be mounted within panels. Alarm horn shall be flush mounted.
- B. Remote alarm station and light shall be located as shown.
- C. Wiring shall be in accordance with the Electrical Section of this specification.

508.3.2 Supervisory Control and Data Collection (SCADA) System

- A. Install SCADA system in accordance with manufacturer's instructions.
- B. Provide radio path survey as directed by manufacturer.
- C. Assist Owner in obtaining necessary FCC permits.
- D. Upgrade CTU as necessary to interface with new RTU.
- E. Upgrade and interface with plant alarm system as necessary.

508.3.3 Testing

- A. Provide start-up and system testing in accordance with Quality Control Section.

SECTION 509 - ELECTRICAL GENERAL PROVISIONS

509.1 GENERAL

509.1.1 Drawings and Specifications

- A. Electrical drawings are schematic. Reference shall be made to engineering drawings for dimensions, type of construction, layout, door swings, ceiling types, etc. Unless dimensioned, electrical items are shown in approximate locations. Minor relocations of these items may be made by the contractor after approval by the Engineer at no expense to the Owner.
- B. The complete specifications shall be utilized to define the electrical work. Electrical work that is not defined in the electrical plans or specifications, but is defined elsewhere in the

plans and specifications, shall be the responsibility of the Electrical Contractor equally with work that is defined in the electrical plans and specifications.

- C. NOTE: The work in the wet well shall be in compliance with the appropriate sections of the NEC covering hazardous (classified) locations NEC 500-501. The area in the wet well shall be considered Class 1, Division 1, Group D.

509.1.2 Summary

- A. The facilities and systems of the electrical work shall include:
1. Electrical service.
 2. Power distribution.
- B. Electrical connections and provisions for motors and equipment furnished under other Divisions.

509.1.3 Coordination

- A. General: Refer to the Division I sections for general coordination requirements applicable to the entire work. It is recognized that the Contract Documents are diagrammatic in showing certain physical relationships that must be established within the electrical work, and in its interface with other work including mechanical work and that such establishment is the exclusive responsibility of this Contractor.
- B. Contractor shall coordinate their work with all other trades and the Owner.
- C. Conflicts of any type shall be immediately reported to the Engineer and City.
- D. Coordinate completion dates and sequence of work with "Progress and Completion" and other applicable notes and specifications.
- E. Locate operating and control equipment properly to provide easy access and arrange entire electrical work with adequate access for operation and maintenance.

509.1.4 References

- A. All material and work shall conform to the applicable portions of the latest issues of the following standards:

UL	Underwriters Laboratories, Inc.
NEMA	National Electrical Manufacturers Association
NEC	National Electrical Code
NECA	National Electrical Contractors Standards of Installation
ANSI	American National Standards Institute
IEEE	Institute of Electrical and Electronic Engineers
ASTM	American Society for Testing Materials
NFPA	National Fire Protection Association
IPCEA	Insulated Power Cable Engineers' Association
FM	Factory Mutual
ETL	Electrical Testing Laboratories
FIA	Factory Insurance Association

509.1.5 Submittals

- A. General: Refer to the 16000 series sections for general requirements concerning work-related submittals (refer to Division I sections for administrative submittals).
- B. Shop Drawings and/or Product Data: Shall be submitted in accordance with the requirements of Division 1 for the following items:
 - 1. Circuit breakers, panel boards and distribution equipment.
 - 2. Safety switches and motor disconnect switches.
 - 3. Motor starters.
- C. Material schedule for:
 - 1. Wire and cable.
 - 2. Conduit and raceways.
 - 3. Outlet boxes.
 - 4. Wiring devices and plates.
- D. Submittals shall clearly identify by means of a yellow highlighter, equipment and accessories being submitted.
- E. Submittals shall include manufacturers wiring and connection diagrams for this project where applicable, in sufficient detail so that system function may be evaluated.

509.1.6 Quality Assurance

- A. General: Refer to the Division I sections for general administrative/procedural requirements related to compliance with codes and standards. Specifically, for the electrical work (in addition to standards specified in individual work sections), the following standards are imposed, as applicable to the work in each instance.

509.1.7 Standards for Materials and Workmanship

- A. All materials shall be new and shall conform to the standards of the Underwriters Laboratories, Inc. (UL) in every case where the UL has established a standard of such materials. In addition, these materials shall bear the UL label to show their conformance. Materials not covered by UL standards shall also be new and shall be processed, supplied or manufactured to NEMA, IEEE, or other accepted industry standards for these materials and shall also be labeled or properly identified as being in conformance with the appropriate standards. Substitute standards for those listed are not acceptable. Materials and equipment shall be protected during delivery and handling to prevent damage; and shall be stored in a clean dry area to prevent contamination. Damaged materials shall not be used.
- B. All work shall be executed in a neat and workmanlike manner by personnel thoroughly qualified in the trade or duties they are to perform. A rough or unworkmanlike installation will be cause for removal and replacement of said installation.

509.1.8 Substitution of Materials

- A. The contractor shall note the article regarding substitutions.
- B. All requests for substitutions shall be in writing and shall include sufficient product information to permit the Engineer and City to evaluate the request.

- C. Engineer and City specifically reserves to themselves the right to reject or approve any and all substitute materials or equipment in order to insure compliance with the minimum standards of quality established for the project herein specified, and also to insure that any substitute materials or equipment maintain the trends of style and appearance established for this project.
- D. Contractor shall choose from the listed manufacturers for specific items or a substitute manufacturer if approved, but once a manufacturer has been chosen, all similar items shall be by the same manufacturer.

509.1.9 Codes, Permits and Fees

- A. The entire project shall comply with the current issue of the National Electric Code (NEC) including amendments, and with all State, local and other codes as applicable. The current issue shall be the issue that is in effect when the contracts are awarded for the work. The interpretations and decisions of the authority having jurisdiction of applicable codes shall govern.
- B. Where a conflict exists between the applicable codes and the plans and the specifications, the one shall be followed which results in the higher quality, most complete installation.
- C. Contractor shall obtain all permits and pay all fees as required by applicable jurisdictional bodies.

509.1.10 Project/Site Conditions

- A. Contractor shall visit the site of the work and familiarize themselves with conditions that will affect their work, the locations where the work will be performed and other pertinent factors.
- B. Contracts are based on the Contractor furnishing all labor and material to complete each installation ready for use.
- C. No additional allowances will be granted because the Contractor's knowledge of job site conditions was incomplete.

509.1.11 Warranty

- A. The Contractor shall warranty:

All material furnished by them to be perfect in every respect; and, if not, will replace it immediately. Replacement of any material or part showing defects within a minimum of one year of date of substantial completion or within the warranty period of the item if greater than one year. This one-year warranty period shall be binding even though it may exceed the product warranty period normally furnished by some manufacturers. The apparatus to be installed in strict accordance with these specifications and the various codes covering this work.

509.2 PRODUCTS

509.3 EXECUTION

509.3.1 Electrical System Identification and Instruction

- A. All panel boards shall include a typewritten directory in the space provided designating each branch circuit as well as the spares.
- B. Install by bolting or cementing, engraved metal or engraved plastic nameplates with 1/4-inch-high lettering or stenciling with minimum 1/2-inch-high letters on panels, cabinets (inside panel or cabinet door in finished areas), starters, junction boxes (larger than 8 inches square), etc.; Dymo adhesive labels on all switches, motor controls and 8-inch and smaller square systems junction boxes. Nameplates to indicate (1) voltage, (2) system, device, motor or panel served. All panels, junction boxes, etc., shall be clearly labeled as to voltage or cable or system terminated therein.
- C. Embossed adhesive labels shall have 3/8-inch minimum width. Labels shall be applied only after surface has been wiped with cleaner to remove dust and grease.
- D. Identify each conductor at each panel, each pull box and at each switch, receptacle outlet, and other electrical outlets with permanently attached wrap-around adhesive markers as manufactured by Brady Company.
- E. Identification shall include circuit number, phase, control circuit number, or other appropriate number or lettering that will expedite the future tracing and trouble shooting.
- F. Abbreviations shall be used sparingly and only when there can be absolutely no confusion as to the meaning or interpretation.
- G. Use color-coding to identify phases, grounding conductors and control wires in a consistent manner and in accordance with the Code requirements.
- H. Signs and nameplates shall describe a load served by a function and location.
- 1. Starter identification shall be as indicated on the electrical plans.

509.3.2 Interruption of Services

Contractor shall thoroughly familiarize themselves with existing special or electrical systems, which will affect, and be affected by, installation of the new systems and services. They shall plan the installation of their work so that interruptions of services to the building shall occur at City's convenience. Contractor shall obtain permission from the Owner's Representative to shut off services.

509.3.3 Test

- A. Test all new circuits and feeders at 500V. DC with all lamp holders, devices and motors connected and the neutral disconnected at the source of supply. All parts of the system shall test not less than 1 megohm to ground.
- B. At the time of connection, or energizing, check all motors for proper rotation, conferring with contractor furnishing equipment, if necessary, to determine proper direction.
- C. Test all grounded outlets and equipment frames for proper grounding.
- D. Final settlement with Contractor will not be made until system has been thoroughly checked and found in good operating condition.

- E. All materials and workmanship is subject to inspection, examination and tests by Engineer at any and all times.
- F. Engineer and City shall have the right to reject defective material and workmanship and require its correction without any extra cost to Owner.

509.3.4 Electrical Work Close-out

- A. General: Refer to the Project Closeout Section.

509.3.5 Coordination with Mechanical

- A. Coordinate closet operations with closet of mechanical systems, and other power-consuming equipment. Accurately record locations of main feeder conductors that are concealed. Test run electrical equipment in coordination with test runs of mechanical systems. Clean operational equipment. Instruct City's operating personnel thoroughly in the operation, sequencing, and maintenance of the electrical systems. Turn over the operations to the City's personnel at the time(s) of substantial completion. Until the time of final acceptance of the total work of the contract, respond promptly with consultation and services to assist the City's personnel with operation of electrical systems.

SECTION 510 – CONDUITS

510.1 General

510.1.1 Summary

Work Included:

- 1. Rigid metal conduit (threaded)
- 2. Rigid metallic conduit, PVC coated
- 3. Type MI cable
- 4. Rigid non-metallic conduit (PVC)
- 5. All materials and accessory items as required for the installation of above
- 6. All materials within wet well shall be rated for use in *Class 1, Division I areas*

510.1.2 Submittals

Submit a material list and schedule for approval indicating types and manufacturers for conduits, tubing, raceways, coupling, connectors and accessories that will be used on the project.

510.2 PRODUCTS

510.2.1 Materials

- A. General: For each electrical raceway system indicated, provide a complete assembly of conduit or tubing with fittings, including, but not necessarily limited to, connectors, nipples, couplings, expansion fittings, other components and accessories as needed to form a complete system of the type indicated and rated for Class 1, Division I, installations.
- B. Threaded heavy wall where the size is over 1/2 inch, or where in contact with the earth, or where exposed to the weather, or where installed in a slab on grade or fill, or where embedded in structural concrete, horizontally or vertically, or where noted on plan. All conduits passing out of the Class 1, Division I area shall be sealed per NEC-501.

- C. PVC coated rigid metallic conduit shall be used in all subgrade applications and as shown on plans. Conduit shall be rigid galvanized steel conduit with external PVC coating, 40 mil thick. Conduit shall be provided with an internal epoxy coating. Conduit shall comply with NEMA standard RN1. Fittings and conduit bodies shall be steel with PVC coating to match conduit. Fitting and conduit bodies shall comply with ANSI/NEMA standard FB1.
- D. Rigid non-metallic conduit shall be schedule 40 PVC minimum, carrying UL listing, Rigid non-metallic conduit bodies and fittings shall comply with NEMA TC2 and shall be UL listed.
- E. Do not use indenter or set screw type fittings.
 - 1. "Short" ells are not acceptable.
 - 2. Aluminum conduit is not acceptable.
 - 3. Intermediate metal conduit is not acceptable.
- F. Connections to all motors and equipment: Flexible fittings approved for Class 1, Division I use for equipment connections. Provide green insulated grounding conductor in all connections to motors, equipment and lighting fixtures.
- G. Observe National Electrical Code requirements for insulated bushings on 1-1/4 inch and larger conduits. Double locknuts and fiber bushings with threads fully engaged are required. Steel bushings with integral plastic linings are also acceptable. Note that in some locations it will be necessary to lengthen conduit threads to accommodate these requirements.

510.3 EXECUTION

510.3.1 Installation

- A. General: Install conduit as indicated, in accordance with the manufacturer's written instructions, the applicable requirements of NEC and the NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products serve the intended function.
- B. In general, conduit shall be installed concealed in walls, ceilings, spaces, floor slabs and similar construction, in finished spaces and where possible or practical, or as noted on drawings. See Section 16010 for Cutting and Patching. In unfinished spaces, mechanical, and utility areas conduit may be run either concealed or exposed as conditions dictate and as practical unless otherwise noted on plans; coordinate with mechanical and other contractor.
- C. Complete electrical raceway installation before starting the installation of cables.
- D. Provide flexible conduit fittings for connection of motors and other electrical equipment subject to movement and vibration, and in compliance with NEC 500 and 501.
- E. The metallic circuit from source to outlet must be continuous and of the lowest practical resistance. Bends and offsets in parallel conduits to present a neat symmetrical appearance. Split, crushed, or scarred conduit not acceptable. Connections to boxes and equipment must be thoroughly cleaned and made up permanently tight.

- F. Install conduit with sizes as indicated or required and rigidly secured in place with not less than one malleable corrosion proof alloy strap or hanger per 8 feet of conduit. Perforated strapping is not acceptable.
- G. Rigid metal conduit shall be securely fastened within three feet of each outlet box, junction box, cabinet, or fitting.
- H. Support all conduits from structural slabs, walls, structural members and roof joists. Do not support conduits from ceiling tie wires, ductwork, piping or other nonstructural members.
- I. Keep conduit plugged, clean and dry during construction. Where conduit is to run in masonry walls, be responsible for the necessary chases where applicable in order to have the conduit fully concealed beneath the finished surfaces.
- J. Install nylon or galvanized steel fish wire in all empty conduit.
- K. Conduits shall not be run in concrete topping over precast construction.
- L. In general, conduits shall be run in fill below concrete slabs on grade or in joist/ceiling space below for concrete structure on top of steel joist construction so as not to interfere with WWM, vapor barrier, or concrete placement.
- M. Conduits, if run in concrete structure, shall be run parallel to each other and spaced on center of at least three times conduit trade diameter with minimum 2-inch concrete covering. Conduits over 3/4 inches may not be installed in slab without prior approval of City Engineer.

SECTION 511 CABLE, WIRE, AND CONNECTORS

511.1 GENERAL

511.1.1 Summary

- A. Work Included:
 - 1. Service entrance conductors
 - 2. Feeder conductors
 - 3. Lighting circuitry
 - 4. Wiring device circuitry
 - 5. Equipment circuitry
 - 6. Motor branch circuitry
 - 7. Control circuitry
 - 8. Branch circuit connectors
 - 9. Cable connectors
 - 10. All materials and accessory items as required for the installation of above

511.1.2 Submittals

- A. Submit a material list and schedule for approval indicating types and manufacturers for cable, wire, connectors and accessories that will be used on the project.

511.2 PRODUCTS

511.2.1 Manufacturers

- A. Provide products produced by one of the following:
 - 1. Cable and Wire: (Copper Only)
 - Cyprus Wire and Cable Co.
 - Electrical Cable Div., USS Corp.
 - General Cable Corp.
 - Triangle Industries, Inc.
 - Collyer Insulated Wire Co.
 - Cablec Corporation
 - Wire and Cable Dept., General Electric Co.
 - 2. Connectors:
 - Ideal Industries, Inc. -"Wing-Nuts"
 - Buchanan - "B-Caps"
 - Minnesota Mining and Mfg. Co. – "Scotch –Loks" or "Hyflex." Burndy Corp.
 - Thomas & Betts Co.
 - Square D-Anderson

511.2.2 Materials

- A. General: Except as otherwise indicated, provide cable, wire and connectors of manufacturer's materials, as indicated and as required for the installation. Conductor smaller than #12 AWG is not acceptable, except for control and signal systems.
- D. Wire for 120/240V. distribution: #12 through #3 – THWN/THHN; #2 and larger THW or XHHW, except that type USE-XLP shall be installed for service entrance conductors and for all secondary feeder cables in ground or underground floor slabs. THW or XHHW shall be used on all feeder wire #3 and larger. (THWN or THHN is not acceptable.)
- E. Conductor ampacity is based on 60°C rating for 100A (#2) and smaller and on 75°C rating for all sizes over 100A (#1 and larger) regardless of insulation type or rating. Where conductor sizes are not noted on plan or riser, they shall be sized to match the rating of the overcurrent protective device and in accordance with above.
- D. Install 90° C wire in high ambient mechanical rooms, and utility rooms.
- E. Connectors: #18 through #10 – Ideal "Wing-Nuts," Buchanan "B-Caps," 3M "Hyflex" or "Scotch-Loks," or approved equal. Self-stripping tap connectors are not acceptable. Number 8 (#8) and larger - parallel clamp, bolted or hydraulically swaged. Split-bolt connectors are not acceptable.

511.2.3 Branch Circuit Conduit Runs

- A. Minimum 3/4 inch with maximum 9-#12 AWG-THWN/THHN (underground minimum--one inch with maximum 9-#10 AWG-THWN/THHN). No multiple branch circuits in new conduit runs utilizing more than 9 wires in a conduit run so that 1/2 of the allowable fill space is available for adding wires in the future. Contractor shall not utilize conduits larger than 3/4 inch for #12 branch circuit conduit runs (one inch for #10 where applicable) as a means of conveying a large number of circuits from the panel board to a given use area or for use within any area.

- B. Contractor shall be responsible to see that all outlet boxes, junction boxes, pull boxes, etc. are properly sized to accommodate the quantity (and size) of wires permitted in same in accordance with above paragraph and per NEC 370 and any other applicable codes.
- C. Contractor shall increase the size of branch circuit wiring one size (i.e., from #12 AWG to #10 AWG) where the distance from the panel to the center of the load is more than 100 feet long for 120V circuits.
- D. Dedicated circuits shall have a separate neutral run for each dedicated branch circuit conductor.
- E. Dedicated isolated circuits shall have a separate neutral run for each dedicated branch circuit conductor and shall be run in a separate conduit run from the outlet(s) back to the panel board.
- F. Where more than one neutral is run in a common raceway, they shall be separately identified throughout.
- G. Color coding shall be strictly adhered to including switch legs, etc. Control and special systems wiring shall be the only exceptions.
- H. All wiring in conduit unless specifically indicated otherwise.

511.3 EXECUTION

511.3.1 Installation

- A. Install electrical cable, wire and connectors as indicated, in accordance with the manufacturer's written instructions, the applicable requirements of NEC and the NECA's "Standard of Installation and in accordance with recognized industry practices to ensure that products serve the intended functions.
- B. Keep conductor splices to a minimum.
- C. Install splices and taps which have equivalent or better mechanical strength and insulation as the conductor.
- D. Use splices and tap connectors that are compatible with the conductor material.
- E. Loop slack all through conductors in outlet boxes or junction boxes where not spliced.
- F. Apply electric joint compound (Penetrox) to all terminations and contact surfaces including lugs, studs, bolts, set screws, connectors, fittings, cable, etc. - for wire #8 and larger. Wipe off excess compound.
- G. Contractor to exercise caution in installation of feeder cables and, in particular, Thermo-plastic insulations, avoiding sharp bends in conduit and cable, and pressure contact of cable at bushings, pull boxes, panel boards, etc., because of the thermal plastic properties and cold flow tendencies.

- H. No conductors shall be installed until all masonry, plaster, etc., is dry and until all work that might cause damage to the wiring has been completed.

511.3.2 Field Quality Control

- A. Prior to energization, check cable and wire for continuity of circuitry, and for short circuits. Correct malfunction when detected.
- B. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

SECTION 512 BOXES AND FITTINGS

512.1 GENERAL

512.1.1 Summary

- A. Work Included:
 - 1. Outlet boxes
 - 2. Junction boxes
 - 3. Pull boxes
 - 4. Conduit bodies
 - 5. Bushings
 - 6. Locknuts
- B. All materials and accessory items as required for the installation of above. All material shall be rated for use in a Class 1, Division I application. Explosion-proof where requested.

512.1.2 Submittals

- A. Submit a material list and schedule for approval indicating types and manufacturers for boxes and fittings that will be used on the project.

512.1.3 Quality Assurance

- A. Comply with applicable portions of the NECA's "Standard of Installation."

512.2 PRODUCTS

512.2.1 Manufacturers

- A. Provide products produced by one of the following:
- B. Junction and Pull Boxes: Arrow-Hart, Inc.; Hoffman Engineering Co. Keystone Columbia, Inc.; O.Z./Gedney Co.; Square D Co.
- C. Conduit Bodies: Appleton Electric Co.; Crouse-Hinds Co.; Killark Electric Mfg. Co.; Pyle-National Co.
- D. Bushings, Knockout Closures and Locknuts: Appleton Electric Co.; Raco, Inc.; Steel City, Midland-Ross Corp.; Thomas and Betts Co., Inc.

512.2.2 Materials

- A. Octagon Boxes: 4 inches, 2-1/8 inch deep minimum. Use "no-bolt" studs where required. In unfinished areas (mechanical, utility and storage), use 4-inch-square boxes with 1/2- inch raised covers.
- B. CAUTION: Gangable switch boxes shall not be installed under any circumstances. All #6-32 Machine screw ears shall turn in toward the box center line and not out as is typical of switch boxes and some plaster rings. All outlet boxes shall be flush unless otherwise noted on the electrical drawings.
- C. Weatherproof Outlet Boxes: Provide corrosion resistant cast metal weatherproof outlet wiring boxes of types, shapes and sizes, including depth of boxes, with threaded conduit ends, cast metal faceplates with spring-hinged waterproof caps suitably configured for each application, including faceplate gaskets and corrosion resistant fasteners.
- D. Junction and Pull Boxes: Provide galvanized sheet steel junction and pull boxes, with screw-on or hinged covers; of the type, shape and size, to suit each respective location and installation; with welded seams (where applicable) and equipped with corrosion-resistant nuts, bolts, screws and washers.
- E. Conduit Bodies: Provide galvanized cast metal conduit bodies, of the type, shape and size to suit each respective location and installation, constructed with threaded conduit ends, removable cover, and corrosion-resistant screws.

512.3 EXECUTION

512.3.1 Installation

- A. Install electrical boxes and fittings as indicated, or in compliance with NEC requirements and the NECA's "Standard of Installation," in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that the boxes and fittings serve the intended purposes. All boxes and fittings to be installed according to NEC 500-501.
- B. Outlet boxes in unfinished spaces, mechanical and utility areas may be either recessed mounted or surface mounted as conditions dictate and as practical unless otherwise noted on plans; coordinate with other contractors.
- C. Contractor shall be responsible to see that all outlet boxes, junction boxes, pull boxes, etc. are properly sized to accommodate the quantity (and size) of wires and conduits permitted in same per NEC 370 and any other applicable codes.
- D. In general, 4-inch-square or 4-1/16-inch-square junction boxes shall not have more than four (4) conduit entries in and/or out of box (total) except with prior approval for any specific application.
- E. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- F. Locate boxes and conduit bodies so as to assure accessibility of electrical wiring.
- G. Secure boxes rigidly to the substrate upon which they are being mounted. Boxes shall be fastened to a surface or they shall be supported by a structural member of the

building per NEC 370-13. Boxes shall not be supported by conduit or raceways or from ceiling tie wires, ductwork, piping or other nonstructural members.

- H. Label/mark cover plates for all junction, outlet or pull boxes indicating system served such as "F.A." for fire alarm, "SIG" for signal, etc. or PNL-AL, 3, 5 for panel designation and branch circuits 1, 3, 5. Labeling shall be 3/18-inch dymo (color coded) or permanent magic marker (color coded), neatly hand labeled. Color-coding shall be for different systems, i.e., Panel-black; Fire Alarm-red; Signal-blue, etc. Labeling shall include boxes above accessible ceilings.

SECTION 513 WIRING DEVICES

513.1 GENERAL

513.1.1 Summary

- A. Work Included:

- 1. Receptacles
- 2. Switches
- 3. Wall plates
- 4. Plugs
- 5. Connectors
- 6. All materials and accessory items as required for the installation of above

513.1.2 Description of Work

- A. The extent of wiring device work is indicated by drawings and schedules, and by the requirements of this Section. Wiring devices are defined as single discrete units of electrical distribution systems that are intended to carry but not utilize electric energy.

513.1.3 Submittals

- A. Submit a listing of brand names and types of materials proposed for use in the work of this Section.

513.1.4 Quality Assurance

- A. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of electrical wiring devices.
- B. Provide electrical wiring devices that have been listed and labeled by Underwriters Laboratories.
- C. Comply with NECA's "Standards of Installation" for wiring device products.

513.2 PRODUCTS

513.2.1 Manufacturers

- A. Provide products produced by one of the following (for each type of wiring device):

Devices	Plates
Arrow-Hart, Inc.	Sierra (only)
General Electric Co.	Bell (exterior)
Hubbell Wiring Device Division	
Leviton	
Pass and Seymour, Inc.	

513.2.2 Fabricated Devices

- A. Provide factory-fabricated wiring devices, in the type, color, and electrical rating for the service indicated.
- B. Equivalent heavy-duty premium specification grade shall mean that other manufacturer's devices are listed in the manufacturer's cross-reference chart as being comparable to the device listed or specified.
- C. Once a specific approved manufacturer has been chosen, all wiring devices shall be by the same manufacturer, wherever applicable and available.
- D. All duplex receptacles installed within six feet of a sink shall have ground fault circuit-interrupter protection.
- E. Provide duplex receptacles with ground fault circuit-interrupter protection at outside locations and other applicable/wet locations as noted on plans.

513.2.3 Wiring Device Accessories

- A. Plates: Provide switch and outlet wall plates for wiring devices, provided with metal screws for securing plates to devices, screw heads colored to match finish of plate, and wall plates possessing the following additional construction features: In general, plates shall be #302 satin stainless steel, supplied by one manufacturer.
- B. Device plates for surface mounted, 4-inch square boxes to be 1/2 inch raised galvanized steel covers.
- C. Exterior devices or devices in damp locations to have appropriate plates-W. P. Bell with padlock hasp provision and 4 corner screws for mounting on Bell cast aluminum (flush) outlet box.

513.3 EXECUTION

513.3.1 Examination

- A. Examine the areas and conditions under which wiring devices are to be installed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

513.3.2 Installation

- A. Install wiring devices where indicated, in accordance with manufacturers written instructions, applicable requirements of NEC and the NECA:s "Standard of Installation," and in accordance with recognized industry practices to ensure that products served the intended function.
- B. Wiring devices in unfinished spaces, mechanical, and utility areas may be either flush mounted or surface mounted as conditions dictate and as practical unless otherwise noted on plans; coordinate with other contractors.
- C. All duplex receptacles mounted in a vertical position shall be mounted with the ground opening down. Verify acceptance with architect, owner and local code authorities having jurisdiction before installing.
- D. All duplex receptacles mounted in a horizontal position shall be mounted with the neutral up.
- E. Delay installation of devices until wiring is completed.
- F. Install receptacles and switches only in electrical boxes that are clean; free from excess building materials, debris, etc.
- G. Switches and operating devices shall not be installed higher than 42" in compliance with handicap code requirements, where applicable.
- H. In general, light toggle switches shall be installed within 6-8 inches of the door frame - latch side - etc. Contractor shall be responsible for achieving same.
- I. Install separate green ground wire from ground terminal on all grounded receptacles to backbox (and from backbox to ground bar in panel board). Self-grounding clip is not acceptable.
- J. Terminals on, wiring devices (hot or neutral) shall not be used for feed-through connections looped or otherwise. Circuit connections shall be made via wire connectors and pigtails.

513.3.3 Testing

- A. Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements.

SECTION 514 - DISCONNECT SWITCHES

514.1 GENERAL

The requirements of the Contract Documents, including the General Conditions, Supplementary Conditions, and Division 1 - General Requirements apply to this section except as modified herein.

514.1.1 Description

Work included: The work for the disconnect switches is indicated on the drawings and includes, but is not necessarily limited to, disconnect switches.

514.2 PRODUCTS

514.2.1 Disconnect Switches

- A. Disconnect switches shall be heavy-duty type, NEMA 3R for outdoors, NEMA 1 for indoor, NEMA 12 JIC type without knockouts for indoors below grade areas, and special NEMA rated for hazardous areas.
- B. Service entrance disconnect switch shall be provided with special lock-on and lock-off provisions.
- C. All disconnect switches shall be horsepower rated.
- D. All fuses shall be dual-element type, 100,000 amperes symmetrical minimum interrupting capacity.
- E. Typical motor and power circuits shall be protected by dual element fuses.
- F. Services in excess of 200 amperes capacity shall incorporate dual element limiting fuses.
- G. Services in excess of 600 amperes capacity shall incorporate current limiting fuses.
- H. Where materials, equipment, apparatus, or other products are specified by manufacturer, brand name, and type or catalog number, such designation is to establish standards of desired quality and style and shall be the basis of the bid.
- I. The Contractor shall provide materials and equipment of the type for which there are National Board of Fire Underwriters' Laboratories (UL) listings available.
- J. All materials used for the electrical installation shall be new and unused, except as otherwise indicated, and shall be uniform in type and manufacture for the entire electrical installation.
- K. All materials shall be suitable for the conditions and duties imposed upon them in service and shall be the latest standard catalog product of reputable manufacturers.

514.3 EXECUTION

514.3.1 Installation

Provide disconnect switches as shown on plans and install as required.

SECTION 515 SUPPORTING DEVICES

515.1 GENERAL:

515.1.1 SUMMARY

- A. Work Included:
 - 1. Channel support
 - 2. Anchors
 - 3. Toggle bolts
 - 4. Structural supports
 - 5. All materials and accessory items as required for the installation of above

515.1.2 Description of Work

- A. This section specifies hangers, supports and anchors for use in supporting or mounting conduits, boxes, disconnect switches, starters, lighting fixtures, etc.

515.2 PRODUCTS

515.2.1 Fixtures

- A. Fixtures shall be mounted as specified. Provide hardware required to securely attach fixtures to ceilings or walls.

515.2.2 Fixture Supports

- A. Studs and Unistrut support for fixtures and outlets by this Contractor.
- B. All wall and ceiling fixtures shall be securely mounted so that they are not dependent on surface finish for support and cannot be rotated or displaced.

515.2.3 Structural Supports

- A. Structural supports for panels, boxes, etc., by this Contractor as required.
- B. In general, fixture and equipment channel supports shall be Unistrut channel or approved equal channel support system.
- C. Anchors and/or supports in concrete or masonry surfaces shall be drilled expansion insert type suitable for load and application requirements and equivalent to Red Head sleeve anchors, lag shields, plastic anchors, etc. as required.

515.3 EXECUTION

515.3.1 Examination

- A. Prior to installation of hangers, supports, anchors and associated work, meet at the project site with other trades for the purpose of reviewing the material selections and procedures to be followed in performing the work in compliance with the requirements specified.
- B. Examine the areas and conditions under which equipment and associated components are to be installed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

515.3.2 Installation

- A. Building Attachments: Install building attachments at the required locations onto concrete or structural steel for proper raceway and equipment support. Install additional building attachments where support is required for additional concentrated loads.
- B. Hangers and Supports: Install hangers, supports, clamps and attachments to support raceways and equipment properly from the building structure. Arrange for grouping of parallel runs of horizontal raceways to be supported together on strut channel trapeze type hangers where possible. Do not use wire or perforated metal to support conduits and do not support conduits from other conduit.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

- C. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- D. Anchors: Install anchors at the proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent the transfer of loading and stresses to connected equipment.

SECTION 516 - SERVICES, METERING, AND GROUNDING

516.1 GENERAL

516.1.1 Summary

- A. Work Included:

- 1. Services
- 2. Metering
- 3. Grounding
- 4. All materials and accessory items as required for the installation of above

516.1.2 Description of Work

- A. The extent of services, metering and grounding work is indicated by drawings and schedules, and by the requirements of this Section.
- B. Services: Local Utility will provide underground electrical service (277/480V., 3 phase-, 4 wire) from Power Company termination point to service entrance equipment. The Electrical Contractor shall provide the metering compartment meter socket. Electrical Contractor to make application for service, make all arrangements and coordinate installation with Local Utility. Local utility contact is Rick Wickland, Sun Prairie Utilities (608) 837-5500. All work above to be in accordance with Local Utility standards and requirements. Electrical Contractor to include in their bid, payment to Local Utility for chargeable work and material (if any) by Local Utility for installation of new service entrance. Any charges, if applicable, will be invoiced by utility directly to the Electrical Contractor.

- C. Metering: Meter by utility, Electrical Contractor to provide meter socket that is in accordance with utility standards and requirements. Contractor to coordinate metering requirements and installation with utility.
- D. Grounding: Provide all grounding material and wiring for main electrical services, feeder systems, panels, motors and equipment furnished and installed under this section and grounding for equipment provided by all other Contractors as shown on the Drawings and as described herein.

516.1.3 Quality Assurance

- A. Comply with National Electrical Code (NFPA 70) as applicable to services, metering, and grounding provisions.

516.2 PRODUCTS

516.2.1 Grounding

- A. Conductors: Insulated stranded copper - aluminum not allowed.
- B. Connectors: Cast bronze with non-ferrous bolts, nuts and lock washers. Thermally Welded Connections: Cadweld, Bumey, or equal, where specified.

516.3 EXECUTION

516.3.1 Examination

Examine the areas and conditions under which services and grounding are to be installed and notify the A/E in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

516.3.2 Installation

- A. Grounding: Ground service neutral and equipment to ground rods driven near meter. In addition, provide additional grounding electrode system in accordance with NEC 250-81. Service ground shall be insulated copper wire in heavy wall conduit with both conductor and conduit attached to ground clamp meter ground, coated with Penetrox before and after connection to protect against corrosion.
- B. Grounding systems for main service shall be installed such that the ground resistance at these points does not exceed 15 ohms.
- C. Neutral shall not be grounded except at service ground.
- D. Provide separate green ground wire for conduit connections to motors, equipment, and fixtures.
- E. Install separate green ground wire from ground terminal on all grounded receptacles to backbox. Self-grounding clip is not an acceptable substitute.
- F. Install insulated green ground wire from ground terminal on all grounded receptacles to ground bar in panel board.
- G. Install insulated green ground wire with branch circuit conductors supplying lighting fixtures and fixed equipment from ground bars in panel boards to all conductive surfaces

of lighting fixtures and fixed electrical equipment and ground thereto. Size ground wires per NEC 250-95.

- H. Install separate green ground bar in panels as noted on riser and run green ground wire from lighting fixtures, equipment connections, and receptacles to ground bar per plan notes. Size ground wires per NEC 250-95.
- I. Apply electric joint compound (Penetrox) to all ground terminations and contact surfaces; wipe off excess compound.
- J. In general, all equipment connections which are supplied from a panel board or motor control center having a separate ground bar shall have a separate green insulated ground wire run with circuit conductors and connected to equipment.
- K. Each ground connection shall be made with mechanical connectors unless otherwise specified. Connections shall be accessible for inspection and checking; no insulation shall be installed over ground connections. All ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
- L. All grounds shall be permanently attached before any permanent building service is energized.

