



Standard Specifications & Details for Construction

Revised 2026

I hereby certify that the attached plan, specification,
or report was prepared by me or under my
direct supervision and that I am a duly registered
Professional Engineer under the laws of the State of North Dakota.



Lance Meyer, PE
City Engineer

FOREWORD

The year in the footnote of each section of the City of Minot Standard Specifications & Details indicates the year in which that specific section was last updated.

References herein to NDDOT Specifications shall refer to the 2025 edition of NDDOT Standard Specifications for Road and Bridge Construction if the footnote of the section is dated in 2026. If the footnote of the section is dated 2025, then that section shall refer to the 2024 edition of the NDDOT Standard Specifications for Road and Bridge Construction.

In the event of a new edition of NDDOT Standard Specifications being released, this edition of the City of Minot Standard Specifications & Details for Construction shall still refer to the NDDOT Standard Specifications for Road and Bridge Construction editions as described above.

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SECTION 100 – WORK WITHIN PUBLIC RIGHT OF WAY

WORK WITHIN PUBLIC RIGHT OF WAY

PART 1 – GENERAL

1.01 Right of Way Location

- A. City of Minot right-of-way includes but is not limited to the boulevard, sidewalk, public street, or alley. The typical right-of-way width of a residential road is 66 feet or one foot behind the sidewalk (house side). Nonresidential roads may have different right-of-way widths.
- B. The City of Minot does not locate property pins. If property pin locates are needed, a professional land surveyor will need to be hired at the cost of the property owner or contractor.

1.02 Datum

- A. The City of Minot requires all projects constructed in the City right-of-way to use the following datums:
 - 1. Vertical Datum: North American Vertical Datum of 1988 (NAVD88)
 - 2. Horizontal Datum: North American Datum of 1983 (NAD83)
 - 3. Coordinate System: North Dakota State Plane, North Zone, US Survey Foot
- B. All plans and specifications for work within the City right-of-way must have the NAVD88 datum printed on the Plan and referenced in the Specification.

1.03 Right of Way Permit

- A. All work within City of Minot right-of-way must obtain a right-of-way permit before any work is to begin per Minot Code of Ordinances Chapter 28, Article IV, Division 3-Permits.
- B. The work includes, but is not limited to, connection, disconnection, or repair to any sanitary sewer, storm sewer, water services, water main, ground water devices, gas, power, telephone, television, communications, or any other underground utilities. The work also includes any sidewalk, curb & gutter, street patching, and any excavation.

1.04 Licensing Requirements

- A. Contractors must be licensed in accordance with Chapter 28, Article IV, Division 2 of City of Minot Ordinance.

1.05 Bonding Requirements

- A. Contractor must provide the original copy of the company's Performance Bond in the amount stated in the City of Minot Council Resolution. Performance bonds must state "in accordance with City of Minot Ordinances." Any and all work in the City of Minot right-of-way is required to be covered by a warranty period of two (2) years for each permit approved starting at the permit closed date; see Warranty section.

1.06 Working Hours

- A. Except as otherwise required for the safety or protection of persons or the work, all work shall be performed from 7:00 am to 10:00 pm, Monday through Saturday.
 - 1. Any work requiring inspection by City of Minot staff shall be completed during regular working hours 7:00 am to 4:30 pm, Monday through Saturday.
- B. Contractor will not perform work on a Sunday or any legal City holiday.
- C. Contractor may perform work outside regular working hours or on Sundays, or legal holidays only with consent given after a 72-hour advance request to the City Engineer.

1.07 Protection of Existing Utilities

- A. The Contractor, prior to excavation, shall determine the location of all existing utilities within the work area and shall exercise all due caution to prevent damage thereto during all excavation or backfilling operations.
- B. The contractor shall provide advance notification to operators of underground facilities prior to excavations, drilling, boring, blasting, or other activities that may endanger underground facilities by using the ND One-Call system. The ND One-Call number is 1-800-795-0555.
- C. Any utility damaged during construction shall be repaired by the Contractor at their expense. Existing manholes and gate valves shown on the drawings are to be used by the Contractor as general information only and are not to be construed, in any way, as relieving the Contractor of any responsibilities outlined in this Section.
- D. Temporary provisions shall be made by the Contractor to ensure the use of sidewalks and the proper functioning of all gutters, storm sewer inlets, and drainage ditches, which shall not be obstructed except as approved by the City Engineer.

- E. Fire hydrants on or adjacent to the work shall be kept accessible to the firefighting equipment at all times.

1.08 Protection of Property Pins

- A. The protection of property pins/corners or other monuments is the responsibility of the contractor. If a property pin needs to be moved to allow for work within or adjacent to the right of way, it shall be offset prior to construction. Offsetting or replacement of disturbed or damaged monuments shall be accomplished by a registered land surveyor at the expense of the contractor.

1.09 Safety

- A. The Contractor shall provide, at the site, such equipment and medical facilities as are necessary to supply first-aid service to anyone who may be injured in connection with the work.
- B. The Contractor must promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance of the work; which caused death, personal injury, or property damages, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the Engineer and the Owner.
- C. The Contractor and sub-contractors shall perform the work in compliance with the latest North Dakota Safety Code adopted by the North Dakota Workman's Compensation Bureau.
- D. Safety apparel meeting the ANSI/ISEA 107-2004, as Revised, Standard for High Visibility Safety Apparel and Headwear, shall be worn when working in the right-of-way.

1.10 Traffic Control Requirements

- A. The Contractor shall at all times so conduct their work as to insure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work, and to insure the protection of persons and property in a manner satisfactory to the City Engineer.
- B. No road or street shall be closed to the public except with the permission of the City Engineer or Traffic Engineer.
- C. Contractors are responsible for placing and maintaining all traffic control devices. All traffic control devices shall follow and comply with Chapter 6 in the most recent version of the Manual on Uniform Traffic Control Devices (MUTCD). The materials and equipment used for traffic control on all work in the City of Minot right-of-way shall comply with section 704 of the North

Dakota Department of Transportation's Standard Specifications for Road Bridge Construction and the Design Standard Drawings.

- D. All traffic control plans shall be submitted with the right-of-way permit application. Allow up to ten (10) days for traffic control plans to be reviewed.

1.11 Hydrants and Valves

- A. No person or Contractor shall operate any water system valve or hydrant without permission from the Superintendent of Water and Sewer.
- B. The contractor is required to notify the Fire Department (701-857-4740), Water Department (701-857-4150), and Engineering Department (701-857-4100) when any fire hydrant is to be removed or returned to service.
- C. The Contractor is requested to make special note of the following paragraphs taken from the City Ordinances:
 - 1. Sec. 31-44: No person except City Employees in performance of their official duties shall open or cause to be opened any fire hydrant without written permission of the Superintendent of Water and Sewer.
 - 2. Sec. 1-8: The doing of any act prohibited or declared to be unlawful by this Code, or the omission or failure to perform any act or duty required by this Code, is, unless another penalty is specified, punishable by fine in a sum not exceeding five hundred dollars (\$500.00) and imprisonment not to exceed thirty (30) days, or by both such fine and imprisonment. Each day any person violates any provision of this Code shall constitute a separate offense.
 - 3. It shall be the responsibility of the Contractor to secure permission from the Superintendent of Water and Sewer at least 24 hours before any hydrant is used. Such permission will be given by the Superintendent only after he has determined that the usage will not be a detriment to the water system or to Fire Department operations.

1.12 Cleaning Up

- A. The Contractor must keep all streets, alleys, and sidewalks as free from material and debris as the character or the Work will permit, and upon completion of any part of the Work, must within reasonable time, remove all surplus materials and debris, and leave right-of-way in acceptable conditions.
- B. Failure to comply with this provision after due and proper notice has been given by the Owner, will be sufficient grounds for the Owner to proceed to clean up such material and debris and make such repairs, charging the same to the Contractor, who hereby agrees to the provisions as above set forth.

1.13 Inspection of Work and Products

- A. All products installed within public right of way shall meet the requirements set forth in the Standard Specifications and Details for Construction, as amended.
- B. All execution of work within public right of way shall meet the requirements set forth in the Standard Specifications and Details for Construction, as amended.
- C. Whenever any products or execution of work shall be condemned by the Engineer, such work or material shall be removed at once from the line of work at the Contractor's expense.
- D. For all work covered by the City of Minot Standard Specification and Details and done in the right of way or public easement, the engineer or their qualified representative must be present at all times to observe and inspect the work. Failure by the engineer to be present at all times will be cause for the City of Minot to stop the work until a qualified representative is present or can be cause for the City of Minot to reject the work.
 - 1. All water and sanitary sewer must meet specification and be inspected by the engineer or their representative, and shall pass all required testing per section 1000.
- E. Water services and sewer services shall be inspected by the Water Department prior to backfilling.
- F. Concrete forms, rebar, and appurtenances shall be inspected by the Engineering Department prior to concrete placement.
- G. All backfilling within the ROW shall require soil density testing to be performed pursuant to Section 1000 of these specifications, as stated in Section 28 of the City of Minot Ordinance.
 - 1. The cost of performing the density tests by a certified testing company and providing the results to the City shall be at the expense of the permittee.

1.14 Suspension of Work

- A. The Engineer shall have the authority to suspend the work, wholly or in part, for such period or periods, as he may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for prosecution of work, or failure on the part of the contractor to carry out the provisions of the Contract or to supply materials meeting the requirements of the Specifications.

1.15 Warranty of Work

- A. The Contractor guarantees all work constructed under the Contract for a period of two (2) years from the date of final acceptance against defects in material or workmanship. The Contractor shall bear the entire cost and expense of all repairs which may, from any imperfection in work or materials become necessary within that time.
- B. If at any time within the period of guarantee, any of the work included in the guarantee shall, in the judgment of the Engineer, require any repair or reconstruction, he shall notify the Contractor to make the repairs required. Upon receipt of the notice, the Contractor shall proceed with such repairs and shall complete the same within a reasonable time.
- C. If the Contractor shall neglect or fail to proceed with the repairs within twenty (20) days or if, in the opinion of the Engineer, the repairs do not admit of sufficient delay to issue said notice and to await the action of the Contractor, then the Owner shall have the right to cause such repairs to be made and the cost shall be paid by the Contractor. The liability of the bond given to secure the faithful performance of the Contract shall continue during the full guarantee period.
- D. At the expiration of the guarantee period, the Contractor and their surety shall be released from further obligation under this Contract, providing the Engineer will certify to the Owner that the work performed under this Contract is in good and proper condition at the time.

1.16 Record Drawings

- A. All Contractors working within the public right of way are required to submit record drawings for any work completed, in accordance with the City of Minot Record Plan Standards.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

(Not Used)

PART 4 – MEASUREMENT AND PAYMENTS

- A. Contract Bond: shall be paid for on a Lump Sum (LS) basis.
 - 1. Partial payments will be made as follows:

First Partial Payment	25% of Contract Bond Item
Percent of Original Contract Earned – 10	50% of Contract Bond Item
Percent of Original Contract Earned – 50	100% Contract Bond Item

END OF SECTION

SECTION 1000 – QUALITY REQUIREMENTS

QUALITY REQUIREMENTS

PART 1 – GENERAL

1.01 Section Summary

- A. This section includes information on testing and inspection services and procedures for quality control and quality assurance for City of Minot projects and projects in City right-of-way.

1.02 Related Sections

- A. Section 1800 – Excavation and Embankment
- B. Section 1900 – Subgrade Preparation
- C. Section 2000 – Trench Excavation and Backfill
- D. Section 2100 – Water Main
- E. Section 2200 – Water Main Services
- F. Section 2300 – Sanitary Sewer
- G. Section 2400 – Sanitary Sewer Services
- H. Section 2700 – Storm Sewer
- I. Section 2900 – Aggregate Base Course
- J. Section 2910 – Cement Stabilized Base
- K. Section 3000 – Hot Mix Asphalt Pavement
- L. Section 3010 – Bituminous Pavement Maintenance and Repair
- M. Section 3100 – Portland Cement Concrete Pavement
- N. Section 3110 – Concrete Pavement Repair
- O. Section 3200 – Concrete Curb and Gutter
- P. Section 3300 – Concrete Walk, Medians, and Driveways
- Q. Section 3700 – Lawns and Grasses

1.03 References

- A. North Dakota Department of Transportation (NDDOT) "Standard Specifications for Road and Bridge Construction" Current Edition, As Revised.
- B. NDDOT Field Sampling and Testing Manual.
- C. American Association of State Highway Transportation Officials (AASHTO) testing procedures.
- D. ASTM International (ASTM) testing procedures.

1.04 Submittals

- A. Before construction may start, submit testing agency information for approval by the Engineer.
- B. All testing reports and manufacturer's certificates of quality control and/or testing shall be submitted or copied to the City Engineer's Office.
- C. On City of Minot projects, all submittals and submittal procedures shall conform to the requirements outlined in the Contract Documents.
- D. If requested by the Engineer, provide manufacturer's certificates along with any shop drawings certifying that products meet or exceed specified requirements executed by a responsible officer.

1.05 Tests and Inspections

- A. City of Minot Projects
 - 1. Engineer Responsibilities
 - a. Enlist the services of an independent testing agency to perform testing, except for those tests specified to be performed by the Contractor.
 - b. With proper notice given by the Contractor, arrange for tests to occur, except for those tests specified to be performed by the Contractor.
 - c. Pay the independent testing agency for tests performed and properly reported, except for those tests specified to be paid for by the Contractor.

2. Contractor Responsibilities

- a. Notify Engineer 48 hours in advance of tests and inspections, weekends excluded.
 - b. Provide incidental labor and facilities to obtain, handle, and store samples at the project site or at the sample source.
 - c. Provide adequate quantities of representative samples of materials, transportation of samples to the testing agency, facilitate tests and inspections for storing and curing of test samples.
 - d. Perform or arrange for and pay for all tests specified to be performed or paid for by the Contractor.
- B. All other projects: The Contractor shall perform or arrange for and pay for all tests.

1.06 Testing Agency Responsibilities

- A. Conduct and interpret tests and inspections and state in each report whether tested inspected work complies with or deviates from the requirements.
- B. Notify Engineer and Contractor immediately of irregularities or deficiencies observed in the work during performance of its services.
- C. Provide qualified personnel.
- D. Provide interpretation of test results when requested by the Engineer.
- E. Submit a certified written report of each service performed.

1.07 Laboratory Reports

- A. After each test and inspection, submit 1 copy of Laboratory Reports to the Engineer.
- B. Include in the report the following information:
 - 1. Date Issued.
 - 2. Project Name and City Project Number.
 - 3. Name of the individuals performing tests and inspections.
 - 4. Date, time, and location of sample, test, and inspection.

5. Type of tests/re-tests and inspection/re-inspection, methods used for each.
6. Results of tests and conformance to Contract Documents.
7. Recommendations on re-testing or re-inspecting.

1.08 Limits on Testing Agency Authority

- A. Laboratory has no authority to release, revoke, alter, or increase the Contract Document requirements.
- B. Laboratory may not accept or approve any portion of the work.
- C. Laboratory has no authority to stop the work.
- D. Laboratory may not perform any duties of the Contractor.

1.09 Manufacturer's Field Services

- A. Engage a qualified representative to observe field conditions, conditions of surfaces and installations, quality of workmanship, start-up of equipment, and to test, adjust, and balance equipment.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

3.01 General

- A. The Contractor shall be responsible for ensuring the quality of work meets the requirements of the Contract Documents.
- B. Contractor shall assist Engineer or designated representative in obtaining materials needed for conducting tests of material properties. Contractor will supply labor and equipment necessary for taking samples.
- C. Engineer shall determine all test locations.
- D. When the work does not meet test requirements, the Engineer shall have sole authority to reject the work and require the Contractor to take corrective action.
- E. The testing frequency in this Section may be adjusted with approval of the City Engineer.
- F. All acceptance testing must be witnessed by the Engineer or designated representative.

- 3.02 Excavation, Embankment, and Aggregate Base – Summary below. See Sections 1800.3 and 2900.3 for details.

Type of Construction:		Excavation, Embankment, and Aggregate Base
Test Required	Frequency	Specification
1. Gradation		
(a) Granular Borrow	1/500 Tons	Section 1800 2.01C
(b) Aggregate Base	1/1000 Tons	Section 2900 2.02
2. Moisture-Density (Standard Proctor)		
(a) Embankment Soil	1 per major soil	AASHTO T-99
(b) Aggregate Base	1 per source	AASHTO T-99
3. Compaction		
(a) Embankment Soil (subgrade)	1/600 SY or 1/STA for Each Lift, Whichever is More Frequent	100% Maximum Density (AASHTO T-99) within 1 foot of subgrade, otherwise 95% Maximum Density with $\pm 3\%$ optimum moisture.
(b) Aggregate Base	1/600 SY or 1/STA Whichever is More Frequent	100% Maximum Density (AASHTO T-99)
(c) Cement Stabilized Base/Subgrade	1/600 SY or 1/STA Whichever is More Frequent	98% Maximum Density (AASHTO T-99) with moisture per Section 2920 3.06.C
(d) Utility Trench Backfill	1/100 LF at Various Depths	100% Maximum Density (AASHTO T-99) within 1 foot of street subgrade, otherwise 95% Maximum Density with $\pm 3\%$ optimum moisture.
(e) Utility Service Trench Backfill	50% of Total Services at Various Depths	100% Maximum Density (AASHTO T-99) within 1 foot of subgrade, otherwise 95% Maximum Density with $\pm 3\%$ optimum moisture.

- A. Compaction testing shall be performed in accordance with NDDOT procedures, except using a nuclear density gauge (AASHTO T 310) is permitted.

3.03 Water Main and Services – Summary below. See Section 2100.3 for details.

Type of Construction:		Water Main and Services
Test Required	Frequency	Specification
1. Hydrostatic Pressure	From Valve to Valve Maximum of 1200 LF	150 PSI for 2 hours, Zero Drop in Pressure
2. Total Coliform (Bacteria)	2/Test Section, maximum of 1200 LF	2 passing tests per test section taken 24 hours apart.
3. Tracer Wire	Within one week after passing pressure tests, in all cases before paving.	Verify tracer wire installation by using low frequency (512 Hz or similar) line locating equipment. Must be able to locate all water mains and hydrant leads.

3.04 Sanitary Sewer and Services – Summary below. See Section 2300.3 for details.

Type of Construction:		Sanitary Sewer and Services
Test Required	Frequency	Specification
1. Deflection (Mandrel)	Manhole to Manhole	30-day minimum wait after installation before test, 5% maximum deflection
2. Closed Circuit TV Inspection (Televis)	Manhole to Manhole	Accurate to 1 ft, label each run, audio description of condition, STA location for service, DVD and paper report submittal
3. Leakage Testing	Manhole to Manhole	Low pressure air test for pipe 30" diameter and smaller. Hydrostatic pressure test for pipes larger than 30" diameter.
4. Tracer Wire	Within one week after passing pressure tests, in all cases before paving.	Verify tracer wire installation by using low frequency (512 Hz or similar) line locating equipment. Must be able to locate all water mains and hydrant leads.

3.05 Storm Sewer – Summary below. See Section 2700.3 for details.

Type of Construction:		Storm Sewer
Test Required	Frequency	Specification
1. Closed Circuit TV Inspection (Televising)	Manhole to Manhole	Accurate to 1 ft, label each run, audio description of condition, DVD and paper report submittal

3.06 Concrete

Type of Construction:		Concrete
Test Required	Frequency	Specification
1. Air Entrainment	1 Test on First 50 CY, then 1/100 CY thereafter or 1/Day, Whichever is More Frequent	ASTM C231 (%)
2. Slump	1/150 CY or 1/Day, Whichever is More Frequent	ASTM C143
3. Compressive Strength	1/150 CY or 1/Day, Whichever is More Frequent	ASTM C39 & ASTM C31
4. Temperature	1/150 CY or 1/Day, Whichever is More Frequent	ASTM C1064 (F)

3.07 Hot Mix Asphalt (HMA) – Summary below. See Section 3000.3 for details.

Type of Construction:		HMA Paving
Test Required	Frequency	Specification
1. Gradation		
(a) Chip Seal Cover Aggregate	1/250 Tons	ND T-27 & ND T-11
(b) Plant Mix Aggregate	1/1000 Tons	ND T-27 & ND T-11
2. Superpave Mix Properties	1 per Job	NDDOT 430.03.C
3. Asphalt Binder Content (%)	Daily	Provide bitumen cutoff report daily. AASHTO T-164 may be required at Engineer's discretion.
4. Density		
(a) Air Voids	1/1000 tons of mix produced/day (minimum of once per day)	ND T-209 & ND T-166; Single Test 2 – 6% Moving Avg. 2.5 – 5%
(b) Density by Nuclear Method	1/1500 SY/Day	ASTM D2950; minimum in-place density of 92% of daily average maximum theoretical density for FAA 40, 41, 42, 43, 44, and 45
(c) Density by Coring	1/15,000 SY/lift (or 10% of lots), minimum of 1/lift/project. Core density can be substituted for nuclear density testing	4" or 6" diameter cores ND T-166; minimum in-place density of 92% of daily average maximum theoretical density for FAA 40, 41, 42, 43, 44, and 45

3.08 Lawns and Grasses

Type of Construction:		Lawns and Grasses
Test Required	Frequency	Specification
1. Seed Mixture	1 per Seed Mixture	Submit seed bag tags to Engineer

PART 4 – MEASUREMENT AND PAYMENT

- A. On City of Minot projects, the Owner will pay for all passing material and compaction tests required by these specifications.
- B. All cost associated with failing tests shall be paid for through deductions from the contractor's payment.
- C. The Contractor shall pay all costs for testing that is required by these specifications to be performed by the Contractor, and those that are specified as included in Bid Unit Items.

END OF SECTION

SECTION 1100 – MOBILIZATION, TEMPORARY FACILITIES AND CONTROLS

MOBILIZATION, TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.01 Section Summary

- A. Mobilization shall include, but not be limited to, these principal items:
 - 1. Preparatory work and operations that must be performed before beginning work on the project site.
 - 2. Obtaining required permits.
 - 3. Establishing and administering health and safety programs and procedures.
 - 4. Moving tools, equipment, and personnel to and from the project site and/or staging area(s).
 - 5. Project management and coordination including, but not limited to, providing updates, attending meetings, and the oversight and supervision of Contractor's personnel and all its subcontractors.
- B. Temporary facilities and utilities required during construction.

1.02 References

- A. North Dakota Department of Transportation "Standard Specifications for Road and Bridge Construction", Current Edition, as Revised.
- B. Federal Highway Administration "Manual on Uniform Traffic Control Devices" (MUTCD), 2009 Edition, as revised.

1.03 Submittals

- A. At least 14 days prior to planned start of work:
 - 1. Submit a traffic control plan to include the following:
 - a. Access, detour, and haul routes.
 - b. Traffic control measures and devices.
 - d. Permits or applications required by local authorities.
 - e. Temporary facilities required.

2. Furnish a schedule for all temporary facilities and controls detailing coordination and timeframe for completion.
- B. At or before the preconstruction meeting:
1. Furnish names, addresses, and phone numbers of at least 2 individuals who will be on call 24 hours a day, 7 days a week for placement and maintenance of traffic control devices.
 2. Submit proof of successful completion of the Traffic Control Technician and Traffic Control Supervisor courses, if applicable.
- C. Weekly during the project, submit documentation of all watch persons' hours and activities.

PART 2 – PRODUCTS

2.01 Traffic Control Devices

- A. Shall conform to the MUTCD.

2.02 Temporary Safety Fence

- A. Shall conform to NDDOT Specification 752.04.E.

PART 3 – EXECUTION

3.01 Mobilization

- A. Move equipment, materials, personnel, and all other items required to complete the work at the Project Site.
- B. Temporarily hold or relocate utilities and any miscellaneous structures, such as signs, power poles, guy wires, and mailboxes disturbed.

3.02 Salvage and Reinstall Signs and Mailboxes

- A. Remove, store, and reinstall all signs, posts, etc. that may be within the Project Site in accordance with Section 1500 – Removals.
- B. Mailbox relocation shall be in accordance with Section 1500 – Removals.

3.03 Temporary Utilities

- A. Provide and maintain all temporary facilities, controls, and utilities for as long as needed to maintain safe and proper completion of the work. Remove temporary facilities, controls, and utilities as work progresses or as directed by the Engineer.

B. Temporary Water for Construction

1. Under no circumstances shall the Contractor operate any valves or hydrants to obtain water without the authorization of the Water and Sewer Superintendent.
2. Provide temporary water service to properties whose service will be interrupted for more than 12 hours.
 - a. All piping shall be rated for potable water use.
 - b. Minimum pipe size shall be 1-inch diameter for up to three service connections and 2-inch diameter for four or more connections. Use larger pipes where necessary to provide adequate domestic service throughout the duration of the temporary connection.
 - c. Valves shall be provided on temporary piping at intervals not to exceed 500 LF.
 - d. The method of providing the temporary water service (which hydrant to use, direction to feed, etc.) shall be an option of the Contractor subject to the approval of the Engineer.
 - e. All temporary water mains and services shall be disinfected in accordance with Section 2100.
 - f. One passing bacteria test per tested segment is required. No connections will be allowed in a segment without a passing bacteria test. One water sample per block at the end of a to-be-connected service line shall be tested after the temporary water line is flushed.
 - g. No additional contract time will be allowed for failure to pass bacteria test(s).

3.04 Temporary Construction

A. Dewatering

1. Work to be performed may require draining, pumping, and dewatering. These items shall be considered incidental unless otherwise specified in a bid item.
2. It shall be the sole responsibility of the Contractor to obtain permission from the City and/or landowner for the purposes installing equipment and discharging water.

3. The Contractor shall protect the site and adjacent property from damages caused by dewatering and pumping.
4. The Contractor shall be responsible for designing the dewatering system, obtaining permission for discharging on private property, and obtaining the appropriate permits.

B. Bypass Pumping

1. Bypass all sewers affected by the work in accordance with Section 2310 – Bypass Pumping.

3.05 Project Traffic Control

A. General

1. The Contractor is responsible for signing, barricades, and traffic control devices to protect the traveling public and direct them around the work zone.
2. A work zone consists of an area with construction, maintenance, or utility work activities, and extends from the first sign to the last device on any roadway segment.
3. All traffic control shall conform to MUTCD.
4. Traffic control devices shall be installed at the inception of the construction process and shall be maintained for the duration of the project. They shall remain in place only as long as they are needed and shall be immediately removed thereafter.
5. Provide access for emergency vehicles to all properties at all times except when the nature of the work makes emergency vehicle access unachievable. In such cases, facilitate access as much as possible and accommodate emergency workers.
6. No materials or equipment shall be placed on City streets that are open to traffic if it interferes with traffic flow or creates an unsafe environment.

B. Pedestrian and Bicycle Safety

1. The Contractor shall not create a hazardous condition or block movement of pedestrian or bicycle traffic without an appropriate ADA compliant alternate route and closure established.

2. The Contractor shall provide for pedestrian and bicycle traffic by phasing construction operations and/or by providing alternative pedestrian and bicyclist access through or adjacent to construction areas.
3. Proper advance notice signage with reasonable detours shall be installed and maintained through all phases of construction.
4. Access to pedestrian and bicycle devices at traffic signals shall be maintained at all times.
5. At no time shall pedestrians be diverted into a portion of the street used for vehicular traffic or on to private property unless proper barriers, delineations, and adequate signage are in place.

C. Traffic Control Deficiencies

1. The Engineer, Owner, or any law enforcement agency will notify one of the two 24-hour contact persons designated by the Contractor in the project submittals of any deficiencies.
2. The Contractor will have one-hour from the time of first notification to correct the deficiencies and thereby avoid a fee.
3. If the Contractor does not correct the deficiencies within one hour of first notification, the Contractor will be subject to a fee as follows:
 - a. An initial fee of \$900, plus a fee of \$100 per hour for each hour or any portion thereof that the Engineer determines the deficiency still exists.
 - b. The minimum fee is \$1,000 (initial fee plus one hourly fee). There will be no charge, however, if the deficiency is corrected within one hour of first notification.
 - c. The Engineer or Owner will notify the Contractor when the charges begin.
 - d. Once the deficiencies have been corrected, the Contractor shall notify the Engineer of same. If the Engineer concurs, charges will be deemed to have stopped accruing at the time of Engineer notification. Otherwise, the Contractor shall correct remaining deficiencies and hourly charges will continue to accrue until the Engineer concurs that the deficiencies have been corrected.

4. If the Contractor is deemed by the Engineer or Owner to be non-responsive and/or does not make reasonable efforts to correct the deficiencies in a timely manner, work on the entire project will be shut down until the deficiencies are corrected. Prior to resuming construction activities, the Contractor shall provide a plan to the Engineer as to how future problems will be avoided. All applicable fees will accrue during the shutdown.

D. Local Traffic Control

1. This category of traffic control is generally used for sites with limited outside traffic and limited exposure to the traveling public, such as entrances to private construction sites and entrances to new development projects.
2. The Contractor is responsible for signing and barricading entrance points to the construction site to restrict access and maintain the safety of the general public.

E. Traffic Control - Minor

1. This category of traffic control is used for short term stationary and mobile operations where device installations are not used or left in place at night. Examples include minor pavement maintenance, crack filling, and minor boulevard utility or tree work.
2. The Contractor shall provide flaggers and have them stationed near the work zone to assist the general public and construction vehicles in and around the work zone.

F. Traffic Control – Type 1

1. This category of traffic control is for low-traffic areas and requires the Contractor to provide a watch person to monitor and document the site.
2. The Contractor shall provide flaggers in controlled access areas of the work zone that has work occurring in the normal traveled lane.
3. The project shall be patrolled at least twice daily, at least once during daylight hours before 10:00 am and,
 - a. on working days, at least once after the Contractor has shut down for the day;
 - b. on non-working days, after 6:00 pm.

4. Watch Person(s)

- a. Watch person(s) shall be provided to patrol the project to ensure that the traffic control devices are properly placed in accordance with the traffic control plans and standards.
- b. The Contractor shall keep written documentation of all watch persons' hours and activities on the project.
- c. The Contractor shall immediately assist the watch person whenever necessary to correct conditions that cause erratic traffic movement, unexpected braking, etc., and erect, repair, replace, or relocate the required traffic control devices. In such instances, the Contractor shall provide emergency assistance to motorists affected by the deficient conditions.
- d. Upon written request to the Engineer, suspension of watch person service may be permitted during periods of authorized work suspension or after substantial completion of the work, provided the project site is in a safe condition.

5. Qualifications of Watch Person(s)

- a. Watch person(s) shall have completed a NDDOT-approved Traffic Control Technician (TCT) course.
- b. Watch person(s) shall be familiar with the traffic control requirements outlined herein as well as the plans and specifications for the project.

G. Traffic Control – Type 2

- 1. This category of traffic control is for high-traffic areas and requires the Contractor to provide a traffic control supervisor in addition to watch person(s) to monitor and document the site.
- 2. Flagging, patrol, and watch person requirements shall be per Traffic Control – Type 1 except that watch person duties must be performed by a traffic control subcontractor.

3. Traffic Control Supervisor

- a. The Contractor shall designate a qualified traffic control supervisor in addition to the watch person(s) to supervise the installation, operations, inspection, maintenance, and removal of the traffic control system, and to serve as the watch person in his/her absence.
- b. Traffic control supervisor shall correct traffic control conditions that cause erratic vehicle movements, unexpected braking, etc. and propose changes to improve traffic flow through the work zone.
- c. The traffic control supervisor shall be accessible to the job site within one hour of notification and be "on call" on a 24-hour basis.
- d. In the event the traffic control supervisor becomes unavailable during the project, the Contractor shall designate a qualified replacement supervisor.

4. Qualifications of Traffic Control Supervisor

- a. Traffic control supervisor shall have completed a NDDOT-approved Traffic Control Supervisor (TCS) course.
- b. Traffic control supervisor shall be familiar with the traffic control requirements outlined herein as well as the plans and specifications for the project.
- c. Traffic control supervisor shall have completed a total of at least 12 months of field experience with traffic control plans, layouts, and maintenance.
- d. Traffic control supervisor must be competent to supervise personnel in traffic control operations.

3.06 Temporary Barriers and Enclosures

- A. Provide approved temporary covers, enclosures, markers, and barriers as necessary to protect the work.
- B. Install safety fence around all excavations where work is suspended and other areas that pose a hazard to workers and/or the public.

PART 4 – MEASUREMENT AND PAYMENT

A. Mobilization

1. Shall be paid for on a Lump Sum (LS) basis.

2. Partial payments will be made as follows:

First Partial Payment	25% of Mobilization Item
Percent of Original Contract Earned – 10	50% of Mobilization Item
Percent of Original Contract Earned – 50	90% of Mobilization Item
Percent of Original Contract Earned – 75	100% of Mobilization Item

3. If the Project has more than one (1) Work Unit and Mobilization is provided in the Bid Form for each Work Unit, each Work Unit's Mobilization item shall be paid for on a lump sum basis.

B. Traffic Control

1. No bid item will be provided for Local Traffic Control. All costs associated with providing Local Traffic Control as specified herein shall be included in the prices bid for other items.

2. Traffic Control – ____: Shall be paid for on a Lump Sum (LS) basis and shall include all work as specified herein. This shall be considered payment in full for all labor, equipment, and materials associated with required traffic control devices for the entire project.

3. If the project has more than one (1) Work Unit and Traffic Control is provided in the Bid Form for each Work Unit, each Work Unit's Traffic Control item shall be paid for on a lump sum basis.

4. Partial payments will be made as follows:

First Partial Payment	50% of Traffic Control Item
Percent of Original Contract Earned – 50	75% of Traffic Control Item
Percent of Original Contract Earned – 100	100% of Traffic Control Item

Partial payments as indicated on the table above will be paid by either the Original Contract amount for a single Traffic Control bid item or per the Contract amount per each Work Unit if there is a Traffic Control bid item per Work Unit.

C. Temporary Water Service

1. Temporary Water Service shall be paid for on a Lump Sum (LS) basis and shall include all work as specified herein. This shall be considered payment in full for all labor, equipment, and materials associated with providing temporary water service as specified in Section 1100 – 3.03.B Temporary Water for Construction.
2. If the project has more than one (1) Work Unit and Temporary Water Service is provided in the Bid Form for each Work Unit, each Work Unit's Temporary Water Service item shall be paid for on a lump sum basis.

3. Partial payments will be made as follows:

First Partial Payment	50% of Temporary Water Service Item
Percent of Original Contract Earned – 50	75% of Temporary Water Service Item
Percent of Original Contract Earned – 100	100% of Temporary Water Service Item

Partial payments as indicated on the table above will be paid by either the Original Contract amount for a single Temporary Water Service bid item or per the Contract amount per each Work Unit if there is a Temporary Water Service bid item per Work Unit.

- D. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 1200 – TEMPORARY EROSION AND SEDIMENT CONTROL

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.01 Section Summary

- A. Temporary erosion and sedimentation control devices and techniques.

1.02 Related Sections

- A. Section 1800 – Excavation and Embankment
- B. Section 3700 – Lawns and Grasses

1.03 References

- A. North Dakota Department of Transportation “Standard Specification for Road and Bridge Construction” Current Edition, As Revised.

- 1. Sections 251, 252, 253 – Seeding, Sodding, and Mulching
- 2. Sections 255 and 856 – Erosion Control Blanket and Turf Reinforcement Mat
- 3. Section 256 – Riprap
- 4. Section 258 – Concrete Slope Protection
- 5. Section 260 – Silt Fence
- 6. Section 261 – Fiber Rolls
- 7. Section 262 – Floatation Silt Curtain
- 8. Section 265 – Stabilized Construction Access
- 9. Sections 709 and 858 – Geosynthetics

1.04 Submittals

- A. Erosion and Sediment Control Plans
 - 1. Temporary Erosion and Sediment Control Plan for use during construction activities.
 - 2. Permanent Erosion Control Plan for site restoration after construction activities.

3. Storm Water Pollution Prevention Plan (SWPPP)
 4. "Notice of Intent to Obtain Coverage Under NDPDES General Permit for Storm Water Discharge Associated with Construction Activity" (NOI).
- B. Erosion and Sediment Control Inspection Reports
1. Submit copies to Engineer with each pay request.
- 1.05 Permits
- A. NDPDES General Permit
1. Contractor shall acquire and maintain a NDPDES permit from the North Dakota Department of Environmental Quality. The Contractor shall pay all fees associated with acquiring and maintaining compliance with the permit.
- 1.06 Sequencing and Scheduling
- A. Before starting any grading or construction activities, submit for approval all items listed in 1.04 of this Section and all permits listed in 1.05 of this Section.
 - B. All temporary erosion control devices shall be installed before any construction may begin and shall remain in place and be maintained at all times, at the Contractor's expense.
 - C. Temporary stabilization is required if work ceases for greater than 14 days.
 - D. Permanent erosion control shall be installed as soon as construction shall allow.
 - E. The Contractor is responsible for establishing permanent turf to avoid excessive soil erosion and for installation of landscaping and final project site stabilization.

PART 2 – PRODUCTS

- 2.01 Silt Fence
- A. Pre-fabricated silt fence will not be permitted. Any other variations in materials and/or devices shall be approved by the Engineer.
 - B. Posts: Conform to NDDOT Specification Section 260.03.A
 1. Wood Post
 - a. Length: Minimum 4 feet green treated.

- b. Width: 2-inch diameter round or 1-1/2 x 1-1/2 inch rectangular.
 - 2. Steel
 - a. Length: Minimum 4 feet with projections for fastening wire or fabric and steel plate welded to bottom for extra support.
 - b. Minimum weight of 0.95 lbs/LF
- C. Filter Fabric: Conform to NDDOT Spec 260.03.B
 - 1. Minimum width of 36 inches.
 - a. Provide fabric as specified in AASHTO M288.
 - b. Monofilament geotextile fabric shall be used.
- D. Silt Fence Backing (for Silt Fence – Supported):
 - 1. Minimum width of 32 inches.
 - 2. Maximum opening size of 6 inches X 6 inches.
 - 3. Minimum 14 gauge, Grade 60 wire.

2.02 Stabilized Construction Access

- A. Aggregate
 - 1. Washed rock having 90 percent fractured faces with 100 percent passing a 4-inch sieve and 0 percent passing a 2-inch sieve.
- B. Woodchip Material (in lieu of aggregate)
 - 1. Coarse-graded shredded wood and/or bark with 95 percent passing a 5-inch sieve and no more than 45 percent passing a 3/4-inch sieve.
 - 2. Shall have a bulk density less than 22.2 pounds per cubic foot.
 - 3. Shall not contain substances that would be harmful to equipment.
 - 4. Shall not contain compounds in quantities detrimental to animal life, plant life, or water quality.
- C. Geosynthetic Material
 - 1. Meet the requirements for R1 reinforcement fabric according to NDDOT Specification Section 858.

2.03 Storm Drain Inlet Protection

A. Approved devices for inlets/catch basins in turf areas:

1. Fiber rolls, minimum 6-inch diameter.
2. Gravel bags filled with 3/8-inch pea gravel.
3. Dandy Pop® by Dandy Products, Inc.

B. Approved devices for street inlets/catch basins:

1. Gravel Bags filled with 3/8-inch pea gravel.
2. Road Drain Top Slab by Wimco, LLC.
3. Dandy Curb Bag® by Dandy Products, Inc. (Dandy Sack® is not approved).
4. Combo Guard by ERTEC Environmental Systems.

2.04 Ditch Checks and Velocity Checks

A. Silt Fence - Supported.

B. Straw bales.

C. Fiber rolls, minimum diameter as specified below in PART 3.

2.05 Erosion Control Blanket

A. Shall meet the requirements of the type specified on the Project Plans, or as detailed in NDDOT Specification Section 856, Tables 856-01 and 856-02.

2.06 Turf Reinforcement Mat

A. Shall meet the requirements of the type specified on the Project Plans, or as detailed in NDDOT Specification Section 856, Table 856-03.

2.07 Dust Control

A. Water: free of any material which impedes flow through spraying device.

2.08 Temporary Cover Crop

A. Seed

1. Shall conform to NDDOT Specification Section 251.03.E.

B. Equipment

1. Conform to NDDOT Specification Section 251.02.B

2.09 Concrete Wash-Out Container

- A. Leak-proof such that no concrete material comes into contact with surrounding soil.
- B. Shall be of adequate size for expected volume of concrete poured.

PART 3 – EXECUTION

3.01 General

- A. Conform to NDDOT Specification Sections referenced within this Specification Section and as modified herein:
 1. Where not specifically stated, use Best Management Practices (BMPs) at a minimum.
 2. Only disturb or grade areas necessary for construction.
- B. Inspections
 1. Inspect all sediment control devices within 24 hours of each rainfall greater than 0.25 inches and at least daily during prolonged rainfall, in any case, no less frequently than once every 14 days.

3.02 Installation

- A. Silt Fence: Conform to NDDOT Specification Section 260 except as modified herein.
 1. Bury bottom of silt fence a minimum of 6 inches, in a "J" configuration. The trench on the upstream side shall be filled with soil and compacted.
 2. Posts shall be 4 feet apart and driven to a minimum of 20 inches into the ground. Depth shall be increased to 24 inches if on a slope 3:1 or greater.
 4. Attach filter fabric to posts with staples, wire, nails, or in accordance with manufacturer's specifications.
 5. Silt fences should be continuous and transverse to flow and shall be placed so water cannot flow around the edge.

- B. Stabilized Construction Entrance: Conform to NDDOT Specification Section 265.
 - 1. If an access is constructed that restricts flow through a ditch, the Contractor shall determine the length and size of culvert needed to meet the conditions. Installation is incidental to the Stabilized Construction Entrance.
 - 2. If an access is constructed where topsoil exists, the topsoil shall be stripped and salvaged before construction and replaced and reseeded after construction.
- C. Storm Drain Inlet Protection
 - 1. Gravel Bags
 - a. Fill gravel bags and secure ends so material will not escape.
 - b. Place gravel bags around inlet on all sides no closer than 1 foot from the inlet.
 - 2. Turf Area Drains
 - a. Install Dandy Pop® or other approved devices per manufacturer's recommendations.
 - b. Place gravel bags or fiber rolls around inlet on all sides no closer than 1 foot from the inlet.
 - 3. Curb and Gutter Drains
 - a. Insert on/into catch basin in accordance with manufacturer's recommendations and as detailed on the City of Minot Standard Details. Inlet grate shall be able to be inserted over top of the device.
- D. Ditch Checks and Velocity Checks
 - 1. Silt Fence
 - a. Conform to the requirements for Silt Fence outlined elsewhere in this Section.
 - b. In high flow, high velocity situations, supported silt fence may be used. The top of the mesh must be a minimum of 32 inches above the ground.
 - c. Straw bales may also be used in conjunction with slit fence for ditch and velocity checks.

2. Straw Bales

- a. Bales must be packed tightly together to avoid gaps in protection.
- b. Each bale shall be secured in place with two 3-foot (min.) long wooden stakes at least 1 ½ inches in diameter, driven through each bale into the ground a minimum of 18 inches.

3. Fiber Rolls

- a. Each roll shall be overlapped by 1 foot minimum and tied tightly together. Fiber rolls shall be trenched and staked according to the manufacturer's recommendations and as shown in the City of Minot Standard Details.
- b. Use 6-inch rolls for sheet flows down backslopes and foreslopes. Use 12-inch and 20-inch rolls in ditch bottoms, pipe inlets, and at the edge of the right-of-way.
- c. Wooden stakes at least 1 inch in diameter shall be used to secure fiber rolls, angled such that the force of water would rotate the stakes vertically. Secure stakes a minimum of 1 foot into the ground.

E. Erosion Control Blanket and Turf Reinforcement Mat

1. Erosion Control Blankets and Type 1 Turf Reinforcement Mat:

- a. The area to be covered shall be properly prepared and seeded before the blanket is applied. All rocks and clods over 1 inch in diameter, and all sticks and other foreign material shall be removed.

2. Type 2 Turf Reinforcement Mat

- a. Conform to NDDOT Specification Section 255.04.C

F. Dust Control

- 1. Contractor shall apply water to areas where dust is being generated due to construction activities. The Contractor shall apply water as directed by the Engineer.

G. Temporary Cover Crop

1. Seed

a. Conform to NDDOT Specification Section 251.04.

2. Cover Material

a. Conform to NDDOT Specification Section 253.04.

H. Concrete Wash-Out Facility

1. Install where visible from pour location or provide directional signage.

3.03 Maintenance

A. Conform to NDDOT Specification Sections referenced in Part 1 of this Specification Section for maintenance information, and as follows:

1. The Contractor is responsible for maintenance and repair of any washouts or accumulations of sediment that occur on site.
2. Perform a daily review of the location of sediment control devices and ensure that the devices are properly located for effectiveness.
3. Immediately repair or remove and replace ineffective devices.
4. Remove any material that has been deposited onto public roadways as soon as possible, no later than at the end of each day.
5. Concrete Wash-Out Facilities shall not be filled past 75% of total capacity. Excess water shall be vacuumed off or allowed to evaporate. Hardened cementitious solids shall be removed and properly disposed of. Facility shall be inspected for leaks before further use.
6. Damage from the elements, Contractor's operation, or negligence shall be repaired at the Contractor's expense. Repair must be made before final acceptance.

PART 4 – MEASUREMENT AND PAYMENT

- A. Bid Items have been provided for the work described herein. Payment at the Bid Unit Price will be considered compensation in full for all work necessary to complete the Bid Item(s) in full, including installation, maintenance, sediment removal, repairs, removals, and administration.
1. Storm Water Management: Shall be paid for on a lump-sum (LS) basis on the schedule defined for Mobilization (refer to Section 1100 – MOBILIZATION, TEMPORARY FACILITIES AND CONTROLS) and shall include: all administrative effort required to comply with the NDPDES permit requirements including obtaining the permit, documentation and reporting, preparation of the Storm Water Pollution Prevention Plan, and transferring or terminating the permit, as applicable; and implementing any erosion and sediment controls required for permit compliance but not specifically identified on the Plans or having Bid Items.
 2. Silt Fence and Silt Fence – Supported: Measurement will be made by linear foot (LF) of material specified on the Plan.
 3. Stabilized Construction Entrance: By each (EA) entrance installed.
 4. Storm Drain Inlet Protection: By each (EA) inlet structure protected. For example, a 2'x3' (single) inlet and a 2'x6' (double) inlet would each be considered one single inlet structure.
 5. Erosion Control Blanket and Turf Reinforcement Mat: Measurement will be made by the square yard (SY) for each type of material specified on the Plan, without regard to overlap.
 6. Ditch Check: Measurement shall be by the linear foot (LF) for the type of ditch check specified on the Plan.
 7. Velocity Check: Measurement shall be by the linear foot (LF) for the type of velocity check specified on the Plan.
 8. Dust Control: Measurements shall be based on units of M (1000) gallons (MGAL) and shall be paid per Plan Quantity.
 9. Temporary Cover Crop: Measurements will be made by the acre (AC) or by the square yard (SY), and shall include seeding, cover crop, and soil preparation.
- B. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the bid form.

END OF SECTION

SECTION 1400 – OPERATION AND MAINTENANCE MANUALS

OPERATIONS AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.01 Section Summary

- A. Requirements for preparing Operation and Maintenance Manuals.

1.02 Sequencing and Scheduling

- A. Before placing the equipment in operation, all Operation and Maintenance Manuals must be approved by the Engineer.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

3.01 Submittal Procedures

- A. Submit 1 hard copy and one digital PDF copy of approved and final sets of detailed equipment drawings and explicit instructions on the operation and maintenance of each piece of equipment furnished on the Project at least 15 days before any final inspection.

3.02 Operation and Maintenance Manuals

- A. Manuals are required for all equipment, accessories, devices, etc. that require adjustment, maintenance, operation, or repairs by the Owner's personnel, including driver, motors, controls, etc. All information shall be supplied by the appropriate equipment manufacturers, neatly bound in rigid cover ring binders by the Contractor, and properly indexed.

Manuals shall include record shop drawings and copies of factory certified tests. Each manual shall contain at the minimum, the following information where applicable:

1. Operation and Maintenance Manuals shall be clearly identified as operation and maintenance manual. Manual shall identify the project name and project number.
2. All performance and design characteristics and unit identification, such as model and serial numbers and performance curves.
3. All accessories or options furnished with unit.

4. Complete instructions on lubrication, testing, balancing, etc.
 5. List of recommended lubricants.
 6. Step-by-step instructions for startup, shutdown, repair and overhaul.
 7. Parts list and parts diagram.
 8. Wiring diagrams.
 9. Control Diagrams.
 10. Operating Procedures.
 11. Copy of approved/revised shop drawings.
 12. Listing of spare parts the Owner should keep on hand as recommended by the manufacturer.
 13. Name and phone number of supplier where repair parts or additional information can be obtained.
- B. Each manual shall be specifically for the items actually installed. Where manuals show several models or options, the manual shall be clearly marked to indicate what was furnished and which instructions apply to the furnished unit.
- C. Superfluous information pertaining to other models, options, etc. not furnished shall be clearly crossed out or otherwise eliminated.

PART 4 – MEASUREMENT AND PAYMENTS

- A. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for items on the Bid Form.

END OF SECTION

SECTION 1500 – REMOVALS

REMOVALS

PART 1 – GENERAL

1.01 Section Summary

- A. Removal of utilities, structures, obstructions, surfacing, streetscapes, and miscellaneous items.

1.02 Related Sections

- A. Section 1200 – Temporary Erosion and Sediment Control
- B. Section 1600 – Project Site Clearing
- C. Section 1800 – Excavation and Embankment
- D. Section 3400 – Post Mounted Traffic Signs

1.03 References

- A. North Dakota Department of Transportation "Standard Specification for Road and Bridge Construction" Current Edition, As Revised.
 - 1. Section 107.17 – Removed Material
 - 2. Section 202 – Removals
 - 3. Section 411 – Milling Pavement Surface

1.04 Definitions

- A. Obliterate/Remove: To completely take away from the Project Site without regard for the condition of the item after being removed.
- B. Salvage: To remove an item in a manner that it is saved from loss, damage, or destruction so the item can be used again for a similar purpose in a workable condition equal to its pre-removal condition.
- C. Abandon
 - 1. General: To leave items in place without disturbing the surroundings.
 - 2. Pipes: To fill, bulkhead, or close off pipes and structures so no settlement or flow can occur.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

3.01 General

- A. The Contractor shall obtain permission from the Engineer before abandoning or removing items that are not specified for removal or abandonment on the Plans.
- B. All items or materials removed shall be taken off the Project Site at a location determined by the Contractor.
- C. All items or materials salvaged shall be stored or stockpiled at locations provided by the Contractor.
- D. All items indicated as Salvage and Deliver to Owner will be identified on the Plans and indicated on the Bid Form. Location of delivery will be identified on the Plans and/or identified in the Specifications.
- E. Fill holes and depressions resulting from removal or salvage immediately in accordance with the requirements of Section 1800 – Excavation and Embankment.
- F. Where streets, driveways, or parking areas are removed, provide a temporary driving surface where traffic will be present prior to construction of the new driving surface.
- G. Develop a plan acceptable to Engineer and postal service for maintaining mail service. Temporary locations of mailboxes may be necessary; those locations are directed by the postal service.
- H. Meet with owners of signs and structures for requirements of salvage, storage, and replacement.
- I. Cause existing utilities to be located and coordinate all necessary utility relocations required to proceed with construction.
- J. Disposing of Material
 - 1. Burying of materials and debris is not allowed within the Project Site.
 - 2. The Contractor shall be responsible for disposing of removed materials off site and be in compliance with all government regulations.

3.02 Protection

- A. Temporary erosion and sediment control measures must be installed in accordance with Section 1200 prior to disturbing existing vegetated land cover, removing existing pavements or structures, or exposing erodible soils.
- B. Proceed in such a manner as to minimize the spread of dust and flying particles and to provide safe working conditions for personnel.
- C. Avoid disturbing any material not marked for removal. Where removal work will be conducted around areas not to be disturbed or removed, the Contractor shall not damage those areas. If damage occurs, the Contractor shall repair those areas to their original condition at no expense to the Owner.
- D. Limit damage to existing turf whenever possible.
- E. Holes or depressions created by removals shall not be left open longer than necessary to perform the removals. All holes within 10 feet of sidewalks or other travelled ways that are not immediately filled shall be suitably marked or covered immediately.
- F. Conduct operations with minimal amount of traffic interference. Do not store or place materials in passageways or other means of egress.
- G. All street signs, traffic control signs, mailboxes, fences, etc. that interfere with construction shall be salvaged, stored safely, and reinstalled.
- H. Take all necessary precautions to protect personal, private, and public property in all areas of work.
- I. Adjacent items that are damaged during the work shall be, to the satisfaction of the Engineer, promptly repaired or removed and replaced by the Contractor at its expense. Any new items provided shall be of equal type and quality as the damaged item when it was new.
- J. The use of explosives will not be permitted.

3.03 Sawing Pavement

- A. Bituminous and Concrete Pavement: Saw pavement full depth, along the removal line. Saw-cuts shall be marked by the Engineer.
 - 1. Bituminous pavement may be coultter cut as long as the edges of the cut are straight and uniform.

3.04 Sawing Curb and Gutter

- A. Saw curb and gutter full depth, along the removal line. Removal lines shall be marked by the Engineer.

3.05 Pavement Removal

- A. Remove in accordance with NDDOT Spec 202.04D except as modified herein:
 - 1. Removal lines shall be marked by the Engineer.
 - 2. Saw-cut to the full depth of the existing pavement prior to removal.
 - 3. Remove pavement in a manner such that remaining surfacing is not damaged.
 - 4. Damaged areas not marked for removal shall be replaced by the Contractor at its expense.
 - 5. Prior to restoring trenches, all bituminous edges along the trench shall be saw-cut.

3.06 Pavement Milling

- A. Milling pavement surfaces shall be done in accordance with NDDOT Specification Section 411 except as modified herein:
 - 1. Surface shall be milled to the depth and cross section specified on the Plan or as directed by the Engineer.
 - 2. All saw-cuts associated with milling operations and bituminous surface removal shall be considered incidental to those items of work.
 - 3. Care shall be taken when milling around structures and curb and gutter. Damaged surfaces shall be replaced or repaired to the satisfaction of the Engineer.
 - 4. Surface shall be swept clean after milling using a mechanical sweeper.
 - 5. Use water as necessary for dust control.
 - 6. The millings produced from the project shall become the property of the City of Minot and shall be delivered clean to a designated area as specified.

3.07 Pavement Reclamation

- A. Existing surfaces to be reclaimed shall be kept in service until removal is necessary for the continuation of work.
- B. The Contractor shall provide a 48-hour notice before reclamation shall begin.
- C. The existing pavement shall be pulverized and blended to the width and depth shown on the plans in one or more passes, so the entire mass of material is uniformly blended/mixed.
- D. The Contractor shall not pulverize any more pavement than can be spread, shaped, and compacted in one working day.
- E. No additional compensation will be made for any materials, whether on site or imported, to maintain the drivable surface.

3.08 Remove Curb and Gutter

- A. The Contractor shall saw-cut the curb & gutter full depth then remove the section marked by the Engineer.
- B. Damage caused by the Contractor to curb not marked for removal shall be replaced by the Contractor.
- C. The removal section for asphalt curb & gutter shall be considered the curb section plus 18 inches from the face of the curb.

3.09 Remove Valley Gutter

- A. The Contractor shall saw-cut the valley gutter full depth then remove the section marked by the Engineer.
- B. Damage caused by the Contractor to valley gutter not marked for removal shall be replaced by the Contractor.

3.10 Remove Sidewalk

- A. The sidewalk to be removed shall be marked by the Engineer.
- B. Saw-cut to full depth before removal.
- C. Sidewalk not marked for removal that is damaged during construction shall be removed and replaced by the Contractor at its expense.

3.11 Remove Concrete – Miscellaneous

- A. Any concrete requiring removal from a project site that is not designated as either concrete sidewalk, curb and gutter, valley gutter, or concrete pavement shall be removed under the Unit Bid Item – Remove Concrete – Miscellaneous.
- B. This item shall include, but may not be limited to the following:
 - 1. Miscellaneous equipment slabs, foundation under slabs, footings, retaining walls or other concrete items as may be shown on the Plans.

3.12 Remove Existing Pipe

- A. Remove existing pipe encountered during excavation as indicated on the Plans or as directed by the Engineer.
- B. Sewer services taken out of service shall be removed to the main and capped at the wye.
- C. Water services taken out of service shall be removed to the main and the corporation stop shall be shut off.
- D. Bulkhead the ends of existing lines to be abandoned but not removed. Use appropriate caps or plugs to create an airtight condition except for gravity lines, where formed concrete or brick and mortar may be used.
- E. The removal of portions of abandoned utility lines or conduits when required for new construction will be considered incidental work and no direct compensation will be paid.

3.13 Salvage and Reinstall

- A. Signs
 - 1. In no case shall a street or traffic sign be removed or disturbed by the Contractor without contacting the Engineer and then only after satisfactory arrangements have been made for a temporary installation for its disposition.
 - a. Street identification signage shall be maintained at all times due to its importance to the 911 emergency response system.
 - 2. Remove, store, and reinstall all signs, posts, brackets, stringers, nuts, bolts, washers, etc.
 - 3. Use care against damage to signs during storage and installation.

B. Mailboxes

1. Remove and salvage existing mailboxes that interfere with the work or whose access is restricted due to the work.
2. Place at temporary locations as directed by the Engineer or as shown on the Plans.
3. Removal, temporary re-installation, and replacement shall occur so that mail service is not interrupted.
4. Re-install mailboxes at locations directed by the Engineer or as shown on the Plans.

C. Fences

1. Salvage and store fence material where they are not in conflict with the work.
2. After completion of the work, reinstall the fence to the condition existing or better prior to removal.

D. Field Quality Control

1. Salvaged items shall be reinstalled to the same shapes, dimensions, and locations of the original items prior to construction, or as directed by the Engineer.
2. Items damaged during salvaging operations shall be replaced by the Contractor at its expense with new material of equal type and quality of the damaged item when it was new.

3.14 Removal of Pavement Markings

A. Obliterate Pavement Markings

1. This bid item applies to removal of existing pavement markings that will not be replaced.
2. Method of removal must be approved by the Engineer prior to removal operations. Contractor may be required to demonstrate the method(s) in the field prior to Engineer approval of same.
3. No carbide or diamond-tipped blades/wheels are allowed on removal equipment.

B. Removal of Tape and Epoxy

1. Existing tape and/or epoxy pavement markings that will be replaced shall be removed by the Contractor prior to grooving operations and prior to installing new tape and/or epoxy.

PART 4 – MEASUREMENT AND PAYMENT

A. Removal items: Payment at the Bid Unit Price will be considered compensation in full for all work necessary to complete each Bid Item in full, including all costs for saw-cutting, excavation, backfill, removal, transport, and disposal.

1. Obliterate pavement markings: By square foot (SF) obliterated.
2. Mill Pavement: By square yard (SY) milled for the depth specified on the Plans. Price shall include the cost for milling, hauling, handling, and sweeping the surface when milling is complete.
2. Micro-Mill Pavement: By square yard (SY) milled for the depth specified on the Plans. Price shall include the cost for milling, hauling, handling, and sweeping the surface when milling is complete.
3. Reclaim Bituminous Pavement: By square yard (SY) reclaimed, without regard to thickness.
4. Remove Bituminous Pavement: By square yard (SY) removed, without regard to thickness.
5. Remove Concrete Pavement: By square yard (SY) removed, without regard to thickness.
6. Remove Curb and Gutter: By linear foot (LF) for the type removed, without regard to thickness.
7. Remove Curb: By linear foot (LF) for equipment, labor, and incidentals necessary to remove curb wall, without regard to thickness.
8. Remove Valley Gutter: By square yard (SY) for the type removed, without regard to type or thickness.
9. Remove Driveway Pavement: By square yard (SY) for the type removed, without regard to type or thickness.
10. Remove Sidewalk: By square yard (SY) removed, without regard to thickness.

11. Remove Concrete – Miscellaneous: Either by square yard (SY) removed or cubic yard (CY) removed, as designated in the Bid Form and on the Plans.
 12. Remove Existing Pipe: By linear foot (LF) for the size and type removed.
 13. Remove Manhole: By each (EA) structure removed.
 14. Remove Inlet: By each (EA) inlet removed.
 15. Remove Hydrant: By each (EA) hydrant removed.
 16. Remove Gate Valve: By each (EA) gate valve removed.
 17. Remove Traffic Signal: By Lump Sum (LS) as defined on the Plans.
- B. Salvage items: Payment at the Bid Unit Price will be considered compensation in full for all work necessary to complete each Bid Item in full, including all costs for removal, salvage, transport, storage, and reinstallation.
1. Salvage and Reinstall Fence: By linear foot (LF) salvaged and reinstalled as specified and/or shown on the Plans.
 2. Salvage and Reinstall Sign: By each (EA) sign salvaged and reinstalled as specified and/or shown on the Plans.
 3. Salvage and Reinstall Mailbox: By each (EA) mailbox salvaged and reinstalled as specified and/or shown on the Plans, or by lump sum (LS) for all mailboxes on the project, as designated on the Bid Form.
 4. Salvage and Deliver to Owner: By each (EA) item identified on the Plans and/or on the Bid Form.
- C. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 1600 – PROJECT SITE CLEARING

PROJECT SITE CLEARING

PART 1 – GENERAL

1.01 Section Summary

- A. Clearing, grubbing, removing, and disposing of all vegetation and debris. Stripping and stockpiling of topsoil.