SECTION 517 - LIFT STATION SITEWORK

517.1 GENERAL

517.1.1 Summary

- A. Perform necessary site work for construction and access to lift station.

517.1.2 Sitework General

- A. Clearing & Grubbing. Lift Station to be located on wooded site. The Contractor shall clear and grub and area sufficient in size to install the lift station, control panel, transformer, and driveway, and grade the lift station for proper drainage. Clearing and grubbing shall be in accordance with the State Specification, Sections 201.1 and 201.2. Payment for clearing & grubbing shall be inclusive with payment for work associated with lift station construction.
- B. Site Grading. Topsoil shall be stripped from all cut and fill areas on the lift station site and stockpiled at the site. The site shall be graded to drain away from lift station. No portions of the site shall drain toward the lift station, control panel, or transformer.

517.1.3 Asphalt Driveway.

- A. Aggregate Base Course materials shall be in accordance with Section 401.2 of the City Specifications, and shall be 8 or 9 inches of Gradation No. 2 aggregate base course (compacted thickness). Base course shall be compacted over the entire area to a minimum density of 92%, of the Modified Proctor density, ASTM D1557.

- B. Asphaltic Concrete Surface shall be in accordance with section 402.3 of the City Specifications, and shall be 2 inches in thickness, surface course pavement.
- C. Concrete driveway apron shall be installed by others.

517.1.4 Measurement & Payment -Site Grading and Driveway.

- A. Measurement and payment for the site grading and driveway shall be per lump sum.

517.1.5 Replace Topsoil.

- A. Topsoil salvaged during the site grading shall be placed on unpaved areas of the lift station site. The topsoil shall be placed and minimum of 6 inches thick, and may be used to fill outside the driveway and lift station, control panel, and transformer. Topsoil shall meet the requirements in the Site Restoration section of this specification.

SECTION 518 – SUBMITTALS

518.1 GENERAL

518.1.1 Applicable Provisions

- A. Applicable provisions of Division 1 shall govern work of this section.

518.1.2 Applicable Publications (NONE)

518.1.3 Description of Work

The work under this section shall cover furnishing submittal information as required by the contract drawings, other specification sections and as specified herein.

518.1.4 Related Work Elsewhere (NONE)

518.1.5 Shop Drawings

- A. As soon as possible after Notice to Proceed, submit brochures of catalog cuts and specifications for all new equipment. Submittal of product data shall comply with the requirements for shop drawings.
- B. Prior to fabrication or installation, submit shop drawings for review. Shop drawings shall be submitted to the Engineer electronically.
- C. Shop drawings shall include layout details, schedules, setting instructions, and manufacturer's literature. Concrete reinforcing steel shop drawings shall include a concrete pouring sequence for structures with vertical construction joints.
 - 1. Shop drawings shall be identified with the name of the project, numbered consecutively and bear the stamp of approval of the Contractor as evidence that all drawings have been checked by the Contractor for accuracy and compatibility with contract requirements. Drawings not so checked and noted will be returned without being examined.

2. Partial lists will not be considered; shop drawings for each part of work shall be complete in one submittal.
- D. If information on previously submitted shop drawings is altered, in addition to the notations made by the Engineer, the Contractor shall bring all changes to the attention of the Engineer. Corrections or changes indicated on reviewed shop drawings shall not be considered an order for extra work.
 - E. Shop drawings will not be considered reviewed unless they bear the stamp of review and signature of the Engineer. Drawings will be reviewed for general design only. Dimensions and fit of units of various parts shall be the Contractor's responsibility.
 - F. Prior to work at the site, submit samples allowing reasonable time for review and testing. Submit samples in sufficient quantity (minimum of five), of adequate size showing quality, type, color range, finish and texture. Label each sample stating material, description, applicable specification sections, intended use, project name, and Contractor's name.
 - G. Order no materials subject to sample review until receipt of written approval. Materials installed shall match reviewed samples. No approval of samples shall be taken in itself to change or modify contract requirements beyond the expressed stipulations of the approval letter.

518.1.6 Operation/Maintenance Manuals and Instructions

- A. Prior to startup of the equipment, the Contractor shall provide the Engineer with four operation and maintenance manuals covering each item of equipment furnished or installed under their contract as follows:
 1. Supplier and manufacturer's name, address, telephone number, and local representative's name, address and telephone number. Sources of service and parts and a list of local repair services, supply houses and potential sources for the types of repairs and equipment parts.
 2. Complete and accurate set of as-built drawings including drawing dimensions, schematics of hydraulics, wiring, and piping.
 3. Warranties and bonds shall be included in manual.
 4. Catalog literature complete with test data and performance data and ratings.
 5. Specify equipment function, normal operating and limiting conditions.
 6. Assembly, installation, alignment, adjusting and checking instructions.
 7. Operating instructions for start-up, shutdown, routine and normal operation.
 8. Emergency operating instructions indicating range and flexibility during emergencies.
 9. Detailed service information including schedule of recommended maintenance.
 10. Troubleshooting, common operating problems, problems that might occur in unit/process. List probable causes and discuss control/prevention.

11. Detailed safety section covering the operation and maintenance of unit. Contractor shall supply a complete list of equipment service numbers, model numbers, electrical requirements, manufacturer's names, etc.

12. The correct model number shall be designated where the literature covers more than one model.

13. For items assembled by the Contractor, the Contractor shall write and provide duplicate operation and maintenance instructions.

14. Data shall be folded to 8-1/2 inch x 11-inch size and placed into hard cover binders. Material shall be grouped according to specifications section and filed behind individual filing tab pages on which the following is to be typed: Item, Manufacturer, Contractor's Order Number, Supplier's Order Number, and Manufacturer's Order Number.

15. Manuals shall be delivered to the Engineer for approval prior to job completion.

518.1.7 Permits and Approvals

- A. Obtain and submit copies of all permits, code inspections, and approval documents, as specified.

518.1.8 Construction Schedule

- A. Submit a minimum of five copies of a schedule of operation prior to construction. The schedule shall provide for activities of the various trades and shall be sequenced to provide a minimum of interruption to the operation of existing facilities. Allow ample time for the Owner to alter operations as required by the construction of the various components of the work. Revised and updated construction schedule shall be provided throughout the construction as deemed necessary and requested by the Engineer.

The construction schedule shall be supplemented by a list of shop drawings, dates they will be submitted for approval and a reasonable time allowance for review.

518.1.9 Start-up Reports

- A. Where equipment startup by a factory-trained representative is required, a minimum of three copies of the start-up report shall be submitted which describe the representatives' activities and installation approval.
1. Start-up report shall be a typewritten document containing descriptive information specifically identifying the piece by equipment, all tests conducted and the results of the tests.
 2. Start-up role log, with the dated signatures of those conducting and accepting all start-up instructions and tests shall be provided as part of the report.
- B. Substantial completion will not be issued until all start-up reports have been submitted.

518.1.10 Record Drawings

- A. The Engineer will provide the Contractor with a suitable set of contract drawings on which daily records of changes and deviations from contract shall be recorded. All buried or concealed piping, conduit, or similar items shall be located by dimensions and elevations on the record drawings.

1. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.
2. At completion of the project, the Contractor shall submit the marked-up record drawings to the Owner.

518.2 PRODUCTS AND MATERIALS (N/A)

518.3 CONSTRUCTION METHODS (N/A)

518.4 MEASUREMENT AND PAYMENT

518.4.1 General

- A. Submittals shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Schedule or Special Conditions - Division 1.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated, unless indicated otherwise in the Bid Schedule or Special Conditions - Division 1.

518.4.2 Submittals

- A. Submittals, Inclusive. The cost for all submittals shall be considered inclusive to payment for work related to the respective equipment, associated construction or utility, unless indicated otherwise in the Bid Schedule or Special Conditions - Division 1.

SECTION 519 - QUALITY CONTROL

519.1 GENERAL

519.1.1 Applicable Provisions

- A. Applicable provisions of Division 1 shall govern work of this section.

519.1.2 Applicable Publications (NONE)

519.1.3 Description of Work

- A. Provide quality control for all work performed under this contract as described in this section.

519.1.4 Related Work Elsewhere

- A. Submittals - Division 1
- B. Material and Equipment - Division 1

519.1.5 Quality Assurance

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturer's instructions, including each step in sequence.

- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.
- F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

519.1.6 Tolerances

- A. Monitor tolerance control of installed products to produce acceptable work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturer's tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

519.1.7 References

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of the Engineer shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

519.1.8 Mock-up

- A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups are representative of the quality required for the work.
- D. Where mock-up has been accepted by Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so.

519.1.9 Inspecting and Testing Laboratory Services

- A. Owner will appoint the services of an independent firm to perform inspecting and testing. Owner shall contract and pay for services.
- B. The independent firm will perform inspections, tests, and other services specified in

individual specification sections and as required by the Engineer or the Owner.

- C. Inspecting, testing, and source quality control may occur on or off the project site. Perform off-site inspecting or testing as required by the Engineer or the Owner.
- D. Reports will be submitted by the independent firm to the Engineer indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify Engineer and independent firm 24 hours prior to expected time for operations requiring services.
 - 2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
- F. Testing or inspecting does not relieve Contractor to perform work to contract requirements.
- G. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Engineer. Payment for retesting will be charged to the Contractor by deducting inspecting or testing charges from the Contract Sum/Price.

519.1.10 Manufacturers' Field Services and Reports

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, and test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- C. Submit report within 30 days of observation to Engineer for information.

519.2 PRODUCTS AND MATERIALS (N/A)

519.3 CONSTRUCTION METHODS (N/A)

519.4 MEASUREMENT AND PAYMENT (N/A)

SECTION 520 - PROJECT CLOSEOUT

520.1 GENERAL

520.1.1 Applicable Provisions

- A. Applicable provisions of Division 1 shall govern work of this section.

520.1.2 Applicable Publications (NONE)

520.1.3 Description of Work

- A. The Contractor shall assume the responsibility for the protection of all finished construction until accepted by the Owner. The Contractor shall repair and restore any and all damage to finished work to the satisfaction of the Engineer.
- B. The Contractor shall require each trade to clean the premises of accumulations of surplus materials and rubbish caused by their activities. Burning of rubbish on site will not be permitted.

520.1.4 Related Work Elsewhere (NONE)

520.1.5 Tests and Adjustments

- A. The completed work in accordance with requirements of the contract documents when ready in all respects for use by the Owner shall be subjected to a performance test at operating conditions. The Contractor shall make all adjustments necessary to fulfill requirements and to comply with the instructions and recommendations of manufacturers, and to comply with all codes and regulations.

520.1.6 Loose and Detachable Parts

- A. The Contractor shall retain all loose and small detachable parts of apparatus and equipment furnished under this contract, until completion of the work and shall turn them over to the Owner.

520.1.7 Operating and Maintenance Instructions

- A. Provide operation and maintenance manuals covering each item of equipment furnished. Submit manuals to Engineer prior to "Substantial Completion" in accordance with Submittals - Division 1 of these specifications.

520.1.8 Guarantee Documents

- A. Upon "Substantial Completion" of the project, the Contractor shall submit written guarantees where specified to the Engineer for presentation of the Owner. Furnish guarantees in triplicate unless otherwise indicated.

520.2 PRODUCTS AND MATERIALS (N/A)

520.3 CONSTRUCTION METHODS (N/A)

520.4 MEASUREMENT AND PAYMENT (N/A)

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PART 6

SUN PRAIRIE UTILITIES

WATER MAIN SPECIFICATIONS

SECTION 601 - WATER MAIN SPECIFICATIONS

601.1 MATERIALS

601.1.1 PIPE

General:

The Contractor shall furnish and install ductile iron pipe and all appurtenances, complete in place, in accordance with the requirements of the Contract Documents. Where standards, specifications or methods are cited without dates, the reference shall be construed to apply to the latest revision in effect at the time of contract.

All ductile iron pipe shall be designed and manufactured in accordance with AWWA C150 and AWWA C151, respectively. All ductile iron pipe and appurtenances, as detailed in this specification, shall be manufactured in the United States of America and the raw material for ductile iron shall have an average minimum recycled content consisting of 90% scrap iron and steel. Ductile Iron Pipe shall be furnished with push-on joints, push-on restrained joints, or flanged joints as required.

Unless otherwise noted in these specifications or on the drawings, all ductile iron for water main installation shall be Special Thickness Class 52 meeting the requirements of AWWA C150.

The pipe trench, per AWWA C150, for design purposes shall be Laying condition Type 5 – “Pipe bedded to its centerline in compacted granular material, 6” minimum under pipe. Compacted granular or select material a minimum of 1 ft. above the top of the pipe. (Approximately 90% Standard Proctor, AASHTO T-99.) (E’=700psi)”

The Contractor shall submit catalog cuts of pipe in accordance with the requirements of this Section including dimensional drawings of joints, showing the manufacturer’s allowable deflections and the manufacturer’s approved installation instructions for the types of joints being used.

The Contractor shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section, as specified in the referenced standards including AWWA C150, AWWA C151, AWWA C104, ISO 8179, AWWA C105, AWWA C111, AWWA C115, AWWA C600, and AWWA M41.

All pipe and appurtenances shall have part numbers or product identification available in the field to verify compliance with standard specifications and/or approved product submittals.

Lining:

All ductile iron pipe shall be lined with cement-mortar lining without an asphaltic seal coating, in accordance with the lining options provided in AWWA C104.

Coating:

Outside coating shall be an asphaltic coating approximately one mil thick per AWWA C104 and AWWA C151.

Joints:

Push-on joints shall conform to AWWA C111. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR). The pressure rating for push-on joints shall be a minimum of 350 psi or the specified pressure rating of the pipe, whichever is less.

Use push-on restrained joint when electing to or are otherwise required to meet thrust-restraint requirements. Restrained-joint locking gaskets must be certified as compliant for use with the furnished pipe material by the pipe manufacturer, and pre-approved by Sun Prairie Utilities.

All exposed water main, interior piping, and piping in pits or manholes shall be flanged joint and minimum special thickness Class 53 with a minimum rated working pressure of 350 psi. Candidate pipe for flanged pipe thread-fabrication shall be in accordance with AWWA C115. Bolts, gaskets and installation shall be in accordance with AWWA C115, Appendix A requirements, and flanged gaskets shall be full-face Toruseal gaskets as manufactured by American Ductile Iron Pipe, with a special seal design, or approved equal. Toruseal gaskets, or approved equal, must be used for all buried flanged joints. Gaskets shall meet applicable requirements of AWWA C111 and shall be SBR.

Conductivity:

All buried ductile iron pipe and fittings shall be furnished with cable bond conductors, AMERICAN Conductive Gaskets, or electrobond conductivity strips. Thermite welded straps are allowed provided weld points are thoroughly coated with bitumastic material.

Polyethylene Encasement:

All buried ductile iron water main piping and fittings shall be polyethylene encased in accordance with AWWA C105. In addition, polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low-density polyethylene (LLDPE), fused into a single thickness of not less than eight mils. The inside surface of the polyethylene wrap to be in contact with the exterior of the pipe and appurtenances shall be infused with a blend of anti-microbial biocide to mitigate microbiological influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

Ductile iron pipe and the polyethylene encasement used to protect it shall be installed in accordance with AWWA C600 and AWWA C105. Specifically, the wrap shall be installed by modified method A for wet trench conditions and overlapped a minimum of one foot at joints. Wrap at tap locations shall be taped tightly with two or three wraps of tape prior to tapping through the tape and polyethylene encasement and inspected for any needed repairs following the tap. All installations shall be carried out by personnel trained and equipped to meet these various requirements.

601.1.2 FITTINGS**General:**

All fittings used for water main installation shall be ductile iron in accordance with AWWA C153 or AWWA C110. Fitting sizes 4" – 24" shall be rated for 350 psi working pressure.

All fittings shall be set on a 4" x 8" x 16" concrete block, or equivalent. (Valves, bends, hydrant 90 degree bend, etc.). Costs for blocks shall be included in the UNIT Bid Prices.

The Contractor shall submit catalog cuts of fittings in accordance with the requirements of this Section including dimensional drawings of joints and the manufacturer's approved installation instructions for the fittings used.

The Contractor shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section, as specified in the referenced standards including AWWA C110, AWWA C153, AWWA C104, AWWA C111, AWWA C600, and AWWA M41.

T-Bolts shall have a fluoropolymer coating (Cor-Blue or equivalent), be made in United States of America, and pre-approved by Sun Prairie Utilities.

Lining:

All ductile iron fittings shall be internally lined with cement mortar in accordance with AWWA C104.

Coating:

All buried ductile iron fittings shall be coated with a standard 1-mil shop coat in accordance with AWWA C110, Section 4.4.1 and AWWA C153, Section 4.4.1.

Joints:

Mechanical joints conforming to AWWA C111 shall be used in all buried locations. Flanged fittings may be allowed inside vaults. Mechanical Joint restraint shall be accomplished using MEGALUG® Mechanical Joint Restraints, manufactured by EBBA Iron, or equivalent USA manufactured product. PVC restraints glands are prohibited.

601.1.3 HYDRANTS

The hydrant pumper nozzle shall be of a non-threaded design, compatible with 5" Storz hose coupling. The hose nozzle shall be an integral part of the fire hydrant and must be furnished by the manufacturer or authorized distributor designated by the manufacturer. Storz adapters will not be accepted. The nozzles and the caps for the nozzles shall meet the applicable requirements of NFPA 1963. The connecting main shall be 6 inches with mechanical joint. Each hydrant shall have a drain port. Height shall be 7 feet from the ground line to the bottom of the trench. Fire Hydrants to be wrapped in V-Bio polyethylene encasement per requirements of AWWA C105. The wrap in the area of the drain hole shall be taped off above and below the drain and the wrap removed in the area of the drain between the taped off areas so the hydrant can drain freely. The fire hydrant shall be set on a concrete block above a minimum of 8-inches of 1-inch washed stone, and backfilled to at least 18-inches above the drain, with 1-inch washed stone. The washed stone shall be covered with 8 mil polyethylene sheeting to prevent backfill from contaminating the washed stone.

WATEROUS WB 67

All hydrant heads shall be valved with the valve tied to Hydrant Tee. Hydrants at dead ends shall be tied from the valve to the hydrant. All hydrants shall be equipped with a marker - Hydrafinder, 5 ft. length with a flat bracket, or equal approved by utility.

601.1.4 VALVES

WATEROUS 2500 Series

Valves shall conform to AWWA C-515 with mechanical joints, non-rising stem, bronze-mounted, double-seated, open to left and 2-inch square operating nut. Tie valves to Tee in Hydrant leads with tar coated tie rods, "Mega-Lug" restraining glands or approved equal. To obtain optimal compaction, valves shall be spaced at a minimum of 15 feet.

601.1.5 VALVE BOXES

Valve boxes shall be three piece or Buffalo type with adjustable two-section screw type telescoping 5-1/4 inch inside diameter column or shaft and a separate base that covers the operating nut gland, stuffing box and upper bonnet of the valve. Covers shall have service identification shown as "WATER VALVE." Gate valve adaptors shall be used to stabilize valve box.

601.1.6 SERVICE LATERALS

Service connections shall be laid with Type "K" copper tubing of 1-inch diameter unless other diameters are specified.

Corporation stops shall be Mueller Compression Fitting, Part # H15008.

Curb stops shall be Mueller Compression Fitting, Part # B25155.

Service boxes shall be Arch Pattern with 1-1/4" Upper Section -Type PL Lid Stationary Rod or equal Mueller pattern for standard 6.5' depth. Part # H10385. Cotter pins shall be stainless steel.

Service connections 1-1/2-inch and 2-inch diameters:

Corporation stops shall be Mueller Compression Fitting Part # H15013.

Curb Stops shall be Mueller Compression Fitting Part # B25155.

Service Boxes shall be Arch Pattern with 1-1/4" upper section – Type PL Lid Stationary Rod or equal Mueller Pattern for standard 6.5' depth, Part # H10386. Cotter pins shall be stainless steel.

All fittings shall be set on a 4" x 8" x 16" concrete block, or equivalent. (Curb stop, coupling, etc.). Costs for blocks shall be included in the UNIT Bid Prices.

All service boxes must be poly-wrapped where the arch sits on the block to prevent debris from getting to the curb stop

Lots designated for duplexes shall have two separate water services.

**** Approved alternate Corporation stops or Curb stops to be used if the above specified cannot be produced at the project commencement:**

Corporation stops:

Ford Compression Fitting. Part # FB1000-x

Curb stops:

Mueller Compression Fitting. Part # B25209N

Ford Compression Fitting. Part # B44-xxx-Q-NL

601.1.7 WATER MANHOLES

Refer to section 502.5, 502.7, and detail 5-15 for manhole and casting specifications. For reconstruction, the existing casting shall be re-used unless directed by the Sun Prairie Utility Engineer.

All adjusting rings for water manholes shall be made from Expanded Polypropylene (EPP) as manufactured by CRETEX (PRO-RING) or approved equal and meet the requirements of ASTM D3575 and ASTM D4819-13. The contractor shall use flat and sloping adjusting rings to match manhole casting to 3/8" below road grade. The adjusting rings shall be sealed using M-1 Structural Adhesive/Sealant, or approved equal, meeting requirements of ASTM C-920. The adjustment rings shall be tested to assure compliance with impact and loading requirements per AASHTO M-306, H-25, and HS-25. Maximum height of adjusting rings shall not exceed 7.50". The inner diameter of the adjustment rings must match the inner diameter of the cone installed. The contractor shall supply all adjustment rings for reconstruction projects.

601.2 CONSTRUCTION METHODS

601.2.1 GENERAL

The water main construction shall include the Contractor/Developer furnishing all materials consisting of pipe, bends and other fittings, hydrants, valves, house fitting where specified, manholes or valve boxes where specified, concrete or gravel where specified, and any other specials, as shown on the plans and specifications.

The Contractor shall make all necessary excavations, provide the necessary foundations, and provide bracing, backfill and restoration of the site and damaged utilities.

American Water Works Association Standards of Recommended Installation Procedure, per AWWA C600 and manufacturer's recommendations, shall be followed.

All materials shall be installed per manufacturers' recommendations. Manufacturers' installation specifications shall be submitted with the product submittals prior to construction.

Valves and hydrants may only be operated in the presence of, and with the authorization of the Sun Prairie Utility Engineer and/or SPU designee.

Working on or near pressurized water systems may pose significant risks to workers. Never assume sufficient thrust restraint mechanisms are properly employed on existing water system infrastructure. Implement all necessary worker safety and protection methods whenever required,

all in accordance with current local, state and federal laws, codes and ordinances. Protect the integrity (physical and operational) of the existing water system during all construction activities.

601.2.2 EXCAVATION

Trenches shall be excavated to the line and grade as shown on the plans. No deviation from line and grade will be permitted unless directed by the Engineer.

The excavations shall be so made that a pipe shall be laid on a 6-inch bed of granular material.

The Contractor will be required, at their own expense, to sustain all water, sewer, gas pipes or other utility, which may in any manner be affected by this work, and do everything necessary to protect, support and maintain in service, so long as needed, all such water mains, sewer or gas pipes, lamp post, poles, service pipes and other fixtures laid across of along the streets, and shall in no way affect the gutters of the street or affect the flow of water in the same, and shall use means acceptable to the Engineer to permit the flow of surface water along the gutters while work is progressing.

The Contractor/Developer shall not in any manner unnecessarily obstruct the streets or crossing, and shall at all times and under all circumstances provide safe and sufficient means for foot passengers and vehicles.

The Contractor/Developer shall erect and keep erect a fence or other barrier along the line of work and across the ends of the trenched in order to guard the public effectively from liability to accident during the entire progress of the work, both by day and by night, and they will be held responsible for damages arising in consequence of neglecting the precautions herein specified. In addition to the necessary barriers, amber lights must be maintained at night, from twilight in the evening until sunrise, at the end and along the sides of the trench. A watchman shall be employed by the Contractor/Developer as additional security at the project site whenever the same shall be needed.

Shoring and sheeting shall be in accordance with the Wisconsin Industrial Commission Code and the cost for it shall be included in the Unit Bid Prices.

601.2.3 DEWATERING

The Contractor shall remove by pumping, bailing, or otherwise, any water which may accumulate or be found in the trenches and other excavations made under the Contract, and shall form all dams, flumes or other works necessary to keep them entirely clear of water while the sewers and their foundations, and other foundation works are being constructed, and shall conduct all water from such excavations so as not to flow over or damage private property. Costs of this work shall be at the Contractor's expense.

When the condition exists, the Contractor shall furnish and install well points or deep wells to lower the groundwater below the bottom of the trench. Any permits required for dewatering operations shall be the responsibility of the Contractor to obtain and pay for.

No additional payment will be made for dewatering of the trench or other excavations, whether accomplished by trench sumps, pumps, well points, or deep wells.

The Contractor shall direct the discharge to the nearest existing public drainage facility. Any damages, either directly or indirectly related to the dewatering operations, including the cleaning

of streets and drainage ways, shall be rectified by the Contractor. Should the dewatering operation affect a private water supply well, the Contractor shall be responsible for providing the affected parties with alternative potable and non-potable water supplies until dewatering has ceased and normal water levels have returned. If the water in the water supply well, as tested by the Engineer, is found to be contaminated, through no fault of the Contractor, after normal water levels returned, the Engineer shall make arrangements to restore water potability. The Contractor shall be held responsible only until dewatering has ended and the ground water table has reached its normal elevation.

When dewatering operations are required the Contractor shall avoid any noise disturbances to adjacent property owners in accordance with local noise ordinances 8.32. Adjacent residents may be accommodated by locating pumps or generators as remotely as possible. The use of intake and exhaust silencers may also be required.

601.2.4 PIPE LAYING

Water main shall in general be laid with a cover over the main of 6.5 feet. Where cover is less than 6.5 feet the main shall be insulated to prevent freezing. Seven feet of cover is a minimum on all cul-de-sacs.

Whenever other utilities (storm or sanitary sewer) cross over water mains with a resultant of less than five feet of cover in between, then 2-inch polystyrene board insulation should be laid perpendicular to the water main or service and six inches above it.

The pipe shall be laid to the line and grade, as given by the Engineer, and in such manner as they direct. The horizontal tolerance shall be 1/10 of the inside diameter of the pipe. The vertical tolerance shall be 0.2 feet. The pipe shall be laid on a 6-inch bed of granular material. The entire area from the bottom of the pipe to 12 inches above the zenith of the pipe shall be filled with granular material. The cover material shall be compacted using either a walk behind plate compactor or a jumping jack compactor prior to backfilling.

If in the opinion of the Engineer, an artificial foundation should be necessary; the Contractor shall make the necessary excavation and shall refill the same with sand, thoroughly rammed into place, all done to the satisfaction of the Engineer and without cost to the Owner. In every case, the pipe shall have a uniform bearing along its entire length and shall never be laid directly on rock. Before lowering the pipe into the trench, grooves for the pipe bells shall be dug in the trench of sufficient size to insure proper joint making. The contractor shall take care that the inside of the pipe is clean because they will be charged with any damage to hydrants or valves that is caused by materials being washed onto them. Pipe shall be lowered into the trench by mechanical equipment, if possible, and shall never be rolled or pushed into the trench from the bank. Every pipe, before being lowered into the trench, shall be inspected for damage.

601.2.5 JOINING AND ADJUSTING OF PIPES

MECHANICAL JOINT PIPE AND FITTINGS

A mechanical pipe joint is made by squeezing a sealing gasket between a flange, cast on the end of the pipe, and a movable flange that slides along the barrel of the pipe to be joined. The flanges are tightened by the use of bolts and nuts. The pipe, sealing gasket and the recess in which the sealing gasket seats must be cleaned before making up the joint.

PUSH ON JOINT PIPE

A push on joint is made by squeezing a sealing gasket between a bell, cast on the end of one pipe, sealing gasket and the recess in which the sealing gasket seats shall be cleaned before making up the joint. The sealing gasket is inserted into the bell and then lubricated, and then the pipe is pushed together.

601.2.6 FITTINGS /HYDRANTS

The manner of laying pipe, fittings, setting valves and other appurtenances if not herein specified shall, at the direction of the City Engineer or their inspector, and when not in conflict with these specifications, have the same force as said specifications. Valves must be adjusted so they will work easily and properly and must be left with the valve closed. All nuts on valves shall be checked for tightness before the valve is lowered into the ditch.

A 6-bag mix, or acceptable equivalent, concrete foundation with approximate dimensions of 18" x 18" x 6" (1.1 cu. ft.) shall be provided as a firm base for setting of a hydrant. The hydrant shall be set in a truly vertical position and securely braced until the backfilling is completed. The wrap in the area of the drain hole shall be taped off above and below the drain and the wrap removed in the area of the drain between the taped off areas so the hydrant can drain freely. The fire hydrant shall be set on a concrete block above a minimum of 8-inches of 1-inch washed stone, and backfilled to at least 18-inches above the drain, with 1-inch washed stone. The washed stone shall be covered with 8 mil polyethylene sheeting to prevent backfill from contaminating the washed stone. (See detail 6-2).

The remainder of the excavation shall then be filled with material acceptable to the Engineer, well tamped around the hydrant (minimum of 1 foot from back of hydrant to trench wall) so that no uneven pressure is brought to bear upon the stem. Washed stone should be 2 foot above weep hole. The cost of all materials used in setting the hydrant shall be included in the bid item for hydrants in place.

All valves, tees, and HYD 90's shall be placed on concrete blocks, 4" x 8" x 16". (Costs for blocks shall be included in the UNIT Bid Prices.

No hydrant, valve or fitting shall be set unless the Engineer or Inspector is present and the setting approved before backfilling. The Contractor shall be responsible for the proper operation of all hydrants until the mains laid are formally accepted. Unless otherwise ordered, all hydrants shall set so the back is seven (7) feet from the property line.

If the Engineer and/or SPU determines that a valve box is improperly aligned or otherwise damaged and unacceptable, excavate and expose the water valve box to the depth needed to install a new valve box with a new lid, center the valve box over the operating nut and adjust the valve boxes to 3/8" below finished surface elevation. Ensure that all adjusted valve boxes are centered over the valve operating nut and free of dirt and debris when complete. The Contractor is responsible for contacting SPU to schedule an inspection of the valve boxes. SPU will need to approve the valve boxes after finished road grading and prior to paving.

During asphalt paving, valve boxes shall be adjusted to 3/8" below the surface for each lift of asphalt. Upon completion of all asphalt lifts, the contractor shall install a circular concrete collar around EACH valve box. The finished valve box must remain at 3/8" below finished grade. Refer to Detail 5-16. Should the concrete collar or asphalt adjacent to the concrete collar fail or not

meet the engineer's requirements within the warranty period, the concrete collar shall be replaced or enlarged to meet the requirements.

601.2.7 THRUST BLOCKING

Poured concrete blocking or solid concrete blocks shall be constructed behind all hydrants, tees, caps, plugs and bends, between it and the undisturbed side of the excavation. The blocking shall not extend beyond the joint. Costs for blocking shall be included in the UNIT Bid Prices. (See details 6-1 and 6-2).

601.2.8 INSTALLATION OF COPPER SERVICES

Taps shall be made in accordance with **Section 601.6 TAPPING**

When cover is less than 6.5 feet the service shall be insulated to prevent freezing.

The copper service should consist of a continuous section of tubing to the curb stop, unless otherwise directed. The use of coupling will not be allowed. Tape or cover ends of copper when lowering into trench to keep debris out of service.

Copper shall be installed straight into the corporation and curb stop, creating a tight and gapless seal. The ends of the copper must be in full contact with the receiving end of the corporation and curb stop. There shall be no vertical or horizontal angle between the copper and fitting.

One and one half (1-1/2) inch and two (2) inch services shall require the use of saddles.

The copper tubing shall be looped out and then back towards the main, and then back away from the main to form the shape of a horizontal "S" that maintains the 6.5 feet of cover. This loop shall be of sufficient size so that it uses at least two (2) feet of copper tubing and shall be made prior to the connection to the corporation stop. The intent of this section is to provide for slack in the service pipe in case of settlement.

Unless otherwise directed by the Engineer, a curb stop shall be inserted on the service at a point eight (8) feet from the property line. A curb box shall be installed vertically over the curb stop so that after the service is backfilled to final grade, a key may be placed on the rod of the curb stop and may be operated easily. All curb boxes shall be set on a concrete block.

Bury curb boxes 2 inches below the finished ground elevation when located in unpaved areas. Set curb boxes 1/4-inch below finished grade in paved areas. Water curb boxes shall not be adjusted by anything mechanical, they shall be raised/lowered manually and without excessive force. Once the water curb boxes are adjusted to 2 inches below finished ground elevation, the contractor shall contact SPU for inspection and approval.

All service boxes must be poly-wrapped where the arch sits on the block to prevent debris from getting to the curb stop.

For 1-1/2 inch and 2-inch services, a standard 1-1/4 inch curb box with enlarged base is required.

The end of the pipe shall be capped shut to keep rocks and dirt out of the lateral. Caps shall be made of copper, lead free brass, or ductile iron and approved by the Engineer.

All copper tubing shall be cut with a pipe cutter. The use of hacksaws or other such devices to cut copper will not be tolerated.

601.2.9 SERVICES OVER 2" IN SIZE

All services over 2 inches in size shall be installed in the same manner as main line construction.

The tie in to the main line shall be a main line tee or other tap approved by the Water Utility. Unless otherwise directed by the Engineer, a gate valve and standard box shall be located in the lateral eight (8) feet from the property line. The end of the lateral shall terminate at the property line and be capped.

601.2.10 STERILIZING THE PIPE

The Contractor/Developer must constantly bear in mind that these pipelines are to be used to convey water for drinking purposes. The interior of each pipe shall be swabbed clean by the use of a rod to the end of which is fastened a clean cloth swab of about the same size as the pipe being laid. This shall be done immediately before each length of pipe or each fitting is lowered into the trench. Special care shall be taken to see that no dirt or foreign matter enters the pipe during the process of joining the pipe to the existing bell of the pipe in the trench. The Contractor/Developer shall furnish a blank plug, which shall be placed in the bell of the pipe or fitting in the ditch whenever the work is temporarily stopped. The Contractor/Developer will be charged for work and materials necessary for cleaning pipelines that have not been properly plugged during construction.

For each 18-foot length of line:

NUMBER OF TABLETS OF HYPO CHLORITE TABLETS OF 5-G

(Each tablet shall contain 3-3/4 g available chorine)

LENGTH	PIPE DIAMETER			
18'	6"	8"	10"	12"
Tablets	2	3	5	6

When the water is turned on only enough water shall be permitted to enter the pipe to fill the line slowly with water. The chlorinated water shall remain in the pipe until such time as the Engineer directs that it be flushed out. The Contractor/Developer will collect samples for making bacterial tests of the water, and the newly laid line must not be put in service until the water is pronounced safe.

Alternate types of chlorination may be used as approved by the City Engineer or Sun Prairie Utilities.

Flushing shall be in accordance with AWWA C501 at a velocity of 3.0 feet per second (AWWA C651).

Flushing is prohibited from being discharged into the wastewater sewer system. Refer to ANSI/AWWA C655 "Field Dechlorination" for dechlorination procedures. The Engineer must approve the flushing location and dechlorination procedures.

601.2.11 BACKFILLING

The pipe trench, per AWWA C150, for design purposes shall be Laying condition Type 5 – "Pipe bedded to its centerline in compacted granular material, 4" minimum under pipe. Compacted granular or select material a minimum of 1 ft. above the top of the pipe. (Approximately 90% Standard Proctor, AASHTO T-99.) (E'=700psi)"

The trench and other excavations shall be refilled with such excavated material and in such a manner as directed by the Engineer. No boulders over six (6) inches shall be included in the backfilling material. The ditches shall be mechanically compacted to 95% compaction in the amount and manner as the Engineer may direct. Crushed stone screenings or asphalt millings shall not be used as backfill material.

Whenever the Engineer so directs, the Contractor/Developer shall remove all excavated material and backfill the trench with sand in the same manner as above. The price in the Schedule of Unit Prices for sand backfill shall be in full payment for this work.

601.2.12 MISCELLANEOUS CONNECTIONS

The Contractor/Developer shall furnish all labor and materials necessary to make a satisfactory connection to the existing main. The Contractor/Developer shall also furnish, at their own expense, all labor and help necessary to notify properly all water users before a main is shut off, and also all labor necessary to shut off the necessary valves, open hydrants, etc.

601.3 PRESSURE AND LEAKAGE TEST

On completion of the water mains, and services, or as soon thereafter as convenient for the Contractor to make such test, the pipes shall be filled with water removing all air pockets, and a pressure of one hundred-fifty (150) pounds per square inch applied. The pressure shall be applied for a period of two hours. The Contractor shall repair any and all leaks or breaks, which may occur during the test, after which the test shall be resumed and so on until all defects are remedied. After all visible leaks are repaired, a leakage test shall be run and no main will be accepted which has a leakage greater than determined by the following formula for rubber sealed joints. Pressure test must comply with AWWA Standard C600 Section 5 specifications.

Leakage shall be tested by installing a 5/8-inch water meter around a closed valve, and the final test duration shall be for one hour. Failed sections shall be tested by the Contractor at their expense.

$$L = \frac{S D \sqrt{P}}{148,000}$$

In which: L = Gallons per Hour

S = Length of test main in feet

D = Diameter of Pipe in inches

P = Average Pressure in Pounds per Square Inch during test.

DEFECTIVE WORK

If it is found that any defective work of any kind has been done, such defective work shall be re-excavated and replaced by acceptable work and at the expense of the Contractor/Developer and without extra charge to Sun Prairie Utilities.

601.4 BACTERIAL TESTING

The Contractor/Developer shall cause the completed mains to be filled slowly with water for a reasonable period of time (approximately seven (7) days). The Contractor shall then flush the lines (See 601.2.10) and take samples in containers furnished by the State of Wisconsin Laboratory of Hygiene, 2601 Agriculture Drive, Madison, WI 53718. The samples are to be delivered within six (6) hours such that the Laboratory has normal working time to test the samples. Sun Prairie Utilities shall supply the necessary documents and test bottles to the Contractor.

Refer to AWWA C651-14 (Section 5.1) for sampling guidelines and procedures.

Sample results are to be sent by the State of Wisconsin Laboratory of Hygiene back to the Engineer and Sun Prairie Utilities.

Upon safe result, the water will be turned on by Sun Prairie Utilities personnel. If the samples fail, the Contractor/Developer will be notified immediately by Sun Prairie Utilities in order that the Contractor/Developer may make repairs and re-test the system before the water can be turned on by Sun Prairie Utilities.

601.5 ABANDON PIPE

See Section 204.

601.6 TAPPING

601.6.1 MATERIALS

- 601.6.1.1 Service saddles shall be used on all corporation valve sizes larger than 1", subject to specific pipe manufacturer restrictions for the pipe to be tapped. Saddles shall be all 304 stainless, double bolt saddle.
- 601.6.1.2 Tapping sleeves, that have a flanged outlet, shall be used when tapping all existing pipe in service for branch lines 3" and larger in size. The body shall be 304 stainless steel, with a minimum working pressure of 240 PSI, have a minimum of 1/3 of the interior surface fully lined with a raised "donut" area around the branch opening, and a test port. All bolts, washers, and nuts shall be stainless steel.

601.6.2 DESIGN STANDARDS

- 601.6.2.1 Location of all taps, tapping devices or fittings/valves for all water pipes shall be in accordance with the following:
- 601.6.2.2 The minimum distance from the beginning/end of the Bell of MJ of a water pipe, fitting or another tap shall be:
- Corporation direct tap = 2.0 ft.
 - Corporation Tapping Saddle (up to 2" size) = not less than 2.0 ft.
 - Branch Tapping Sleeve = not less than 4.0 ft.
- 601.6.2.3 Taps shall be made and pipe lay at right angle to the water main. The tap shall be made at the spring line of the pipe, on the side of the main to which service is to be extended.

601.6.3 INSTALLATION

- 601.6.3.1 Activation of tap can only be authorized by the Water Utility after passing pressure tests and safe water tests. A Water Utility representative shall be present on-site during tapping and sleeve work and any connection(s) to existing main(s). Two working days advance notice before making the connection is required by the Water Utility.
- 601.6.3.2 All taps to water mains shall be made under full system pressure, with the main full of water. No taps may be made on an inactive or non-pressurized main.
- 601.6.3.3 All curb stops shall be installed under full system pressure prior to hydrostatic testing for acceptance of installation.
- 601.6.3.4 When tapping, thoroughly clean and inspect the pipe surface. Wet the pipe surface with a soap/water solution prior to placing a saddle, sleeve or repair clamp. Confirm that the main OD falls with the tapping device's OD range. Ensure that the tapping device is properly aligned to connect with the branch pipe. Ensure that the tapered ends of the gasket are smooth, not folded or rolled in any manner.

- 601.6.3.5 The saddle, sleeve or repair clamp shall be installed and all bolts finger-tightened for uniform gap. Tighten all bolts working from the ends to the center using torque wrenches in accordance with manufactures specifications. After approximately 10 minutes to allow the gasket to fully compress, all bolts shall be re-tightened to manufacturers specifications, but not exceeding 150 ft-lbs torque. Make sure the tapping device and tapping machine are fully supported and all cutting edges sharpened. Teflon tape or Teflon pipe dope shall be used on the corporation stop and all other pipe threads.
- 601.6.3.6 If tapping device is for 3" or larger branch line, the sleeve shall have a test port and be tested at 100 psi for 5 minutes by the Contractor before the actual tap proceeds. A Water Utility representative shall witness the tapping device installation, pressure test and tapping procedure.
- 601.6.3.7 All taps to existing and new mains shall be "live" or "wet" taps, utilizing a tapping machine with appropriate cutting tools and sharp cutting heads. All tap cut-outs shall be given to the Construction Inspector or Water Utility representative witnessing the tap.
- 601.6.3.8 No taps will be permitted to begin after 1:00 P.M. Additionally, pre-approval by the Water Utility is required for tapping on a Friday or preceding a holiday.
- 601.6.3.9 Two business days prior notice to Water Utility is required to be given prior to installation of new taps on existing mains.

601.7 WATERMAIN BORING, JACKING, AND CASING

601.7.0 DESCRIPTION OF WORK

- A. Work includes the excavation of boring and receiving pits, any required sheeting, shoring, and bracing, dewatering, and the boring and jacking of a casing pipe. The work also includes installation and backfilling of the carrier pipe within the casing pipe. Watermain Casing shall be installed under storm sewer that is 48" or greater in size and dual pipes that have a width of 6' or greater. Watermain valves shall be installed on both sides of the casing.

601.7.0.1 SUBMITTALS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications.
- B. Contractor shall submit such submittals and details required for the construction and installation of the materials. Submittals and details shall indicate the intended materials arrangement, dimensions, major support requirements, plot area and intricate or detailed construction requirements.
- C. Submit plan for boring and jacking operation to the Engineer, including backfill methods within the casing pipe if required.

- D. Submit submittals on carrier pipe support systems and manufacturers' recommendation for casing spacer placement.

601.7.1 PRODUCTS AND MATERIALS

601.7.1.1 Casing Pipe

The casing diameter should be sized to provide a minimum of 4 inches between the inside of the casing pipe and the largest outside diameter of the carrier pipe (including pipe bells).

- A. Steel Pipe. Casing pipe shall be welded steel pipe, Grade B, meeting the requirements of ASTM A139. The wall thickness of steel pipe shall conform to the following:

Casing Diameter (Inches)	Minimum Casing Pipe Wall Thickness (Inches)	
	Under Roadways	Under Railroad
8-12	1/4 (0.250)	1/4 (0.250)
14-18	5/16 (0.3125)	5/16 (0.3125)
20	3/8 (0.375)	3/8 (0.375)
24	3/8 (0.375)	7/16 (0.4375)
30	3/8 (0.375)	1/2 (0.500)
36-42	3/8 (0.375)	9/16 (0.5625)
48	3/8 (0.375)	5/8 (0.625)

- B. Reinforced Concrete Pipe. Casing pipe shall be reinforced concrete pipe meeting the requirements of ASTM C76 Class IV, Wall B.

601.7.1.2 Carrier Pipe

The carrier pipe shall be specified in section 601.1.1.

601.7.1.3 Casing Spacers

- A. Casing spacers for pipe up to 6 inches in diameter shall be PVC, HDPE, or stainless steel with HDPE, nylon, or PVC runners. Larger sizes shall be stainless steel with HDPE, nylon, or PVC runners.
- B. 2x4 or 2x6 oak wood skids with steel banding to support pipe may also be used.

601.7.1.4 End Seals

- A. Provide water-tight rubber end seals as approved by Engineer
- B. Provide 12-inch concrete bulkhead end seals.

601.7.2 CONSTRUCTION METHODS

601.7.2.1 Boring and Jacking

- A. The joints of a steel casing shall be welded with a continuous circumferential weld. It shall be the responsibility of the Contractor to provide stress transfer across the joints, which is capable of resisting the jacking forces involved.
- B. The Contractor shall excavate the boring and receiving pits at the locations shown on the contract drawings. The Contractor shall provide any required sheeting, shoring, or bracing which is required to provide safe working conditions.
- C. Removal of water shall be in accordance with Dewatering, section 601.2.3, of these specifications as they apply to the work.
- D. After the excavation is opened, the placing and jacking of the pipe shall follow immediately to avoid unnecessarily disturbing the stability of the embankment or roadbed.
- E. Boring shall be carried out with the proper equipment and procedure such that the carrier pipe and the casing pipe can be installed to the grades specified without disturbance to the adjacent earth.
- F. The jacking pit shall be adequate length to provide room for the jacking frame, the jacking head, the reaction blocks, the jacks, auger rig, and the jacking pipe. The pit shall be sufficiently wide to allow ample working space on each side of the jacking frame. The depth of the pit shall be such that the invert of the pipe, when placed on the guide frame, will be at the elevation desired for the completed line. The pit shall be tightly sheeted and kept dry at all times. The jacking frame shall be designed so that it applies a uniform pressure over the entire pipe wall area of the pipe to be jacked.
- G. The reaction blocks shall be adequately designed to carry the thrust of the jacks to the soil without excessive soil deflection and in such a manner as to avoid any disturbance of adjacent structures or utilities. Adequate protective railings shall be provided at the top of the pit at all times.
- H. Hydraulic jacks shall be used in the jacking operation, and extreme care shall be taken to hold the pipe to exact line and grade. Excavation at the heading shall be advanced manually or with an auger and shall not exceed one foot ahead of the casing pipe.
- I. The leading section of the pipe shall be equipped with a jacking head securely anchored thereto to prevent any wobble or variation in alignment during the boring and jacking operation.
- J. The driving end of the pipe shall be properly protected against damage, and the intermediate joints shall be similarly protected by the use of sufficient bearing shims to properly distribute the jacking stresses. Any section of casing pipe showing signs

of damage shall be removed and replaced, or repaired to the satisfaction of the Engineer.

- K. The bore excavation shall not be made in excess of the outer dimensions of the pipe being jacked unless approved by the Engineer. Every effort shall be made to avoid loss to earth outside the jacking head. Excavated material shall be removed from the conduit as excavation progresses, with no accumulation of such material within the pipe.
- L. Should appreciable loss of soil occur during the boring and jacking operation, the voids shall be backfilled promptly to the extent practicable with soil-cement consisting of a slightly moistened mixture of 1 part cement to 2 parts sand mortar. This mixture shall be thoroughly mixed and rammed into place as soon as possible after the loss of soil occurs.
- M. The Contractor is responsible to safely mark and protect the excavation until the operation is complete and the excavation is backfilled.
- N. The pit excavations shall be backfilled in accordance with 601.2.11.

601.7.2.2 Installation of Carrier Pipe

- A. Following the completion of the boring and jacking operation, the Contractor shall install the carrier pipe, backfill the space between the casing pipe and the carrier pipe if required, and seal the casing ends.
- B. Casing spacers shall be installed per manufacturer's instructions and recommendations.
- C. If wood skids are used, a minimum of two shall be installed and shall support the full length of pipe.
- D. When wood skids are used, the annular space between the casing pipe and carrier pipe shall be filled with sand or pea gravel.

601.7.2.3 Special requirements for Railroad Operations

- A. Provide a minimum of 72 hours notice to the area roadmaster of the railroad company prior to commencing work within or immediately adjacent to railroad right-of-way.
- B. During all work within railroad right-of-way, the Contractor shall arrange with the railroad company for the provision of railroad flaggers and on-track safety training.
- C. Additional railroad restrictions may be shown on the contract drawings.

601.7.3 MEASUREMENT AND PAYMENT

601.7.3.1 General

- A. Utility pipe jacking installation of pipe shall be paid for at the bid price in accordance with one of the following methods.
- B. All work specified herein shall be considered in each of the measurement and payment method(s) stipulated.

601.7.3.2 Utility Pipe Jacking

- A. Utility Pipe Jacking, Lump Sum. When so provided, payment for utility pipe jacking installation shall be lump sum for the length specified. Payment shall include cost of the casing, carrier pipe, casing spacers, end seals and backfill within the casing pipe. No partial payments shall be paid until the pipe(s) are successfully installed.
- B. Utility Pipe Jacking, Linear Foot. Measurement for utility pipe jacking installation shall be per lineal foot of a specific diameter pipe installed. Payment shall be made at the contract unit price bid per lineal foot of the respective pipe. Payment shall include the cost of the casing, carrier pipe, casing spacers, end seals and backfill within the casing pipe. No partial payments shall be paid until the pipe(s) are successfully installed.
- C. Utility Pipe Jacking Installation of Pipe, Inclusive. When no quantity is provided, payment for utility pipe jacking installation shall be considered inclusive to installation of the respective size transmission main to be installed. No payments shall be made until the pipe(s) are successfully installed and tested.

PART 7

DETAIL DRAWING SPECIFICATIONS

STANDARD DETAIL DRAWINGS

DESCRIPTION	PAGE
CURB RAMPS - TYPE 2 AND 3.....	SDD 08D05-21b
CURB RAMPS - TYPE 4A AND 4A1.....	SDD 08D05-21c
CURB RAMPS - TYPE 4B AND 4B1.....	SDD 08D05-21d
CURB RAMPS - TYPE 5, 6, 7A, 7B & 8.....	SDD 08D05-21e
CURB RAMPS - RADIAL DETECTABLE WARNINGS.....	SDD 08D05-21f
CURB RAMPS – RECTANGULAR AND RADIAL DETECTABLE WARNINGS PLATES.....	SDD 08D05-21g
TYPICAL SIDEWALK	3-2
TYPICAL RESIDENTIAL DRIVEWAY APPROACH	3-3
STANDARD RESIDENTIAL DRIVEWAY OPENING	3-4
SIDEWALK DRAIN WAY DETAIL	3-5
CONCRETE RETAINING WALL DETAIL	3-6
CONCRETE CURB & GUTTER DETAILS.....	3-7
CURB & GUTTER - INLET DETAIL	3-8
COMMERCIAL DRIVE ENTRANCE	3-9
PAVEMENT MARKING DETAILS	3-10
ROAD SIGN DETAILS	3-11
CURB & GUTTER BUMP-IN	3-12
CONCRETE SPEED HUMP, FLOW THROUGH GUTTER	3-13
CONCRETE SPPED HUMP, RAISED GUTTER	3-14
TYPICAL ASPHALT BIKE/PEDESTRIAN PATH	4-1
STORM AND SANITARY SEWER BEDDING STANDARDS.....	5-1
SANITARY SEWER LATERALS STANDARD DETAILS.....	5-2
TYPICAL STORM SEWER LATERAL	5-3
STORM LATERAL CLEANOUT CONNECTION.....	5-4
PIPE INSULATION DETAIL	5-5
CONCRETE PIPE SUPPORT DETAIL	5-6
SANITARY MANHOLES IN STREET LOCATIONS.....	5-7
SANITARY MANHOLES IN REMOTE LOCATIONS	5-8
OUTSIDE SANITARY DROP REMOTE MANHOLE.....	5-8a
OUTSIDE DROP TO SANITARY SEWER MANHOLES	5-9

TYPICAL INLET DETAIL.....	5-10
STANDARD CONCRETE MASONRY ENDWALLS	5-11
STANDARD PIPE GATE FOR CONCRETE APRON ENDWALL	5-12
PANEL INSTRUMENTATION	5-13
RIP-RAP AND FABRIC DETAIL.....	5-14
CAST IN PLACE STORM STRUCTURE	5-15
CONCRETE COLLAR FOR MANHOLE CASTINGS/WATER VALVES.....	5-16
BUTTRESS FOR BENDS AND PLUGS	6-1
BUTTRESS FOR TEES AND HYDRANT DETAIL.....	6-2
PIPE INSULATION AND WATER SERVICES	6-3

GENERAL NOTES

AVOID PLACING DRAINAGE STRUCTURES, JUNCTION BOXES OR OTHER OBSTRUCTIONS IN FRONT OF RAMP ACCESS AREAS.

DETAILS OF CONSTRUCTION, MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIFICATIONS. DETECTABLE WARNING FIELDS THAT ARE INSTALLED AS A GROUP OR SIDE BY SIDE SHALL BE FROM THE SAME MANUFACTURER.

② GRADE CHANGE BETWEEN GUTTER FLAG SLOPE AND THE CURB RAMP SLOPE SHALL NOT EXCEED 1%. MAXIMUM GUTTER FLAG SLOPE IS 4%. PROVIDE LONGITUDINAL DRAINAGE AROUND CURB AND AWAY FROM CURB RAMP. NO VERTICAL LIPS OR DISCONTINUITIES GREATER THAN 1/4" ARE ALLOWED. SLOPE OF CURB HEAD OPENING SHALL MATCH THE RAMP SLOPE, MINIMALLY 1.5% AND NOT TO EXCEED 7%. WHEN ADJACENT TO 1.5% LANDING, CONSTRUCT CURB HEAD OPENING AT 1.5% IN THE DIRECTION OF PEDESTRIAN TRAVEL.

③ AN 8.33% CURB RAMP SLOPE IS ALLOWABLE WITH FLATTENED GUTTER FLAG SLOPE (2.67% OR LESS) AND NOT TO EXCEED 11% GRADE CHANGE.

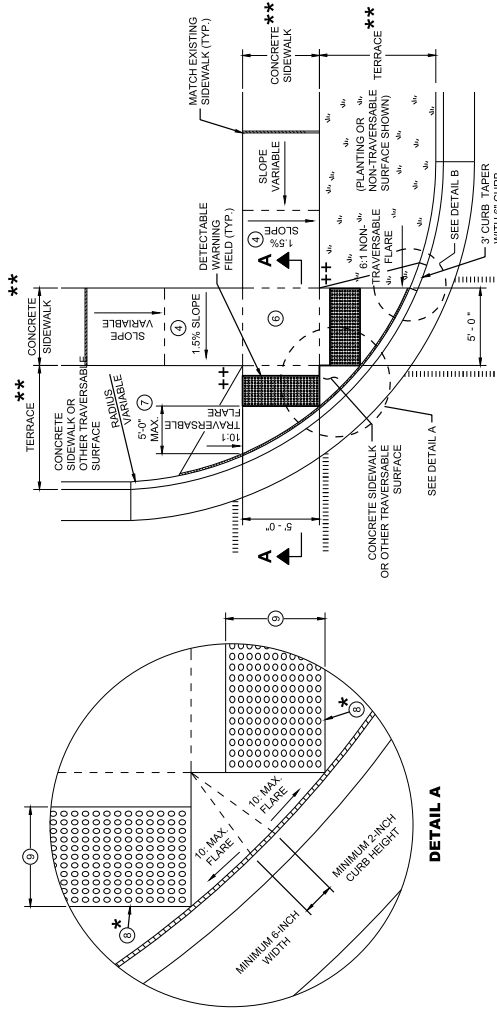
④ 40.5% CONSTRUCTION TOLERANCE IN SIDEWALK CROSS SLOPE. THE SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2% WITHOUT PRIOR APPROVAL FROM THE ENGINEER.

⑥ PROVIDE A LEVEL LANDING (MAXIMUM 2% SLOPE) IN ANY DIRECTION OF PEDESTRIAN TRAVEL. STANDARD LEVEL LANDING SIZE IS 5 FEET X 5 FEET.

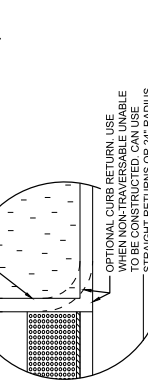
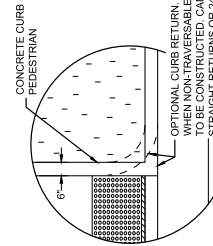
⑦ WHEN GRADE BREAK DISTANCE EXCEEDS 5 FEET, USE RADIAL DETECTABLE WARNING FIELD PER SDD 8D5-4.

⑧ PROVIDE GRADE BREAK PERPENDICULAR TO DIRECTION OF WHEELCHAIR TRAVEL.

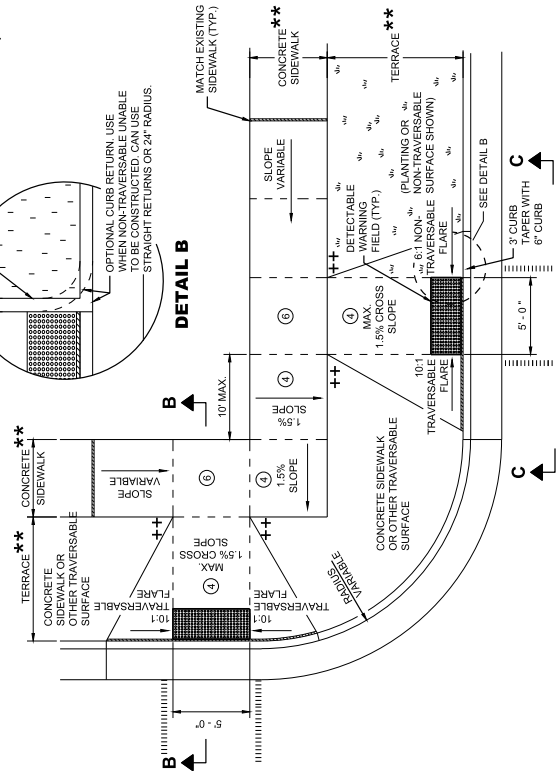
⑨ WHEN DISTANCE IS LESS THAN 6'-0", IT MAY BE DIFFICULT TO ACHIEVE A 7% SLOPE OR FLATTER ALONG THE RAMP. REDUCE CURB HEIGHT IN TRIANGLE AREA TO ACHIEVE 7% SLOPE OR FLATTER ON RAMP. CONSTRUCT ZINCH MINIMUM CURB HEIGHT BETWEEN 10:1 FLARES.



**PLAN VIEW
CURB RAMP TYPE 2
(CENTER OF CORNER RADIUS)**

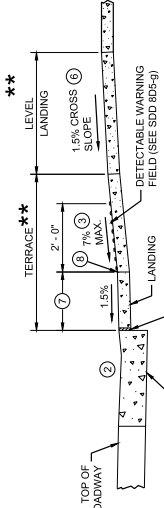


DETAIL B



**PLAN VIEW
CURB RAMP TYPE 3
(OUTSIDE OF CROSSWALK AREA)**

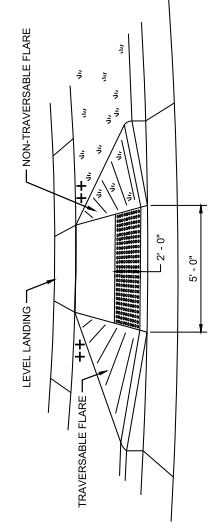
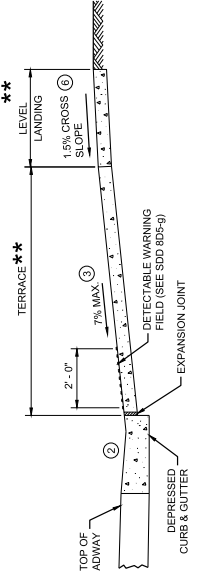
SECTION A - A FOR TYPE 2



LEGEND

- 1/2" EXPANSION JOINT SIDEWALK
- CONTRACTION JOINT SIDEWALK
- PAVEMENT MARKING CROSSWALK (WHITE)

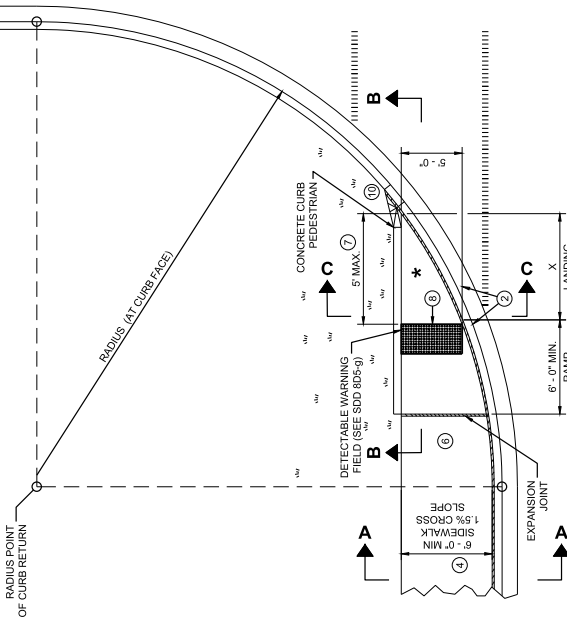
SECTION B - B FOR TYPE 3



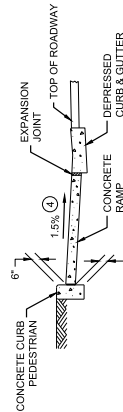
VIEW C - C FOR TYPE 3

CURB RAMPS TYPE 2 AND 3

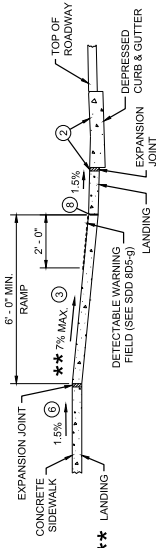
STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION



PLAN VIEW
CURB RAMP TYPE 4A



SECTION C - C FOR TYPE 4A

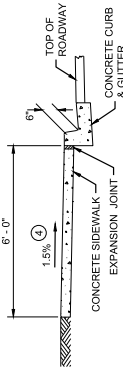


SECTION B - B FOR
TYPE 4A AND TYPE 4A1

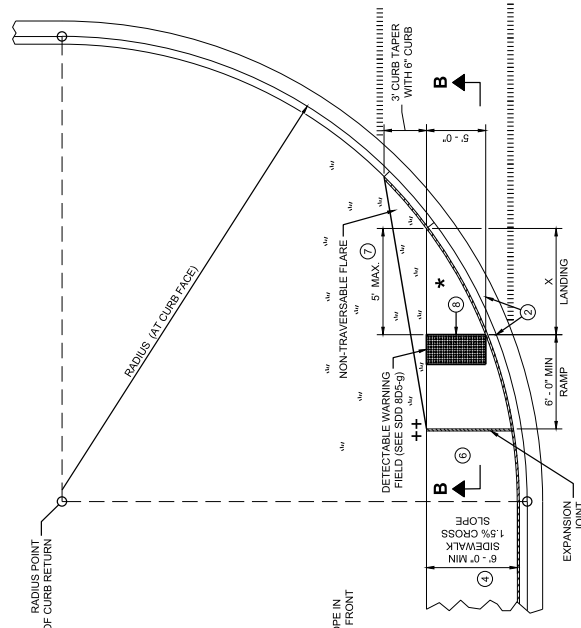
★★ IF RAMP SLOPE IS LESS
THAN 5.0%, THEN NO
LANDING IS REQUIRED

RADIUS (AT CURB FACE)	X
10 FEET	4' - 7"

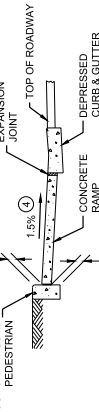
INTERMEDIATE RADII CAN BE INTERPOLATED



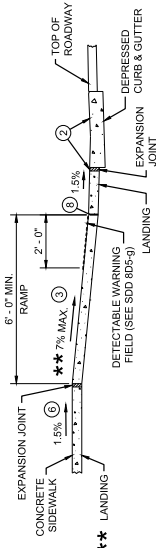
SECTION A - A FOR TYPE 4A



PLAN VIEW
CURB RAMP TYPE 4A1



SECTION C - C FOR TYPE 4A1



SECTION B - B FOR
TYPE 4A1

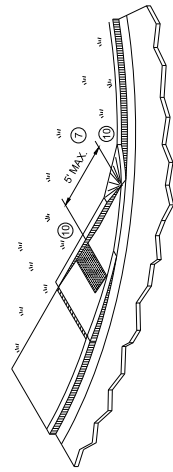
★★ IF RAMP SLOPE IS LESS
THAN 5.0%, THEN NO
LANDING IS REQUIRED

GENERAL NOTES

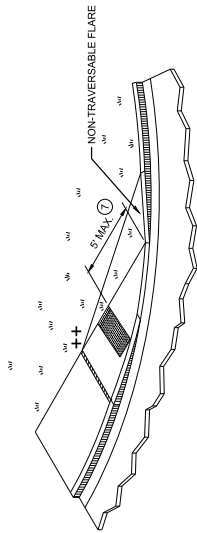
- AVOID PLACING DRAINAGE STRUCTURES, JUNCTION BOXES OR OTHER OBSTRUCTIONS IN FRONT OF RAMP ACCESS AREAS.
- DETAILS OF CONSTRUCTION, MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.
- DETECTABLE WARNING FIELDS THAT ARE INSTALLED AS A GROUP OR SIDE BY SIDE, SHALL BE FROM THE SAME MANUFACTURER.
- GRADE CHANGE BETWEEN GUTTER FLAG SLOPE AND THE CURB RAMP SLOPE SHALL NOT EXCEED 1%. MAXIMUM GUTTER FLAG SLOPE IS 4%. PROVIDE LONGITUDINAL DRAINAGE AROUND CURB AND AWAY FROM CURB RAMP. NO VERTICAL LIPS OR DISCONTINUITIES GREATER THAN 1/8" INCH ARE ALLOWED. SLOPE OF CURB HEAD OPENING SHALL MATCH THE RAMP SLOPE, MINIMALLY 1.5% AND NOT TO EXCEED 7%. WHEN ADJACENT TO 1.5% LANDING, CONSTRUCT CURB HEAD OPENING AT 1.5% IN THE DIRECTION OF PEDESTRIAN TRAVEL.
- AN 8.33% CURB RAMP SLOPE IS ALLOWABLE WITH FLATTENED GUTTER FLAG SLOPE AND NOT TO EXCEED 11% GRADE CHANGE.
- ±0.5% CONSTRUCTION TOLERANCE IN SIDEWALK CROSS SLOPE. THE SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2% WITHOUT PRIOR APPROVAL FROM THE ENGINEER.
- PROVIDE A LEVEL LANDING (MAXIMUM 2% SLOPE) IN ANY DIRECTION OF PEDESTRIAN TRAVEL. STANDARD LEVEL LANDING SIZE IS 5 FEET BY 5 FEET.
- WHEN THIS GRADE BREAK DISTANCE EXCEEDS 5 FEET, USE RADIAL DETECTABLE WARNING FIELD PER SDD 8D5-4.
- PROVIDE GRADE BREAK PERPENDICULAR TO DIRECTION OF WHEELCHAIR TRAVEL.
- INSTALL TRANSITION NOSE (INCIDENTAL TO OTHER PAY ITEMS). DO NOT MARK TRANSITION NOSE.

LEGEND

- 1/2" EXPANSION JOINT SIDEWALK
- CONTRACTION JOINT SIDEWALK
- PAVEMENT MARKING CROSSWALK (WHITE)



ISOMETRIC VIEW FOR TYPE 4A

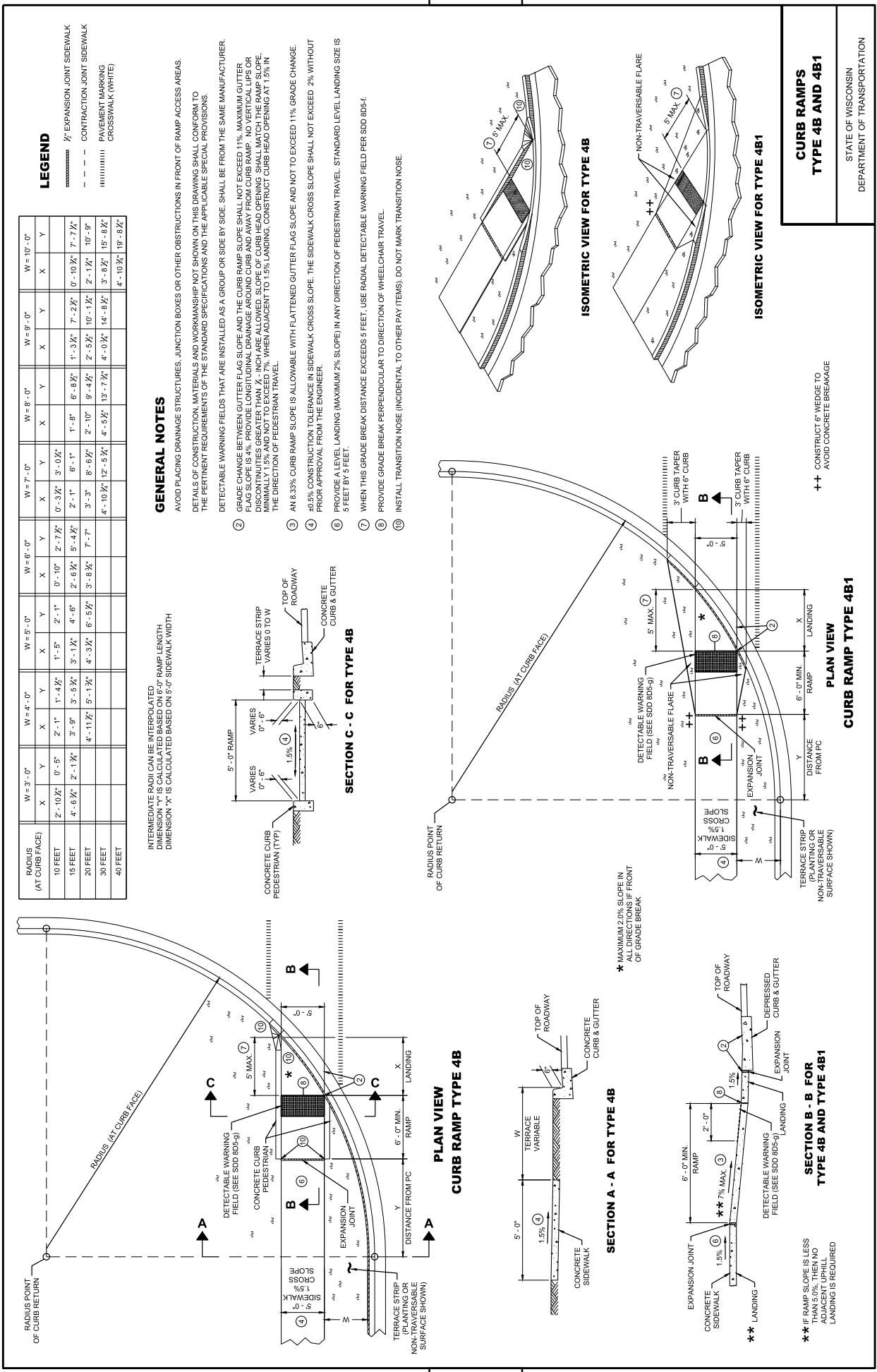


ISOMETRIC VIEW FOR TYPE 4A1

++ CONSTRUCT 6" WEDGE TO
AVOID CONCRETE BREAKAGE

CURB RAMPS TYPE 4A AND 4A1

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION



AVOID PLACING DRAINAGE STRUCTURES, JUNCTION BOXES OR OTHER OBSTRUCTIONS IN FRONT OF RAMP ACCESS AREAS.