1.02 Related Sections

- A. Section 1500 – Removals
- B. Section 1800 – Excavation and Embankment

1.03 References

- A. North Dakota Department of Transportation "Standard Specification for Road and Bridge Construction" Current Edition, As Revised.
 - 1. Section 107.17 – Removed Material
 - 2. Section 201 – Clearing and Grubbing
- B. United States Department of Agriculture (USDA) Forest Service "Tree Owner's Manual", Current Edition, As Revised.

1.04 Definitions

- A. Brush: All bushes, shrubs, and other vegetation including small isolated trees with a diameter of 4 inches or less at a point 2 feet above the ground surface.
- B. Clearing: Cutting, removing, and disposing of trees, shrubs, bushes, windfalls, and other vegetation in the designated area.
- C. Grubbing: Removing and disposing of stumps, roots, and other remains in the designated area.
- D. Tree Trimming/Pruning: Cutting broken, damaged, or obstructing branches and installing wound dressing.
- E. Windfall/Deadfall: Trees and limbs laying on the ground in the removal area, and not caused by clearing activities.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

3.01 General

- A. Since the plans may not specifically identify all trees to be removed, review all tree removals and trimming with the Engineer in the field prior to any work. The Engineer will clearly mark all trees to be removed.
- B. Protect trees not specifically identified in the plans for removal or as directed by the Engineer in the field.
- C. Install the appropriate temporary erosion control measures ahead of site clearing activities.
- D. After clearing and grubbing operations are complete, stockpile soils to prevent contamination with other materials.

3.02 Clearing and Grubbing

- A. Clearing Trees: Cut, remove, and dispose of trees and brush marked in the clearing area. Trees located within the boundary of the new construction shall be removed to a depth of 18 inches below the finished ground line or 3 feet below the final sub grade whichever is lower.
- B. Clearing brush: Cut even with the ground surface.
- C. Grubbing: Remove brush, stumps, roots, and other remains to a depth consistent with tree clearing.
- D. All depressions from clearing and grubbing operations shall be backfilled in accordance with Section 1800 – Excavation and Embankment.

3.03 Trimming and Pruning

- A. Trim all trees that are to be saved but interfere with construction activities.
- B. All tree trimming and pruning shall be in accordance with International Society of Arboriculture (ISA) guidelines and those outlined in the USDA Forest Service Tree Owner's Manual.
- C. The Contractor and Engineer shall review the extent of tree trimming prior to construction with the intent to minimize damage to trees during construction.

- D. Upon completion of utility installation, the Contractor shall trim and dress all damaged tree limbs as directed by the Engineer.

3.04 Stripping

- A. After clearing and grubbing have been completed, strip sod and topsoil to a line 1 foot outside areas to be occupied by sidewalks, roadways, structures, or any other areas shown.
- B. Stockpile sufficient topsoil to re-spread to a uniform depth of 6 inches to all disturbed areas identified for seeding or sodding.
- C. Do not strip topsoil within the drip line (branch spread) of trees identified to remain.

3.05 Disposal

- A. Dispose of all cleared and grubbed material and debris outside of the right-of-way at a location selected by the Contractor.
- B. Contractor shall conform to local and state regulations when disposing of materials.
- C. Stripped materials shall not be used as embankment material.
- D. Onsite burial of any debris is not permitted.

3.06 Protection

- A. Protect all trees and shrubs indicated on the plans or by the Engineer from damage or removal.
- B. Protect the property surrounding the clearing area from damage by clearing and grubbing operations.

PART 4 – MEASURE AND PAYMENT

- A. The bid items below shall include removal, loading, hauling, disposing of material, and restoration of depressions.
 - 1. Clearing and Grubbing: Shall be paid for by the square yard (SY).
 - 2. Remove Tree: Shall be determined by measuring the diameter 2 feet above the ground and must be 4 inches or greater in diameter. Removal shall be measured by each (EA).
 - 3. Topsoil Stripping: Shall be incidental to the Project.
 - 4. Remove Brush: Shall be incidental to the Project.
 - 5. Remove windfall/deadfall: Shall be incidental to the Project.
 - 6. Trimming: Shall be incidental to the Project.
- B. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 1700 – ADJUSTMENT OF STRUCTURES

ADJUSTMENT OF STRUCTURES

PART 1 – GENERAL

1.01 Section Summary

- A. Adjustment of manholes, catch basins, gate valves, and other structures to plan grade.

1.02 Related Sections

- A. Section 2100 – Water Main
- B. Section 2300 – Sanitary Sewer
- C. Section 2700 – Storm Sewer

1.03 References

- A. American Society of Testing Materials (ASTM)
 - 1. A48 – Specification for Gray Iron Casting.
 - 2. C6 – Specification for Normal Finishing Hydrating Lime.
 - 3. C150 – Specification for Portland Cement Concrete (Rings and Mortar).
 - 4. D4976 – Polyethylene Plastics Molding and Extrusion Materials
- B. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. M306 – Standard Specification for Drainage, Sewer, Utility and Related Castings.

PART 2 – PRODUCTS

2.01 Adjustment Units

- A. Concrete
 - 1. Units shall be 2-inches thick.
 - 2. Units shall have a minimum compressive strength of 4000 psi, be steel reinforced and meet AASHTO H-20 Loading Requirements.

3. Units shall be adhered to each other, the structure, and casting by using either Portland Cement Concrete or non-shrink Hydrated Lime.
- B. Engineered Polymer (not allowed at catch basins and catch basin manholes)
 1. Injection molded High Density Polyethylene (HDPE) as manufactured by Ladtech, Inc. or IPEX, Inc. HDPE materials shall conform to ASTM D4976.
 2. Expanded Polypropylene (EPP) as manufactured by Cretex Specialty Products.
 3. Each unit shall be 2-inches to 6-inches thick, measured at its thickest point.
 4. Units shall be adhered to each other, the structure, and casting by using an adhesive/sealant recommended by the manufacturer.

PART 3 – EXECUTION

3.01 General

- A. All finish grades of castings and valve boxes shall be 1/4 inches to 3/8 inches below the finish grade of the pavement.
- B. Perform adjustments after construction is to a point that the work will not become damaged by other construction activities.
- C. Clean all structures after adjustment to remove any sediment or mortar from the structure.
- D. All manhole and gate valve pick holes must be cleaned and accessible after paving operations.

3.02 Adjust Casting

- A. Install adjusting rings to provide 4-inch min., 12-inch max. of adjustment, 8-inch preferred.
- B. Casting adjustments will only be allowed after the first lift of pavement is placed.
- C. The raised castings shall not be exposed to traffic for more than 14 days. The raised casting must be ramped with bituminous pavement if traffic is allowed in the same lane as the raised casting. This cost shall be included in the price for adjustment.
- D. Clean the top of the structure prior to setting rings.

E. Concrete Rings

1. No wooden shims or other organic shims will be allowed.
2. Use 2-inch thick adjusting units.
3. Apply mortar to the top and bottom of the units a minimum of $\frac{1}{4}$ inch to a maximum of $\frac{1}{2}$ inch thick.
4. Seal around and underneath all castings with mortar.
5. Clean all excess mortar from the structure, wiping the inner surfaces of the units clean and smooth.

F. Engineered Polymer Rings

1. Flat and/or sloped adjustment rings shall be added or removed as needed to achieve finished grade. No shims will be allowed.
2. A minimum of two rings shall be used to make the adjustment.

G. The exterior of all adjustment units shall be wrapped with geotextile fabric except for adjustment units on sanitary sewer manholes, which shall be wrapped with an exterior chimney seal.

H. Total allowable ring offset at all structures shall be 2-inch maximum.

3.03 Adjust Valve Boxes

- A. The raised valve box shall not be exposed to traffic for more than 14 days. The raised valve box must be ramped with bituminous pavement if traffic is allowed in the same lane as the raised valve box. This cost shall be included in the price for adjustment.
- B. Valve boxes shall be adjusted by screwing the top section up or down to the finish surface elevation.
- C. Any material deposited in the valve box must be removed.

3.04 Replace Casting

- A. If the casting being replaced is for a sanitary sewer manhole, an external chimney seal must be installed if one is not present. Chimney seal shall be installed and paid for as specified in Section 2300 – Sanitary Sewer.

PART 4 – MEASUREMENT AND PAYMENT

- A. The cost to adjust castings and valve boxes for new structures shall be included in the price of that structure.
- B. Adjust Casting: Item shall be paid for by each (EA). The item shall include all labor, equipment and materials to complete the work for removal and salvaging of existing casting, adjustment units, adhesion material, wrapping materials and resetting of casting to finish grade. Each adjustment will only be paid for once, regardless of the number of pavement lifts or sequencing.
- C. Replace Casting: Item shall be paid for by each (EA). The item will include all labor and materials required to Adjust Casting as specified in Section 1700 of the Standard Specifications. Repair Casting shall also include providing and installing a new casting/frame and cover/grate, in accordance with the contract documents, as well as salvaging the existing casting, lid, or grate and delivering to location designated by City of Minot representative.
- D. Adjust Valve Box: Item shall be paid for by each (EA). Item shall include all labor, equipment and materials to complete adjustment of the valve box including any excavations necessary for adjustment. Each adjustment will only be paid for once, regardless of the number of pavement lifts or sequencing.
- E. Replace Valve Box Top Section: Item shall be paid for by each (EA). The item will include all labor and materials required to replace the top section of the gate valve box up to 3 feet in depth. This item shall include excavation, new class 5 aggregate, and compaction. Pavement patching will be paid separately.
- F. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 1800 – EXCAVATION AND EMBANKMENT

EXCAVATION AND EMBANKMENT

PART 1 – GENERAL

1.01 Section Summary

- A. This section includes excavation, haul, placement, disposal, backfilling, and compaction of embankment materials.
- B. General excavation of ponds, channels, and other areas.

1.02 Related Sections

- A. Section 1100 – Mobilization, Temporary Facilities and Controls
- B. Section 1500 – Removals
- C. Section 1600 – Project Site Clearing
- D. Section 1900 – Subgrade Preparation
- E. Section 2000 – Trench Excavation and Backfill

1.03 References

- A. American Society of Testing and Materials (ASTM):
 - 1. D698 – Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
 - 2. D2487 – Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- B. North Dakota Department of Transportation “Standard Specification for Road and Bridge Construction” Current Edition, As Revised.
 - 1. Section 203 – Excavation and Embankment

1.04 Submittals

- A. Gradation test results
- B. Compaction test results

1.05 Definitions

- A. Common Excavation: All excavations not otherwise classified.

- B. Muck Excavation: Excavation and disposal of saturated mixtures of soils and organic matter that are unsuitable for use as embankment material.
- C. Borrow Excavation: Excavation, haul, placement, and compaction of embankment material obtained from locations off the project site.
- D. Subgrade: Top of the surface underneath the aggregate base layer or, if present, the subbase layer.
- E. Backfill: Soil material used to backfill excavations and to backfill excavated spaces adjacent to foundation walls, building walls, retaining walls, head walls, and abutments.

PART 2 – PRODUCTS

2.01 Soil Materials

- A. Embankment and Fill
 - 1. Soil material placed to raise the subgrade or natural grade of the site.
 - 2. Shall be compactable, free of organic materials, frozen clumps, and rocks larger than 4 inches in any dimension.
- B. Impervious Fill
 - 1. Shall be cohesive soil consisting of material classified by ASTM D2487 as CL or CH.
 - 2. Gradation shall not have less than 40 percent by weight passing the No. 200 sieve.
 - 3. The liquid limit shall be greater than 25 percent.
 - 4. The plasticity index shall be greater than 10 percent.
 - 5. Shall be free of ice, snow, frozen earth, trash, debris, sod, roots, organic matter including silts which are unstable, inorganic materials too wet to be stable, or stones larger than 3 inches in any dimension.
- C. Granular Borrow: Any pit-run or crusher-run material that is graded from coarse to fine such that the portion passing the #200 sieve divided by the portion passing the 1-inch sieve may not exceed 10 percent by mass.
- D. Topsoil – Imported: Shall conform to Section 203.04.D.3 of the NDDOT Specification.

PART 3 – EXECUTION

3.01 General

- A. In addition to the following, conform to Section 203.04 of the NDDOT Specification.
- B. Contractor shall be responsible for locating all utilities and coordinating all utility relocations due to construction.
- C. Before any construction activities begin; erosion control must be in place.
- D. Strip and stockpile (salvage) all topsoil to be used for restoration purposes.
- E. Prior to placement of the embankment material, the site must be reviewed by the Engineer.
- F. Material excavated from any part of the project, if used as fill on the project, shall be paid for only under excavation bid items and not as "fill".

3.02 Excavation

- A. Perform excavations to line, grade, cross section, and contours as detailed in the Plans or as directed by the Engineer.
- B. If unsuitable materials are discovered, these materials shall be excavated and removed at the direction of the Engineer. If the Contractor proceeds without the direction of the Engineer, all work and material to restore the subgrade to the proper grade will be at the Contractor's expense.
- C. Protect the subgrade from weather events. Provide drainage away from the excavation to prevent washouts and damage to the subgrade.
- D. Remove all rocks that measure more than 4-inches in any dimension that are encountered during the course of the work within 12 inches below the subgrade.

3.03 Excess Excavation

- A. Suitable material shall be used as backfill unless directed otherwise by the Engineer.
- B. Any excess remaining after backfilling shall become the property of the Contractor and shall be disposed of away from the work site at such locations and in such a manner as the Engineer may direct.
- C. On projects where the City retains ownership of the excess material at a site designated on the Plans or otherwise, the Contractor shall stockpile the material and shape it to a drainable, mowable stockpile.

3.04 Compacting Embankments

- A. Place soil in layers not to exceed 6 inches. Place layers evenly to provide for uniform compaction.
- B. All embankments shall be compacted by specified density method:
 - 1. Under areas with proposed paved or structural improvements: 100% Standard Proctor from the proposed pavement subgrade elevation down 1 foot.
 - 2. 95% Standard Proctor from the bottom of the excavation up to 1 foot below the subgrade elevation. Moisture content shall be within $\pm$ 3% of optimum.
 - 3. 95% Standard Proctor for areas with no paved or structural improvements. Moisture content shall be within $\pm$ 3% of optimum.

3.05 Topsoil

- A. In addition to the following, conform to Section 203.04.D.2 of the NDDOT Specification.
- B. Place topsoil in all areas where turf will be established to provide soil capable of supporting grass growth.
- C. Place topsoil to specified thicknesses and to achieve positive drainage, 4-inch minimum thickness.
- D. Topsoil shall be graded to drain then moderately compacted by use of a soil-roller or other Engineer-approved method.
- E. Irregularities or low spots shall be corrected by the Contractor at its expense.
- F. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to the grading operations or proposed plantings.

3.06 Field Quality Control

- A. The minimum amount of testing must be completed as detailed in Section 1000 – Quality Requirements.
 - 1. City Projects
 - a. The City will engage the services of a qualified independent testing laboratory to perform geotechnical testing.

- b. The Contractor shall coordinate, schedule, and assist the testing agency in performing field tests.
- 2. Non-City Projects
 - a. The Contractor shall engage the services of a qualified independent testing laboratory to perform geotechnical testing.
 - b. The Contractor shall coordinate, schedule, and assist the testing agency in performing field tests.
- B. Failing Tests
 - 1. Failing tests will not be counted as part of the required testing.
 - 2. Retests shall be taken at the same location as the failing test.
 - 3. For each failing test, Contractor shall correct the deficiencies at its expense until a subsequent test confirms that the specifications have been met.
 - 4. The extent and quantity of material represented by the failing test shall be determined by the Engineer up to the quantity represented by the specified testing frequency.
 - 5. The Contractor may order additional testing to delineate the extent of non-conformance. Such additional testing shall be at the Contractor's expense.
- C. Before placement of subsequent materials, subgrade will be checked by the Engineer.
 - 1. A tolerance of 0.04 feet above or below the specified subgrade elevation will be allowed.

PART 4 – MEASUREMENT AND PAYMENT

- A. Common Excavation: By cubic yard (CY) excavated and shall include all costs to excavate, load, haul, place and compact materials excavated on the project, and dispose of excess materials, including stockpiling when specified. The Engineer will compute the volume by comparing the preconstruction surface after topsoil stripping with the post-construction surface prior to topsoil placement.

- B. Muck Excavation: By cubic yard (CY) excavated and shall include all costs to excavate, load, haul, and dispose of materials. The Engineer will cross section the original and final-cut surfaces and the average end area will be used to compute the volume excavated.
- C. Common Borrow: By cubic yard (CY) compacted and shall include all costs to excavate, load, haul, place, and compact the materials. The Engineer will cross section the material prior to any borrow excavation and again after borrow excavation has occurred, and the average end area will be used to compute the volume excavated.
- D. Impervious Fill: By cubic yard (CY) compacted and shall include all costs to excavate, load, haul, place, and compact the materials. The Engineer will cross section the area of placement prior to and after placement of Impervious Fill, and the average end area will be used to compute the volume placed.
- E. Granular Borrow: By cubic yard (CY) excavated and shall include all costs to excavate, load, haul, place, and compact the materials. The Engineer will cross section the original material prior to any borrow excavation and again after borrow excavation has occurred, and the average end area will be used to compute the volume excavated.
- F. Topsoil: All costs for stripping and re-spreading topsoil shall be included in the price bid for other items.
- G. Topsoil – Import: By cubic yard (CY) at plan quantity and shall include all costs to excavate, load, haul, place and compact the materials. The Engineer will adjust the plan quantity only to reflect changes to the plan, should they occur during construction.
- H. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 1900 – SUBGRADE PREPARATION

SUBGRADE PREPARATION

PART 1 – GENERAL

1.01 Section Summary

- A. This work consists of scarifying, shaping, compacting, and maintaining the subgrade, or reshaping an existing roadway before constructing a base or surface course.

1.02 Related Sections

- A. Section 1800 – Excavation and Embankment

1.03 References

- A. North Dakota Department of Transportation “Standard Specification for Road and Bridge Construction” Current Edition, As Revised.
 - 1. Section 230 – Reshaping Roadway and Subgrade Preparation
 - 2. Section 709 – Geosynthetics
 - 3. Section 858 – Geosynthetics

1.04 Submittals

- A. Geosynthetic Material Certification

PART 2 – PRODUCTS

2.01 Geosynthetic Material

- A. Conform to NDDOT Specification Sections 858.01 Type R1 woven.

PART 3 – EXECUTION

3.01 General

- A. Conform to NDDOT Specification Section 230.04.D except as modified herein:
 - 1. Subgrade elevations shall not vary by more than 0.04 feet from the prescribed elevation.

2. Scarification of subgrade must be approved by the Engineer before beginning the work. If the subgrade is unstable due to excessive moisture content, the subgrade shall be scarified and dried over a reasonable time period. When the material has been dried, it shall be returned to the roadbed and compacted to proper elevation and once again be test rolled. If the material continues to be unstable, the Engineer may authorize removal of the material as Muck Excavation.

3.02 Compaction of Subgrade

- A. Compact to 100% of Standard Proctor density from the proposed subgrade elevation down 1 foot.

3.03 Field Quality Control

- A. Subgrade will be checked by the Engineer after grading operations but before placement of geosynthetic or aggregate material, as applicable.
 1. Subgrade shall be test rolled using a tandem-axle truck with a gross weight of 45,000 pounds. The Contractor shall provide evidence of its weight. The test must be witness by the Engineer. A failing test will be indicated by yielding and rutting of 1 inch or greater.
 2. Subgrade shall be constructed to specified elevations within a tolerance of 0.04 feet at any point checked.

3.04 Geosynthetic Material Installation

- A. Conform to NDDOT Specification Section 709.04 except as modified herein:
 1. Install over the subgrade to 1-foot behind the curb or as otherwise specified.
 2. Overlap a minimum of 30 inches in the same direction as the aggregate will be spread.
 3. Metal pins will be allowed in lieu of stitching.
 4. Spread the first lift of aggregate in the same direction as any geosynthetic material overlap to a minimum thickness of 8 inches.

PART 4 – MEASUREMENT AND PAYMENT

- A. 12 inch Subgrade Preparation: Shall be measured by the square yard (SY) along the centerline of the road for the width of the roadway 1 foot behind each curb line.
- B. Muck Excavation: Shall be measured and paid for in accordance with Section 1800 – Excavation and Embankment.
- C. Geosynthetic Material: By square yard (SY) of ground coverage without regard to overlap, and shall include all labor, materials, equipment, and delivery costs.
- D. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 2000 – TRENCH EXCAVATION AND BACKFILL

TRENCH EXCAVATION AND BACKFILL

PART 1 – GENERAL

1.01 Section Summary

- A. Trenching, backfilling, and compacting of underground infrastructure.

1.02 Related Sections

- A. Section 1100 – Mobilization, Temporary Facilities and Controls
- B. Section 1600 – Project Site Clearing
- C. Section 1800 – Excavation and Embankment

1.03 References

- A. North Dakota Department of Transportation "Standard Specification for Road and Bridge Construction" Current Edition, As Revised.

1.04 Submittals

- A. Gradation of each granular borrow material.
- B. Compaction test results.

1.05 Definitions

- A. Bedding Material: Soil material surrounding the pipe that provide structural support and secures the pipe true to line and grade.
- B. Pipe Foundation: Soil material below the pipe that provides support.
- C. Pipe Foundation Fill: Material used when unstable materials are encountered and added pipe support is needed.
- D. Pipe Zone: The area of the trench measured from 1 foot above the pipe to the bottom of the excavation.
- E. Sand Cushion: Aggregate bedding used around the pipe in the trench.

1.06 Correction Period

- A. Any trench settlements that occur during the Correction Period equal to or greater than 1/2" as measured by an 8' straight edge shall be repaired in a manner acceptable to the Owner at the expense of the Contractor.

PART 2 – PRODUCTS

2.01 Pipe Bedding Material

A. Bedding material shall be screened, pit run, or crusher run sand.

1. No onsite granular material may be used for bedding.

2.02 Pipe Foundation Fill

A. Conform to NDDOT Spec 816.02 Class 5 Aggregate or crushed concrete.

1. No onsite granular material may be used for improved pipe foundation.

2. Crushed concrete shall have no foreign objects nor chunks larger than 1-inch in diameter.

2.03 Trench Backfill Material

A. Suitable excavated materials from trench excavation, or other suitable onsite material shall be used.

B. Material shall be free from organic materials, frozen clumps, large rocks, concrete and bituminous chunks, rubbish, and other materials deemed unsuitable.

C. Questionable materials shall be reviewed by the Engineer before backfilling shall begin. The Contractor shall proceed at its own risk if the Engineer was not consulted.

PART 3 – EXECUTION

3.01 Existing Utilities

A. The Contractor shall locate and protect all utilities that interfere with trench excavation. In the event the utility cannot be protected adequately, the Contractor shall work directly with the utility owner to schedule any outages and shall be required to remove and restore the utility.

B. The inverts of existing utilities shall be protected during construction. The Contractor is responsible for inspecting and cleaning, if necessary, all lines which have been compromised by construction activities.

C. Backfill and compact around all existing utilities to 100 percent Standard Proctor density (AASHTO T 99) in lifts not to exceed 6 inches.

D. Report and repair damage to utilities prior to backfill operations.

3.02 Trench Construction

- A. Strip and stockpile all topsoil in areas of excavation.
- B. Construct trench to line and grade shown on the drawings or as directed by the Engineer.
- C. Excavate to a depth 6 inches below the bottom of the pipe to allow for bedding materials to be placed.
- D. Dewatering shall be in accordance with Section 1100 – Mobilization, Temporary Facilities and Controls
- E. Apply bedding materials in 6-inch lifts and compact to 95 percent Standard Proctor density (AASHTO T 99) or as recommend by the pipe manufacturer, whichever is denser. Where CLSM is used as bedding material, no compaction is necessary.
- F. Where CLSM is used as bedding material, support the pipe to allow for 6" of CLSM below the pipe.
- G. Remove any bedding and/or backfill material that enters the pipe.
- H. Check line and grade of pipe for conformance to the drawings. Correct any deficiencies.

3.03 Trench Backfill

- A. Backfill around all manholes, catch basins, valve boxes, curb boxes, and hydrants with granular bedding material and compact with hand operated motorized compactors. The maximum lift thickness shall be 6 inches.
- B. Flexible Pipe Materials
 - 1. Pipe shall be bedded and backfilled with Pipe Bedding Material to an elevation 12 inches above the pipe the full width of the trench. Bedding shall be compacted to 95 percent Standard Proctor density (AASHTO T 99). The maximum lift thickness shall be 6 inches.
- C. Rigid Pipe Materials
 - 1. In ordinary trench conditions, granular bedding shall be used to the haunch line and compacted to 95% Standard Proctor density (AASHTO T 99).

- D. All trench backfilling operations shall use Trench Backfill Material and shall be compacted to 95% Standard Proctor density (AASHTO T 99) at $\pm$ 3% optimum moisture content except the top 1 foot below the subgrade elevation which shall be compacted to 100 percent Standard Proctor density (AASHTO T 99) at $\pm$ 3% optimum moisture content.
- E. If in the Engineer's opinion, the onsite material cannot be compacted to specification or is deemed otherwise unsuitable, the Contractor shall remove it as Muck Excavation and shall import suitable backfill.

3.04 Respread Topsoil

- A. Stripped topsoil shall be respread in accordance with Section 1800 – Excavation and Embankment.

3.05 Field Quality Control

- A. Density tests shall be taken as specified in Section 1000 – Quality Requirements. The Engineer may determine that additional tests should be taken and their locations. The Contractor shall assist the Engineer in conducting the tests.
- B. All failing tests shall be excavated and re-compacted until the density and moisture content requirements are met.

PART 4 – MEASUREMENT AND PAYMENT

- A. Trench Excavation: Excavation and backfill of trench and pipe bedding shall be included in the price of pipe installed.
- B. Pipe Foundation Fill: Shall be paid for by linear foot (LF) 6 inches deep below the pipe bedding. Payment shall include geosynthetic material. The required overlap and sewing of the joint shall be incidental.
 - 1. For example, if a 2-foot thickness of foundation fill is required below the pipe bedding, the payment would be for 4 – 6 inch lifts multiplied by the lineal foot of pipe installed requiring the foundation fill below the normal pipe bedding material.
 - 2. No payment will be made unless directed by the Engineer.
 - 3. No payment will be made for rock used for dewatering purposes unless specified.
- C. Muck Excavation: Shall be measured and paid for in accordance with Section 1800 – Excavation and Embankment.

- D. Imported Backfill: Shall be measured either by cubic yard (CY) compacted or ton (TN) of material placed as determined by weight tickets and haul sheets delivered to the Engineer. Payment shall include all labor and costs to excavate, load, haul, and place, and compact the materials. For CY measurements, the Engineer will cross section the original and final-cut surfaces and the average end area will be used to compute the volume excavated. No compensation will be provided for material brought to the site without prior approval by the Engineer.
- E. Temporary Bracing or Sheet piling: Considered part of excavation costs and no extra payment shall be provided.
- F. Dewatering: Shall be considered incidental to the size and type of pipe installed unless a bid item is provided.
- G. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 2100 – WATER MAIN

WATER MAIN

PART 1 – GENERAL

1.01 Section Summary

- A. This section includes product and installation requirements for water main pipe, gate valves, hydrants, fittings, and miscellaneous items.

1.02 Related Sections

- A. Section 600 – Project Testing Requirements
- B. Section 1100 – Temporary Facilities and Controls
- C. Section 1700 – Adjustment of Structures
- D. Section 1800 – Excavation and Embankment
- E. Section 2000 – Trench Excavation and Backfill

1.03 References

- A. American Water Works Association (AWWA):
 - 1. C104/A21.4 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - 2. C105/A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - 3. C110/A21.10 – Ductile Iron and Gray Iron Fittings, 3-inch through 48-inch for Water and Other Liquids.
 - 4. C111/A21.11 – Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
 - 5. C116/A21.16 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.
 - 6. C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast.
 - 7. C153/A21.53 – Ductile-Iron Compact Fittings, 3-inch through 64-inch.
 - 8. C219 – Bolted, Sleeve-Type Couplings for Plain-End Pipe

9. C228 – Stainless Steel Pipe Flange Joints for Water Service – sizes 2 inch through 72 inch.
 10. C502 – Dry-Barrel Fire Hydrants.
 11. C504 – Rubber-Seated Butterfly Valves.
 12. C508 – Swing-Check Valves or Waterworks Service, 2-inch Through 48-inch.
 13. C515 – Reduced-Wall Resilient-Seated Gate Valves for Water Supply Service.
 14. C512 – Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
 15. C550 – Protective Interior Coatings for Valves and Hydrants.
 16. C600 – Installation of Ductile-Iron Mains and Their Appurtenances.
 17. C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
 18. C651 – Disinfecting Water Mains.
 19. C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-inch Through 60-inch.
- B. American Society of Testing and Materials (ASTM):
1. A48 – Gray Iron Castings
 2. A126 – Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 3. B170 – Oxygen-Free Electrolytic Copper – Refinery Shapes
 4. B869 – Copper-Clad Steel Electrical Conductor for CATV Drop Wire
 5. C578 – Rigid, Cellular Polystyrene Thermal Insulation
 6. D1238 – Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
 7. D1784 – Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
 8. D3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

9. F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- C. National Sanitation Foundation (NSF):
 1. 60 – Drinking Water Treatment Chemicals – Health Effects
 2. 61 – Drinking Water System Components – Health Effects
 3. All products (treatment chemicals and materials) that may come into contact with water intended for use in a public water system shall meet National Sanitation Foundation (NSF) International Standards / American National Standards Institute (ANSI) 60 and 61, as appropriate. A product will be considered as meeting these standards if so certified by NSF, the Underwriters Laboratories, or other organizations accredited by ANSI to test and certify such products.

1.04 Sequencing and Scheduling

- A. Notify the City of Minot Public Works Department and City Engineer at least 48 hours before water service is interrupted.
- B. Notify all property owners effected by water service interruption 48 hours in advance.
- C. The City of Minot must open and close all valves under live city pressure. The Contractor shall coordinate all water main flushing with the Engineer and Public Works personnel at least 24 hours in advance of planned flushing.
 1. The Contractor is responsible for erosion control and restoration from flushing activities. Superchlorinated water shall be discharged in accordance with all applicable laws and regulations.

1.05 Submittals

- A. Submit all shop drawings and manufacturers' information in accordance with the Conditions of the Contract.

PART 2 – PRODUCTS

2.01 Polyvinyl Chloride Pipe (PVC)

- A. Pipe sizes 4 inch through 60 inch conform to AWWA C900 or as specified by the Engineer.
 1. Minimum water main pipe size is 8 inch. All hydrant leads shall be 6 inch.
- B. All sizes are Cast-Iron Pipe O.D.

- C. Pipe shall be manufactured to cell classification 12454 as defined in ASTM D1784 and in accordance with the latest revision of AWWA C900.
- D. All pipes shall be DR-18, 235 psi pressure class.

2.02 Ductile Iron Pipe (DIP):

- A. All Ductile Iron Pipe shall conform to AWWA C151/A21.51.
- B. Cement-mortar lining shall conform to AWWA C104/A21.4.
- C. Pipe Class:
 - 1. Class 52: diameters less than 20 inches.
 - 2. Class 51: diameter greater than and equal to 20 inches.
- D. Wrap all pipe with pipe encasement material, minimum 8 mil thickness.
- E. Ductile Iron Pipe shall only be allowed if design conditions warrant or if approved by the Engineer.

2.03 Fittings

- A. All fittings shall conform to AWWA C153/A21.53 and AWWA C111/A21.11 latest revisions and shall be mechanical joint.
- B. All fittings shall be Ductile Iron with 250 psi working pressure.
- C. All fittings shall be cement mortar lined on the interior and bituminous coated on the exterior. Cement lining shall conform to AWWA C104/A21.4.
- D. Wrap all fittings with a minimum of 8 mil polyethylene pipe encasement material.
- E. Nuts and T-bolts for mechanical joint fittings shall be 304 Stainless Steel suited for underground use

2.04 Hydrants

- A. Hydrants shall conform to AWWA C502
- B. Waterous Pacer WB67-250 or American Darling B-62-B-5.
- C. Two 2-1/2-inch hose nozzles and One 4-1/2-inch pumper nozzle. Nozzle caps shall be attached with metal chains. Pumper nozzle shall face the street.

- D. Nozzle threads shall be:
 - 1. 2 ½" hose nozzles: Thread number 6038.
 - 2. 4 ½" pumper nozzle: Thread number 80430.
- E. Hydrant caps shall be 1-5/16-inch pentagon style.
- F. Hydrant shall be 9-foot bury. Upper standpipe section shall be 22 inches; nozzles must be at least 31 inches from ground level.
- G. Minimum opening of 5-1/4 inches for 6-inch water lines, 6-inch mechanical joint pipe connection.
- H. Working pressure of 250 psi and tested up to 500 psi.
- I. Fiberglass Flag: Hydrafinder Hydrant Marker or approved equal.
 - 1. White fiberglass rod, with 4 red reflective bands without a bulb end. Attached to top bolt.
 - 2. 54 inches long, 3/8-inch diameter.
- J. Break-off flange with breakable rod.
- K. All bolts, nuts, and hardware shall be stainless steel.
- L. Hydrants shall be restrained with thrust blocks and approved Mechanical Joint Restraints or tie rods.
- M. Standpipe above traffic flange shall be painted traffic yellow, the bonnet and caps shall be painted red.

2.05 Gate Valve and Box

- A. All valves under 18 inches in diameter shall be gate valves conforming to AWWA C515 manufactured by American Flow Control or Mueller Co.
- B. Stainless Steel or Bronze stemmed, ductile iron body valves.
 - 1. Minimum working pressure of 250 psi.
- C. O-ring seals.
- D. All surfaces shall be fusion-bonded epoxy coated conforming to AWWA C550.
- E. Stainless steel hardware.

- F. Standard 2-inch operating nut.
- G. All Gate Valves shall open counterclockwise
- H. Mechanical joint ends conforming to AWWA C111/A21.11.
- I. Gate valves and valve boxes shall be wrapped in polyethylene pipe encasement material.
- J. Boxes shall be 3-piece cast iron, screw type, Tyler No. 6860 or approved equal.
- K. Adjustment for 8'-6" of cover.
- L. Each box shall include a 2" steel adjusting ring below the cover when located in asphalt.
- M. Drop style covers, with "WATER" on the top.
- N. Gate Valve Adaptor by Adaptor, Inc. or approved equal.

2.06 Butterfly Valve

- A. All valves 18 inches in diameter and larger shall be butterfly valves conforming to AWWA C504 manufactured by American Flow Control or Mueller Co.
- B. Conform to AWWA C504, Class 150B valve shaft diameter, resilient seated.
- C. All surfaces shall be fusion-bonded epoxy coated conforming to AWWA C550.
- D. Valve Body: Class 150B valve bodies shall be ASTM A126, Class B gray cast iron or ASTM A536 Grade 65-45-12 ductile iron.
 - 1. Minimum working pressure of 250 psi.
- E. Valve Disk: Shall be constructed of ductile iron ASTM A536 with 316 stainless steel disc edge, seated to provide 360° continuous uninterrupted seating surface.
- F. Operator: Shall be traveling nut type sealed, gasketed, and lubricated for underground service.
- G. All hardware shall be stainless steel.
- H. Test plug shall be brass.
- I. Standard 2-inch operating nut.

- J. Mechanical joint ends conforming to AWWA C111/A21.11.
- K. Butterfly valves shall not be direct-bury, but shall be installed inside a concrete manhole.
- L. Manhole and casting per Section 2300 – Sanitary Sewer except lid shall be marked "WATER".

2.07 Joint Restraint

A. Mechanical Joint Restraints:

- 1. All mechanical joint fittings shall have joint restraints, except where joining to cast iron pipe.
- 2. All restraints shall be epoxy-coated ductile iron, EBAA Iron MEGALUG, ROMAC GripRing, or approved equal.
- 3. Working pressure must be at least 250 psi.
- 4. All mechanical joint restraints must be wrapped with polyethylene pipe encasement materials.

B. Tie Rods: Shall be stainless steel.

2.08 Polyethylene Pipe Encasement

- A. Shall conform to AWWA C105/A21.5, Black in color, 8 mil thick, tube form.

2.09 Insulation

A. Conform to ASTM C578 Type X.

- 1. Minimum total thickness shall be 4 inches, with no individual insulation board less than 2 inches thick.

2.10 Tracer Wire

- A. Wire shall be blue in color and conform to the following:
 - 1. Direct bury: Solid 12 awg fully annealed carbon-steel conductor, copper-clad, with minimum 450 lb. break load rating, insulated with minimum 30 mil thick HDPE insulation.
 - 2. Boring/Directional Drilling: Solid 12 awg hard drawn high carbon-steel conductor, copper-clad, with minimum 1,150 lb. break load rating, insulated with minimum 45 mil thick HDPE insulation.
 - 3. Pipe Bursting/Slip-Lining: 7 x 7 stranded hard drawn high carbon-steel conductor, copper-clad, with minimum 4,700 lb. break load rating, insulated with minimum 50 mil thick HDPE insulation.
- B. Wire shall be identified by markings on its surface indicating manufacturer's identification, conductor size, and other appropriate information.
- C. In-line splices shall be made with DryConn Direct Bury Lug Aqua, Copperhead SnakeBite Locking Connector, or approved equal. Wire nut splices are not allowed.
- D. Access points shall be blue in color, be manufactured by Copperhead Industries, and conform to the following:
 - 1. Terminations at hydrants: Cobra T3 Test Station access point with Hydrant Flange, part # T3-*FLPKG-5/8 for hydrants with 5/8-inch bolts or T3-*FLPKG-3/4 for hydrants with 3/4-inch bolts (where * equals B for BLUE) with 3/4-inch schedule 40 PVC conduit below the test station to protect the wire from weed whips, mowers, etc.
 - 2. Terminations in non-paved areas: At-grade SnakePit Lite Duty Adjustable Access Point with Two-Terminal Switchable Lid, part # LD14*2T-ADJ-SW where * equals B for BLUE.
- E. Ground Rods
 - 1. Drive in Magnesium Ground Rod: Part # ANO-12 (1.5 lb) or approved equal.
- F. Marker Posts
 - 1. TriView Plus by Rhino Markers and Protection Systems, blue in color, 66 inches long, with custom decal reading "City of Minot Public Works Utility Locating Station".

2.11 Marking Tape

- A. Non-detectable or detectable polyethylene, min. 4.5 mil thickness.
- B. Blue in color, marked continuously "CAUTION BURIED WATER LINE BELOW".

2.12 Tapping Gate Valve & Sleeve

- A. Tapping Sleeve Assembly:
 - 1. Comply with MSS SP-60.
 - 2. Include sleeve and valve compatible with drilling machine.
 - 3. Stainless steel, two-piece bolted sleeve with mechanical joint adapter outlet for new branch connection. Adapter gasket shall be type Buna N per ASTM D2000. Include sleeve matching size and type of pipe material being tapped and with recessed flange in accordance with AWWA C228 for branch valve. Sleeve assembly shall be equipped with a standard square head $\frac{3}{4}$ " stainless steel test plug for pressure testing. Entire assembly shall be stainless steel.
- B. Approved Manufacturers:
 - 1. Romac Industries
 - 2. Power Seal – Pipeline Products Corp.
 - 3. Ford
- C. Tapping Gate Valves:
 - 1. Conform to 2.05 – Gate Valve and Box of this Specification Section.

2.13 Check Valves

- A. Conform to AWWA C508.
- B. American Flow Control Series 2100 or approved equal.
 - 1. Minimum working pressure of 250 psi.
- C. Resilient seated with optional back-flushing actuator.
- D. Conform to AWWA C116 and C550 for fusion-bonded epoxy coatings.
- E. All hardware shall be stainless steel.
- F. All valves shall have a mechanical indicator.

2.14 Water Meters and Meter Pits

- A. All meters shall be manufactured by Sensus and installed with a check valve.
- B. All meters shall be installed in pits having solid concrete floors and deep enough to provide at least 8.5 feet of cover over the water line.
 - 1. Meters on lines up to 4 inches in diameter shall be installed inside a standard 84-inch diameter precast concrete manhole.
 - 2. Meters on larger lines shall be installed inside meter pits designed for the application by a licensed engineer.

2.15 Transition Couplings

- A. Conform to AWWA C219.
- B. Manufacturers
 - 1. Hymax Grip by Krausz, Macro HP or Alpha by Romac.

PART 3 – EXECUTION

3.01 Pipe Installation

- A. Pipe Handling
 - 1. All pipe shall be tarped for transportation to the site, any and all pipe arriving not tarped will be rejected at no expense to the owner.
 - 2. All pipe shall be new, unused, and clean.
 - 3. All pipe cutting shall be according to manufacturer's instructions.
 - 4. Pipe shall be lowered in place by appropriate rigging and in a manner not to damage the pipe.
- B. Trench Excavation and Backfill
 - 1. Conform to Section 2000 – Trench Excavation and Backfill.
- C. Granular Pipe Bedding
 - 1. Granular pipe bedding must be used and shall be in accordance with Section 2000 – Trench Excavation and Backfill.

D. Pipe Laying

1. Lay pipe in accordance with manufacturer's recommendations. No pipe shall be laid in water or unstable trench conditions.
2. Pipe shall be laid true to location, line, and grade. No deviation is allowed unless specifically approved by the Engineer. All water main shall have a minimum of 8'-6" of cover.
3. The Contractor must protect its work at all times; no damage to the pipe is acceptable and no groundwater or debris shall be allowed to enter the pipe.
4. Install polyethylene pipe encasement material on all ductile iron pipe per AWWA C-105, Method A.
5. Install tracer wire on pipe as specified in Section 2100 - 3.06 Tracer Wire. Any pipe installed without tracer wire will not be accepted. Pipe with tracer wire that was not installed as specified in the aforementioned section will also not be accepted.

E. Underground Piping for Fire Protection

1. Contact the Minot Fire Department (701-857-4740) with any questions or to witness installation, testing, or flushing of the fire protection system.

3.02 Fittings

- A. Fittings shall be secured to pipe using restrained mechanical joints conforming to AWWA C600.
- B. All fittings shall be installed with the appropriate restrained joints and with the appropriate thrust blocks which are poured or set against undisturbed earth.
- C. Encase all fittings in polyethylene pipe encasement, overlapping the polyethylene pipe encasement on adjacent pipes by at least 12 inches.

3.03 Hydrants

- A. Set on 15-inch square solid concrete blocks stacked at least 8-inches thick.
- B. Use mechanical joint restraints or stainless-steel rods on all joints to secure hydrant lead back to the main. If using rods, the hydrant shall be restrained to the valve and the valve shall be separately restrained to the tee.

- C. Encase hydrant base with no less than one cubic yard of 3/4 inch to 1-1/2-inch washed rock. Ensure weep holes are surrounded by rock. Place 2 layers of polyethylene, minimum of 8 mil, or separation fabric, over the rock to prevent the voids from filling with sediment.
- D. Encase hydrant barrel and base in polyethylene pipe encasement.
- E. Hydrant must be installed plumb; no deviation is allowed.
- F. Attached fiberglass flag to the top of the hydrant using a flange bolt.
- G. Deliver to the Superintendent of Water and Sewer an extra hydrant flag for each new hydrant installed.
- H. Install tracer wire per Section 2100-3.06 Tracer Wire.
- I. Maximum fire hydrant spacing shall be 400 feet.

3.04 Valves and Boxes

- A. Set each valve up to 12-inches in diameter on 15-inch square solid concrete blocks stacked at least 8-inches thick. Set each larger valve on a concrete slab designed for the application by a licensed engineer.
- B. Valves and boxes shall be set plumb. Using approved valve box adaptor, the operating nut must be in the center of the box.
- C. Top of boxes shall be set, including the 2" steel adjusting ring, 1/4 to 3/8 inch below finish grade. Valve boxes shall be installed so as to have 1 foot of adjustment remaining.
- D. Valves shall be restrained with mechanical joint restraints.
- E. Encase valves and boxes in polyethylene pipe encasement.

3.05 Joint Restraint

- A. All valves and hydrants shall be restrained per this Section 2100-3.
- B. All dead-end lines shall be secured back at least 2 joints including the plug with steel tie rods or mechanical joint restraints. The number of tie rods required depends on water main size as follows:

Pipe Size	Number of ¾ Inch Rods
6 Inch	2 each
8 Inch	2 each
12 Inch	4 each

16 Inch	6 each
18 Inch	6 each
20 Inch	8 each
24 Inch	10 each

3.06 Tracer Wire

- A. Install along the top of the pipe between the 10 o'clock and 2 o'clock positions.
- B. Fasten to the main every five to eight feet with tape.
- C. Splices shall not occur more frequently than one per 800 LF of pipe and shall be made using approved splice kits.
- D. Tracer wire shall be terminated at each hydrant. The tracer wire shall be routed along the hydrant lead, up the side of the hydrant, through the protective conduit, and securely fastened to the test station attached to the breakoff flange. The length of protective conduit shall be sufficient to extend at least 6 inches below finished grade. Ground wire shall be connected to the center terminal.
- E. Where indicated on the plans, tracer wire access point boxes shall be installed per manufacturer's recommendations, in no case more than 1,000 feet between access points. Access point boxes shall not be placed in roadways and may only be placed in sidewalks/driveways with permission from the City Engineer.

Mark each at-grade tracer wire access point with a Marker Post placed within 6 inches of the access point on the side farthest away from the right-of-way or easement centerline.

- F. Tracer wire must be properly grounded at all terminations.

Grounding of tracer wire shall be achieved by driving in the magnesium grounding rod at the same elevation as the pipe.

When grounding the tracer wire at an access point, the grounding rod shall be installed in a direction 180 degrees opposite of the vertical tracer wire to create the maximum possible distance between the wire termination and the end of the grounding rod.

Where the grounding rod wire will be connected to a tracer wire access point, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.

- G. The Contractor shall periodically ensure tracer wire conductivity during construction. Upon completion of the project, the Contractor shall perform an acceptance test of all tracer wire in accordance with Section 1000 and the requirements herein.

3.07 Insulation

- A. Insulation shall be installed where shown on the Plans or as directed by the Engineer such that butt-joints of insulation layers are staggered by at least 18 inches.
- B. Insulation shall be installed when water main comes within 2.5 feet of storm sewer smaller than 24-inch, within 5 feet of 24-inch and larger storm sewer, or when the pipe is less than 6.5 feet deep.
- C. Insulation shall have a 6-inch sand cushion above and below the board.

3.08 Marking Tape

- A. Tape shall be installed 18 to 24 inches above, and along the centerline of all water mains.

3.09 Pipe Crossings and Conflicts

- A. Water mains crossing sanitary sewer mains or services shall have a minimum of 24-inch vertical separation, and 10 foot separation from edge to edge horizontally. Water mains crossing storm sewers shall have a minimum of 30-inch vertical separation. When it is impossible to achieve such separation, the following construction methods must be followed:
 - 1. Sewers passing over or under water main must be constructed to water main standards. A full length of water main pipe must be centered on a full sewer pipe when crossing.
 - 2. The bedding and soil surrounding the crossing must be compacted to 100 Percent Standard Proctor.
 - 3. Where water mains cross storm sewers with less than 30-inch vertical separation from edge to edge, a minimum of 4 inches of insulation shall be used along with the requirements for sewer crossings.

3.10 Protection

- A. Existing hydrants, existing valves, and new valves tapping into existing mains shall only be operated by Public Works Staff; Contractor must contact the Water and Sewer Superintendent a minimum 24 hours in advance of need for aforementioned services.
 - 1. Any watermain tapping larger than 8" shall be consulted out at the expense of the Contractor. Contractor must still contact the Water and Sewer Superintendent 24 hours prior to tapping.
- B. Securely plug all water main openings to prevent debris and other substances from entering the water main.
- C. Protect all water main structures from damage during construction.

3.11 Disinfection and Testing

- A. General
 - 1. Contractor must perform all testing and disinfection.
 - 2. All new water mains, dead ends, hydrant leads, fittings and valves shall be disinfected and included in tests.
 - 3. Potable water must be used to fill pipe for testing and service tapping.

4. Engineer must visually inspect and verify all acceptance tests. A 48-hour notice must be given to the Engineer.

B. Hydrostatic Pressure Test

1. Minimum test pressure: 150 psi.
2. Test duration: 2 hours
3. Criteria: No drop in pressure is allowed. If this test requirement cannot be met, the Contractor shall investigate the cause, make corrections, and retest until the pressure drop requirement can be met.

Only if several consecutive tests indicate a consistent pressure drop and only after the Contractor has made numerous attempts to resolve the problem, acceptable to the City Engineer, may the Contractor request in writing and the City Engineer consider the use of a leakage test. When allowed, the leakage test and pipeline acceptance shall be in accordance with AWWA C-600 or AWWA C-605, as applicable.

The leakage test may be performed by the Contractor to determine the magnitude of the leak, however, meeting the leakage allowance shall not automatically be considered acceptance, in lieu of the pressure test, for the section being tested. Final acceptance shall be at the discretion of the City Engineer.

4. Gauge shall be liquid filled, labeled in 1 lb. or 2 lb. increments. The dial shall register from 0 - 200 psi and have a dial size of four- and one-half inches (4 ½").
5. The Contractor shall coordinate with the Engineer and the Fire Department for testing on all fire service lines.
6. Contractor and Engineer shall visually verify water services are not leaking after the mainline pressure test has passed.

C. Disinfection and Bacteria Testing

1. All testing shall conform to ANSI/AWWA C651-14 Disinfecting Water Mains.
2. Prior to disinfection, all lines shall be flushed with high velocity water through fire hydrant nozzles.

3. All lines shall be sterilized with an injected chlorine solution conforming to AWWA B301. Granular calcium hypochlorite shall not be used.
4. A minimum of 50 ppm chlorine residual shall be maintained during disinfection.
5. Chlorine solution shall remain in the system for a minimum of 24 hours and a maximum of 36 hours.
6. Extreme care shall be taken during disinfection to ensure that super chlorinated water does not enter existing water mains or water supply.
7. After disinfection, the lines shall be flushed until chlorine concentrations are within normal operating levels (1 to 2 ppm).
8. A minimum of 1 set of samples shall be collected every 1,200 ft of new water main, plus one set from the end of the line and at least one from each branch greater than one pipe length.

Option A: Before approving a main for release, take an initial set of samples and then resample again after a minimum of 16 hr using the sampling site procedures outlined. Both sets of samples must pass for the main to be approved for release.

Option B: Before approving a main for release, let it sit for a minimum of 16 hr without any water use. Then collect, using the sampling site procedures outlined and without flushing the main, two sets of samples a minimum of 15 min apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release.

9. Test all samples at a North Dakota-certified laboratory.

D. Tracer Wire Test

1. The Contractor shall, within one week after completion of pressure testing and prior to aggregate base installation, use low frequency (512 Hz or similar) line locating equipment to perform a test of all tracer wire to ensure continuous and sufficient conductivity for the purpose of tracing water main for utility location.
2. Connections at all hydrants and all access points shall be tested.

PART 4 – MEASUREMENT AND PAYMENT

- A. Water Main Pipe: Shall be paid for by the linear foot (LF) for each size and type specified on the Plans. Pay quantity will be determined by measuring horizontally along the axis of the pipe the actual quantity installed. Price shall include all materials and labor for installing and testing the pipe complete and in place as specified, including all excavation, bedding, joints, joint restraints, pipe encasement, tracer wire systems (wire, splices, terminations, ground rods, etc.), marking tape, backfilling, and compaction.
- B. Fittings: Shall be paid for by each (EA) for the size and type specified on the Plans for each fitting. Fittings shall include all materials and labor for the complete installation as specified.
- C. Valve and Box: Shall be paid for by each (EA) for the size and type specified on the Plans and shall include all materials and labor for the complete installation as specified.
- D. Fire Hydrant: Shall be paid for by each (EA) and shall include all materials and labor costs for the complete installation as specified.
- E. Insulation: Shall be paid for by cubic foot (CF) and shall include all materials and labor for the complete installation as specified including granular bedding.
- F. Tapping Gate Valve and Sleeve: Shall be paid for by each (EA) for the size and type specified on the Plan and shall include all materials and labor for the complete installation as specified including the Valve Box.
- G. Water Meter and Meter Pit: Shall be paid for by each (EA) for the size and type specified on the Plan and shall include all materials and labor for the complete installation as specified.
- H. Connect to Existing Water Main: Shall be paid for by each (EA) and shall include all materials and labor for the complete connection including all fittings.

- I. Water Main Flushing and Testing: Shall be considered incidental to the installation of water main.
- J. Disinfection and Testing: Shall be considered incidental to the installation of water main.
- K. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 2110 – FUSIBLE POLYVINYL CHLORIDE PIPE

FUSIBLE POLYVINYL CHLORIDE PIPE

PART 1 – GENERAL

1.01 Section Summary

- A. This section includes product information for fusible polyvinyl chloride (FPVC) pipe. This section also includes acceptable fusion techniques, handling, and storage.

1.02 Related Sections

- A. Section 2100 - Watermain.
- B. Section 2150 – Pipe Bursting for Watermain.

1.03 Quality Assurance

A. References

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of design, bid, or construction, whichever is earliest. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.
3. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/AWWA C110/A21.10	American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids
ANSI/AWWA C111/A21.11	American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C605-94	Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C651	Standard for Disinfecting Water Mains
AWWA C900-97	Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. (100mm through 300mm), for Water Distribution
AWWA C905-97	Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. (350mm-1200mm), for Water Distribution
AWWA M23	AWWA Manual of Supply Practices PVC Pipe—Design and Installation, Second Edition
ASTM C923	Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D1785	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2152	Test Method for Degree of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
ASTM D2241	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D2665	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F679	Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings

Reference	Title
ASTM F1057	Standard Practice for Estimating the Quality of Extruded Poly (Vinyl Chloride) (PVC) Pipe by the Heat Reversion Technique
ASTM F1417	Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
UNI-B-6	Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe
UNI-PUB-08	Tapping Guide for PVC Pressure Pipe
NSF-14	Plastics Piping System Components and Related Materials
NSF-61	Drinking Water System Components--Health Effects
PPI TR-2	PVC Range Composition Listing of Qualified Ingredients

B. Manufactures Requirements

1. Fusible polyvinyl chloride pipe shall be tested at the extrusion facility for properties required to meet all applicable parameters as outlined in either AWWA C900, AWWA C905, applicable sections of ASTM D2241, ASTM D3034, or ASTM F679. Testing priority shall be in conformance with AWWA C900 and AWWA C905, except for pipe made to the ASTM D3034 or ASTM F679 standards, which shall be tested to those standards. All piping shall be made from a PVC compound conforming to cell classification 12454 per ASTM D1784.

C. Fusion Technician Requirements

1. Fusion Technician shall be fully qualified by the pipe supplier to install fusible polyvinyl chloride pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

D. Specified Pipe Suppliers

1. Fusible polyvinyl chloride pipe shall be used as manufactured under the trade names Fusible C-900®, Fusible C-905®, and FPVC™, for Underground Solutions, Inc., Poway, CA, (858) 679-9551. Fusion process shall be as patented by Underground Solutions, Inc., Poway, CA, Patent No. 6,982,051. Owner and engineer are aware of no other supplier or fusible polyvinyl chloride pipe that is an equal to this specified pipe supplier and product.

E. Warranty~~yee~~

1. The pipe shall be warranted for two years per the pipe supplier's standard terms.
2. In addition to the standard pipe warranty, the fusion services shall be warranted for two years per the fusion service provider's standard terms.
3. The general contractor shall provide a warranty~~yee~~ as stated in subsection 1.15 of Section 100 – Work Within Public Right of Way, section 249 of the City of Minot Standard Specifications.

F. Pre-Construction Submittals

1. The following PRODUCT DATA is required from the pipe supplier and/or fusion provider:
 - a. Pipe Size
 - b. Dimensionality
 - c. Pressure Class per applicable standard
 - d. Color
 - e. Recommended Minimum Bending Radius
 - f. Recommended Maximum Safe Pull Force
 - g. Pipe and fusion services warranty information.
 - h. Written procedural documentation for piping products including proper handling and storage, installation, tapping, and testing.
 - i. Fusion technician qualification indicating conformance with this specification.

G. Post-Construction Submittals

1. The following AS-RECORDED DATA is required from the contractor and/or fusion provider to the Owner or pipe supplier upon request:
 - a. Fusion report for each fusion joint performed on the project, including joints that were rejected. Specific requirements of the Fusion Technician's joint report shall include:
 - b. Pipe Size and Thickness

- c. Machine Size
- e. Fusion Technician Identification
- f. Job Identification
- g. Fusion Joint Number
- h. Fusion, Heating, and Drag Pressure Settings
- i. Heat Plate Temperature
- j. Time Stamp
- k. Heating and Cool Down Time of Fusion
- l. Ambient Temperature

PART 2 – PRODUCTS

2.01 Fusible Polyvinyl Chloride Pressure Pipe for Potable Water

- A. Fusible polyvinyl chloride pipe shall be DR 18 and conform to AWWA C900 or AWWA C905, and/or ASTM D2241 or ASTM D1785 for IPS standard dimensions if applicable. Testing shall be in accordance with AWWA standards for all pipe types.
- B. Rework material shall be allowed per AWWA C900 and AWWA C905 standards.
- C. Fusible polyvinyl chloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.
- D. Fusible polyvinyl chloride pipe shall be manufactured in a standard 20', 30' or 40' nominal length.
- E. Fusible polyvinyl chloride pipe shall be blue in color for potable water use.
- F. Pipe generally shall be marked per AWWA C900 or AWWA C905, and shall include as a minimum:
 - 1. Nominal pipe size
 - 2. PVC
 - 3. Dimension Ratio, Standard Dimension Ratio or Schedule
 - 4. AWWA pressure class or standard pressure rating for non-AWWA pipe

5. AWWA Standard designation number or pipe type for non-AWWA pipe
 6. NSF-61 mark verifying suitability for potable water service
 7. Extrusion production-record code
 8. Trademark or trade name
 9. Cell Classification 12454 and/or PVC material code 1120 may also be included
- G. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.
- 2.02 Fusion Joints
- A. Unless otherwise specified, fusible polyvinyl chloride pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed as described in this specification.
- 2.03 Connections And Fittings For Pressure Applications
- A. Connections shall be defined in conjunction with the coupling of project piping, as well as the tie-ins to other piping systems.
- B. Ductile Iron Mechanical and Flanged Fittings: Acceptable fittings for use with fusible polyvinyl chloride pipe shall include standard ductile iron fittings conforming to AWWA/ANSI C153/A21.53 and AWWA/ANSI C111/A21.11 latest revision, and shall be mechanical joint with mega-lug restraints.
1. Bends, tees and other ductile iron fittings shall be restrained with the use of thrust blocking and mega lug restraints.
 2. Ductile iron fittings and glands must be installed per the manufacturer's guidelines.
 3. Fittings must also conform to Section 2100, 2.03 Fittings.
- 2.04 Sleeve-Type Couplings
- A. Couplings shall be Hymax 2000 series, or approved equal.
- 2.05 Connection Hardware
- A. Every bolt and nut for mechanical joint fittings shall be 304 stainless steel suited for underground use.

PART 3 – EXECUTION

3.01 Delivery and Off-Loading

- A. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the owner or engineer.
- B. Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify owner or engineer immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and proper pipe size, color and type.
- C. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23, and all of the pipe supplier's guidelines shall be followed.
- D. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.
- E. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.
- F. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to insure that pipe is not dropped or damaged. Pipe should be carefully lowered, not dropped, from trucks.

3.02 Handling And Storage

- A. Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the owner or engineer.
- B. Any scratch or gouge greater than 10% of the wall thickness will be considered significant and can be rejected unless determined acceptable by the owner or engineer.
- C. Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

- D. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way.
- E. If pipe is to be stored for periods of 1 year or longer, the pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.
- F. Pipe shall be stored and stacked per the pipe supplier's guidelines.

3.03 Fusion Process

A. GENERAL

1. Fusible polyvinyl chloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.
2. Fusible polyvinyl chloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.
3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine.
4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following properties, including the following elements:
 - a. HEAT PLATE - Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly, cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.
 - b. CARRIAGE - Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
 - c. GENERAL MACHINE - Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

- d. DATA LOGGING DEVICE - The current version of the pipe supplier's recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.
- 5. Other equipment specifically required for the fusion process shall include the following:
 - a. Pipe rollers shall be used for support of pipe to either side of the machine
 - b. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement and /or windy weather.
 - c. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
 - d. Facing blades specifically designed for cutting fusible polyvinyl chloride pipe shall be used.
- B. Joint Recording
 - 1. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of thermoplastic pipe. The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

3.04 General Installation

- A. Installation guidelines from the pipe supplier shall be followed for all installations.
- B. The fusible polyvinyl chloride pipe will be installed in a manner so as not to exceed the recommended bending radius.
- C. Where fusible polyvinyl chloride pipe is installed by pulling in tension, the recommended Safe Pulling Force, according to the pipe supplier, will not be exceeded.

3.05 Preparation Prior To Making Connections into Existing Piping Systems

- A. Approximate locations for existing piping systems are shown in the construction documents. Prior to making connections into existing piping systems, the Contractor shall:
 - 1. Field verify location, size, piping material and piping system of the existing pipe.
 - 2. Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents.
 - 3. Have installed all temporary pumps and/or pipes in accordance with established connection plans.
- B. Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

3.06 Pipe System Connections

- A. Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines and as indicated in the construction documents. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines.