DETAILS OF CONSTRUCTION, MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.

SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2%.

② DETECTABLE WARNING FIELDS THAT ARE INSTALLED AS A GROUP OR SIDE BY SIDE SHALL BE FROM THE SAME MANUFACTURER.

GRADE CHANGE BETWEEN GUTTER FLAG SLOPE AND THE CURB RAMP SLOPE SHALL NOT EXCEED 11%, MAXIMUM GUTTER FLAG SLOPE IS 4%, PROVIDE LONGITUDINAL DRAINAGE AROUND CURB AND AWAY FROM CURB RAMP. NO VERTICAL LIPS OR CURB RAMP SLOPE CHANGES SHALL BE ALLOWED. THE CURB RAMP SHALL BE CONSTRUCTED WITH A MINIMUM 1% MINIMUM LIFT, MINIMUM 1% AND NOT TO EXCEED 7% WHEN ADJACENT TO A LANDING. CONSTRUCT CURB-HEAD OPENING AT 15% IN THE DIRECTION OF PEDESTRIAN TRAVEL.

- ③ AN 8.33% CURB RAMP SLOPE IS ALLOWABLE WITH FLATTENED GUTTER SLOPE AND NOT TO EXCEED 11% GRADE CHANGE.
- ④ $\pm 0.5\%$ CONSTRUCTION TOLERANCE IN SIDEWALK CROSS SLOPE. THE SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2% WITHOUT PRIOR APPROVAL FROM THE ENGINEER.

⑥ PROVIDE A LEVEL LANDING (MAXIMUM 2% SLOPE) IN ANY DIRECTION OF PEDESTRIAN TRAVEL. STANDARD LEVEL LANDING SIZE IS 5 FEET BY 5 FEET.

⑩ INSTALL TRANSITION NOSE (INCIDENTAL TO OTHER PAY ITEMS). DO NOT MARK TRANSITION NOSE.

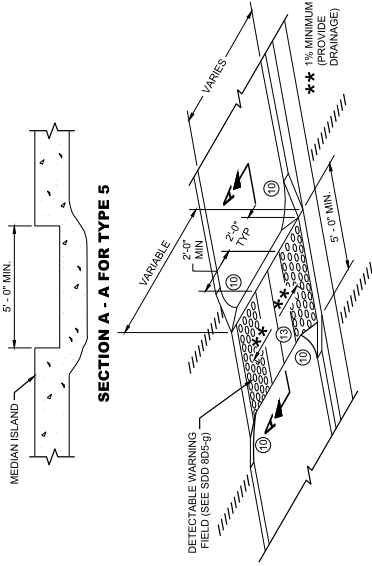
11) SLOPE SIDEWALK TOWARD LANDING AS SHOWN WHERE THERE IS NO TERRACE OR WHERE THE TERRACE WIDTH IS LESS THAN 6 FEET WIDE.

12 THE EDGE OF THE DETECTABLE WARNING FIELD NEAREST TO A RAILROAD CROSSING SHALL BE 1.5 FEET ±0.1' FROM THE FACE OF THE GATE ARM IF THE GATE ARM EXTENDS ACROSS THE SIDEWALK/PATH. WHERE THERE IS NO PEDESTRIAN GATE, THE EDGE OF THE DETECTABLE WARNING FIELD NEAREST TO THE RAILROAD TRACK IS 15 FEET MAXIMUM AND 12 FEET MINIMUM, 15 FEET TYPICAL FROM THE NEAREST RAIL.

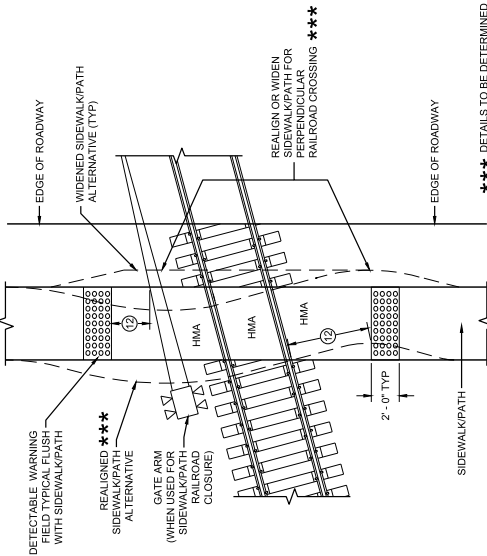
13 DO NOT INSTALL DETECTABLE WARNING FIELDS AT THE EDGES OF STEEL-LEVEL PEDESTRIAN REFUGE ISLANDS IF A MINIMUM 2 FOOT CONCRETE SURFACE WITHOUT DETECTABLE WARNINGS (MEASURED IN THE DIRECTION OF PEDESTRIAN TRAVEL) CANNOT BE ACHIEVED.

LEGEND

	1/2" EXPANSION JOINT SIDEWALK
	CONTRACTION JOINT FIELD LOCATED
	PAVEMENT MARKING CROSSWALK (WHITE)

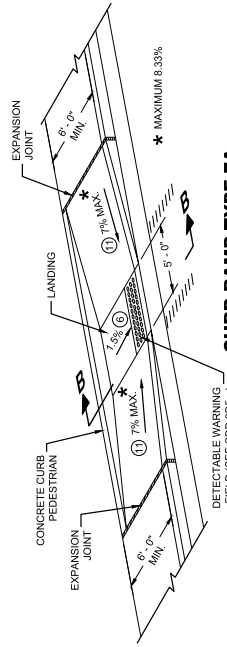


SECTION A - A FOR TYPE 5

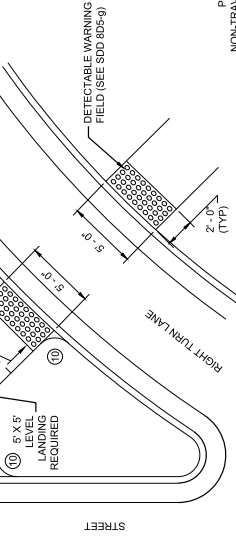


CURB RAMP TYPE 8
DETECTABLE WARNINGS
FOR SIDEWALKS OR SHARED USE PATHS
AT RAILROAD CROSSINGS

*** DETAILS TO BE DETERMINED
BY ENGINEER

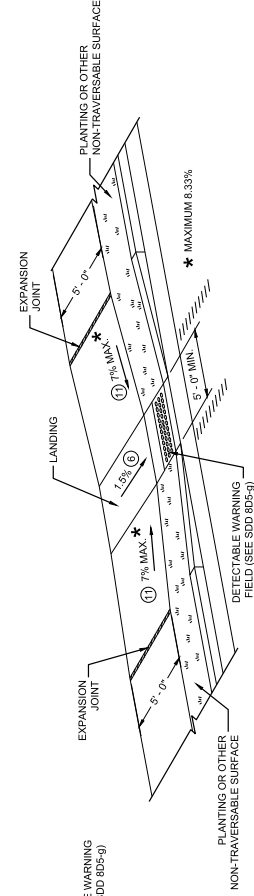


**CURB RAMP TYPE 7A
FOR INTERSECTIONS AND
MID BLOCK CROSSINGS**

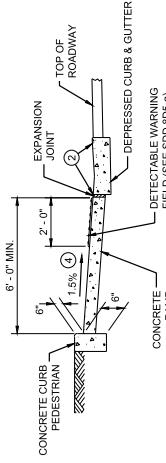


CURB RAMP TYPE 6 DETECTABLE WARNING AT ISLANDS

REFER TO GENERAL NOTES ② AND ③
FOR ALL ISLAND CURB RAMPS



**CURB RAMP TYPE 7B
FOR INTERSECTIONS AND
MID BLOCK CROSSINGS**



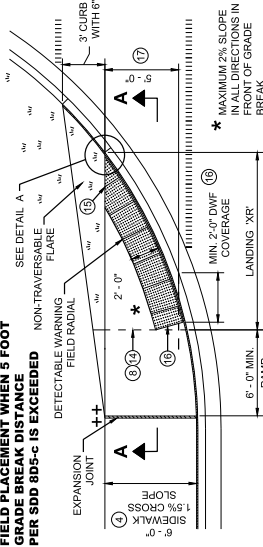
SECTION B - B FOR TYPE 7A

**CURB RAMPS
TYPE 5, 6, 7A, 7B & 8**

LEGEND

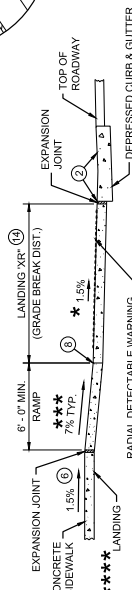
- 1/2" EXPANSION JOINT SIDEWALK
- - - CONTRACTION JOINT SIDEWALK
- ||||| PAVEMENT MARKING CROSSWALK (WHITE)

RADIAL DETECTABLE WARNING FIELD PLACEMENT WHEN 5 FOOT GRADE BREAK DISTANCE PER SDD 805-c IS EXCEEDED



PLAN VIEW CURB RAMP TYPE 4A1

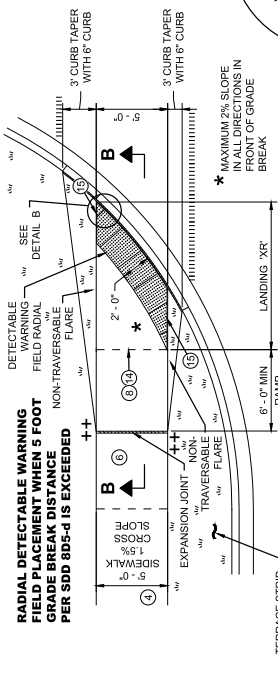
(GRADE BREAK DISTANCE GREATER THAN 5 FEET)



*** IF RAMP SLOPE IS LESS THAN 5.0%, THEN NO LANDING IS REQUIRED

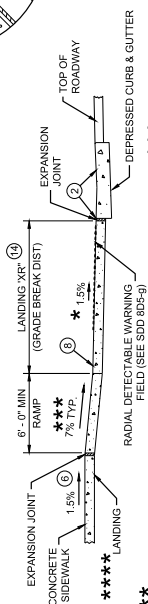
SECTION A - A FOR TYPE 4A1

RADIAL DETECTABLE WARNING FIELD PLACEMENT WHEN 5 FOOT GRADE BREAK DISTANCE PER SDD 805-c IS EXCEEDED



PLAN VIEW CURB RAMP TYPE 4B1

(GRADE BREAK DISTANCE GREATER THAN 5 FEET)



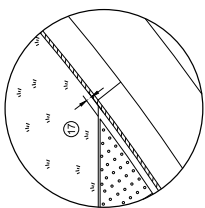
*** IF RAMP SLOPE IS LESS THAN 5.0%, THEN NO LANDING IS REQUIRED

SECTION B - B FOR TYPE 4B1

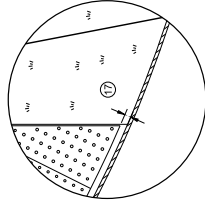
GENERAL NOTES

1. AVOID PLACING DRAINAGE STRUCTURES, JUNCTION BOXES OR OTHER OBSTRUCTIONS IN FRONT OF RAMP ACCESS AREAS.
2. DETAILS OF CONSTRUCTION, MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.
3. DETECTABLE WARNING FIELDS THAT ARE INSTALLED AS A GROUP OR SIDE BY SIDE, SHALL BE FROM THE SAME MANUFACTURER.
4. APPLY RADIAL DETECTABLE WARNING PLACEMENT SIMILARLY FOR TYPE 4A AND 4A1 CURB RAMPS AND SIMILARLY FOR TYPE 4B AND 4B1 CURB RAMPS.
5. REFER TO SDD 805-g FOR ADDITIONAL RADIAL PLATE REQUIREMENTS.
6. FIELD CUTS AT INTERMEDIATE JOINTS WITHIN THE RADIAL DETECTABLE WARNING FIELD ARE PROHIBITED.
7. DETERMINE FINAL RADIAL WARNING FIELD CONFIGURATION AT ITS INDIVIDUAL PLATE LOCATIONS. PERFORM PRE-LAYOUT PRIOR TO PLACEMENT IN PLASTIC CONCRETE. FOLLOW MANUFACTURER'S PRODUCT LIST AND INSTALLATION RECOMMENDATIONS.
8. GRADE CHANGE BETWEEN GUTTER FLAG SLOPE AND THE CURB RAMP SLOPE SHALL NOT EXCEED 11%. MAXIMUM GUTTER FLAG SLOPE IS 6.4%. PROVIDE LONGITUDINAL DRAINAGE AROUND CURB AND AWAY FROM CURB RAMP. NO VERTICAL LIPS OR DISCONTINUITIES GREATER THAN 1/8" ARE ALLOWED. SLOPE OF CURB HEAD OPENING SHALL MATCH THE RAMP SLOPE. MINIMALLY 1.5% AND NOT TO EXCEED 7% WHEN ADJACENT TO 1.5% LANDING. CONSTRUCT CURB HEAD OPENING AT 1.5% IN THE DIRECTION OF PEDESTRIAN TRAVEL.
9. AN 8.33% CURB RAMP SLOPE IS ALLOWABLE WITH FLATTENED GUTTER FLAG SLOPE AND NOT TO EXCEED 11% GRADE CHANGE.
10. A 5% CONSTRUCTION TOLERANCE IN SIDEWALK CROSS SLOPE. THE SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2% WITHOUT PRIOR APPROVAL FROM THE ENGINEER.
11. PROVIDE A LEVEL LANDING (MAXIMUM 2% SLOPE) IN ANY DIRECTION OF PEDESTRIAN TRAVEL. STANDARD LANDING SIZE IS 5 FEET BY 5 FEET.
12. PROVIDE GRADE BREAK PERPENDICULAR TO DIRECTION OF WHEELCHAIR TRAVEL.
13. CONSULT ENGINEER IF GRADE BREAK LOCATION (END OF LANDING DIMENSION "X"R") REQUIRES FIELD ADJUSTMENT WHEN ESTABLISHING FINAL RADIAL DETECTABLE WARNING FIELD LOCATION.
14. FIELD SAW CUTS ALONG RADIAL DETECTABLE WARNING PLATES WILL BE NECESSARY TO MATCH EACH CURB RAMP EDGE. AVOID CUTTING THROUGH DOMES WHENEVER POSSIBLE.
15. MAKE FIELD CUTS TRUE TO LINE AND WITHIN 1/8" DEVIATION. SMOOTH EDGES OF FIELD CUT PLATES.
16. USE 1" X 2" RECTANGULAR END PLATE AT END OF TYPE 4A1 RAMP AND PROVIDE MINIMUM 2' - 0" DETECTABLE WARNING FIELD COVERAGE (IN DIRECTION OF PEDESTRIAN TRAVEL) ALONG THE ENTIRE CURB RAMP WIDTH.
17. A MAXIMUM 3 INCH CONCRETE BORDER WIDTH IS ALLOWABLE IN FRONT OF RADIAL DETECTABLE WARNING FIELD FOR CONSTRUCTABILITY PURPOSES. CONCRETE BORDER WIDTH MAY VARY UP TO 1 INCH.

DETAIL A

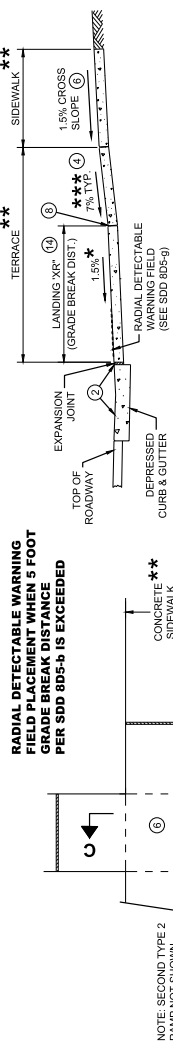


DETAIL C



SECTION C - C FOR TYPE 2

RADIAL DETECTABLE WARNING FIELD PLACEMENT WHEN 5 FOOT GRADE BREAK DISTANCE PER SDD 805-g IS EXCEEDED



PLAN VIEW CURB RAMP TYPE 2

(GRADE BREAK DISTANCE GREATER THAN 5 FEET) (ON LINE WITH SIDEWALK)

*** MAXIMUM 2% SLOPE IN ALL DIRECTIONS IN FRONT OF GRADE BREAK

** WIDTH SHOWN ELSEWHERE IN THE PLANS

*** MAXIMUM 8.33%

++ CONSTRUCT 6" WEDGE TO AVOID CONCRETE BREAKAGE

CURB RAMPS RADIAL DETECTABLE WARNING

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

GENERAL NOTES

DETECTABLE WARNING FIELDS THAT ARE INSTALLED AT A CURB RAMP SHALL BE FROM THE SAME MANUFACTURER. PLACE ALL DETECTABLE WARNING FIELD SYSTEMS IN ACCORDANCE TO THE MANUFACTURER'S RECOMMENDATION. FIELD CUTS AT INTERMEDIATE JOINTS WITHIN THE RADIAL DETECTABLE WARNING FIELD ARE PROHIBITED.

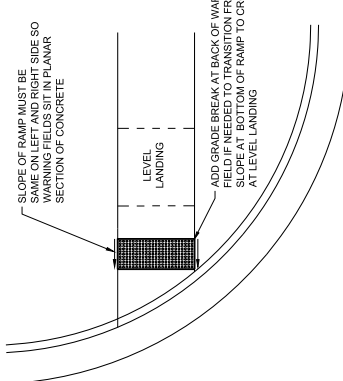
DETERMINE FINAL RADIAL WARNING FIELD CONFIGURATION AND ITS INDIVIDUAL PLATE LOCATIONS. PERFORM PRE-LAYOUT PRIOR TO PLACEMENT IN PLASTIC CONCRETE. FOLLOW MANUFACTURER'S PRODUCT LIST AND INSTALLATION RECOMMENDATIONS.

FOR RADIAL DETECTABLE WARNING FIELD APPLICATIONS WHERE STANDARD RADIAL PLATES ARE NOT AVAILABLE AT AN INTERSECTION CURB RADIUS, A COMBINATION OF SQUARE OR RECTANGULAR PLATES AND RADIAL PLATES MAY BE USED TO FORM THE RADIAL WARNING FIELD. SQUARE PLATES IN COMBINATION WITH SQUARE PLATES ARE ALSO ACCEPTABLE. FOLLOW MANUFACTURER'S RECOMMENDATIONS.

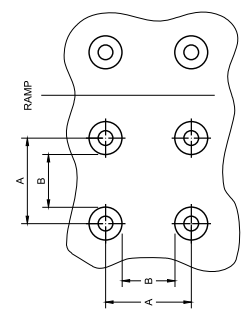
REFER TO CONTRACT AND STANDARD SPECIFICATIONS FOR FIELD CUTTING REQUIREMENTS.

DO NOT EMBED IN CONCRETE ANY FIELD-CUT PLATES WITH CUT EDGES SHORTER THAN 6 INCHES. CONSULT WITH MANUFACTURER FOR RE-DRILLING AND ANCHORING REQUIREMENTS OF FIELD-CUT PLATES.

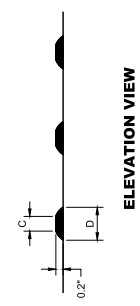
FIELD SAW CUTS ALONG RADIAL DETECTABLE WARNING PLATES WILL BE NECESSARY TO MATCH EACH CURB RAMP EDGE. AVOID CUTTING THROUGH DOMES WHENEVER POSSIBLE. MAKE FIELD CUTS TRUE TO LINE AND WITHIN $\frac{1}{8}$ " DEVIATION. SMOOTH EDGES OF FIELD CUT PLATES.



**DETECTABLE WARNING FIELD
PLANAR INSTALLATION**



PLAN VIEW

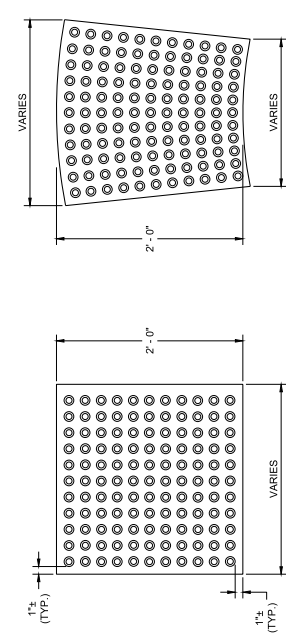


ELEVATION VIEW

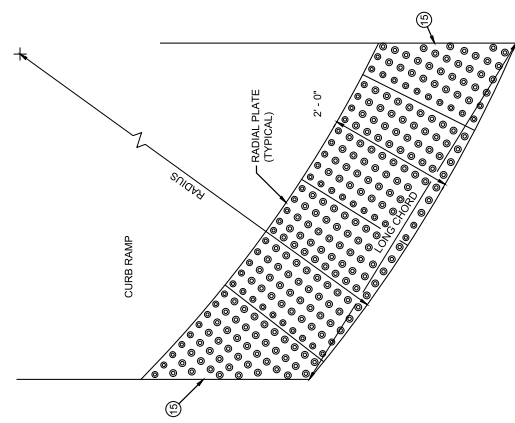
	MIN.	MAX.
A	1.0"	2.4"
B	0.65"	1.5"
C	*	*
D	0.9"	1.4"

* THE C DIMENSION IS 50% TO 65% OF THE D DIMENSION.

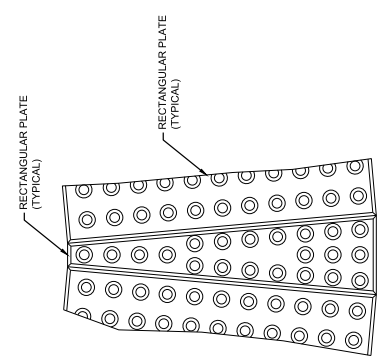
**TRUNCATED DOMES
DETECTABLE WARNING PATTERN DETAIL**



**PLAN VIEW
DETECTABLE WARNING FIELDS (TYPICAL)**



**PLAN VIEW
RADIAL FIELD ATTRIBUTES**



**PLAN VIEW
RADIAL WEDGE PLATE
CONNECTION DETAIL**

SDD 08D05-21g

6

CURB RAMPS
RECTANGULAR AND RADIAL
DETECTABLE WARNING PLATES

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

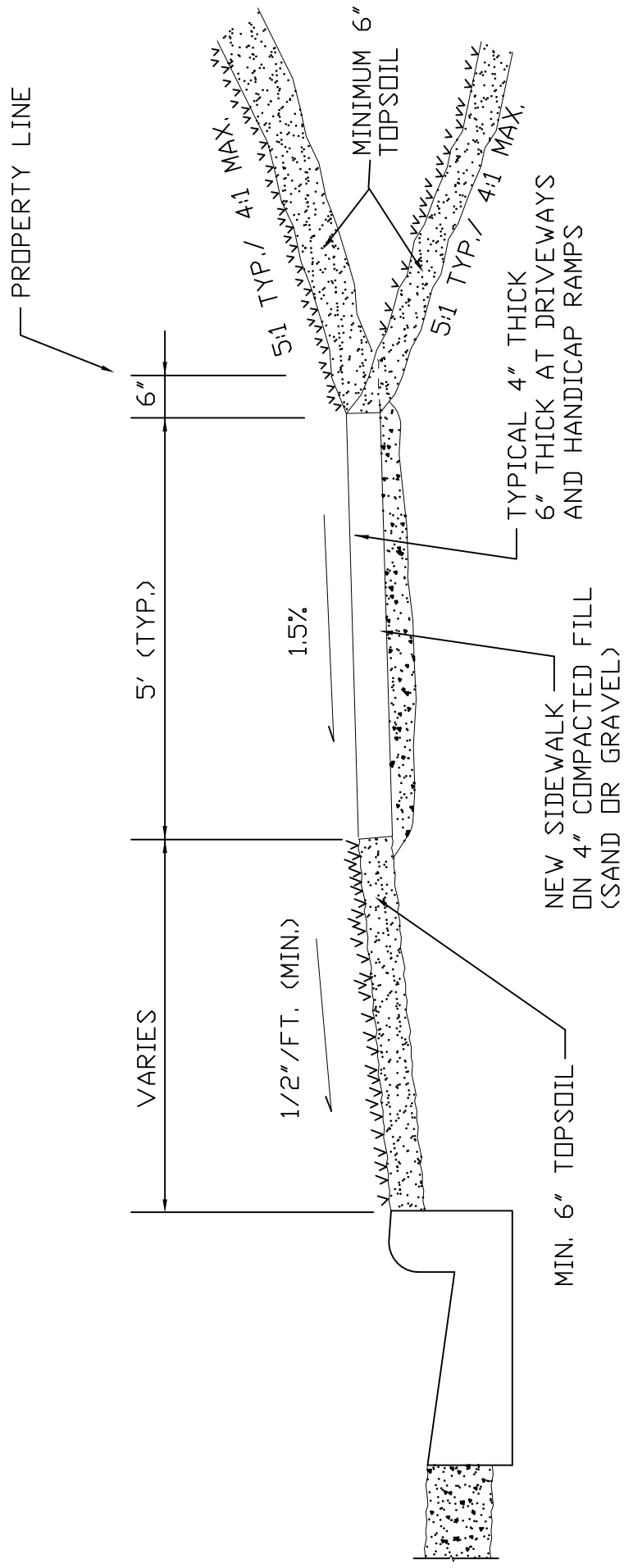
APPROVED
JULY 2023

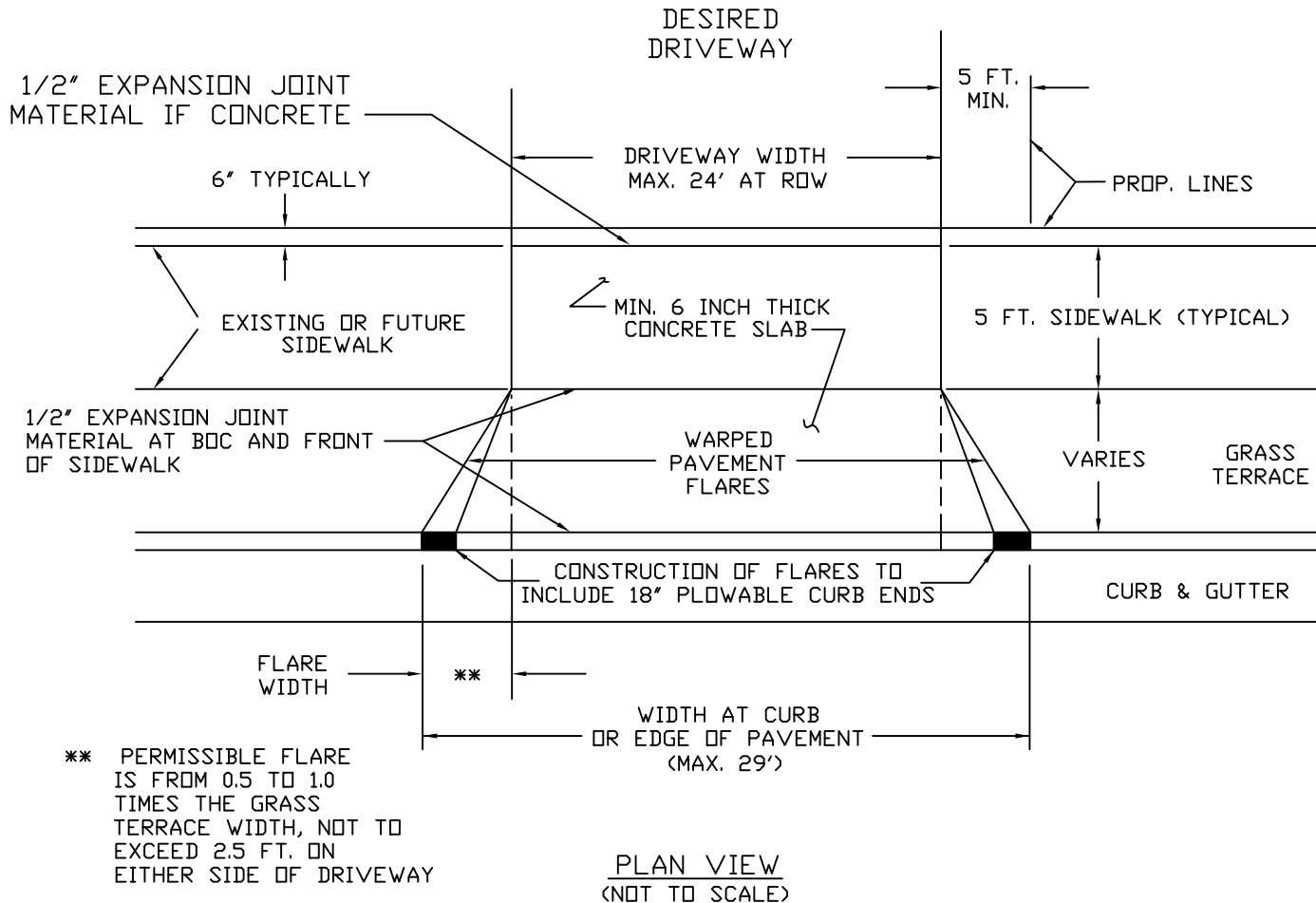
/S/ Rodney Taylor
ROADWAY DESIGN DEVELOPMENT
UNIT SUPERVISOR

DATE

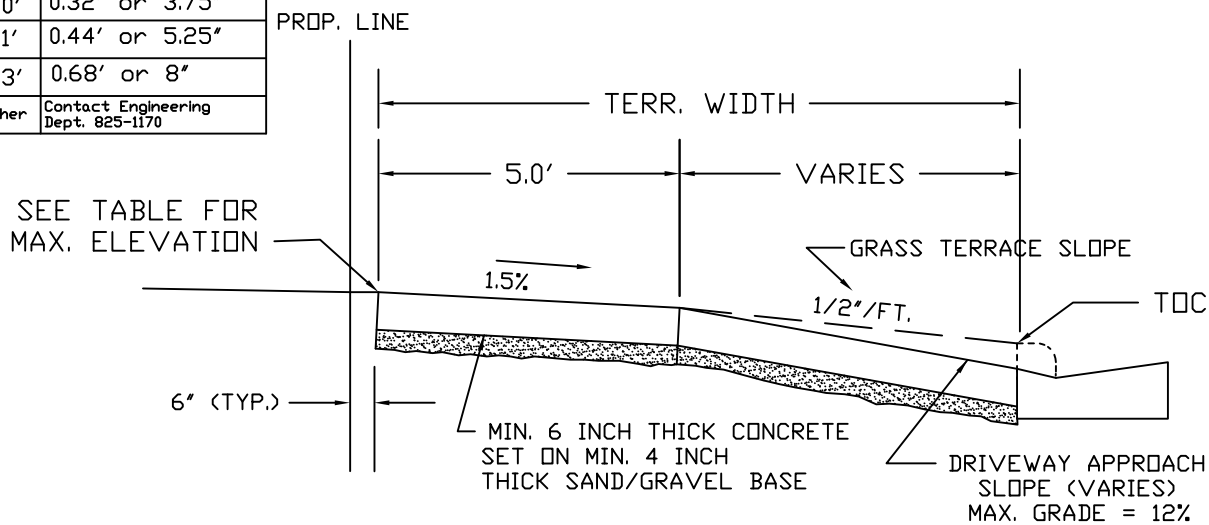
SDD 08D05-21g

6





TERR. WIDTH	MAX. ELEV. 6" FROM PROP. LINE. (ABOVE TOC)
10'	0.32' or 3.75"
11'	0.44' or 5.25"
13'	0.68' or 8"
other	Contact Engineering Dept. 825-1170

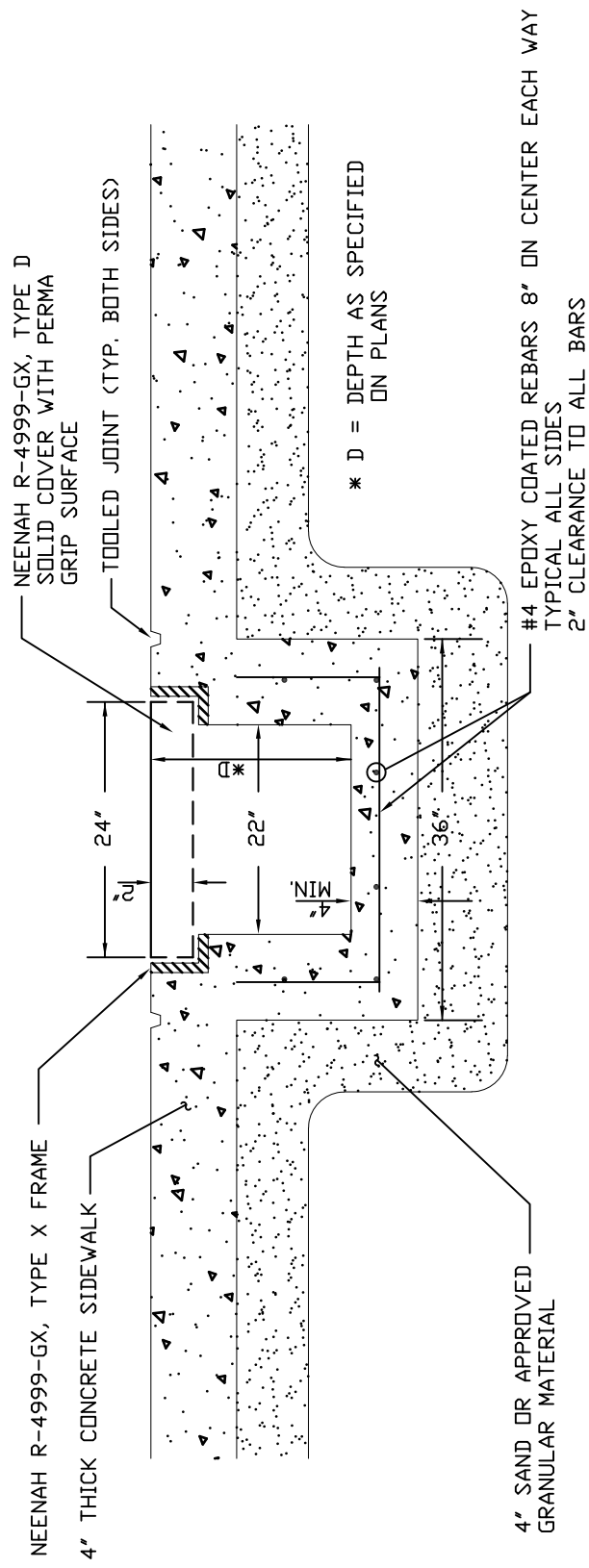


CROSS SECTION
(NOT TO SCALE)