3.07 Tapping For Potable And Non-Potable Water Applications

- A. Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles. NO DIRECT TAPPING WILL BE PERMITTED.
- B. All connections requiring a larger diameter than that recommended by the pipe supplier, shall be made with a pipe connection as specified and indicated on the drawings.
- C. Equipment used for tapping shall be made specifically for tapping PVC pipe:
 - 1. Tapping bits shall be slotted "shell" style cutters, specifically made for PVC pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are strictly prohibited.
 - 2. Manually operated or power operated drilling machines may be used.
- D. Taps must be performed while the pipeline is filled with water and under pressure ('wet' tap), unless approved by the Engineer.

3.08 Disinfection and Testing

- A. Conform to Section 2100 – Watermain, 3.10 for disinfection and testing requirements.

END OF SECTION

SECTION 2150 – PIPE BURSTING FOR WATER MAIN

PIPE BURSTING FOR WATER MAIN

PART 1 – GENERAL

1.01 Section Summary

- A. This section shall include the rehabilitation of existing water mains using a pipe bursting system.

1.02 Referenced Sections

- A. Section 2100 – Water Main.
- B. Section 2110 – Fusible Polyvinyl Chloride Pipe.
- C. Section 2200 – Water Services.

1.03 Qualifications

- A. The pipe-bursting manufacturer shall certify that the Contractor is a fully trained user of the pipe-bursting system.
- B. Fusible PVC pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment and recommended methods for new pipe connections. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the Fusible PVC pipe. A qualified representative shall perform training.
- C. Personnel trained in the use of butt-fusion equipment shall perform Fusible PVC.
- D. The Contractor must have successfully completed 3,000 feet of pipe bursting with the pipe material they will use on the project, which shall include one successful static pipe-bursting project. The Contractor shall submit a statement of experience in pipe bursting.
- E. The Contractor shall hold the Owner whole harmless in any legal action resulting from patent infringements.

1.05 Submittals

- A. Shop drawings, catalog data and manufacturer's technical data showing complete information on material composition, physical properties and dimensions of new pipe and fittings. Include manufacturer's recommendations for handling, storage and repair of pipe and fittings damaged.

- B. Method of construction with descriptions of the entire construction procedure to insert the pipe, pipe fusion techniques, non-fusion pipe jointing techniques and connections to water services, intersecting water mains and existing water mains.
- C. If required, plan and procedure for supplying temporary water service during pipe bursting operation.
- D. Certification of workmen training for installing pipe.
- E. Details of connections to existing water mains that allow for restraint or pipe expansion/contraction to avoid leaks.
- F. Shop drawings of the hydrants, hydrant leads, and associated connections.

PART 2 – PRODUCTS

2.01 Pipes and Fittings

- A. Conform to Section 2110 – Fusible Polyvinylchloride Pipe.
- B. Hydrants and Hydrant Leads
 - 1. All hydrant leads shall be 6" PVC C-900 from the hydrant to the mainline tee. The tee shall be ductile iron.
 - 2. Conform to Section 2100 – Water Mains.

PART 3 – EXECUTION

3.01 Equipment

- A. The pipe-bursting system, which shall be a static bursting unit capable of installing a new Fusible PVC pipe of the same size or larger size pipe where the old pipe existed, shall be designed and manufactured to force its way through existing pipe material by fragmenting the pipe and compressing the old pipe sections into the surrounding soil as it progresses. The bursting unit shall generate sufficient force to burst and compact the existing pipeline into the surrounding ground creating the void into which the burster can be statically pulled, which enables forward progress to be made. Simultaneously, the new pipe, directly attached to the expander, shall also move forward.
- B. The unit must maintain automatic thrust and pull back.
- C. The static unit must be capable of pipe bursting in two directions from the same excavation.

- D. Pneumatic bursting that introduces any lubricants into the pipe will not be allowed.

3.02 Pipe Joining

- A. Conform to Section 2110 – Fusible Polyvinylchloride Pipe.

3.03 Bursting Operations and Pipe Installation

- A. Location and Protection of Underground Utilities

1. Correct location of all underground utilities that may impact the installation is the responsibility of the Contractor.
2. Utility location and notification services shall be contacted by the Contractor prior to the start of construction.
3. All existing lines and underground utilities shall be positively identified, including exposing those facilities that are located within an envelope of possible impact of the bursting operation as determined for the project specific site conditions.
4. It is the Contractor's responsibility to determine this envelope of safe burial depth and offset from existing utilities. This will include, but is not limited to soil conditions and layering, utility proximity and material, pipe bursting system and equipment, and foreign subsurface material.

- B. Excavation and Access Pits

1. Access pit length shall be such that the minimum bending radius for the pipe, per the pipe supplier is maintained. Sheet piling, shoring, and bracing requirements shall be in accordance with these specifications and applicable jurisdictional standards.
2. Access pit excavations shall be performed at all points where the pipe will be inserted into the existing pipeline. When possible, access pit excavations shall coincide with host pipe lateral connection points or other appurtenance installations.
3. The pipe may be continuously or partially supported on rollers or other Engineer approved friction decreasing implement during joining and insertion, as long as the pipe is not over-stressed or critically abraded prior to or during installation.
4. The number, location, and size of insertion and receiving excavation shall be planned by the Contractor and submitted in writing for approval by the Engineer prior to construction.

5. The number of pits for machine, pipe insertion, and service connections shall be the minimum necessary to most efficiently accomplish the work. The Contractor shall give consideration to the use of excavation required for other purposes such as valve installations and existing pipe connections.

3.04 Testing and Disinfection

A. Pressure Test

1. Pressure tests shall be performed in accordance with Section 2100 – Water Main or as directed by the manufacturer. The more stringent individual provisions of each specification shall govern.

B. Disinfection

1. Disinfection of the new water main system shall conform to Section 2100 – Water Main.

PART 4 – MEASUREMENT AND PAYMENT

- A. Pipe Burst with _____" Fusible C900: Shall be paid for by the linear foot (LF) for each size of new watermain specified on the Plans, regardless of pipe type. Pay quantity will be determined by measuring from point of connection at the bore pit to point of connection at the receiving pit. Price shall include all materials, labor, and equipment for installing and testing the pipe complete and in place as specified, including all excavation, shoring, bedding, joints, joint restraints, pipe encasement, tracer wire systems (wire, splices, terminations, ground rods, etc.), marking tape, backfilling, and compaction. Pipe removal for pit area and service connections will be paid under the "Remove Pipe All Types and Sizes" bid item.
- B. All other items shall be per Section 2100 – Water Main.

END OF SECTION

SECTION 2200 – WATER SERVICES

WATER SERVICES

PART 1 – GENERAL

1.01 Section Summary

- A. This Section includes the construction of water main services including the corporation stop, service pipe, curb stop and box, and other items.

1.02 Related Sections

- A. Section 2000 – Trench Excavation and Backfill
- B. Section 2100 – Water Main

1.03 References

- A. American Water Works Association:
 - 1. AWWA C800 –Underground Service Line Valves and Fittings.
 - 2. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, 3/4-inch through 3-inch for Water Service.
- B. American Society for Testing and Materials:
 - 1. ASTM B88 –Seamless Copper Water Tube.
 - 2. ASTM D3035 –Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
 - 3. ASTM D3350 –Polyethylene Plastics Pipe and Fittings Materials.
- C. National Sanitation Foundation (NSF):
 - 1. 60 – Drinking Water Treatment Chemicals – Health Effects
 - 2. 61 – Drinking Water System Components – Health Effects
 - 3. All products (treatment chemicals and materials) that may come into contact with water intended for use in a public water system shall meet National Sanitation Foundation (NSF) International Standards / American National Standards Institute (ANSI) 60 and 61, as appropriate. A product will be considered as meeting these standards if so certified by NSF, the Underwriters Laboratories, or other organizations accredited by ANSI to test and certify such products.

D. Plastics Pipe Institute:

1. TR-3 (Latest Revision) – Policies and Procedures for [developing design bases, design stresses, strength ratings, and required strengths] for Thermoplastic Piping Materials and Pipe.
2. TR-4 (Latest Revision) – PPI Listing of design bases, design stresses, and strength ratings] for Thermoplastic Piping Materials and Pipe.

1.04 Submittals

- A. Submit all shop drawings and manufacturers' information in accordance with Conditions of the Contract.
- B. Submit to the Engineer for review:
1. Curb stop location (station).
 2. Three (3) ties to 3 permanent structures (house corners, manholes, catch basins, fire hydrants. Do not tie curb boxes to gate valves, street signs, street lights or fences).
 3. Length of service line.
- B. Final payment will not be made until all service information is submitted to and reviewed by the Engineer.

PART 2 – PRODUCTS

2.01 Water Service Pipe

A. Copper

1. All water service lines 1-inch through 2-inch diameter shall be Copper, Type K, Soft Annealed Temper and shall conform to ASTM B88.
2. Minimum service size shall be 1-inch diameter.

B. PVC

1. All water service lines 4-inch diameter or larger shall conform to requirements of Section 2100 – Water Main.

C. HDPE

1. HDPE water service lines may be used outside of City right of way, from the curb stop to the structure.

2. Service lines shall consist of High-Performance PE4710 High Density Polyethylene Pipe, cell classification of 445574 conforming to the requirements of ASTM D3035, ASTM 3350 and AWWA C901.
3. PE Pipe shall be DR 7 Iron Pipe Size (IPS) for service lines 1-inch to 2-inche diameter.

2.02 Water Service Appurtenances

- A. The following table is a list of approved water service appurtenances.

Water Service Appurtenances				
Item	Service Pipe Size (dia.)	Flared Type Valves & Fittings for Type K Copper Pipe		
Corporation Stop		Ford	A.Y. McDonald	Mueller
	1"	FB-600	4701B	B-25000
	2"	FB-600	4701B	B-25000
Tapping Saddle		Romac		
	1"	306		
	2"	306		
Curb Stop		Ford	A.Y. McDonald	Mueller
	1"	B22-444-M	6104	B25154
	2"	B22-777-M	6104	B25154
Curb Box		Ford	A.Y. McDonald	Mueller
	1"	EM2-80-56	5614	H-10300
	2"	EM2-80-57	5615	H-10304

- B. Corporation Stops
1. Shall be AWWA taper thread inlet by flared copper outlet.
- C. Tapping Saddle
1. Saddles are required on all service taps.
 2. All saddles must be a complete wrap around composed of type 304 stainless steel with a minimum of two stainless steel bolts.
- D. Curb Stops
1. All curb stops shall be one-piece, flare by flare, non-pipe-thread and include a solid copper disk on the property side of the curb stop.
 2. The property side of the curb stop must be protected from the elements at all times.
 3. Combination stop and waste valves or cocks shall not be installed underground.

E. Curb Boxes

1. Shall be Minneapolis Pattern.
2. Stationary rods must be stainless steel with a length of 72 inches.
3. Polyethylene pipe encasement shall be in accordance with Section 2100 – Water Main.
4. When placed in concrete, curb box shall be covered with a 2" riser and a Tyler No. 6860 or Mueller No. H-10361 drop lid.

2.03 Marking Tape

- A. Tape shall conform to Section 2100 – Water Main.

PART 3 – EXECUTION

3.01 Service Installation

- A. All water services shall be a minimum of 8.5 feet below the ground surface and in accordance with manufacturer's recommendations.
- B. Field flaring shall be performed in conformance with current standards of the plumbing industry and manufacturers' recommendations.
- C. All curb stop and boxes shall be marked with a steel fence post.
- D. Water Service Pipe
1. Lines must be installed parallel to and upstream of sanitary sewer service lines. Water service lines must have a minimum of 10-foot horizontal separation and 24 inches of vertical separation from sewer service lines.
 2. Water line marking tape shall be installed 18 – 24 inches above, and along the centerline of all water service lines.
- E. Corporation Stops
1. Main must be pressurized when tapping "wet tap".
 2. Corporation stops shall be inspected by the Contractor for leaks prior to backfilling.
 3. Encase corporation stop with sand bedding.

F. Service Saddles

1. Saddles must be secured in place before tapping can begin.
2. Dry tapping will not be allowed.

G. Curb Stops

1. Curb stops shall be supported on a solid sewer brick.
2. Curb stop shall be inspected by the Contractor for leaks prior to backfilling.
3. Curb stops located in driveways/sidewalks shall be protected with the top section of a 10-inch gate valve box top section, including the lid.
4. Curb stops located in gravel alleys shall be protected with the top section of a 10-inch gate valve box section, including the lid and be covered with a minimum 6-inches of gravel.

H. Curb Boxes

1. Boxes must be installed plumb in a vertical position.
2. Wrap all curb boxes with polyethylene pipe encasement.
3. Curb boxes in concrete shall be protected with a gate valve lid and riser.

I. Construct all trenches in accordance with Section 2000 – Trench Excavation and Backfill. Service trench settlements shall be repaired in a manner acceptable to the Engineer at no cost to the Owner.

J. All new curb stops installed must have the unconnected side protected from the elements by installing a solid copper disk with the flare nut. The cost for the protection shall be incidental to the cost of the curb stop.

K. Reconnect Existing Water Services

1. No warranty is expressed or implied as to the location, size, or material type of existing service lines. The Contractor shall furnish and install all fittings required to make the connection.

L. Testing and Disinfection: Shall conform to Section 2100 – Water Main.

M. Supplemental Requirements

1. For any property served by the City of Minot, the City is responsible to the first or master curb stop or gate valve. Subsequent subdivision of the property necessitating a split of the water service and curb stops, gate valves, pipe, and fittings installed after the master curb stop or gate valve shall be the responsibility of the property owner(s).

PART 4 – MEASUREMENT AND PAYMENT

- A. Water Service Pipe: Shall be paid for by the linear foot (LF) for the size and type specified on the Plans. Measurement shall be the two-dimensional horizontal length along the axis of the pipe from the centerline of the water main to either the point of connection with the existing service line or the end of the new service line. Price shall include all pipe, fittings, adapters, laying, excavation, backfilling, and testing.
 1. Granular backfill around the corporation stop and gooseneck shall be incidental to the corporation stop.
 2. Fence post markers shall be incidental to the curb stop and box.
 3. Payment for bored water services shall include the cost of the bore and the pipe/tubing for the length of the bore. Where services that are shown to be open-cut on the plans are bored as a more feasible option, payment will be made on the open-cut bid item.
- B. Service Tap: Shall be paid for by each (EA) for the size and type specified on the Plan. Service tap shall include tapping saddle and corporation stop and all materials and labor necessary to install the service tap.
- C. Curb Stop and Box: Shall be paid for by each (EA) for the size and type specified on the Plan.
- D. Gate Valve Riser and Lid for Curb Box: Shall be paid for by each (EA) curb box protected. Price shall include all materials and labor needed to protect curb box from surrounding concrete.
- E. Reconnect Existing Services: Shall be paid for by each (EA). Price shall include all materials and labor needed to reconnect the existing service to the new water main.

- F. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 2300 – SANITARY SEWER

SANITARY SEWER

PART 1 – GENERAL

1.01 Section Summary

- A. This Section includes sanitary sewer pipe, manholes, and appurtenances.

1.02 Related Sections

- A. Section 1700 – Adjustment of Structures
- B. Section 2000 – Trench Excavation and Backfill
- C. Section 2310 – Bypass Pumping

1.03 References

- A. American Society of Testing and Materials (ASTM)
 - 1. A48 –Gray Iron Castings
 - 2. A615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - 3. C139 –Concrete Masonry Units for Construction of Catch Basins and Manholes
 - 4. C150 –Portland Cement
 - 5. C206 – Finishing Hydrated Lime
 - 6. C270 – Mortar for Unit Masonry
 - 7. C309 – Liquid Membrane-Forming Compounds for Curing Concrete
 - 8. C443 – Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 - 9. C478 – Circular Precast Reinforced Concrete Manhole Sections
 - 10. C923 – Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
 - 11. C990 – Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
 - 12. C1714 – Preblended Dry Mortar Mix for Unit Masonry

13. D698 – Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
14. D1784 –Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
15. D1785 –Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
16. D2241 – Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
17. D2321 –Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity–Flow Applications
18. D3034 –Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
19. D3212 –Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
20. F477 –Elastomeric Seals (Gaskets) for Joining Plastic Pipe
21. F679 –Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
22. F794 –Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
23. F1417 – Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air

B. American Water Works Association (AWWA)

1. C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
2. C151 – Ductile-Iron Pipe, Centrifugally Cast

1.04 Submittals

A. Submit to the Engineer for review:

1. Concrete mix design.
2. Manhole shop drawings.
3. Manufacturer’s information:
 - a. Pipe.

- b. Manhole castings.
- c. Lining system.
- d. Marking tape.
- e. Manhole Chimney Seals.
- f. Tracer wire and associated components (force mains only).
- g. Repair couplings for coupled connections.

PART 2 – PRODUCTS

2.01 Concrete and Mortar

- A. All concrete products shall use Type 1 Portland Cement (conform to ASTM C150), washed sand, and crushed aggregate free of deleterious materials.
- B. Mix designs shall be approved by the Engineer and must obtain 4000 psi compressive strength at 28 days.
- C. Mortar mix shall be designed to be compatible with the characteristics of the materials used in manhole construction and shall conform to ASTM C270, and ASTM 1714 for preblended mixes.

2.02 Manholes

- A. Manhole sections shall be precast and shall conform to ASTM C478.
- B. Joints shall be sealed with either rubber gaskets to conform to ASTM C443 or premium-grade butyl rubber joint sealant to conform to ASTM C990.
- C. Bases:
 - 1. Shall be pre-cast and integral with bottom section of manhole.
 - 2. Invert shall be pre-cast and shall be graded to provide flow through the structure with 0.1 feet of drop across the structure.
 - 3. Dead end manholes shall have the invert continue to the opposite side of the manhole.
- D. Drop Connections: A drop pipe shall be provided for sewer entering a manhole at an elevation of 24 inches or more above the manhole invert.

1. Outside Drops: Shall have upper and lower rubber boot connections. The drop pipe shall be supported by concrete horseshoes. All voids around pipes shall be filled with concrete.
 2. Inside Drops: Only by approval of City Engineer.
- E. Manhole Steps: No manhole steps are allowed.
- F. Pipe Connections: Manholes shall be cast with the appropriate size openings for the size of pipe shown on the plans. Resilient manhole boot connectors conforming to ASTM C923 shall be cast into the base during fabrication of all new manhole bases.
- G. Lining System: New manholes shall be lined in the field with a spray-on epoxy lining system to provide corrosion protection.
1. Approved manufacturers: Raven Lining Systems, Inc. and Tnemec, Inc.
 2. Prime coat required. Primer per manufacturer's recommendations.
 3. Coating Products: Raven 405 or Tnemec Series 434.
 4. Submit manufacturer's information with manhole shop drawings.
- H. Manhole Castings:
1. Concrete pavement: Neenah R-1955-1 or approved equal.
 2. All other locations: Neenah R-1642 lid type B, EJ 1045Z with lid type 1040AGS, or approved equal.
 3. Machine cover and frame contact surface for non-rocking protection.
 4. Include 2 concealed pick holes, Type F.
 5. Shall be stamped "SANITARY SEWER" on the lid.
 6. Lid shall be self-sealing.

2.03 Polyvinyl Chloride (PVC) Sewer Main Pipe

- A. All PVC sewer main pipe and fittings shall conform to:
1. For non-pressure piping: ASTM D3034 for sizes 4 – 15 inch and ASTM F679 for sizes 18 – 24 inch unless the Engineer requires a higher standard.

2. For pressure piping: ASTM D2241 for sizes 4 – 16 inch and AWWA C900 for sizes up through 36 inch unless the Engineer requires a higher standard. Pipe shall have a pressure rating at least twice the expected operating pressure.
 - B. All pipes shall be bell and spigot.
 - C. All pipe joints shall be push-on type and shall conform to ASTM D3212. All pipe shall have Elastomeric Seal (Gasket), polymer based synthetic rubber conforming to ASTM F477 which shall be bonded to the inner walls of the gasket recess of the bell socket. Natural rubber gaskets are not allowed.
 - D. Each pipe shall be identified by name of manufacturer, nominal pipe size, and PVC cell classification.
 - E. Minimum pipe size shall be 8 inch for sewer mains.
 - F. For depths less than 20 feet of cover to finished grade, all pipe shall be a minimum of SDR-35. For pipes having more than 20 feet of cover to finished grade, pipe shall be a minimum of SDR-26.
 - G. PVC shall be used for all sewer main pipe unless conditions or design constraints warrant the use of another material as approved or directed by the City Engineer.
- 2.04 Ductile Iron (DIP) Sewer Main Pipe (only where allowed by the City Engineer)
- A. All DIP sewer main pipe and fittings shall conform to AWWA C151.
 - B. Joints shall be mechanical or push-on type and conform to AWWA C111.
 - C. All DIP shall have a protective interior lining and shall be PROTECTO 401 Ceramic Epoxy, or approved equal, and shall be 40 mil thick. The pipe must be marked stating the lining product used and the date applied.
 - D. All DIP shall be encased in polyethylene pipe encasement conforming to the requirements of Section 2100 – Water Main.
- 2.05 Marking Tape
- A. Tape shall be per Section 2100 – Water Main except it shall be green in color, having black lettering with words "CAUTION SEWER LINE BELOW".
- 2.06 Manhole Chimney Seals
- A. External Chimney Seals, Cretex X-Lite External Seal or approved equal.
 1. Unless otherwise specified, all sanitary manholes shall have external chimney seals installed.

2. The frame seal shall remain flexible allowing for repeated vertical movement of the frame of not less than 2 inches and/or repeated horizontal movement of not less than 1/2 inch. The sleeve portion of the seal shall have a nominal vertical height of 7 inches, 11 inches, 16 inches or 20 inches. The sleeve shall have a minimum thickness of 60 mils and shall be made from a high-quality EPDM rubber suitable for both above and below grade applications. A full circumferential butyl rubber strip conforming to ASTM C990 shall be positioned and attached 1/4 inch from the bottom inside edge of the sleeve. The butyl rubber strip shall be 1-1/2 inch wide by 1/4 inch thick. A form fitted flange gasket shall be used on the base flange of the manhole frame casting and shall be EPDM rubber with a hardness (durometer) of 40±5.
 3. The top compression band shall be "C" shaped to uniformly compress the flange gasket and mechanically lock the seal onto the base flange of the manhole frame casting. Both the top and bottom compression bands shall have a take-up mechanism capable of developing a minimum of 400 lbs. of torque.
- B. Internal Chimney Seals, Cretex Specialty Products or approved equal.
1. Internal chimney seals shall be installed only when directed by the Engineer.
 2. The sleeve and extensions shall have a minimum thickness of 3/16 inches and shall be made from a high-quality rubber compound conforming to the applicable material requirements of ASTM C-923, with a minimum 1500 psi tensile strength, a maximum 18% compression set and hardness (durometer) of 48+5.
 3. The expansion bands shall be integrally formed from 16-gauge stainless steel conforming to the applicable material requirements of ASTM C-923, Type 304, with no welded attachments. The expansion bands shall have a minimum adjustment range of 2-1/2 diameter inches and a positive locking mechanism which secures the band in its expanded position after tightening.
- C. I/I Barriers, Strike Products or approved equal.
1. I/I Barriers shall be installed only when directed by the Engineer.

2.07 Tracer Wire (Force Mains Only)

- A. Tracer wire system shall conform to Section 2100 – Water Main except that all references to blue coloring and/or “WATER” shall be green and/or “SEWER”, respectively.

2.08 Coupled Connections

- A. Coupled connections to existing pipes shall be made with a flexible repair coupling wrapped in a stainless-steel shear ring, Strong Back RC Series by Fernco or approved equal.

PART 3 – EXECUTION

3.01 General

- A. All trenching activities shall conform to Section 2000 – Trench Excavation and Backfill.
- B. Service Interruptions: The Contractor shall sequence sewer system installation and perform bypass pumping to maintain sewer flows during construction as much as possible. When an interruption of sewer service is deemed unavoidable and allowed by the Engineer, the Contractor shall notify affected users at least 14 hours in advance of the interruption.
- C. All bypasses shall conform to Section 2310 – Bypass Pumping.

3.02 Installation of Pipe and Fittings

- A. Connect to Existing System
 - 1. Connections to existing manholes shall be installed to a watertight condition using a rubber boot with a stainless-steel band.
 - 2. All new manhole connections where a new hole must be made shall be made by coring the manhole and installing a new rubber boot with stainless-steel band.
 - 3. Reconstruct manhole invert to allow for flow through the manhole.

B. Pipe Installation

1. Pipe shall be laid to the line and grade as shown on the Plan as staked in the field. No deviation is allowed unless directed by the Engineer. Deviation shall be cause for removal and relaying pipe at the Contractor's expense.
2. Lay pipe in accordance with manufacturer's recommendations, upgrade with spigot end pointing in the direction of flow. Lubricate all joints and push pipes home, using care to ensure not to push past the home line. Ensure pipe is to line and grade before bedding and backfilling.
3. Install marking tape per Section 2100 – Water Main.
4. Tracer wire shall be installed along all force mains in accordance with Section 2100 – Water Main. Wire shall be connected per the manufacturer's recommendations at locating pedestals/access points as located on the Plans and at intervals no greater than 2,500 linear feet.
5. Contractor shall protect pipe during construction at all times. Any material that enters the pipe shall be removed. All pipes shall be clean before being put in service.

3.03 Manholes

- A. Shall be installed level. No deviation is allowed.
- B. Precast integral base shall be placed on compacted granular bedding.
- C. Vertical wall of the eccentric cone section shall be on the downstream side.
- D. Install rings and casting in conformance to Section 1700 – Adjustment of Structures.
- E. All lift holes must be completely filled with mortar or approved plugs.
- F. Invert shall be constructed smooth. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent deposition of solids. Where the difference in elevation is 24 inches or greater, a drop connection is required.
- G. Lining system shall be installed in all new manholes in the field by an experienced applicator per manufacturer's recommendations.

3.04 Service Connections

- A. Wye shall be installed at a 45-degree angle to the horizontal.
- B. Risers shall be supported at the wye with concrete and shall be supported on undisturbed trench slope for the entire length.

3.05 Insulation

- A. Insulation shall be installed where shown on the Plans or as directed by the Engineer such that butt-joints of insulation layers are staggered by at least 18 inches.
- B. Insulation shall be installed when sanitary sewer comes within 2.5 feet of storm sewer smaller than 24-inch, within 5 feet of 24-inch and larger storm sewer, or when the pipe is less than 8.5 feet deep.
- C. Insulation shall have a 6-inch sand cushion above and below the board.

3.06 Bulkhead and Abandon Existing Lines

- A. Existing pipes and openings in manholes shall be sealed using mortar to obtain a watertight seal.
- B. Abandoned lines shall be filled with silica sand or flowable fill to completely fill the line to prevent collapse and groundwater infiltration.
- C. Before lines are abandoned, live services must be connected to the new sewer main and in service.

3.07 Manhole Chimney Seals

A. General

- 1. Install after casting has been adjusted to final grade.
- 2. Install in accordance with manufacturer's recommendations.

B. External Chimney Seals

- 1. All sanitary manholes shall have an external chimney seal installed and shall be included in the price for the manhole.
- 2. Clean surface of casting and adjustment units to allow external chimney seal to fasten to structure.

C. Internal Chimney Seals

- 1. Internal chimney seals shall be installed only when directed by the Engineer.

2. Secure the chimney seal to the casting and structure to prevent infiltration.

3.08 Field Quality Assurance

A. General

1. Contractor shall provide all labor and materials necessary for inspections and tests.
2. Engineer shall be present and observe all required testing. Contractor shall notify Engineer 48 hours before testing.

B. System Cleanup

1. Contractor shall ensure pipe and manholes are clean and free of material.
2. If system is dirty due to Contractor negligence, the system will be cleaned at the sole expense of the Contractor. Jetting may be required. Complete before final inspection and televising.

C. Testing

1. Testing shall begin only after the system has been cleaned.
2. Deflection Testing: The Contractor shall test all flexible pipe types (PVC, HDPE, CCF) for deflection. Deflection testing shall occur at least 30 days after the main has been backfilled to finish grade, and shall be done in the presence of the Engineer. Deflections shall be determined by use of a mandrel.
 - a. Mandrel shall have a minimum diameter equal to 95 percent of the Average Internal Diameter of the pipe. The 5 percent deflection shall include deflection from burial and manufacturing process.
 - b. Mandrel shall be constructed of rigid steel, be non-adjustable, and have an odd number of legs (9 legs minimum). Its effective length shall not be less than its nominal diameter.
 - c. Owner reserves the right to measure the deflection at any time during the Correction Period. Deflections greater than 5 percent shall be considered failure and the Contractor may be required to re-excavate, replace the pipe if necessary, re-compact the backfill and restore the surface with no additional costs to the Owner for such work.

3. Televising

- a. The Contractor shall televise all new and rehabilitated sanitary sewer lines.
- b. Contractor shall clean all lines prior to televising.
- c. All sewer mains 8" and larger in the public right-of-way and on private property shall be televised using equipment properly sized for the pipe being televised so as to adequately illuminate the pipe for identification of distresses and obstructions.
- d. Contractor shall provide to Public Works staff, one (1) bound hard copy of the Televised Inspection Reports. Any distresses, leaks, and/or other abnormalities shall be noted on the reports. The bound cover shall clearly indicate the project description, project number and date. Accompanying the bound hard copy shall include a digital copy of the video stored on a DVD or flash drive in a file format that supports fast-forward and rewind. The video shall include an audio description and printed stationing of each lateral service accurate to the foot. Each run shall be identified by location and manhole to manhole description.

4. Low Pressure Air Test:

- a. For pipes 30 inches in diameter and smaller and having no live service connections, the Contractor shall perform a low-pressure air test per the criteria set forth in ASTM F1417.
- b. Pipe shall be cleaned but may be wetted. Pneumatic balls shall be used to plug the ends at manholes. Low pressure air shall be introduced into plugged line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any groundwater pressure that may submerge the pipe. At least two minutes shall be allowed for the pressure to stabilize before readings are taken and the timing started. During this time, check all plugs with soap solution to detect plug leakage. If any plugs are found to leak, air shall be bled off, the plugs shall be retightened, and the air shall be reintroduced into the line.

- c. To determine the air pressure to be added for the average ground water above the pipeline, the ground water height in feet above the pipeline shall be divided by 2.31, and that incremental pressure added to the gauge pressure. A table for converting water height to gauge pressure is as follows:

Ground Water Level Over Top of Pipeline	Incremental Air Pressure to be Added to Gauge Pressure Readings
1 foot	0.43 psig (4.43 psig total)
2 feet	0.83 psig (4.86 psig total)
4 feet	1.72 psig (5.72 psig total)
8 feet	3.44 psig (7.44 psig total)
10 feet	4.30 psig (8.30 psig total)
Over 10 feet	*DO NOT PERFORM TEST

** If the air pressure required to run the test exceeds 8.3 psig, the Contractor shall lower the groundwater to acceptable levels by means of dewatering (incidental) and perform the test.*

- d. The Low-Pressure Air Test will be accepted as having passed if the pressure does not drop more than 0.6 psig in less time than 0.5 minute per inch in diameter of the pipe being tested. The minimum starting pressure is 3.6 psig.
- e. Should a line or manhole fail to pass any of the accepted test as outlined, the Contractor shall, at his expense, determine the source of the failure, make any necessary repairs, and retest the segment of piping or manhole in question at no cost to the Owner.
5. Hydrostatic Leakage Test:
- a. For sewers over 30 inches in diameter and having no live service connections, perform an exfiltration or infiltration leakage test to verify that leakage criteria are met.
- b. The leakage exfiltration or infiltration shall not exceed 100 gallons per inch of pipe diameter per mile per day for any section of the system. An exfiltration or infiltration test shall be performed with a minimum positive hydrostatic head of 2 feet.
- c. When pipes are installed more than 2 feet below the groundwater level, an infiltration test shall be used in lieu of the exfiltration test.

6. Tracer Wire Test

- a. The Contractor shall, within one week after completion of leakage testing and prior to aggregate base installation, use low frequency (512 Hz or similar) line locating equipment to perform a test of all tracer wire to ensure continuous conductivity for the purpose of tracing force mains for utility location.
- b. Sufficient conductivity shall be provided to allow for the location of force main segments at least one thousand two hundred (1,200) linear feet in length.
- c. Connections at all terminal points shall be tested.
- d. All areas failing the location test shall be corrected at the Contractor's expense.

PART 4 – MEASUREMENT AND PAYMENT

4.01 All prices shall include all costs for labor, materials, equipment, and delivery for the item specified.

- A. Sanitary Sewer Pipe: By linear foot (LF) for each size and type installed for each depth range specified on the Plans. Price shall include installation, testing, and televising the pipe complete and in place as specified, including all excavation, bedding, pipe encasement, tracer wire systems (wire, splices, terminations, grounding rods, etc.), marking tape, backfilling, and compaction. Pipe shall be measured from connection point or from center to center of manholes.
- B. Manhole Structure: By each (EA) for the diameter specified on the Plan up to 8 foot in depth. Price shall include manhole structure, frame and casting, lining system, external seal, and adjustment to finish grade surface.
- C. Manhole Overdepth: By linear foot (LF) for the diameter of the installed manhole. Measurement will be made in 0.1-foot increments from the rim elevation to the lowest invert elevation of the manhole, minus 8 feet.
- D. Outside Drop Inlet Pipe: By linear foot (LF) measured from the outlet invert to the inlet invert. Price shall include all pipe, pipe encasement, base slab, fittings, and concrete collars to construct the drop connection.
- E. Inside Drop Inlet Pipe: By linear foot (LF) measured from the outlet invert to the inlet invert. Price shall include all manhole preparation, trenching, pipe, bedding, encasement, fittings, appurtenances, backfill, and compaction to construct the drop connection.

- F. Wyes: By each (EA) for the size and type installed.
- G. Riser Pipe: By linear foot (LF) measured vertically from centerline of sewer main up to the service riser invert elevation. Price shall include specified support and/or reinforcement around the wye and riser.
- H. Connect to Existing System: By each (EA) connection performed and shall include all core drilling, fittings, sleeves, and reconstruction of existing inverts.
- I. Plug: By each (EA) plug for the size and type installed.
- J. Bulkhead and Abandon Existing Sewer: By each (EA) bulkhead completed and shall include the cost of filling the existing sewer line as specified.
- K. Internal Seal: By each (EA) seal installed. Item shall only be installed when directed to do so by the Engineer.
- L. All costs to properly complete the work specified herein and/or shown on the Plans, including bypass pumping as required, shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 2310 – BYPASS PUMPING

BYPASS PUMPING

PART 1 – GENERAL

1.01 Section Summary

- A. The Contractor or subcontractor performing the bypass pumping shall have a minimum of five (5) industrial projects of at least equal scope and complexity within the last ten (10) years.
- B. Control and maintain all sanitary sewer flows within the sewer system during the Work. Service will always be maintained.
- C. Precautions shall be taken to prevent potential spillage from reaching the storm water system.
- D. Section Includes:
 - 1. Minimum requirements for bypass pumping for sewage flow control necessary to facilitate sewer line crossing or replacement construction activities.
 - 2. Provide all labor, equipment, supervision, and materials necessary to eliminate flows via bypass pumping through a section or sections of pipe designated at crossing or replacement locations.
 - 3. Contractor may convey existing flows by bypass pumping or other appropriate methods approved by the Engineer.
 - 4. Plugging of sewer lines shall not be permitted without bypassing except for Engineer approved private gravity laterals under specific conditions.
- E. Conform to applicable requirements of the OSHA Standards for Construction.
- F. Contractor shall maintain existing flow capacities at all points of connection and in areas where the existing line conflicts with the construction of the new lines.
- G. Where no right-of-way or easement is shown to accommodate bypass operations, Contractor shall be responsible for coordinating with private property owners.
- H. All bypass operations shall include overflow prevention monitoring and odor control in accordance with this section.

1.02 References

- A. Uniform Plumbing Code, most recent accepted edition.

1.03 Submittals

- A. Submittals: Comply with the Conditions of the Contract.
- B. Submit bypass pumping plan to the Engineer for review and approval 14 days in advance of the bypass work.
- C. Submit a Spill Prevention Containment and Countermeasure Plan (SPCC) in accordance with the Spill Prevention and Emergency Response Planning guidelines.
- D. Contractor shall obtain and submit a copy to the Engineer of all permits required for bypass pumping operation.

1.04 Bypass Pumping Plan

- A. Prepare a detailed Bypass Pumping Plan, prepared by a licensed professional engineer licensed in the state of North Dakota, which describes the measures to be used to control flows. Submit the Plan to and obtain approval of the Plan from the Engineer prior to beginning bypass pumping work. Contractor's Plan shall include, but not be limited to the following:
 - 1. Drawings indicating the scheme and location of pumps, suction manhole, suction piping, discharge manhole, discharge piping, temporary sewer plugs, flow diversion structures, dams, odor control, overflow prevention monitors, and related materials and equipment for each of the bypass pumping sites.
 - a. Plan shall show location of all bypass pumping systems, including odor control, and shall discuss phasing, reuse, and movement of systems during construction as applicable.
 - b. Bypass pumping plan shall designate which system/setup will be used where and when as applicable.
 - c. Structures and equipment within the public right-of-way shall be identified as such on the plans.
 - d. Plan shall show the sewer installation or sewer alterations to be accomplished during each bypass pump set up. The plan shall list the order of work requiring bypass pump set ups to verify downstream sewers are ready to accept bypass flows. The order of work shall correspond with the overall Project Schedule.
 - 2. Right of Way Ownership.
 - 3. Contractor shall submit to and obtain appropriate permits from each entity having jurisdiction when the pump bypass plan encroaches into their right of way.
 - 4. Vehicular and pedestrian access to public and private facilities shall be coordinated with the traffic control plan. The traffic control plan shall show how vehicles and pedestrians will be protected from injury resulting from bypass operations.

5. Contractor-performed flow monitoring results.
 6. Capacities and sizes of pumps (including backup pumps), standby equipment, and power requirements if applicable.
 7. Key operational control factors (i.e., maximum flow elevations upstream of dams).
 8. Design calculations proving adequacy of the system and selected equipment, including static lift, friction losses, fitting losses, flow velocity, pump curves identifying operating range, and pipe thickness calculations. Pipe thicknesses calculations shall assume an H2O live loading at crossings.
 9. Sewer plugging method and type of plug.
 10. Provide location of plug in manhole (upstream or down-stream of manhole).
 11. Method of noise control for each pump and generator.
 12. Thrust restraint block sizes and locations where space is limited.
 13. Method of securing and bracing of sewer plug shall be submitted. At a minimum, the plug must attach to a cable/chain which is then connected/tied off to an immobile object, as approved by the Engineer.
 14. Temporary pipe supports, and anchoring required.
 15. Contingency plan for cleanup and disinfection procedures in the event of a sewer spill. Contingency plan will identify equipment, tools, and manpower necessary to complete clean up, disinfect and repair.
 16. Staffing plan including name and qualifications for on-site operators. Trained bypass pumping personnel (pump operator) shall be present during the entire bypass operation. Logs shall be maintained by the bypass pumping personnel. Submit bypass pumping personnel qualifications for agency review and approval.
 17. Site layout showing all major components.
 18. Wet weather event procedures.
 19. An emergency response plan that addresses containment, notification procedures, and equipment failure procedures. An emergency contact list with 24-hour phone numbers shall be submitted and updated as needed.
 20. Schedule including durations and dates for each sequence.
 21. Protection method for existing utilities.
- B. Number and size of pumps used in bypass pumping shall be such that if the largest pump is out of service, bypass flows will be maintained during the bypass operation.

- C. Contractor may obtain current flow estimates from the Engineer, but shall field verify minimum, maximum, and average flow to be bypassed as detailed in this section.

1.05 Notifications

- A. In addition to providing the Bypass Pumping Plan, Contractor shall notify the Engineer and receive written approval from the City Engineer prior to each bypass operation.
- B. Contractor shall provide written notice to affected properties both 7 days and 24 hours prior to bypass work. The written notice shall list the date and times when sewer service will be affected and when it will be returned to normal service along with a phone number that owners can call for information.

1.06 Interruption of Sewer Service

- A. Sewer service shall be maintained to all customers.
- B. Sewer service shall not be stopped.
- C. Service shall not be interrupted, and no bypass operations shall occur during special events, if any, as identified by the City Engineer.
- D. Only 1 pipe segment, and the associated laterals, may be affected at 1 time.
- E. Lateral lines into manholes shall be bypassed from the next upstream structure in which no work is required or has been or is yet to be completed. If the structure upstream is private, Contractor shall notify the Engineer and receive written approval from the City Engineer prior to bypass operations.
- F. Lateral lines tying directly into the pipe shall be bypassed to the next downstream structure in which no work is required for that segment.

1.07 Noise Control

- A. Noise Control: Contractor shall comply with all local and agency noise limitation requirements.
- B. Contractor shall be required to limit noise production by using special mufflers, barriers, enclosures, equipment positioning, and other approved methods.

1.08 System Protection

- A. At each bypassing site, the Contractor shall have the entire bypassing system in place, functional, and tested before bypassing any sewage.
- B. Contractor shall be responsible for all bypass flows. Contractor shall inspect each bypass pumping, piping system, and odor control system in its entirety for leaks or spills on an hourly basis. Each bypass operation shall have a minimum of 1 trained and qualified attendant who shall provide 24/7 coverage and whose only duty is to maintain the bypass pumping and odor control systems until the bypassing of that specific pipeline is no longer required. An inspection log shall be kept at each pumping location.

- C. The attendant shall be qualified to both operate and repair any and all problems that may occur. The attendant shall have a cellular phone for communication between the Engineer and the site in the event of emergencies. No bypassing to the ground surface, receiving waters, storm drains, or bypassing which results in soil or groundwater contamination or any potential health hazards shall be permitted. In the event of any sewage spill, Contractor shall be responsible for the prompt notification of the City Engineer, cleanup, and disinfecting of the spill as called for in the bypass plan. Contractor shall compensate the City for the cost of fines levied as the result of a spill or unauthorized discharge.
- D. Work stoppage may be required due to a large storm event common to the seasons for which the Work is scheduled.

1.09 Quality Control

A. Hydrostatic Pressure Test

1. Bypass lines, fittings and accessories shall withstand twice the maximum pressure of the system or 50 psi, whichever is greater.
2. The test shall run for a period of 24 hours.
3. Contractor shall fill the line with water.
4. The line shall be sealed on the discharge end.
5. The line may be put in service if after the 24-hour period the pressure has been maintained and there are no observable leaks.
6. Notify the Engineer 24 hours prior to testing.

B. Inspection

1. Operator shall inspect temporary bypass pumping and piping system at a minimum of every hour.
2. Inspection Log: Keep at each pumping location.

PART 2 PRODUCTS

2.01 Equipment

- A. Supply the pumps, conduits, and other equipment to divert the flow of sewage around the sewer(s) or manhole(s) in which work is to be performed.
- B. Pumps used for bypassing shall be capable of passing at least a 3-inch solid sphere, and bypass piping shall have a minimum size of 4-inch diameter
 1. Furnish the necessary labor and supervision to set up and operate the pumping and bypassing system.
 2. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum, and a spare back-up pump shall be required.

3. All fuel tanks for pump or generator motors shall be filled by Contractor prior to leaving the job site if bypass pumping must continue.
 4. Do not suspend work for more than 24 hours during operation of a bypassing system, unless otherwise permitted by the Engineer.
- C. Bypass pumping pipe shall be located with the least impact on vehicular and pedestrian traffic, shall have no visible leaks, and shall be restrained as necessary to prevent any movement of the pipe. If the pipe must run perpendicular to traffic, the pipe shall be buried to prevent traffic restrictions. A plan to prevent Sanitary Sewer Overflows (SSOs) shall be approved by the Engineer and a redundant force main shall be provided. Contractor shall submit pipe design calculations and manufacturer information as well as emergency operation procedures to prevent a SSO as part of the Bypass Pumping Plan.
 - D. All pumps, generators, and other equipment shall be placed in a secondary containment or on a plastic tarp to protect against spills of petroleum products used by the equipment.
 - E. Bypass pumping system shall be cleaned and drained prior to being dismantled and moved to the next location. Contractor shall alternate pigging and purging of the system to remove all loose material. After Contractor has cleaned the pipe, and prior to dismantling of the piping for removal from the Project site, Contractor shall disinfect the pipe with 10 percent chlorine and water solution.
 - F. No "lay flat" pipe shall be allowed. All pipe shall be rigid pipe.
 - G. Overflow prevention monitors shall be field-ready corrosion resistant housings meeting IP67/NEMA 4, 4X standards with cellular communication capability, the ability to send text alerts to at least three user-designated phone numbers, non-confined space installation, and maintenance free operation.

2.02 Temporary or Permanent Bypass Pumping Facilities

- A. In establishing a bypass pumping facility on private property under a right-of-entry and/or right-of-access agreement, Contractor shall provide preference to an existing access location (manhole and/or cleanout) on the private property to establish the bypass pumping facility. Where an existing access location is utilized, no payment for temporary or permanent bypass pumping facilities will be authorized by the Engineer.
- B. Where an existing access location on private property is not available or would be impractical to use and a right-of-entry and/or right-of-access agreement from the property owner has been obtained, as approved by the Engineer, Contractor shall construct such temporary or permanent access as may be required to establish the bypass pumping facility.
 1. Temporary bypass pumping facility shall comply with the Uniform Plumbing Code and Standard Specifications, as applicable.

PART 3 EXECUTION

3.01 Preparation

- A. Contractor shall notify the Engineer 48 hours prior to bypassing or diverting flow in any of the pipelines or laterals.
- B. Take precautions to ensure that bypass pumping shall not cause damage to public or private properties.
 - 1. In the event damage occurs, make provisions to correct such damage at no additional cost to the City.
 - 2. Contractor shall be responsible for damages to public or private property, overflows from the sewer system, and violations resulting in fines as a result of the bypass operation.
- C. Contractor shall include 100 percent redundancy for bypass piping; 2 or more pipes (same size or larger) shall be installed. Redundancy shall be such that if 1 line is damaged during operation a second or third pipe can immediately take its place. Contractor shall include 1 redundant pump with the following minimum requirements.
 - 1. 100 percent redundancy for 2 pump operations, (1 in operation and 1 on standby), each pump with project peak flow capacity.
 - 2. 50 percent redundancy for 3 pump operations, (2 in operation and 1 standby), each pump with 50 percent project peak flow capacity.
 - 3. Different arrangements will be allowed with prior approval by the Engineer.
 - 4. Standby pumps shall be plumbed, fueled, and operational at all times. Standby pumps shall be maintained by Contractor and ready for immediate operation.
- D. The Contractor shall maintain on site a sufficient number of valves, tees, elbows, connections, tools, sewer plugs, piping, and any other spare parts or system hardware to ensure immediate repair or modification of any part of the system as necessary.
- E. Bypassing systems shall not be shut down between shifts, on holidays or weekends, or during work stoppages without written permission from the Engineer.
- F. Overflow prevention monitors shall be programmed to alert the Contractor, the Engineer, and designated City of Minot Public Works staff.

3.02 Bypass Pumping

- A. Contractor's sewage bypass pumping operations shall not harm the City of Minot, nor any other public or private party. Any and all penalties, fines, judgments, or injunctions levied due to Sanitary Sewer Overflow (SSO) spills or any other problems caused or related to Contractor's bypass pumping operations, monetary and otherwise, shall be borne and paid by Contractor.

- B. Bypass shall be made by diversion of the flow from at least 1 manhole upstream from section where work is taking place, around the section to be taken from service for new construction, to an existing downstream location, at least 1 manhole beyond the section where work is taking place.
- C. Bypass Pumping Capacity:
1. Prior to construction, Contractor shall perform flow monitoring on all lines to be bypassed in accordance with the following requirements. The measured flow rate, minimum, average, and peak shall be included in the bypass pumping plan.
 - a. Contractor shall be required to monitor flows for a minimum of 7 consecutive days encompassing 2 weekends. The flow data shall be collected and recorded at 15-minute intervals.
 - b. Contractor shall complete 7-day area/velocity flow monitoring on all pipes proposed for diversion. Diverted flows shall be discharged to the trunk line (downstream of the diversion), unless otherwise authorized by the Engineer.
 - c. Project Peak Flows shall be calculated without any upstream diversions in place, using the highest flow determined from the following criteria:
 - 1) Times the Peak 15 Minute Flow or
 - 2) Times the Average 15 Minute Flow
 - d. Project Peak Flows shall be used to determine the number and size of primary pumps, standby pumps, suction pipes, discharges pipes, redundant discharge pipes, and any other flow related element of the bypass pumping system.
 - e. Pipe velocity through force mains shall be at least 3 fps but not exceed 12 fps.
- D. Bypass Pumping Minimum Procedures:
1. Contractor shall provide bypass pumping capable of handling Project Peak/ Maximum and Minimum flow loads for the pipeline(s) to be bypassed.
 2. When performing bypass work, ensure that pumping redundancy is on-site with all appurtenances (suction/discharge pipe) attached so that a pump can immediately be started when another pump has to be taken out of service.
 3. Provide on-site a minimum of 1 trained and qualified operator for each bypass operation who shall provide 24/7 coverage and possess the experience and knowledge to operate, maintain, repair, refuel, and so forth at all times while bypass pumping systems are required.

4. Install plugs in upstream portion of pipe in manhole, if operation allows. If not, bag or plug shall be secured with length of cable that will extend to the next downstream manhole for retrieval. This is to prevent rogue/runaway bags/plugs from entering the collection system. Opening in retrieval manhole shall be large enough to allow bag/plug removal. Also take into consideration the invert/base construction, 90-degree manholes, offset/angle points, and so forth when determining the retrieval manhole.
5. Pumping systems for laterals shall be designed for frequent pump operation in accordance with the following requirements:
 - a. Contractor shall maintain existing working levels in existing lift station wet wells.
 - b. Sewage level in manholes shall be maintained at as low a level as possible to prevent odor problems and the bypass pumping equipment shall at a minimum pump at the same rate as the flow rate into the manhole.
 - c. All bypass pumping operations shall be individually addressed in the bypass pumping plan.
6. Contractor shall submit a written bypass pumping plan addressing the above requirements before proceeding with work. Provide emergency list of phone numbers.

3.03 Removal

- A. Remove bypass pumping system when no longer needed. The Contractor shall notify the Engineer 48 hours prior to shutting down the bypass system.
- B. After completion of bypass pumping operations, Contractor shall clean disturbed areas, restoring them to their original condition. This operation shall include but not be limited to, pavement restoration and landscaping, at least equal to that which existed prior to start of Work.

PART 4 – MEASUREMENT AND PAYMENT

- A. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 2315 - CURED-IN-PLACE PIPE (CIPP)

CURED-IN-PLACE PIPE (CIPP)

PART 1 - GENERAL

1.01 Section Summary

- A. This section includes pipe rehabilitation to a watertight condition by the installation of a cured-in-place pipe (CIPP) lining system.

1.02 Related Sections

- A. Section 2300 – Sanitary Sewer
- B. Section 2310 – Bypass Pumping

1.03 References

- A. American Society for Testing and Materials (ASTM)
 - 1. D543 - Evaluating the Resistance of Plastics to Chemical Reagents
 - 2. D638 - Tensile Properties of Plastics
 - 3. D790 - Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials
 - 4. D2990 - Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.
 - 5. D5813 - Cured-in-Place Thermosetting Resin Sewer Piping Systems
 - 6. F1216 - Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.
 - 7. F1743 - Rehabilitation of Existing Pipelines and Conduits by the Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)

1.04 Qualification Requirements

- A. Pre-Approved Manufacturers for use on the project:
 - 1. National Liner, LLC of Delafield, WI.
 - 2. Inliner Technologies, Inc. of Paoli, IN.
 - 3. Insituform Technologies, Inc. of Chesterfield, MO.
 - 4. C.I.P.P. Corporation of Hudson, IA.
 - 5. Applied Felts, Inc. of Martinsville, VA.
 - 6. Pipenology, LLC O'Fallon, MO.

B. Pre-Approved Installers for work on the project:

1. HK Solutions Group of Watertown, SD.
2. Lametti & Sons, Inc. of Hugo, MN.
3. Visu-Sewer of Pewaukee, WI.
4. Insituform Technologies, Inc. of Chesterfield, MO.
5. Municipal Pipe Tool Company LLC of Hudson, IA.
6. SAK Construction of O'Fallon, MO.
7. Planned and Engineered Construction, Inc. of Helena, MT.
8. S.J. Louis Companies of Rockville, MN.

C. Pre-Approval Prior to Bidding

1. Trenchless rehabilitation products and installers who are not listed above must be pre-approved prior to the bid opening. All required submittals must be satisfactory to the Owner. Products and Installers seeking approval must meet all the following criteria to be deemed Commercially Acceptable:
 - a. Product:
 - i. A minimum of 5 successful wastewater collection system projects of a similar size and scope of work shall have been performed in the United States and documented to the satisfaction of the Owner.
 - ii. Products submitted for approval must provide third party test results supporting the structural performance (short-term and long-term) of the product and such data shall be satisfactory to the Owner. No product will be approved without third party testing verification.
 - b. Installer:
 - i. Must have at least 5 years active experience in commercial installation.
 - ii. Must have successfully installed at least 50,000 feet of cured-in-place product in wastewater collection systems. The installation shall have been on pipe sizes similar to those proposed for use on this project.
 - iii. Acceptable documentation of these minimum installations must be submitted to the Owner.

1.05 Quality Assurance

- A. Products used in the work of this section shall be produced by manufacturers regularly engaged in the manufacture of cured-in-place

liners for municipal wastewater systems with a history of successful production acceptable to the Owner.

- B. The installing Contractor shall be licensed by the cured-in-place lining system manufacturer and shall have successful experience in the installation of cured-in-place lining systems in municipal wastewater systems. The Contractor shall also be familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- C. The Contractor shall submit evidence acceptable to the Owner, such as a certified copy of a license or agreement, that it has the authority to use and/or install the liner product.
- D. The finished liner shall be continuous over the entire length of the liner insertion run between the manholes and shall be free from visual defects such as foreign inclusions, dry spots, pinholes, and delamination.
- E. Wrinkles in the finished liner pipe which cause a backwater of one inch or more or reduce the hydraulic capacity of the pipe are unacceptable and shall be removed or repaired at the Contractor's expense. If a void between the wrinkle and the pipe develops, the Contractor shall repair or replace that section of the pipe. Methods of repair shall be proposed by the Contractor and submitted to the Owner for review and approval.
- F. Following sewer cleaning and prior to installation of the liner and finish work at the manholes, the sewer shall be televised and recorded in a digital format acceptable to the Owner, then furnished to the Owner on media such as a USB flash drive. The Contractor shall also televise the sewer after completion of all liner installation and finish work at the manholes and similarly provide copies to the Owner.

1.06 Superintendent Requirements

- A. Regardless of method of pre-approval, the successful bidder's construction superintendent shall have a minimum of three (3) years' experience in all aspects of the lining process to be used, and shall be on the project at all times during performance of the work.
- B. In lieu of the above requirement for the construction superintendent, a representative of the liner manufacturer, with a minimum of three years' experience, shall be present at all times that the liner is being installed.

1.07 Submittals

- A. The successful Contractor shall submit the following information prior to the pre-construction meeting:
 - 1. Manufacturer's certification that materials to be used meet the referenced standards and these specifications.
 - 2. License or certificate verifying manufacturer/licensor approval of installer.
 - 3. Proposed equipment and procedures for accomplishing work.

4. Product data and manufacturer's instructions for resin and catalyst system.
 5. Bypass pumping plan as required in Section 2310 – Bypass Pumping.
 6. Traffic control plan.
- B. The Contractor shall submit the following prior to performing any CIPP work:
1. Field measurements.
 2. Pipe sizing calculations which demonstrate the liner tube has been properly sized to avoid creation of wrinkles or folds.
 3. Liner size.
 4. Thickness calculations and assumptions used as the basis for calculations.

PART 2 - PRODUCTS

2.01 A resin impregnated flexible tube is inverted into the existing pipe utilizing a hydrostatic head, air pressure, or other approved method. The tube shall then be cured to form a hard, impermeable pipe. When cured, the liner shall extend over the designated length of the existing pipe in a continuous tight-fitting watertight pipe-within-a-pipe. The CIPP shall be fabricated from the materials which, when cured, shall be chemically resistant to withstand internal exposure to the type of fluid to be carried by the pipe.

- A. Tube:
1. Shall meet the requirements of ASTM F1216 or ASTM F1743, Section 5.
 2. Should consist of one or more layers of flexible needled felt or an equivalent nonwoven or woven material, capable of carrying resin, withstanding installation pressures and curing temperatures.
 3. Shall be compatible with the resin system used.
 4. Shall be able to stretch to fit irregular pipe sections and negotiate bends.
 5. Shall have sufficient strength to bridge missing pipe sections.
 6. Outer layer shall be plastic coated with a material that is compatible with the resin system used.
 7. Tube shall be fabricated to a size that, when installed, will tightly fit the internal circumference and length of the original conduit. Allowance shall be made for the circumferential stretching during installation process.
 8. Seams shall be stronger than the non-seamed felt.

9. Outside of tube shall be marked at regular intervals along the entire length. Markings shall also include Manufacturers name or identifying symbol.

B. Resin:

1. Shall be a general purpose, unsaturated, styrene based, thermoset resin and catalyst system or an epoxy resin and hardener.
2. Shall be compatible with the inversion process being used.
3. Shall meet the requirements of ASTM F1216 and ASTM F1743.
4. Must be able to cure in the presence of water.
5. Initiation for cure shall be less than 180°F (82.2°C).

C. Strength

1. The CIPP shall conform to the following minimum structural standards:

Property	Standard	Cured Composite	
		per ASTM F1216	Enhanced Resin
Flexural Strength	ASTM D790	4,500 psi	4,500 psi
Flexural Modulus	ASTM D790	250,000 psi	400,000 psi

D. Minimum Thickness

1. The CIPP shall be designed as per ASTM F1216, Appendix X1. The CIPP design shall assume no bonding to the original pipe wall. The long term Flexural Modulus used in the design shall be verified by independent testing. Such long term Modulus values shall not exceed 50% of short-term values given in 2.01.C above.
2. The existing pipe shall be considered fully deteriorated. The minimum service life of the CIPP shall be 50 years. The enhancement factor 'K' shall not be greater than 7, the minimum ovality of the host pipe shall be 2 percent, and the minimum safety factor shall be 2.0. The ground water depth to be used in design is 4 feet (assumed). The soil modulus used shall be 1000 psi (for pipes less than 20 feet of bury) and 1500 psi (for pipes with 20 feet of bury and greater), the soil density shall be 120 pcf and the live load used shall be H20 Highway.
3. The CIPP thickness shall not be less than those shown in the table below for the given physical properties. The CIPP shall conform to the following minimum thickness standards:

Pipe Size	Thickness required with 250,000 psi	Thickness required with 400,000 psi
	<u>Flexural Modulus</u>	<u>Flexural Modulus</u>
8" Pipe	0.178 inches	0.153 inches
10" Pipe	0.229 inches	0.196 inches
12" Pipe	0.359 inches	0.332 inches

4. And layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

PART 3 - EXECUTION

3.01 The following procedures shall be adhered to unless otherwise approved by the Engineer/Owner.

3.02 Safety

- A. The installer shall carry out operations in strict accordance with all OSHA and manufacturers safety requirements. Particular attention is drawn to those safety requirements involving working with scaffolding and entering confined spaces.

3.03 Cleaning of Pipes and Obstructions

- A. Prior to installation, the Contractor shall clean the line that is to receive the liner. It shall be the responsibility of the installer to clear the pipe of obstructions such as solids, protruding service connections, or collapsed pipe that could prevent insertion of the liner or adherence to the pipe wall. If inspection reveals an obstruction that cannot be removed by conventional pipe cleaning equipment, the Contractor shall make a point repair excavation to remove or repair the obstruction. Such excavation shall be approved in writing by the Engineer prior to the commencement of the work and shall be considered as a separate pay item.
- B. The Owner will provide a dump site for all debris removed from the sewers during the cleaning operation. Unless stated otherwise, it is assumed this site will be at or near the sewage treatment facility to which the debris would have arrived in absence of the cleaning operation.

3.04 Inspection of Original Pipe

- A. Inspection of the original pipe shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed circuit television (CCTV). The interior of the pipe shall be carefully inspected to determine the location of any conditions that may prevent the proper installation of the liner. A videotape and log noting all services and defects

shall be submitted to the Engineer/Owner, prior to installation of liner, for future reference.

- B. The Contractor will be required to use a jetter simultaneously with the televising in order to "draw down" the flow within the pipe so that the bottom of the pipe can be visually inspected. Failure to do so will result in non-payment for the cleaning process. If the flow is such that the bottom of the pipe is not visible, the Contractor shall initiate the by-pass pumping prior to the televising.

3.05 Resin Impregnation

- A. The tube should be vacuum-impregnated with resin (wet-out) under controlled conditions. The volume of resin used shall be sufficient to fill all voids in the tube material at nominal thickness and diameter. The volume shall be adjusted by 5-10% excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe.

3.06 Notification

- A. The Contractor shall notify all parties who will be affected by the lining operation. For sanitary sewers, the notice shall advise against water usage until the lateral is reconnected and the sewer back in service.
- B. The following information should also be provided on the notification: a 24-hour contact person and telephone number, information regarding the work to be conducted, and when the sewer will be off-line. The Contractor shall make personal contact with any home or business which cannot be reconnected within the time stated in the written notice.
- C. Contractor shall notify the Public Works Department office, 48 hours in advance, anytime they plan on working on the project so proper notification can be made to all departments and the general public.

3.07 Installation of The Liner

- A. The Contractor shall designate a location where the uncured resin in the original containers and the unimpregnated tube will be vacuum impregnated prior to installation. The installer shall allow the Engineer/Owner to inspect the materials and "wet out" procedure. A resin and catalyst system compatible with requirements of this method shall be used. The quantities of the liquid thermosetting material shall be per manufacturer's standards to provide the wall thickness specified.
- B. The Contractor shall field-verify tube lengths and diameters for each run of pipe to be rehabilitated prior to ordering.

3.08 Inversion

- A. The wet out tube shall be inserted through an existing manhole or other approved access by means of an inversion process and the application of a hydrostatic head, air pressure or mechanical means sufficient to fully extend the tube to the next designated manhole or termination point. The tube shall be inserted into the vertical inversion standpipe or guide chute with the impermeable plastic membrane side out and attached with a leak

proof seal. The hydrostatic head or air pressure shall be adjusted to cause the impregnated tube to invert from the point of inversion to the point of termination, turning the tube inside out and holding the tube tight to the wall, producing dimples at lateral connections. Care shall be taken to avoid overstressing the fabric. The tube manufacturer shall provide information on the maximum allowable tensile stress for the tube.

- B. Before the inversion begins, the tube manufacturer shall provide the minimum pressure required to hold the tube tight against the existing conduit and the maximum allowable pressure so as not to damage the tube. Once the inversion has started, the pressure shall be maintained between the minimum and maximum pressures until inversion has been completed. If the pressures are not maintained, the tube shall be removed from the pipe.

3.09 Lubricant

- A. The use of a lubricant during inversion shall be allowed to reduce friction during inversion. The lubricant shall be a nontoxic, oil-based product that has no detrimental effect on the tube, does not support bacteria growth or affect the general characteristics of the fluid to be carried by the pipe.

3.10 Curing

- A. After inversion has been completed, the inversion water shall be uniformly raised above the temperature required to effect a cure of the resin as recommended by the manufacturer. The inversion water shall be recirculated by means of a pump throughout the tube and temperature monitors shall be placed on the ingoing and outgoing lines to determine that the correct temperature is maintained. Additionally, a temperature gauge shall be installed between the tube and the pipe invert at the termination point to determine temperatures during cure.
- B. If steam is used to cure the tube, the temperature within the tube shall be uniformly raised by means of steam generating equipment. Temperature gauges shall be placed on the outgoing line and also gauges shall be placed between the tube and invert of the existing pipe at both the upper and lower ends of the pipe to determine the temperature during cure.
- C. The recommended temperature shall be held for the length of time recommended by the resin manufacturer. Initial cure occurs during heat up and is indicated when the exposed portions of the tube appear to be hard and sound and the remote temperature sensor(s) indicate that the temperature is of a magnitude to realize an exotherm or cure in the resin. The temperature should then be raised to post cure temperatures and held for the duration recommended by the resin manufacturer.
- D. Pressure shall be maintained as per the manufacturer's recommendations to hold the flexible tube tight against the existing pipe. This pressure shall be maintained until the cure has been completed.
- E. The Contractor shall provide a continuous log of the designated temperatures and pressures during the time of the cure. The Contractor shall also furnish the Engineer with the resin manufacturers recommended cure temperatures and pressures prior to the start of the inversion process.

3.11 Cool Down

- A. The liner pipe shall be cooled down to a temperature below 100° F (113° F for steam cured) before relieving the internal pressure. Cool down may be accomplished by introducing cool water into the section as the water and/or steam is drained off through a small hole in the downstream end. Care must be taken to avoid causing a vacuum that could damage the newly installed pipe.

3.12 Finish

- A. The finished CIPP shall be continuous over the entire length between manholes and be free from visual defects such as foreign inclusions, dry spots, lifts, pinholes, or delamination. The new pipe shall be free of leaks and any defects that will affect the integrity or strength of the CIPP shall be repaired at the Contractor's expense in a manner acceptable to the Engineer.

3.13 Sealing CIPP at Manholes

- A. Hydrophilic seals shall be used to achieve a watertight connection at manholes. If the CIPP fails to make a tight seal at the manhole walls the Contractor shall apply a resin mixture seal at that point. The resin seal shall be compatible with the resin mixture of the CIPP.

3.14 Service Connections

- A. After the new pipe has been cured in place, the Contractor shall reconnect all existing active service connections. This shall be done without excavation by means of a television camera and cutting device. The services shall be restored to not less than 95% of their original capacity and shall be free of any sharp edges or protrusions, which could cause paper, rags or debris to accumulate.
- B. All services shall be reconnected unless deemed to be inactive by the Owner.
- C. Any plugs removed during the service connection process shall be caught at the downstream manhole so as not to cause problems with any pumps located further downstream.
- D. Sanitary services shall not be out of service for more than 8 hours.

3.15 Inspection/Testing Requirements

- A. CIPP samples shall be prepared for 20% of the project sections installed with a minimum of 1 sample per pipe size. The contractor is responsible for all expenses for obtaining and testing samples. Pipe physical properties will be tested in accordance with ASTM F1216 or F1743, Section 8, using either method proposed.
- B. The flexural properties must meet or exceed the values listed in the table on 2.01.3 of this specification section, Table 1 of ASTM F1216, or the values submitted to the Owner/Engineer by the Contractor for this project's CIPP, whichever is greater.

- C. The samples shall be clamped between flat plates and the mold placed in the downtube when circulating water is used or in the silencer when steam is used. The samples shall be large enough to provide a minimum of five specimens for flexural and tensile testing. After curing, the samples will be submitted to an independent testing firm to confirm the finished product meets the requirements of these Specifications.
- D. Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less than 87.5% of the submitted minimum design wall thickness as calculated for the submittals.
- E. The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers. If separation of the layers occur during testing of field samples, new samples will be cut from the work. Any reoccurrence may cause rejection of the work.

3.16 Clean-Up

- A. Upon completing the installation work, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

3.17 Environmental Requirements

- A. Prior to starting construction, the contractor shall supply to the Owner a plan describing how the contaminated water will be captured and/or pre-treated. The plan shall also include the location to be used for disposal. The plan will be subject to Owner approval.

PART 4 – MEASUREMENT & PAYMENT

- A. Trim Protruding Tap – Iron: Shall be paid for by each (EA) and shall include all material, labor, and equipment necessary to determine which taps are to be trimmed and to grind or cut the protruding “iron” service pipe flush with the sewer so the CIPP can be installed to manufacturer’s specifications. “Iron” shall be defined as pipe materials of a metallic nature, including, but not limited to cast iron, ductile iron, galvanized steel, and CMP.
- B. Trim Protruding Tap – Non-Iron: Shall be paid for by each (EA) and shall include all material, labor, and equipment necessary to determine which taps are to be trimmed and to grind or cut the protruding “non-iron” service pipe flush with the sewer so the CIPP can be installed to manufacturer’s specifications. “Non-iron” shall include all materials not defined as “iron” above including, but not limited to PVC, HDPE, vitrified clay, and bituminous fiber (Orangeburg).
- C. _____” (Sanitary or Storm) Sewer Point Repair: Shall be paid for by the linear foot (LF) for all types and depth ranges and shall include all material, labor, and equipment necessary for installing, testing, and televising the pipe complete and in place as specified, including all excavation, bedding, pipe encasement, marking tape, backfill, and compaction. Pipe shall be

measured from point of repair connection to point of repair connection. The minimum payment per each repair shall be 10 LF. If a repair is in excess of 10 LF, payment shall be made per LF installed for that repair location.

- D. Sewer Line Preparation: Shall be paid for by the linear foot (LF) from center of manhole to center of manhole and shall include all material, labor, and equipment necessary to inspect, remove line obstructions or debris, clean, and prepare the sewer main for the CIPP.
- E. CIPP Lining - _____" (Sanitary or Storm) Sewer: Shall be paid for by the linear foot (LF) from center of manhole to center of manhole for the size installed and shall include all material, labor, and equipment necessary to install the CIPP within manufacturer's specifications, as well as expenses for obtaining and testing samples.
- F. CIPPLL from Sewer Main: Shall be paid for by each (EA) service lateral that is lined from the sewer main, regardless of diameter, including any cleanouts required by the lining method chosen by the Contractor. Each sewer service shall be lined a minimum of 10' as measured from the service tap.
- G. CIPPLL from Manhole: Shall be paid for by the linear foot (LF) of service lateral that is lined from an existing manhole, regardless of diameter. This bid item applies to sewer services that connect to existing manholes. Each sewer service shall be lined to a minimum of 10' as measured from the inside edge of the manhole.
- H. Reconnect Sewer Services All Types and Sizes: Shall be paid for by each (EA) and shall include all material, labor, and equipment necessary to reconnect the sewer service after the liner has been installed.
- I. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

SECTION 2400 – SANITARY SERVICES

SANITARY SERVICES

PART 1 – GENERAL

1.01 Section Summary

- A. Sanitary sewer service pipe installation and appurtenances.

1.02 Related Sections

- A. Section 2000 – Trench Excavation and Backfill
- B. Section 2300 – Sanitary Sewer

1.03 References

- A. American Society of Testing Materials (ASTM)
 - 1. D698 – Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - 2. D2665 – Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
 - 3. D1785 – PVC Plastic Pipe, Schedules 40, 80, and 120
 - 4. D2241 – Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
 - 5. D2321 – Joints for Drain and Sewer Pipes Using Gaskets
 - 6. D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 7. D5926 – Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
 - 8. F679 – Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
- B. NSF International Standard / American National Standard (NSF/ANSI)
 - 1. NSF/ANSI 14 – Plastics Piping System Components & Related Materials

1.04 Submittals

- A. Submit to the Engineer for review:
 - 1. Wye location (station).
 - 2. Depth of service.
 - 3. Length of service line.
- B. Manufacturer's information:
 - 1. Pipe and appurtenances.
 - 2. Saddle wyes.
 - 3. Repair couplings for coupled connections.
 - 4. Cleanout covers.
- C. Final payment will not be made until all service information is submitted to and reviewed by the Engineer.

PART 2 – PRODUCTS

2.01 Service Connections

- A. To new mains: Install inline wyes with new sewer mains.
- B. To existing clay tile wyes:
 - 1. Option A: Pliable elastomeric PVC compression seals (donuts) by Fernco, GPK Products, or approved equal
 - 2. Option B: Flexible repair coupling wrapped in a stainless-steel shear ring, Strong Back RC Series by Fernco or approved equal.
- C. To existing mains where no wye is present:
 - 1. PVC mains: Install rigid SDR-35 PVC saddle wye conforming to ASTM D3034 or F679 as applicable or flexible PVC saddle wye conforming to ASTM D5926.
 - 2. Other than PVC mains: Install flexible PVC saddle wye conforming to ASTM D5926.
 - 3. Saddle wyes shall be gasketed to the main with bentonite tape or approved equal to achieve a watertight seal and shall be installed with two stainless steel straps.

- D. To existing service pipes of a material other than PVC: Flexible repair coupling wrapped in a stainless-steel shear ring, Strong Back RC Series by Fernco or approved equal.

2.02 Service Pipes and Risers

A. Polyvinyl Chloride (PVC) Service Pipe

1. Pipe shall conform to ASTM D1785. Fittings and solvents shall conform to ASTM D2665.
2. All pipes shall be bell and spigot.
3. Each pipe shall be identified by name of manufacturer, nominal pipe size, and PVC cell classification.
4. Minimum service size is 4-inch.
5. Minimum wall thickness is Schedule 40.
6. Solvent welded joints will be required and must be done in accordance with manufacturer's instructions.
7. SDR 26 pipe conforming to ASTM D3034 shall be required for 6" diameter services.

2.03 Marking Tape

- A. Tape shall be per Section 2300 – Sanitary Sewer.

2.04 Pipe Bedding

- A. Bedding material shall conform to Section 2000 – Trench Excavation and Backfill.

2.05 Cleanout Covers

- A. All covers shall be clearly marked "SEWER".
- B. Covers shall be cast iron.
 1. 4-inch diameter cleanouts: Use a standard 10" gate valve box section with lid.
 2. 6-inch diameter cleanouts: Use PROSELECT Assembled Cast Iron Clean Out Body with Cover, model number PSVBM1007SWR or approved equal.

PART 3 – EXECUTION

3.01 Pipe Installation

- A. Governing Code shall be North Dakota Plumbing Code and all City Ordinances that apply.
- B. Minimum grade shall be 1/4-inch per foot for 4-inch diameter pipe and 1/8-inch per foot for 6-inch diameter pipe unless otherwise directed by the Engineer.
- C. Install pipe, fittings, and marking tape in accordance with Section 2300 – Sanitary Sewer.
- D. Service locations shall be shown on the Plans and installed downstream of, and a minimum distance of 10 feet from, water service pipes.
- E. Record all necessary information to comply with the submittal requirements of this Section.
- F. Plug end of service to protect the system with a mechanical type plug or cap, easily removed and re-installed when required that will completely seal the end of the service pipe. No wood plank, mortar, rags, soils, brick, block or other undesirable materials shall be used or will be accepted to plug the end of the service line.
- G. Mark end of new service stubs:
 - 1. Install a 2 X 4 green-treated wood post, painted green, extending from the service cap vertically to 4 feet above the surface.
 - 2. Install a 24-inch-long 2 X 2 green-treated wood post, painted green, extending from the service cap vertically toward the surface.

3.02 Reconnect Existing Sewer Services

- 1. No warranty is expressed or implied as to the location, size, or material type of existing service lines. The Contractor shall furnish and install all fittings required to make the connection.

3.03 Cleanouts

- A. Cleanouts shall be installed on 4 and 6 inch service lines that exceed 80 feet in length. Cleanouts shall be spaced no greater than 80 feet apart with the first cleanout installed 80 feet from the connection to the main.
- B. The cleanout wye shall be encased in concrete.

- C. Where the cleanout is extended to grade, install a cleanout cover to protect the cleanout.

3.04 Televising

- A. All repaired and/or replaced service lines not visually inspected by the Public Works Department, and all service lines installed by boring or pipe bursting shall be televised by the Contractor in a manner that adequately illuminates the pipe for identification of distresses and obstructions.
- B. Contractor shall clean each line by flushing with water immediately prior to televising.
- C. Contractor shall provide to Public Works staff, one (1) bound hard copy of the Televised Inspection Reports, one report for each address. Each report shall clearly indicate the property address and date. Any distresses, leaks, and/or other abnormalities shall be noted on the reports. Accompanying the bound hard copy shall include a digital copy of the video stored on a DVD or flash drive in a file format that supports fast-forward and rewind. The video shall include an audio description and printed property address and stationing of each abnormality accurate to the foot.

PART 4 – MEASUREMENT AND PAYMENT

- A. PVC Service Pipe: Shall be paid for by the linear foot (LF) for each size and type specified on the Plan. Measurement shall be the two-dimensional horizontal length along the axis of the pipe without regard to fittings, from the centerline of the sewer main to either the point of connection with the existing service line or the end of the new service line. Price shall include all materials and labor necessary for installation including excavation, bedding, necessary fittings, backfill and compaction. Payment for bored sewer services shall include the cost of the bore and the pipe for the length of the bore. Where services that are shown to be open-cut on the plans are bored as a more feasible option, payment will be made on the open-cut bid item.
- B. Reconnect Existing Service: Shall be paid for by each (EA) existing service that is reconnected. Price shall include all materials and labor required to make the connections to the sewer main and to the existing service pipe.
- C. Risers: Shall be paid for by linear foot (LF) for each size and type specified on the Plan. Measurement shall be the sloped length along the axis of the pipe without regard to fittings, from the point of connection with the sewer main to the point of connection with the horizontal portion of the service line.
- D. Cleanout: Shall be paid for by each (EA) cleanout installed as specified.

- E. No Bid Items shall be provided for plugs or 2 X 4 and 2 X 2 wood markers, these costs shall be included in the price bid for PVC Service Pipe.
- F. Televising: Shall be incidental to the repaired, replaced, bored, or bursted pipe.
- G. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 2700 – STORM SEWER

STORM SEWER

PART 1 – GENERAL

1.01 Section Summary

- A. Construction of storm sewer systems including pipes, manholes, catch basins, and appurtenances.

1.02 Related Sections

- A. Section 1200 – Temporary Erosion and Sediment Control
- B. Section 1700 – Adjustment of Structures
- C. Section 2000 – Trench Excavation and Backfill
- D. Section 2800 – Subsurface Drainage
- E. Section 3200 – Concrete Curb and Gutter

1.03 References

- A. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. M111 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- B. American Society of Testing Materials (ASTM)
 - 1. A48 – Gray Iron Castings
 - 2. A153 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 3. A615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - 4. C76 – Reinforced Concrete Culvert, Drain, and Sewer Pipe
 - 5. C139 – Concrete Masonry Units for Construction of Catch Basins and Manholes
 - 6. C150 – Portland Cement
 - 7. C206 – Finishing Hydrated Lime
 - 8. C270 – Mortar for Unit Masonry

9. C443 – Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 10. C478 – Circular Precast Reinforced Concrete Manhole Sections
 11. C990 – Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
 12. C1714 – Preblended Dry Mortar Mix for Unit Masonry
- C. North Dakota Department of Transportation "Standard Specification for Road and Bridge Construction" 2020 Current, As Revised.
1. Section 256 – Riprap
 2. Section 714 – Culverts, Storm Drains, Edge Drains, and Underdrains
 3. Section 722 – Manholes, Catch Basins, and Inlets
 4. Section 858 – Geosynthetics
- 1.04 Submittals
- A. Contractor to supply the Engineer with shop drawings for all structures, castings, and other manufactured materials.

PART 2 – PRODUCTS

- 2.01 Concrete and Mortar
- A. All concrete products shall use Type 1 Portland Cement (conform to ASTM C150), washed sand, and crushed aggregate free of deleterious materials.
 - B. Mix designs shall be approved by the Engineer and must obtain 4000 psi compressive strength at 28 days.
 - C. Mortar mix shall be designed to be compatible with the characteristics of the materials used in manhole, catch basin, and catch basin manhole construction and shall conform to ASTM C270, and ASTM 1714 for preblended mixes.
- 2.02 Castings
- A. All castings shall conform to ASTM A48, class 35 cast iron.
 - B. The type and style of casting is shown on the Plan or is indicated on the detail drawings.
 - C. All storm manhole castings with solid lid cover shall be stamped "STORM SEWER."

- D. Covers shall have 2 concealed pick holes, Type F.
- E. Standard castings to be used for each structure are as follows:
 - 1. Storm Manholes: Neenah 1642, Type B or approved equal.
 - 2. Storm Manholes located in concrete pavement: Neenah R-1955-1 or approved equal.
 - 3. Catch Basin (2'x3'): Neenah R-3067-L, EJ 7030 with grate 7010M4, or approved equal.
 - 4. Catch Basin (2'x6'): Neenah R-3295-2, hood type 7005, grate type L or approved equal.
 - 5. Catch Basin (30" round): Neenah R-3065-L or approved equal.
 - 6. Catch Basin (turf area): Neenah R-2561, Beehive grate 9" height or approved equal.

2.03 Storm Manholes and Catch Basins

- A. Structures shall conform to ASTM C478.
- B. All structures shall be precast; no block structures are allowed.
- C. Joints shall be sealed with either rubber gaskets to conform to ASTM C443 or premium-grade butyl rubber sealant to conform to ASTM C990.
- D. Structure base slabs shall be precast concrete.
- E. Catch Basin Manholes shall be the only approved junction structure where both inlet pipes and an opening for accepting surface storm water are needed.
- F. Provide holes for drain tile connections, either precast or core-drilled and sized appropriately for the connecting pipe including fabricated sand collar.

2.04 Reinforced Concrete (RCP) Pipe

- A. General
 - 1. All reinforced concrete pipe shall conform to ASTM C76, wall B or wall C, with circular reinforcing.
 - 2. Each pipe shall be marked with name of manufacturer, plant, date of manufacture, pipe class, and specification design.

B. Tongue and Groove RCP

1. Unless otherwise stated on the plan, this type of joint shall be specified.
2. Gaskets or premium grade butyl sealant shall be used on all joints.
3. All joints shall be securely wrapped with type R1 or S1 geosynthetic material.

C. Bell and Spigot RCP

1. Joints shall use rubber gaskets to conform to ASTM C443.

2.05 End Sections and Trash Racks

- A. Trash racks required on all end sections.
- B. All grates and hardware shall conform to ASTM A153.
- C. Size and configuration of bars shall be as shown on the detail drawings.
- D. Trash rack must be securely attached to the end section.
- E. Each end section at outfalls shall have a cutoff wall per the detail drawings.

2.06 Slotted Inlet Drains

- A. Inlet Pipe: Shall be Corrugated Steel Pipe (CSP) of the size specified on the Plan and shall conform to AASHTO M36.
 1. Coupling band shall be 10-1/2 inches minimum with a 1/2-inch carriage bolt.
- B. Slotted Drain System: Shall be fabricated and attached to the CSP and shall be coated according to AASHTO M111.
 1. Butt welded No 4 rebar, 9 inches in length, with 1-1/2 inches of cover, shall be attached to the slots.
 2. Inlet slots shall have a 1-3/4-inch opening at the surface that will expand to 3 inches at the top of pipe.
 3. Inlet slots shall be vane type, spaced every 6 inches.

2.07 Rip Rap

- A. Material: Field stone or crushed stone may be used. Riprap size and gradation shall be determined from Table 256-1 of the NDDOT Standard Specification Section 256. Stone shall not be sandstone, shale, or soft limestone. Stone shall not abrade or crush.
- B. Geosynthetic Material: Shall be Type RR or R1 as defined by NDDOT Specification Section 858.
- C. Grout: Proportion grout using one (1) part Portland Cement and two (2) parts sand by volume.

PART 3 – EXECUTION

3.01 General

- A. All excavation and bedding requirements shall conform to the Standard Detail plates or Section 2000 – Trench Excavation and Backfill.
- B. Contractor shall be responsible for all bypass pumping and drainage required during construction.
- C. Establish temporary erosion control as Specified in Section 1200 – Temporary Erosion and Sediment Control as soon as practical.

3.02 Connect to Existing

- A. Connect to Existing Structure
 - 1. Cut hole into side of structure and insert pipe flush with interior wall.
 - 2. Mortar all void spaces between pipe and structure to provide a watertight seal. Apply mortar to give an even surface.
 - 3. Reconstruct invert to provide flow through the structure.
- B. Connect to Existing Pipe
 - 1. Utilize tongue and groove joint if possible and wrap with geosynthetic material.
 - 2. If butt joint must be used, wrap joint with geosynthetic material and place concrete collar around the joint per the detail drawings.

3.03 Pipe Installation

- A. Lay pipe to alignment, grade, and location staked in the field or shown on the Plans. No deviation is allowed unless approved by the Engineer. Deviation from grade in excess of 0.05 percent may be cause for rejection and remove and replace pipe at the Contractor's expense.
- B. Lay pipe in accordance with manufacturer's recommendations, upgrade with tongue/spigot ends pointing in the direction of flow.
- C. Joints shall be wrapped with Geotextile fabric 24 inches wide centered on the joint and secured to the pipe.
- D. Dirt or other foreign materials in the pipe must be removed prior to installation. Contractor is responsible for system maintenance until accepted by the City of Minot.
- E. Where storm sewer outlets to grade or where line is terminated by a flared end section, the last 3 joints shall be tied together with 2 U-bolt fasteners per joint and as recommended by the pipe manufacturer.

3.04 Structure Installation

- A. Shall be installed level. No deviation is allowed.
- B. Precast slab shall be placed on compacted granular bedding.
- C. Inverts shall be poured to half equivalent pipe size of the inlet and outlet pipe to allow for a free and uninterrupted flow. All surfaces must be smooth and slope to flow line. Preformed inverts are not allowed.
- D. Vertical wall of the eccentric cone section shall be positioned above the outlet pipe.
- E. Install rings and casting in conformance to Section 1700 – Adjustment of Structures.
- F. Connect drain tile pipes using specified sand collars.
- G. Cut pipes as necessary to achieve a 4-inch-maximum protrusion into each structure.
- H. All pipe and drain tile connections must be neatly sealed with mortar and have a smooth finish.
- I. All lift holes must be completely filled with mortar or approved plugs.

3.05 Slotted Drains

- A. Fabricate and install according to manufacturer's instructions.
- B. Top of inlet slots shall be 1/2-inch below the surface of the concrete curb and gutter.
- C. Insert CSP into structure a maximum of 4 inches. Excess shall be cut off and void around pipe shall be sealed neatly with grout.

3.06 Bulkhead

- A. Bulkheads shall be built with non-shrink grout. Bulkhead shall provide a watertight seal.

3.07 Rip Rap

- A. In general, conform to NDDOT Specification Section 256 except as modified herein:
 - 1. Grout and wire mesh shall not be used unless specified on the Plan.
 - 2. Rip Rap placement size and shape shall be Specified on the Standard Detail.

3.08 Field Quality Control

- A. General
 - 1. Contractor shall provide all labor and materials necessary for inspections and tests.
 - 2. Contractor shall notify Engineer 48 hours before testing.
- B. System Cleanup
 - 1. Contractor shall ensure pipe and manholes are clean and free of material.
 - 2. If system is dirty due to Contractor negligence, the system will be cleaned at the sole expense of the Contractor. Jetting may be required and shall be completed prior to final inspection.

- C. Testing and Televising
 - 1. Testing shall begin only after the system has been cleaned.
 - 2. Televising
 - a. All storm sewer lines in the public right of way and on private property shall be televised in accordance with Section 2300 – Sanitary Sewer.

PART 4 – MEASUREMENT AND PAYMENT

- A. Storm Sewer Pipe: Shall be paid for by the linear foot (LF) for each size, type, class, and depth increment specified. Measurements shall be from center to center of manholes. Price shall include all materials and labor necessary for installation and televising, including all excavation, pipe, geotextile fabric, bedding, backfill, and compaction.
- B. Catch Basin, Catch Basin Manhole, and Manhole Structure: Shall be paid for by each (EA) for the size and type specified on the Plan up to 8 feet in depth. Price shall include all material and labor necessary to install the structure including connections to storm sewer and drain tile pipes, the casting frame and cover, adjusting rings, and adjustment to finish grade surface.
- C. Structure Overdepth: Shall be paid for by the linear foot (LF) for the diameter specified on the Plan greater than 8 foot in depth. Measurement will be made in 0.1-foot increments from the rim elevation to the lowest invert elevation of the catch basin, catch basin manhole, or manhole structure, minus 8 feet. Price shall include all materials and labor necessary for installation.
- D. Slotted Drain: Shall be paid for by the linear foot (LF) for the size and type specified on the Plan. Measurement shall be from the end cap of the CSP to the end of the CSP inserted in the structure. Price shall include all materials and labor necessary including fabricated slotted drain system, rebar, and fittings.
- E. Flared End Section with Trash Guard: Shall be paid for by each (EA) for the size and type specified on the Plan. Price shall include all material and labor necessary for installation including tie bars and Trash Guard.
- F. Rip Rap: Shall be paid for by the cubic yard (CY) delivered and in place. Price shall include geosynthetic material.
- G. Bulkhead: Shall be paid for by each (EA) and shall include all materials and labor necessary for complete installation.

- H. Connect to Existing Structure: By each (EA) connection performed and shall include all core drilling, sleeves, grout, and reconstruction of existing flow lines.
- I. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 2800 – SUBSURFACE DRAINAGE

SUBSURFACE DRAINAGE

PART 1 – GENERAL

1.01 Section Summary

- A. Underground drainage pipe not covered in storm sewer section.

1.02 Related Sections

- A. Section 2000 – Trench Excavation and Backfill.
- B. Section 2700 – Storm Sewer.

1.03 References

- A. American Society of Testing Materials (ASTM)
 - 1. D1784 – Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Polyvinyl Chloride (PVC) Compound.
 - 2. D2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
 - 3. D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 4. D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
 - 5. F758 – Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Under Drain Systems for Highway, Airport, and Similar Drainage.
- B. North Dakota Department of Transportation “Standard Specification for Road and Bridge Construction” Current Edition, As Revised.
 - 1. Section 816 – Aggregates.
 - 2. Section 858 – Geosynthetics.

PART 2 – PRODUCTS

2.01 PVC Pipe

- A. Conform to ASTM F758.
- B. Minimum cell classification of 12364C as found in ASTM D1784.

- C. Size shall be 6 inch. Minimum pipe stiffness of 46.
 - D. Joints shall be bell and spigot with either gaskets conforming to ASTM D3212 or PVC cemented joints.
 - E. Drain tile perforations shall be circular at 3-1/4 inch on center $\pm 1/4$ inch. Maximum hole size shall be 3/8 inch with minimum size 3/16 inch, arranged in 4 rows along the full length of the pipe.
- 2.02 PVC Fittings
- A. Conform to ASTM D3034.
 - B. Cleanout wyes shall be long-sweep type.
 - C. Sand collars shall be factory-fabricated.
- 2.03 Permeable Trench Backfill
- A. Conform to NDDOT Specification Section 816, Class 2 Aggregate.
- 2.04 Geosynthetic Material
- A. Conform to NDDOT Specification Section 858, Geosynthetics for Drainage, Type S1.
- 2.05 Circular-Knit Geosynthetic Sock
- A. Conform to ASTM D6707.
 - B. Sock to be knit of polymeric materials.
 - C. Exhibit minimum sag or run potential.
 - D. Shall be factory-applied so as to maintain uniform mass.
 - E. Shall conform to the outside diameter of the tubing with a snug fit throughout.

PART 3 – EXECUTION

- 3.01 General
- A. Drain tile location is shown on the Plans in a general way. Contractor should expect minor variations in location.
 - B. Conform to layout on City Standard Details.

3.02 Drain Tile Installation

- A. Construct to location and elevation shown on the Plans or as directed by the Engineer.
- B. Pipe grade shall be as indicated on the Plan but at a minimum not flatter than 0.40%.
- C. Geosynthetic material shall be placed in in such manner as to line the trench and fully encase the Permeable Trench Backfill and Drain Tile. Drain Tile shall rest on a 2-inch bed of Class 2 Aggregate at the bottom of the trench. Permeable Trench Backfill shall be placed on top of the pipe up to the surface. Geosynthetic material shall overlap itself at the surface by a minimum of one foot.
- D. Seal upstream end of pipe with a solid PVC cap.
- E. Drain tile shall be connected to storm structure with specified sand collar. Core drill a connection if a precast connection does not exist. A headwall shall be installed when drain tile daylights to surface.
- F. Drain tile cleanouts shall be installed at the end of runs and where indicated on the Plans. Cleanout shall include a long sweep wye and riser to the surface with an iron cap.

PART 4 – MEASUREMENT AND PAYMENT

- A. Drain Tile: Shall be paid for by the linear foot (LF) measured along the axis without regard for fittings. Price shall include excavation, pipe, geosynthetic material, and aggregate.
- B. Connect Drain Tile to Existing Structure: Shall be paid for by each (EA) and shall include all materials and labor necessary for connecting Drain Tile to an existing structure.
- C. Headwall: Shall be paid for by each (EA) and shall include all materials and labor necessary for installation.
- D. Drain Tile Cleanout: Shall be paid for by each (EA) and shall include all materials and labor necessary for installation including the wye, riser, and cap.
- E. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 2900 – AGGREGATE BASE COURSE

AGGREGATE BASE COURSE

PART 1 – GENERAL

1.01 Section Summary

- A. Aggregate base course installation.

1.02 Related Sections

- A. Section 1900 – Subgrade Preparation
- B. Section 3000 – Hot Mix Asphalt Pavement

1.03 References

- A. North Dakota Department of Transportation “Standard Specification for Road and Bridge Construction” Current Edition, As Revised.
 - 1. Section 302 – Aggregate Base and Surface Course
 - 2. Section 709 – Geosynthetics
 - 3. Section 816 – Aggregates
 - 4. Section 817 – Salvaged Base Course

1.04 Submittals

- A. Submit gradation sample report for aggregate and/or blended material proposed for use.

1.05 Sequence and Scheduling

- A. Prior to installing aggregate base:
 - 1. The subgrade must pass all compaction tests and grade checks per Section 1900 – Subgrade Preparation.
 - 2. All tracer wire to-be-placed below aggregate base must be functional as evidenced by passing tests per Section 2100 – Water Main.

PART 2 – PRODUCTS

2.01 Geosynthetics

- A. If specified and/or shown on the Plans, geosynthetics shall conform to NDDOT Specification Section 858 Type G, R, or S.

2.02 Aggregate Base

- A. Conform to NDDOT Specification Section 816.02, Class 5 Aggregate.
- B. With Engineer approval, asphalt millings may be blended with Class 5 Aggregate.
 - 1. Ensure all millings are free of debris and/or deleterious materials.
 - 2. The base material shall be made by uniformly blending asphalt millings with Aggregate Base material.
 - 3. The percentage of recycled asphalt millings shall not exceed 50 percent of the blended base material.
 - 4. Conform to NDDOT Specification Section 817.01 B for gradation.
- C. With Engineer approval, crushed concrete may be blended with Class 5 Aggregate or used as Aggregate Base.
 - 1. Ensure all crushed concrete is free of debris and/or deleterious materials.
 - 2. Up to 100 percent of the base material may be crushed concrete.
 - 3. If the base material is less than 100 percent crushed concrete, it shall be made by uniformly blending crushed concrete with Aggregate Base material.
 - 4. Conform to NDDOT Specification Section 817.01 B for gradation.

PART 3 – EXECUTION

3.01 Preparation

- A. Before installation of aggregate base course, the subgrade shall be prepared as specified in Section 1900 – Subgrade Preparation.
- B. Geosynthetic material shall be installed per NDDOT Specification 709.04 and approved by the Engineer.

3.02 Aggregate Base Installation

- A. Conform to NDDOT Specification Section 302 except as modified herein:
 - 1. Water shall be applied to the aggregate base material during placement so that the moisture content is no less than 4 percent of its dry weight at the time of compaction.
 - 2. Aggregate base shall be compacted to 100% of Standard Proctor density.

- 3. Finished aggregate base surface shall not vary from Plan elevation by more than 0.04 feet.
 - B. Weight tickets and haul sheets shall be delivered daily to the Engineer for aggregate brought to the site. Missing tickets and/or haul sheets shall not be paid.
 - C. If the aggregate base is being wasted or placed excessively, the Owner reserves the right to deduct quantities that are in excess of Plan thickness.
- 3.03 Field Quality Control
- A. The Owner shall have an independent laboratory test the material for conformance to specifications. The Engineer will determine the test locations and the minimum number of tests according to Section 1000 – Quality Requirements.
 - B. Line and grade will be checked by the Engineer. The grade shall not vary by more than 0.04 feet from Plan elevation. Contractor shall provide Engineer notice when tolerances need to be checked. If the grades are out of tolerance, all costs for rechecks will be deducted from Contractor progress payments.
- 3.04 Site Protection
- A. Contractor shall be responsible to protect the aggregate base from damage until it is covered by pavement. Aggregate base shall be free of ruts or other damage. Any damage shall be repaired prior to being paved at the Contractor's expense.

PART 4 – MEASUREMENT AND PAYMENT

- A. Aggregate Base, Class 5: Shall be measured by the ton (TN) of material compacted in place as determined by weight tickets and haul sheets delivered to the Engineer.
- B. Geosynthetic Material: By square yard (SY) of ground coverage without regard to overlap, and shall include all labor, materials, equipment, and delivery costs.
- C. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 2910 – CEMENT STABILIZED BASE

CEMENT STABILIZED BASE

PART 1 – GENERAL

1.01 Section Summary

- A. This work consists of removing existing asphalt pavement and mixing the existing aggregate base course with Portland Cement, water and either existing subgrade soil, imported new aggregate, or salvaged base materials to produce a treated base to the specifications described herein and shall conform to the lines, grades, thickness and typical cross sections shown on the Plans.
- B. The reclaimed aggregate base and subgrade material shall be sufficiently mixed, scarified, shaped, compacted, cured and maintained to the existing roadway; to the lines, grades and shape as indicated on the Plans prior to constructing the surface course.

1.02 Related Sections

- A. Section 1800 – Excavation and Embankment
- B. Section 2900 – Aggregate Base Course
- C. Section 2910 – Salvaged Base Course

1.03 References

- A. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. M85 – Standard Specification for Portland Cement.
 - 2. T2 – Sampling of Aggregates
 - 3. T11 – Materials Finer than #200 sieve in Mineral Aggregates by Washing
 - 4. T27 – Sieve Analysis of Fine and Coarse Aggregates
 - 5. T89 – Standard Method of Test for Determining the Liquid Limit of Soils.
 - 6. T90 – Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils.
 - 7. T99 – Moisture-Density Relations of Soils

8. T134 – Moisture-Density Relations of Soil-Cement Mixtures
 9. T208 – Standard Method of Test for Unconfined Compressive Strength of Cohesive Soil.
 10. T248 – Reducing Samples of Aggregate to Testing Size
 11. T265 – Standard Method of Test for Laboratory Determination of Moisture Content of Soils.
- B. North Dakota Department of Transportation “Standard Specification for Road and Bridge Construction” Current Edition, As Revised.
1. Section 302 – Aggregate Base and Surface Course
 3. Section 802 – Portland Cement Concrete
 4. Section 804 – Cement and Lime
 5. Section 816 – Aggregates
 6. Section 817 – Salvaged Base Course

1.04 Submittals

- A. Preconstruction Mix Design
1. At least 7 days before stabilization work is to begin, submit mix design(s) for the Portland cement stabilization to the Owner that meet(s) the requirements specified herein. If the Owner does not approve the mix design, revise and submit a revised mix design. Allow for up to 7 additional days for the Owner to review the revised mix design before beginning stabilization work. Approval of the mix design by the Owner is solely for monitoring quality control and in no way releases Contractor from its responsibilities.
 2. The Contractor shall employ an independent testing laboratory to perform a mix design to determine the optimum cement content to stabilize the existing aggregate base and subgrade soil. The mix design should be prepared under the supervision of a registered professional engineer.

3. Contractor shall assist the testing laboratory in obtaining samples of the existing aggregate base and subgrade soil to the specified depth and perform appropriate testing to establish the mix design. Samples are to be obtained by the testing laboratory only. Location of samples are to be determined by the Engineer or the testing laboratory. Samples must be obtained inclusive of the depth to be stabilized. Sampled materials must be properly processed and prepared to closely simulate field conditions. When in-place materials change significantly, additional mix designs may be performed to establish representative mixes for the entire project.
4. Mix Design: The Contractor's mix design report shall contain the following minimum requirements:
 - a. Moisture-density relation to determine maximum dry density and optimum moisture of the prepared blend of existing aggregate base and subgrade soil in accordance with AASHTO T99.
 - b. Atterberg limits tests to determine liquid limit, plastic limit, and plasticity index of the prepared blend of existing aggregate base and subgrade soil in accordance with AASHTO T89 and T90.
 - c. Particle size analysis of the prepared blend of existing aggregate base and subgrade soil in accordance with AASHTO T11 and T27.
 - d. Moisture-density relation for each cement content tested to determine maximum dry density and optimum moisture of the prepared blend of existing aggregate base and subgrade soil with Portland cement in accordance with AASHTO T134.
 - e. Specimens of cement treated aggregate base/subgrade soil blend shall be prepared and molded for strength testing. The specimens shall be prepared as described in AASHTO T-134.

The specimens shall be allowed to cure at room temperature for a period of 7 days in an environment that will prevent moisture loss.

After curing, compressive strength of prepared specimens of cement treated aggregate base/subgrade soil blend shall be determined in accordance with AASHTO T208.

A cement content curve shall be generated by plotting compressive strength of cement treated aggregate base/subgrade soil blend versus the cement content used in each sample. Specimens shall be prepared for a minimum of 3 cement contents. Specimens shall be prepared at a range of cement contents sufficient to achieve a minimum compressive strength of 200 psi. The lowest cement content, for each test at various moisture contents, with the unconfined compressive strength greater than 200 psi, but not greater than 400 psi, shall be the design cement content to stabilize that blend of aggregate base and subgrade soil. Specimens shall be molded at varying moisture contents to determine an allowable tolerance of water to maintain the performance of the mix but allows the Contractor to make slight adjustments based on field conditions during the time of application.

- f. Recommendation for the percent of Portland cement to be blended into the existing aggregate base and subgrade soil. A recommendation should also be provided for the tolerance for moisture content.

PART 2 – PRODUCTS

2.01 Cement

- A. Conform to NDDOT Specification Section 804 except as modified herein:
 - 1. Cement shall be either Portland Cement – Type I, IA, or II, or
 - 2. Blended Hydraulic Cement – Type IL(MS).

2.02 Aggregate

- A. Conform to Section 2900 – Aggregate Base.

2.03 Water

- A. Use only potable water, free of contaminants and substances deleterious to the hardening of the cement treated material.

PART 3 – EXECUTION

3.01 General Requirements

- A. Prior to the start of the work, all utilities and drainage systems shall be protected or relocated as necessary.

- B. Milling, blending and reclamation may be performed with any machine or combination of machines or equipment as approved by the Engineer prior to the start of the Project which will produce a satisfactory product meeting the requirements for pulverization, cement and water application, mixing, compacting, finishing, and curing as provided in this specification.
- C. Prior to the actual reclaiming of the roadway, drop inlets or catch basins that might be affected shall be sufficiently barricaded to prevent reclaimed subbase material, silt or runoff from plugging the drainage system.
- D. Sufficient surface drainage must be provided for each stage of construction so that ponding does not occur on the exposed roadway surface prior to the placement of bituminous concrete.

3.02 Pavement Milling

- A. Existing bituminous surface course and existing aggregate base shall be milled to the depth of ½" below the bottom of the existing asphalt pavement layer. Millings are the property of the City and shall be transported and stockpiled at the City Landfill or at another location specified, by the Contractor.
- B. Care shall be taken when milling around structures and adjacent to curb and gutter. Damaged surfaces shall be replaced or repaired to the satisfaction of the Engineer at no cost to the Owner.

3.03 Cement Stabilization Preparation

- A. Cement stabilization process shall not commence when the soil aggregate or sub-grade is frozen, or when the air temperature is below 40°F (4°C).
- B. Before cement is applied, initial pulverization or scarification may be required to the full depth of mixing. Scarification or pre-pulverization is a requirement for the following conditions:
 - 1. When the processed material is more than five (5) percent above or below optimum moisture content. When the material is below optimum moisture content, water shall be added. The pre-pulverized material shall be sealed and properly drained at the end of the day or if rain is expected.
 - 2. For slurry application of cement, initial scarification shall be required to provide a method to uniformly distribute the slurry over the processed material without excessive runoff or ponding.

3.04 Cement Application

- A. The operation of cement application, mixing, spreading, compacting, and finishing shall be continuous and completed within 2 hours from the start of

mixing. Any processed material that has not been compacted and finished shall not be left undisturbed for longer than 30 minutes.

- B. The specified quantity of cement shall be applied uniformly over the existing base in a manner that minimizes dust and is satisfactory to the Engineer. If cement is applied as a slurry, the time from first contact of cement with water to application on the soil shall not exceed 60 minutes. The time from cement placement on the soil to start of mixing shall not exceed 30 minutes.
- C. Spreading of the Portland cement shall be performed with a spreader truck designed to spread dry particulate such as Portland cement to insure a uniform distribution. Spreaders or distributors used shall be able to demonstrate a consistent and accurate application rate, as well as dust control during application. The mechanical cement spreader shall be capable of dispensing a measured quantity of cement +/- 3 pounds per square yard in advance of the reclaimer/pulverizer just prior to each pass of the stabilizing operation. The blending equipment shall abut or slightly overlap (.5") previous pass to ensure a continuous homogeneous mass of granular material and cement. Cement spreader does not have to abut or overlap previous pass as long as the calculated quantity of cement is dispersed in front of the reclaimer/pulverizer.
- D. Portland cement shall not be spread over puddled water, during rain, or when rain is imminent. Spreading shall not be performed when wind speeds are 12 miles per hour or greater, with wind gusts at speeds of 15 miles per hour or greater, or any time when excessive drifting occurs.

3.05 Blending

- A. Blending shall be accomplished by means of a self-propelled, traveling rotary reclaimer or equivalent machine capable of cutting through existing bituminous concrete pavement, aggregate base, and subgrade soil to depths of up to 16 inches with one pass. The machine shall be equipped with an adjustable grading blade leaving its path generally smooth for initial compaction. Equipment such as road planers or cold milling machines designed to mill or shred the existing bituminous concrete, rather than crush or fracture it, shall not be allowed during the reclaiming process.

Agricultural disks or motor graders are not acceptable blending equipment.
- B. Any existing bituminous concrete pavement that remains after milling must be removed or pulverized and blended with the existing aggregate base and subgrade soil to form a homogenous mass which will bond together when compacted.
- C. Moisture in the blended material shall be monitored during construction. Water shall be added as necessary to adjust the moisture content of the

blended material to within the tolerances defined in the mix design prior to the start of compaction.

- D. Water may be applied through the mixer or with water trucks equipped with pressure-spray bars. If using the spray bar system, road base shall be pre-wet to obtain required moisture content prior to the dispensing of cement.
- E. Mixing shall begin as soon as possible after the cement has been spread and shall continue until a uniform mixture is produced. Cement and water shall be incorporated into the existing base material at the prescribed percentages and mixed to a depth of 12 inches into the existing aggregate base and subgrade soil. The mixed material shall meet the following gradation conditions:
 - 1. The final mixture (bituminous surface, granular base, and sub-grade soil) shall be pulverized such that 100% passes the 1-in. (25 mm) sieve, except for occasional rocks present in the subgrade soil.
 - 2. Blending operations shall be continued until the product is uniform in color, meets gradation requirements, and is at the required moisture content throughout. The entire operation of cement spreading, water application, and mixing shall result in a uniform pulverized asphalt, soil, cement, and water mixture for the full design depth and width.
- F. Reshaping using the reclaimed base material should be minimized in order to ensure that the roadway has a uniform thickness of stabilized aggregate base/subgrade material throughout.
- G. A motor grader shall be used for shaping, fine grading, and finishing the surface of the reclaimed material or any other granular materials placed to form the surface prior to paving.
- H. Any surface irregularities which develop during or after the above described work shall be corrected until it is brought to a firm and uniform surface satisfactory to the Engineer.

3.06 Compaction

- A. The processed material shall be compacted with one or a combination of the following: Tamping or grid roller, pneumatic-tire roller, steel-wheel roller, vibratory roller, or vibrating-plate compactor. The blended material shall be rolled with a vibratory pad/tamping foot roller and a vibratory steel drum soil compactor. The pad/tamping foot roller drum shall have a minimum of 112 tamping feet 3" in height, a minimum contact area per foot of 17 in², and a minimum width of 84 in. The vibratory steel drum roller shall have a minimum 84 in width single drum.
- B. The blended material shall be uniformly compacted to a minimum of 98% of maximum density. Field density of compacted material can be determined by nuclear method in the direct transmission mode (AASHTO T 310), sand

cone method (AASHTO T 191), or rubber balloon method (ASTM D 2167). Optimum moisture and maximum density shall be determined for samples of the blended material in the field during construction by a moisture-density relation test (AASHTO T 134).

- C. At the time of compaction, the moisture content shall be maintained within range of moisture determined by the mix design. No section shall be left undisturbed for longer than 30 minutes during compaction operations. All compaction operations shall be completed within 2 hours from start of mixing.

3.07 Grading

- A. Survey staking can be provided by the City at the request of the Contractor for points identified on the project plans with 48 hours of notice in advance.
- B. For urban road sections with existing curb & gutter on both sides of the road, the Contractor is responsible for all material and labor for survey staking operations to bring the finished road base to proposed grades.
- C. If additional base material is needed after blending and compaction of cement stabilized base, Class 5 Aggregate is the only approved material to be used to bring the base to proposed grade. Class 5 Aggregate used for this purpose will be at the Contractor's expense.

3.08 Finishing and Curing

- A. As compaction nears completion, the surface of the stabilized base material shall be shaped to the specified lines, grades, and cross sections. If necessary or as required by the Engineer, the surface shall be lightly scarified or broom-dragged to remove imprints left by equipment or to prevent compaction planes. Compaction shall then be continued until uniform and adequate density is obtained.
- B. During the finishing process the surface shall be kept moist by means of water spray devices that will not erode the surface until paving operations have begun. Compaction and finishing shall be done in such a manner as to produce a dense surface free of compaction planes, cracks, ridges, or loose material. All finishing operations shall be completed within 4 hours from start of mixing.
- C. Finished portions of the stabilized base that are traveled on by equipment used in constructing an adjoining section shall be protected in such a manner as to prevent equipment from marring or damaging completed work.
- D. After completion of final finishing, the surface shall be cured by being kept continuously moist for a period of 7 days, or until surface pavement is

placed, with a water spray that will not erode the surface of the cement stabilized base.

- E. Sufficient protection from freezing shall be given to the cement-treated material for 7 days after its construction or as approved by the Engineer. Contractor assumes all materials and costs to keep cement stabilized base moist for the period of protection, or until the surface course is applied.
- F. The stabilized base shall be allowed to cure a minimum of 72 hours before subsequent aggregate or pavement layers can be placed. Cure time may be reduced if approved by the Engineer and provided the stabilized base is sufficiently stable to support the required construction equipment without marring or permanent distortion of the surface.

3.09 Micro-Cracking for Cement Stabilized Base

- A. Begin micro cracking between 48 hours and 72 hours of finishing of the cement stabilized base.
- B. Micro crack all but the outside 1 foot area of the roadway.
- C. Use a 12-ton steel-wheel vibratory roller traveling at 2mph and vibrating at the maximum amplitude to generate micro cracking.
- D. Cure subgrade for additional 24 hours after micro cracking before applying bituminous asphalt or additional aggregate while maintaining section within tolerance of optimum moisture.

3.10 Traffic

- A. Completed portions of cement stabilized base may be opened upon approval from the Engineer, provided that traffic is limited to low-speed local traffic and to construction equipment only, further provided the curing material or moist curing operations are not impaired, and provided the stabilized base is sufficiently stable to withstand traffic without marring or permanent deformation.

3.11 Maintenance

- A. The Contractor shall maintain the stabilized material in good condition until all work is completed and accepted. Such maintenance shall be done by the Contractor incidental to the Item of Work to cement stabilize the existing base material.
- B. Maintenance shall include immediate repairs of any defects that may occur. If it is necessary to replace any processed material, the replacement shall be for the full depth, with vertical cuts, using either cement-treated material or concrete. No skin patches will be permitted.

3.12 Field Quality Control

- A. Contractor shall coordinate and schedule a qualified independent testing laboratory to perform geotechnical testing.
- B. Contractor shall assist the testing agency in performing field tests.
- C. If testing agency reports failing tests, Contractor shall correct the deficiencies until specified compaction is obtained.
- D. The minimum amount of testing must be completed as detailed in Section 1000 – Quality Requirements.
- E. Before placement of base material, subgrade will be checked by the Engineer.
 - 1. A tolerance of 0.04 feet above or below the finished subgrade elevation will be allowed.

PART 4 – MEASUREMENT AND PAYMENT

- A. Cement Stabilized Base: Shall be paid for by the square yard (SY) for to a depth of 12 inches measured along the centerline of the road for the width of the roadway base being stabilized or as directed by the Engineer. This work shall include all equipment and labor required for testing and sampling, application of cement and water, mixing, pulverizing, shaping and compacting, inspections, curing, protection and all other appurtenances associated for the Item of work.
- B. Portland Cement: Shall be paid for by the ton (TN). The quantities for cement shall be estimated based on 65 pounds per square yard of Cement Stabilized Base.
- C. All costs to properly complete the work specified herein and/or shown on the Plans, including mix designs, shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 3000 – HOT MIX ASPHALT PAVEMENT

HOT MIX ASPHALT PAVEMENT

PART 1 – GENERAL

1.01 Section Summary

- A. Bituminous pavement, bituminous prime, and tack coat.

1.02 Related Sections

- A. Section 2900 – Aggregate Base Course
- B. Section 3010 – Bituminous Pavement Repair

1.03 References

- A. North Dakota Department of Transportation “Standard Specifications for Road and Bridge Construction” Current Edition, as revised.

- 1. Section 401 – Prime, Tack, or Fog Coat
- 2. Section 420 – Bituminous Seal Coat
- 3. Section 430 – Hot Mix Asphalt (HMA)
- 4. Section 816 – Aggregates
- 5. Section 818 – Bituminous Materials
- 6. Section 826 – Joint Materials

- B. North Dakota Department of Transportation “Field Sampling and Testing Manual”

1.04 Submittals

- A. Contractor shall submit mix design to Engineer for approval prior to construction.
- B. Contractor shall be responsible for all Quality Control (QC) on the Project, including determining the specific gravity of the material for mix designs. The Contractor shall conduct tests and submit results to the Engineer as described in the appropriate NDDOT Specification/Manual referenced above.

PART 2 – PRODUCTS

2.01 Hot Mix Asphalt Paving Materials

- A. Bituminous Tack
 - 1. CSS-1h or SS-1h emulsified asphalt.
- B. Performance Graded (PG) Asphalt Cement
 - 1. Unless otherwise specified on the Plans, PG 58S-28 asphalt cement shall be specified that meets AASHTO M 332.
- C. Aggregate
 - 1. The minimum aggregate designation for bituminous pavement mixes on City streets shall be in compliance with NDDOT Specification Section 430 Superpave, FAA 43.
 - 2. Aggregate designation for driveways and bituminous trails shall be in compliance with NDDOT Specification Section 430 Superpave, FAA 40 at a minimum.
- D. Recycled Asphalt Pavement (RAP)
 - 1. Use of RAP may be allowed at the discretion of the Engineer and shall conform to NDDOT Specification Section 430, except as modified herein:
 - a. Contractor must provide gradation of the standalone RAP as well as the blended mix. The blended mix design using RAP shall meet the gradation requirements shown in NDDOT Specification, Table 430-01.
 - b. Blended mix shall not consist of more than 20% RAP by weight.
 - c. Contractor must provide existing oil content of the RAP.

PART 3 – EXECUTION

3.01 General

A. Before paving operations may begin:

1. Aggregate base or existing surface to be overlaid must be approved by the Engineer.
2. Mix designs must be submitted and approved by the Engineer.
3. All concrete curb and gutter and/or sidewalk ramps and concrete drive approaches shall be constructed and accepted.
4. Existing pavement that will receive a bituminous paving lift or will receive a bituminous seal coat must be free from weeds and other organic material and swept clean, free of dirt and water. Weed/grass removal shall occur one week prior to application of seal coat. If an herbicide is used, the Contractor shall use caution to prevent damage to private property. The cost of removing weeds/grass shall be included in the price bid for other items.
5. Televises any newly installed storm sewer or sanitary sewer lying within the roadway footprint for acceptance by the Engineer prior to proceeding with any paving operations. Any abnormalities such as, but not limited to, deviations of grade, misaligned joints, cracked/defected pipe, or rolled gaskets shall be repaired at the Contractor's expense. Sections requiring repair shall be re-televised to verify conditions of repair. It is the Contractor's responsibility to provide drivable access to each manhole for the televising camera truck. Include all costs associated with this work in the price bid for the respective storm sewer or sanitary sewer line item.

3.02 Hot Mix Asphalt Paving Operations

A. Paving operations shall conform to NDDOT Specification Section 430 except as modified herein:

1. HMA overlay must be placed within 14 days after the pavement surface has been milled. Each day pavement is not placed after 14 days of pavement milling, liquidated damages shall be charged at the amount specified in the Contract until paving has been completed. Any damage to the milled surface shall be corrected to the satisfaction of the Engineer at the Contractor's expense.
2. All edges of existing pavement must be saw cut full depth or must be milled to provide a smooth transition for new pavement.
3. All concrete edges, including curb and gutter must be tacked prior to paving operations for all paving lifts.
4. Tack shall be applied according to the table shown below:

Type of Surface to be Tacked	Target Residual Rates (Gal/SY)	Undiluted Rate (Gal/SY) @ 60°F	70:30 Diluted Rate (Gal/SY) @ 60°F	50:50 Diluted Rate (Gal/SY) @ 60°F
Milled HMA, Aged HMA	0.05	0.08	0.12	0.16
New HMA	0.03	0.05	0.08	0.10

5. Testing and Acceptance

- a. Shall conform to the NDDOT Specification except as modified herein and in Section 1000 – Quality Requirements.
- b. The Contractor shall be solely responsible for the quality control (QC) portions of the mixture and compaction.
- c. Densities per subplot will be taken at random with a minimum of 1 nuclear density (ASTM D2950) per subplot, and the mean density in each subplot shall equal or exceed the specified density. A minimum of 10 percent of the sublots shall be cored. Core density testing may be substituted for nuclear density testing.
- d. The density of the compacted bituminous pavement shall be determined in accordance with Section 1000 – Quality Requirements.

- e. Each day's haul will be considered a "lot" and each "lot" shall be divided into acceptance sublots not to exceed 1,500 square yards except as modified in Section 1000 – Quality Requirements.
 - f. Contract price adjustments shall be per Section 430.06C of the NDDOT Specification. If the average density of the pavement compared to the maximum theoretical density is below the minimum densities shown Table 430-10, then the pavement shall be removed and replaced at the Contractor's expense.
- 6. All pavement surfaces shall be 1/4-inch above all curb edges, manholes, gate valves, and inlets. Areas found to be out of tolerance shall be corrected at the Contractor's expense.
 - 7. The finished surface shall not vary by more than 3/8-inch when tested with a 10-foot straight edge applied parallel with or at right angles to the centerline. Areas found to be out of tolerance shall be corrected at the Contractor's expense.

3.03 Leveling Operations

- A. The leveling course is intended as a "scratch course" to fill in dips and smooth-out undulations prior to a subsequent paving lift.
- B. The area to be leveled shall be detailed in the plan or located in the field by the Engineer.
- C. The surface to be leveled shall be cleaned, tacked, and of the same material as the subsequent paving lift.
- D. Leveling shall be done by a paver or blade in lifts up to 3 inches thick.
- E. The leveling course shall be compacted by vibratory methods.

PART 4 – MEASUREMENT AND PAYMENT

- A. Contract price adjustments shall be per Section 430.06C of the NDDOT Specification.
- B. Bituminous Tack Coat: Shall be paid for by gallons (GAL). Measurements will be based on undiluted emulsified asphalt corrected to 60°F. The costs for cleaning the surface prior to placement shall be included in the cost. The cost for tacking exposed edges of pavement or curb shall be included in the cost of Patching or Hot Bituminous Pavement.

- C. Hot Mix Asphalt (HMA) FAA ___ PG ___-___: Shall be paid for by the ton (TN) for the aggregate and asphalt binder specified. The price shall include both aggregate and binder material and shall include all materials, labor, and equipment necessary for placement. Contractor shall provide the Engineer weight tickets for measurement.
- D. Bituminous Leveling: Shall be paid for by the ton (TN) for the aggregate and asphalt binder specified and shall include all equipment, labor, and materials as specified including bituminous tack coat.
- E. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 3010 – BITUMINOUS PAVEMENT MAINTENANCE AND REPAIR

BITUMINOUS PAVEMENT MAINTENANCE AND REPAIR

PART 1 – GENERAL

1.01 Section Summary

- A. Bituminous pavement patching, tack coat, crack sealing, and seal coating.

1.02 Related Sections

- A. Section 1500 – Removals
- B. Section 2900 – Aggregate Base Course
- C. Section 3000 – Hot Mix Asphalt Pavement

1.03 References

- A. North Dakota Department of Transportation "Standard Specification for Road and Bridge Construction" Current Edition, As Revised.
 - 1. Section 401 – Prime, Tack, or Fog Coat
 - 2. Section 420 – Bituminous Seal Coat
 - 3. Section 430 – Hot Mix Asphalt (HMA)
 - 4. Section 816 – Aggregates
 - 5. Section 818 – Bituminous Materials
 - 6. Section 826 – Joint Materials
- B. North Dakota Department of Transportation "Field Sampling and Testing Manual" Current Edition, as revised.
- C. Federal Highway Administration "Manual on Uniform Traffic Control Devices" (MUTCD), 2009 Edition, as revised.

1.04 Submittals

- A. All submittals are due to the Engineer at least 14 days prior to construction.
- B. Submittals shall be as follows, as applicable to the project:
 - 1. Pavement patching/leveling: per Section 2900 – Aggregate Base Course and Section 3000 – HMA Pavement.

2. Crack sealing: per Section 826 of the NDDOT Specification, except submit manufacturer's data only; no samples are required.
3. Bituminous seal coating: per Section 420 of the NDDOT Specification.

PART 2 – PRODUCTS

2.01 Aggregate Base

- A. Aggregate base for patches, when required, shall conform to Section 2900 – Aggregate Base Course.

2.02 HMA Materials

- A. Aggregate: Conform to NDDOT Specification Section 430 for FAA 43.
- B. Asphalt Cement: Unless otherwise specified on the Plans, PG 58S-28 asphalt cement conforming to AASHTO M 332 shall be specified.
- C. Tack Coat: CSS-1h or SS-1h emulsified asphalt for Chip Seal.
- D. Fog Coat: CSS-1h diluted to equal parts water to emulsion (1:1).