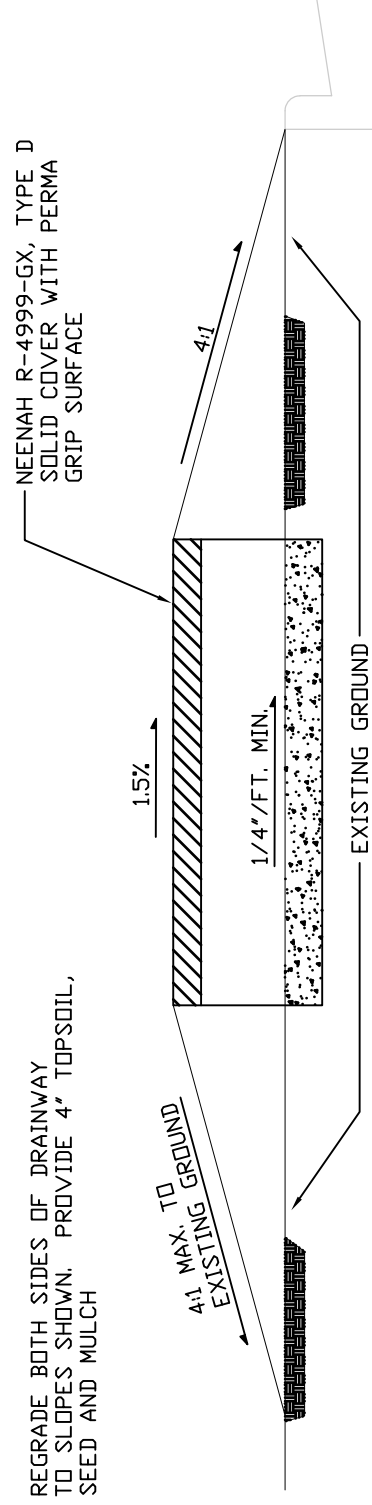
CITY OF SUN PRAIRIE
STANDARD RESIDENTIAL
DRIVEWAY OPENING

DATE: FEB. 2016

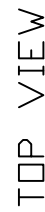
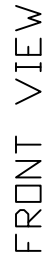
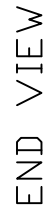
DRAWING NO.
3-4

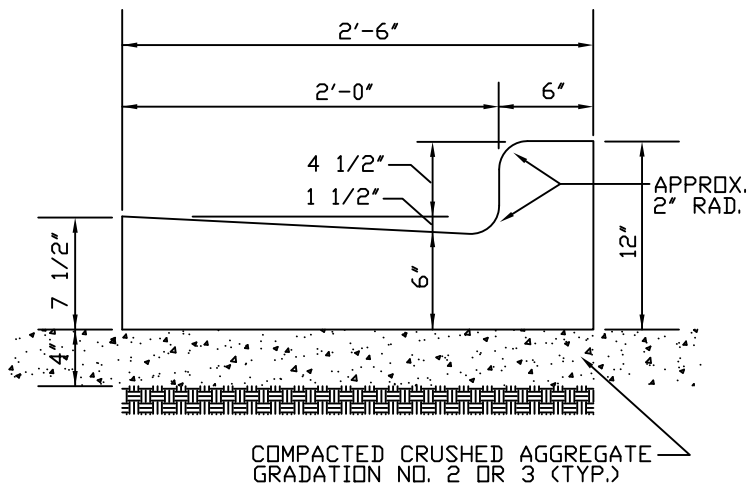


END VIEW
NO SCALE

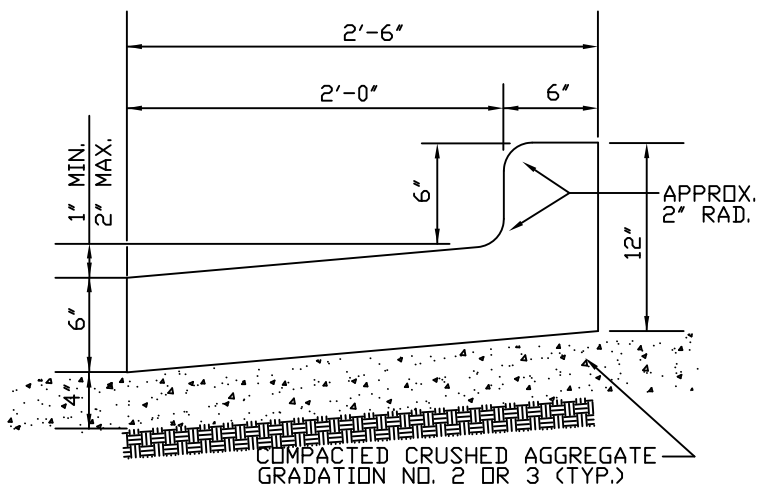


SIDE VIEW
NO SCALE

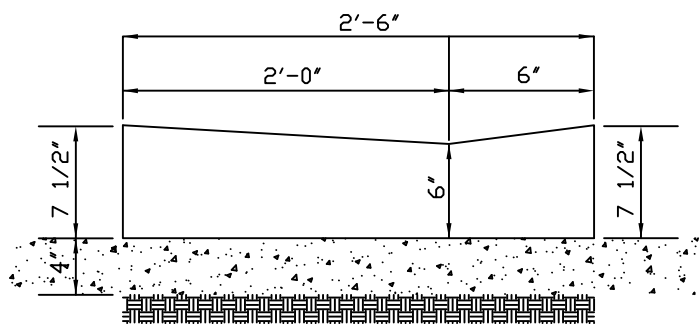




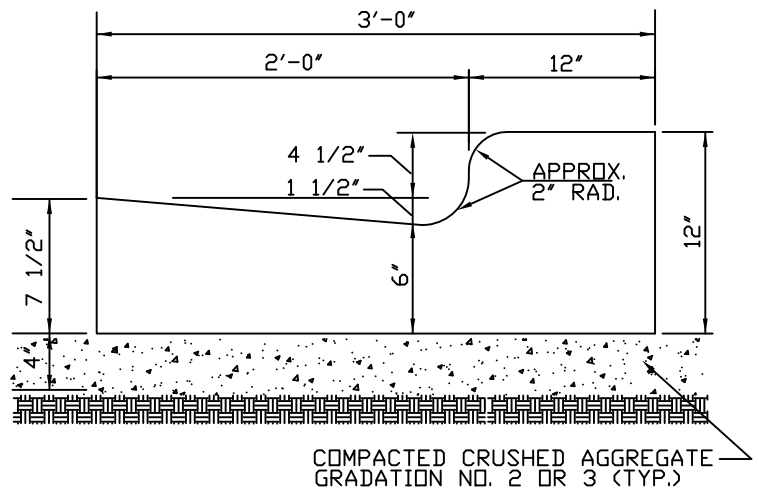
STANDARD SECTION



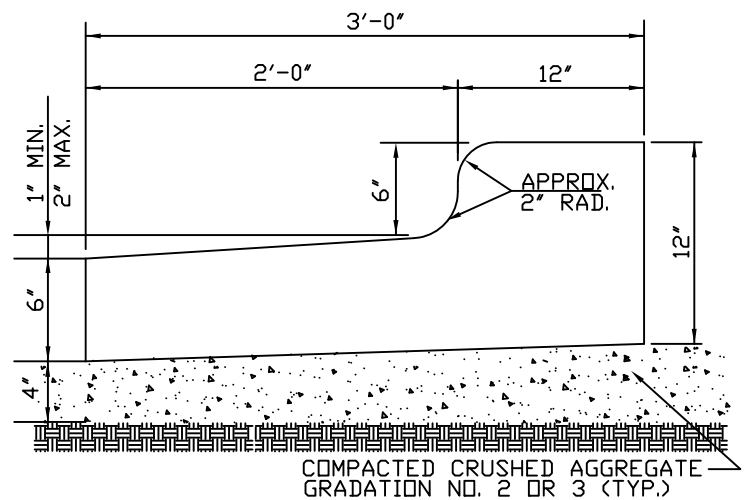
REJECT SECTION



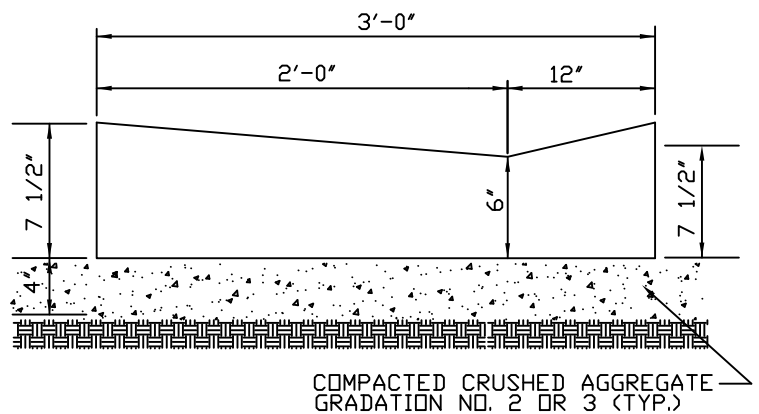
DRIVEWAY SECTION



STANDARD SECTION



REJECT SECTION

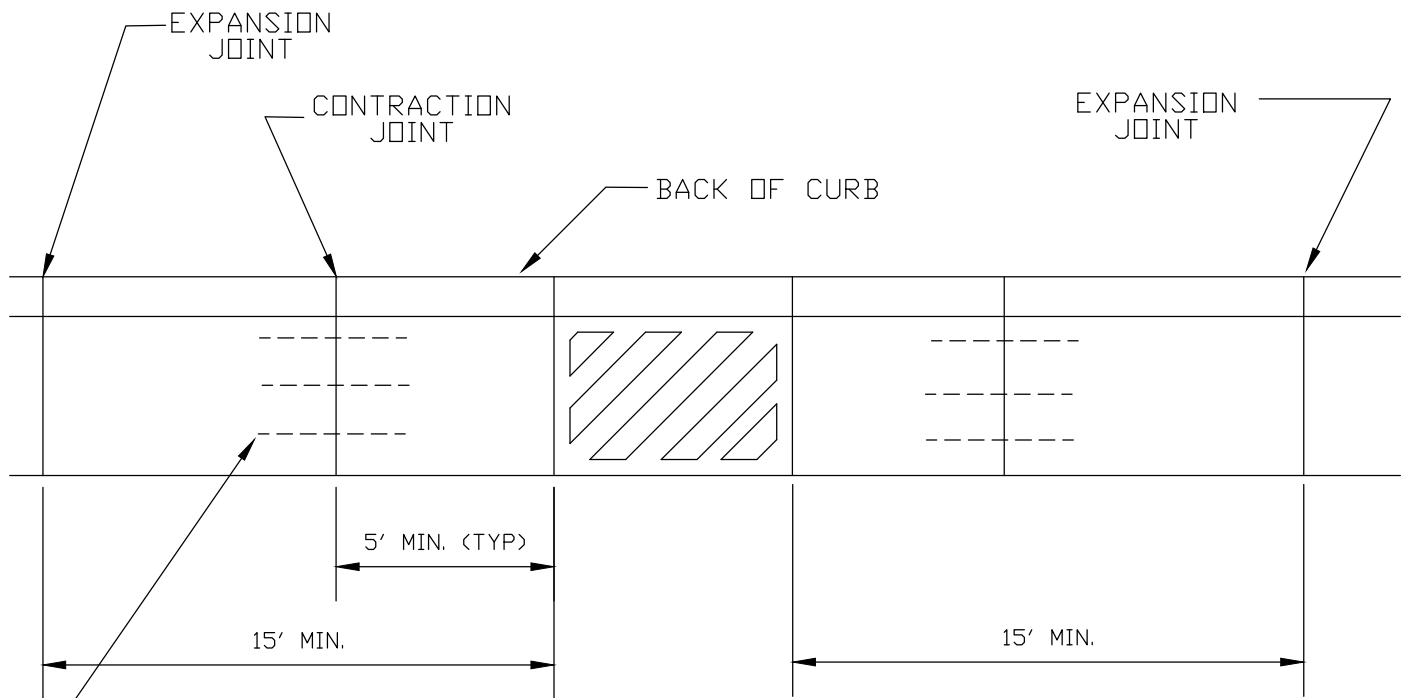


DRIVEWAY SECTION

CITY OF SUN PRAIRIE
CONCRETE CURB & GUTTER
DETAILS

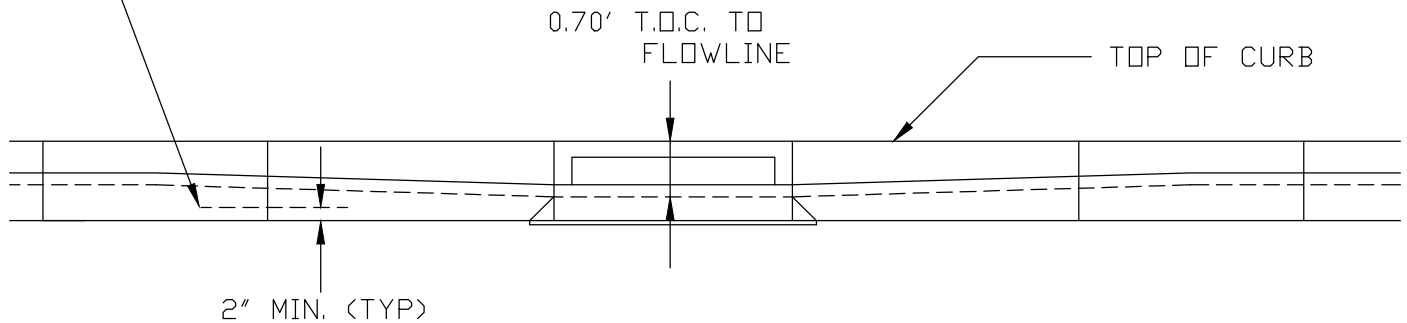
DATE: MAR. 2005

DRAWING NO.
3 - 7



INSTALL 3 - #4 X 1' EPOXY COATED REBARS OR 2 - #6 X 1' EPOXY COATED REBARS EQUALLY SPACED AT ANY COLD JOINTS ADJACENT TO INLET.

TOP VIEW



FRONT VIEW

NOTE:

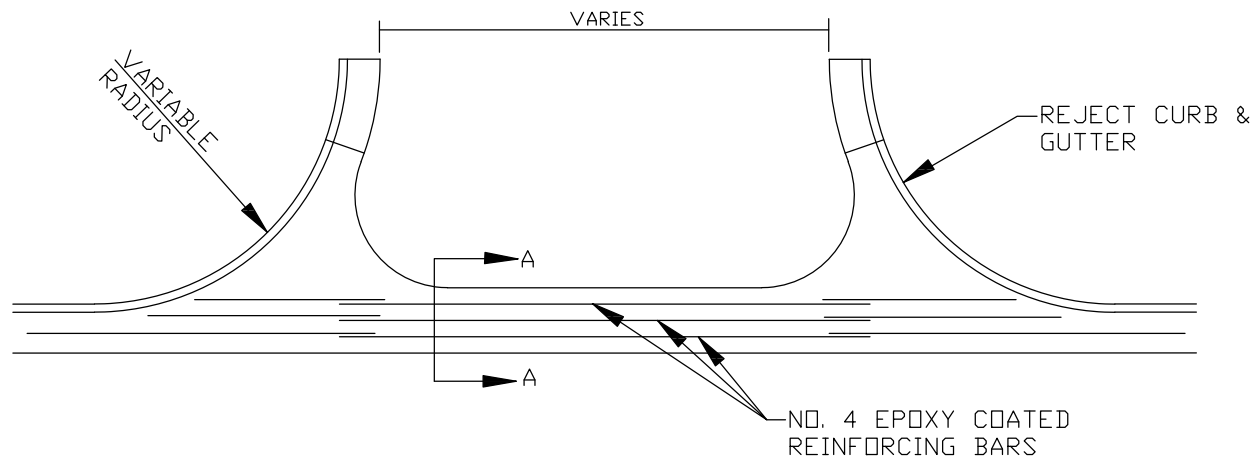
EXPANSION JOINT MATERIAL SHALL NOT BE PLACED WITHIN 15' OF ANY INLET.

CITY OF SUN PRAIRIE
CURB & GUTTER-
INLET DETAIL

DATE: FEB. 2021

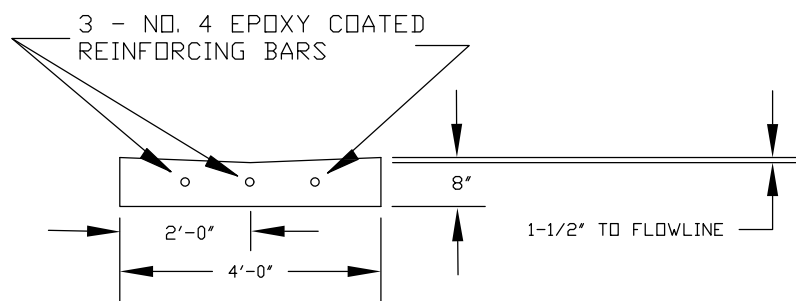
DRAWING NO.

3-8



COMMERCIAL DRIVE APRON

NO SCALE



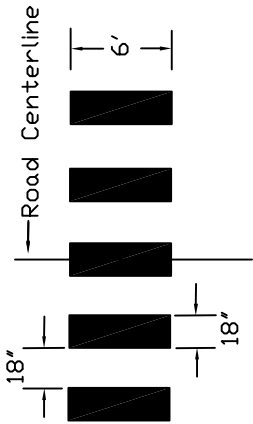
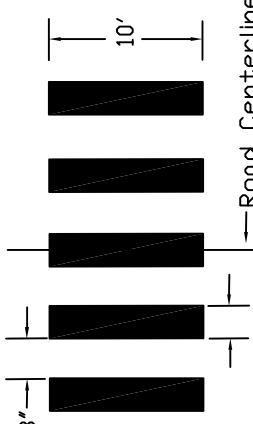
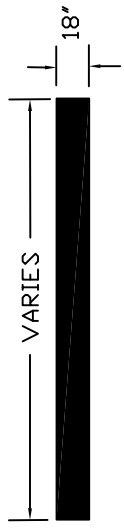
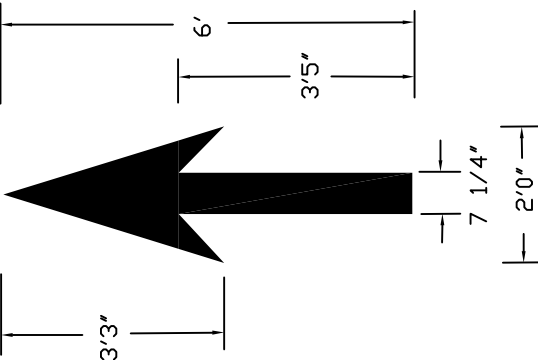
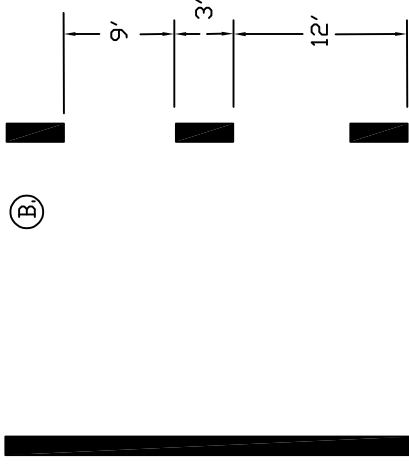
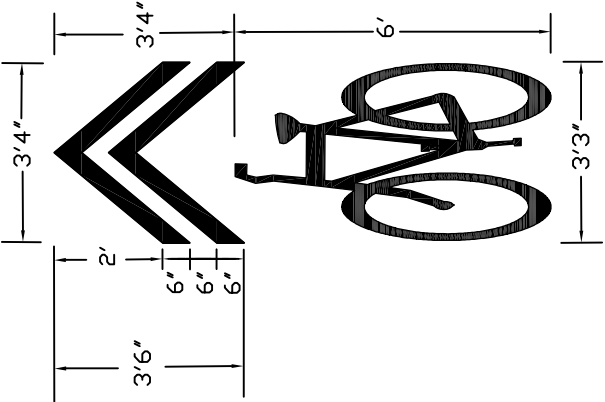
WATERWAY SECTION A - A

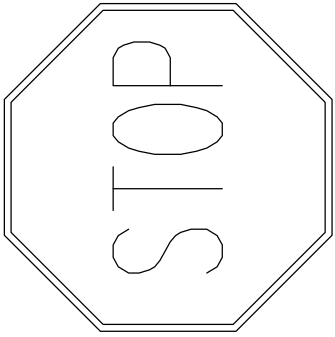
CROSS SECTION
(NOT TO SCALE)

CITY OF SUN PRAIRIE
COMMERCIAL
DRIVEWAY OPENING

DATE: JAN. 2018

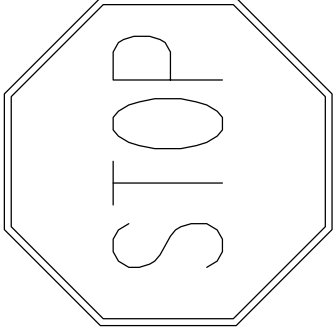
DRAWING NO.
3-9

Lines shall be spaced 18" apart.  LONGITUDINAL BAR CROSSWALK MUTCD 3C.03	Lines shall be spaced 18" apart.  LONGITUDINAL BAR CROSSWALK (PATH) MUTCD 3C.03	 TYPICAL STOP BAR MUTCD 3B.19	 BIKE LANE ARROW DOT # S.D.D.15 C 7-16e	① SOLID 4-INCH WHITE CENTERLINE FOR AREAS WHERE PASSING IS PROHIBITED. ② BROKEN 4-INCH WHITE CENTERLINE FOR AREAS WHERE PASSING IS ALLOWED. BROKEN LINES SHOULD HAVE A 1-TO-3 SEGMENT-TO-GAP RATIO. A NOMINAL 3 FT. SEGMENT WITH A 9 FT. GAP IS RECOMMENDED.  SHARED PATH PAVEMENT MARKINGS	 BIKE SYMBOL FOR SHARED LANE DOT # S.D.D.15 C 7-16e	NOTES: - ALL PAVEMENT MARKINGS SHALL BE EPOXY OR METHYL METHACRYLATE (MMA) - REFER TO WISCONSIN DEPARTMENT OF TRANSPORTATION STANDARD DETAIL DRAWING, SERIES 15, AND MUTCD CHAPTER 3C FOR COMPLETE PAVEMENT MARKING DETAILS - REFLECTIVE BEADS SHALL BE USED ON ALL PAVEMENT MARKINGS - ALL SIDEWALK OR MULTI-PURPOSE PATH CROSSWALKS SHALL REQUIRE LONGITUDINAL BAR CROSSWALK MARKINGS. CITY OF SUN PRAIRIE PAVEMENT MARKING DATE: JAN. 2026 DRAWING NO. 3 - 10
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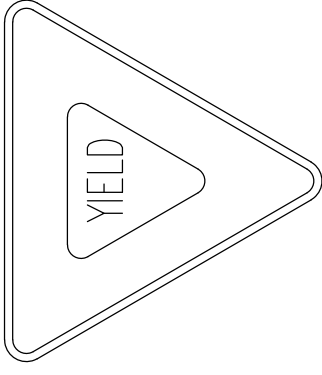
R1-1
24"X24"
DIAMOND GRADE

LOCAL ROADS



R1-1
30"X30"
DIAMOND GRADE

ARTERIAL/COLLECTOR ROADS



R1-2
24"X24"
HIGH INTENSITY SHEETING

ALL ROADS

NOTES:

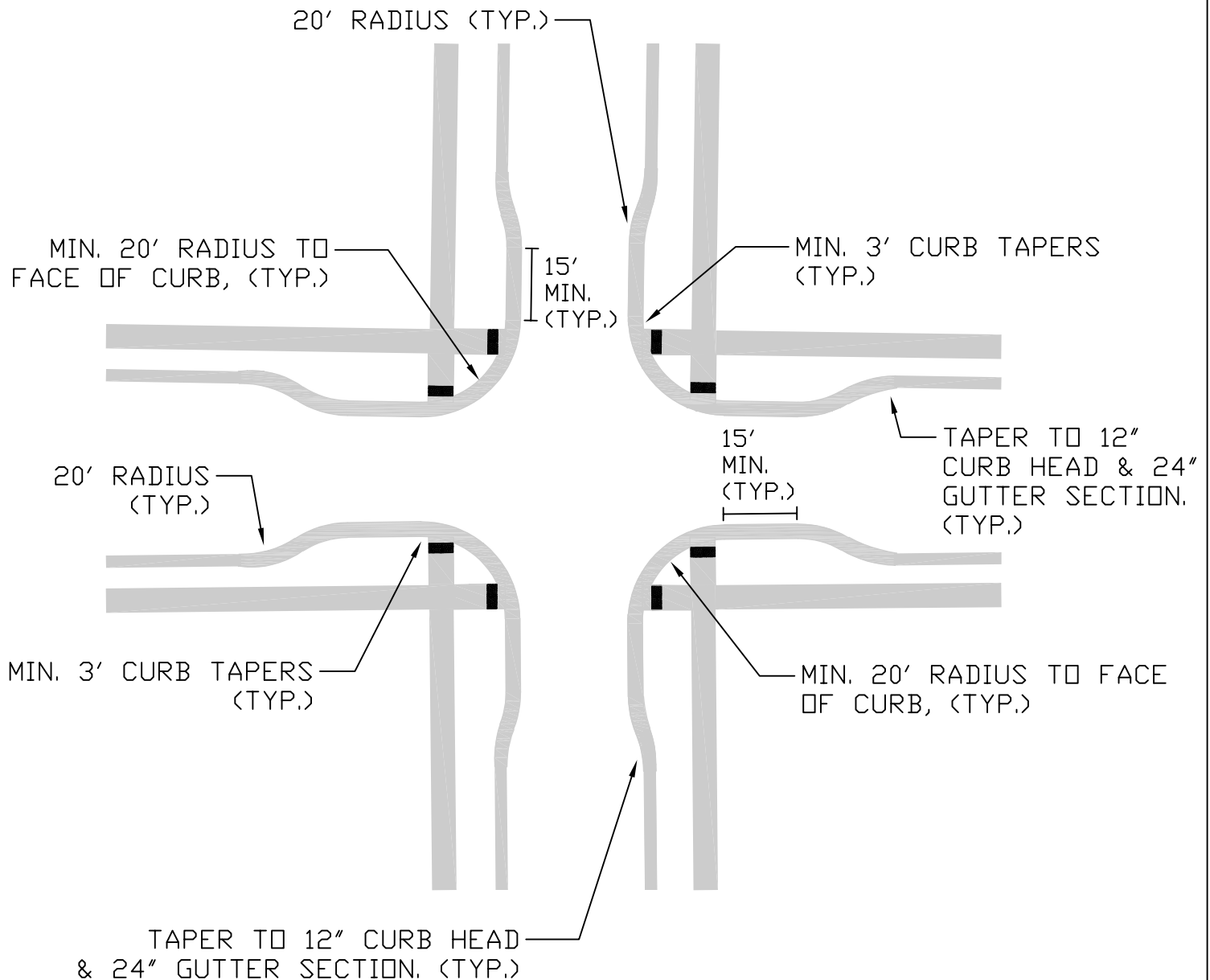
1. POLES: 2" SQUARE TUBING, 14 GAUGE, 10 FOOT IN LENGTH.
2. ANCHORS: 2-1/4" SQUARE, 12 GAUGE, 36" IN LENGTH.
3. NAME PLATES: ALL EXTRUDED, DOUBLE SIDED, 9" IN HEIGHT.
4. CAPS FOR NAME PLATES 12" IN LENGTH, MADE FOR EXTRUDED SIGNS, #3930 3M SHEETING. FIRST LETTER CAPITALIZED AND REMAINING LETTERS LOWERCASE.
5. CROSSES: 12" IN LENGTH, MADE FOR EXTRUDED SIGNS.
6. CORNER BOLTS WITH JAM NUT TO ATTACH TO POLE ANCHOR.
7. SIGNS SHALL BE INSTALLED WITH DRIVE RIVETS AND NYLON WASHER.

CITY OF SUN PRAIRIE
ROAD SIGNS

DATE: JAN. 2018

DRAWING NO.
3 - 11

CURB & GUTTER BUMP-IN



NOTES:

- 1.) TAPER CURB HEAD TO 12" WITH A 24" GUTTER SECTION ENTERING BUMP-IN.
- 2.) THE RADIUS FOR ENTERING AND EXITING THE BUMP-IN SHALL BE 20'.
- 3.) THE LENGTH OF THE CURB & GUTTER AT CROSSWALKS SHALL BE A MINIMUM OF 15'.

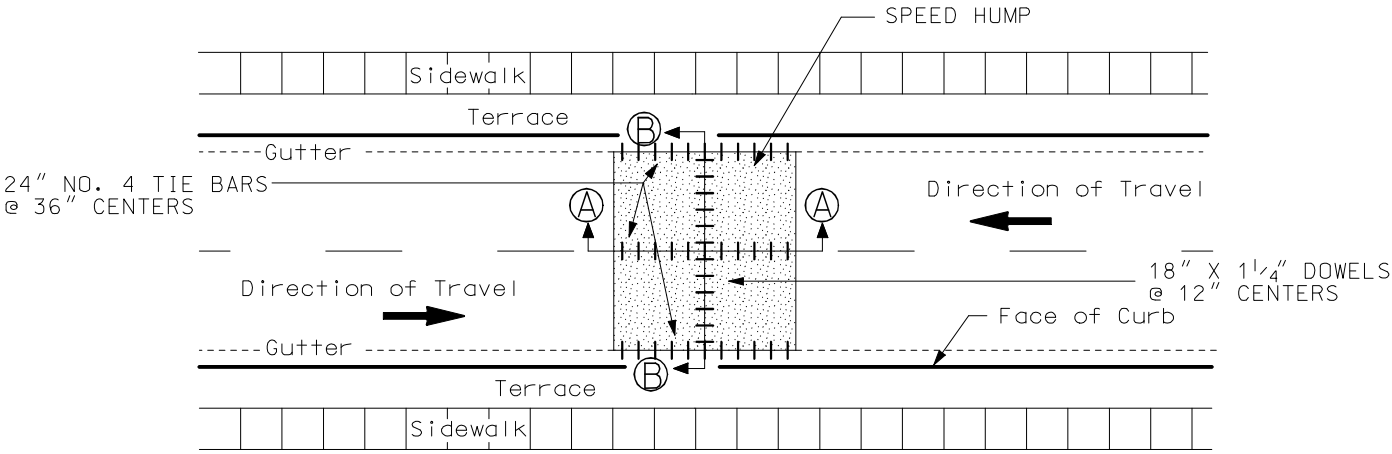
CITY OF SUN PRAIRIE
TYPICAL CURB & GUTTER
BUMP-IN

DATE: JAN. 2026

DRAWING NO.

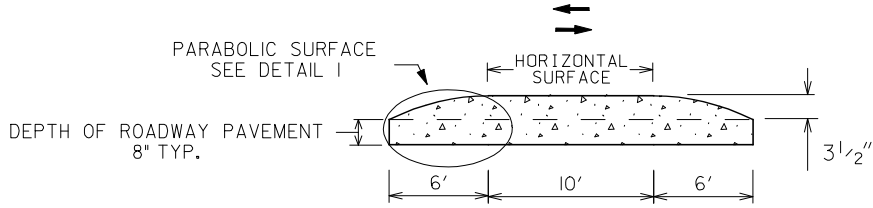
3-12

SPEED HUMP DETAIL



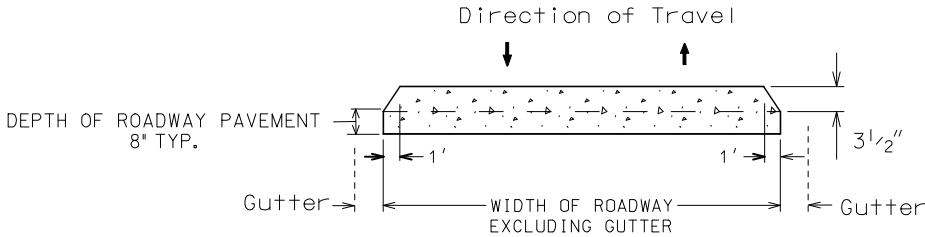
PLAN VIEW

SPEED HUMP ON TYPICAL URBAN STREET



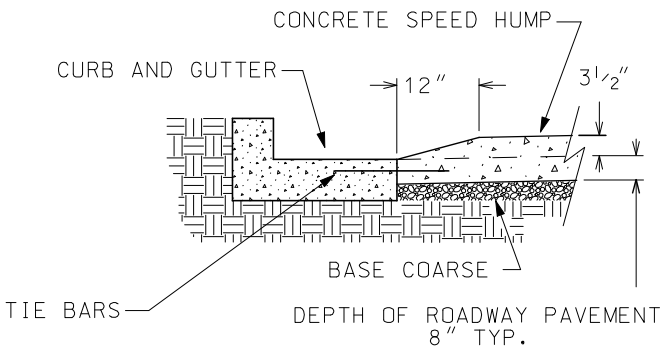
SECTION AA

NOT TO SCALE
(VERTICAL SCALE IS EXAGGERATED)



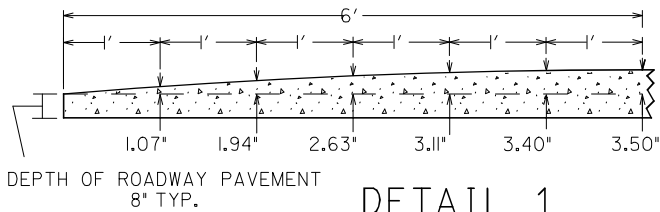
SECTION BB

NOT TO SCALE
(VERTICAL SCALE IS EXAGGERATED)



CURB DETAIL

CROSS SECTION



DETAIL 1

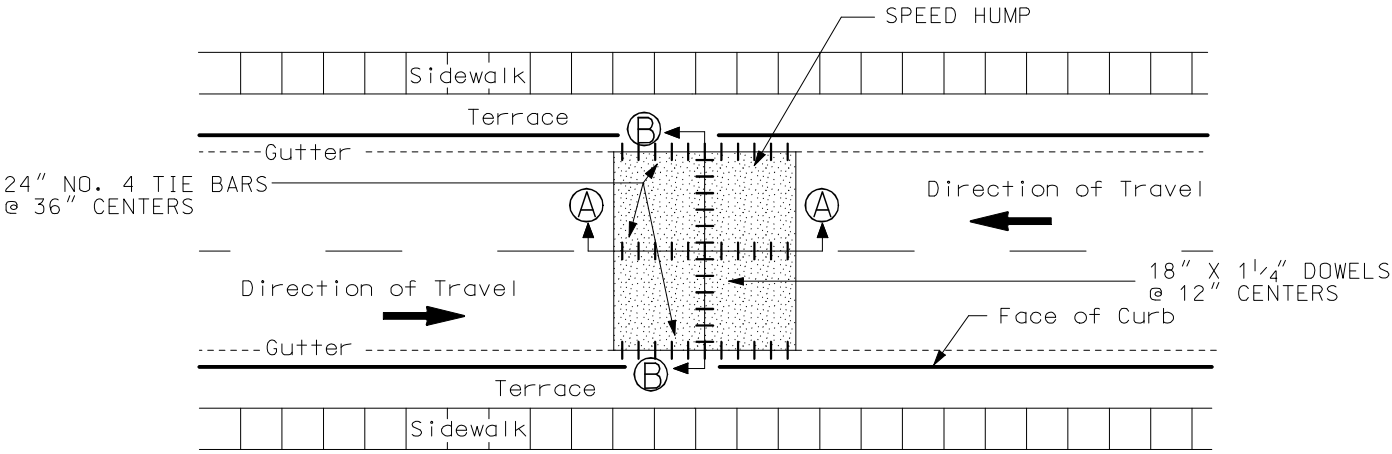
PARABOLIC SURFACE

CITY OF SUN PRAIRIE
CONCRETE SPEED HUMP FLOW
THROUGH GUTTER

DATE: JAN. 2026

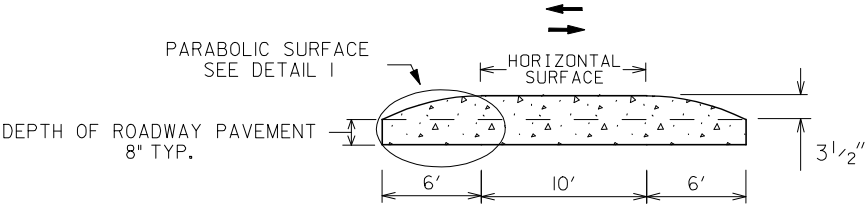
DRAWING NO.
3-13

SPEED HUMP DETAIL



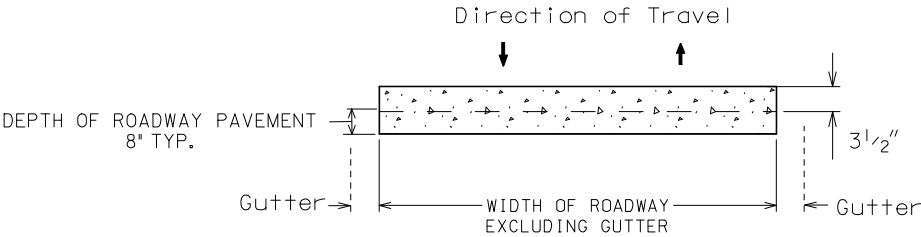
PLAN VIEW

SPEED HUMP ON TYPICAL URBAN STREET



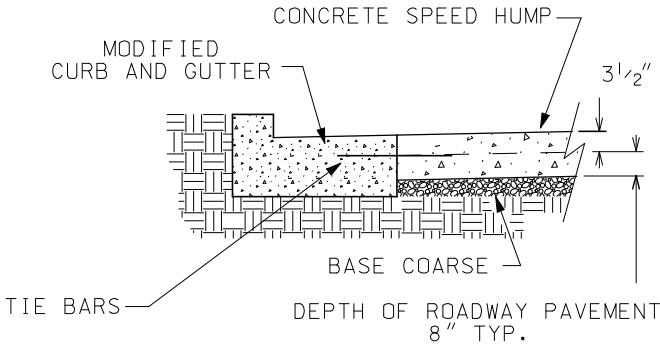
SECTION AA

NOT TO SCALE
(VERTICAL SCALE IS EXAGGERATED)



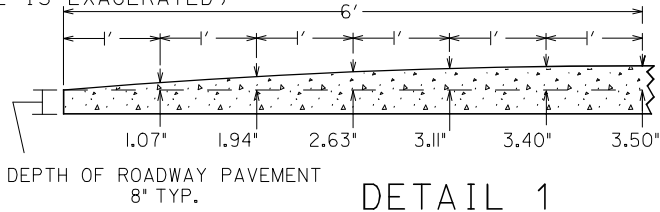
SECTION BB

NOT TO SCALE
(VERTICAL SCALE IS EXAGGERATED)



CURB DETAIL

CROSS SECTION



DETAIL 1

PARABOLIC SURFACE

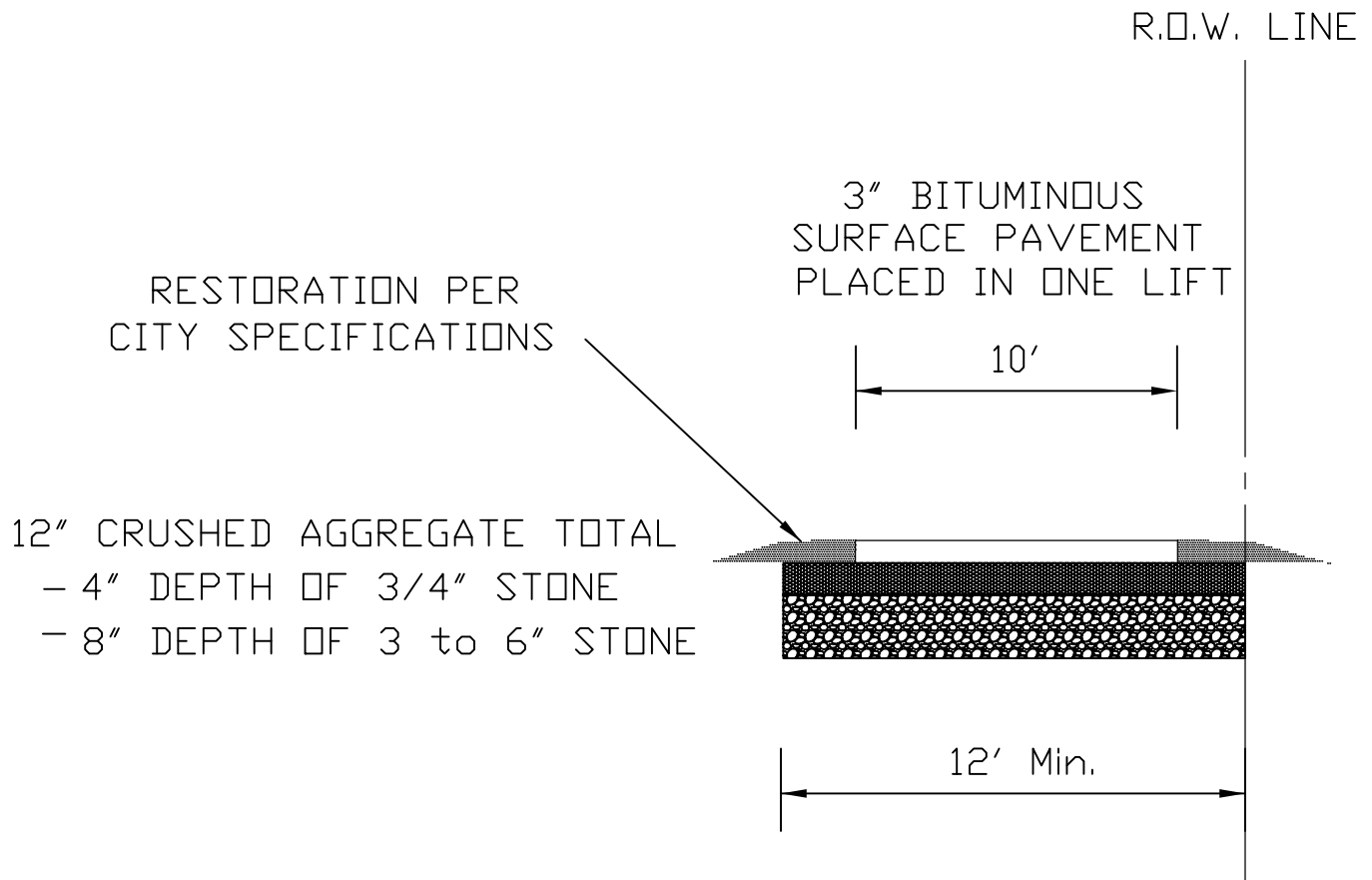
CITY OF SUN PRAIRIE

CONCRETE SPEED HUMP RAISED
GUTTER

DATE: JAN. 2026

DRAWING NO.
3-14

BIKE/PEDESTRIAN PATH



NOTES:

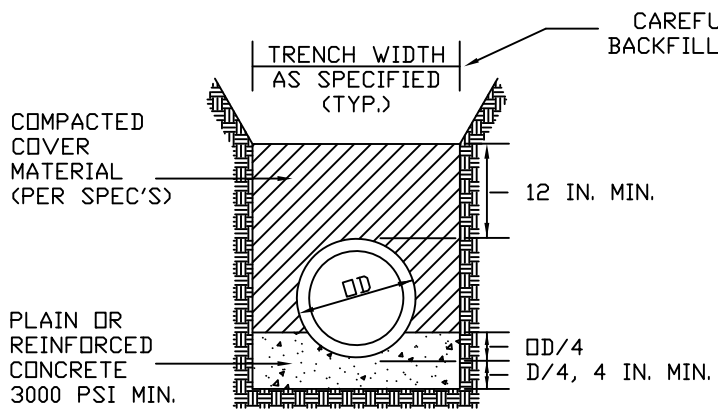
- 1.) CROSS SLOPE OF PATH SHALL BE 1.5%.
- 2.) WIDTH OF BASECOURSE MATERIAL TO BE A MINIMUM OF 12 FEET.

CITY OF SUN PRAIRIE
TYPICAL ASPHALT BIKE/
PEDESTRIAN PATH

DATE: JAN. 2018

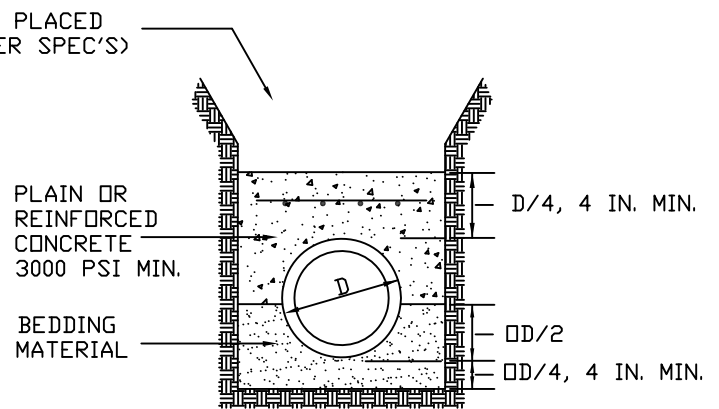
DRAWING NO.

4-1



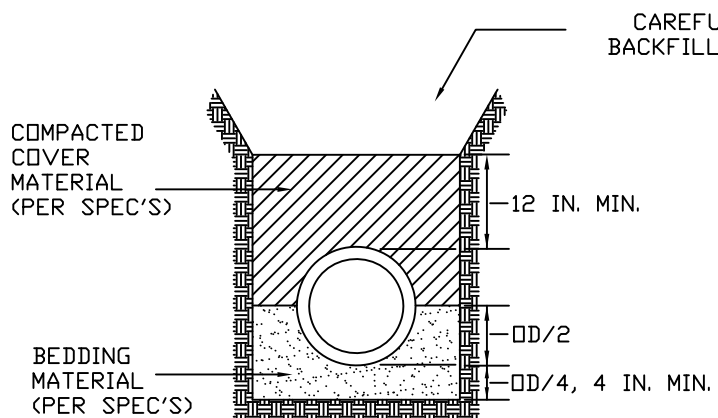
NOTE - MINIMUM WIDTH OF CONCRETE CRADLE
= OD + 8 IN.

CLASS A
CONCRETE CRADLE

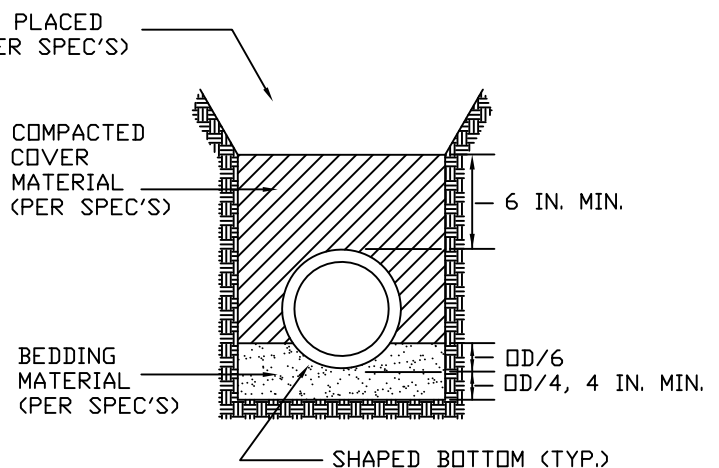


NOTE - MINIMUM WIDTH OF CONCRETE ARCH
= OD + 8 IN.

CLASS A-1
CONCRETE ARCH



CLASS B



CLASS C

NOTES: ALL PVC AND ABS SEWER MAINS AND LATERALS SHALL BE CLASS "B" MIN., OR AS CALLED FOR IN THE SPECIAL PROVISIONS.

ALL BEDDING AND COVER MATERIALS SHALL BE AS SPECIFIED AND SHALL BE SUBJECT TO THE APPROVAL OF THE ENGINEER.

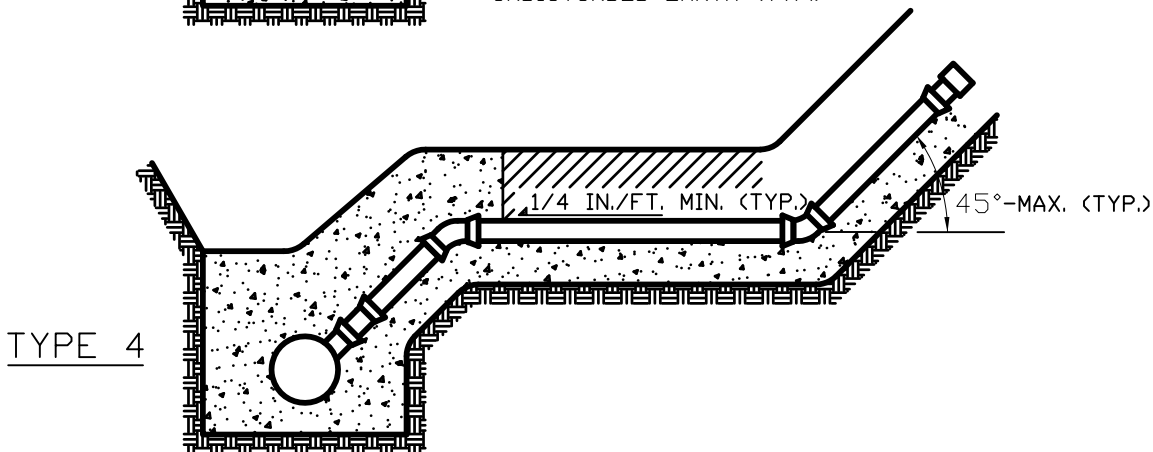
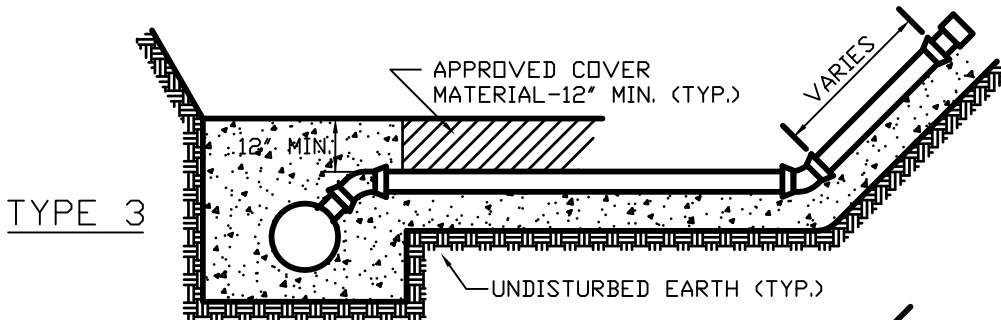
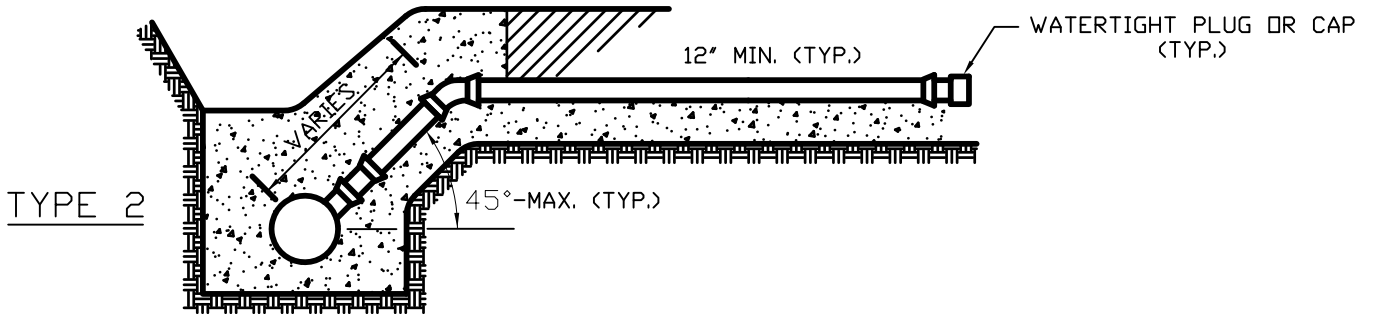
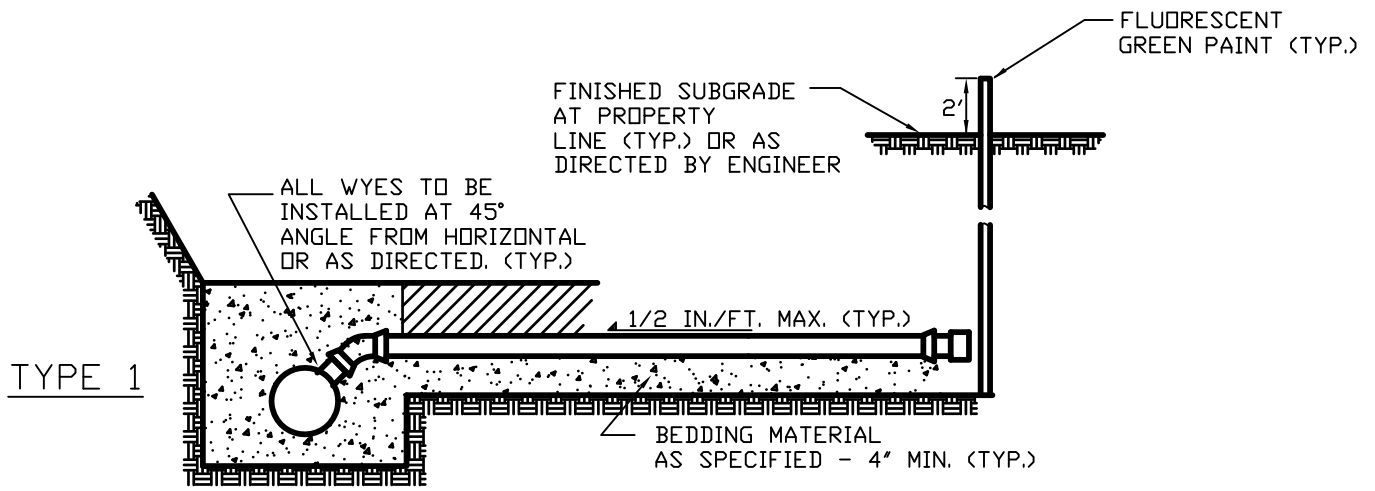
UNDERCUT SHALL BE IN ACCORDANCE WITH SECTION 3 OF THE STORM AND SANITARY SEWER STANDARD SPECIFICATIONS.

CITY OF SUN PRAIRIE
STORM AND SANITARY SEWER
BEDDING STANDARDS

DATE: SEPT. 1996

DRAWING NO.

5 - 1



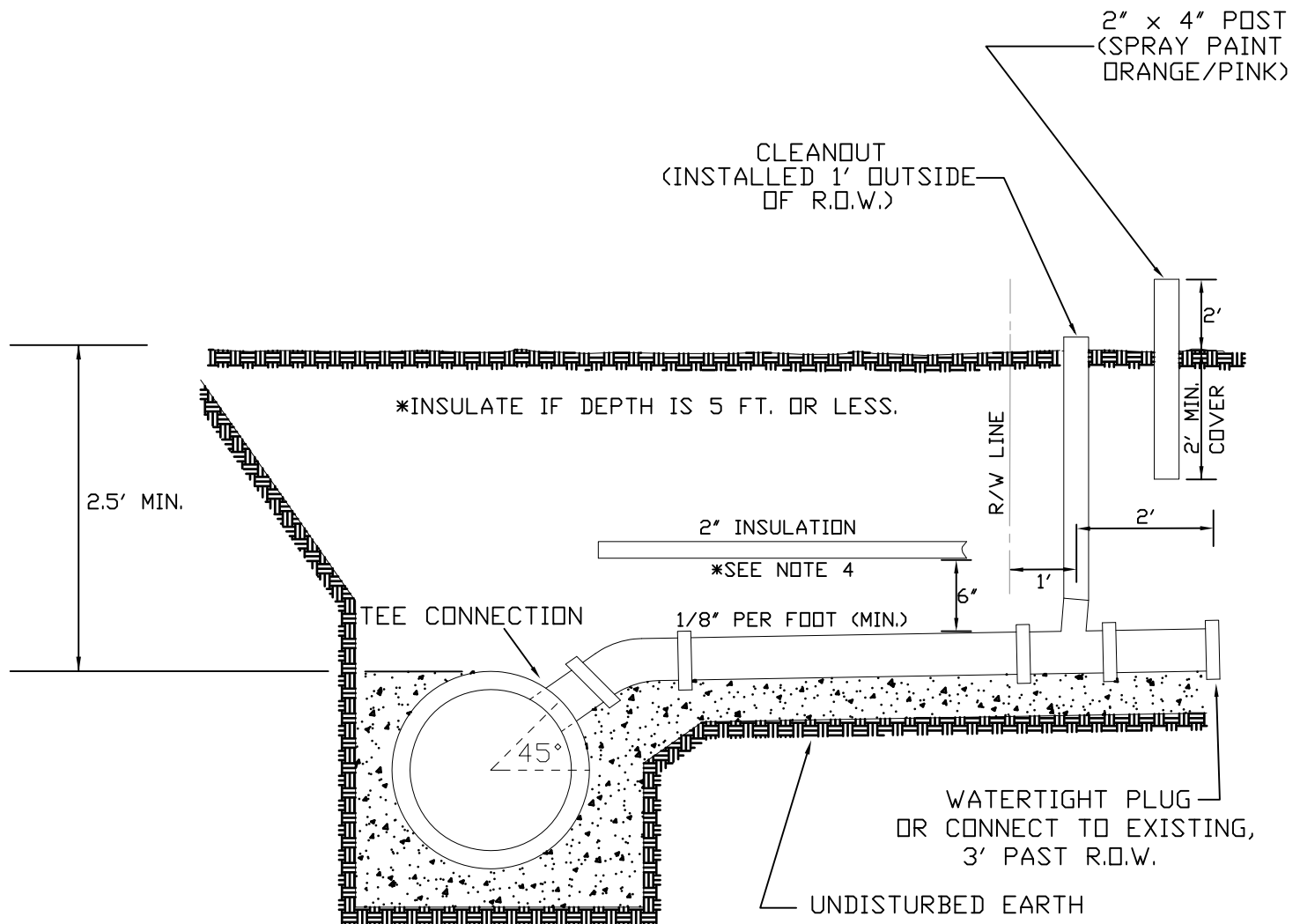
- NOTES:
- 1.) BEDDING MATERIAL SHALL BE 3/4" CLEAR STONE, UNLESS OTHERWISE APPROVED BY CITY ENGINEER.
 - 2.) ENDS OF ALL LATERALS TO BE 10 FT. MIN. COVER AT END, AND BE MARKED BOTH BELOW AND ABOVE SURFACE WITH 4' LONG 2" x 4".
 - 3.) ALL NEW CONSTRUCTION TO BE PLACED ON UNDISTURBED GROUND OR SAND COMPACTED TO 95% MAXIMUM DENSITY.
 - 4.) LATERAL MATERIAL INCLUDING FITTINGS SHALL BE OF SAME MATERIAL AS THE SEWER MAIN, OR AS DIRECTED BY ENGINEER.

CITY OF SUN PRAIRIE
SANITARY SEWER LATERALS
STANDARD DETAILS

DATE: FEB. 2011

DRAWING NO.

5 - 2



NOTES:

- 1.) NEW CONNECTIONS SHALL CONSIST OF A FACTORY SUPPLIED 4" DIAMETER TEE CONNECTION WITH AN ENGINEER APPROVED METHOD AND MATERIAL.
- 2.) LATERAL PIPE SHALL BE SCHEDULE 40 PVC OR EQUAL.
- 3.) LATERAL PIPE SHALL HAVE CLASS "B" BEDDING. BEDDING AND COVER MATERIAL SHALL CONSIST OF 3/4 INCH CLEAR STONE.
- 4.) LATERAL SHALL BE INSULATED AT ALL LOCATIONS WITH LESS THAN 5 FT. OF COVER MATERIAL. (4'X8'X2" INSULATION OR BOX-IN METHOD ALLOWED).
- 5.) EXISTING STORM SEWER SHALL BE CORED USING PORTABLE CORE DRILL AND THE CONNECTION SHALL BE MADE USING STRAPPED ON SADDLE AS APPROVED BY CITY ENGINEER.

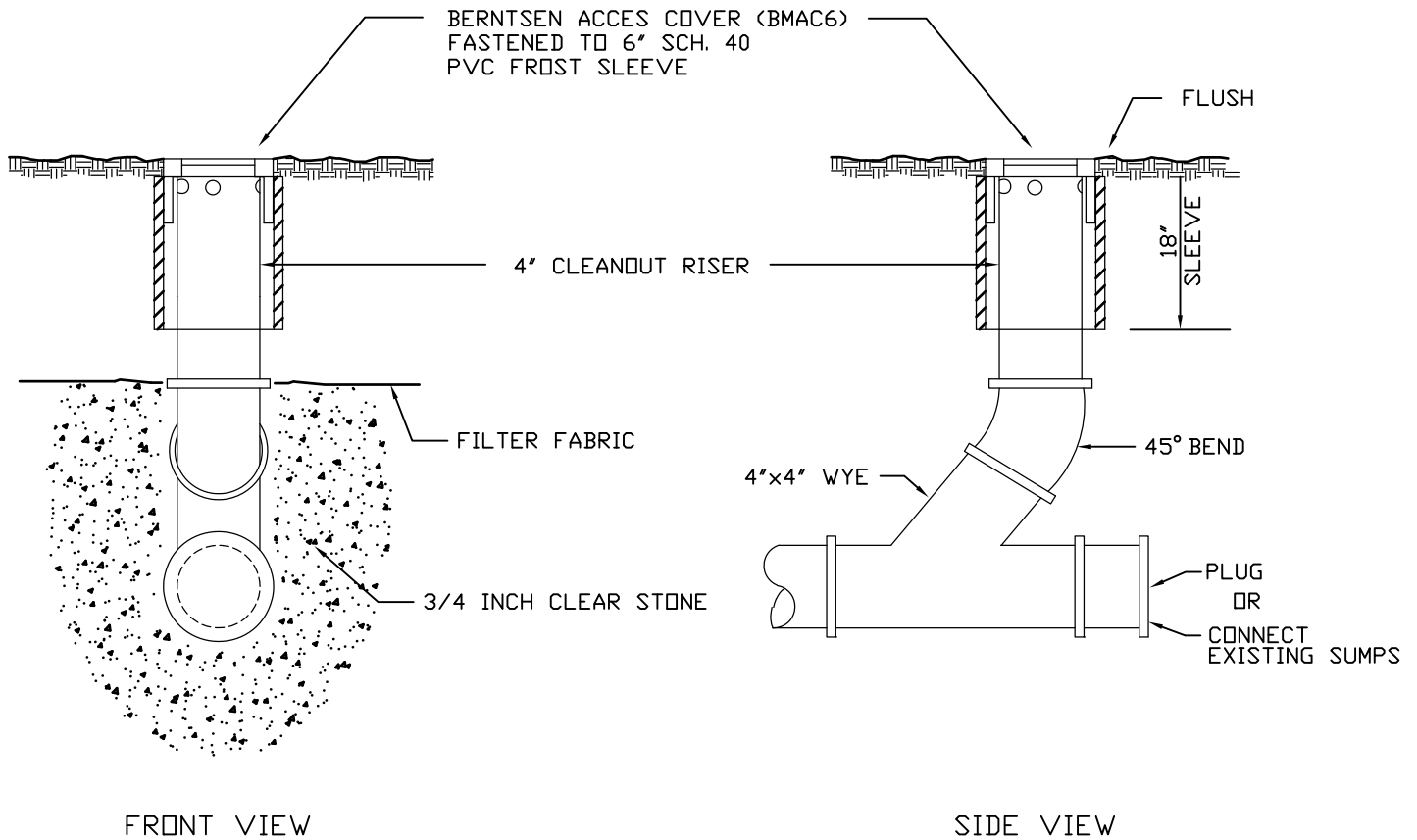
CITY OF SUN PRAIRIE
TYPICAL STORM SEWER
LATERAL

DATE: FEB. 2011

DRAWING NO.

5 - 3

STORM LATERAL CLEANOUT CONNECTION



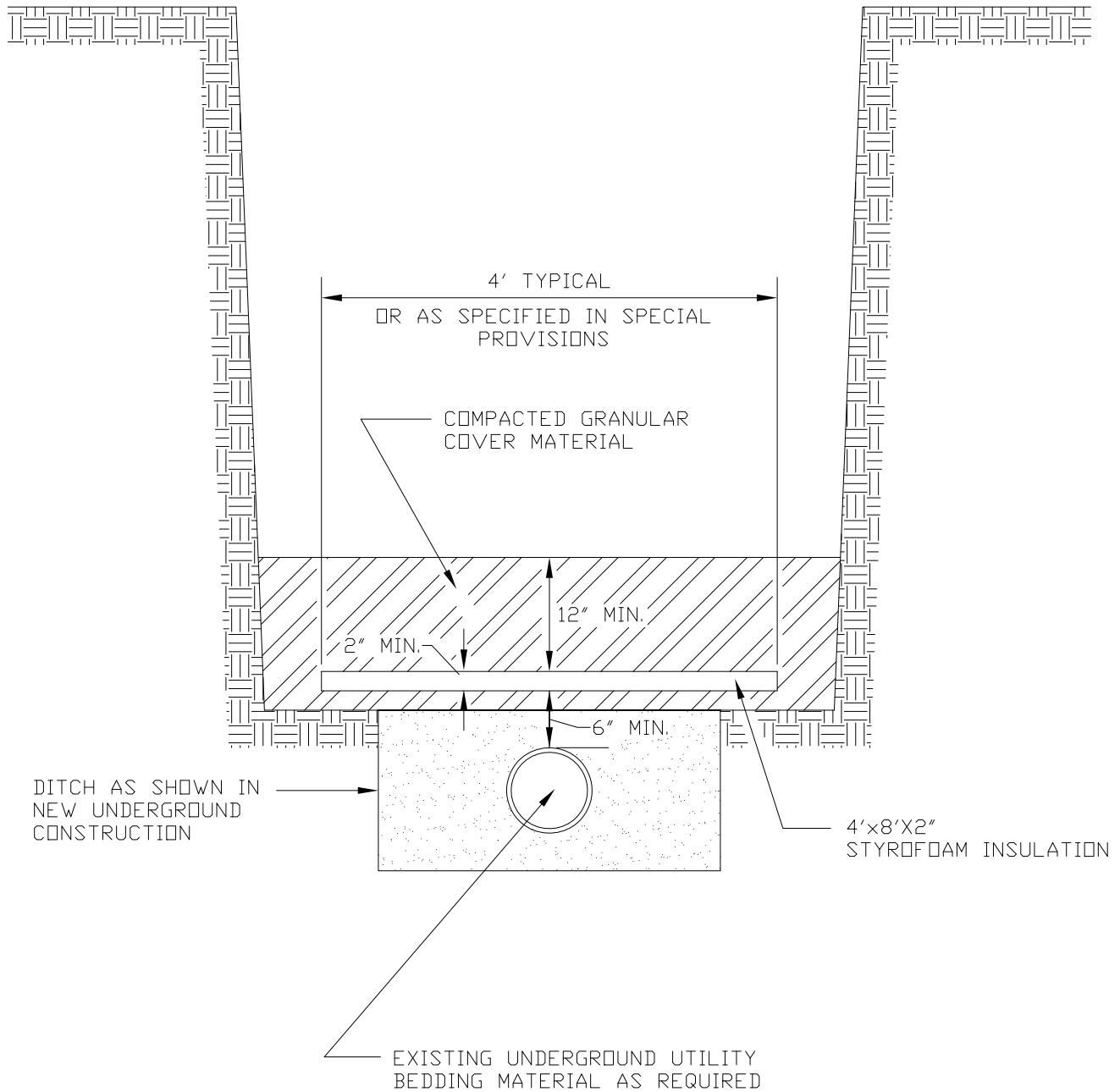
- NOTES:
- 1.) THE TOP OF THE CLEANOUT RISER SHALL NOT EXTEND ABOVE EXISTING GROUND ELEVATION.
 - 2.) THE CONTRACTOR SHALL DRILL FOUR - 1 INCH DIAMETER HOLES WITHIN CLEANOUT RISER APPROXIMATELY 4 INCHES BELOW EXISTING GROUND ELEVATION.
 - 3.) THE CONTRACTOR SHALL REMOVE THE EXISTING SUMP PUMP DISCHARGE PIPE WITHIN THE STREET RIGHT-OF-WAY AND CONNECT EXISTING SUMP LINE, 3' PAST R.O.W.
 - 4.) THE CLEANOUT RISER SHALL BE ENCASED IN A 6 INCH SCH. 40 PVC FROST SLEEVE WITH A BERNTSEN ACCESS COVER (BMAC6).
 - 5.) THE CLEANOUT RISER SHALL BE INSTALLED 1' OUTSIDE OF R.O.W.

CITY OF SUN PRAIRIE
STORM LATERAL CLEANOUT
CONNECTION

DATE: JAN. 2018

DRAWING NO.