2.03 Crack Sealing

- A. Type IV asphalt rubber sealant with a minimum of 12 percent rubber of the total weight of sealant, meeting ASTM-D6690 and AASHTO M226 or Federal Specification SS-S-1401C.
- B. A Type II or Type III sealant with the same requirements in 2.03.A may also be used if specified by the Engineer in the Plans.

2.04 Chip Seal Coating

- A. Bituminous Seal: Modified Cationic Emulsified Asphalt - CRS-2P.
- B. Aggregate: NDDOT Class 41M aggregate.
- C. Blotter Sand: NDDOT Class 44 aggregate.

2.05 Micro Surfacing

- A. Bituminous Seal: Emulsified Asphalt – CQS-1hP or CQS-1P. Must meet AASHTO M 316 and Table 818-01 in NDDOT Specifications.
- B. Aggregate: Type II or Type III aggregate that has the following gradation:

SIEVE SIZE	TYPE II PERCENT PASSING (%)	TYPE III PERCENT PASSING (%)
3/8"	100	100
#4	90 – 100	70 – 90
#8	65 – 90	45 – 70
#16	45 – 70	28 – 50
#30	30 – 50	19 – 34
#50	18 – 30	12 – 25
#100	10 – 21	7 – 18
#200	5 – 15	5 – 15

PART 3 – EXECUTION

3.01 General

- A. Before pavement maintenance and/or repair operations can begin:
 - 1. Submittals must be received and approved by the Engineer.
 - 2. The Contractor shall place and maintain work zone traffic control devices as the work progresses in accordance with the MUTCD.
 - a. Refer to specific requirements for seal coat projects below.
 - 3. Any other designated work relative to the pavement maintenance and/or repair, i.e., structure adjustments, concrete curb and gutter and/or sidewalk ramps and concrete drive approaches shall be constructed and accepted.

3.02 Patching

- A. Pavement repair operations which require the use of a paving machine due to the extent of the repair being made shall be completed and paid for in accordance with Section 3000 – Hot Mix Asphalt Pavement.
 - 1. Any pavement repair 12 feet wide or greater and over 450 SF shall be repaired using a paving machine.

- B. Pavement repair areas shall be marked by the Engineer. Minimum patch size shall be 2' in any direction, to allow proper compaction.
- C. Patching shall include the removal of existing pavement and replacement with Hot Mix Asphalt Pavement (HMA) FAA 43, PG 58S-28 to specified thickness.
- D. All pavement repair patches shall be saw cut full depth prior to removal. Coulter cutting shall be permitted as long as edges are cut straight.
- E. The existing base material must be approved by the Engineer prior to placement of bituminous materials. Areas requiring replacement of the existing base material or subgrade shall be excavated to the depths as indicated on the Plans or as directed by the Engineer. Sub-cuts shall be reviewed by the Engineer after notification of the condition by the Contractor. Engineer approval is required prior to the Contractor starting work on any over-excavation.
 - 1. Sub-cut areas shall be replaced with Class 5 Aggregate Base, and shall be constructed and paid for under the separate bid items for Common Excavation, Subgrade Preparation, Geotextile Fabric (if required by the Engineer), and Class 5 Aggregate Base as indicated on the Bid Proposal Form.
- G. Edges of existing bituminous or concrete shall be tacked prior to placement of bituminous pavement. Tack coat shall not be measured separately and will be included in the Unit Bid Price for the Bituminous Pavement Repair Bid Item.
- H. HMA lift thickness: Base course lifts shall be from 1.5 inches to 3.0 inches in thickness. Wear course lift shall be from 1.5 to 2.0 inches.
- I. Each lift of all HMA patches shall be compacted by vibratory methods unless patches are larger than 450 SF and as specified otherwise on the plans or directed by the Engineer.

3.03 Leveling

- A. Shall be in accordance with Section 3000 – Hot Mix Asphalt Paving.

3.04 Crack Sealing

- A. Apply sealant when ambient air temperature is 40°F or higher.
- B. Cracks less than $\frac{3}{4}$ inch wide shall be routed to a depth not to exceed $\frac{3}{4}$ of the router bit diameter. Cracks larger than $\frac{3}{4}$ inch wide do not need to be routed.

- C. All cracks shall be cleaned with compressed air prior to placement of sealant.
- D. Sealant shall be applied at the rate necessary to flush fill the crack but shall not be excessively placed.
- E. Sealant shall be covered with paper to protect the sealant while curing.

3.05 Seal Coating

- A. Seal coat operations shall conform to NDDOT Specification Section 420 except as modified herein:
 - 1. Prior to seal coat application, all patching, leveling, and crack sealing must be complete and have been in place for at least 14 days. All masking and structure protection must be in place and approved by the Engineer.
 - 2. Seal Coat work shall be completed by September 1st unless written permission is obtained by the City Engineer.
 - 3. Steel wheel rollers shall not be allowed.
 - 4. Asphalt emulsion application rates shall be specified on the Plan or as directed by the Engineer. Aggregate shall be applied to cover the emulsion uniformly before the emulsion "breaks".
 - 5. Blotter material shall be used where bleeding occurs. Material must be spread with a mechanical spreader.
 - 6. The maintenance period shall be considered incidental and shall last 14 days after completion of the entire project.
 - 7. After the seal coat has set and within 48 hours of application, the Contractor shall sweep and remove any loose cover coat material. If Contractor fails to sweep areas within the time specified, the City reserves the right to remove the material and assess the charges of doing so to the Contractor either directly or by offsetting any payments due.
 - 8. Traffic signs shall be temporarily installed warning traffic with the phrase "Fresh Oil Loose Rock." The signs shall be located at each entrance to the project area and shall remain in place until the maintenance period is complete.
 - 9. Temporary marking tabs shall be required on previously striped streets and on streets that will receive new pavement markings. Color shall match existing striping where applicable. Temporary

marking tabs shall meet NDDOT Standard Detail D-704-3. Temporary marking tabs shall be removed after permanent markings are in place.

10. Manholes and gate valves shall be protected prior to application of the seal coat. All coverings shall be tabbed or marked and shall be removed after the seal coat has been applied and rolled.
11. Seal coat work shall not be applied when the relative humidity of the work site is 70.0% or greater.

3.06 Fog Coat

- A. Fog Coat operations shall conform to NDDOT Specification Section 401 except as modified herein:
 1. Fog Coat work shall be completed by September 1st unless written permission is obtained by the City Engineer.
 2. Application rates shall be specified on the Plan or as directed by the Engineer.

3.07 Micro Surfacing

- A. Micro surfacing operations shall conform to NDDOT Specification Section 421.04.

3.08 Mill & Fill

- A. Pavement repair areas shall be marked by the Engineer. Minimum mill & fill size shall be 2' in any direction, to allow proper compaction.
- B. Mill & fill shall include the removal of existing pavement and replacement with Hot Mix Asphalt Pavement (HMA) FAA 43, PG 58S-28 to specified thickness.
- C. Edges of existing bituminous or concrete shall be tacked prior to placement of bituminous pavement. Tack coat shall not be measured separately and will be included in the Unit Bid Price for the Bituminous Pavement Repair Bid Item.
- D. Each lift of mill & filled area shall be compacted by vibratory methods unless areas are larger than 450 SF and as specified otherwise on the plans or directed by the Engineer.

PART 4 MEASUREMENT AND PAYMENT

A. General

1. All preparatory cleaning of pavement surfaces and cracks as specified herein shall be considered incidental to related bid items.
2. The price bid for each bid item shall include all materials, equipment and labor necessary to complete the work for that bid item as specified herein and as shown on the Plans.

B. HMA Full Depth Patch: Pavement patches shall be paid for by the square foot (SF) and shall include saw cutting and removal of existing pavement, leveling and compacting aggregate base, and placement of 4 inches (unless otherwise specified) of hot mix asphalt pavement with tack coat as specified and detailed on the Plans.

1. Patches with HMA thicknesses over or under 4 inches will be paid proportionally based on linear interpolation by applying a pay factor to the bid item quantity. Pay factors for common thicknesses are as follows:

Remove and Replace Pavement Thickness	Bid Item Quantity Pay Factor
2.0 inches	0.500
3.5 inches	0.875
4.0 inches	1.000
4.5 inches	1.125
6.0 inches	1.500
7.0 inches	1.750

2. Contractor must notify the Engineer of subcut areas and patches with a thickness varying from 4 inches before work begins. Subcuts and patches with no notification will not be considered for additional quantity.
3. Subcut area items shall be paid for separately as follows:
 - a. Common Excavation: Per Section 1800 – Excavation and Embankment.
 - b. Subgrade Preparation: Per Section 1900 – Subgrade Preparation
 - c. Geotextile Fabric: Per Section 2900 – Aggregate Base Course

- d. Class 5 Aggregate Base: Per Section 2900 – Aggregate Base Course
- C. Crack Sealing: Shall be paid for by the linear foot (LF) for both Routed and Non-Routed.
- D. Bituminous Seal Oil, CRS-2P: Shall be paid for by the gallon (GAL) measured at 60° F.
- E. Cover Coat Aggregate, Class 41M: Shall be paid for by the square yard (SY) as measured in the field.
- F. Blotter Sand, Class 44: Shall be paid for by the ton (TN).
- G. Fog Coat, CSS-1h: Shall be paid for by the gallon (GAL) measured at 60° F.
- H. Micro Surfacing Aggregate, Type II/III Scratch/Wear Course: Shall be paid for by the ton (TN).
- I. Bituminous Seal Oil, CQS-1hP/CQS-1P: Shall be paid for by the gallon (GAL) measured at 60° F.
- J. ___IN HMA Mill & Fill: Shall be paid for by square foot (SF). The item includes milling the existing bituminous surface to specified depth, pre-leveling preceded by a tack coat in the patch area with hot mix asphalt any deviations to a smooth and compacted bottom; tacking all sides of the patch; filling the patch area with hot mix asphalt; and compacting the patch using ordinary compaction techniques to a dense and level surface relative to the adjacent pavement. All tack oil, HMA pre-level material, HMA patch material, removals, and related items to complete the work shall be incidental to the item.
- K. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 3100 – PORTLAND CEMENT CONCRETE PAVEMENT

PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 – GENERAL

1.01 Section Summary

- A. Construction of Portland Cement Concrete Pavements.

1.02 Related Sections

- A. Section 1800 – Excavation and Embankment
- B. Section 2900 – Aggregate Base Course.
- C. Section 3200 – Concrete Curb and Gutter.
- D. Section 3300 – Concrete Walks, Medians and Driveways.

1.03 References

- A. North Dakota Department of Transportation "Standard Specification for Road and Bridge Construction" Current Edition, As Revised.
 - 1. Section 107 – Legal Relations and Responsibilities
 - 2. Section 550 – Concrete Pavement
 - 3. Section 802 – Portland Cement Concrete
 - 4. Section 804 – Cement and Lime
 - 5. Section 806 – Grout and Epoxy
 - 6. Section 808 – Concrete Admixtures
 - 7. Section 810 – Concrete Curing Materials
 - 8. Section 816 – Aggregates
 - 9. Section 820 – Supplementary Cementitious Materials (SCM)
 - 10. Section 826 – Joint Materials
 - 11. Section 836 – Reinforcing Steel, Dowel Bars, and Tie Bars

1.04 Submittals

- A. Contractor shall submit the following to the Engineer at least 14 days before construction:
 - 1. Concrete mix design
 - a. Certified by a professional engineer licensed in ND.
 - b. Identification of aggregate source and compliance test to specified requirements.
 - c. Compressive strength at 7 days.
 - d. Brand, type, and amount of cementitious material in mix.
 - e. Proportions of each material required per cubic yard.
 - 2. Batch plant information including its name, address, phone number, distance to project site, and evidence of NRMCA certification.
 - 3. Fly ash certification (if used).
 - 4. Steel certification.
 - 5. Manufacturer's descriptive literature and product specifications for each product, such as curing compound.
- B. Batch Tickets
 - 1. Generate a batch ticket for each load of concrete and send one copy with the load to the work site.
 - 2. Include the following information on each batch ticket:
 - a. Ticket number;
 - b. City project number;
 - c. Delivery date;
 - d. Contractor name and Subcontractor name if applicable;
 - e. Time of weighing;
 - f. Identification number of truck; and
 - g. Quantity of each material in the mix.

PART 2 – PRODUCTS

2.01 Concrete Equipment

- A. Provide a NRMCA Certified plant for concrete supplied for this Section and Section 3110 – Concrete Pavement Repair.

2.02 Portland Cement Concrete

- A. Conform to NDDOT Specification Section 550.03 except as modified herein:
 - 1. Where high early strength concrete is specified, concrete mix shall be Class ASE.

2.03 Aggregate

- A. Aggregate in concrete mix design shall conform to NDDOT Specification Section 802.01.C.2.
- B. Coarse aggregate used shall be Size 3 gradation, as specified in NDDOT Specifications, Table 802-03.
- C. Aggregate must conform to combined gradation requirements specified in NDDOT Specifications, Table 802-03.

2.04 Water

- A. Use only potable water, free of contaminants.

2.05 Fly Ash

- A. Conform to NDDOT Specification Section 820 for Fly Ash requirements.

2.06 Admixtures

- A. Conform to NDDOT Specification Section 802.02.D.2.

2.07 Reinforcing Steel, Dowel Bars, and Tie Bars

- A. Conform to NDDOT Specification Section 836 except as modified herein:
 - 1. All reinforcing steel, dowel bars, and tie bars shall be epoxy coated.

2.08 Concrete Curing Materials

- A. Concrete curing compound shall be white liquid-membrane Type 2, Class B per Section 810 of the NDDOT Specification.

2.09 Jointing Materials

- A. Conform to NDDOT Specification Section 826.02.A.2, Hot Applied Joint Sealant, Type IV.

2.10 Air Content

- A. Concrete with air content measured at time of placement of below 5.0 percent or above 8.0 percent will be rejected.

2.11 Cement and Lime

- A. Conform to NDDOT Specification Section 804.

PART 3 – EXECUTION

3.01 Pavement Installation

- A. Conform to NDDOT Specification Section 550 except as modified herein:
 - 1. Reinforcing steel shall not be more than 1-inch out of specified tolerance. Reinforcing steel out of tolerance shall cause the concrete to be rejected and shall be replaced at the expense of the Contractor.
 - 2. Dowel bars shall be placed in close alignment, both horizontally and vertically, with the direction of the anticipated thermal movement of the slab. Tolerances are as follows:
 - a. Rotational alignment, both horizontal and vertical: 1/8-inch per foot.
 - b. Longitudinal shift: 1.5-inches.
 - c. Vertical placement: 1/4-inch above, 1/2-inch below the height specified.
 - 3. Where full width vibratory equipment is not feasible, Contractor shall utilize approved portable vibratory equipment. Concrete placed without the use of vibratory consolidation tools shall be removed and replaced at the Contractor's expense.
 - 4. Final surface finish shall provide a minimum texture depth of 0.06 inches.
 - 5. Texturing: Surface shall be broomed parallel to the direction of vehicle travel. At the direction of the Engineer, the surface can be broomed perpendicular to the direction of vehicle travel. If directed

by the Engineer to use a tine instead of a broom, use a tine that provides:

- a. 1/8 inch $\pm$ 1/64 inch groove width
 - b. 3/16 inch $\pm$ 1/16 inch groove depth
 - c. 3/4 inch spacing between grooves
6. Imprinting: The Contractor is not required to imprint the information required in Section 550.04.H.1e.
 7. Curing: All surfaces shall be coated with membrane curing compound within 30 minutes of finishing at the specified rate. Curing compound shall be applied in 2 different directions perpendicular to each other. Applications shall not be more than 30 minutes apart.
 8. Tolerance in Surface and Ride Quality shall be as specified below in this Section.
 9. Pavement thickness shall not vary from the thickness specified by more than 0.3 inches. The Contractor is not required to core the pavement as specified in Section 550.04.N. The Engineer will monitor thicknesses during construction and may core the pavement for verification. Pavement that is deficient by 0.3 inches or more shall be removed and replaced at the expense of the Contractor.
- B. Rumble strips shall not be installed unless called for in the Plans.
- 3.02 Field Quality Control
- A. Testing shall follow the requirements of Section 1000 – Quality Requirements.
- 3.03 Protection
- A. Freshly finished surface shall be protected, surfaces pitted by rain will be considered unacceptable. Concrete damaged by vehicle traffic, pedestrians, rain, cold weather, or other causes occurring prior to final acceptance shall be removed and replaced at expense of the Contractor.
- 3.04 High Early Strength Concrete
- A. Use only when specified or specifically requested by the Engineer.
- 3.05 Cold Weather Concrete

- A. When temperatures are outside the recommended temperature ranges set forth by the NDDOT, the Contractor shall adhere to the requirements of Section 550.04.C.f of the NDDOT Specification.
- B. A written request shall be submitted to the Engineer for approval before concrete can be placed at temperatures below 35 degrees. Concrete placed without approval shall be rejected.

3.06 Tolerance in Surface and Ride Quality

A. General

- 1. All profiling and grinding shall be at the Contractor's expense.
- 2. Pavement roughness shall be determined and reported in 0.1-mile segments using a profiler on all traffic lanes, including intersections, roundabouts, tapered sections, and turn lane widening segments.
- 3. Profiles shall be measured by the Contractor in each wheel path per lane and shall be reported as inches per mile in International Roughness Index (IRI) in graph and tabular formats.
- 4. Intersections, roundabouts, tapered sections, and turn lane widening segments will not be included in pay adjustment calculations. However, all areas of localized roughness found to be out of tolerance will be required to be corrected.

B. Profiler

- 1. The Contractor shall furnish a lightweight, non-contact profile measuring device/vehicle capable of measuring IRI in dual wheel paths using a line laser.
- 2. Prior to performing profiling operations, proof of profiler calibration shall be furnished to the Engineer by the Contractor.

C. Measuring Roughness with a 10-foot Straightedge

- 1. Where directed by the Engineer, pavement shall be measured for roughness using a 10-foot straightedge.
- 2. Tolerances:
 - a. High spots of more than 1/4-inch but not exceeding 5/8-inch in 10 feet shall be grinded to an elevation where the deviation is less than 1/4-inch.

- b. When the deviation exceeds 5/8-inch, the area shall be grinded to the specified 1/4-inch deviation or the pavement shall be removed and replaced at the Contractor's expense. The Contractor shall repair the area as directed by the Engineer, including installing dowel bars at each end of the repair.

D. Corrective Action

1. Correct all areas identified through the use of a 10-foot straightedge.
2. Correct all localized roughness areas having deviations in excess of 0.3 inches in 25 feet or less as indicated by the profiler.
3. Correct areas in accordance with the Pay Adjustment section below.
4. All grinding shall be performed as follows:
 - a. Use equipment that does not cause strain or damage to the underlying surface of the pavement.
 - b. Do not cause excessive ravels, aggregate fractures, spalling, or disturbance of the joints.
 - c. Perform grinding in the longitudinal direction so grinding begins and ends at lines normal to the pavement centerline.
 - d. Do not overlap more than 2 inches between passes and ensure the depth variance between adjacent passes is less than 1/8 inch.
 - e. Feather the grinding at the beginning and end of each pass.
 - f. Ensure the surface of the ground pavement has a texture consisting of grooves between 0.090 and 0.130 inches wide. Keep the peaks of the ridges approximately 1/32 inch higher than the bottom of the grooves.
 - g. Where shoulders are present, grind high shoulders to provide drainage and safety. Daylight on the shoulder by performing a feather pass.
 - h. Grinding areas shall be no narrower than one lane in width nor shorter than one panel in length. Join grind sections if the distance between grind sections is less than 30 feet.

- i. Continuously collect all slurry or residue resulting from the grinding operation. Dispose of the slurry or residue as specified in Section 107.17 of the NDDOT Specification.

E. Ride Quality Pay Adjustment

1. The Engineer will review the profile data supplied by the Contractor for each individual wheel track to determine areas of localized roughness and the average IRI per lane per segment.
2. Using the table below, the Engineer will determine if a payment adjustment is acceptable or if the Contractor will be required to correct the deficient segments to produce an IRI below the acceptable threshold.
3. Areas measured for roughness using a 10-foot straightedge shall be paid for at 100% when they are replaced or corrected to within the tolerances specified above.

	Payment (Percent of Contract Unit Price)			
	100%	98% or Correct	95% or Correct	Correct or Replace
IRI	<121	121-130	131-140	>140

4. Areas measured for roughness using a 10-foot straightedge shall be paid for at 100% when they are replaced or corrected to within the tolerances specified above.
5. The Contractor may, at its option, attempt to reduce the IRI and reduce the pay adjustment by correcting rough pavement.
6. Wherever corrections are completed, second profiler runs shall be performed to verify that the corrections have produced an IRI under the acceptable threshold, and to determine the pay adjustment, if any.

PART 4 - MEASUREMENT AND PAYMENT

- A. _IN Non-Reinforced Concrete Pavement CI ____ - Doweled: Shall be paid for by the square yard (SY) and shall include all equipment, materials and labor necessary for installation of concrete pavement including all dowels, tie bars, curing, sawing, and sealing of joints.
- B. _IN Reinforced Concrete Pavement CI ____: Shall be paid for by the square yard (SY) and shall include all equipment, materials and labor necessary for installation of concrete pavement including all dowels, tie bars, reinforcement, curing, sawing and sealing of joints.
- C. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 3110 – CONCRETE PAVEMENT REPAIR

CONCRETE PAVEMENT REPAIR

PART 1 - GENERAL

1.01 Section Summary

- A. This section describes replacement of pavement over trenches; placement of materials around footings, vaults, or other appurtenances installed in existing pavement; and replacement of damaged pavement.

1.02 References

- A. AASHTO: American Association of State Highway and Transportation Officials
 - 1. M 85 – Standard Specification for Portland Cement.
 - 2. M 154 – Standard Specification for Air Entrainment.
 - 3. M 194 – Standard Specification for Chemical Admixtures.
 - 4. M-295 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- B. ASTM: American Society for Testing and Materials
 - 1. C33 – Standard Specification for Concrete Aggregates.
 - 2. C150 – Standard Specification for Portland Cement.
 - 3. C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
 - 4. C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 5. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 6. A775 – Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 - 7. D6690 – Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
- C. North Dakota Department of Transportation "Standard Specification for Road and Bridge Construction" Current Edition, As Revised

1. Section 550 – Concrete Pavement.
2. Section 570 – Concrete Pavement Repair.
3. Section 802 – Portland Cement Concrete.
4. Section 804 – Cement and Lime.
5. Section 806 – Grouts and Epoxy.
6. Section 808 – Concrete Admixtures.
7. Section 810 – Concrete Curing Materials.
8. Section 816 – Aggregates.
9. Section 820 – Supplementary Cementitious Materials (SCM).
10. Section 826 – Joint Materials.
11. Section 836 – Reinforcing Steel, Dowel Bars, and Tie Bars.

1.03 Submittals

- A. At least 14 days prior to beginning material placement, submit documentation confirming that materials and mix designs for aggregate base and Portland cement concrete meet the requirements specified herein.

PART 2 - PRODUCTS

2.01 Portland Cement Concrete

- A. Conform to NDDOT Specification Section 570.03.B except as modified herein:
 1. Concrete mix shall be class AAE for all types of repairs.
 2. Where high early strength concrete is specified, concrete mix shall be Class ASE.

2.02 Aggregate

- A. Conform to NDDOT Specification Section 802.01.C except as modified herein:
 1. Coarse aggregate gradation shall conform to NDDOT Specification Section 802.01.C.2, Size No. 3.

2.03 Water

- A. Use only potable water, free of contaminants.

- 2.04 Fly Ash
 - A. Conform to NDDOT Specification Section 820 for Fly Ash requirements.
- 2.05 Admixtures
 - A. Conform to NDDOT Specification Section 808 except as modified herein:
 - 1. Concrete with air content measured at time of placement of below 5 percent or above 8 percent will be rejected.
- 2.06 Reinforcing Steel
 - A. Conform to NDDOT Specification Section 836 except as modified herein:
 - 1. All reinforcing steel, dowel bars, and tie bars shall be epoxy coated.
- 2.07 Concrete Curing Materials
 - A. Concrete curing compound shall be white liquid-membrane Type 2, Class B per Section 810 of the NDDOT Specification.
- 2.08 Jointing Materials
 - A. Conform to NDDOT Specification Section 826.02.A.2, Hot Applied Joint Sealant, Type IV.
- 2.09 Cement and Lime
 - A. Conform to NDDOT Specification Section 804.

PART 3 - EXECUTION

- 3.01 Concrete Pavement Repair
 - A. Conform to NDDOT Specification Section 570 except as modified herein:
 - 1. All areas of full depth repair shall be saw cut to the full depth of the pavement. Existing pavement to be replaced shall be removed in a manner as to not disturb adjacent pavement and with minimal disruption to existing subgrade. Any existing pavement, not marked for repair and is damaged by Contractor's negligence shall be replaced at the Contractor's expense.
 - 2. Newly placed concrete shall be on dry, unfrozen surfaces when the air temperature is at least 35°F and rising, unless otherwise directed by the Engineer.

3. Shape subgrade to the lines, grades, and sections shown on the drawings.
4. Trim subgrade surface as detailed on the Plans or as specified otherwise to within 0.05 foot of original bottom of aggregate base.
5. Subgrade Preparation and Aggregate Base Course shall be in accordance with sections 1900 and 2900.
6. Where necessary, construct forms on all exposed edges. All forms shall be clean and smooth, free of debris.
7. Where shown on the Plans, standard details, or as directed by the Engineer, place reinforcement in accordance to NDDOT Specification Section 836.
8. Do not place concrete until the forms and reinforcement have been inspected and accepted by the Engineer.
9. Consolidate concrete with suitable mechanical vibrators, supplemented by hand spading with suitable tools.
10. Construct all joints at locations consistent with adjacent pavement or as shown on the Plans.
11. All Concrete surfaces shall be finished in accordance with NDDOT Specification Section 550.04.H and to match existing adjacent surfaces.
12. Curing: All surfaces shall be coated with membrane curing compound within 30 minutes of finishing at the specified rate. Curing compound shall be applied in 2 different directions perpendicular to each other. Applications shall not be more than 30 minutes apart.
13. Protect newly placed concrete from construction and public traffic for a minimum of 7 days or until concrete attains strength specified in NDDOT Specification Section 550.04.L.

3.02 Field Quality Control

- A. Testing shall follow the requirements of Section 1000 – Quality Requirements.

3.03 Cold Weather Concrete

- A. When temperatures are outside the recommended temperature ranges set forth by the NDDOT, the Contractor shall adhere to the requirements of Section 550.04.I.1 of the NDDOT Specification.

- B. A written request shall be submitted to the Engineer for approval before concrete can be placed at temperatures below 35 degrees. Concrete placed without approval shall be rejected.

PART 4 - MEASUREMENT AND PAYMENT

- A. IN Non-Reinforced Concrete Pavement Repair CI ____: Shall be paid for by the square yard (SY) and shall include all equipment, materials and labor necessary for the concrete pavement repair. The price shall include aggregate base, all dowels, tie bars, curing, sawing, sealing of joints and protection of newly placed concrete.
 - 1. High Early Strength Concrete shall not be subject to a price increase from the Contractor unless High Early Strength is specifically requested by the Engineer and no bid item is provided. In that case, the negotiated price for High Early Strength shall not exceed 20 Percent of the Contract price paid per cubic yard for standard concrete.
- B. IN Reinforced Concrete Pavement Repair CI ____: Shall be paid for by the square yard (SY) and shall include all equipment, materials and labor necessary for the concrete pavement repair. The price shall include aggregate base, all dowels, tie bars, reinforcement, curing, sawing, sealing of joints and protection of newly placed concrete.
 - 1. High Early Strength Concrete shall not be subject to a price increase from the Contractor unless High Early Strength is specifically requested by the Engineer and no bid item is provided. In that case, the negotiated price for High Early Strength shall not exceed 20 Percent of the Contract price paid per cubic yard for standard concrete.
- C. Spall Repair: Item shall be paid for by the square foot (SF). Item will include all labor and materials necessary for installation. Item shall be installed per Plan and in accordance with NDDOT Specification Section 570.
- D. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 3200 – CONCRETE CURB AND GUTTER

CONCRETE CURB AND GUTTER

PART 1 – GENERAL

1.01 Section Summary

- A. Construction of concrete curb and gutter and valley gutters.

1.02 Related Sections

- A. Section 1800 – Excavation and Embankment
- B. Section 2900 – Aggregate Base Course
- C. Section 3000 – Bituminous Paving
- D. Section 3100 – Portland Cement Concrete Pavement
- E. Section 3300 – Concrete Walk, Medians, and Driveways

1.03 References

- A. American Society of Testing Materials (ASTM)
 - 1. ASTM D8139 – Semi-Rigid, Closed-Cell Polypropylene Foam, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
- B. North Dakota Department of Transportation “Standard Specification for Road and Bridge Construction” Current Edition, As Revised.
 - 1. Section 550 – Concrete Pavement
 - 2. Section 748 – Curb and Gutter
 - 3. Section 750 - Detectable Warning Panels, Sidewalks, Driveways, and Medians
 - 4. Section 802 – Portland Cement Concrete
 - 5. Section 804 – Cement and Lime
 - 6. Section 806 – Grouts and Epoxy
 - 7. Section 808 – Concrete Admixtures
 - 8. Section 810 – Concrete Curing Materials

9. Section 816 – Aggregates
10. Section 820 – Supplementary Cementitious Materials (SCM)
11. Section 826 – Joint Materials
12. Section 836 – Reinforcing Steel, Dowel Bars, and Tie Bars

1.04 Submittals

A. Contractor shall submit the following to the Engineer at least 14 days before construction:

1. Concrete mix design
 - a. Certified by a professional engineer licensed in ND.
 - b. Identification of aggregate source and compliance test to specified requirements.
 - c. Compressive strength at 7 days.
 - d. Brand, type, and amount of cementitious material in mix.
 - e. Proportions of each material required per cubic yard.
2. Batch plant information including its name, address, phone number, and distance to project site
3. Fly ash certification (if used).
4. Steel certification.
5. Manufacturer's descriptive literature and product specifications for each product, such as curing compound.

B. Batch tickets (at time of concrete mix delivery).

PART 2 – PRODUCTS

2.01 Portland Cement Concrete

A. Conform to NDDOT Specification Section 748.03 except as modified herein:

1. Where high early strength concrete is specified, concrete mix shall be Class ASE.

2.02 Aggregate

A. Coarse Aggregate: Conform to NDDOT Specification Section 802.01.C.2, Size No. 3.

- B. Fine Aggregate: Conform to NDDOT Specification Section 802.01.C.3.
- 2.03 Water
 - A. Use only potable water, free of contaminants.
- 2.04 Fly Ash
 - A. Conform to NDDOT Specification Section 820 for Fly Ash requirements.
- 2.05 Admixtures
 - A. Conform to NDDOT Specification Section 808 except as modified herein:
 - 1. Concrete with air content measured at time of placement of below 5 percent or above 8 percent will be rejected.
- 2.06 Reinforcing Steel, Dowel Bars, and Tie Bars
 - A. Conform to NDDOT Specification Section 836 except as modified herein:
 - 1. All reinforcing steel, dowel bars, and tie bars shall be epoxy coated.
- 2.07 Concrete Curing Materials
 - A. Concrete curing compound shall be white liquid-membrane Type 2, Class B per Section 810 of the NDDOT Specification.
- 2.08 Jointing Materials
 - A. Conform to NDDOT Specification Section 826.02.A.2, Hot Applied Joint Sealant, Type IV.
- 2.09 Expansion Joint Material
 - A. Provide a semi-rigid, closed-cell polypropylene foam, preformed joint filler that fully complies with ASTM D8139. NOMAFLEX® by Nomaco, Inc.
- 2.10 Cement and Lime
 - A. Conform to NDDOT Specification Section 804.

PART 3 – EXECUTION

3.01 Curb and Gutter

- A. Conform to NDDOT Specification Section 748 except as modified herein:
 - 1. Curing: All surfaces shall be coated with membrane curing compound within 30 minutes of finishing at the specified rate. Curing compound shall be applied in 2 different directions perpendicular to each other. Applications shall not be more than 30 minutes apart.
 - 2. Curb and gutter thickness shall not vary from the thickness specified by more than 0.3 inches. Curb and gutter that is deficient by 0.3 inches or more shall be removed and replaced at the expense of the Contractor.
 - 3. Uniformly consolidate the concrete by vibration. Any concrete placed without the use vibratory consolidation tools shall be removed and replaced at the expense of the Contractor.
- B. All curb and gutter shall be Minot Standard Type 1A unless another type has been specifically approved by the City Engineer.
 - 1. Type 1A: Normal high-back curb and gutter.
 - 2. Type 1B: Outflow high-back curb and gutter.
 - 3. Type 2: Mountable curb and gutter.
- C. Provide copies of batch tickets of the concrete mixture to the Engineer when the material arrives on site.
- D. Construct concrete curb and gutter to the line, grade, and type shown on the Plan.
- E. Construct transitions at inlets as shown on City Standard Details.
- F. Construct curb ramp and driveway depressions as shown on City Standard Details.
- G. Finishing:
 - 1. Completed curb and gutter shall have an even, uniform appearance in surface contour and texture.
 - 2. The surface of the curb and gutter shall have a light broom finish at right angles to the street.

3. Any deviation from specified lines and grades or design curvature of concrete edges more than 1/4 inch, measured with a 10-foot straight edge, will be considered unacceptable.
 4. Any surface area holding water 1/8 inch deep or greater will be considered unacceptable.
 5. Any curb and gutter deemed unacceptable by the Engineer shall be replaced by the Contractor at its expense.
- H. Connecting to existing curb and gutter: Tie all new concrete to existing curb and gutter with two 18-inch-long No. 4 epoxy coated deformed bars.
- I. Deficient curb and gutter shall be replaced, at the Contractor's expense, to removal lines congruent with existing control joints. This typically requires a minimum of ten (10) feet of curb and gutter removal/replacement.
- J. Existing pavement may be used as a form for new curb and gutter only with approval from the Engineer. Existing pavement edge must be smooth and in line with the existing adjacent curb line. Joint between curb toe and existing pavement must be sealed with sealant conforming to 2.08 in this section, or a gray low-modulus self-leveling silicone sealant that fully complies with ASTM D5893.
- K. If Engineer deems existing pavement edge unfit to use as a form, a minimum 2-foot-wide HMA patch with a length equal to the length of the new curb and gutter is required when replacing existing curb & gutter. This HMA patch shall be installed according to the requirements of Section 3010 – Bituminous Pavement Maintenance and Repair.

3.02 Curb_IN

- A. Construct curb as shown on City Standard Details, at the height and thickness specified on the Plan. The "_IN" specified on the plan and in the bid item name pertains to the thickness of the curb, measured from front of curb face to back of curb.
- B. Construction of curb shall adhere to the same technical requirements specified above in 3.01, where applicable.

3.03 Field Quality Control

- A. Testing shall follow the requirements of Section 1000 – Quality Requirements.

3.04 Aggregate Base

- A. Aggregate base shall be placed and compacted in conformance with Section 2900 – Aggregate Base and as shown on the Plans or in the City Standard Detail Plates.
- B. Base shall be approved by the Engineer prior to placement of concrete.

3.05 Forms

- A. Shall conform to NDDOT Specification Section 750.04.A.
- B. Material for fixed forms shall be plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
- C. Form release agent shall be commercially formulated and shall not bond with, stain, or adversely affect concrete surfaces nor impair any subsequent treatments of concrete surfaces.

3.06 Reinforcement

- A. Placement shall conform to the Plans and Minot Standard Details.
- B. Provide 2-inch minimum cover on all sides.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement.
- D. Reinforcing steel shall not be more than 1/2-inch out of specified tolerance. Reinforcing steel out of tolerance shall cause the concrete to be rejected and shall be replaced at the expense of the Contractor.

3.07 Joint Construction

A. Expansion Joints

1. Shall be 3/4-inch wide, installed every 100 feet and as close to lot lines as possible.
2. Shall be installed at the interface of curb and gutter and gutter concrete that has been or will be poured monolithically with driveway aprons.
3. Shall be installed as shown on the plans and City Standard Details or as otherwise directed by the Engineer.
4. All smooth dowels shall be greased or coated for debonding, installed perpendicular to the joint, and installed parallel to adjacent dowels.
5. Expansion joints shall be sealed with a gray low-modulus self-leveling silicone sealant that fully complies with ASTM D5893.

B. Contraction Joints

1. Shall be spaced a maximum of 10 feet apart.
2. All joints shall be tooled or sawed to a depth sufficient to control cracking, typically 1/4 of the thickness of the concrete.
3. Match joints of adjacent concrete work when possible.
4. Sawed joints shall be sawed within 24 hours after pouring the concrete.
5. A 3/8-inch-wide groove shall be made at each control joint.

C. Joint Seal

1. Seal joints per Section 550.04.F of the NDDOT Specification.

3.08 Valley Gutters

A. Conform to NDDOT Specification Section 748 except as modified herein:

1. Curing: All surfaces shall be coated with membrane curing compound within 30 minutes of finishing at the specified rate. Curing compound shall be applied in 2 different directions perpendicular to each other. Applications shall not be more than 30 minutes apart.
2. Valley gutter thickness shall not vary from the thickness specified by more than 0.3 inches. Valley gutter that is deficient by 0.3 inches or more shall be removed and replaced at the expense of the Contractor.
3. Uniformly consolidate the concrete by vibration. Any concrete placed without the use vibratory consolidation tools shall be removed and replaced at the expense of the Contractor.
4. Seal contraction joints in valley gutter per Section 550.04.F of the NDDOT Specification, using a Type IV hot-poured sealant.

3.09 Protection

A. Freshly finished surface shall be protected, surfaces pitted by rain will be considered unacceptable. Curb and gutter damaged by traffic, rain, cold weather, or other causes occurring prior to final acceptance shall be removed and replaced at expense of the Contractor.

3.10 High Early Strength Concrete

A. Use only when specified or specifically requested by the Engineer.

3.11 Cold Weather Concrete

- A. When temperatures are outside the recommended temperature ranges set forth by the NDDOT, the Contractor shall adhere to the requirements of Section 748.04.B of the NDDOT Specification.
- B. A written request shall be submitted to the Engineer for approval before concrete can be placed at temperatures below 35 degrees. Concrete placed without approval shall be rejected.

3.12 Backfilling

- A. Allow at least 72 hours of cure time before the curb is backfilled.
- B. Any damage during backfilling operations is the responsibility of the Contractor.

PART 4 – MEASUREMENT AND PAYMENT

- A. Concrete Curb and Gutter: Shall be paid for by the linear foot (LF) for the type specified on the Plan. Price shall include all labor, materials, and equipment necessary for installation of concrete curb and gutter complete and in place as specified, including cold weather techniques (if applicable).
- B. Curb _IN: Shall be paid for by the linear foot (LF) when constructed at the curb thickness specified. Price shall include all labor, materials, and equipment necessary for installation of curb including all dowls, tie bars, curing, sawing, sealing of joints, and cold weather techniques (if applicable).
- C. Valley Gutter: Shall be paid for by the square yard (SY). Measurement shall be made from end radius to end radius in length multiplied by the width. Price shall include all labor, materials, and equipment necessary for installation of concrete valley gutter complete and in place as specified.
- D. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.
- E. Prices for all the above items should not include the price for Aggregate Base – Class 5.

END OF SECTION

SECTION 3300 – CONCRETE WALKS, MEDIANS, AND DRIVEWAYS

CONCRETE WALKS, MEDIANS, AND DRIVEWAYS

PART 1 – GENERAL

1.01 Section Summary

- A. Construction of concrete walks, medians, and driveways.

1.02 Related Sections

- A. Section 1800 – Excavation and Embankment.
- B. Section 2900 – Aggregate Base Course.
- C. Section 3000 – Bituminous Paving.
- D. Section 3100 – Portland Cement Concrete Pavement.
- E. Section 3200 – Concrete Curb and Gutter.

1.03 References

- A. American Society of Testing Materials (ASTM)
 - 1. ASTM D8139 – Semi-Rigid, Closed-Cell Polypropylene Foam, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
- B. North Dakota Department of Transportation “Standard Specification for Road and Bridge Construction” Current Edition, As Revised.
 - 1. Section 550 – Concrete Pavement
 - 2. Section 748 – Curb and Gutter
 - 3. Section 750 – Detectable Warning Panels, Sidewalks, Driveways, and Medians
 - 4. Section 802 – Portland Cement Concrete
 - 5. Section 804 – Cement and Lime
 - 6. Section 806 – Grouts and Epoxy
 - 7. Section 808 – Concrete Admixtures
 - 8. Section 810 – Concrete Curing Materials

9. Section 816 – Aggregates
10. Section 820 – Supplementary Cementitious Materials (SCM)
11. Section 826 – Joint Materials
12. Section 836 – Reinforcing Steel, Dowel Bars, and Tie Bars

1.04 Submittals

- A. Contractor shall submit the following to the Engineer at least 14 days before construction:
 1. Concrete mix design
 - a. Certified by a professional engineer licensed in ND.
 - b. Identification of aggregate source and compliance test to specified requirements.
 - c. Compressive strength at 7 days.
 - d. Brand, type, and amount of cementitious material in mix.
 - e. Proportions of each material required per cubic yard.
 2. Batch plant information including its name, address, phone number, and distance to project site
 3. Fly ash certification (if used).
 4. Steel certification.
 5. Manufacturer's descriptive literature and product specifications for each product, such as curing compound and detectable warning panels.
- B. Batch tickets (at time of concrete mix delivery).
- C. Permits
 1. Obtain all necessary permits to complete work in Right-of-Way as outlined in Section 100.

PART 2 – PRODUCTS

2.01 Portland Cement Concrete

- A. Conform to NDDOT Specification Section 748.03 except as modified herein:

1. Where high early strength concrete is specified, concrete mix shall be Class ASE.
- 2.02 Aggregate
 - A. Coarse Aggregate: Conform to NDDOT Specification Section 802.01.C.2, Size No. 3.
 - B. Fine Aggregate: Conform to NDDOT Specification Section 802.01.C.3.
- 2.03 Water
 - A. Use only potable water, free of contaminants.
- 2.04 Fly Ash
 - A. Conform to NDDOT Specification Section 820 for Fly Ash requirements.
- 2.05 Admixtures
 - A. Conform to NDDOT Specification Section 808 except as modified herein:
 1. Concrete with air content measured at time of placement of below 5 percent or above 8 percent will be rejected.
- 2.06 Reinforcing Steel, Dowel Bars, and Tie Bars
 - A. Conform to NDDOT Specification Section 836 except as modified herein:
 1. All reinforcing steel, dowel bars, and tie bars shall be epoxy coated.
- 2.07 Concrete Curing Materials
 - A. Concrete curing compound shall be white liquid-membrane Type 2, Class B per Section 810 of the NDDOT Specification.
 - B. Concrete curing compound for Pigmented Imprinted Concrete shall conform to NDDOT Specification Section 810.01.B.3 and shall be a clear all-resin based curing compound.
- 2.08 Jointing Materials
 - A. Conform to NDDOT Specification Section 826.02.A.2, Hot Applied Joint Sealant, Type IV.
 1. Hot Applied Joint Sealant is only required by default on construction and contraction joints on concrete regularly driven over in the street, whether they are saw-cut or tooled. Additional joint types may be specified for requiring hot-pour sealant in the plans.

2.09 Expansion Joint Material

- A. Provide a semi-rigid, closed-cell polypropylene foam, preformed joint filler that fully complies with ASTM D8139. NOMAFLEX® by Nomaco, Inc.
- B. Seal expansion joint with a gray low-modulus self-leveling silicone sealant that fully complies with ASTM D5893.

2.10 Detectable Warning Panels

- A. Vitrified polymer composite tiles shall not be used.
- B. Galvanized steel for cast-in-place installation as manufactured by TufTile® or approved equal.
 - 1. Tiles shall be federal yellow in color.
- C. Cast iron tiles, unpainted, for cast-in-place installation as manufactured by East Jordan Iron Works, Neenah Foundry, or approved equal.
- D. Panels may be one singular piece, or assembled from multiple pieces if pieces are flush against each other with no gaps. Individual pieces do not need to be tied together.

2.11 Pigmented Imprinted Concrete

- A. Color shall be the following:
 - 1. SikaColor-100 U24 Georgia Clay or approved equal.
 - 2. Match existing, if placed next to existing pigmented concrete. Provide 2 - 2' x 2' samples of color options to Engineer 14 days prior to placement.
- B. Pattern shall be the following:
 - 1. 4" x 8" Brick pattern
 - 2. Herringbone stamp pattern
 - 3. Match existing, if placed next to existing imprinted concrete.

2.12 Cement and Lime

- A. Conform to NDDOT Specification Section 804.

PART 3 – EXECUTION

3.01 General

- A. The Contractor shall maintain access to properties at all times while installing the concrete walks and aprons. Multiple pours or temporary access must be provided for properties with only one access.
- B. Provide copies of batch tickets of the concrete mixture to the Engineer when the material arrives on site.
- C. Construct walks, medians, and driveways at the location and elevation indicated on the Plans.
- D. Construct driveway aprons, walks, and curb ramps according to City Standard Details.
- E. Verify location of driveways in the field with the Engineer prior to placement.
- F. Uniformly consolidate the concrete by vibration. Any concrete placed without the use of vibratory consolidation tools shall be removed and replaced at the expense of the Contractor.
- G. Retempering of concrete that has partially hardened with or without additional materials or water is prohibited.
- H. The Contractor shall stamp the pavement on each side of all expansion joints with the Contractor's name and year the work was done. The stamp shall have letters 5/8-inch high and shall imprint the concrete 1/8 inch deep.
- I. Concrete thickness shall not vary from the thickness specified by more than 0.3 inches. Concrete that is deficient by 0.3 inches or more shall be considered unacceptable.
- J. Any concrete work deemed unacceptable by the Engineer shall be replaced at the Contractor's expense.

3.02 Field Quality Control

- A. Testing shall follow the requirement of Section 1000 – Quality Requirements.

3.03 Aggregate Base

- A. Aggregate base shall be placed and compacted in conformance with Section 2900 – Aggregate Base and as shown on the Plans or in the City Standard Details.
- B. Base shall be approved by the Engineer prior to placement of concrete.

3.04 Forms

- A. Shall conform to NDDOT Specification Section 750.04.A.

3.05 Reinforcement

- A. Placement shall conform to the Plans and Minot Standard Details.
- B. Provide 2-inch minimum cover on all sides.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement.
- D. Reinforcing steel shall not be more than 1/2-inch out of specified tolerance. Reinforcing steel out of tolerance shall cause the concrete to be rejected and shall be replaced at the expense of the Contractor.

3.06 Joint Construction

- A. Conform to NDDOT Spec Section 750.04.F except as modified herein:
 - 1. Maximum contraction joint spacing shall be 10 feet for driveways and as shown on the City Standard Detail for sidewalks and pathways.
 - 2. Maximum expansion (isolation) joint spacing shall be 60 feet for sidewalks, and as shown on the City Standard Details.
 - 3. Match joints of adjacent concrete work when possible.
 - 4. All contraction joints shall be tooled or sawed to a depth sufficient to control cracking, typically 1/4 of the thickness of the concrete.
 - 5. Sawed joints shall be sawed within 24 hours after pouring the concrete.

6. Expansion joints shall be installed at the interface of curb and gutter and gutter concrete that has been or will be poured monolithically with driveway aprons.
7. Expansion joints shall be installed as shown on the plans and City Standard Details or as otherwise directed by the Engineer.
8. Expansion joints shall be 3/4-inch wide with smooth dowels greased or coated for debonding, installed perpendicular to the joint, and installed parallel to adjacent dowels.
9. Seal joints per Section 550.04.K of the NDDOT Specification.

3.07 Finishing

- A. Completed concrete work shall have an even, uniform appearance in surface contour and texture.
- B. Finished concrete surfaces shall have a light broom finish at right angles to the length of walk, median, or driveway being installed.
- C. Any deviation from specified lines and grades or design curvature of concrete edges in excess of 1/4 inch, measured with a 10-foot straight edge, will be considered unacceptable.
- D. Any surface area holding water 1/8 inch deep or greater will be considered unacceptable.

3.08 Curing

- A. All surfaces shall be coated with membrane curing compound within 30 minutes of finishing at the specified rate.
- B. Curing compound shall be applied in 2 different directions perpendicular to each other.
- C. Applications shall not be more than 30 minutes apart.

3.09 Pedestrian Curb Ramps

- A. Conform to American's with Disabilities Act (ADA) standards for constructing curb ramps.
- B. Conform to the City Standard Details for typical size and dimensions. Curb ramps shall be constructed in accordance with NDDOT Standard Drawing D-750-3.

- C. Detectable Warning Panels shall be installed according to manufacturer's recommendations and as follows:
 - 1. Shall be placed on a minimum of 6 inches of wet concrete prior to finishing the surface of the adjacent concrete surface of the pedestrian ramp. The joint between the panel and concrete shall be edged with a ½ inch radius edging tool.
 - 2. Seal all joints required by the manufacturer.
- 3.10 Protection
 - A. Freshly finished surface shall be protected, surfaces pitted by rain will be considered unacceptable. Curb and gutter damaged by traffic, pedestrian traffic, rain, cold weather, or other causes occurring prior to final acceptance shall be removed and replaced at expense of the Contractor.
- 3.11 High Early Strength Concrete
 - A. Use only when specified or specifically requested by the Engineer.
- 3.12 Cold Weather Concrete
 - A. When temperatures are outside the recommended temperature ranges set forth by the NDDOT, the Contractor shall adhere to the requirements of Section 750.04.A.2 of the NDDOT Specification.
 - B. A written request shall be submitted to the Engineer for approval before concrete can be placed at temperatures below 35 degrees. Concrete placed without approval shall be rejected.
- 3.13 Backfilling
 - A. Perform backfilling operations no sooner than 72 hours after placement of the concrete.
 - B. Any damage during backfilling operations is the responsibility of the Contractor.
- 3.14 Pigmented Imprinted Concrete
 - A. Contractor shall adhere to the requirements of Section 750.04.C of the NDDOT Specification and color/stamp manufacturer's recommendations.
 - B. The color shall be uniform throughout the entire project.

3.15 Detectable Warning Panel

- A. Dome panel shall be installed such that there are no gaps between individual panels or pieces of panels. Adjacent panels do not need to be tied together. Single panels may be cut or modified to make a curved detectable warning panel.

PART 4 – MEASUREMENT AND PAYMENT

- A. Driveway Pavement: By square yard (SY) installed to the thickness specified. Price shall include all equipment, materials and labor required for installation including cold weather techniques (if applicable).
- B. Concrete Sidewalk ___IN: By square yard (SY) installed to the thickness specified. Price shall include all materials and labor required for installation including cold weather techniques (if applicable).
- C. Detectable Warning Panel: By square foot (SF) of units installed in the concrete. Price shall include all finishing and sealing of joints if required.
- D. Concrete Median Pavement: By square yard (SY) installed to the thickness specified. Price shall include all materials and labor required for installation including cold weather techniques (if applicable).
- E. Pigmented Imprinted Concrete: By square yard (SY) installed to the thickness specified. Price shall include all materials and labor required for installation including cold weather techniques (if applicable).
- F. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.
- G. Prices for all the above items should not include the price for Aggregate Base - Class 5.

END OF SECTION

SECTION 3400 – POST MOUNTED TRAFFIC SIGNS

POST MOUNTED TRAFFIC SIGNS

PART 1 – GENERAL

1.01 Section Summary

- A. Furnishing, fabricating, and installing highway signs, delineators, and supporting structures.

1.02 References

- A. North Dakota Department of Transportation "Standard Specifications for Road and Bridge Construction" Current Edition, as revised.
 - 1. Section 754 – Highway Signs.
 - 2. Section 894 – Highway Signs and Posts.
- B. Manual on Uniform Traffic Control Devices, 2009 Edition, as revised.

PART 2 – PRODUCTS

2.01 Sign Material

- A. All sign backing material shall comply with section 894.01 of the NDDOT Specifications.
 - 1. Flat sheet aluminum: minimum of 0.08 inches thick.
- B. All retroreflective sheeting material shall comply with section 894.02 of the NDDOT Specifications.
 - 1. All signs: minimum of Type III High Intensity Prismatic.

2.02 Posts and Hardware

- A. All hardware material for signs shall comply with section 894.03.A of the NDDOT Specifications.
- B. All post materials shall comply with section 894.03.B of the NDDOT Specifications.
 - 1. All Square Steel Telescoping Tubular Posts shall have a cross section size of 2-inches x 2-inches per section 894.03.B.4.d of the NDDOT Specifications.

2. All Square Steel Telescoping Tubular Anchors shall have a cross section size of 2 1/4-inches x 2 1/4-inches per section 894.03.B.4.d of the NDDOT Specifications.

2.03 Delineators

- A. All delineator materials shall comply with section 894.04 of the NDDOT Specifications.

1. All delineators shall be square tube.

2.04 Structures for Overhead Signs

- A. Materials used for the structures of overhead signs shall comply with section 894.05 of the NDDOT Specifications.

PART 3 – EXECUTION

3.01 Construction Requirements

- A. Locating and Positioning Signs and Sign Structures: According to Section 754.04.A of NDDOT Specifications.
- B. Sign Fabrication: According to Section 754.04.B of NDDOT Specifications.
- C. Shipping and Storage: According to Section 754.04C of NDDOT Specifications.
- D. Erection of sign Supports and Delineators: According to Section 754.04.D of NDDOT Specifications.
 1. When sign installation occurs in a permanent surface, a 4-inch PVC sleeve shall be installed around the post for the thickness of the permanent surface. The sleeve shall be backfilled with loose, clean sand. The cost shall be included in the sign price.
 2. Drive anchors for telescoping perforated tubes supports 2" to 4" above finish grade.
- E. Mounting Flat Sheet Signs: According to Section 754.04.E of NDDOT Specifications.
- F. Removing and Resetting Signs and Supports: According to Section 754.04.F of NDDOT Specifications.
- G. Remove Sign Foundations: According to Section 754.04.G of NDDOT Specifications.

- H. Remove Overhead Sign Structures: According to Section 754.04.H of NDDOT Specifications.
- I. Overlay Panel Sign Refacing: According to Section 754.04.I of NDDOT Specifications.
- J. Auxiliary Signs: According to Section 754.04.J of NDDOT Specifications.

PART 4 – MEASUREMENT AND PAYMENT

- A. Signs: Shall be paid for by the square foot (SF) measured to the nearest tenth of a square foot for the size and type specified on the Plan. Price shall include all materials and labor necessary for sign installation including all hardware, mounts, posts, anchors and concrete foundations.
- B. Delineators: Shall be paid for by each (EA) delineator installed as specified on the Plans. Price shall include all equipment, materials and labor necessary for delineator installation, including all hardware, mounts, posts, anchors and any appurtenances.
- C. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 3500 – PAVEMENT MARKINGS

PAVEMENT MARKINGS

PART 1 – GENERAL

1.01 Section Summary

- A. Furnishing and installing specified pavement markings at the designated locations.

1.02 Related Sections

- A. Section 1500 – Removals
- B. Section 3000 – Hot Mix Asphalt Pavement
- C. Section 3100 – Portland Cement Concrete Pavement

1.03 References

- A. North Dakota Department of Transportation “Standard Specifications for Road and Bridge Construction,” Current Edition, as revised.
 - 1. Section 762 – Pavement Marking.
 - 2. Section 880 – Pavement Markings.
- B. Manual on Uniform Traffic Control Devices, 2009 Edition, as Revised.

PART 2 – PRODUCTS

2.01 Materials

- A. All pavement marking materials used, besides Thermoplastic Pavement Markings, shall be in conformance with Sections 880 of the NDDOT Specifications.

2.02 Equipment

- A. All equipment used for the installation of pavement markings shall be in compliance with section 762.02 of the NDDOT Specifications.

2.03 Thermoplastic Pavement Markings

- A. The retroreflective marking material shall consist of a resilient polymer thermoplastic (alkyd, no hydrocarbon) with uniformly distributed glass beads and abrasives throughout its entire cross section.

- B. The thermoplastic material will be preformed Thermoplastic PreMark with Vizigrip as manufactured by Ennis-Flint, or 125mil Optamark as manufacture by Geveko Markings, or 3M Durable Retroreflective Liquid Pavement Markings Series 500, or approved equivalent, and shall be approved by the Engineer prior to ordering.

PART 3 – EXECUTION

3.01 General

- A. A project layout of the pavement striping and marking shall be prepared and submitted to the Engineer for approval 48 hours before any installation work.

3.02 Preparation

- A. Surfaces to which various pavement markings will be applied shall be prepared in accordance with Section 762.04.A of the NDDOT Specifications.

3.03 Traffic Control

- A. All traffic control during pavement marking operations shall conform to Section 762.04.B of the NDDOT Specifications.

3.04 Application

- A. Method of application, application dates and temperatures, rate(s) of application, and short-term pavement markings shall conform to Section 762 of the NDDOT Specifications.
- B. Preformed Patterned Pavement Marking Film
 - 1. The application of preformed patterned pavement marking film shall conform to Section 762.04.C.4 of the NDDOT Specifications.
- C. Epoxy Paint Pavement Markings
 - 1. The application of epoxy paint and glass beads are to conform to Section 762.04.C.3 of the NDDOT Specifications.
- D. Water Based Paint
 - 1. The application of water based paint is to conform to Section 762.04.C.2 of the NDDOT Specifications.

F. Short-Term Pavement Markings

1. Raised Pavement Markers

- a. The installation of raised pavement markers shall conform to Section 762.04.D.5 of the NDDOT Specifications.

2. Short-Term Pavement Marking - Seal Coat Projects.

- a. The installation of short-term pavement marking – seal coat projects is to conform to Section 762.04.D.4 of the NDDOT Specifications.

G. Thermoplastic Pavement Markings

1. Provide a uniform thickness of 125 +/-5 mils thick.
2. The thermoplastic marking materials shall be fusible to asphalt and Portland cement concrete pavements by means of the normal heat of a propane type torch. The installation and use of any adhesives, primers, or sealers will be per manufacturer's instructions.
3. The thermoplastic marking materials shall be highly durable, designed for, and subjected to high urban traffic volumes and particularly severe wear conditions including winterized maintenance practices employed by various regions of the US DOT market.
4. Groove to make a recess in the concrete pavement surface for the thermoplastic pavement markings.

The groove shall meet the following tolerances:

Depth	125 mils ± 5 mils
Smoothness	Ridges, within the groove, no more than 6 mils higher than either adjacent valley
Width	Line width plus 1/2 inch
Length	Line length plus 3 inches per end of line
Line End Tapers	3 inches

3.05 Inspection and Acceptance

- A. The inspection and acceptance of various pavement markings and the correction of defects/penalties will be according to Section 762.04.C.1.c of the NDDOT Specifications.

PART 4 – MEASUREMENT AND PAYMENT

- A. For all pavement markings besides Thermoplastic, Method of measurement and basis of payment shall conform to Section 762.05 and 762.06 of the NDDOT Specification.

- 1. Upon discretion of the Engineer, a reduction in pay for long line striping shall be made for reduced thickness and/or width. Width shall be computed by random measuring. Thickness shall be computed by the following formula:

$$\text{Mils Thickness} = \frac{\text{Gallons} \times 231}{\text{Linear Length} \times \text{Striping Width}}$$

The Contractor shall provide the Engineer with the linear feet of 4-inch stripe and gallons of paint used at the end of each days striping.

Where yield computations show a deficiency in material usage of not more than 10 percent, the City may require satisfactory repair or may accept the work at a reduced unit price, which is in direct proportion of the percent of the deficiency. Where the deficiency in material usage exceeds 10 percent, the City may require restriping to the satisfaction of the Engineer.

- B. Thermoplastic Pavement Mark Message: Shall be paid for by the square foot (SF).
- C. Thermoplastic Pavement Mark Message – Grooved: Shall be paid for by the square foot (SF).
- D. Thermoplastic Pavement Mark _IN: Shall be paid for by the linear foot (LF).
- E. Thermoplastic Pavement Mark _IN – Grooved: Shall be paid for by the linear foot (LF).
- F. Obliterate Pavement Markings: Shall be paid for in accordance with Section 1500 – Removals.
- G. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 3600 – STREET LIGHTING

STREET LIGHTING

PART 1 – GENERAL

1.01 Section Summary

- A. Street lighting construction requirements and materials.

1.02 References

- A. North Dakota Department of Transportation "Standard Specifications for Road and Bridge Construction," Current Edition, as revised.

- 1. Section 770 – Highway Lighting.

- B. National Electric Code, as revised.

- C. North Dakota State Electrical Board, recommendations as revised.

- D. City of Minot Ordinances, as approved.

- E. Serving franchise utilities, as recommended.

1.03 Submittals

- A. Contractor shall follow submittal instructions found in the General and Supplementary Conditions.

- 1. Before any of the materials are delivered to the job, submit to Engineer complete Shop Drawings for each item indicated.

- 2. Include catalog numbers, performance data, dimensions and other descriptive information.

- 3. Provide Manufacturers warranties and guarantees with the City listed as owner.

- 4. Shop Drawings may be in the form of printed catalog sheets showing all necessary information and shall be bound together, neatly indexed, and tabbed.

- 5. Each Shop Drawing folder shall be stamped, initialed, and dated by Contractor to indicate he has thoroughly reviewed them.

6. Shop drawings not in conformance with Specifications will be returned to Contractor without review.
7. Two copies will be retained by Engineer after review and balance will be returned to contractor.
8. Provide Shop Drawing for:
 - a. Feed point cabinet, relays, circuit breakers, switches, panels and photo electric cells.
 - b. Light standard poles, each type, including: All necessary calculations and drawings used in the design of the light standard.
 - c. Luminaires, each type.
 - d. Junction boxes.
9. Provide Product Specifications Sheets for:
 - a. Cable.
 - b. Conduit.
 - c. Splice connectors.

B. Manuals

1. Upon completion of Work of this Section and as condition of its acceptance, Contractor shall compile one Manual in 3-ring binder.
2. List project name, date, Contractor's name, address and telephone number on exterior label of Manual.
3. Include an index sheet indicating each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment. All items listed in the Submittals Section above.
4. Manual information shall be included for all equipment/material where Shop Drawings are required. Also include all installation, operation and maintenance data packaged with all equipment.

PART 2 – PRODUCTS

2.01 Feeder and Distribution Circuits

- A. All feeders and distribution circuits shall be of the multiple type, 120/240 volt, single phase and shall consist of two or three conductors constituting one or two 120 volt circuits or a single 240 volt circuit. The Plans will clearly indicate where three wire (2-120 volt circuits) and two wire (1-120 volt circuit) are to be installed.
- B. The system shall be laid out as shown on the Plans and distribution circuits shall be routed as shown. Any changes to this will require "red-lined" plans prior to the initial inspection and drawings to be re-drawn as "As Built."
- C. Individual lamp circuits are to be fused in the base of each lighting standard with Buss type HEB in line fuse holder. Tape fuse kits with ½ lapped layer of scotch 88 for a distance of 1½" each side of joint with conductor. Fuse holders to be complete with proper fuse to protect the system. Provide enough wiring to allow for extraction of the fuse holders from the hand hole without the need to extract the feeder conductor(s), typically 18 to 24 inches. The neutral conductor shall be solidly connected, unfused, throughout system.
- D. Ground Conductors
 - 1. Type "C" Poles - shall be provided between all metal poles and associated feed points. Bond to metal pole, to ground rod in pole base, feed point enclosure, feed point panels, relay cabinets, ground wire, and ground rod.
 - 2. Type "A" Poles - shall be provided from Electrical Service to the street lighting Feed Point cabinet and be grounded inside the cabinet enclosure via the ground rod.

2.02 Underground Conductors

- A. Underground circuit conductors shall be stranded copper, Type "RHH/RHW" or "USE," conductors insulated for direct burial and rated 600 volts. Shall not be any smaller than #6 AWG (#4 preferred) regardless of any Calculated Voltage Drop(VDI) This is for the integrity of the underground electrical system itself. Conductor sheath shall be marked as to voltage, AWG, Type (RHH/RHW-USE), and manufacturer. The conductor sheath shall be color coded to indicate black-power, red-power, blue-power (for festoons-only) and white-neutral. There shall not be more than 1 of each color conductor, per circuit. Underground ground conductor shall be #6 or #8 stranded bare copper or Type TW insulated copper ground conductor.

Service conductors from electric utility service point shall be Type RHW-USE, sized as per utility company requirements and electrical loading.

- B. Conductors shall be continuous from pole base to pole base or from feed point to pole base. Splicing conductors underground will not be allowed without specific approval of the Engineer.

2.03 Junction Boxes / Pull Boxes

- A. Provide junction boxes at locations shown on drawings. Junction boxes to be installed in boulevard or as shown on drawings. Top of junction boxes to be same elevation as top of adjacent curb or sidewalk. See detail on drawing. Junction boxes shall be made of a lightweight, high density polymer concrete composite, UL listed with knockouts for cable entrance. The box shall comply with ANSI/SCTE 77 with a design load of 22,500 lbs., a test load of 33,750 lbs. and meet ANSI Tier 22 test provisions. The cover shall meet an 8,000 lbs. design load and 12,000 lbs. test load. Boxes shall be resistant to sunlight exposure, weathering, chemicals and unaffected by freeze-thaw cycles to -50 degrees F. Minimum dimensions shall be 24 inch L x 13 inch W x 26 inch D with stackable boxes or extensions allowed to achieve required depth. Box covers shall have stainless steel hex bolts and be stamped with standard logo "Street Lighting". Box manufacturer shall be QUAZITE® (Hubbell Lenoir City, Inc.), model PG, Oldcastle Precast, Inc., model Synertech Heavy-Duty, or approved equivalent.
- B. Provide slack loop in conductors not being spliced so conductor can be pulled up out of junction box to a minimum of 24 inches above ground.
- C. Provide one of the following Blackburn type USL insulated street lighting connectors for all splicing:
 - 1. No. USL-11 Straight splice
 - 2. No. USL-30 Three conductor splice
 - 3. No. USL-40 Four conductor splice
 - 4. No. USL-50 Five conductor splice
 - 5. No. USL-60 Six conductor splice
- D. Tape connector kits with ½ lapped layer of rubber or synthetic rubber tape and one layer of scotch 88 for a distance of 1½-inches each side of joint.

2.04 Splice Connectors

- A. Splice connectors at junction boxes for multiple connections shall be Hovac, type RAB-X-URD-BUSS submersible insulated subsurface terminal for

copper conductor or approved equivalent. Splice connectors at pole hand hold shall be Penn-Union IPBNA2/0XS or approved equivalent.

2.05 Street Light Feed Points

A. Pad-Mounted Feed Points

1. Feed point enclosure to be as shown. Enclosure sides and top to be solid - no louvers. Pad mounted feed point enclosure shall be made of minimum 1/8-inch aluminum, with a brushed aluminum finish, rated for NEMA 3R and be ETL or UL listed in accordance with UL 50. Dimensions of the enclosure shall be 42"W x 12"D x 51"H and shall have a domed roof with a NEMA 3R drip shield and two doors. The doors shall have an aluminum continuous piano-style hinge, a neoprene gasket, and a stainless steel 3-point latch capable of being padlocked. Padlocks to be furnished by City. The enclosure shall be equipped with back panel rails such that equipment may be mounted in the cabinet with no penetrations to the exterior of the cabinet. The back panel shall be galvanized steel. All hardware shall be non-corrosive. The enclosure shall be manufactured by Povolny Specialties or approved equivalent.
2. Concrete pad to be sized a minimum of 6 inches beyond feed point enclosure on all four sides. Concrete pad shall be 54 inches long by 24 inches wide by 12 inches deep (54"L x 24"W x 12"D). Foundation is to be solid and poured in place. Hollow and/or preform foundations will not be accepted. Provide seven (7) 2-inch PVC stub outs down through concrete base and a minimum of 12 inches beyond edge of base. Point one (1) conduit towards power company transformer and six (6) towards direction of outgoing circuits. Provide one 1-inch conduit for ground rod through the base only. All stub outs shall be no closer than 2-inches to the concrete pad surface and shall not protrude above the opening for the cabinet door. Provide 2-inch, minimum, PVC conduit inside the cabinet for the incoming service conductors towards direction of utility transformer. Pad shall have a minimum of 4 each 1/2-inch diameter anchor bolts, poured in place, to bolt anchor the feed point cabinet. Notify Engineer a minimum of 24 hours prior to pouring concrete base such that the form and cable entrance may be inspected. Provide a 1 inch chamfer all around and down vertical sides to minimum of 2 inches below grade. Concrete to have a minimum strength of 3000 PSI in 28 days. Minimum of 5.75 bags cement per cubic yard. Whenever possible, concrete pad shall be placed 5 feet behind the back of curb.

3. Electric panel shall be single-phase load center with enclosure rated NEMA 1 with minimum 12 spaces/24 circuits, rated 120/240 volt, 100-amp two-pole main breaker, copper bus, and a minimum 10,000 amp IR. The load center shall be Square D, model QO120M100, or approved equivalent. Provide 40-amp single pole breakers for each 120 volt street light circuit, one 15 amp single pole breaker for control circuit and one 20 amp single pole breaker for G.F.I outlet receptacle.
4. Street light relays to be RCOC type MR-UD No. 6342 (N.O. contact). Provide one relay for each three-wire street light circuit (2-120V) or one relay for each two wire street light circuit (1-240V).
5. Provide a single pole switch and a 20-amp G.F.I. outlet (1900 box and raised switch cover). Switch to be connected into control circuit to bypass photocell for daytime test of street lights. Mark "Test Switch" with $\frac{3}{4}$ inch x 3 inch nameplate. Marker as a means of labeling will not be acceptable.
6. Provide duplex receptacle (1900 box and raised cover).
7. Provide $\frac{5}{8}$ inch x a 10 foot ground rod in blocked out area below cabinet. Rod shall be in $\frac{1}{2}$ " electrical PVC conduit through the foundation. Bond all conduits, relay cabinets, electric panel cabinet, enclosure and neutral.
8. Provide photo cell for control of relays. Hubbell PBT-1 (button type), or traffic department approved equal. Photo cell shall be mounted flush through the cabinet to face North. At no time shall the photocell be mounted through a door or below a meter socket.
9. Exact field location of pad mounted and pole mounted feed points, as shown on plans, to be determined by Engineer.
10. Terminal blocks or mechanical connector lugs shall be used for connection within the feedpoint. Wire nuts shall not be permitted in pad mounted feedpoints.
11. Splice kits with silicone shall not be permitted in any place in the lighting system.
12. Nameplates
 - a. Photo off-set printed on thermosetting laminated plastic or phenolic core and melamine surface.

- b. Mount in front of feed point with combination of aluminum round head screws and 3M adhesive similar to Type EC-847.
- c. Black background with white characters.
- d. 2-inch x 6-inch with legend:
 - "Keep Out" (3/8 inch letters)
 - "City of Minot, North Dakota" (1/4 inch letters)
 - "Street Light Control" (1/4 inch letters)
 - "N.E.C. requires 3 ft. clearance in front of this cabinet" (3/8 inch letters)
- e. Center all legends on nameplate.

B. Service

- 1. Provide 120/240 volt single phase service from serving utility transformer.
- 2. Service to be three #2 AWG type USE conductors installed direct burial between feed point and serving utility transformer. Location of this service to be drawn in on 'red-lined' and "As-Built" plans.
- 3. Install in trench, 36-inches deep, separate from underground street light feeder circuitry. Costs for service lateral to be included with Feed Point bid item.
- 4. Route 2-inch service entrance stub-out conduit inside of feed point, through meter, to panel main circuit breaker panel. All unfused conductors within the feed point enclosure SHALL be in non-metallic conduit.
- 5. Meter socket as per serving utility requirements, including manual bypass. All conduits
- 6. Pad-mounted transformer
 - a. Provide sufficient conductor length for utility company to terminate at transformer secondary bushings.
 - b. Provide pad for utility company transformer as required. Coordinate requirement with utility company.

2.06 Street Light Standard Foundations

- A. Shall conform to NDDOT Specifications Section 770.04 C. except:

1. Concrete shall have a minimum 28-day design compressive strength of 4000 psi.
2. All stub outs shall be no closer than 1-inch to the concrete foundation and shall not protrude above the opening for the hand hole cover.
3. All concrete foundations shall have two 2-inch PVC conduits installed.

2.07 Street Light Standards

- A. Self-Adhesive Numbering: The Contractor shall supply numbering for street light poles as directed by the City of Minot Traffic Division.
 1. Shall be Black on silver reflective, 2-inch characters on a 6.5-mil thick Mylar sticker, with the overall length and width being 2-3/8-inches Tall by 1-1/2-inches wide, Hillman Group self-adhesive, series 839380-839xxx, or approved equal.
- B. Type A – Fiberglass Round Tapered Anti Rotation Direct Burial Pole 14-foot Mounting Height
 1. Fiberglass lighting pole shall be round, hollow and of uniform taper along its length. The pole shall be non-conductive and chemically inert.
 2. A hand hole shall be provided in shaft opposite the road side of the pole. Hand holes to be a minimum of 4-inch x 6-inch with reinforced frame and removable cover. Cover to be secured in place with hex head screws.
 3. The butt-end of the fiberglass pole shall be enlarged and square to increase resistance to rotation and provide maximum ground bearing resistance.
 4. The pole shall be designed with a minimum safety factor of 2:1 and have no more than a 10% deflection at full wind loading.
 5. The pole shall be capable of supporting 1.3 EPA (Effective Projected Area) at 80 mph with a 1.3 gust factor.
 6. The pole shall deflect no more than 5% of the above-ground length with 100 pounds of lateral top load. The pole shall be capable of withstanding 450 pounds of top load before failure.
 7. The surface of the pole shall have a smooth finish. The finish color shall be Federal Standard Color No. 36231-grey. Coloration will be throughout the entire wall thickness of the pole.

C. Types C & C-1 – Steel Galvanized Standards

1. Steel light standards shall be galvanized steel of one- or two-piece construction. Galvanizing shall be in accordance with ASTM A-123. The shaft shall have only one longitudinal weld and shall have a minimum yield strength of 50,000 P.S.I. Shaft may be round or octagonal.
2. The Davit type mast arm shall be constructed of same material and by same method as the shaft. Mast arm shall have a Tenon adaptor for luminaire mounting.
3. The anchor shall be a one-piece steel casting secured to the lower end of the shaft by two continuous welds. One weld shall be inside the base at the bottom of the shaft and the other shall be on the outside of the shaft at the top of the anchor base. The welded connection shall develop the full strength of the adjacent shaft section. The anchor base shall be complete with bolts, washers, shims and bolt covers with cap screws for attaching covers to base. Grounding lug to be provided inside of base.
4. Install a 1/2-inch X 10-foot ground rod in each street light base.
5. A hand hole shall be provided in shaft opposite the road side of the pole. Hand holes to be a minimum of 4-inch x 6-inch with reinforced frame and removable cover. Cover to be secured in place with hex head screws.
6. All Type C poles shall be installed with a breakaway type transformer base.

2.08 Street Light Luminaire

A. Type A Streetlight Post-Top Luminaire

1. Newest version of the Holophane Taft LED Post-top Lantern or approved equal
 - a. Model - PTUE3 P20 30K MVOLT GL3 BK BL

B. Type C Streetlight Luminaire - steel pole/Davit arm.

1. Newest version of the American Electric Lighting Autobahn Series ATB2 or approved equal
 - a. Model ATB2 P603 MVOLT R3L 3K NL NR AO

- 2. Color temperature is to be 3000k.
 - C. Heads to be of aluminum casting designed for internal wiring and shall be furnished with 2-inch slip fitter for horizontal mounting. Luminaires shall be adjustable plus or minus five degrees from horizontal.
- 2.09 Post Wiring, Bonds and Grounds
- A. All post wiring between cable or neutral wires, and the luminaires or convenience outlet, shall be No. 12 A.W.G. copper stranded, (THWN/THHN) 600-volt cable of the same type specified for the underground distribution circuits.
 - B. In each post, two feeder leads shall be run from the cable in the base to each luminaire.
 - C. The feeder leads to the luminaire shall extend from the cable in the post base through a Buss type HEB in line fuse holder with a type FNM 10 ampere fuse. The fuse housing shall be supported by the conductors at the level of the post hand hole. Sufficient excess conductor (12-inches to 24-inches) in length shall be provided to permit withdrawal of the fuse holder through the hand hole for purposes of fuse installation and inspection, without having to pull out feeder wire. The neutral wire shall not be fused.
 - D. Ground all metal standards. Bond to ground conductor and to ground rod.
 - E. Fuse holders shall be connected directly, via the crimped ends to the feeder leads and the luminaire wiring. There is to be no other connection.

PART 3 – EXECUTION

3.01 Lighting System Installation

- A. The 120-volt or 240-volt distribution circuits, consisting of single conductor cables, quantity and size as designated on the drawings and these specifications, installed direct burial underground in boulevards, shall be installed in conduits under the streets and drives and when rising up into feed points.
- B. Conductors installed direct burial in trench or in conduit shall be installed to a depth of not less than twenty-four inches (24 inches) below finished grade. Under streets, drives and sidewalks conductor shall be installed not less than 24 inches below underside of concrete, asphalt or hard surface.
- C. Provide 2-inch PVC (heavy wall - Schedule 40) in trench areas designated on plans.

- D. Provide heavy wall plastic (PVC) conduits installed with "mole" or drilling device under existing hard surfaced driveways, streets and alleys.. Conduits shall extend 12 inches beyond each side of roadway or alley surface. PVC conduits to be complete with bell end fittings. Conduits under gravel or dirt driveways or streets to be laid in trench a minimum of 24 inches" below bottom of hard surface or grade.

- E. If an obstruction is encountered when "jacking" or "drilling" conduit under a concrete or asphalt street, driveway or alley or for any other reason it becomes impractical to install the conduit in this manner, the Engineer or their authorized representative may grant the contractor permission to cut the street, drive or sidewalk with a concrete saw so conduit can be trenched into place. The width of the concrete or asphalt to be removed and the depth of the saw cutting shall be performed as directed by the Engineer or their authorized representative. No extra payment will be made for cutting the concrete or asphalt. Cost of installing conduit by this method shall be included in the price for 2-inch conduit jacked or pulled in place. Street "cuts" shall not be started until permission is granted by Engineer - in writing.
- F. Where conduits cross streets, drives, and other paved surfaces; install wiring in a 2-inch conduit. A maximum of six (6) conductors may be installed in a single 2-inch conduit.
- G. Conduit shall be sloped to provide drainage. Provide sand pocket at lower end.
- H. Rigid steel conduit ends shall be carefully reamed to provide a smooth surface for conductor. Provide plastic bushing on all rigid steel conduit ends. PVC conduit ends shall be terminated with bell type fittings. Close up conduit by inserting a loose stopper plug of 'dry oakum' or similar material to prevent earth from entering the conduit.
- I. 2-inch PVC conduit shall be provided for the risers at the pad mounted feed points and 2-inch rigid steel galvanized at pole mounted feed points. Do not seal lower end of conduits at pole mounted feed points.
- J. During installation, cables shall be handled with care. Do not bend or kink cables to a radius of less than six (6) times cable diameter.
- K. All cables run through conduit shall be pulled by hand and shall not be strained in any manner in so doing. Provide a slack loop in conductors prior to entering any conduit that rises vertically.
- L. The street light branch circuit feeders consist of two 120-volt circuits or one 240-volt circuit routed underground from pole to pole. Street lights that are alternated on circuits shall be brought up into pole for splicing and marking.

- M. Where conduit or pipe is not used, cable shall be packed in sand to provide a cushion and to facilitate drainage in the following manner; Excavate trench to required depth minimum of 27 inches (Exception: 48 inches from feed points in residence back yards to boulevards) then fill with 3 inches of clean, washed sand, leveled and lightly tamped; single conductor cables shall be laid loosely in the trench and spaced. Conductor crossovers shall be avoided. Contractor shall use a paddle template just ahead of 3-inch sand cover operation to insure proper spacing. Cover conductors with not less than 3 inches of sand. Sand shall be leveled and lightly tamped about the sides and over the cable. The trench shall then be filled and finished in the regular manner. Exception: If Engineer approves specific excavation as being free of rock and debris, Contractor may use said backfill without sand cushion.
- N. Where excavations for cables or conduits are provided as noted above, the backfill shall be compacted in 4-inch lifts or layers.
- O. Provide 6-inch wide red plastic marker tape near top of trench (6 inches below final grade) in all trenches. Tape to read "Caution - Buried Electric Cable."
- P. The arrangement of circuits requires no splicing of cable underground. Splicing will only be allowed in junction boxes, pole bases or feed point cabinets.
- Q. A minimum of 10-percent spare pole/luminaire/lamp assemblies and transformer bases, rounded up to the nearest whole number shall be delivered to the City of Minot unless otherwise stated in the Plans.
- R. Self-adhesive numbering supplied by the Contractor shall be installed by the City of Minot Traffic Department.

3.02 Street and Sidewalk Crossings

- A. When it is necessary to cross under a street or sidewalk, the Contractor shall bore underneath and install a conduit for the utility. If conditions do not allow for a bore, the utility may be open cut but only after written permission is obtained from the City Engineer.
- B. All damage caused by utility installation shall be repaired by the Contractor including all settlements caused by open cut or trenchless methods.

3.03 Field Quality Control and Acceptance

- A. Each segment of underground circuitry shall be tested with a megohm-meter prior to termination in order to ensure no damage to the conductors or insulation has occurred during installation. Meter shall read infinite

resistance at a minimum of 500 volts. Contractor shall provide the Engineer with a meter reading for each segment.

- B. The Contractor shall be responsible for the lighting system and any damage or maintenance required prior to final acceptance by the City of Minot. Completion of the inspection checklist and submittal of record drawings to the Engineer shall constitute acceptance by the City of Minot.

PART 4 – MEASUREMENT AND PAYMENT

- A. Type _ Street Light: Shall be paid for by each (EA) as specified on the Plan. Price for each unit shall include the following:
 - 1. Type _ Luminaire specified for the type of pole or as shown on the Plans.
 - 2. Type _ pole as specified or shown on the Plans with appropriate mounting Tenon adaptor for luminaire mount as required.
 - 3. Pole wiring and connections to underground circuits.
 - 4. Fuse holder(s) and fuse(s).
 - 5. Tamped backfill and trim ring.
 - 6. Unit set in place and ready for operation.
- B. Conductor: Shall be paid for by the linear foot (LF) for the size and type specified on the Plan. Measurement shall be made from center to center of pole, box, or feed point.
- C. ____-Inch Conduit: Shall be paid for by the linear foot (LF) installed by the method specified on the Plan. Cost shall include all materials and labor necessary for installation.
- D. Trenching: Shall be paid for by the linear foot (LF). Price shall include all materials and labor necessary for completion of the work including sand cushion, marking tape, excavation and backfill.

- E. Feed Point: Shall be paid for by each (EA) as specified on the Plan. Price for each Feed Point shall include the following:
1. Concrete foundation/pad.
 2. Aluminum enclosure.
 3. Panel board with breakers.
 4. Relays.
 5. Photocell and bypass switch.
 6. Servicing receptacle.
 7. Conduit, wire and inter-connections.
 8. Meter socket.
- F. Spare Pole: Shall be paid for by each (EA) unit delivered to the City of Minot. Typically, 10 percent of the number installed, rounded up.
- G. Spare Luminaire: Shall be paid for by each (EA) unit delivered to the City of Minot. Typically, 10-percent of the number installed, rounded up.
- H. Junction Box / Pull Box: Shall be paid for by each (EA) as specified on the Plan.
- I. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 3700 – LAWNS AND GRASSES

LAWNS AND GRASSES

PART 1 – GENERAL

1.01 Section Summary

- A. Restoration of construction areas using topsoil, seed, mulch, and other materials.

1.02 Related Sections

- A. Section 1200 – Temporary Erosion and Sediment Control
- B. Section 1500 - Removals
- C. Section 1800 – Excavation and Embankment

1.03 References

- A. North Dakota Department of Transportation "Standard Specifications for Road and Bridge Construction," Current Edition, as revised.
 - 1. Section 202 - Removals
 - 2. Section 203 – Excavation and Embankment
 - 3. Section 251 – Seeding
 - 4. Section 252 – Sodding
 - 5. Section 253 - Mulching
 - 6. Section 255 – Erosion Control Blanket and Turf Reinforcement Mat.
 - 7. Section 856 – Erosion Control Blanket and Turf Reinforcement Mat.

1.04 Submittals

- A. Provide Engineer verification of seed type used on the project per Section 1000 – Quality Requirements.

1.05 Quality Assurance

- A. At the end of the Correction Period, a final inspection shall be made to determine areas of insufficient growth of the specified seed type. Areas of insufficient growth shall be re-seeded and established at the sole expense of the Contractor.

PART 2 – PRODUCTS

2.01 Topsoil

- A. Topsoil shall consist of loose, friable, loamy topsoil free of excess acid, alkali, and objectionable amounts of sod. Topsoil shall have demonstrated the growth of healthy crops or grasses.

2.02 Fertilizer

- A. Conform to NDDOT Specification Section 251.03.G except as modified herein:
1. At least 70% of the nitrogen component shall be slow-release water-soluble nitrogen.
 2. Fertilizer shall be in granular or granulated form, provided in closed containers clearly marked with the following information:
 - a. Its weight.
 - b. Type of nutrients.
 - c. Manufacturer's guaranteed analysis.

2.03 Seed Mixtures

- A. Regularly maintained urban areas (turf areas):

Sunny Mix

Common Name	Bulk Rate lb/acre	% of Mixture Component
Bluegrass – Park	72	60
Ryegrass – Fineleaf Perennial	36	30
Red Fescue, creeping	12	10
Totals	120	100.00

Heavily Shaded Mix

Common Name	Bulk Rate lb/acre	% of Mixture Component
Bluegrass – Park	42	35
Ryegrass – Fineleaf Perennial	36	30
Red Fescue, creeping	42	35
Totals	120	100.00

- B. Levees
 - 1. Dry side and levee top: Conform to Sunny Mix.
 - 2. Wet side: Conform to NDDOT Specification Section 251.03.F, Wetland Seed Mix – West.
 - C. Areas not regularly maintained: Conform to NDDOT Specification Section 251.03.D, Class I.
- 2.04 Sod
- A. Conform to NDDOT Specification Section 252.
- 2.05 Mulch
- A. Conform to NDDOT Specification Section 253.
- 2.06 Erosion Control Blanket
- A. Conform to NDDOT Specification Section 856.
- 2.07 Weed Control Herbicide
- A. Non-Selective Herbicide: broad-spectrum glyphosate-based.
 - B. Selective Herbicide: Trimec, 2-4-D, or approved equal.

PART 3 – EXECUTION

- 3.01 General
- A. Prior to beginning restoration activities, the Contractor will review the site with the Engineer to determine the extent of restoration to take place and to verify seed mix(es) to be used.
 - B. The Contractor shall notify the Engineer at least 14 days in advance of placing topsoil to allow the Engineer to have the topsoil tested.
 - C. All finish grading activities shall be completed and accepted by the Engineer prior to topsoil placement.
 - D. The Contractor shall maintain newly established areas until the project is completed and accepted by the Owner.
 - 1. Watering shall be adequate to establish and maintain healthy, uniform coverage.
 - 2. Mowing to a height of 3 to 4 inches shall be performed when grass reaches a height of 5 to 6 inches.

3.02 Sod

- A. Where shown on the Plans, sod shall be installed according to NDDOT Specification Section 252.

3.03 Seeding

- A. Conform to NDDOT Specification Section 251 except as modified herein:

1. Seedbed Preparation: Topsoil shall be placed 6 inches thick, areas that settle or hold water will be repaired by the Contractor.
2. Sowing Seed: No seeding shall occur when sustained wind velocities exceed 20 mph. A Brillion type seeder is an acceptable piece of equipment for sowing seed if it places seed at the specified depth and rate and rolls in a single operation.
3. Fertilizer: Fertilize in turf areas only. One application either immediately prior to or after seeding. Another application when the grass has been evenly established to a height of 2 inches. Water the turf after each application.
4. The Contractor assumes full risk if seeding is performed outside the seasonal limitations outlined in the NDDOT Specification. All areas damaged by erosion or not established because of seeding outside the recommend dates shall be repaired at no cost to the Owner.
5. Areas of inadequate or non-uniform coverage shall be re-seeded at the Contractor's expense.
 - a. Inadequate is defined as less than 70 percent established vegetative cover.
 - b. Non-uniform is defined as without the presence of bare spots.

3.04 Hydraulic Mulch (hydro-mulch)

- A. In all urban areas where a manicured lawn will be installed (turf areas), the seed shall be covered with hydro-mulch according to NDDOT Specification Section 253.

3.05 Erosion Control Blanket

- A. Where shown on the Plans, the seed shall be covered with erosion control blankets according to NDDOT Specification Section 255.

3.06 Straw Mulch

- A. In all other areas, the seed shall be covered with straw mulch conforming to NDDOT Specification Section 253.03.C.

3.07 Weed Control

A. General

1. Herbicide applications shall be performed according to federal, state, and local regulations.
2. Products shall be used consistent with their labeling.
3. All products, mixes and applications must be approved by the Engineer prior to use.
4. The Contractor or subcontractor applying herbicides is responsible for their purchase, storage, record keeping, and disposal.

B. Applicator Requirements

1. Herbicides may only be applied by qualified applicators who have been trained regarding the product and application method.
2. Applicators must hold, or be directly supervised by someone who holds, a valid North Dakota Pesticide Applicator Certification.
3. All herbicide applications shall be documented by the applicator, who shall submit a copy to the Engineer after each application.
4. Applicators must use extreme caution when applying herbicides near water and adjacent properties that might be damaged.

- C. Selective Herbicide: Apply 2 to 3 days after the first mowing to seeded areas identified by the Engineer.

- D. Non-Selective Herbicide: Apply only where indicated on the Plans or as directed by the Engineer.

3.08 Sprinklers & Irrigation Systems

A. General

1. Any sprinklers, sprinkler heads, or sprinkler lines damaged during construction shall be repaired or removed and replaced by the Contractor. Any new items provided for said repairs shall be of equal type and quality as the damaged item when it was new.

2. Sprinkler repairs shall be considered an incidental cost to the project, unless the "Sprinkler and Irrigation Repair" bid item is included in the project.

PART 4 – MEASUREMENT AND PAYMENT

- A. Seeding (Hydro-mulch): Item shall be paid for by the square yard (SY). The item will include all labor and materials required to place seed mix and hydraulic mulch. No payment shall be made until 70% coverage is achieved and all costs for the following shall be included in the price bid for each seeding bid item:
 1. Mowing, watering, and other turf maintenance as specified.
 2. Furnishing and applying fertilizers and herbicide as specified.
 3. Installing mulch as specified.
- B. Erosion Control Blanket: Shall be measured and paid for according to NDDOT Specification Section 255.
- C. Sod: Shall be measured and paid for according to NDDOT Specification Section 252.
- D. Herbicide – Selective: Shall be paid for by the square yard (SY) based on the measured area of application. This bid item may or may not be used depending on the growing conditions encountered.
- E. Herbicide – Non-Selective: Shall be paid for by the square yard (SY) based on the measured area of application.
- F. Sprinkler and Irrigation Repair: Shall be paid for by the lump sum (LS). Item will include all labor and materials required to repair or remove and replace any potential sprinklers, sprinkler heads, or sprinkler lines damaged during the project. Contractor will not be paid for item if no sprinkler or irrigation systems are damaged under the project.
- G. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 3800 – TRAFFIC SIGNALS

TRAFFIC SIGNALS

PART 1 – GENERAL

1.01 Section Summary

- A. Traffic Signal construction requirements and materials.
- B. Traffic signal design and installation shall comply with the NDDOT "Standard Specification for Road and Bridge Construction," Current Edition, as Revised, except as modified herein.

1.02 Related Sections

- A. Section 3400 – Post Mounted Traffic Signs

1.03 References

- A. North Dakota Department of Transportation "Standard Specifications for Road and Bridge Construction, "Current Edition, as Revised.
 - 1. Section 772 – Highway Traffic Signals.
 - 2. Section 896 – Highway Traffic Signals.
- B. Manual on Uniform Traffic Control Devices for Streets and Highways, 2009 Edition, as revised.
 - 1. Chapter 4 – Highway Traffic Signals.
- C. National Electric Code, as revised.
- D. North Dakota State Electrical Board, recommendations as revised.
- E. City of Minot Ordinances, as approved.
- F. Serving franchise utilities, as recommended.

1.04 Submittals

- A. Contractor shall follow submittal instructions found in the General and Supplementary Conditions.
 - 1. Before any of the materials are delivered to the job, submit to Engineer complete Shop Drawings for each item indicated.

2. Include catalog numbers, performance data, dimensions and other descriptive information.
3. Provide manufacturer warranties and guarantees with the City listed as owner.
4. Shop Drawings may be in the form of printed catalog sheets showing all necessary information and shall be bound together, neatly, indexed, and tabbed.
5. Each Shop Drawing folder shall be stamped, initialed, and dated by Contractor to indicate the Contractor has thoroughly reviewed them.
6. Shop drawings not in conformance with Specifications will be returned to Contractor without review.
7. Three copies will be retained by Engineer after review and the balance will be returned to Contractor.
8. Provide Shop Drawings / Product Specifications for:
 - a. Cable
 - b. Conduit
 - c. Feed Point Cabinet including a safety switch and lightning protector in device
 - d. Traffic Signal Standards.
 - e. Combination Standards including all necessary calculations and drawings used in designing these poles.
 - f. Traffic Signal Heads
 - g. Pedestrian Heads
 - h. Beacon Heads
 - i. Pedestrian Push Buttons
 - j. Traffic Signal Controller and Components, including:
 - i. Controller
 - ii. Flasher
 - iii. Conflict Monitor
 - vi. Coordination Equipment
 - v. External Logic Unit

- vi. Solid state Load Switches
 - vii. Detection Amplifiers
 - viii. Lightning Protector Device
 - k. Traffic Signal Controller Cabinet
 - l. Flashing Beacon Controller Cabinet
 - m. Video Detection
 - n. Emergency Vehicle Pre-Emption
 - o. Signal Head Mounts
 - p. Paint Type and Application Method
- B. The Engineer shall provide three detailed sets of the traffic signal cabinet wiring diagrams to the City of Minot. Schematic diagrams of the circuitries shall be included in the wiring diagram submittal. Place the wiring diagram in the signed cabinet at the location approved by the Engineer.
- 1. Show all equipment and associated connecting cable and termination points.
 - 2. Identify each wire in each connecting cable on the wiring diagram as to its function and terminal number. At each terminal on the wiring diagram, list the cable description and connection letter of the use and the function.
- C. Manuals
- 1. Upon completion of the Work in the Section and as condition of final acceptance, Contractor shall compile one Operators and Maintenance Manual in a 3-ring binder.
 - 2. List project name, date, Contractor's name, address and telephone number on exterior label of Manual.
 - 3. Include an index sheet indicating each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
 - 4. Manual information shall be included for all equipment/material where Shop Drawings are required. Also, include all installation, operation and maintenance data packaged with all equipment.
 - 5. All wiring diagrams and schematic diagrams shall be included as specified in Section 772.03.D of the NDDOT Specification.

PART 2 - PRODUCTS

2.01 Rigid Conduit

A. Shall conform to NDDOT Specification Section 896.01, except as follows:

1. Minimum conduit size shall be 2 inch.

2.02 Conductors

A. Shall conform to NDDOT Specification Section 896.02.

2.03 Pull Box

A. Shall be of a polymer concrete type, Quazite Enclosure, minimum 13 inches x 24 inches, stackable, PG Style as Manufactured by Hubbell Power System, Inc. or an equal approved but the City of Minot Traffic Department.

B. The cover shall clearly state "Signal".

2.04 Saw Slot Sealant

A. Shall conform to NDDOT Specification Section 896.03.

2.05 Feed Points

A. Shall conform to NDDOT Specification Section 896.04.

2.06 Foundations for Traffic Signal Standards

A. Shall conform to NDDOT Specification Section 772.04.B.

2.07 Traffic Signal Standards

A. Shall conform to NDDOT Specification Sections 772.04.G and 896.05 except as modified herein:

1. The pole of the traffic signal standard shall be mounted on a transformer base.
2. Traffic signal system bases, shafts/poles, and mast arms shall be galvanized steel and zinc powder coated gloss black. The color shall be No. 17038 of Aerospace Material Specification Standard No. 595.

2.08 Traffic Signal Heads

A. Shall conform to NDDOT Specification Section 896.06 except as modified herein:

1. Traffic signal head mounting bracket shall be Skybracket SB59-SCK.

2. Traffic signal head mounting hardware shall be colored black. The color "Black" is to be No. 17038 of Aerospace Material Specification Standard No. 595.
3. LED Modules are to be GE GTX VLA 12-inch model.
4. Traffic signal housings and visors are to be of a polycarbonate material and colored black.
5. Traffic signal backplates shall be aluminum and shall be louvered.
6. Traffic signal head backplates are to be a 5-inch backplate with a 1-inch wide retroreflective Type IX border. Material is to be aluminum and the backplate is to be louvered. The border shall be installed around the perimeter of the face of the backplate. Sheeting shall be Type IX reflective sheeting with a smooth surface, a distinct interlocking diamond seal pattern, and orientation marks visible on the face. The border shall have an aggressive pressure sensitive adhesive that is protected by a removable liner. Border shall have a sheeting that consists of prismatic lenses formed in a transparent synthetic resin that is sealed.

2.09 Pedestrian Signal Heads

- A. Shall conform to NDDOT Specification Section 896.07 except as modified herein.
- B. Pedestrian heads shall be Aluminum alloy die cast.

2.10 Pedestrian Push Button and Pedestrian Push Button Post

- A. Shall conform to NDDOT Specification Section 896.08 except as modified herein:
 1. Pedestrian pushbutton posts and pushbutton housing shall be galvanized steel and zinc powder coated gloss black. The color shall be No. 17038 of Aerospace Material Specification Standard No. 595.
- B. Shall meet the requirements of accessible pedestrian signal (APS) pushbuttons
- C. Shall include the following features:
 1. Rapid tick WALK indication, no more than 2–5dBA above ambient sound
 2. Vibrotactile WALK indication
 3. Speaker and vibrotactile indication located at pushbutton
 4. Pushbutton locator tone
 5. Tactile arrow on each device aligned in direction of travel on the crosswalk
- D. Shall meet the following Code Compliance:

1. Functionality: MUTCD 2009 - 4E
2. Temperature and Humidity: NEMA TS 2
3. Transient Voltage Protection: NEMA TS 2
4. Transient Suppression: IEC 61000-4-4, IEC 61000-4-5
5. Electronic Noise: FCC Title 47, Part 15, Class A
6. Mechanical Shock and Vibration: NEMA TS 2
7. EN4 PBS Enclosure: NEMA 250 - Type 4X
8. Electrical Reliability: NEMA TS 4

2.11 Traffic Signal Cabinet

A. Shall meet one of the following cabinet standards:

1. ATC Cabinet – 67-inch H x 45-inch W x 26-inch D, 5052-H32 Aluminum, 0.125-inch thick, 24 or 48-channel input assemblies, 2 or 4-channel industry standard detection modules, 48-channel detector, PPB, EVP, 32-channel output assembly, 32-channel CMU, CMU auxiliary display unit, cabinet power supply, DC power / common assembly, Clean AC power assembly, Police panel with On/Off, MCE, Auto/Flash, and Interval Advance push button cable, Slide-out drawer for storing programming blocks, plans, etc., Fan panel assembly, ATC Controller and Video Detection Assembly, and light to adequately allow work at night.
2. NEMA Cabinet – TS2-1, , 5052-H32 Aluminum, 0.125-inch thick, SDLC serial data bus, serial bus interface to detectors and load switches is via Bus Interface Units (BIUs), shelf rack detector assembly with 4 channel detector cards – 6 detector inputs – full-width Bus Interface Unit (BUI) – 4 channels of EVP preemption, 16 total phase capability – 8 vehicle phases, 4 pedestrian phases, 4 overlaps. Slide-out shelf/drawer storage unit, one slot for two-circuit flasher. Receptacles for up to six flash transfer relays, fan panel assembly, ATC Controller and Video Detection Assembly, and light to adequately allow work at night.
 - a. NEMA Cabinet with Attached Battery Backup – Size 6 - 65-inches H x 58-inches W x 27-inches D.
 - b. NEMA Cabinet without Attached Battery Backup – Size 6 – 65-inches H x 44-inches W x 24-inches D.
3. The traffic signal cabinet shall be fully compatible with the controller and equipment.

- B. The traffic signal cabinet shall be pad-mounted.
 - 1. Traffic signal cabinets shall come with their own installed lock and key.
 - 2. Concrete pad shall extend a minimum of 6 inches beyond the enclosure on all four sides. Provide 1-inch chamfer all around and down vertical sides to a minimum of 2 inches below grade. Concrete shall have a minimum strength of 4000 PSI in 28 days. Minimum of 6 sack cement per cubic yard. Location of concrete pad and cabinet location to be approved by the Engineer.
 - 3. Anchor bolts for signal cabinet shall be cast in place.
- C. Each signal system shall be metered separately and shall not include street lighting feed points.

2.12 Traffic Signal Controller

- A. Shall conform to NDDOT Specification Section 896.11, except as modified herein.
- B. The traffic signal controller shall be Econolite Cobalt Touch (graphics display), or traffic department approved equivalent and shall utilize Aries Software.
- C. The controller is to have traffic counting capability.

2.13 Battery Backup System

- A. The Battery Back-up System (BBS) shall include, but not be limited to the following:
 - 1. UPS with Inverter, charger, Tap Switching Transformer and Internal Power Switch
 - 2. Automatic / Manual Bypass Transfer Switch unit
 - 3. Batteries
 - 4. Battery Management System
 - 5. Cabinet shall have an external generator hook up.
 - 6. Mounting Hardware
 - 7. Wiring
- B. The BBS shall provide the following operational modes when operating on battery power:
 - 1. Full operation of all traffic signal devices
 - 2. Flash operation
 - 3. Combination of full and flash operation

4. External power indication

- C. The BBS shall provide a minimum run time of 8.0 hours of full-time operation with a 450-watt load. The minimum battery size requirement is listed in section 7.0, Battery Type.
- D. The BBS shall be compatible with ATC and NEMA cabinets and controllers; and all cabinet components for full-time operation.
- E. The BBS shall provide a minimum of 1100W/ 1100VA@25° Celsius active output capacity with 83 percent minimum inverter efficiency with 30% minimum loading. When operating in backup mode, the BBS output shall be 120VAC $\pm$ 2%, pure sine wave output, $\leq$ 3% THD, 60Hz $\pm$.3 Hz.
- F. The maximum transfer time allowed, from disruption of normal utility line voltage to stabilized inverter line voltage from batteries, shall be 5 milli-seconds (ms). The same maximum allowable time shall also apply when switching from the inverter line voltage to utility-line voltage. Transfers to and from battery operation shall not interfere with the operation of the other equipment in the intersection.
- G. The BBS and all components shall operate without performance degradation over a temperature range of -40°C (-40°F) to 74°C (165°F) with a maximum load of 70% of rated output of the BBS inverter.
- H. The BBS feedback level shall be tested and certified to Electrical Standards UL 1778 and CSA 107.3.
- I. The BBS shall have surge protection compliant with IEEE/ANSI C.62.41 Cat. A & B.
- J. The BBS system shall have a Mean-Time-Before-Failure (MTBF) of 174,955 hours at a temperature of 25°C (77°F) and 103,030 hours at a temperature of 50°C (122°F) per Telcordia SR- 232, 100% duty cycle, full load. Telcordia SR-232 certificate shall be included with the bid.
- K. The BBS shall be easily installed, replaced, or removed by using easily removable cables for AC input, AC output, DC input, external transfer control/alarm and battery temperature sense.
- L. The AC input and output shall hard wire connections.
- M. The DC connection shall be a recessed one-piece Anderson Style connector rated to handle the maximum DC current required by the inverter while running on batteries.
- N. The battery temperature probe connection inputs shall be panel-mounted Telco style connector.
- O. In the event of inverter/charger failure, battery failure or complete battery discharge, the automatic bypass transfer switch shall revert to Normally Closed (ND) (de-energized) state, where utility line power is connected to the cabinet.

- P. The BBS Inverter Module shall be able to shut down in order to protect against internal damage in the event of an over load at the output. The Inverter shall support an overload up to 115% for 2 minutes and then turn off the inverter output. The fault recovers when the overload is removed and line power returns.
- Q. The BBS shall provide a (2) time-of-day schedule settings programmable by the user.
1. The time-of-day schedule shall allow the user to program schedule operational modes as required, per intersection.
 2. The BBS time-of-day function when programmed shall automatically change operational modes based on the time-of-day schedule.
 3. The BBS shall not switch from Flash Operation to Full Operation mode when the remaining battery capacity is ≤ 40 percent.
- R. The BBS shall prevent a malfunction feedback to the cabinet or from feeding back to the utility service.
- S. In the event of BBS failure (inverter/charger or battery) or complete battery discharge, the internal power transfer relay shall revert to Normally Closed (de-energized) state and provide utility power to the intersection when utility line power is available to the cabinet.
- T. The BBS shall initiate an automatic shutdown when battery output reaches 42.0VDC.
- U. The BBS shall be equipped with an integral system to prevent the battery from destructive discharge or overcharge.
- V. The BBS shall include an Automatic/Manual Transfer Switch rated at 120VAC/30 amps.
1. Automatic Bypass Transfer Switch shall be a combination automatic/manual bypass switch. Placing the bypass switch in the "Bypass" mode shall transfer the intersection load from the UPS output directly to commercial power. AC commercial power must still be available to the UPS input, allowing the UPS to keep the batteries charged. An Inverter Input breaker shall be provided and located on the Bypass Switch so to shut off commercial power to the UPS input, allowing safely disconnecting and removing the inverter. With the inverter turned off, the batteries can be safely disconnected from the system.
 2. The Automatic Bypass Transfer Switch shall include a bypass indicator light that automatically notifies the user when the Manual bypass switch is in Bypass position. The indicator light shall be illuminated when in UPS mode.

3. The Automatic Bypass Transfer Switch shall have an optional bypass status relay with normally open, dry contacts that automatically close when the Manual bypass switch is in Bypass position.
4. The manual bypass switch and the automatic transfer relay shall be integrated together within the Automatic Bypass Transfer Switch allowing the manual bypass switch to be rated at 15 Amp and to be integrated with the bypass indicator light.
5. The Automatic Bypass Transfer Switch shall have terminal blocks capable of accepting #6 AWG wiring for the AC input and output with #10 AWG from the Automatic Bypass Transfer Switch to inverter/charger module.

W. Functionality

1. The BBS shall be Double Buck/Double Boost – Line Interactive, True UPS.
2. The Double Buck/Double Boost mode shall have a minimum range of 88 – 175 VAC.
3. There shall not be any user definable transfer set points for the buck boost mode.
4. Whenever AVE mode is selected the output of the system shall be regulated between 108-130 VAC. When the output of the system can no longer be maintained with this range, the BBS shall transfer to Backup Mode.
5. The BBS shall be equipped with an AC Input circuit breaker that protects both the UPS and the loads connected to the output. Should the AC Input breaker on the UPS trip, it shall allow the UPS to go to inverter mode to power the intersection off the batteries. Should an overload condition still exist when the inverter is energized the inverter will revert to its internal electronic protection, preventing damage to the inverter due to the over load or short circuit condition, on the output. Once this over load condition is cleared the inverter will energize and power the intersection utilizing the available battery power. If the condition does not clear itself, the inverter will stay in the standby mode until manually cleared by a technician.
6. The BBS shall have a flush mounted Battery circuit breaker installed on the front panel of the BBS inverter module.
7. The BBS shall have a user definable line quality time. The user shall be able to select a minimum of six (6) possible settings. The settings shall be 3, 10, 20, 30, 40 and 50 seconds. The default line qualify time shall be 3 seconds.
8. The BBS shall have an integral charger that is compatible with Gel and AGM battery topology. The charger shall be an intelligent charger with control systems that automatically incorporates bulk, absorption and float charging modes.

9. The integral intelligent charger shall use temperature compensation. The charging system shall compensate over a range of 2.5 – 6.0mV/°C per cell user adjustable when required.
 10. A temperature probe which plugs into the front panel of the BBS shall be used to monitor the internal temperature of the batteries. The temperature sensor shall be 2 meters in length, external to the inverter/charger module and taped to the side of a center battery within the battery string.
 11. The batteries shall not be recharged whenever the battery temperature exceeds 50°C (122°F).
 12. The recharge time for the batteries from “protective low-cutoff” to 90% or more of full charge capacity shall not exceed 2-4 hours, subject to temperature compensation. The BBS charger shall be capable of providing 15 amps at 54VDC.
- X. User Interfaces and Displays
1. The BBS inverter/charger unit shall include a backlit LCD display for viewing all status and configuration information. The screen shall be easily viewable in both bright sunlight and in darkness.
 2. The screen shall be large enough to display the following information with the use of menu scrolling buttons to read required information. All active readings shall be real time.
 - a. Operating Mode (Line, Standby, Backup, Buck/Boost)
 - b. Utility input voltage
 - c. BBS output voltage and current
 - d. Battery Temperature
 - e. Input Frequency
 - f. Output Power
 - g. Battery Voltage
 - h. Charger Current
 - i. Shed Timer Relays time to activation
 - j. Ethernet MAC Address and IP Address
 - k. Accumulated output power in kW hours
 - l. Battery Runtime Remaining

- m. Unit Serial Number
 - n. Unit Firmware Version
 - o. Any alarms and faults
 - p. Keypad
- 3. The BBS inverter/charger unit shall include a keypad for navigating system information.
 - 4. The BBS shall be provided with a web-based-interface for user configuration and management through a web browser.
 - 5. The BBS shall allow the user to do the following through the web browser:
 - a. View Logs
 - b. Change modes of operation
 - c. Configure email alarms
 - d. Adjust line qualify time
 - e. Program relay contacts
 - f. Configure network parameters.
 - g. Inverter/charger firmware to be upgradeable remotely via Ethernet
 - h. Communication module firmware upgradeable remotely.
 - 6. The BBS shall have discrete status LED indications on the front of the inverter/charger
 - 7. Green Output LED shall be ON any time that the output of the BBS is in normal mode. When the BBS output is either in Backup Mode or AVR Modes the LED will flash On and Off.
 - 8. Red Fault LED shall be Solid On any time that there are any faults in the system.
 - 9. Red Flashing Alarm LED shall Flash On and Off any time that there are any alarms in the system.
 - 10. The BBS shall maintain an event log containing a minimum of 200 of the most recent events recorded by the BBS. These events shall be downloadable remotely via Ethernet and automatically reported to the central monitoring software. The Events Log shall be date and time stamped.
 - 11. The BBS shall display and log the following events, alarms and faults.

- a. Operating Mode
 - b. Weak Battery
 - c. Overload
 - d. High and Low Temperatures
 - e. User Input, S2 is shorted
 - f. Line Frequency out of specifications
 - g. No temperature probe
 - h. Low Battery
 - i. Battery Breaker Open
 - j. BBS is performing a Self-Test
 - k. Fan Fail
 - l. Incorrect Firmware
 - m. AC Input Breaker Open
 - n. Short Circuit
 - o. Output Voltage High
 - p. Output Voltage Low
 - q. Battery Voltage High
 - r. Battery Voltage Low
 - s. Isolation Relay Fail
 - t. Temperature High
 - u. Counters
12. The BBS shall keep track of the Following:
- a. The number of times that the unit was in Backup Mode
 - b. The accumulated number of hours and minutes that the unit has operated in Backup mode since the last reset.
13. The BBS shall provide the user six (6) programmable dry relay contacts and one (1) 48 DC relay contact. As a minimum, the programmable options shall be On Battery, Low Battery, Timer, Alarm, Fault and Off. The BBS shall also

have three (3) input dry relay contacts. BBS Self-Test, User Alarm, and BBS Shutdown.

14. The relay contacts shall be made available on the front panel of the BBS via 6, 3 position plug-in terminal blocks with screw down wiring connections.
15. Each relay, C-1 through C-5 shall have their own common and their own set of normally open (NO) and normally closed (NC) terminals. The terminals for each relay shall be oriented as NO-C-NC on the terminal block. C-6 shall provide continuous 48 VDC voltage for powering of enclosure DC fan.
16. The contacts on the terminal block shall be labeled 1-18, left to right. Additionally, each set of contact shall be labeled with the NO-C-NC designation, as well as C1 through C6 from left to right. Printed labels noting all alarms and faults shall be provided with the BBS Inverter/Charger to be installed when required.
17. The relay contacts shall be rated at a minimum of 1 amp @ 250 VAC.
18. The dry relay contact that are configured for "on battery" shall only reenergize when the Inverter is operating in Backup Mode.
19. The BBS shall include a timer that will energize the "timer" configured dry relay contact after the user configured time has elapsed. The timer is started when the BBS enters Backup Mode. The user shall be able to configure the timer to the required time. The format shall be Hours, Minutes, Seconds.
20. The BBS shall have an adjustable low battery relay setting so that the user can set the point at which the low battery relay contact is energized.
21. The BBS shall be equipped with an industry standard RS-232 serial Connection for user configuration and management. The serial port shall be an EIA-232 (DB9-Female) connector.
22. The BBS shall have an internal Ethernet communication interface for user configuration and management. The Ethernet Port shall be an RJ-45, EIA 568B Pin Out Connector.
23. The BBS shall include remote monitoring and alarms transmission capabilities through the Ethernet RJ-45 IP Addressable Port, using SNMP protocol.
24. System shall have the capability of notifying Operations, Maintenance or TMC via email of any alarms, faults or events, user selectable. Email set up must allow for different levels of notifications based on the criticalness of the alarms.
25. Email notification shall support 6 different users.

26. All BBS configuration and System menus shall be accessible and programmable from the RS-232 and Ethernet Port.
27. The BBS shall Support TCP and UDP over I P protocol communications.
28. The BBS shall support FTP, Telnet, and HTTP.
29. The BBS shall be SNMP compliant.

Y. Batteries

1. The battery shall be comprised of extreme temperature, float cycle, GEL VRLA (Valve Regulated Lead Acid). Individual batteries shall meet the following specifications:
 - a. Voltage Rating: 12V
 - b. Amp-hour rating: 109 AH, at the 20-hour rate, to 1.75 Volts per cell, minimum battery rating. Larger AH batteries are acceptable providing they do not exceed the group size listed below.
 - c. Group size: Case 31
2. Batteries shall be easily replaced and commercially available off the shelf.
3. Batteries shall provide 100% runtime capacity out-of-box. Each battery must meet its specification without the requirement of cycling upon initial installation and after the initial 24-hour top off charge.
4. Batteries used for the BBS shall consist of 4 batteries configured for a 48 VDC battery buss system.
5. The battery system shall consist of one or more strings of extreme temperature; float cycle GEL VRLA (Valve Regulated Lead Acid) batteries. Batteries shall be certified to operate at extreme temperatures from -40°C to 71°C.
6. The batteries shall have maintenance-free threaded insert terminals eliminating annual torqueing. Battery terminals that require annual torqueing of each post connection shall not be permitted.
7. An integral lifting handle shall be provided on the batteries for ease of removal/installation.

Z. Maintenance

1. The BBS shall provide voltmeter standard probe input-jacks (+) and (-) to read the exact battery voltage drop at the inverter input.

2. The BBS Inverter Module shall be programmable to preform automatic self-testing, programmed in weekly intervals and programmed by the user to meet their specific requirements or manufacturer's recommendation.

AA. Vendor Support

1. The BBS manufacturer shall provide at no charge, a toll-free technical support phone number. The toll-free phone number shall be included in the BBS manual.
2. Equipment manuals shall be provided for each BBS cabinet. Equipment manuals shall include installation, operation, programming, maintenance and troubleshooting.

BB. Quality Assurance (QA)

- A. Each BBS shall be manufactured in accordance with a written manufacture's Quality Assurance (QA) program. The QA program shall include, as a minimum, specific design and production QA procedures.
- B. The BBS Power Module manufacturer shall be ISO 9001 or ISO 9002 certified.
- C. The BBS Power Module shall be Telcordia SR-232 certified.
- D. The manufacturer shall be certified to carry out the CSA and UL Standards testing on the BBS system.

2.14 Emergency Vehicle Pre-Emption (EVP)

- A. Shall conform to NDDOT Spec Section 896.14, except as modified herein:
 1. Shall be Opticom™
 2. Shall be entirely compatible with existing EVP equipment used in the City of Minot.
 3. The Contractor shall notify the City of Minot Fire Chief of EVP testing and date of operation.
 4. Light is to be clear (non-colored).

2.15 Video Detection System

- A. The video detection system shall utilize Aeries Software and be fully compatible with the traffic signal controller.
- B. Each camera in the video detection system shall be IP-addressable.
- C. The video detection system shall be designed to withstand and operate in all weather conditions.

- D. The video detection system shall accurately detect all vehicles.
- E. The video detection system shall transmit real-time, continuous, digital video to a remote computer utilizing digital subscriber lines (DSL) or radio/wi-fi. Each video camera at the intersection shall exhibit these digital video capabilities.
- F. Digital streaming shall be MPEG-4 video output.
- G. Shall be capable of traffic data collection.
- H. Housing for each camera shall be a completely dust and water-tight NEMA-4 enclosure.
- J. Each camera shall be manufactured with a temperature-controlled faceplate heater.
- K. The video detection system and its outputs shall be fully compatible with the controller system.

2.16 Span Wire

- A. Shall conform to Section 896.15 of the NDDOT Specification.

2.17 Stabilization Wire

- A. Shall conform to Section 896.16 of the NDDOT Specification.

2.18 Service Poles

- A. Poles for temporary traffic signals shall conform to Section 896.17 of the NDDOT Specification.

2.19 Rectangular Rapid Flash Beacons (RRFB)

- A. Controller and Cabinet are to be manufactured by Traffic & Parking Control Co, Inc. (TAPCO)
- B. Light bar housing is to be powder-coated aluminum colored black.
- C. The RRFB is to meet conditions set forth by the Federal Highway Administration (FHWA) for interim approval for optional use of RRFB, as well as all current FHWA interpretations.

PART 3 – EXECUTION

3.01 General

- A. Installation shall comply with Section 772 and Section 896 of the North Dakota Department of Transportation "Standard Specifications for Road and Bridge Construction," 2020 Edition, as revised.
1. A minimum of two additional conduit runs of a 2-inch diameter shall be installed in each new controller foundation. The spare conduits shall be capped.
 2. A spare conduit of a 2-inch diameter shall be installed in each signal standard foundation. The spare conduit shall be capped.
 3. A working slab shall be designed and provided for the controller. The working slab shall be 6 feet wide, extend past the controller foundation at a minimum of 4 feet, and shall tie-in with the controller foundation. The top of the slab shall extend 2 inches above finished grade and, if applicable, matched to adjacent sidewalk grade.
 4. When setting cabinet enclosures directly on the concrete slab, sealant shall be placed on the concrete slab prior to setting the enclosure. Also caulk the concrete/enclosure interface both inside and outside of the enclosure.
 5. All field cables installed by the Contractor shall be labeled. The labeling materials shall be approved by the City of Minot and the labels shall be readable without moving the cables. The cabinet wiring system shall include the following labels, in addition to information required by the NDDOT Standard Specifications:
 - a. Labels shall be provided for the video detection cameras and shall be located on the detector panel adjacent to their termination point.
 - b. The signal head control cables shall be labeled on the field wire terminals and shall include the corresponding direction and phase number.
 - c. The Emergency Vehicle Pre-Emption field wire terminals and the associated indicator lights shall be labeled with the corresponding phase number and direction.
 - d. The pedestrian push button cables shall be labeled on the field wire terminals and shall include the corresponding direction and phones number.
 6. All conduits entering and exiting pull boxes shall be sealed with duct seal. All conduit ends shall have bushings , per N.E.C.
 7. The traffic counting capability of the controller shall be fully operational.

8. The confirmation light for the EVP shall be at the same location on the mast arm as the EVP detectors.
9. Coordination with the appropriate electrical company shall be the responsibility of the Contractor.
10. Traffic signal system installation shall meet or exceed all requirements set forth by the Contractor.

3.02 Pedestrian Push Button and Pedestrian Push Button Post

- A. All new pushbuttons are to be Accessible Pedestrian Signals (APS). Make and Model is to be the newest version of the Polera iNavigator S 2-Wire Push Button with iDetection Option (Model IDS2) or approved equivalent. The pushbutton is to be compatible with the PedApp smartphone app, wireless Bluetooth 5.
 - a. Size of Front Plate Adapter is to be 9" x 15"
 - b. Sign to be 800H-135 – which includes the notification to push or wave at button to cross.
- B. Accessible Pedestrian Signals (APS) should be reachable from the level landing of the curb ramp for the crossing or from a level surface with an accessible path to the ramp (MUTCD Section 4E.08 and PROWAG).
- C. APS should be within 5 feet of the crosswalk line furthest from the center of the intersection and within 10 feet of the curb (MUTCD Section 4E.08).
- D. Tactile arrow shall be aligned with parallel to the direction of travel on the crosswalk (MUTCD Section 4E.12, P1).
- E. Pushbutton required to be located within reach range for wheelchair users (PROWAG, R406).

3.03 Field Quality Control and Acceptance

- A. The Contractor shall preform a complete controller conflict monitor test prior to placing the signal in operation. The traffic heads shall not be unveiled prior to the complete controller conflict monitor test being performed. A conflict monitor maintenance form will be supplied by the City of Minot. The instruction on the form must be followed completely before the signals are used.
- B. The Contractor shall be responsible for the traffic signal system and any damage or maintenance required prior to final acceptance by the City of Minot. Completion of the inspection checklist and submittal of record drawings to the Engineer shall constitute acceptance by the City of Minot.