5 - 4



PIPE INSULATION DETAIL

NOTE: INSULATION STANDARDS SHALL BE AS FOLLOWS:
 WATER MAIN: INSULATED AT DEPTHS LESS THAN 6.5 FEET
 WATER MAIN SERVICES: INSULATE AT DEPTHS LESS THAN 6.5 FEET
 SANITARY MAIN SERVICES: INSULATE AT DEPTHS LESS THAN 5.0 FEET

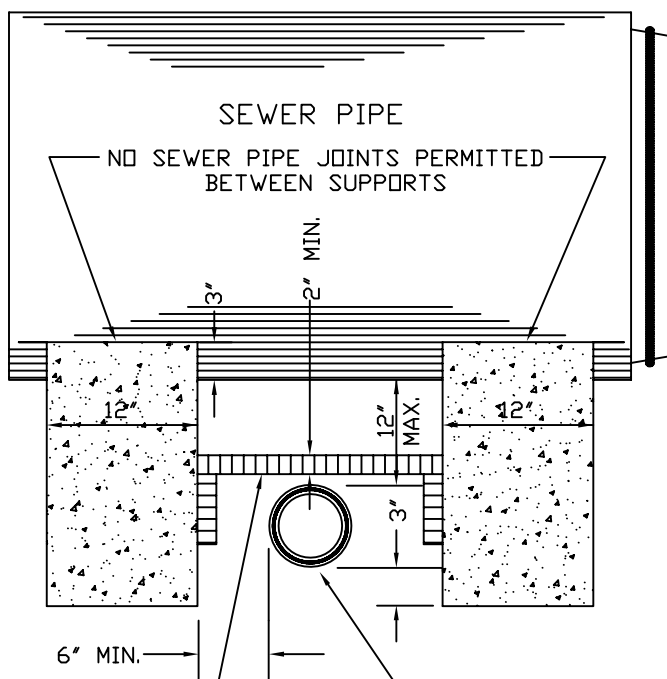
CITY OF SUN PRAIRIE

PIPE INSULATION DETAIL

DATE: FEB. 2011

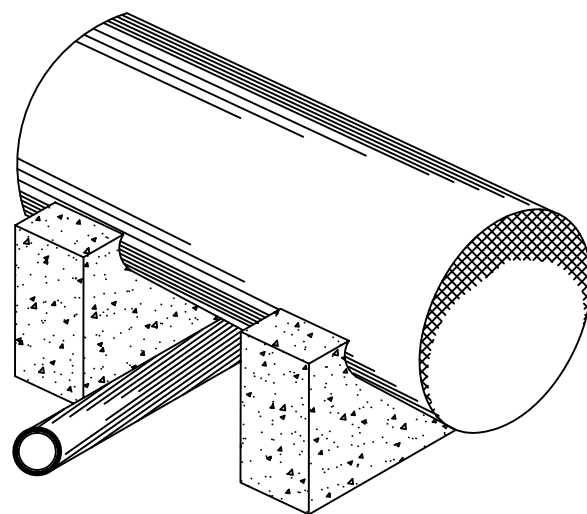
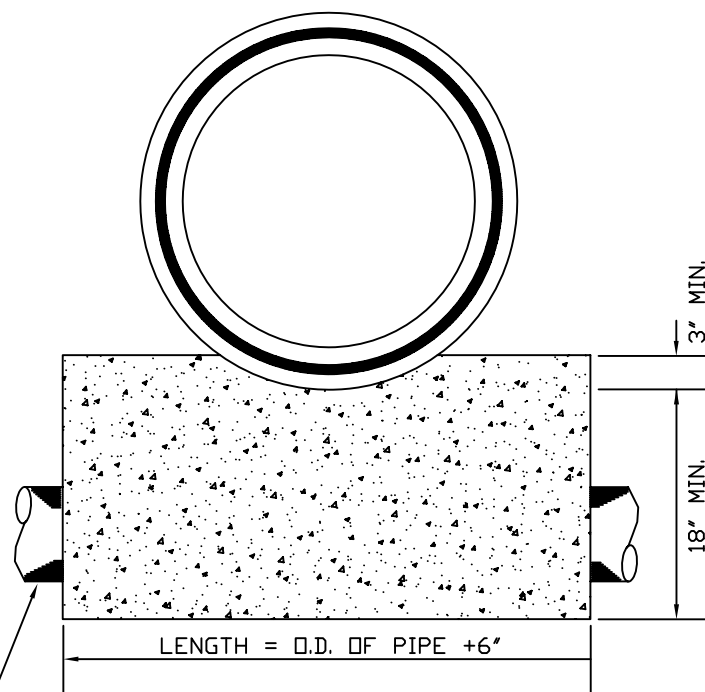
DRAWING NO.

5-5



STYROFOAM BLOCK
4 FT. WIDTH CENTERED
AS SHOWN

UTILITY
LINE



EACH PAIR OF SUPPORTS IN ANY SIZE
IS ONE PAY ITEM

CITY OF SUN PRAIRIE
CONCRETE PIPE SUPPORT DETAIL

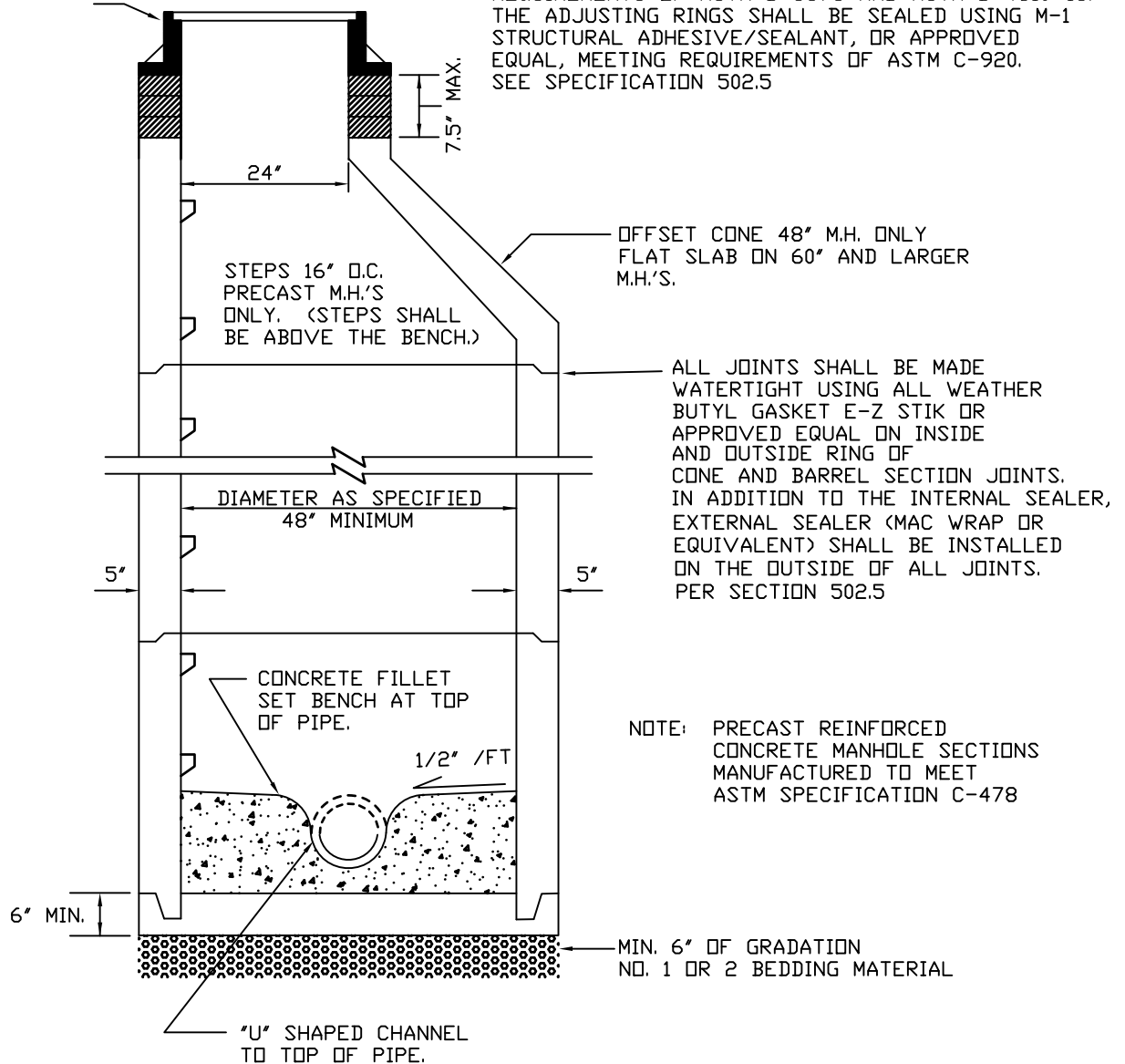
DATE: SEPT. 1996

DRAWING NO.

5 - 6

9" CASTING AS SPECIFIED

ADJUSTING RINGS SHALL BE MADE FROM EXPANDED POLYPROPYLENE (EPP) AS MANUFACTURED BY CRETEX (PRO-RING) OR APPROVED EQUAL AND MEET THE REQUIREMENTS OF ASTM D-3575 AND ASTM D-4819-13. THE ADJUSTING RINGS SHALL BE SEALED USING M-1 STRUCTURAL ADHESIVE/SEALANT, OR APPROVED EQUAL, MEETING REQUIREMENTS OF ASTM C-920. SEE SPECIFICATION 502.5



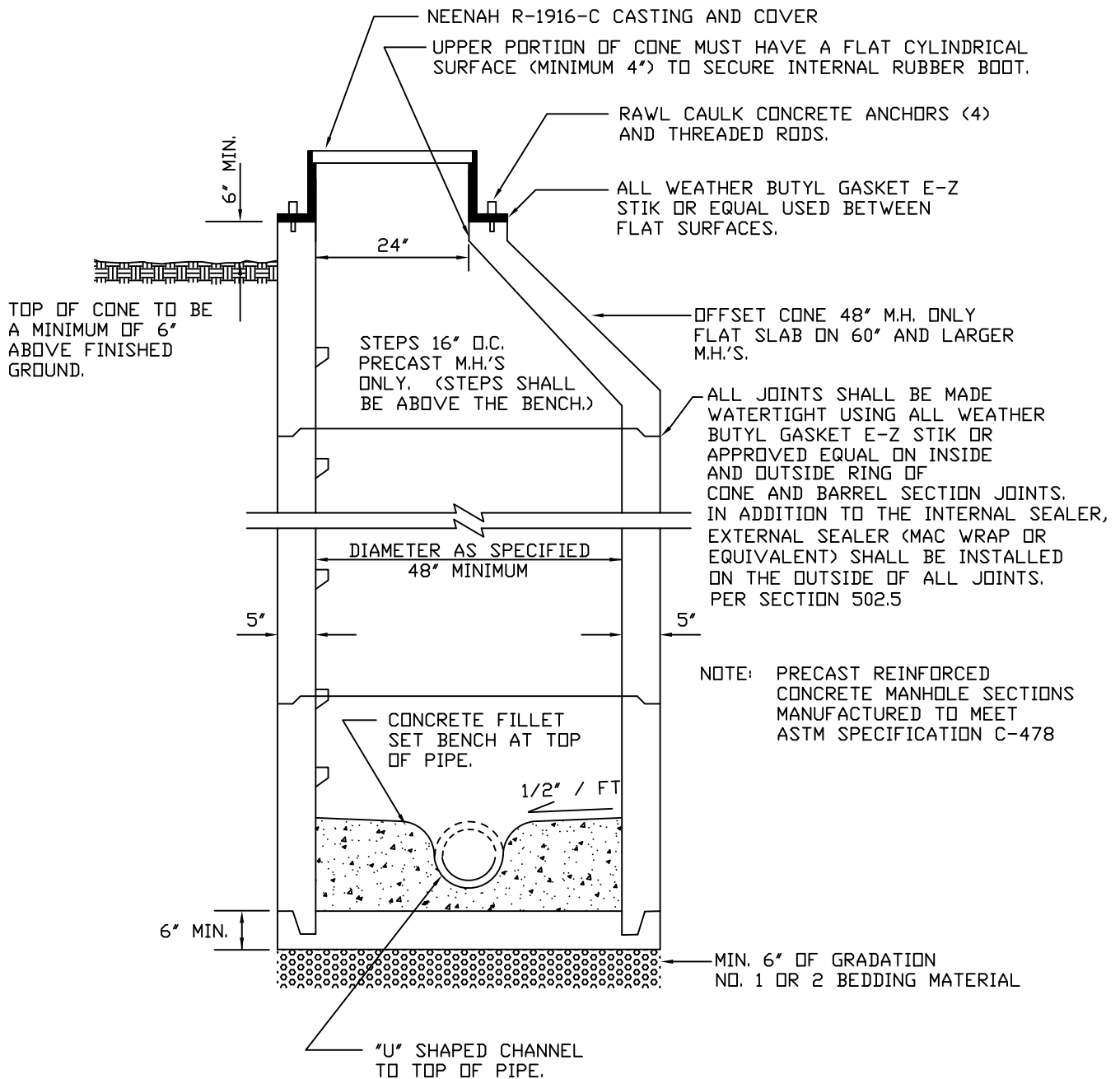
STANDARD PRECAST MANHOLE DETAIL IN STREET LOCATIONS

NOTE: THE ENGINEER MAY ALSO APPROVE THE USE OF STREET LOCATION INSTALLATIONS IN OTHER LOCATIONS.

CITY OF SUN PRAIRIE
SANITARY MANHOLES
IN STREET LOCATIONS

DATE: JAN. 2025

DRAWING NO.
5 - 7



STANDARD PRECAST MANHOLE DETAIL IN REMOTE LOCATIONS

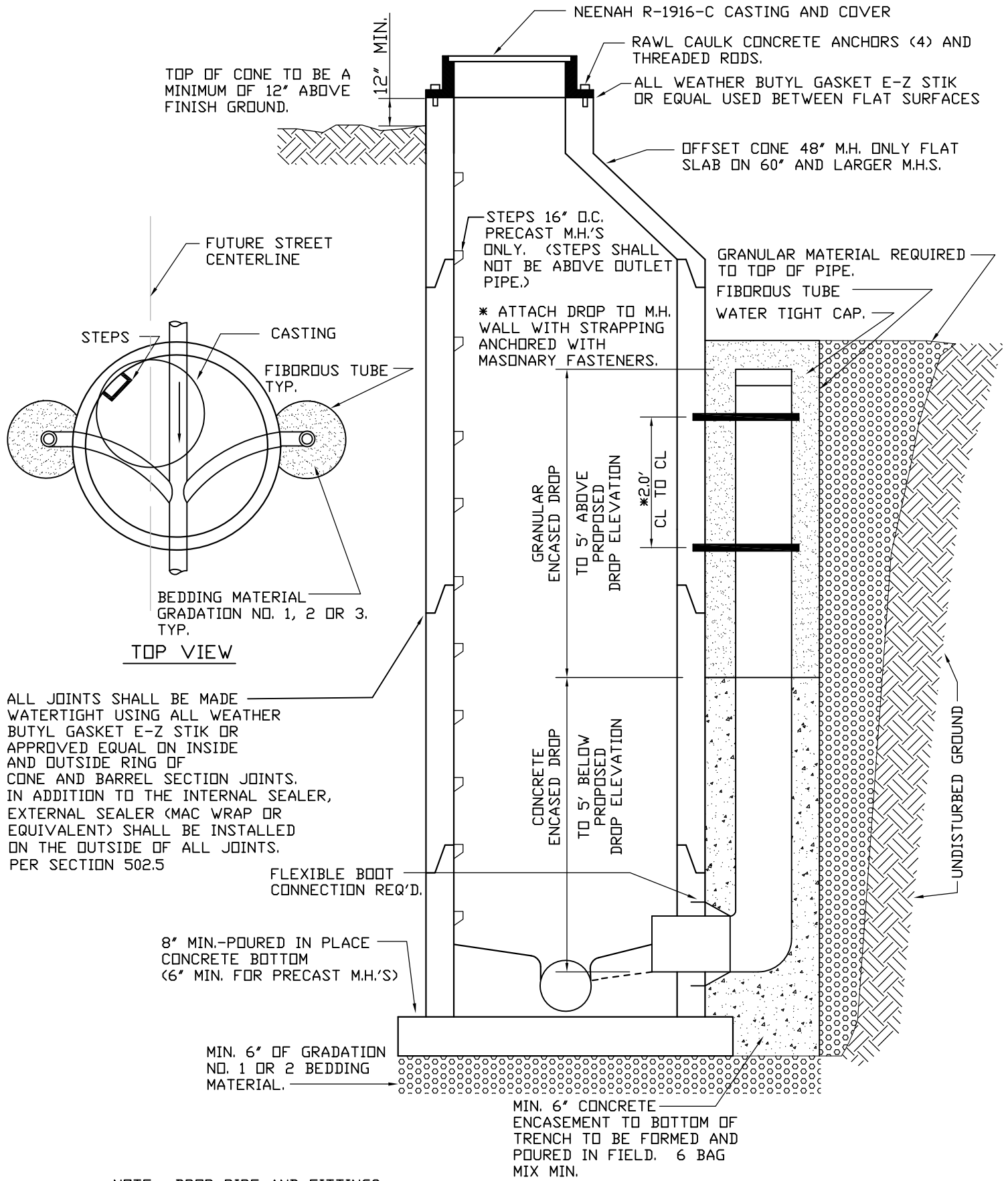
NOTE: THE ENGINEER MAY ALSO APPROVE THE USE OF REMOTE LOCATION INSTALLATIONS IN OTHER LOCATIONS.

CITY OF SUN PRAIRIE
SANITARY MANHOLES
IN REMOTE LOCATIONS

DATE: JAN. 2025

DRAWING NO.

5 - 8



NOTE: DROP PIPE AND FITTINGS SHALL BE SAME MATERIAL AND SIZE AS INCOMING SEWER.

CONCRETE ENCASEMENT SHALL CURE FOR A MINIMUM OF 24 HOURS BEFORE TRENCH IS BACKFILLED.

CITY OF SUN PRAIRIE
OUTSIDE SANITARY DROP
REMOTE MANHOLES

DATE: JAN. 2025

DRAWING NO.

5 - 8a

9" CASTING AS SPECIFIED

ADJUSTING RINGS SHALL BE MADE FROM EXPANDED POLYPROPYLENE (EPP) AS MANUFACTURED BY CRETEX (PRO-RING) OR APPROVED EQUAL AND MEET THE REQUIREMENTS OF ASTM D-3575 AND ASTM D-4819-13. THE ADJUSTING RINGS SHALL BE SEALED USING M-1 STRUCTURAL ADHESIVE/SEALANT, OR APPROVED EQUAL, MEETING REQUIREMENTS OF ASTM C-920. SEE SPECIFICATION 502.5

7.5" MAX.

STEPS 16" O.C. PRECAST M.H.'S ONLY. (STEPS SHALL NOT BE ABOVE OUTLET PIPE.)

FLEXIBLE BOOT CONNECTION REQ'D. (TYP.)

GRADATION NO. 2 or 3 (SEE SECTION 503.5.2) BEDDING MATERIAL REQ'D. FROM SPRINGLINE TO BOTTOM OF TRENCH

ALL JOINTS SHALL BE MADE WATERTIGHT USING ALL WEATHER BUTYL GASKET E-Z STIK OR APPROVED EQUAL ON INSIDE AND OUTSIDE RING OF CONE AND BARREL SECTION JOINTS. IN ADDITION TO THE INTERNAL SEALER, EXTERNAL SEALER (MAC WRAP OR EQUIVALENT) SHALL BE INSTALLED ON THE OUTSIDE OF ALL JOINTS. PER SECTION 502.5

UNIT LENGTH

CONCRETE FILLET SET BENCH AT TOP OF PIPE.

8" MIN.-POURED IN PLACE CONCRETE BOTTOM (6" MIN. FOR PRECAST M.H.'S)

1/2"/FT

MIN. 6" OF GRADATION NO. 1 OR 2 BEDDING MATERIAL.

"U" SHAPED CHANNEL TO TOP OF PIPE.

UNDISTURBED GROUND

MIN. 6" CONCRETE ENCASEMENT TO BOTTOM OF TRENCH TO BE FORMED AND POURED IN FIELD. (6 BAG MIX MIN.)

NOTE: DROP PIPE AND FITTINGS SHALL BE SAME MATERIAL AND SIZE AS INCOMING SEWER.

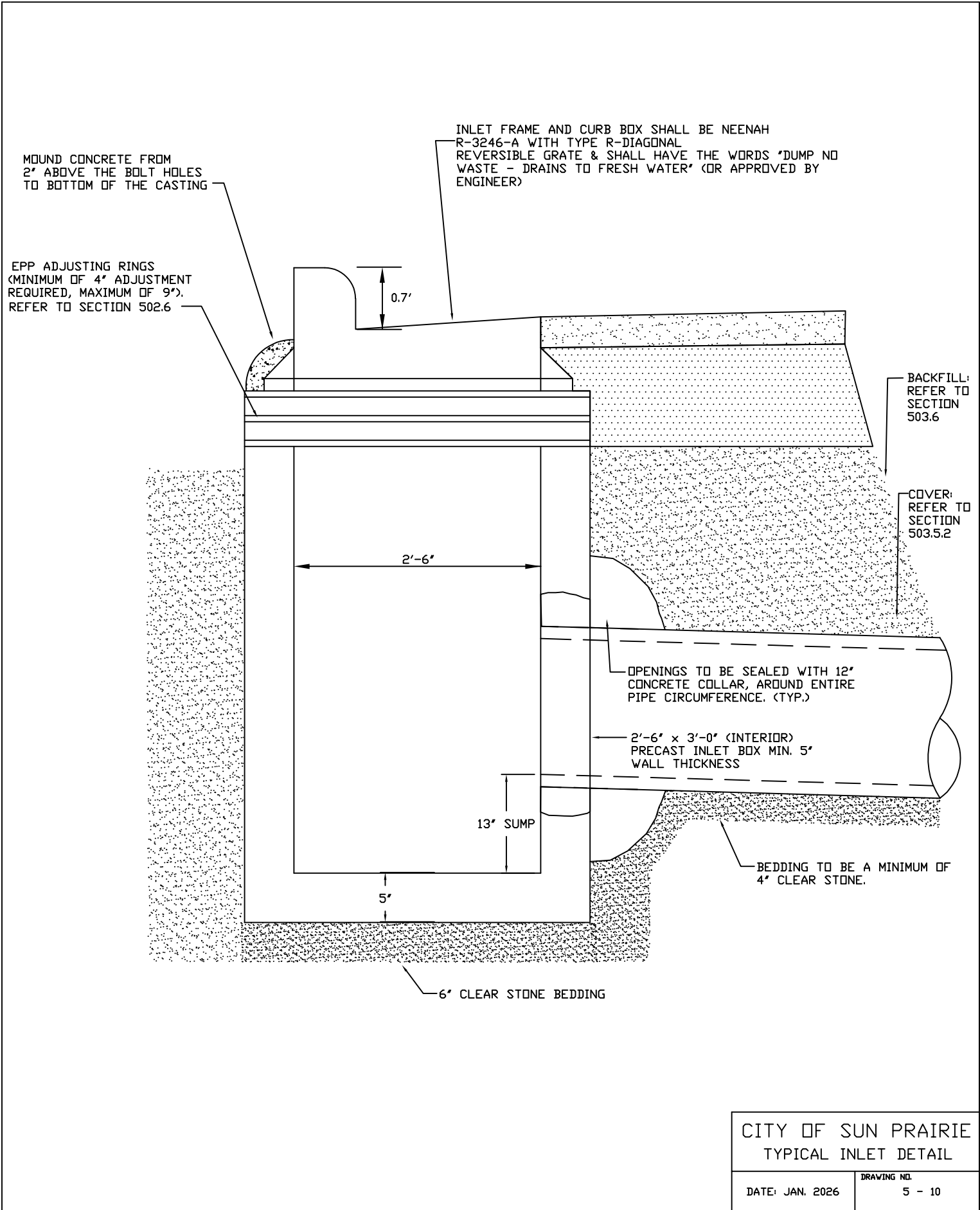
CONCRETE ENCASEMENT SHALL CURE FOR A MINIMUM OF 24 HOURS BEFORE TRENCH IS BACKFILLED.

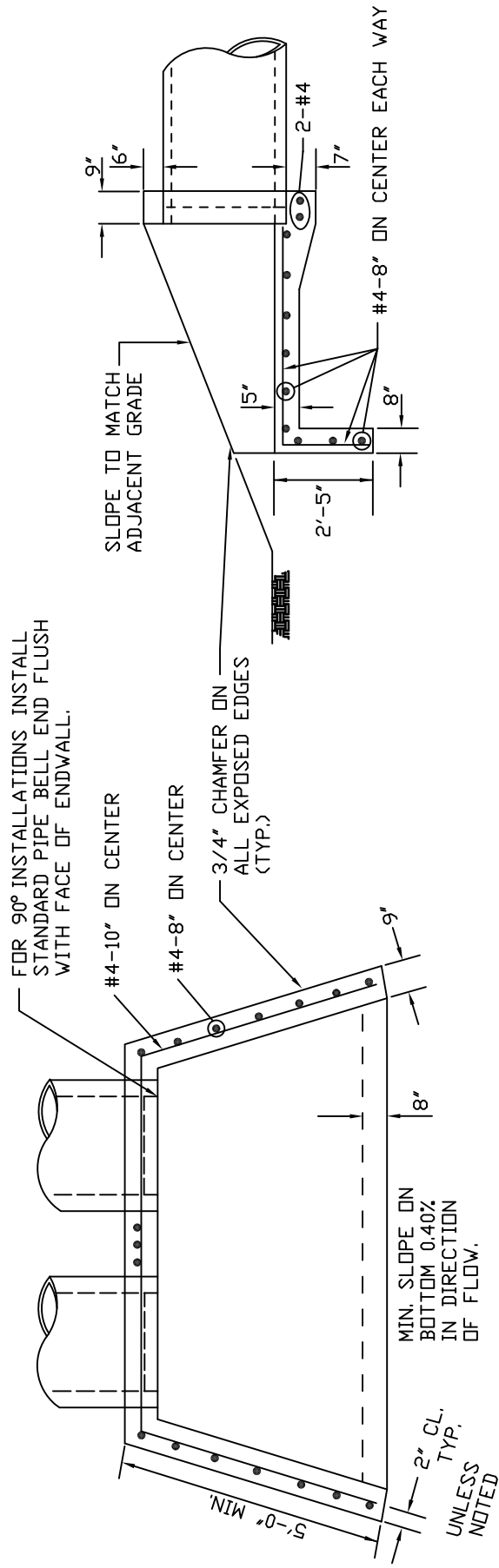
CITY OF SUN PRAIRIE
OUTSIDE DROP TO SANITARY
SEWER MANHOLE

DATE: JAN. 2025

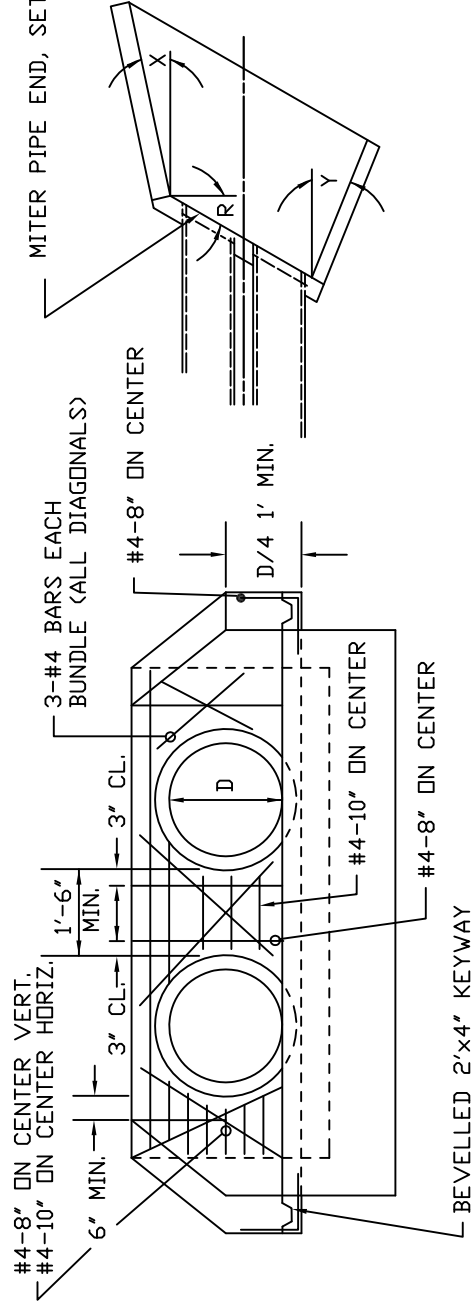
DRAWING NO.

5 - 9





PLAN VIEW



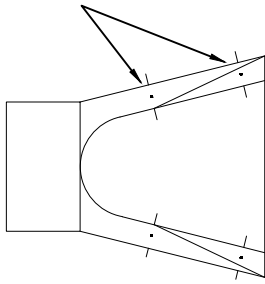
END VIEW

INLET			OUTLET		
R	X	Y	R	X	Y
0 - 7°	30°	30°	0 - 15°	15°	15°
8 - 22°	25°	"	16 - 45°	10°	"
23 - 37°	20°	"	46 - 75°	5°	"
38 - 52°	15°	"	over 75°	0°	"
53 - 67°	10°	"			
68 - 82°	5°	"			
over 82°	0°	"			

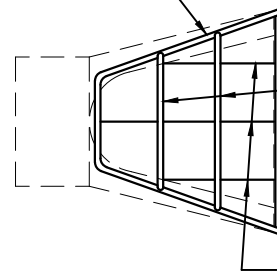
WINGWALL ANGLE DETAILS

NOTE: ALL REQUIRED REBAR MUST BE EPOXY COATED

SHOP DRILL FOUR 7/16"
HOLES AS SHOWN

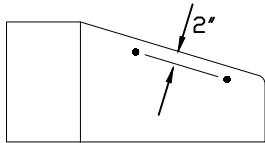


1"Ø STD. PIPE FRAME



1"Ø STD. PIPE
@ 8" O.C.

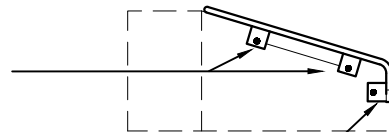
3/4"Ø ROD @ 12"
O.C. MAX - WELD
@ EACH PIPE



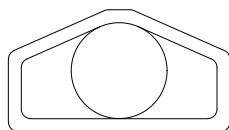
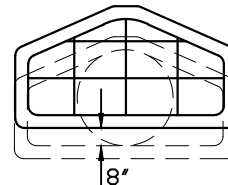
4"x4"x3/16" ANGLES
(4 REQ'D)
WELD TO FRAME
PROVIDE 7/16" HOLE
IN EACH ANGLE

PROVIDE 2 ADDITIONAL
CONNECTIONS WHEN PIPE
IS 36" OR LARGER

NO SCALE



1"Ø STD. STEEL PIPE



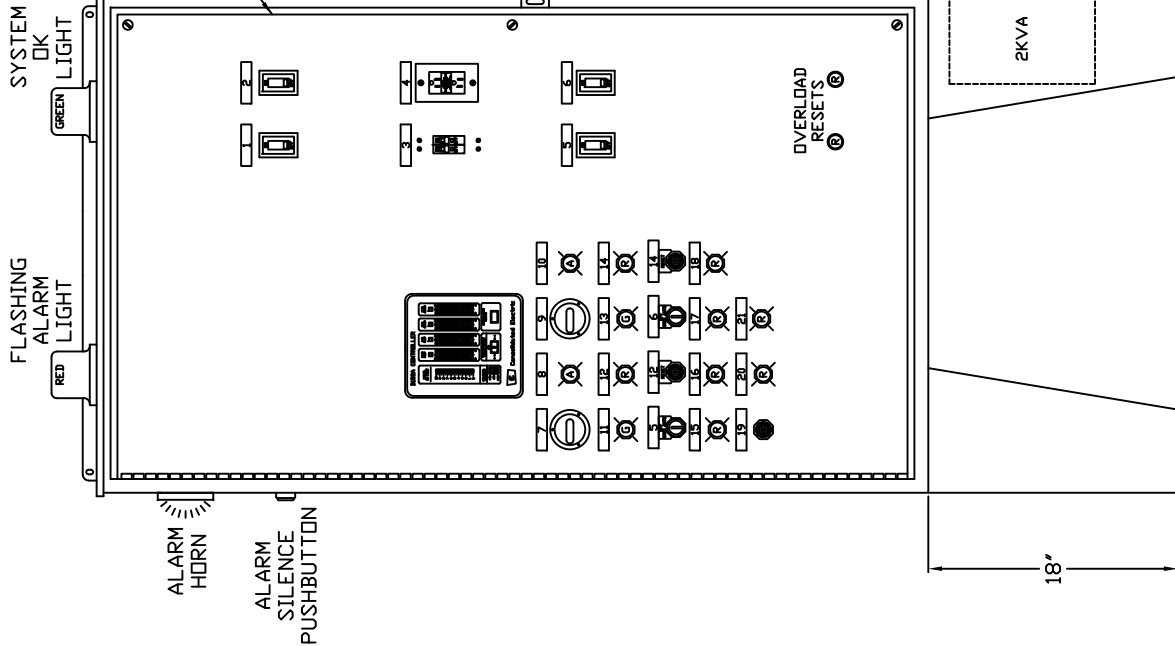
THE CONTRACTOR SHALL BOLT THE PIPE GATE TO THE CONCRETE ENDWALL WITH FOUR 3/8"x6" MACHINE BOLTS WITH NUTS ON INSIDE WALL.

PIPE GATES ARE REQUIRED ON ENDWALLS GREATER THAN OR EQUAL TO 12 INCHES.

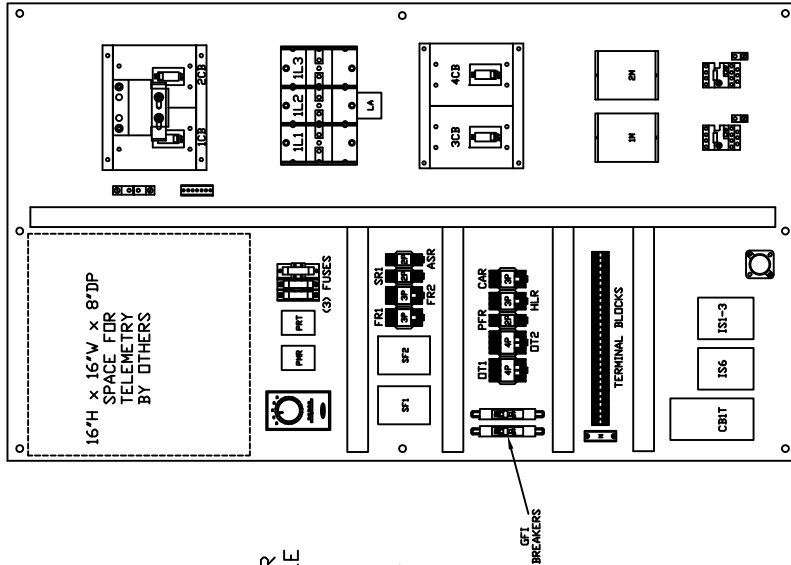
PAINTING SPECIFICATIONS

THE PIPE GATE SHALL RECEIVE THE FOLLOWING PREPARATION & PAINTING. SEE NOTES:
FIRST COAT-RUST-OLEUM X-60 RED BARE METAL PRIMER OR EQUAL. SECOND COAT-
RUST-OLEUM 960 ZINC CHROMATE PRIMER OR EQUAL. THIRD COAT-RUST-OLEUM
1282 (FOREST GREEN) HIGH GLOSS OR EQUAL.

- NOTES: 1. BARE SURFACES - AFTER THROUGH SCRAPING, WIRE BRUSHING & CLEANING
APPLY THE THREE COAT SYSTEM LISTED.
2. ALLOW 24-48 HOURS DRYING TIME BETWEEN COATS.



BACK PANEL LAYOUT
57"H x 33"W



NEMA 3R STAINLESS STEEL ENCLOSURE
60" H x 36" W x 12" DP
OUTER DOOR NOT SHOWN
NAMEPLATE LEGEND

1. SERVICE DISCONNECT
2. EMERGENCY
3. BACK-UP/CONTROL
4. CONVENIENCE
5. PUMP 1
6. PUMP 2
7. PUMP 1 RTM
8. PUMP 1 CALL
9. PUMP 2 RTM
10. PUMP 2 CALL
11. PUMP 1 RUN
12. PUMP 1 OVERTEMP
13. PUMP 2 RUN
14. PUMP 2 OVERTEMP
15. SEAL 1 FAIL
16. PUMP 1 FAIL
17. SEAL 2 FAIL
18. PUMP 2 FAIL
19. ALARM TEST
20. HIGH LEVEL
21. CONTROLLER ALARM

- NOTES:
1. PROVIDE 3-POINT PADLOCKABLE LATCH KIT.
 2. ENCLOSURE FULLY INSULATED.