PART 4 - MEASUREMENT AND PAYMENT

- A. Saw Slot: Shall be paid by Linear Foot (LF). Price for item shall include saw slot sealant and the installation of the saw slot sealant.
- B. Conduit: Shall be paid by Linear Foot (LF) for each size of conduit including installation, regardless of the installation method.
- C. Underground Conductors: Shall be paid by Linear Foot (LF).
- D. Concrete Foundation: Shall be paid per Each (EA).
- E. Pull Box: Shall be paid per Each (EA).
- F. Feed Point: Shall be paid per Each (EA).
- G. Feed Point Modifications: Shall be paid per Each (EA) complete system modified.
- H. Signal Standard: Shall be paid per Each (EA), to include the signal pole, mast arm, transformer base, and paint.
- I. Pedestrian Signal: Shall be paid per Each (EA).
- J. Controller Cabinet: Shall be paid per Each (EA).
- K. Controller: Shall be paid per Each (EA).
- L. ____- Section Traffic Signal Head: Shall be paid per Each (EA), based on the type of section head.
- M. Pedestrian Push Button Post: Shall be paid per Each (EA).
- N. Emergency Vehicle Pre-Emption Unit: Shall be paid per Each (EA).
- O. Traffic Signal System: Shall be paid per Each (EA). This work includes furnishing labor, materials, tools, machinery, and equipment necessary to install and construct an operating traffic signal system conforming to these specifications, complete in place, including:
 - 1. Installing the electrical service and metering facilities and paying for the electric company's charges;
 - 2. Trenching, structural excavating, backfilling, restoring work, and installing pull boxes;
 - 3. Providing a complete and operating traffic signal system with controller, cabinet, auxiliary and support equipment, vehicle detectors, signal standards, traffic signals and appurtenances, signal head mounting, concrete foundations, cables, wiring, cleaning and adjusting signal heads, painting and restoration work, and all incidentals;

4. Coordinating work and arranging for inspection of work with the Engineer and other agencies as required;
 5. Turning over to the City a complete and operating traffic signal system according to the contract.
- P. RRFB LED Crosswalk Warning System: Shall be paid per Each (EA) complete system installed; including all bases, posts, equipment, hardware, wiring, and connections for both directions of travel.
- Q. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION

SECTION 4000 – LIFT STATIONS

LIFT STATIONS

PART 1 – GENERAL

1.01 Section Summary

- A. This Section includes all work necessary to furnish, install and place into operation a lift station, including all appurtenances required to complete the Work. This section includes but may not be limited to electric submersible non-clog pumps, UL listed for Class 1 Div. 1, group C and D hazardous locations, to be supplied with motor, close coupled volute, cast iron discharge elbow guide bars and brackets, Power cable, wet well and valve vault installation and all accessories, control panels and all appurtenances, including feeds lines, conduits, and conductors.
- B. Contractor shall provide all labor, equipment, and materials necessary to construct a lift (pump) station in accordance with these Specifications, Project Plans and manufacturer's recommendations.

1.02 Related Sections

- A. Section 1000 – Quality Requirements
- B. Section 1400 – Operations and Maintenance Manuals
- C. Section 1800 – Excavation and Embankment
- D. Section 2000 – Trench Excavation and Backfill

1.03 References

- A. Publications listed below form part of this Specification to extent referenced in the text by basic designation only. The latest edition of publication governs unless otherwise noted.
 - 1. ANSI - American National Standards Institute
 - 2. AWWA - American Water Works Association Standards
 - 3. ASTM - American Society for Testing and Materials
 - 4. IEC – International Electrotechnical Commission
 - 5. IEEE - Institute of Electrical and Electronics Engineers
 - 6. NFPA – National Fire Protection Association
 - a. NFPA 70 – National Electrical Code (NEC) 2008.

7. NDDOT – North Dakota Department of Transportation “Standard Specifications for Road and Bridge Construction” 2020 Edition, as revised
8. NEC - National Electric Code
9. NEMA - National Electrical Manufacturers Association
 - a. NEMA ICS-@ - Industrial Control Devices, Controllers and Assemblies.
 - b. NEMA 250 – Enclosures for Electrical Equipment.
10. Hydraulic Institute Standard for Centrifugal, Rotary and Reciprocating Pumps.
11. UL – Underwriters Laboratories, Inc.
 - a. UL-698A – Industrial Control Panels Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions.

1.04 Quality Assurance

- A. Testing.
 1. Test the installed pumps in the presence of the Engineer and Owner to demonstrate the proper operation at the design criteria specified herein. Test records shall be retained by the manufacturer and be made available to the Owner in accordance with the Section 900 of the City of Minot Standard Specifications and as outlined herein.
- B. The pumps shall be essentially the standard products of a manufacturer who has been regularly engaged in the successful production of high-quality equipment of this type for at least ten years and shall be manufactured in a facility with ISO 9001:2015 certification.
- C. All equipment furnished under this section shall be from a single supplier which shall assume full responsibilities for system operation regardless of manufacturer.
- D. Provide factory-trained manufacturer's representative to supervise start-up and testing of pumping units and controls.
- E. Equipment Warranty
 1. All pumping equipment shall carry an extended warranty period of two years from the date of acceptance. Additionally, the manufacturer of the pumps shall warrant the pump and motor to be free from defects in materials and workmanship for an extended

five-year prorated warranty from the date of shipment shall be provided against defects in material and workmanship.

1.05 Submittals

- A. Submit all shop drawings and manufacture's information in accordance with the Conditions of the Contract and in accordance with Section 1400 for applicable Operations and Maintenance Manuals for the lift station demonstrating compliance with these Specifications including:
 - 1. Manufacturer's literature, illustrations, specifications, and engineering data defining materials of construction, dimensions, weights and pump and motor performance.
 - 2. Complete electrical schematics and dimensional drawings.
 - 3. Parts list, including a list of recommended spare parts and maintenance tools.
 - 4. Submit certified curves for approval.
 - 5. Submit a final documented copy of PLC ladder logic program
- B. Furnish operation and maintenance data in accordance with Section 1400.
- C. In addition to the requirement of Section 1400 of the City of Minot Standard Specifications, the Contractor shall submit the following prior to final closeout of the Project:
 - 1. Certified final factory test report shall be provided to Owner, certifying the unit's full power rating, stability, voltage and frequency regulation.
 - 2. Three (3) sets of complete pump and generator O&M manuals with part list.
 - 3. Three (3) sets of catalog cuts and wiring diagrams for approval.
 - 4. Three (3) sets of impeller and design information (pump curves).
 - 5. Three (3) sets of factory performance test results for each pump.
 - 6. Three (3) sets of Control Panel O&M manuals.
 - 7. Three (3) copies of the SCADA programming for the lift station.
 - 8. Reports showing that all manufacturer recommended maintenance has been performed on the pumps since delivery was taken.

1.06 Delivery, Storage and Handling

- A. Deliver, store and handle all pumping equipment and controls in accordance with the General and Supplementary Conditions and the manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 Submersible Pumps

A. General

1. All hardware including but not limited to bolts and nuts shall be Type 316 stainless steel.
2. Type 316 stainless steel anchor bolts shall be furnished and sized in accordance with manufacturer's recommendations.
3. Each pump shall be furnished with a stainless-steel data plate securely attached to the unit. Data plates shall contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating and other pertinent data.
4. Paint pumps and motors in accordance with manufacturer's recommendations. Submersible pumps shall be of the centrifugal non-clog type and shall be complete with a self-cooled and contained submersible electric motor as hereafter specified, base elbow, stainless steel pump rails, stainless steel chain, and all other items necessary for a complete installation. The pumps shall be designed to run continuously with their motors entirely submerged.
5. The pumps installed in the lift station shall be installed as shown on the Plans. These pumps will be of a type suitable for a submersible application, shall be design for either raw wastewater or storm water depending on the application, shall have a minimum discharge diameter of 4 inches. Shall be able to pass 3-inch diameter solids. Shall be rated 480 volts, three phase, 60 Hz service.
6. Manufacturer:
 - a. The submersible pumps shall be the product of ABS, Fairbanks Morse, Wilo, Xylem-Flygt, or as explicitly specified otherwise or approved equal.

B. Non-clog Submersible Pumps

1. Pump Design
 - a. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the

wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

2. Impeller

- a. Impeller shall be of the statically and dynamically balanced non-clogging type matched to its constant velocity equalizing pressure with smooth fluids passage to prevent clogging of stringy, fibrous material or other matter found in normal sewage applications. Impeller shall be made of close-grained cast iron conforming to ASTM A48 Class 30. Unless specified otherwise, the impeller shall be of one-piece construction, single suction, enclosed, recessed vortex type, two-vane, radial flow design with well-rounded leading vanes and then tapered toward the trailing edge for a circular flow pattern to prevent the accumulation of solids and stringy material.
- b. If specified, based on the application type, Grinder type impellers shall be multi-vane, semi-open with replaceable cutting heads.
- c. The clearance between the impeller outside diameter and cutwater shall be capable of passing a 3-inch solid sphere.
- d. The impeller is to be dynamically balanced and secured to the shaft by means of a bolt, washer, and key. The arrangement shall be such that the impeller cannot be loosened from torque in either forward or reverse rotation.
- e. Wiper vanes on the back impeller shroud are not allowed.
- f. Impeller shall be trimmed to specifically meet the conditions of operation.

3. Volute/Casing

- a. Volute is to be cast made of close-grained cast iron conforming to ASTM A48, Class 30. It is to be one-piece, constant velocity equalizing pressure with smooth fluid passages large enough to pass any size solid that can pass through the impeller.
- b. The volute shall have an integral tapered suction inlet area to direct flow to the impeller eye and have a centerline-flanged discharge. Volute discharge shall be minimum 4" diameter as

measured on the inside diameter of the discharge flange opening.

- c. A sliding bracket assembly shall be a part of the pumping unit constructed so that when lowered to the discharge base/elbow, the knifing action of the vertical metal-to-metal seal provides a self-cleaning, non-clogging, non-sparking UL Listed explosion-proof assembly.

4. Wear Rings

- a. Except for recessed vortex type impellers, replaceable wear rings shall be fitted to provide efficient sealing between the volute and the impeller. Wear rings shall be provided on both the impeller and front head so that clearances can be maintained throughout the life of the rings and minimize recirculation.
- b. Impeller wear rings shall be of the axial- or face-type.
- c. Front head wear rings shall be of the axial- or face-type.
- d. Wear rings shall be attached to the impeller and front head using an interference fit and Loctite.
- e. Wear rings shall be 400 series stainless steel, with a minimum hardness of 300 BHN.
- f. Wear ring clearance adjustment shall be attained through impeller adjustment shims.

5. Guide Rail/Bracket

- a. Two rails with guide shoes shall be provided to guide the pump assembly when being raised or lowered in the sump. The shoes shall be designed to make contact with the discharge elbow allowing the pump discharge flange to properly engage the discharge elbow providing a leak-tight joint. Single rail or cable guide systems are not acceptable.
- b. The rails shall align the pump with the discharge elbow as it is lowered into place.
- c. A stainless-steel upper rail guide bracket shall be furnished to support and align the rails at the top of the sump. For all rail lengths greater than 20 feet, a stainless-steel intermediate rail guide bracket shall be included.

6. Chain and Cable

- a. 316 stainless steel chain and cable shall be used to lift the pump/motor assembly from the wet well. The upper end forms a closed loop that attaches to a winch cable and also can be hung up on a rope bracket when not in use. Provide adequate length to reach bracket plus 7 feet. The entire lifting assembly shall be comprised of overhead rated materials with a documented working load rating of 125% of the pump and power cable weight.

7. Discharge Base

- a. The installation shall include a rigid discharge base-elbow to support the total weight of the pumping unit. The discharge Elbow shall be made of close grain cast iron ASTM A48, Class 30.
- b. The pump shall automatically connect to the discharge elbow when lowered in place.
- c. The base is to be bolted directly to the floor with the 90-degree elbow having a 125 lb. ANSI flange discharging vertically.

C. Motor

1. Pump(s) shall be driven by completely sealed, electric submersible squirrel cage induction motors with a minimum 1.15 service factor, 480 volts, 3 phase, 60 Hertz. The motor shall be non-overloading throughout the pump operating range. The motor shall be suitable for constant speed/variable speed service.
2. Submersible equipment shall be UL Listed for Class I, Division 1, Groups C and D explosion-proof hazardous locations as defined by the National Electric Code. All electrical parts shall be housed in an air-filled cast iron, watertight enclosure which is sealed by the use of O-rings and rabbeted joints with extra-large overlaps.
3. The stator winding and lead shall be insulated with moisture-resistant Class F insulation for continuous duty in 105° F ambient. The motor shall be designed for continuous duty capable of ten (1) starts per hour. Automatic reset, normally closed thermal overloads shall be imbedded in the motor windings to provide overheating protection. Motor winding thermostats must be connected to an electric controller per local and state codes and the National Electric Code.
4. Motor shaft shall be one-piece, 416 stainless steel. Carbon steel shafts or shaft sleeves are not acceptable. Rotor is to be

dynamically balanced to meet NEMA vibration limits; all external hardware is to be stainless steel.

5. Cable leads are to enter at the top of the motor and are to allow the cable-to-motor connection to be accomplished in the field without soldering. All power and control lead wires are to be double sealed as it enters the motor in such a manner that cable-wicking will not occur. This sealing system shall consist of a rubber grommet followed by epoxy that is high in adhesive qualities and has a low coefficient of expansion. Each cable wire is to have a small section of insulation removed to establish a window area of bare wire and each wire is to be untwisted and surrounded by epoxy potting material. A cable strain relief mechanism shall be an integral part of this sealing system. Cable sealing system shall be capable of withstanding an external pressure test of 1200 PSI as well as a cable assembly pull test as required by Underwriters Laboratories. Singular grommet or other similar sealing systems are not acceptable. Motor shall be supplied with 30 feet, minimum (unless specified otherwise) of multi-conductor type "SOW-A" or "W" power cable and control cable. Cable sizing shall conform to NEC specifications and be UL Listed.
6. Power and control leads shall be terminated on a sealed terminal board. The terminal board and its bronze lugs shall be O-ring sealed.
7. Each pump shall have a Type 316 stainless steel plate permanently attached by stainless steel screws or rivets to the pump frame into which the following information shall be impressed, engraved or embossed: manufacturer's name, pump size, serial number, impeller diameter, capacity, head rating, speed, and bearing numbers. Nameplates shall also include information unique to each item of equipment and device to identify its function as described herein. Function nameplates shall be approximately one inch by 3 inches if made separately. Letters of function titles shall be not smaller than 1/4-inch high.
8. Protective coatings for exposed ferrous metal surfaces shall be standard epoxy coating systems of the manufacture for severe duty unless specified otherwise.

D. Shaft Seal Arrangement

1. Pump(s) shall be provided with two separate tandem-mounted mechanical seals to prevent the pumped liquid from entering the rotor/stator cavity area to ensure reliability of operation. The upper and lower seals are mounted to rotate in the same direction.

2. The lower mechanical seal mating surfaces are to be immersed in an oil bath, sealing the pump volute chamber from the oil cavity. Oil in this cavity shall also lubricate the upper mechanical seal faces. Seal faces of both the upper and lower mechanical seals shall be held in contact by independent polymeric elastomer bellows, which act as a spring mechanism. Seals require neither maintenance nor adjustment but shall be easily inspected and replaced. Pressure generated by the pump assists in sealing the mating surfaces of the lower seal.
3. Component material for the upper seal shall consist of a composite elastomer body, carbon steel snap ring, Buna-N O-ring, carbon rotating face and ceramic stationary face. Lower seal component construction shall include a composite elastomer body, stainless steel clamp and set screws, Buna-N O-ring, silicon carbide rotating face and tungsten carbide stationary face.
4. Two moisture detection probes shall be installed so that they will detect moisture in either the seal or stator cavity measuring resistivity between the probes. They shall be wired internally to the control cable connection at the top of the motor. Float type devices located in the rotor/stator area or single probe-to-ground moisture detectors measuring continuity are not acceptable. O-ring sealed inspection plugs shall be provided in the mechanical seal oil chamber for ease of inspection, draining and filling of oil.
5. The pump shall rotate on a grease lubricated-for-life thrust bearing and grease lubricated radial bearing with a minimum L10 life of 50,000 hours. Lower shaft bearings shall be locked in place to prevent shaft movement and to take thrust loads.

E. Guide and Removal System

1. System shall be designed for pump removal and installation to permit routine maintenance and repair of pumps. Pump supplier/manufacturer shall furnish a reliable, operable system and shall provide technical assistance for installation. Contractor shall demonstrate the use of the system for each pump by removing and reinstalling each pump with the wet well dry. After start-up of pumps, Contractor shall again remove and reinstall each pump then operate pumps again to demonstrate proper installation. The removal system shall be suitable for lifting the pumps with a crane utilizing a stainless-steel cable that will be attached to the pump motor lifting bail assembly. The complete guide and removal system shall be furnished with the pumps.
2. The guide and removal system shall consist of a foot mounted discharge elbow, no less than two 316 stainless steel guide rails,

upper rail support bracket, and intermediate rail guide brackets for each pump. Each pumping unit shall be provided with an integral sliding guide bracket. All guide and removal system components, except pump discharge elbow and pump sliding guide bracket, shall be constructed of 316 stainless steel, or better. The pump guide and removal system shall be non-sparking.

F. Fits and Hardware

1. All machined bolts, nuts, and caps crews shall be stainless steel and be of the hex-head type and will not require the use of any special tools.
2. A heavy-duty stainless-steel lifting bail shall be included and be of adequate strength to lift the entire pump and motor assembly.

G. Spare Parts

1. Contractor shall furnish spare parts for each pumping unit. Spare parts shall be as specified herein or as recommended by the manufacturer, shall be undamaged and packaged in original containers, and supplied to the District at time of final acceptance of the work. Contractor shall furnish the following spare parts:
 - a. Two spare sets of cable entry grommets and O-rings.
 - b. Two spare sets of mechanical seals.
 - c. Two spare impellers.

H. Factory Testing

1. A certified factory performance test shall be performed on each pumping unit in accordance with Hydraulic Institute Standards, latest edition. Certified test results shall be submitted to the City of Minot for approval prior to shipping.
2. Pump curves shall reflect data secured during actual test runs and shall be signed by a responsible representative of the pump manufacturer. Test reports and procedures shall conform to applicable requirements of the Hydraulic Institute Standards, except for testing tolerances for the design condition with one pump operating as shown on the pumping unit performance on the Construction Drawings. Testing tolerance for the design condition shall be +5%-0% for the total dynamic head at the discharge capacity. All other pumping unit performance conditions shall be within the limits shown on the Construction Drawings.

3. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.

2.02 Wet Wells, Valve Vaults and Equipment

A. General

1. Wet wells and valve vaults shall conform to the requirements of precast manholes in Section 2300 of the Minot Standard Specifications, including the lining system for corrosion protection. Base sections shall be designed in accordance with soil boring logs.
2. Structural design shall be performed by a professional engineer licensed in North Dakota.

B. Equipment Access Hatches

1. Furnish and install a single or double leaf equipment access hatch with safety grates and integral cable troughs as shown on the Plans or specified otherwise. The top of the access hatch shall be flush with the top slab of the concrete wet well or valve vault roof. The minimum clear hatch opening dimensions shall be as shown on the Plans or specified otherwise. The access hatch shall be pre-assembled from the manufacturer. The manufacturer shall warranty that the assembled access hatch shall be free of defects in material and workmanship for a period of (5) years from date of project acceptance. The access hatch shall be as manufactured by Xylem-Flygt, Bilco Halliday or equal.
2. The access hatch covers, frame, cable trough, components, and hardware shall be constructed of 316 stainless steel. Hatch covers shall be 3/16" (minimum) thickness with a diamond pattern. Safety grates shall be provided beneath the hatch covers for fall through protection when the covers are open. The hatch covers and safety grates shall be reinforced to support a minimum live load of 300 psf with a maximum deflection of 1/150th of the span. Each safety grate shall be provided with a permanent hinging system that will lock the grates in the 90-degree position once opened. Safety grate hinges shall be specifically designed for horizontal installation and shall be through bolted to the safety grate with tamperproof stainless-steel lock bolts and shall be through bolted to the equipment access hatch frame with stainless steel bolts and locknuts. Safety grate openings shall be 5" by 5" to allow for visual inspection of the wet well or valve vault while the grating is in place. The hatch frame shall be

angle type and shall be provided with full anchor flange around the perimeter.

3. Each cover leaf shall be provided with a lift handle that remains flush with the cover when not in use. A removable exterior turn/lift handle with slam lock shall be provided to open the top leaf. The latch release shall be protected by a flush, gasketed, removable screw plug. The top leaf shall also be provided with a recessed padlock clip and cover box. Each cover leaf shall be equipped with a hold open arm, which automatically locks the covers in the open position. The pump access covers for the wet wells shall consist of access covers installed and positioned.

C. Float Switches (Qty. 4)

1. Polypropylene with encapsulated mechanical tilt (non-mercury) switch.
2. Contact rating: 3 amps, 120 VAC, resistive.
3. Operating differential: 1 inch, nominal.
4. Extra flexible cord in length as required for application.
5. All floats shall be weighted.
6. Float Switches shall be manufactured by Roto, Xylem-Flygt or approved equal.

D. Float Weight Kit

1. For high flow situations, provide 8 lb. vinyl coated cast iron boat anchor for securing the floats in the wet well.
2. Anchor shall be secured by a 3/32-inch stainless steel support cable.
3. Floats and transducer shall be attached to the support cable.
4. Use all stainless-steel clamps and fittings.
5. See contract drawings for details.

E. Submersible Transducer

1. Submersible style transducer with welded 316 stainless steel construction.
2. IP68 and NEMA 6P housing protection rating.
3. Minimum 0.5% accuracy over entire range of wet well.

4. $\frac{5}{8}$ -inch nylon braded rope.
 5. Provided appropriate zener style UL listed barrier with transducer to certify the use transducer in a Class 1, Division 1 area.
 6. Transducer shall be a 2-wire/loop powered device which gets its power from the control panel and provides a 4-20 mA signal proportionate to the level of the wet well.
 7. Transducer range shall be picked in accordance with the wet well requirements.
- F. Vent Pipe
1. Vent pipe and all associated hardware shall be stainless steel, type 304 min.
 2. Vent opening shall include an insect screen.
- G. Floor Drain
1. Body shall be coated cast iron with integral gas-tight trap, side outlet, seepage pan, and backwater valve, Zurn Z450B-V.
 2. Vent opening shall include an insect screen.
- H. Grating
1. Grating, if present, shall be fiberglass pultruded composite with vinyl ester resin coating or aluminum, or approved equal.
 2. Platform systems, if present, shall be designed by a professional engineer licensed in North Dakota.
- I. Magnetic Flow Meter
1. The flow tube shall be DC powered, flanged magnetic type capable of monitoring liquids with a conductivity of 5 micromhos/cm or greater. The tube shall be constructed of carbon steel with a magnetic field generating coils inside the flow tube, 150# carbon steel flanges, and a pressure rating of 258 PSI @ 100°F. The interior of the flow tube shall be lined with polyurethane and the flow tube shall be submersion rated.
 2. Provide 304 stainless steel grounding rings for grounding at each flange.
 3. Flow tube and housing shall be factory-primed/potted and finish coated.

4. The flow transmitter unit shall be remote wall-mounted within the control panel. The flow transmitter shall be capable of processing signals from fluids that are traveling between 0.001 and 40 Feet Per Second (FPS). Full scale continuously adjustable between -40 and 40 FPS.
5. Flow transmitter shall be housed in a NEMA 4X epoxy coated aluminum housing and interconnecting cables shall be potted at the flow tube and of sufficient length to connect between the flow tube and transmitter without splicing.
6. The local operator interface for the flow transmitter shall have alphanumeric characters and in operation the display shall indicate instantaneous flow in percent or direct engineering units, field selectable.
7. The flow transmitter shall be identical and interchangeable for all flow tube sizes.
8. The flow transmitter shall have an analog output signal of 4-20 mA, jumper-selectable as internally or externally powered 5 to 24 VDC, 0 to 1,000 ohms and an isolated, solid state switch-closure frequency signal that is proportional to the flow through the flow tube. The solid state switch shall be designed to handle an external supply voltage of 5 to 24 VDC with an allowable load resistance of 1,000 to 100K ohms. The pulse duration shall be adjustable between 1.5 to 500 msec. The solid state switch shall be designed for a maximum power of 2.0 watts up to 4,000 Hz and 0.1 watts at 10,000 Hz. Low flow cutoff shall be adjustable between 0.04 and 1 FPS. The flow transmitter shall also have a programmable output to indicate a reverse flow condition.
9. Power supply for the flow transmitter shall be 24 VDC.
10. Calibration: The meters shall be calibrated at known process conditions at a facility located in the United States and the calibration shall be traceable to the National Institute of Science and Technology Traceable Flow Facility. Computer printouts of the actual calibration data giving indicated versus actual flow rates at a minimum of three flow rates shall be provided with the meters. The accuracy of the metering system shall be $\pm 0.5\%$ of flow rate from 1 to 40 FPS. For flow rates of 0.04 to 1 FPS, the metering system shall have an accuracy of ± 0.005 FPS.
11. Manufacturer services: Provide equipment manufacturers services at the job site for the minimum of 1 man-days, travel time excluded, to check the installation, supervise start up, supervise testing and

adjustment of equipment, and train owners personnel in the operation and maintenance of the equipment.

12. Manufactures, or Approved Equal:

- a. Flow Tube: Rosemount 8750
- b. Flow Transmitter: Rosemount 8712D

2.03 Piping and Valves

A. Check valves

- 1. Shall be American Flow Control Series 2100 Resilient Seated Check Valve with backflush actuator.

B. Gate Valves

- 1. Gate valves shall be 250 psi working pressure, ductile iron body, bronze mounted, resilient seat type, with O-rings seals. Valves shall conform to AWWA C515 and shall be suitable for wastewater applications. Shall have standard 2-inch operating nut. All hardware shall be stainless steel. Gate Valves shall have mechanical joint ends conforming to AWWA C111 and A21.11. All surfaces shall conform to AWWA C116 and C550 for fusion-bonded epoxy coatings.

C. Piping

- 1. Piping shall be of the diameter as shown on the Plans. All pipe shall conform to Section 2100 of the Minot Standard Specifications. Material shall be either HDPE or PVC.

D. Fittings

- 1. All pipe fittings shall be stainless steel except as specifically allowed by the Minot Public Works department.

E. Each discharge line shall be equipped with a tapped fitting, petcock, and a 4" glycerin filled pressure gauge reading in feet, with the range and scale appropriate for the application. The gauge shall read in the center of the range during normal operations.

F. Air release valves shall conform to AWWA C512 and be suitable for wastewater applications. Size and location shall be as indicated on the Plans. All hardware shall be stainless steel. All surfaces shall conform to AWWA C116 and C550 for fusion-bonded epoxy coatings. Air Release Valves shall be as manufactured by Val-Matic, Model VMC-48 for severe service wastewater applications, or approved equal.

- G. If indicated or shown on the Plans, two emergency signs shall be attached to gate or fence in a location which is readily visible from the street. The sign shall be constructed from 1/8th inch aluminum and be bolted on the gate. All lettering shall be block style in black on a white reflective background. One sign shall contain the emergency phone information and the other shall contain the street address of the facility. Size and wording shall be as indicated on the drawings. Facility number and address shall be provided by The City of Minot Department of Public Works.

2.04 Controls

A. General

1. It is the intent of the Contract Documents that all equipment specified in this section of the specification be supplied by a single-source supplier ("Controls Supplier") except as specifically indicated. Unless specifically indicated, the Controls Supplier shall assume full responsibility for furnishing, installing and field commissioning procedures to make the system operate per the intent of the contract documents.
2. Except as specifically indicated, the work specified in this Section includes furnishing, installing, start-up, testing and adjusting of all required equipment, including instruments, equipment, hardware, software, wiring, accessory equipment, and training.
3. It shall be the responsibility of the Controls Supplier to furnish complete and fully operating lift station control panels that automatically operate the respective lift stations on a stand-alone basis. The control panels will be shipped telemetry ready, but all SCADA programming, configuration, and field commissioning will be by others. The Controls Supplier shall be responsible for all details which may be necessary to properly install, adjust and place the control panels in stand-alone operation.

B. Quality Assurance

1. The Controls Supplier, as a business entity, shall have a minimum of 5 years' experience in systems integration related to water and wastewater control systems. Controls Suppliers without the required minimum experience as a business entity shall not be allowed to substitute experience of individuals in lieu of the required business experience.
2. The Controls Supplier shall maintain a \$1,000,000 product liability insurance policy.
 - a. The Control Supplier must maintain and operate a panel shop with both UL-508A and UL-698A labels.

- b. The Controls Supplier shall have PLC programmers and field service personnel who are permanent, full time employees.
 - 3. The Control Supplier shall have at least 5 references who are owners of successful, Allen Bradley based PLC control panels, provided by the Controls Supplier.
 - 4. Contractor shall provide data supporting their compliance to the above items within 48 hours, upon request from the OWNER or ENGINEER.
- C. Lift Station Control Panel(s)
- 1. The control panel shall be constructed in accordance with Underwriters Laboratories (UL) Standard 698A - "*Industrial Control Panels for Hazardous Locations*". In addition to intrinsically safe circuitry the 698A standard requires that the control panel comply with applicable portions of UL Standard 913 - "*Intrinsically-Safe Apparatus and Associated Apparatus for use in Class I, II and III, Division 1, Hazardous Locations*" and UL standard 508a - "*Industrial Control Panels*". The panel(s) shall be shop-inspected by UL or constructed in a UL-recognized facility. Each completed panel shall bear a serialized UL label indicating acceptance under Standards 698A, 913, and 508A.
 - 2. Enclosures
 - a. NEMA 3R tamper resistant polished stainless steel, 2 door enclosure with minimum dimensions of 48" H x 60" W x 18" D. The enclosure shall contain an interior sub-panel for mounting all control components and the enclosure shall be sufficiently large to accept all control components without crowding. The panel shall be of not less than 12-gauge type 316 stainless steel with continuously welded seams. The enclosure shall contain door and panel stiffeners as required. The front doors shall have a rolled lip and the door flanged and the corners ground smooth. All enclosure welding seams shall also be ground smooth.
 - b. The doors shall be fastened to the enclosure with a continuous type stainless steel piano hinge and locking three-point minimum, stainless steel hardware. The inside of the door shall contain data pockets. The sub-panel shall be painted white.
 - c. Enclosure shall have full-height dead-front inner 12-gauge carbon steel hinged doors that house all front-panel components including switches, indicating lights, running time

meters, overload reset pushbuttons, and other controls that require operator access.

- d. Circuit breakers that cannot be mounted directly to the inner door shall be elevated from sub-panel such that their operators are exposed through cut-outs on the inner door. The use of lever operators with extension shafts is prohibited.
- e. The enclosure shall have a thermostatically-controlled climate control system to prevent overheating as well as condensation and freezing within the enclosure, consisting of a heater, intake/exhaust fans, mechanically operated louvers, and/or air-conditioning equipment. The system shall maintain the temperature within the enclosure at levels within the equipment manufacturer's recommended ranges.
- f. Insulated on all sides with ½" cell foam insulation. Insulation shall be mechanically secured.
- g. 18-inch stainless steel floor stands, with stainless steel louvered skirts.

3. Service Entrance

- a. Each lift station control panel shall be service entrance rated.
- b. Provide mechanically interlocked Normal and Emergency Service circuit breakers. Size these breakers per the one-line diagrams included in the plan set.
- c. Acceptable manufacturers for circuit breakers include Allen Bradley, Square D, Cutler Hammer, or approved equal.

4. Generator Receptacle

- a. Each lift station control panel shall be equipped with a generator receptacle for emergency power. Generator Receptacle shall be Appleton ADR20044.

5. Full Voltage Motor Starters

- a. Starters shall be NEMA rated. The Controls Supplier shall size the motor starters as required, per the requirements of the pump supplier.
- b. Provide external ambient compensated class 10 overload relays with bi-metallic heater elements. Overload relay shall be reset via push button on the inner door. Overload relays shall be NEMA rated and shall be sized to protect the motors.

The Controls Supplier shall size the overloads as required, per the requirements of the pump supplier.

- c. Provide branch protection MCP style, magnetic trip only, breakers with adjustable trip. Use a UL listed combination motor controller per NEC 430.52. C.6. Size MCP such that instantaneous trip value is a maximum of 1300 percent of full-load current.
 - d. Ensure that the MCP style branch protection for each starter has a combination listed short circuit rating of at least 35 KAIC. Use the combination interrupt rating to properly calculate the control panels short circuit rating per UL508A supplement B.
 - e. All motor starters shall be 480 volts, 3 phase, 60 Hz.
 - f. Acceptable full voltage motor starter manufacturers include Allen Bradley, Cutler Hammer or approved equal.
6. Relays shall be of the plug-in type with associated sockets and retaining clips. The relays shall have dust covers. All contacts shall be rated for not less than 10 amps at 120 VAC. Relays shall have either 2 or 3 poles. Relays shall be as manufactured by Cutler-Hammer, Allen Bradley, Idec, or equal.
7. All circuit breakers shall be UL labeled and shall be of the size shown on plans. All circuit breakers ahead of the transformer shall have an interrupting rating of not less than 35,000 amps, sym. Circuit breakers after the transformer shall have an interrupting rating of not less than 10,000 amps, sym.
8. The control panel shall have an interrupt rating of not less than 35 KAIC. Use the UL508A supplement SB analytical method to determine the short-circuit current rating of the control panel. Ensure that lowest component SCCR or overcurrent protective device interrupt rating for devices downstream of the transformer is 2KA or greater so that the transformer's primary overcurrent device (fuse) interrupt rating can be applied to the entire transformer circuit.
9. The panel shall be equipped with an interior convenience receptacle that is accessible on the front of the inner door. This receptacle shall be a 15 amp, UL-listed ground fault interrupter.
10. All field wiring shall be terminated on terminal blocks. Each terminal shall be of the flat head screw type. The contacts shall be capable of carrying 10 amps at 600 VAC. The contacts shall be large enough to accept up to and including No. 12 AWG wire.

11. Number all terminals and tag all conductors on both ends to correlate with the schematic drawings. All conductor tags shall be computer printed shrink style. Brady or equal.
12. Surge Arrestors
 - a. Panel shall include a surge protector for all incoming phases. Surge suppressor shall be TVSS type, UL1449 second edition. Square D or equal.
 - b. Control circuit shall include a surge protector as indicated on drawings. UL 1449 recognized, with diagnostic indicator. Edco or equal.
13. Phase Monitors
 - a. Panel shall include a 3-phase power monitor for monitoring incoming 3 phase power. Phase monitor shall be Time Mark C2644 or equal.
 - b. Control circuit shall include phase failure protection as indicated on drawings. PLC shall also monitor phase failure contact.
14. Indicating Lights
 - a. 30 mm, opaque colored lens.
 - b. Heavy-duty, oil tight.
 - c. Push-to-test.
 - d. Provide the following lights on the inner door: Add additional lights, etc. if more than 2 pumps.
 - i. Pump 1 Run (Green)
 - ii. Pump 2 Run (Green)
 - iii. Pump 1 Thermal Fail (Red)
 - iv. Pump 2 Thermal Fail (Red)
 - v. Pump 1 Seal Fail (Red)
 - vi. Pump 2 Seal Fail (Red)
 - vii. Pump 1 Fail (Red) – based upon contact from overload relay.

- viii. Pump 2 Fail (Red) – based upon contact from overload relay.
 - ix. Wet well High Level (Red)
 - x. Wet well Low Level (Red)
 - xi. Float Mode Active (Red)
 - e. Indicator Lights shall be Cutler-Hammer Type T, Allen Bradley Bulletin 800T, Idec TWTD series, or equal.
15. Inner Door Mounted Switches and Push Buttons
- a. 30 mm, Heavy-duty, oil tight.
 - b. Pump 1 Hand-Off-Auto.
 - c. Pump 2 Hand-Off-Auto.
 - d. Pump 1 Overload Reset (Mounted on swing door in front of overload relay. Provide rod extension kit that extends from swing door to reset push button on the overload relay.)
 - e. Pump 2 Overload Reset (Mounted on swing door in front of overload relay. Provide rod extension kit that extends from swing door to reset push button on the overload relay.)
 - f. Lamp Test.
 - g. Reset Backup Mode.
 - h. Pump 1 Overtemp Reset.
 - i. Pump 2 Overtemp Reset.
 - j. Acknowledge Alarms.
 - k. Lead-Lag Selector Switch. (3 position: 1-2, 2-1, Auto)
 - l. Switches and push buttons shall be Cutler-Hammer Type T, Allen Bradley Bulletin 800T, or Square D Class 9001 units, Idec TWTD series, or equal.
16. Uninterruptible Power Supply (UPS)
- a. The UPS shall continuously sustain operation of the control panel's PLC, transducer, floats and telemetry in the event of a power failure.
 - b. 120 VAC, 60 Hz, single phase input and output.

- c. Minimum 900 VA capacity.
 - d. The control panel shall implement a control relay logic circuit that allows the UPS to be removed from the control panel and automatically provides the controls with bypass power. Additionally, this relay logic circuit shall provide a contact closure to the PLC that indicates a UPS failure.
 - e. Manufacturer shall be Eaton or approved equal.
17. Elapsed Time Meters
- a. Provide Qty. 3 (Pump 1 Run, Pump 2 Run, Pump 1&2 Run) add for additional pumps.
 - b. Six digit, hours and tenths.
 - c. Non-resettable.
 - d. Round, flush mounted.
 - e. Redington Model 722 or approved equal.
18. Enclosure Heater
- a. Manufactured unit with integrated fan and integral thermostat and 0 – 100°F adjustable range.
 - b. UL labeled.
 - c. Wattage shall be appropriate for cabinet size.
 - d. Hoffman "Design-Aire", Stego "CSF 028", or equal.
19. Alarm Beacon
- a. Weatherproof, vandal-proof unit with red polycarbonate globe and 120VAC lamp.
 - b. Suitable for top mounting on panel.
 - c. UL labeled.
 - d. Edwards Model 104FLEDR or equal.
20. Intrinsically Safe Barriers
- a. Provide UL listed isolated switch style barriers for the float signals.
21. Programmable Logic Controller

- a. Used for telemetry and for transducer control of the lift station pumps.
- b. Allen Bradley Micrologix 1400 1766-L32AWA with memory module. Select base unit and expansion I/O modules based upon I/O count.
- c. In Addition to I/O count provide the following spare I/O:
 - i. Qty. 3 spare digital inputs.
 - ii. Qty. 2 spare digital outputs.
 - iii. Qty. 2 spare analog inputs.

22. PLC I/O Count

- a. Controls Supplier responsible for programming and testing all PLC I/O.
- b. Digital Inputs (May need to be adjusted for more than 2 pumps).
 - i. Pump 1 Run
 - ii. Pump 1 Seal Fail
 - iii. Pump 1 Thermal Fail
 - iv. Pump 1 Failure (based upon motor starter overload relay)
 - v. Pump 2 Run
 - vi. Pump 2 Seal Fail
 - vii. Pump 2 Thermal Fail
 - viii. Pump 2 Failure (based upon motor starter overload relay)
 - ix. Control Power Failure
 - x. UPS Failure
 - xi. Enclosure High Temperature Alarm
 - xii. Enclosure Low Temperature Alarm
 - xiii. Alarm Acknowledge
 - xiv. Lead-Lag Selector Switch in 1-2

- xv. Lead-Lag Selector Switch in 2-1
- xvi. Wet well Low-Level Float
- xvii. Wet well Stop All Pumps Float
- xviii. Wet well Start Lead Pump Float
- xix. Wet well Start Lag Pump Float
- xx. Wet well High-Level Float
- xxi. Float Mode Active
- xxii. Phase Failure (where applicable)
- c. Digital Outputs
 - i. Pump 1 Start/Stop
 - ii. Pump 2 Start/Stop
 - iii. Wet well Low-Level Alarm Light
 - iv. Wet well High-Level Alarm Light
 - v. Pump 1 Thermal Fail Alarm Light
 - vi. Pump 2 Thermal Fail Alarm Light
 - vii. Pump 1 Seal Fail Alarm Light
 - viii. Pump 2 Seal Fail Alarm Light
 - ix. Pump 1 Failure Alarm Light
 - x. Pump 2 Failure Alarm
- d. Analog Inputs
 - i. Pump Motor Current Transducer
- 23. Operator Interface
 - a. Mounted on inner panel door. Used for alarm viewing, wet well monitoring, data viewing (ex. pump motor current), and set point changes.
 - b. Provide an LCD Based 6" Grayscale touch screen display, Allen Bradley Panel view or Automation Direct C-more.
- 24. Alarm Thermostat

- a. Provide a High and Low temperature alarm thermostats for the enclosure.
 - b. Stego or equal.
25. Pump Motor Current Monitoring
- a. Provide fixed core current transducer for monitoring pump motor current.
 - b. Provide a separate power distribution block such that the current transducer measures the current going to the motor starters only. Current transducer shall be located upstream of the motor starters.
 - c. Current transducer shall incorporate true RMS technology and be accurate on distorted waveforms such as VFD or SCR outputs and be accurate under noisy power conditions.
 - d. Current transducer shall have a 4-20 mA output and will be wired into an analog input on the PLC.
 - e. The operator interface shall be programmed to allow the operator to view the pump(s) current.
 - f. Current transducer shall be sized to accommodate the expected full load amps of both pumps running simultaneously.
 - g. Provide Acuamp ACTR or approved equal.
26. Power Supplies
- a. UL Listed
 - b. Switching style with 2% maximum point-to-point ripple voltage.
 - c. Overcurrent protection with automatic reset. Overvoltage protection with 120% minimum shutdown.
 - d. Environmental: Operating temperature of 14°F to +140°F, 20-90% relative humidity (non-condensing nonfreezing)
 - e. Din Rail mountable, with 10% voltage adjustment on front.
 - f. Idec PS5R or equal.
27. Use Engraved-Plastic Labels, white letters on black background, to label all components on the inside panel door.

D. SCADA Provisions

1. The controls supplier shall equip the control panel with the specified components to allow the control panel to be integrated into the City's existing telemetry system. The controls supplier shall provide all necessary equipment for radio communication. Controls supplier shall coordinate with City to determine which mode of communication equipment needed to communicate with the City SCADA system. Power to communication equipment shall be wired such that it is UPS backed.
2. All SCADA programming, SCADA startup, and SCADA configuration shall be provided by the Contractor.

PART 3 - EXECUTION

3.01 Installation

- A. The Contractor shall install all equipment and appurtenances in strict accordance with the manufacturer's specifications and installation instructions. Care shall be used in handling to avoid bumping, twisting, dropping, or otherwise damaging the equipment. When code requirements apply to installation of materials and equipment, the more stringent requirements, code, or manufacturer's specifications and installation instructions shall govern the work.

All pump manufacturers shall furnish the services of factory-trained personnel as required to examine the installation, supervise start-up of equipment installed, and repair the equipment at no additional expense to the City.

- B. Contractor shall verify all dimensions and conditions at the site and cross check details and dimensions shown on the Plans with related requirements on the Civil, Mechanical, and Electrical Drawings and Equipment Shop Drawings. Floor and wall openings, sleeves, variations in the structural slab elevations and other civil, mechanical, or electrical requirements must be coordinated before the contractor proceeds with construction.
- C. The precise dimensions and locations of all openings shall be determined from structural, civil, mechanical, electrical, or similar requirements for the actual equipment being furnished. Shop Drawings with adequate accurate dimensions must be submitted and reviewed prior to contractor constructing facilities including concrete, wall, connecting piping or electrical that are affected by said equipment.
- D. The contractor is advised that the work on this project may involve working in a confined air space. Contractor shall be responsible for all confined air space entry and exit safety procedures and protocols.

- E. Contractor shall clean inside of all new pipelines by flushing after successful passing of pressure testing.

3.02 Coordination

- A. The Plans show the general arrangements desired for the principal equipment, piping, and similar appurtenances, and shall be followed as closely as possible. Proper judgment must be exercised in carrying out the work to secure the best possible headroom and space conditions throughout, to secure neat arrangement of piping, valves, fixtures, hangers, and similar appurtenances, and to overcome local difficulties and interferences of structural conditions wherever encountered.
- B. The Contractor shall take all measurements for his work at the installation sites, verify all subcontractor drawings and be responsible for the proper installation, within the available space for the equipment and material specified and shown on the Plans, and must secure the approval of the City for any variations before making any changes.

3.03 Inspection

- A. Inspect each item of equipment for damage, defects, completeness, and correct operation before installing. Inspect previously installed related work and verify that it is ready for installation of the equipment.

3.04 Preparation

- A. Prior to installing equipment, ensure that installation areas are clean and that concrete or masonry operations are completed. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service equipment in accordance with the reviewed Instruction manuals and requirements in other Sections of these Specifications before installing.

3.05 Workmanship

- A. Preparation, handling, and installation shall be in accordance with manufacturer's written instructions and technical data particular to the product specified and/or approved, except as otherwise specified.
- B. Work shall be furnished and placed in coordination and cooperation with other trades.
- C. Electrical work shall conform to the National Electrical Contractors Association Standard of Installation for general installation practice.

3.06 Grading and Site Work

- A. Unless specified otherwise on the Plans, all grading and site work shall be per City Standard Details, Specification Sections 1200, 1800 and 2000 and as specified hereinafter.

- B. Site grading shall be performed in accordance with contract documents, soils report, and grading requirements of the City of Minot, including any special requirements of any applicable permits. An approved copy of the site/grading plan shall be on site while work is in progress.
- C. Excavated soils may be utilized for selected fill material provided these materials are free of vegetative matter and other deleterious substances and shall not contain rocks or irreducible materials with a maximum dimension greater than 6 inches. The final surfaces shall be wheel rolled to a smooth, well compacted surface at both subgrade and at finished grade.
- D. Selected backfill material around proposed wet well shall be placed in layers which, when compacted, shall not exceed 6 inches in thickness. Each layer shall be spread, moistened, and compacted uniformly to insure all backfill is properly compacted. After each layer of backfill has been placed, mixed, and spread evenly, it shall be thoroughly compacted to a minimum relative compaction of 95 percent.

3.07 Equipment Installation

A. Structural Fabrications

- 1. Conform to the AISC Code and Specifications.

B. Equipment

- 1. Conform to reviewed Instruction Manuals. Employ skilled craftsmen experienced in installation of the types of equipment specified. Use specialized tools and equipment, such as precision machinist levels, dial indicators, gauges, and micrometers, as applicable. Produce acceptable installations free of vibration or other defects.

C. Anchor Bolts

- 1. Deliver bolts with templates or setting drawings and verify that bolts are correctly located before structural concrete is placed.

D. Base and Bedplate Grouting

- 1. Do not place grout until initial fitting and alignment of connected piping is completed. Level and align equipment on the concrete foundations, then entirely fill the space under base or bedplates with grout. Grout shall be non-metallic non-shrink type. Bevel exposed grout at 45-degree angle, except round exposed grout at horizontal surfaces for drainage. Trowel or point exposed grout to a smooth dense finish and damp cure with burlap for three days. When grout is fully hardened, remove jacking screws and tighten nuts on anchor bolts. Check the installation for alignment and level, and perform

approved corrective work as required to conform to the tolerances given in the applicable Instruction Manual.

3.08 Conduit Installation

A. General

1. Contractor shall install conduit and electrical equipment in locations that will cause minimal interference with the maintenance and removal of mechanical equipment. Conduits and connections will be installed as shown on the Plans or directed otherwise. Contractor shall run conduit in a neat manner parallel or perpendicular to walls and slabs, and wherever possible, installed together in parallel runs. All conduits shall be installed straight and true with reference to the adjacent work.
2. Locations of conduit runs shall be planned in advance of the installation and coordinated with the mechanical work in the same areas, and shall not unnecessarily cross other conduits or pipe, nor prevent removal of nor block access to mechanical or electrical equipment.
3. Unless noted otherwise on the Plans, buried conduit shall be installed with a minimum of 27 inches of cover. Buried conduit shall be marked with red marking tape 6 inches below the finished grade above the center of the conduit installed. Conduit trench backfill shall be compacted to a minimum of 90 percent relative compaction.

Buried conduit shall be installed using approved spacers and cradles, properly supported/anchored and at sufficient intervals to prevent movement during backfilling operations (maximum spacing of five feet). Where change in direction is required, long radius PVC-coated Rigid Galvanized Steel elbows shall be installed for GF, PF, and MSF conduits. Prior to installation of conductors in underground conduits, a testing mandrel not less than six (6) inches long and with a diameter 1/4 inch less than the conduit diameter shall be drawn through after which a stiff bristle brush of the proper size for the conduits shall be drawn through until the conduits are free of all sand and gravel. Test shall be accomplished prior to placing concrete.

4. Unless noted otherwise on the Plans, conduit cast in concrete, under concrete slabs or footings, or through concrete walls, slabs, or masonry walls shall be PVC coated Rigid Galvanized Steel. Conduits shall be installed beneath concrete slabs, footings, or trenches, and shall be provided with a minimum of 6 inches of clearance between conduit and bottom of concrete. Conduits shall be cast in concrete

only where specifically shown on the Plans or directed by the Engineer.

5. Buried conduit shall be PVC Schedule 40 Rigid Non-Metallic. Transition from PVC to PVC-coated Rigid Galvanized Steel shall be made at the horizontal leg of the buried conduit bend.
6. Exposed or above grade conduit shall be PVC-coated Rigid Galvanized Steel.
7. Spare conduits shall be flush with the top of concrete slab or wall and be provided with threaded cap and polyethylene pull rope with 100-pound (minimum) tensile strength.
8. All conduits shall be tightly sealed during construction by use of conduit plugs. All conduit in which moisture or any foreign matter has collected before pulling conductors shall be cleaned and dried to the satisfaction of the City.
9. Conduits shall be securely fastened to cabinets, boxes, and gutters using locknuts (one inside and one outside enclosure) and an insulating bushing or specified insulated connectors. Grounding bushings or bonding jumpers shall be installed on all conduits terminating at concentric knockouts.
10. Where conduit is stubbed up through concrete slabs or footings into electrical panels, provide a minimum of 1-1/2-inch clearance between rebar and conduit and a minimum of 1-inch clearance between conduits. Adjust rebar spacing as necessary to a maximum of 1/2 the nominal spacing such that maximum rebar spacing does not exceed 1-1/2 times that specified. The total amount of reinforcing steel shall not be reduced.
11. Conduits shall terminate within the respective panel section, or in adjacent section if additional space is required. Contractor shall adjust location of conduit terminations based on the approved panel layout.
12. Underground pull boxes shall be sized and located as shown on the Plans. Additional pull boxes shall be provided as necessary for conductor pulling (total bends between pull boxes shall not exceed 360°). Depending upon the duct bank configuration and pull box knockout area, larger size pull boxes may be necessary. Cost of additional or larger pull boxes shall be borne by Contractor. Pull boxes shall in accordance with Minot City Standards.
13. Contractor shall furnish and install conduit and conductors as shown on the Plans, as shown on the control diagrams, and as listed on the

appropriate Approved Shop Drawing Schedules relating to conduits and conductors.

B. Identification

1. Each end of a conduit shall be provided with an identification tag securely attached to its conduit with a #10 single-jack brass chain or brass fasteners. Each tag shall be provided with a hole for securing tag with chain or fasteners.

C. Rigid Non-Metallic Conduit

1. Unless noted otherwise on the Plans, PVC conduit shall be used underground. PVC conduits shall not be run exposed. Risers to exposed or above grade locations shall be PVC-coated Rigid Galvanized Steel.

D. PVC-Coated Rigid Galvanized Steel Conduit

1. Threadless couplings will not be acceptable. Where necessary for connecting conduit, UL listed PVC-coated couplings shall be used. All ends and joints shall be reamed smooth after cutting.

E. Supports

1. Exposed conduit shall be supported with channel supports spaced per NEC requirements (8'-0" maximum spacing) and within 18 inches of couplings, bends, boxes, etc., unless specifically shown otherwise on the Plans.

F. Termination and Joints

1. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.
2. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using approved connectors and hubs.
3. Conduit bodies (condulets) are not acceptable as enclosures for splices.
4. At all conduit terminations and boxes, conductors shall be protected by a fitting equipped with a plastic bushing having a smoothly rounded insulating surface.

3.09 Conductor and Cable Installation

A. General

1. Conductors shall not be installed in conduit runs until all work is completed for each individual conduit run. Care shall be taken in pulling conductors such that insulation is not damaged. UL approved pulling compounds shall be used.
2. Unless noted otherwise on the Plans, all conductors or cables shall be installed in conduit or electrical enclosures.
3. All cables shall be installed and tested in accordance with manufacturer's requirements and warranty.
4. All field wiring to control panel(s) shall terminate at terminal strips in the respective panels and buckets.
5. Contractor is advised that interconnecting wiring within and between lineups (assembled panels with common interconnecting horizontal wire ways) of control panels is not specifically listed or shown on the Plans. Contractor is directed to control diagrams and RTU connection diagrams on the Plans for these connections, which are subject to change according to approved shop drawings. Contractor shall install wiring for said connections within the bottom wire way of panels.
6. No splices unless specifically approved by the City.

B. Identification

1. All branch-circuits shall be securely tagged, noting the purpose of each.
2. All conductors shall be numbered and labeled with vinyl wrap-around markers. Where more than two conductors run through a single outlet, each conductor shall be marked with the corresponding circuit number at the panel board.
3. Conductors size #6 AWG and larger shall be color coded using specified phase color markers and identification tags.
4. All terminal strips shall have each individual terminal identified with specified vinyl markers.
5. Inside of all junction box cover plates shall be identified via felt-tip pen or decal label, denoting the panel and circuit numbers and voltage contained in the box.
6. All receptacles and switches shall be decal labeled on the plate, denoting the panel and circuit number.

C. Connections to Circuit Breakers, Switches, and Terminal Strips; Stranded Copper Conductors

1. #12 through 8 AWG: Conductor shall be terminated in locking tongue style, pressure type, compression lugs, unless clamp type connection for stranded conductor is provided with device.
2. #6 AWG and larger: Conductor shall be terminated in one-hole flat-tongue style, compression type lugs, or by connectors supplied by the manufacturer.

D. Grounding

1. Enclosures of equipment, raceways and fixtures shall be permanently and effectively grounded. A code-sized, copper, insulated green equipment ground shall be provided for all branch circuit and feeder runs. Equipment ground shall originate at panel board ground bus and shall be bonded to all switch and receptacle boxes and electrical equipment enclosures. Ground terminals on receptacles shall be connected to the equipment grounding conductor by an insulated copper conductor.

E. Status, Alarm, and Control Signal (IO)

1. Status, alarm, and control signal (IO) conductors to and from the RTU terminal strips shall be identified at both ends using labeling designations as approved by the City of Minot.

F. Level Control System

1. Interconnecting cable between transducer and controller shall be supplied with unit and shall be suitable for a maximum system length of 200 feet. Contractor shall verify length of cable required for each specific installation. Cable shall be installed in a single run with no splices. Cable shall be installed in continuously grounded PVC-coated Rigid Galvanized Steel conduit. Conduit shall be installed a minimum of 8 feet from 480V conduits.

3.10 Electrical Short Circuit Coordination and Arc Flash

- A. Contractor shall field verify adjustment of all trip setting with the approved Coordination Study and shall provide arc flash and shock hazard warning labels.

3.11 Concrete Construction

- A. All concrete construction shall be in accordance with the appropriate City of Minot Specifications and NDDOT Specification Sections for footings, foundations, subgrade slabs, slabs on grade and suspended slabs.

1. All concrete work shall have a minimum 28-day compressive strength of 4000 psi.

3.12 Pipe Installation

- A. All pipe bedding and trench backfill shall be per the City of Minot Standard Detail Plates.
- B. Pipe shall be installed in trench condition and as shown on the Standard Detail Plates or as specified otherwise. Backfill shall be completed including compaction tests prior to pressure testing. Backfill in pipe zone shall be compacted to minimum 95 percent compaction of Standard Proctor Test (T-99).

3.13 Pipe Testing

- A. All piping shall be hydrostatically tested per City Standards. Unless specified otherwise, piping shall be tested under a pressure 1-1/2 times the design operating pressure of the pipe. Testing against valves is not permitted. Contractor shall provide temporary bulkheads, skillets, and appurtenances as required for testing. All piping under concrete slabs/foundations shall pass pressure testing prior to placing concrete. No visible leakage is permitted in exposed piping.

3.14 Description of Operation

- A. Control System Description (2-Pump System)
 1. Control the pumps based on the wet well level using a four-float system. As the level increases and reaches the start lead float the PLC shall start the lead pump. If the level continues to increase and reaches the start lag float the PLC shall start the lag pump. When the level decreases and reaches the stop pump float, the PLC shall stop all the pumps.
 2. A pump alternator selector switch shall be mounted on the inner door. When the switch is in 'AUTO' the pumps shall alternate the lead position after every cycle. When the switch is in the '1-2' position, pump 1 will always be the lead pump and pump 2 will always be the lag pump. When the switch is in the '2-1' position, pump 2 will always be the lead pump and pump 1 will always be the lag pump.
 3. The station's high-level float is set at an elevation above the elevations used for normal control of the pumps and a low-level float is set at an elevation below the elevations used for normal control of the pumps. The floats are used for alarming purposes and to provide a backup control mode of the pumps which is entirely independent of the PLC.

4. Provide the required emergency control circuitry to back up the primary controls. If the wet well level increases and reaches the high-level float in the wet well, override the primary controls and start pump 1 followed by pump 2 after an adjustable time delay. Pump 2 is only started if the time delay expires before the low-level float is reached. A time delay shall be implemented for the high-level float alarm. The high-level float alarm time delay shall be adjustable and set such that the station can run in backup mode (between the high and low float) and not generate a high float alarm every time the backup mode cycles between the floats.
5. The backup control mode shall be latched, and a door mounted reset push button shall be provided to allow the system to return to normal operation. A door mounted pilot light shall illuminate when backup mode is active. The backup mode shall be designed such that the PLC is entirely isolated from controlling the pumps once backup mode is active. Any design which merely parallels the backup mode with the PLC control will not be acceptable. Any design which does not provide a latched backup mode will not be acceptable.
6. Except for the float mode active light, alarm lights on the inner door and the exterior alarm beacon shall flash until the operator presses the "Acknowledge" push button. Upon acknowledgment, the inner door alarm lights will remain on (solid) until the alarm condition is cleared.
7. PLC shall calculate Total Runtimes for pump 1, pump 2, and pump 1&2. PLC shall calculate daily summary information for pump 1 and pump 2. Summary information shall include daily runtime and daily cycles.

3.15 Start-Up, Testing and Training

A. Field Testing and Commissioning of Equipment

1. Prior to City's acceptance, calibration and testing, pre-start-up, and start-up shall be performed in accordance with these Specifications.
2. The Contractor shall furnish all labor, equipment, and material necessary to perform field testing and commissioning of equipment, including all related appurtenances. All costs for performing calibration and testing, pre-start-up, and start-up shall be included in the Contract Price, and no extra payment will be made to the Contractor due to overtime, weekend, or holiday labor costs required to perform and complete same. Requirements specified in this Article are in addition to the demonstration and test requirements specified under other Sections of these Specifications.

3. Pre-start-up and start-up shall be performed by the Contractor in accordance with the approved procedure plans to demonstrate to City's satisfaction that:
 - a. All components of the process systems defined herein, and the entire lift station system are fully completed and operable.
 - b. All units, components, systems, and the entire lift station system operate with the efficiency, repeatability, and accuracy indicated and specified.
 - c. All components, systems, and the entire lift station conform to the Contract Documents and the reviewed shop drawings, samples, construction manuals, materials lists, and other reviewed submittals.

B. Prerequisite Conditions

1. Calibration and testing shall not commence for any equipment item or system until all related structures, piping, electrical, instrumentation, control, and like work has been installed and connected in compliance with the pertaining requirements specified elsewhere in the Specifications.
2. Pre-start-up and start-up shall not commence for any equipment item or system until calibration and testing has been completed as specified herein.

C. Demonstration and Testing Materials

1. Furnish materials, necessary fuel, and electrical power for all tests. Use potable water to fill the lift station wet well. Furnish temporary facilities as required such as by-pass or re-circulation piping, diversions, storage, and similar facilities. Use procedures that conserve testing materials and avoid wastage, especially with respect to large quantities of fresh water and electrical power.

D. Inspection and Supervision by Manufacturers

1. Perform pre-start-up and start-up under continuous inspection by City. Technical representatives of the various equipment manufacturers shall be present for the prestart-up and the start-up, shall examine their equipment, and shall supervise the start-up and adjustment procedures.

E. Correction of Defects

1. Immediately correct all defects and malfunctions disclosed by pre-start-up and start-up using approved methods and new materials for repairs as required.

G. Manufacturer's Supervision and Installation Check

1. Each equipment manufacturer shall furnish the services of an authorized representative specially trained and experienced in the installation of his equipment during pre-startup and start-up to:
 - a. Be present when the equipment is first put into operation.
 - b. Inspect, check, adjust as necessary, and approve the installation.
 - c. Repeat the inspection, checking, and adjusting until all trouble or defects are corrected and the equipment installation and operation are acceptable.
 - d. Witness and supervise field testing and commissioning of equipment to the extent specified.
 - e. Prepare and submit to the City, upon successful completion of pre-start-up testing, the specified Manufacturer's Certificate of Proper Installation confirming that all pumping units have been installed, inspected, checked, adjusted, and tested in accordance with the manufacturer's recommendations and requirements specified herein.

H. Calibration and Testing

1. Upon installation of all lift station facilities, Contractor shall perform calibration and testing. At a minimum, calibration and testing shall include the following for all facilities:
 - a. Meggering all motors and their conductors.
 - b. Meggering all conductors for 3-phase power.
 - c. Visually inspecting field wiring against approved shop drawings.
 - d. Checking for abnormalities that may have occurred during shipping or installation of all equipment and components including loose wiring, physical damage, or insecure mounting of components.
 - e. Complete all testing and labeling required prior to energizing any electrical panels or equipment.