CITY OF SUN PRAIRIE
PANEL INSTRUMENTATION

DATE: MARCH 2000
DRAWING NO. 5-13

TABLE OF QUANTITIES
RIPRAP AT RCP OUTLETS

		CLASS II d50=6"	CLASS III d50=9"	CLASS IV d50=12"
DIA. OF ROUND PIPE (IN.)	L (FT.)	12" DEPTH RIPRAP (CU.YDS.)	18" DEPTH RIPRAP (CU.YDS.)	24" DEPTH RIPRAP (CU.YDS.)
12	8	2.8	4.1	5.5
15	8	2.9	4.4	5.8
18	10	3.9	5.9	7.8
21	10	4.2	6.3	8.4
24	12	5.5	8.3	11.0
27	12	5.8	8.7	11.6
30	14	7.3	10.9	14.5
36	16	9.2	13.8	18.3
42	18	10.9	16.3	21.7
48	20	12.9	19.4	25.8

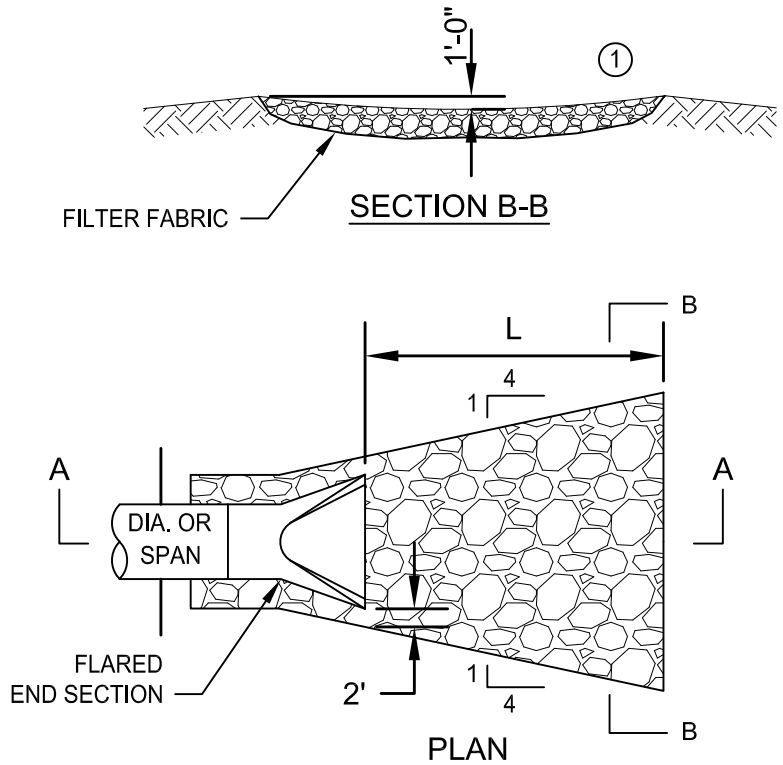
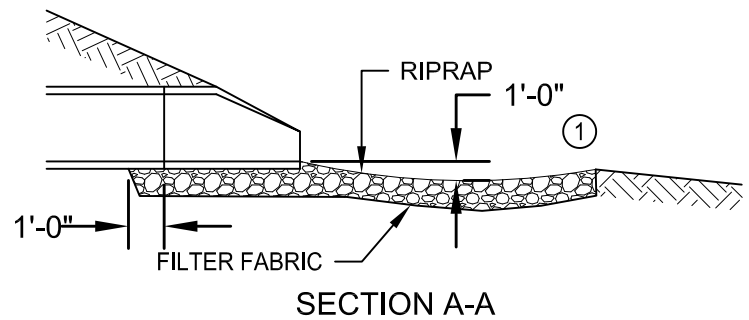


TABLE OF QUANTITIES
RIPRAP AT RCP-A OUTLETS
OR BOXES OF EQUIVALENT SPAN WIDTH

		CLASS II d50=6"	CLASS III d50=9"	CLASS IV d50=12"
SPAN OF PIPE ARCH (IN.)	L (FT.)	12" DEPTH RIPRAP (CU.YDS.)	18" DEPTH RIPRAP (CU.YDS.)	24" DEPTH RIPRAP (CU.YDS.)
22	10	3.9	5.9	7.8
28	12	5.5	8.2	10.9
36	14	7.2	10.8	14.3
43	16	9.2	13.7	18.3
51	18	10.9	16.3	21.7
58	20	12.7	19.0	25.4



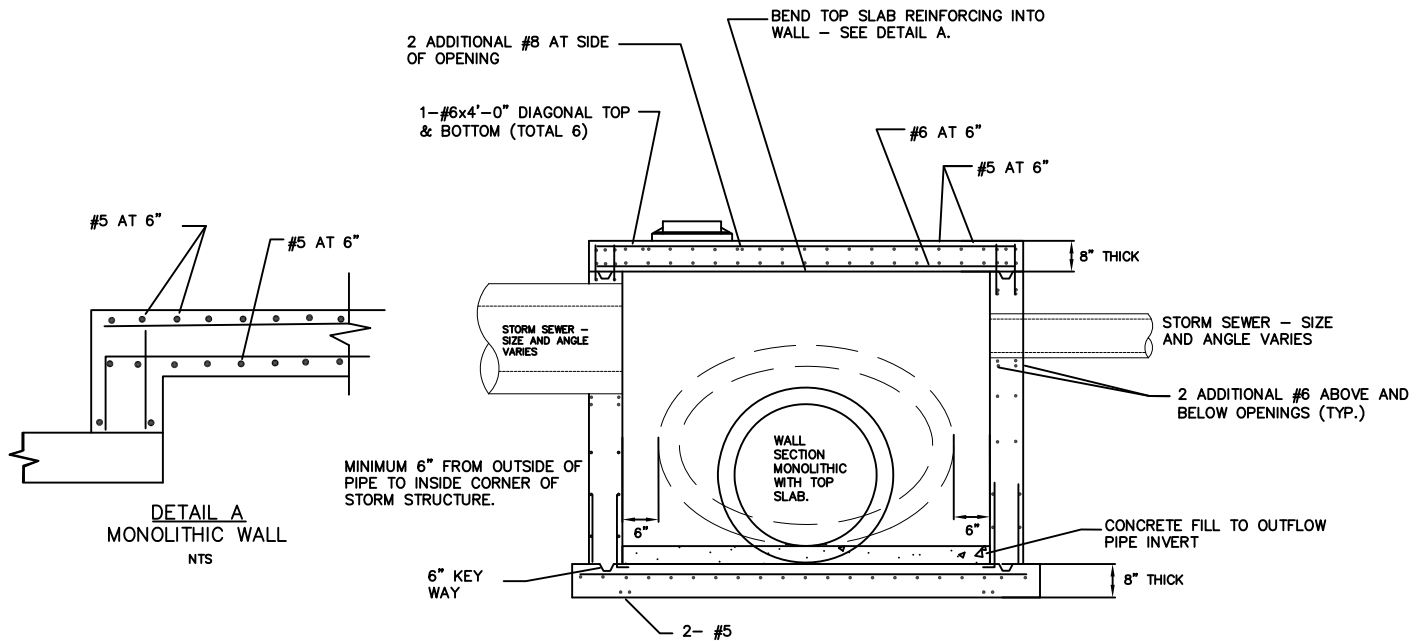
NOTES:

PIPE SIZES LARGER THAN THOSE SHOWN REQUIRE A SPECIAL DESIGN.

GEOTEXTILE FILTER FABRIC SHALL BE TYPE "HR" UNLESS OTHERWISE SPECIFIED. REFER TO SECTION 401.4.1.

① FOR PIPES GREATER THAN OR EQUAL TO 30" USE 1.5'.

RIP RAP AT OUTLETS
NO SCALE

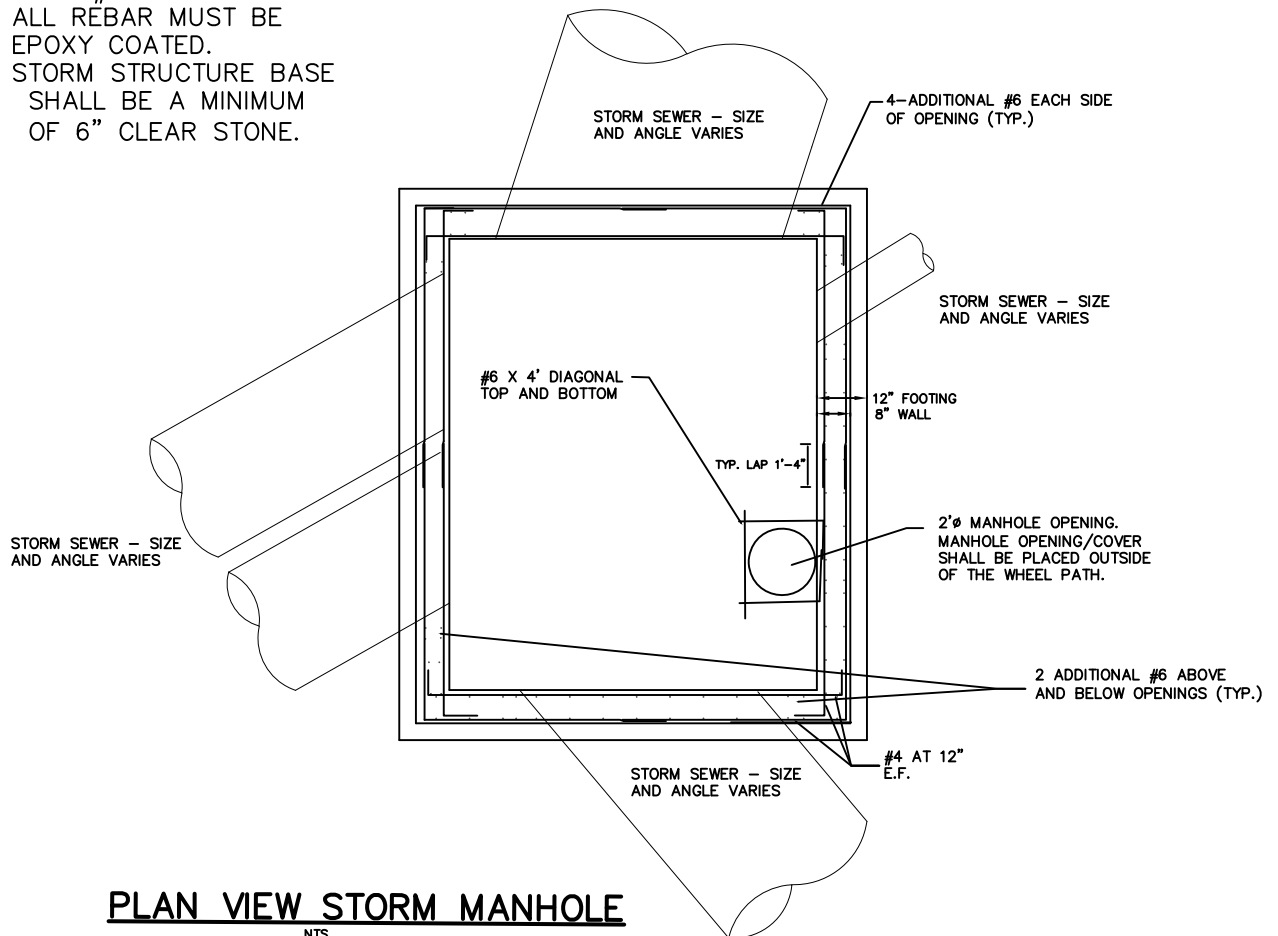


CAST IN PLACE STORM MANHOLE

NTS

NOTE:

- VERTICAL WALLS SHALL HAVE #4 BARS 12" O.C.
- ALL REBAR MUST BE EPOXY COATED.
- STORM STRUCTURE BASE SHALL BE A MINIMUM OF 6" CLEAR STONE.



PLAN VIEW STORM MANHOLE

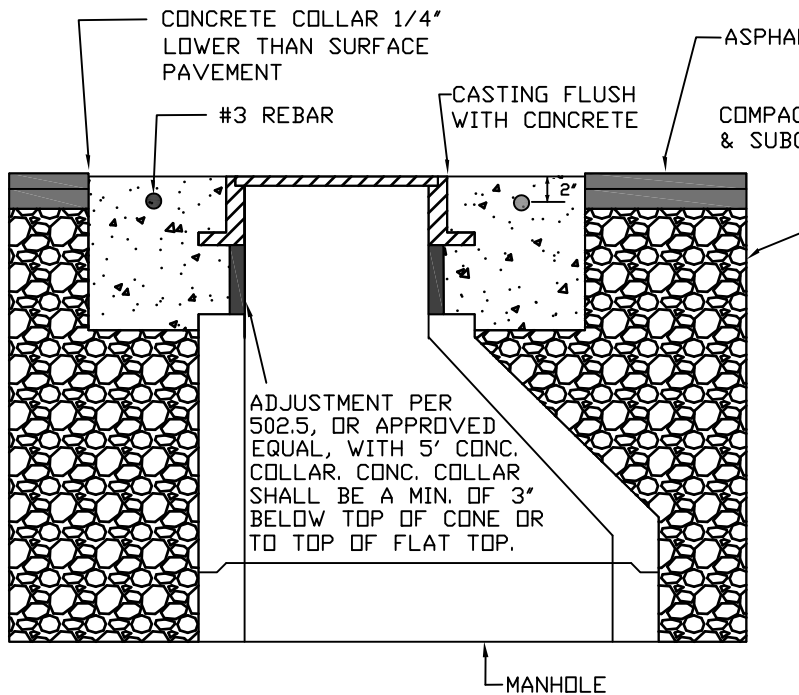
NTS

CITY OF SUN PRAIRIE
CAST-IN-PLACE
CONCRETE STORM STRUCTURE

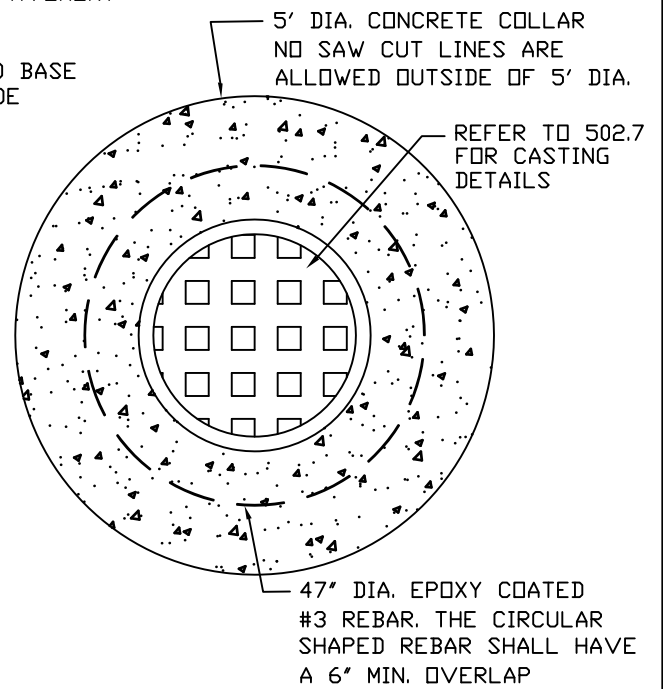
DATE: FEBRUARY 2020

DRAWING NO.

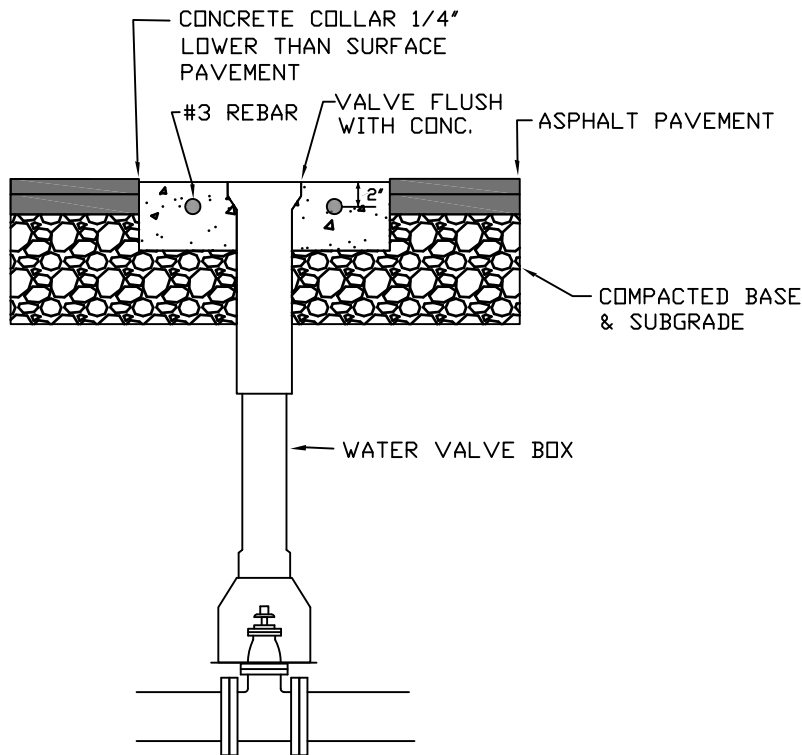
5 - 15



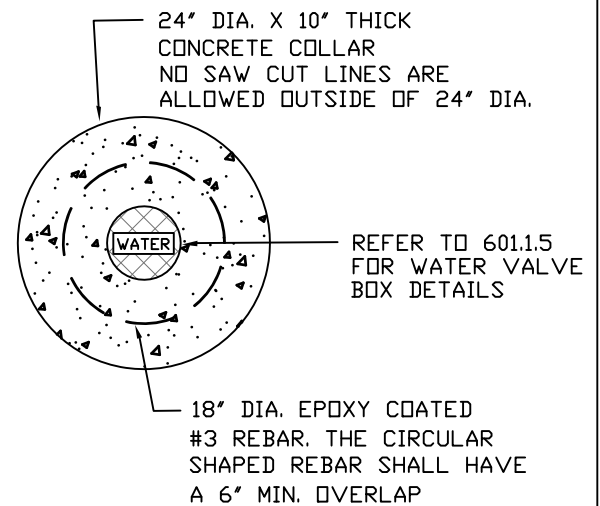
SECTION VIEW



PLAN VIEW



SECTION VIEW



PLAN VIEW

NOT
TO
SCALE

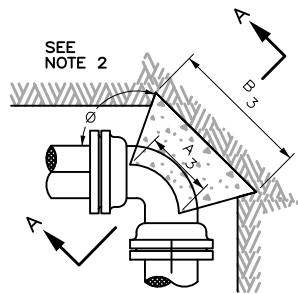
ROUND CONCRETE COLLAR FOR MANHOLE CASTINGS & WATER VALVES

- NOTES: 1. MANHOLES AND/OR WATER VALVES SHALL BE CLEANED OUT DURING AND AFTER CONCRETE COLLAR WORK IS COMPLETE.
2. CONCRETE SHALL BE INSTALLED PER SECTION 301
3. MORE STRINGENT INSTALLATION REQUIREMENTS MAY BE IMPOSED BY THE ENGINEER BASED ON MANHOLE/VALVE LOCATION.

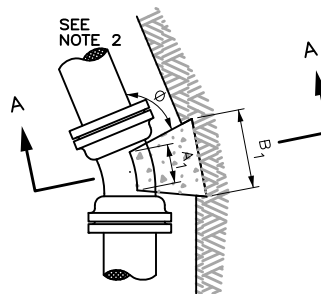
CITY OF SUN PRAIRIE
CONCRETE COLLARS FOR
MANHOLE CASTINGS & WATER VALVES

DATE: JAN. 2024

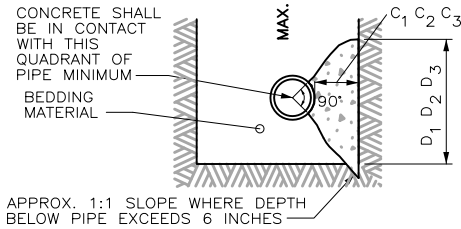
DRAWING NO.
5 - 16



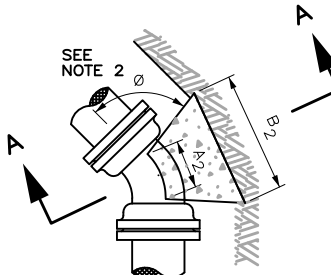
PLAN - 90° BEND



PLAN - 22 1/2° BEND



SECTION A-A



PLAN - 45° BEND

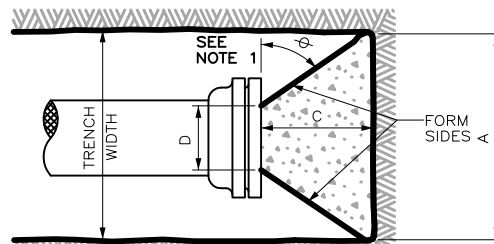
NOTES:

1. DIMENSIONS IN TABLE ARE BASED ON A WATER PRESSURE OF 150 P.S.I. AND AN EARTH RESISTANCE OF 2 TONS PER SQ. FT. INFORM THE ENGINEER IF PRESSURES EXCEED 150 PSI, OR ON-SITE SOIL DOES NOT MEET THIS CONDITION.
2. DIMENSION C₁ C₂ C₃ SHOULD BE LARGE ENOUGH TO MAKE ANGLE Ø EQUAL TO OR LARGER THAN 45°.
3. DIMENSION A₁ A₂ A₃ SHOULD BE AS LARGE AS POSSIBLE WITHOUT INTERFERING WITH THE MECHANICAL JOINT.
4. BUTTRESS TO BE POURED AGAINST FIRM UNDISTURBED SOIL, OR DISTURBED SOIL COMPACTED TO 95% OF MODIFIED PROCTOR DENSITY, ASTM D1557.
5. ALL BUTTRESSED FITTINGS SHALL BE WRAPPED IN POLYETHYLENE.
6. CONCRETE SHALL HAVE A MINIMUM 7-DAY COMPRESSIVE STRENGTH OF 2000 PSI.

PIPE SIZE	BUTTRESS DIMENSIONS					
	22 1/2° BENDS		45° BENDS		90° BENDS	
	B ₁	D ₁	B ₂	D ₂	B ₃	D ₃
6"	1'-0"	1'-0"	1'-0"	1'-0"	1'-4"	1'-2"
8"	1'-0"	1'-0"	1'-4"	1'-2"	1'-10"	1'-6"
10"	1'-2"	1'-2"	1'-7"	1'-7"	2'-3"	1'-10"
12"	1'-4"	1'-4"	1'-10"	1'-10"	2'-8"	2'-3"
16"	1'-10"	1'-8"	2'-6"	2'-4"	3'-10"	2'-10"
20"	2'-4"	2'-0"	3'-3"	2'-10"	5'-0"	3'-4"
24"	2'-10"	2'-4"	4'-0"	3'-3"	6'-4"	3'-10"

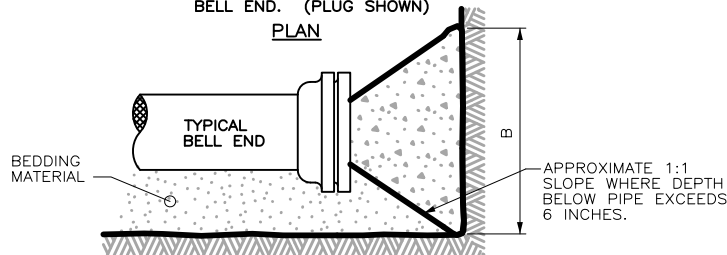
BUTTRESS FOR BENDS DETAIL

SCALE: NONE



CAP ON SPIGOT END, PLUG ON BELL END. (PLUG SHOWN)

PLAN



ELEVATION

NOTES:

1. DIMENSION 'C' SHOULD BE LARGE ENOUGH TO MAKE ANGLE Ø EQUAL TO OR LARGER THAN 45°.
2. DIMENSION 'D' EQUALS APPROX. I.D. OF PIPE LESS 2 INCHES. THE CONCRETE SHOULD NOT INTERFERE WITH THE MECHANICAL JOINTS.
3. WHERE BUTTRESSES ARE NOT POSSIBLE BECAUSE OF POOR SOIL CONDITIONS OR LACK OF ROOM, STRAPPING SHALL BE PERMITTED.
4. BUTTRESS DIMENSIONS ARE BASED ON A SOIL RESISTANCE OF TWO TONS PER SQ. FT. AND A WATER PRESSURE OF 150 PSI. INFORM THE ENGINEER IF ON-SITE SOIL DOES NOT MEET THIS CONDITION OR PRESSURES EXCEED 150 PSI.
5. BUTTRESS TO BE POURED AGAINST FIRM UNDISTURBED SOIL, OR DISTURBED SOIL COMPACTED TO 95% OF MODIFIED PROCTOR DENSITY, ASTM D1557.
6. CONCRETE SHALL HAVE A MINIMUM 7-DAY COMPRESSIVE STRENGTH OF 2000 PSI.
7. ALL BUTTRESSED FITTINGS SHALL BE WRAPPED IN POLYETHYLENE.

BUTTRESS DIMENSIONS				
DIA.	A	B	C	D
6"	1'-6"	1'-2"	SEE NOTE NO. 1	SEE NOTE NO. 2
8"	2'-0"	1'-4"		
12"	2'-5"	1'-10"		
16"	3'-4"	2'-4"		
20"	4'-3"	2'-10"	SEE NOTE NO. 1	SEE NOTE NO. 2
24"	5'-2"	3'-4"		
30"	6'-9"	4'-0"		

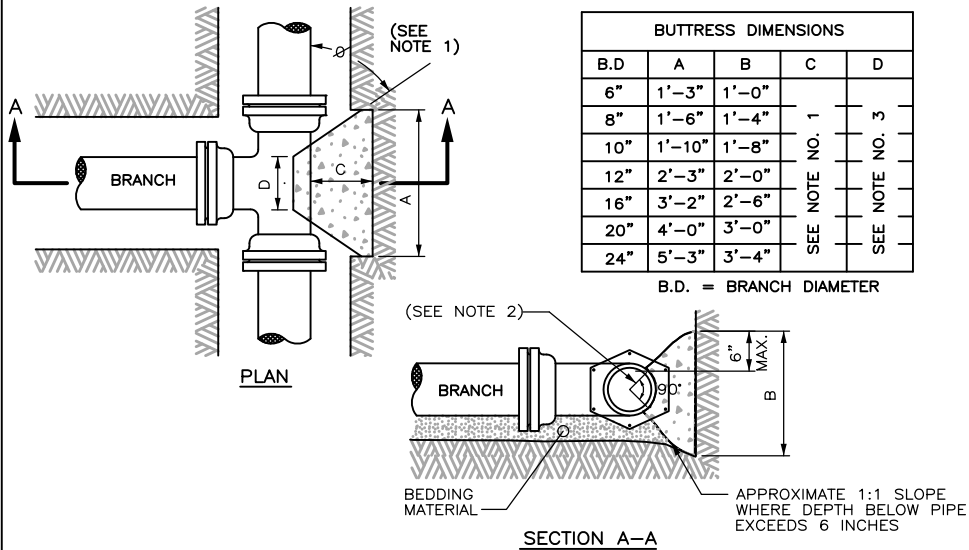
BUTTRESS FOR PLUGS DETAIL

SCALE: NONE

CITY OF SUN PRAIRIE
BUTTRESS FOR BENDS AND PLUGS

DATE: FEB. 2011

DRAWING NO.
6-1

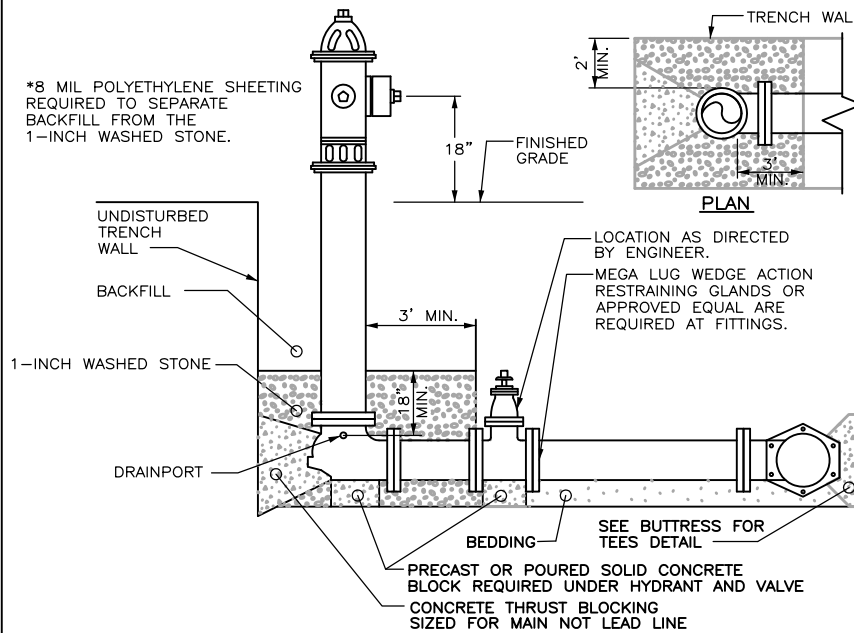


NOTES:

1. DIMENSION 'C' SHOULD BE LARGE ENOUGH TO MAKE ANGLE θ GREATER THAN OR EQUAL TO 45°.
2. CONCRETE SHOULD BEAR ON THIS QUADRANT OF PIPE AT A MINIMUM.
3. DIMENSION 'D' SHOULD BE AS LARGE AS POSSIBLE BUT CONCRETE SHOULD NOT INTERFERE WITH MECHANICAL JOINTS.
4. BUTTRESS DIMENSIONS ARE BASED ON A SOIL RESISTANCE OF TWO TONS PER SQ. FT. AND A WATER PRESSURE OF 150 PSI. INFORM THE ENGINEER IF ON-SITE SOIL DOES NOT MEET THIS CONDITION OR PRESSURES EXCEED 150 PSI.
5. BUTTRESS TO BE POURED AGAINST FIRM UNDISTURBED SOIL, OR DISTURBED SOIL COMPACTED TO 95% OF MODIFIED PROCTOR DENSITY, ASTM D1557.
6. CONCRETE SHALL HAVE A MINIMUM 7-DAY COMPRESSIVE STRENGTH OF 2000 PSI.
7. ALL BUTTRESSED FITTINGS SHALL BE WRAPPED IN POLYETHYLENE.

BUTTRESS FOR TEES DETAIL

SCALE: NONE



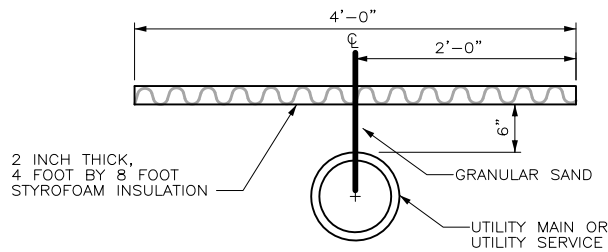
HYDRANT DETAIL

SCALE: NONE

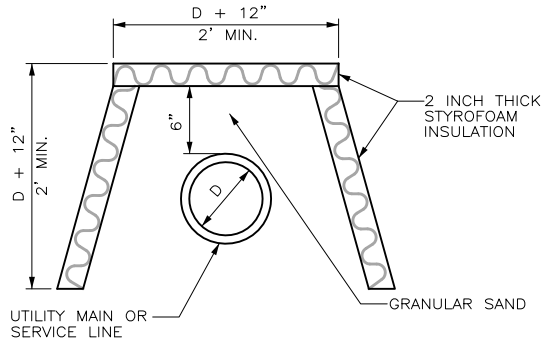
CITY OF SUN PRAIRIE
BUTTRESS FOR TEES/HYDRANT DETAIL

DATE: FEB. 2023

DRAWING NO.
6-2



STANDARD INSTALLATION



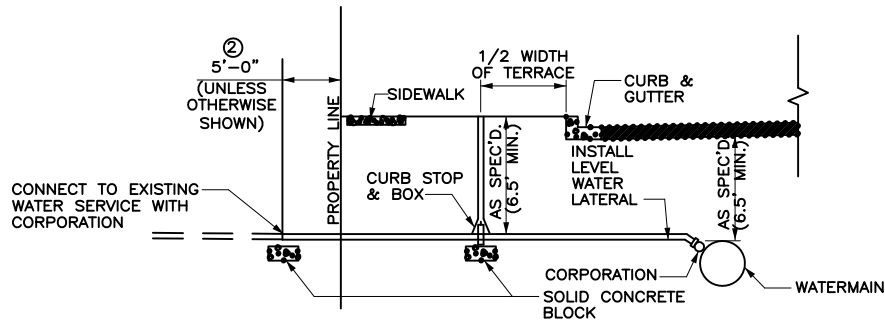
SIDE PROTECTION INSTALLATION

GENERAL NOTES:

1. THE SIDE PROTECTION INSTALLATION SHALL BE USED WHERE FROST WILL PENETRATE BELOW THE PIPE INVERT.

PIPE INSULATION DETAIL

SCALE: NONE

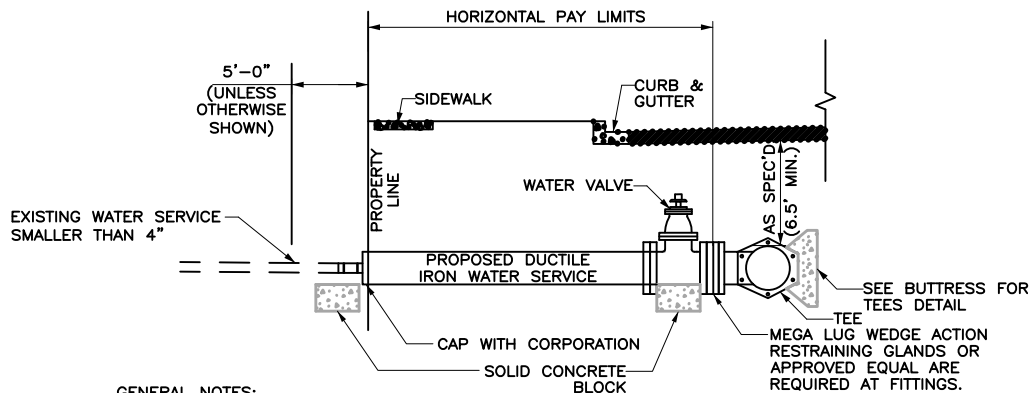


GENERAL NOTES:

1. SEE PLANS AND SPECIFICATIONS FOR SIZE AND TYPE OF CURB STOP AND BOX CORPORATION AND SERVICE LINE.
2. ADDITIONAL CORPORATION MAY BE REQUIRED TO KEEP WATER SERVICE LIVE DURING STAGED CONSTRUCTION.

WATER SERVICE DETAIL - CONNECT TO EXISTING

SCALE: NONE



GENERAL NOTES:

1. IF PROPOSED WATER SERVICE IS STUBBED FOR FUTURE USE, CAP END WITH A CORPORATION.

WATER SERVICE DETAIL (DIAMETER GREATER THAN 2")

SCALE: NONE

CITY OF SUN PRAIRIE
PIPE INSULATION AND WATER SERVICES

DATE: FEB. 2011

DRAWING NO.
6-3