- f. Energizing all panels.
- g. Simulate all controls and equipment start, stop, and shutdown, including checking discrete signals locally at the panel and by jumpering remote devices at the field end to simulate signals (prior to operating equipment).
- h. Testing all interlock and maintenance switches.
- i. Checking analog signals by utilizing loop calibrator as required.
- j. Calibrating all control instrumentation and monitoring equipment (flow, level, pressure, etc.)
- k. Calibrating panel devices as required including timers and controllers.

I. Pre-Start-Up

- 1. General - Upon successful completion of calibration and testing, Contractor shall schedule the pre-start-up. A minimum of fourteen (14) days' notice shall be provided to the City prior to the pre-start-up. The pre-start-up shall be performed on one (1) day and Contractor's representative(s), City Operations representative(s), Inspector, and Manufacturer's representative(s) shall attend the pre-start-up. The pumps shall be tested through the force main. Contractor shall provide water for filling the wet-well, operate the pumps, and assure that the discharge piping and force main is completely filled prior to pre-start-up. All equipment shall be operated for a period of 30 minutes unless otherwise specified. All controls and alarm conditions shall be simulated. If the equipment does not perform in conformity with Contract Documents requirements, the Contractor will be required to remove, replace, and restore the equipment to full compliance with the Contract Documents at his expense.

2. The Controls Supplier shall provide a skilled technician for troubleshooting and startup of the lift station control panel in stand-alone / non-SCADA operation. Startup and testing of the SCADA system shall be coordinated with City personnel. Provide all necessary field visits to fully test system before performing a witnessed test with Engineer and Owner.
3. Coordinate installation, start-up, and testing with general Contractor and Engineer.
4. Once witnessed testing is completed, the integrator is responsible for coordinating and providing training and instruction on the operation and maintenance of the equipment furnished in this section. Training shall be provided for a duration of not less than (1) eight (8) hour period.
5. As a minimum, during pre-start-up the Contractor shall demonstrate a complete and operational lift station as follows:
 - a. Response of equipment to appropriate manual or automatic controls, or combinations of both automatic and manual controls, shall be demonstrated to be correct and accurate. Where applicable, all components shall be tested for both manual and automatic operation. Where a component performs more than one function, every function shall be validated.
 - i. Pumping equipment shall respond accurately and reliably to liquid level from the wet well. Automatic alternation and back-up pump functions shall also be validated.
 - ii. Auxiliary equipment items such as alarm signals to remote telemetry, and like items shall respond accurately and reliably to every condition for which they are programmed, in the manner specified.
 - b. Functionality of all alarm and status lights.
 - c. Demonstrating uninterruptable power supply.
 - d. Demonstrating all control and monitoring features of all main control panels, local control panels, and PLCs in conjunction with associated equipment.
 - e. Measuring and recording voltage and amperage draw readings for all equipment motors under loaded conditions.
 - f. Testing all components of RTUs, including control systems.

- g. Operating all equipment under all conditions and demonstrate all alarms, shutdowns, and operating modes.
 - h. Performance testing of each Pumping Unit through the discharge piping.
 - i. Operation of transportable power generator set.
 - j. Contractor shall refer to various Technical Specifications herein for additional specific equipment testing requirements.
6. Pumping Units
- a. Pre-start-up testing for pumping units shall be performed utilizing potable water. The wet well shall be filled to pump operating level and discharge from the pumps shall be through the force main. Pump discharge valves shall be throttled to simulate the design operating condition.
 - b. Contractor shall provide all required testing equipment to perform pumping unit start-up at no additional cost to the City.
 - c. Contractor shall provide all instrumentation to confirm pumping unit and electric motor performance, including calibrated test gauges for monitoring discharge pressure, and electrical monitoring equipment to measure current, voltage, power, kVA, and power factor.
 - d. Contractor shall record pumping unit flow, discharge pressure, motor voltage, and motor amperage, hourly throughout the test period. The pumping units shall operate as specified without excessive noise, surging, cavitation, vortexing, vibration, or clogging, and without overheating of the bearings. Each pumping unit shall operate a minimum of 30 minutes. All automatic and manual controls shall function in accordance with the specified requirements.
 - e. The Contractor shall perform the following tasks under the supervision of the pump manufacturer:
 - i. Completed pumping unit (pump and motor) shall receive a final field trim balance, as may be required, and vibration shall be checked and recorded. The vibration of all pumps shall be equal or less than the amplitude limits recommended in the Hydraulic Institute Standards and it shall be recorded at a minimum of four pumping conditions defined by the Engineer. All measurements shall be witnessed by the

City. Vibration shall be measured at motor thrust bearing housing and at any other locations on pumping unit as directed by the District. Vibration shall be measured over the full range of the pump operating speed.

- ii. Each pump's performance shall be documented by obtaining concurrent readings showing motor voltage and amperage, pump flow rate, pump suction head, and pump discharge head. Readings shall be documented at a minimum of three pumping conditions, including the specified design point, to ascertain the actual pumping curves. Another test shall be run at shut-off head. Each power lead to the motor shall be checked for proper current balance.
- iii. Pumping units (pump and motor) shall perform substantially in conformance with the certified pump curves and the factory performance test results as adjusted for field conditions. Additionally, discharge from pump shall not exceed the design flow rate by more than 20%. If, in the opinion of the City, the equipment furnished does not perform in accordance with these Specifications, Contractor shall promptly make all necessary repairs or corrections so that the equipment fully complies with these Specifications. Contractor shall remove, restore, and replace the equipment if required at his expense. Factory performance tests, pre-start-up, and start-up testing shall be rerun if necessary, at Contractor's expense.
- iv. Run pumps in the field, witnessed by the manufacturer's representative. Contractor and Engineer to verify operation under field conditions. Measurements shall be taken by the Contractor to determine that the pumping units will operate satisfactorily without cavitation, overheating or overloading of the motor, and free of vibration throughout the entire operating range of head and capacity at rated speed.
- v. Pump Manufacturer to supply all required instrumentation to verify pump performance. Instrumentation to be calibrated in accordance with accepted industry standards. No flow meter is required.

- vi. Report of testing activities shall be prepared and submitted to the Engineer for approval.
- vii. Correct all deficiencies to the satisfaction of the Engineer.
- viii. Have factory-trained manufacturer's service representative instruct operating personnel on the care and maintenance of the pumping units. Such instruction to be provided on-site and consist of a minimum of four hours.

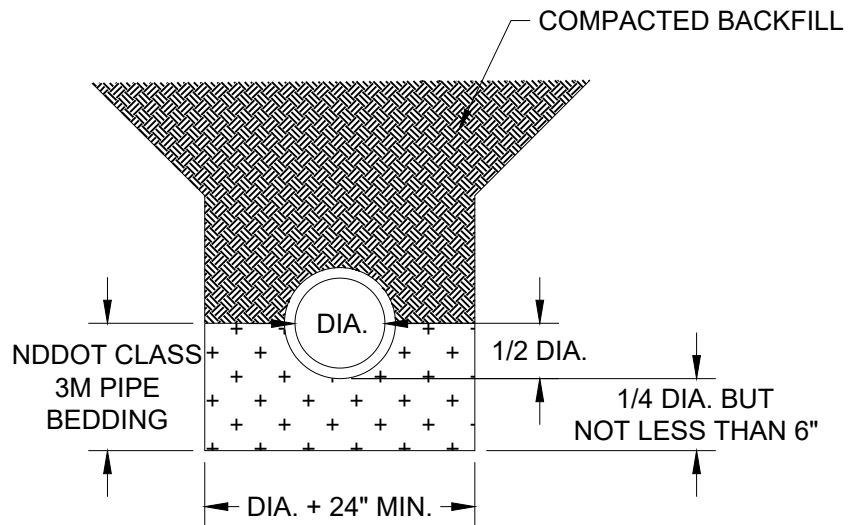
J. Start-Up

- 1. Upon successful completion of pre-start-up and after receipt of all Manufacturer's Certificate of Proper Installation by the City, Contractor shall schedule the start-up. A minimum of three (3) days' notice shall be provided to the City prior to the start-up. The Contractor's representative(s), City's Operations representative(s), Engineering Consultant, Inspector, Design Engineer, and Manufacturer's representative(s) shall attend start-up.
- 2. All testing described for pre-start-up shall be repeated during start-up and the pumps shall be tested through the force main(s). Contractor shall provide water for filling the force main, operate the pumps, and assure that the force main(s) are completely filled prior to start-up.

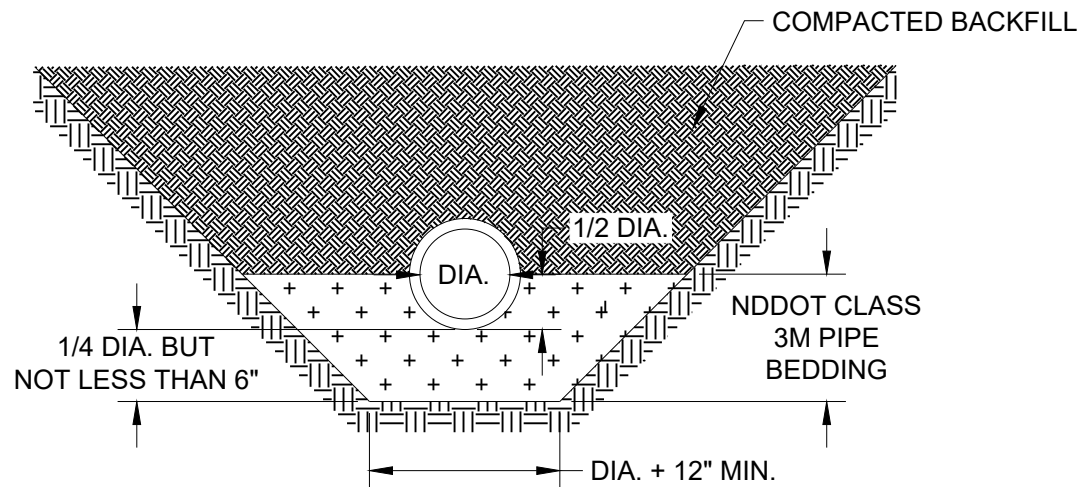
PART 4 – MEASUREMENT AND PAYMENT

- A. All work described herein and/or shown on the Plans, except specific items shown on the Bid Form, shall be paid for under the Lump Sum (LS) bid item for the Lift Station(s). Work described in other Sections that is necessary to make the Lift Station complete and is not included in specific bid items shall also be included in the lump sum payment for the "Lift Station." Such work may or may not include, and may not be limited to, site preparation, access road, wet wells, valve vaults, submersible pumps, piping, valves, lifting/hoist systems, control panels, electrical service and feeds, restoration, start-up, testing, training, manuals and all appurtenances required for complete operation and maintenance of the Lift Station.
- B. All costs to properly complete the work specified herein and/or shown on the Plans shall be included in the prices bid for these or other items unless applicable bid items are included on the Bid Form.

END OF SECTION



TRENCH BOX OR BENCHED TRENCH WALLS



SLOPED TRENCH WALLS

NOTES:

1. "DIA." DENOTES OUTSIDE DIAMETER OF PIPE, EXCLUDING PIPE BELLS.

City Plate No.:

BED-1

Last Revision:

12/18/2020

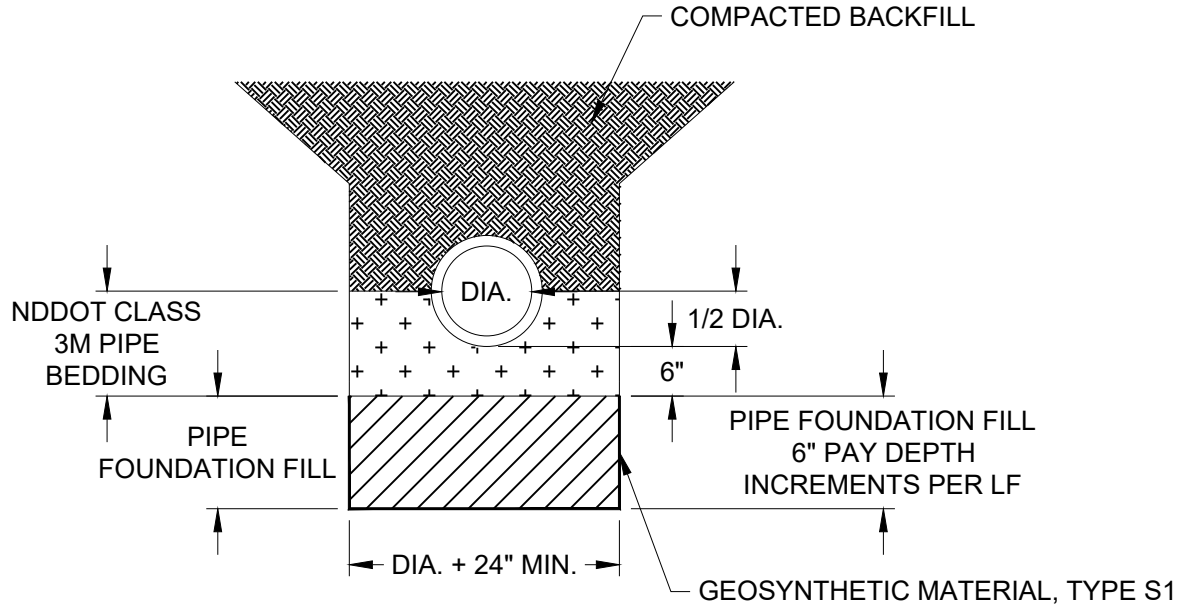
Section:

2000

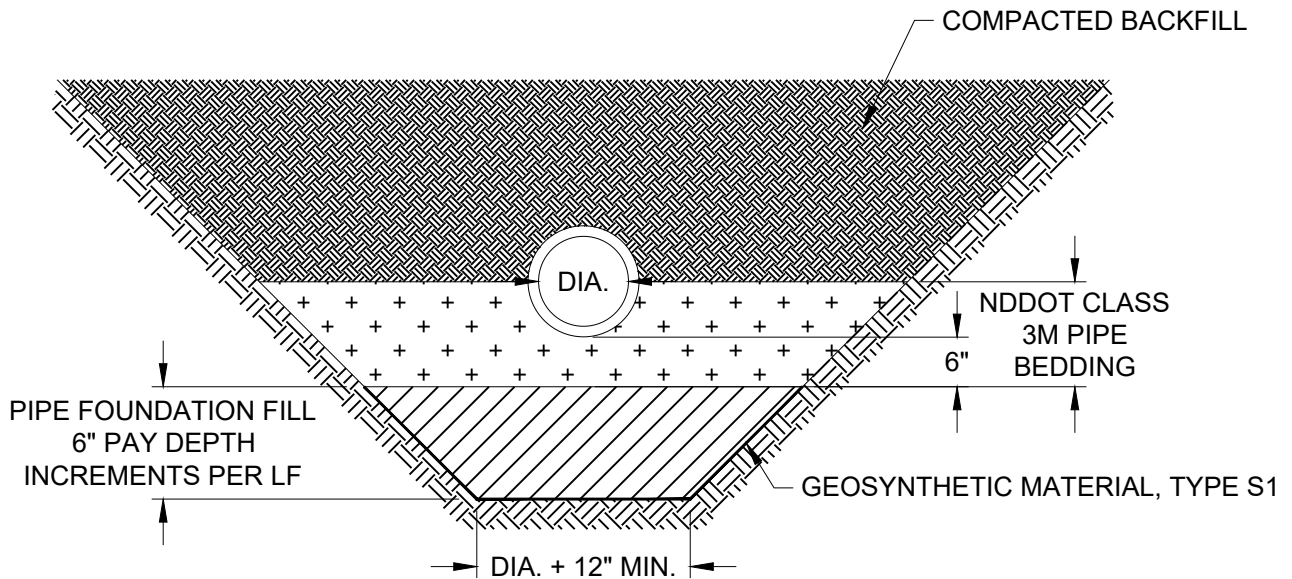
STANDARD DETAILS

BEDDING METHOD FOR RCP OR DIP

City of Minot



TRENCH BOX OR BENCHED TRENCH WALLS



SLOPED TRENCH WALLS

NOTES:

1. "DIA." DENOTES OUTSIDE DIAMETER OF PIPE.
2. NO PAYMENT WILL BE MADE FOR PIPE FOUNDATION FILL UNLESS DIRECTED BY THE ENGINEER.

City Plate No.:

BED-2

Last Revision:

12/18/2020

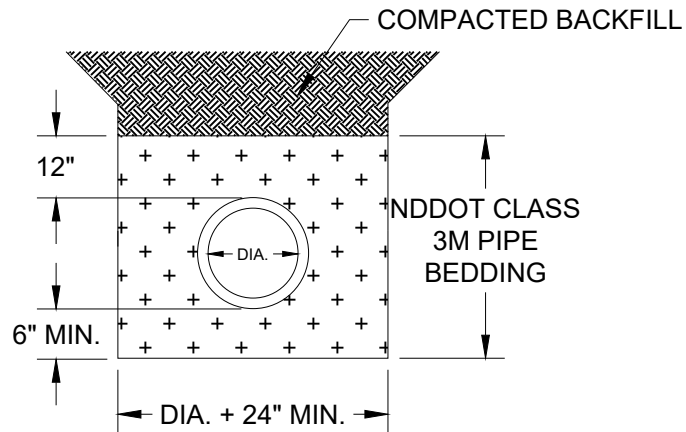
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2000

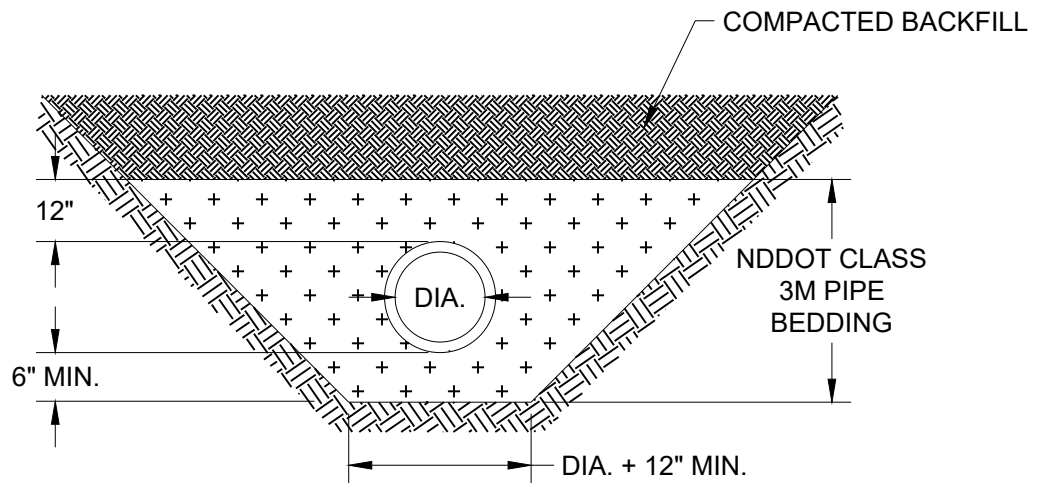
STANDARD DETAILS

IMPROVED FOUNDATION FOR RCP OR DIP

City of Minot



TRENCH BOX OR BENCHED TRENCH WALLS



SLOPED TRENCH WALLS

NOTES:

1. "DIA." DENOTES OUTSIDE DIAMETER OF PIPE.

City Plate No.:

BED-3

Last Revision:

12/18/2020

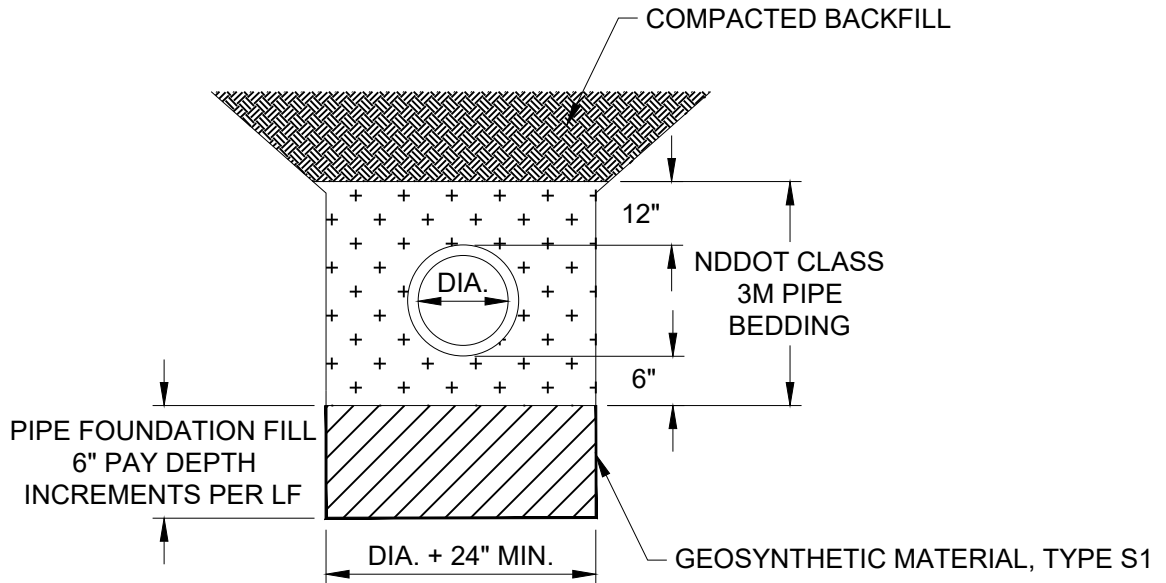
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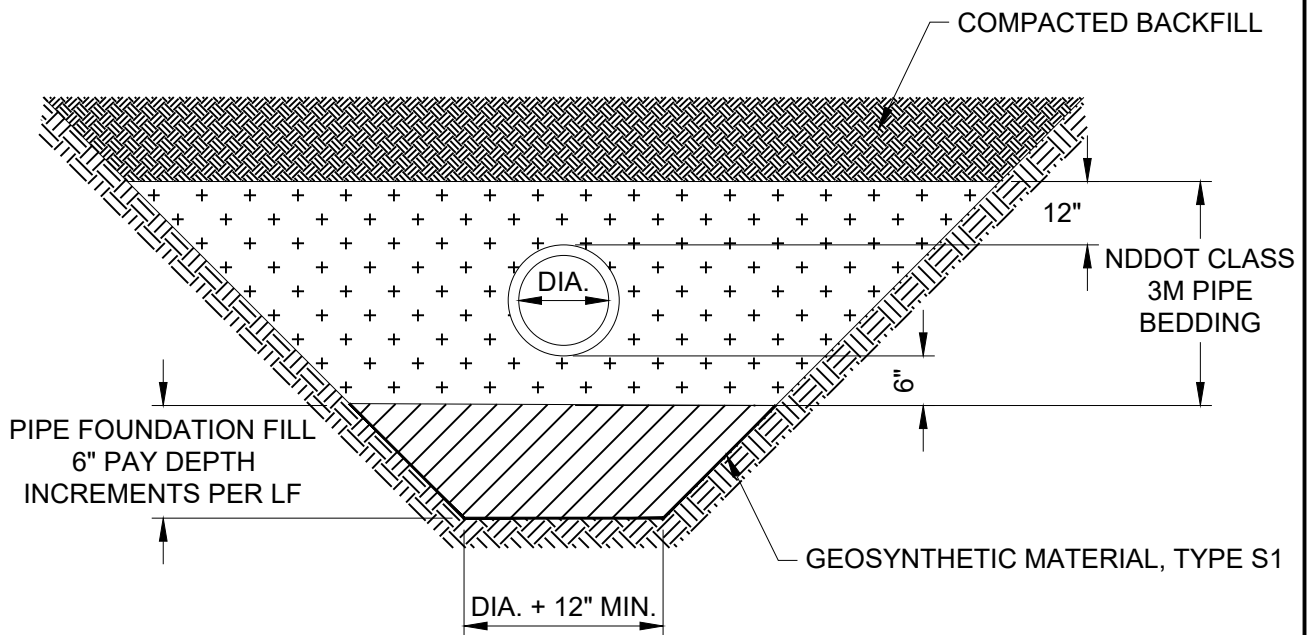
STANDARD DETAILS

BEDDING METHOD FOR PVC

City of Minot



TRENCH BOX OR BENCHED TRENCH WALLS



SLOPED TRENCH WALLS

NOTES:

1. "DIA." DENOTES OUTSIDE DIAMETER OF PIPE.
2. NO PAYMENT WILL BE MADE FOR PIPE FOUNDATION FILL UNLESS DIRECTED BY THE ENGINEER.

City Plate No.:

BED-4

Last Revision:

12/16/2020

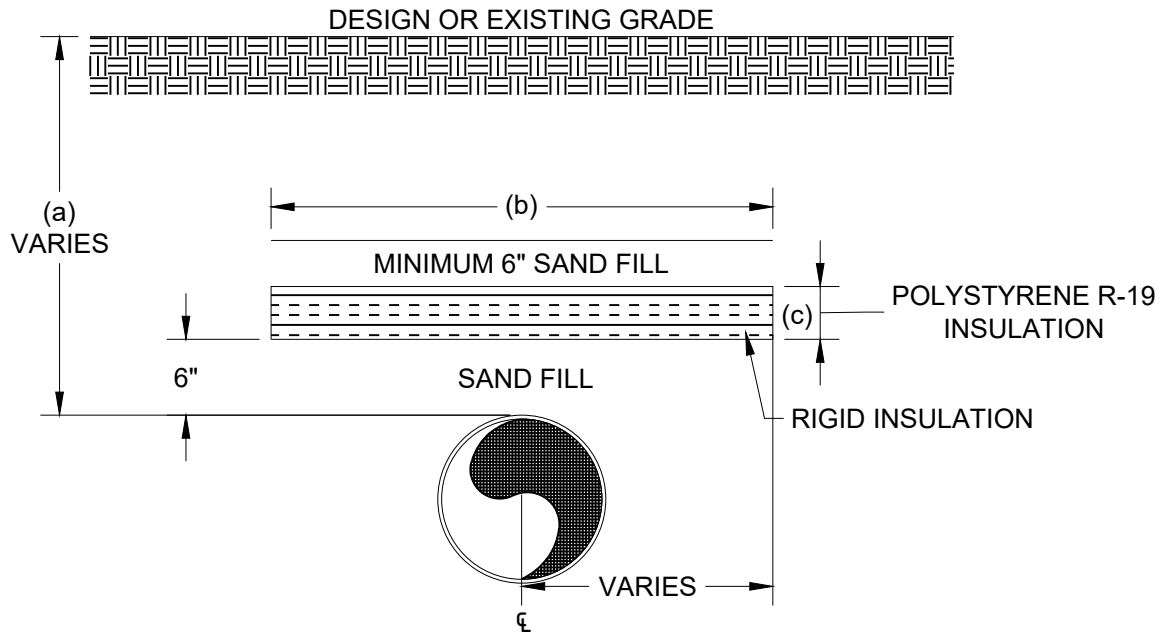
Section:

2000

STANDARD DETAILS

IMPROVED FOUNDATION FOR PVC

City of Minot



NOTES:

1. APPLIES TO SERVICES, WATERMAIN, AND SANITARY SEWER.
2. PIPE SHALL BE CENTERED UNDER INSULATION UNLESS OTHERWISE SPECIFIED.
3. WHEN PIPE CROSSES WITHIN 2.5' OF STORM SEWER, SEE DETAIL BED-6.
4. WHEN STACKING INSULATION BOARDS, STAGGER EACH LAYER SUCH THAT ALL BUTT JOINTS ARE OVERLAPPED BY THE LAYER ABOVE (18" MIN.)

COVER OVER PIPE (a)	WIDTH OF INSULATION BOARD (b)	THICKNESS OF INSULATION BOARD (c)
LESS THAN 4'	*	*
4' - 5'	6'	6"
5' - 6'	4'	4"

*SERVICES, WATERMAINS, AND SANITARY SEWERS WITH LESS THAN 4' OF COVER NEED PRIOR APPROVAL FROM PUBLIC WORKS DEPARTMENT PRIOR TO INSTALLATION.

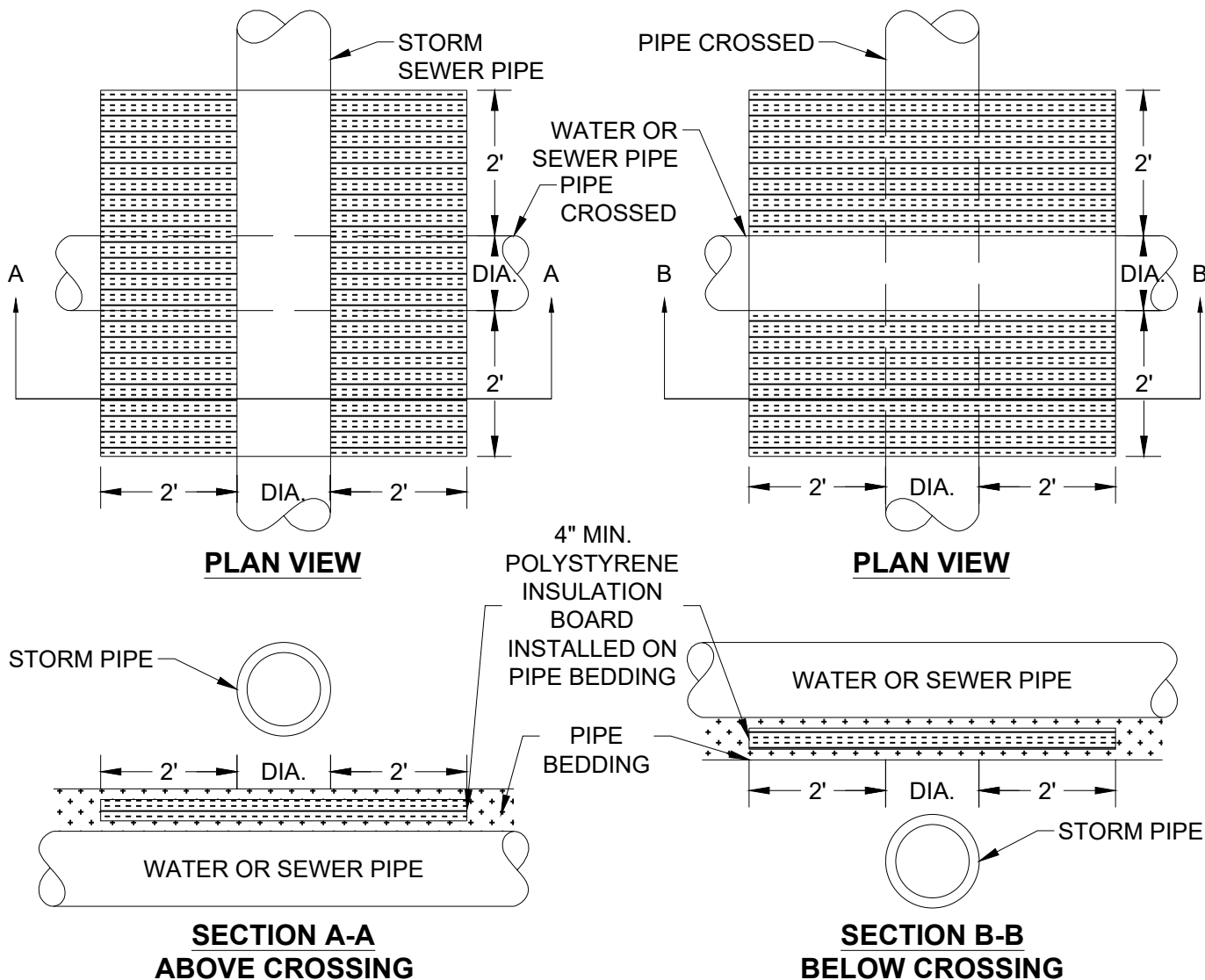
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City Plate No.:
BED-5
Last Revision:
12/30/2024
Section:
2100, 2200, 2300, 2400

STANDARD DETAILS

INSULATION





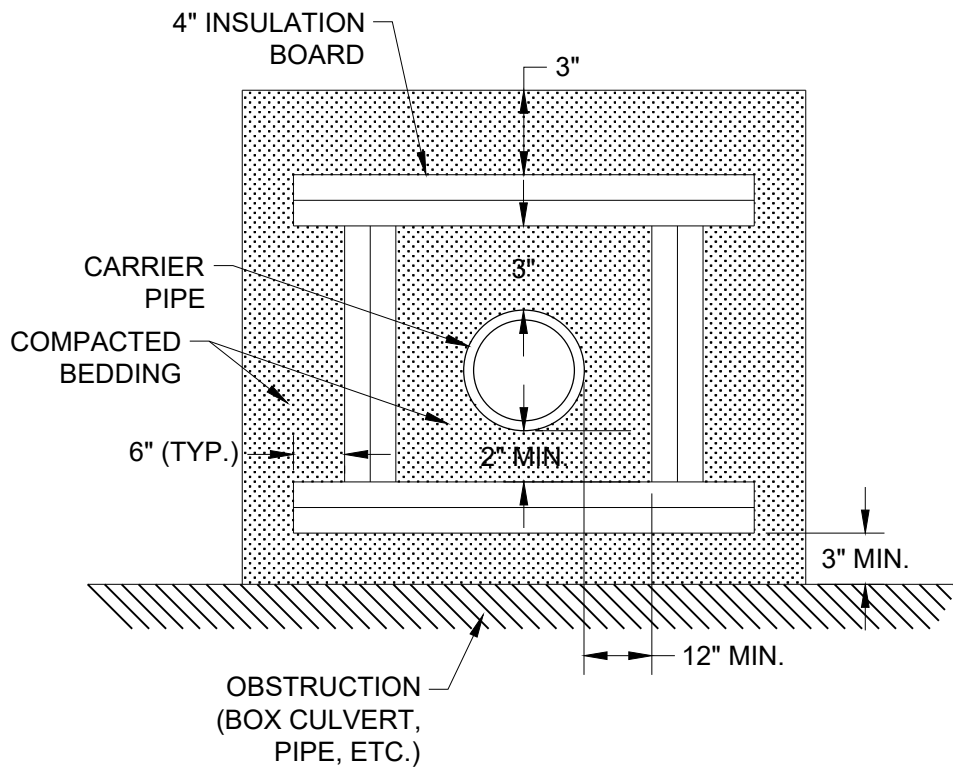
NOTES:

1. THIS DETAIL APPLIES TO BOTH MAINS & SERVICES WHERE CROSSING IS WITHIN 2.5 FEET OF STORM SEWER.
2. WHEN STACKING INSULATION BOARDS, STAGGER EACH LAYER SUCH THAT ALL BUTT JOINTS ARE OVERLAPPED BY THE LAYER ABOVE (18" MIN.)
3. SECTION B-B BELOW CROSSING MAY REQUIRE ENCASEMENT INSULATION IF WATER OR SEWER PIPE COVER IS LESS THAN 8 FEET.
4. MAY BE INSULATED WITH AN APPROVED ENCASEMENT INSULATION IN LIEU OF DETAIL.

City Plate No.:	BED-6
Last Revision:	12/18/2020
Section:	2100, 2200, 2300, 2400

STANDARD DETAILS
INSULATION FOR STORM CROSSING





NOTES:

1. ENCASMENT MUST BE 8 LF MIN. ALONG THE CARRIER PIPE.
2. WHEN STACKING INSULATION BOARDS, STAGGER EACH LAYER SUCH THAT ALL BUTT JOINTS ARE OVERLAPPED BY THE LAYER ABOVE (18" MIN.)

City Plate No.:
BED-7
Last Revision:
12/18/2020
Section:
2100, 2200, 2300, 2400

STANDARD DETAILS
ENCASEMENT INSULATION

City of Minot

4' MAXIMUM POST SPACING
(STEEL POST SHOWN)

POST NOTCHES TO FACE
AWAY FROM FABRIC
(STEEL POSTS ONLY)

ATTACH FABRIC TO POSTS WITH MINIMUM 3 ZIP
TIES (50 LB TENSILE) PER POST IN TOP 8" OF FABRIC

MONOFILAMENT GEOTEXTILE FABRIC

MACHINE SLICE 8"-12" DEPTH
(PLUS 6" FLAP) TRENCH MUST BE
COMPACTED BY LIGHT EQUIPMENT
PRIOR TO PLACEMENT OF STEEL POSTS

DIRECTION OF SURFACE FLOW

20" MIN. POST EMBEDMENT
24" FOR SLOPES 3:1 OR GREATER

NOTE:

THE MACHINE SLICED METHOD (THIS DETAIL) IS THE
STANDARD SILT FENCE INSTALLATION METHOD.
HEAVY-DUTY (ERO-2) OR STANDARD (ERO-3) SILT FENCE
INSTALLATION METHODS SHOULD ONLY BE USED WHEN
APPROVED OR DIRECTED BY THE CITY.

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City Plate No.:

ERO-1

Last Revision:

12/18/2020

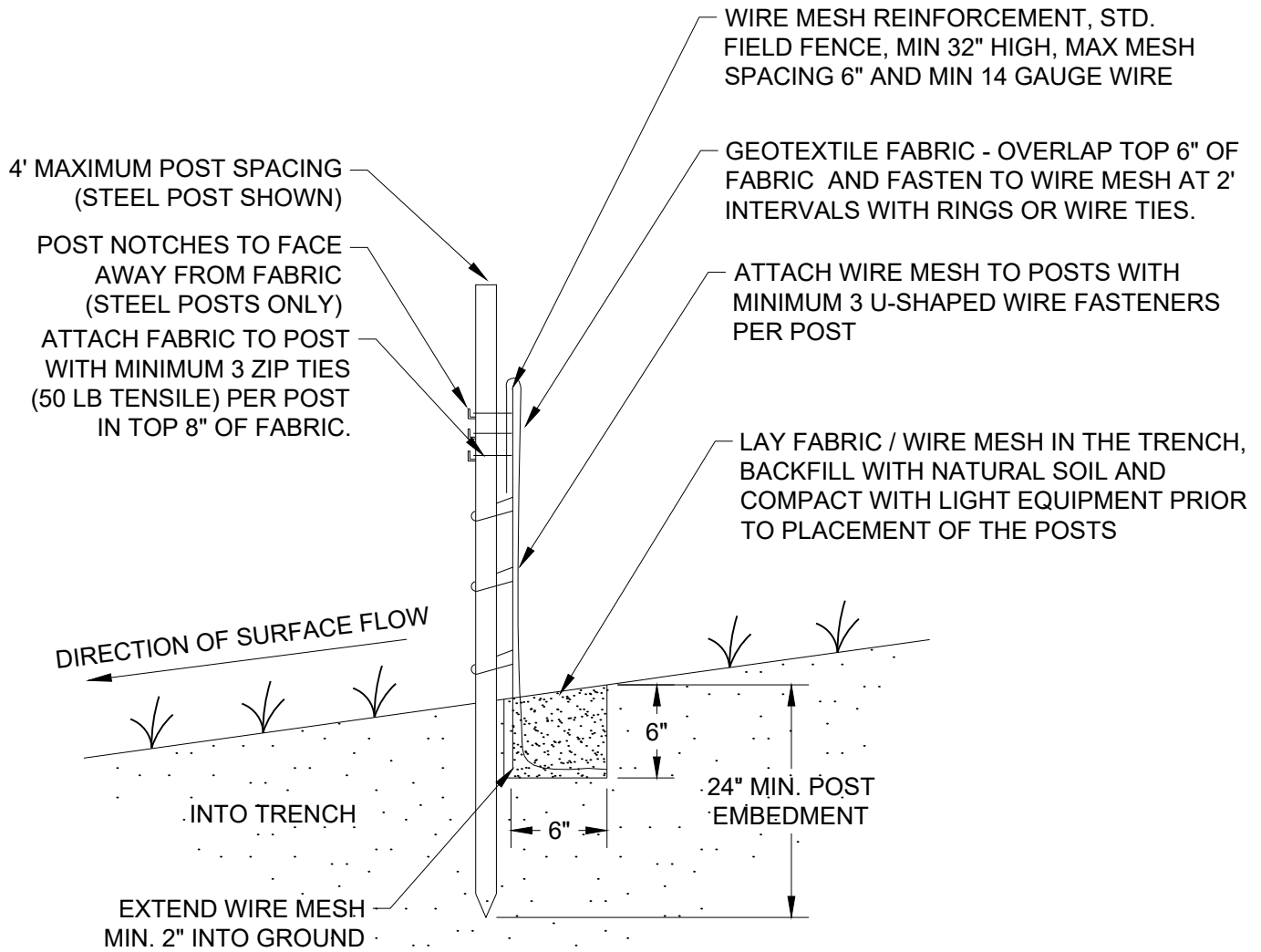
Section:

1200

STANDARD DETAILS

**SILT FENCE
MACHINE SLICED**

City of Minot



City Plate No.:

ERO-2

Last Revision:

12/18/2020

Section:

1200

STANDARD DETAILS

SILT FENCE SUPPORTED

City of Minot

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4' MAXIMUM POST SPACING
(STEEL POST SHOWN)

POST NOTCHES TO FACE
AWAY FROM FABRIC
(STEEL POSTS ONLY)

MONOFILAMENT GEOTEXTILE FABRIC

ATTACH FABRIC TO POST WITH MINIMUM
3 ZIP TIES (50 LB TENSILE) PER POST IN
TOP 8" OF FABRIC

LAY FABRIC IN THE TRENCH, BACKFILL WITH
NATURAL SOIL, AND COMPACT WITH LIGHT
EQUIPMENT PRIOR TO PLACEMENT OF THE
POSTS

24" Min.

DIRECTION OF SURFACE FLOW

6"

20" MIN. POST EMBEDMENT

24" FOR SLOPES 3:1 OR GREATER

6"

City Plate No.:

ERO-3

Last Revision:

12/18/2020

Section:

1200

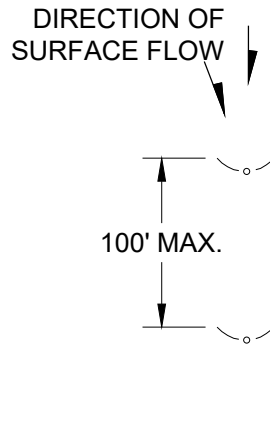
STANDARD DETAILS

SILT FENCE STANDARD

City of Minot

PLAN VIEW

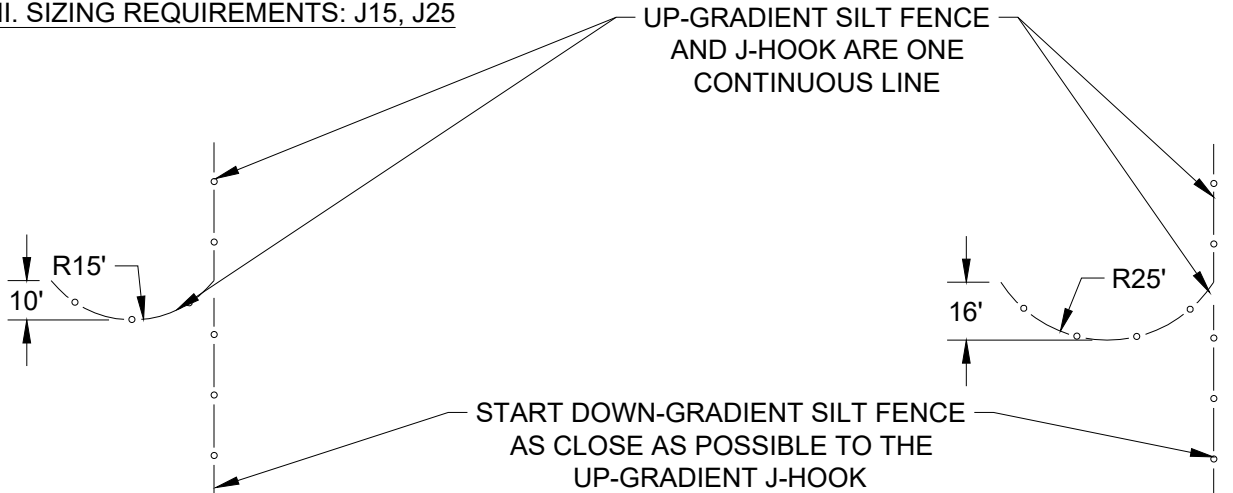
I. SPACING REQUIREMENTS



NOTE:

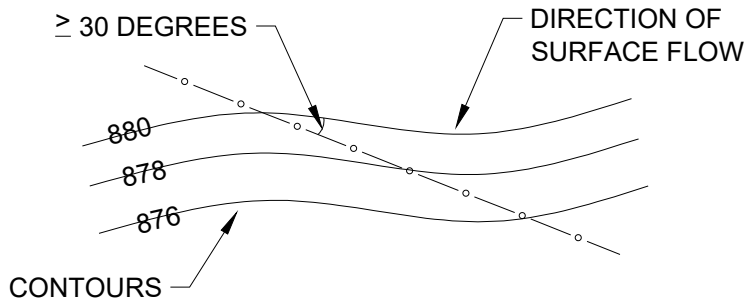
SPACING DISTANCES WILL VARY, BUT ARE NOT TO EXCEED 100 FEET.

II. SIZING REQUIREMENTS: J15, J25



J15 - FOR CATCHMENT AREA <0.25 ACRES

J25 - FOR CATCHMENT AREA $\geq$ 0.25 ACRES



NOTE:

J-HOOKS SHALL BE USED WHEN THE SILT FENCE IS INSTALLED AT AN ANGLE OF 30 DEGREES OR GREATER FROM PARALLEL TO THE CONTOURS.

City Plate No.:

ERO-4

Last Revision:

12/18/2020

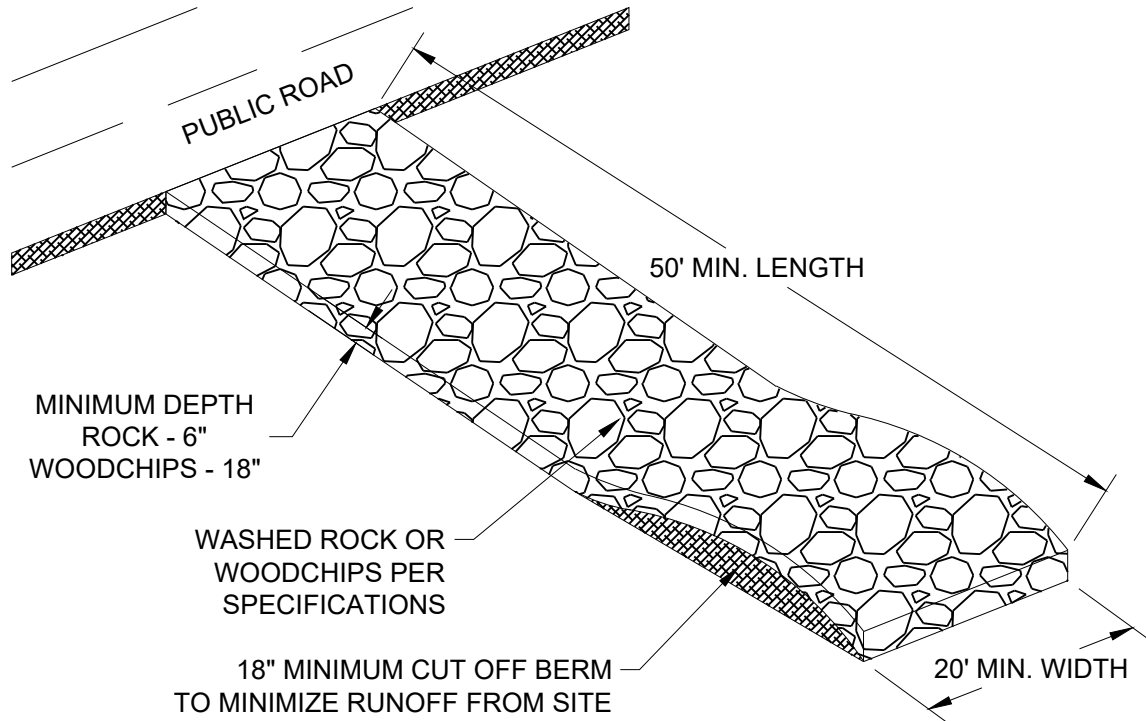
Section:

1200

STANDARD DETAILS

SILT FENCE J-HOOK

City of Minot



NOTES:

1. FILTER FABRIC SHALL BE PLACED UNDER ROCK TO STOP MUD MIGRATION THROUGH ROCK.
2. FILTER FABRIC IS NOT REQUIRED UNDER WOOD CHIPS.
3. ENTRANCE MUST BE MAINTAINED REGULARLY TO PREVENT SEDIMENTATION ON PUBLIC ROADWAYS.
4. CURB AND GUTTER MUST BE PROTECTED AT ALL TIMES FROM DAMAGE DUE TO EQUIPMENT OR CONSTRUCTION ACTIVITIES WHEN CROSSING CURB AND GUTTER.

City Plate No.:

ERO-5

Last Revision:

12/18/2020

Section:

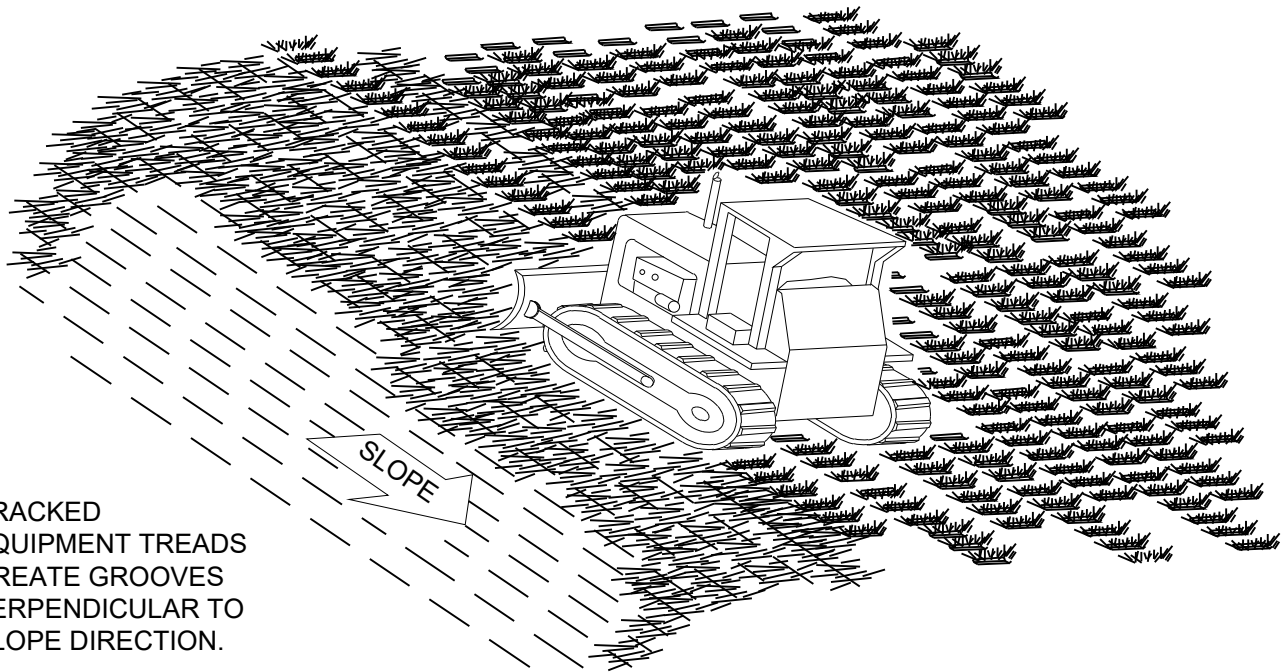
1200

STANDARD DETAILS

**CONSTRUCTION ENTRANCE
ROCK AND WOODCHIPS**

City of Minot

TRACKED
EQUIPMENT TREADS
CREATE GROOVES
PERPENDICULAR TO
SLOPE DIRECTION.



NOTES:

1. ALL SLOPES WITH A GRADE EQUAL TO OR STEEPER THAN 3:1 REQUIRE SLOPE TRACKING.
2. SLOPES WITH A GRADE MORE GRADUAL THAN 3:1 REQUIRE SLOPE TRACKING IF THE STABILIZATION METHOD IS EROSION CONTROL BLANKET OR HYDROMULCH.

City Plate No.:

ERO-6

Last Revision:

12/18/2020

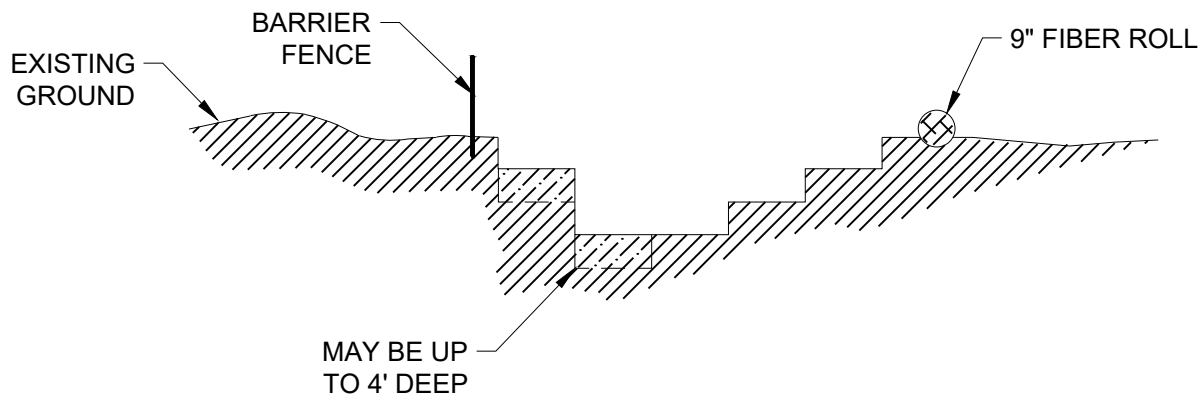
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1200

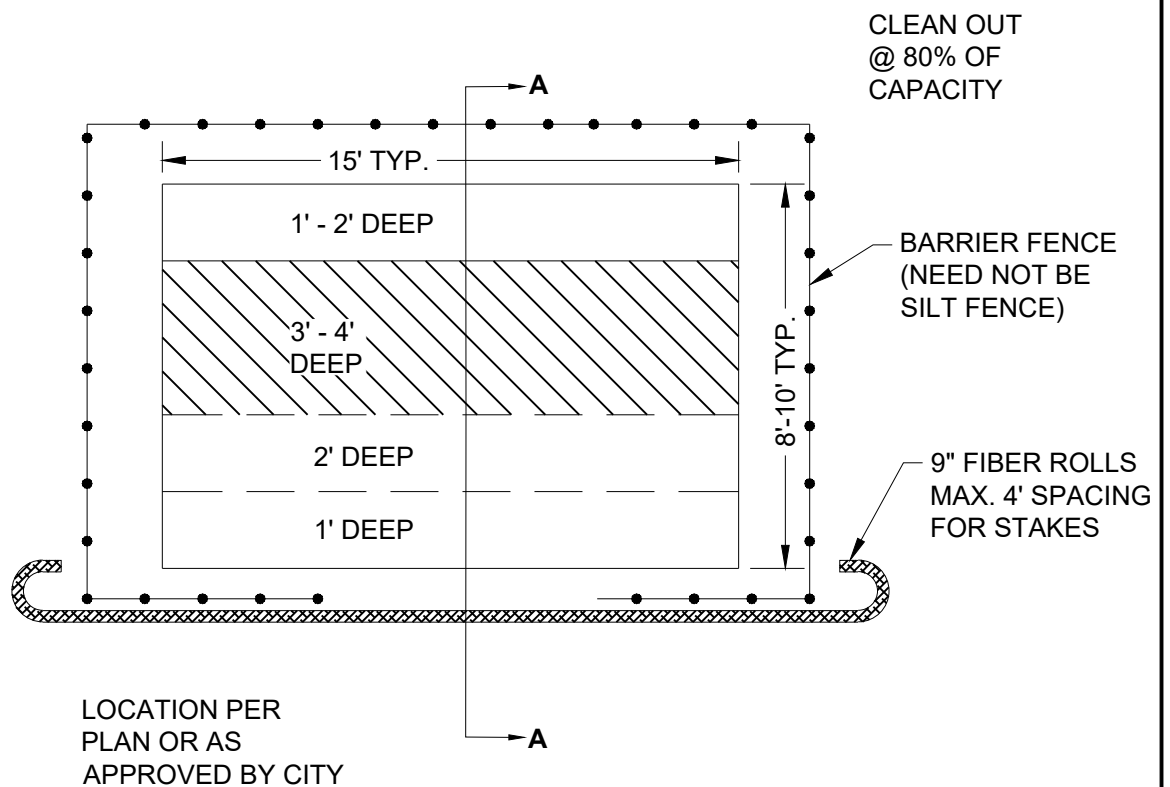
STANDARD DETAILS

SLOPE TRACKING

City of Minot



SECTION A-A



PLAN VIEW

M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\ERO-7_CONCRETE WASHOUT.dwg

City Plate No.:

ERO-7

Last Revision:

12/18/2020

Section:

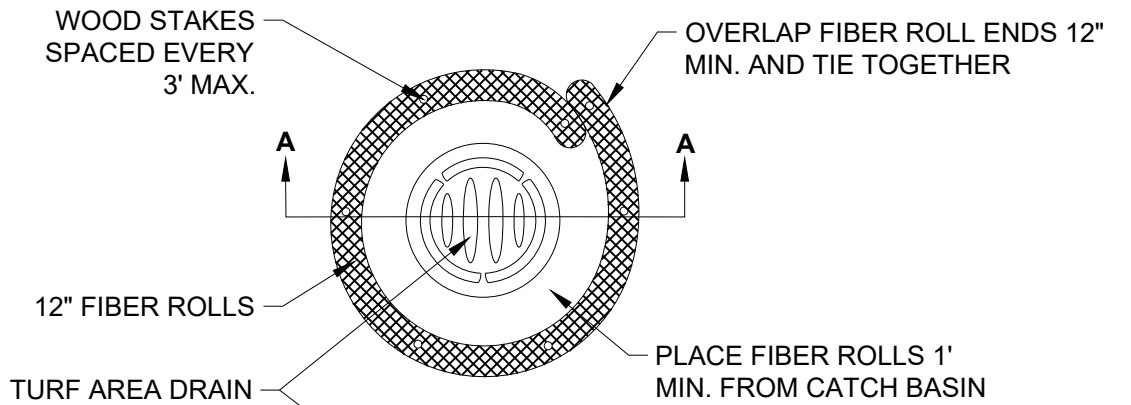
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STANDARD DETAILS

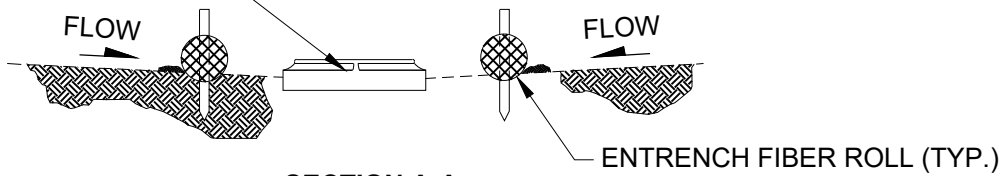
CONCRETE WASHOUT

City of Minot

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\ERO-8 - INLET PROTECTION TURF AREA DRAINS.dwg

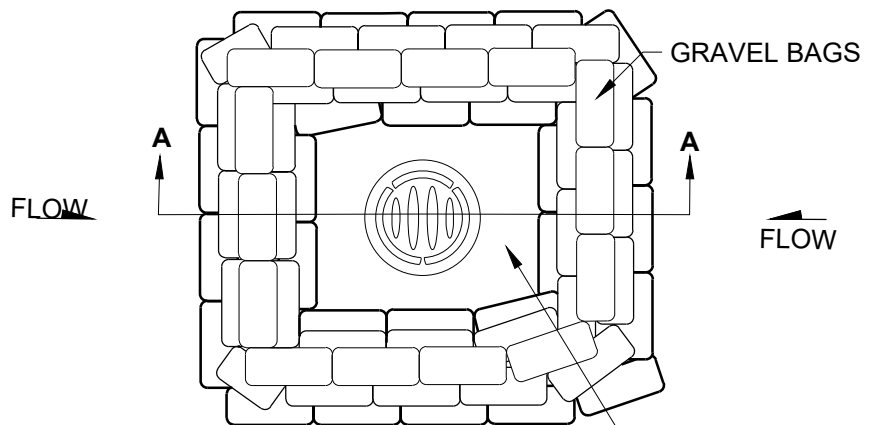


PLAN VIEW

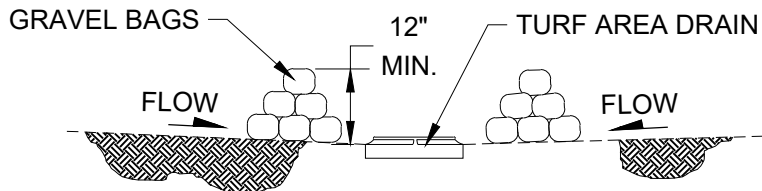


SECTION A-A

FIBER ROLLS



PLAN VIEW



SECTION A-A

GRAVEL BAGS

City Plate No.:

ERO-8

Last Revision:

12/18/2020

Section:

1200

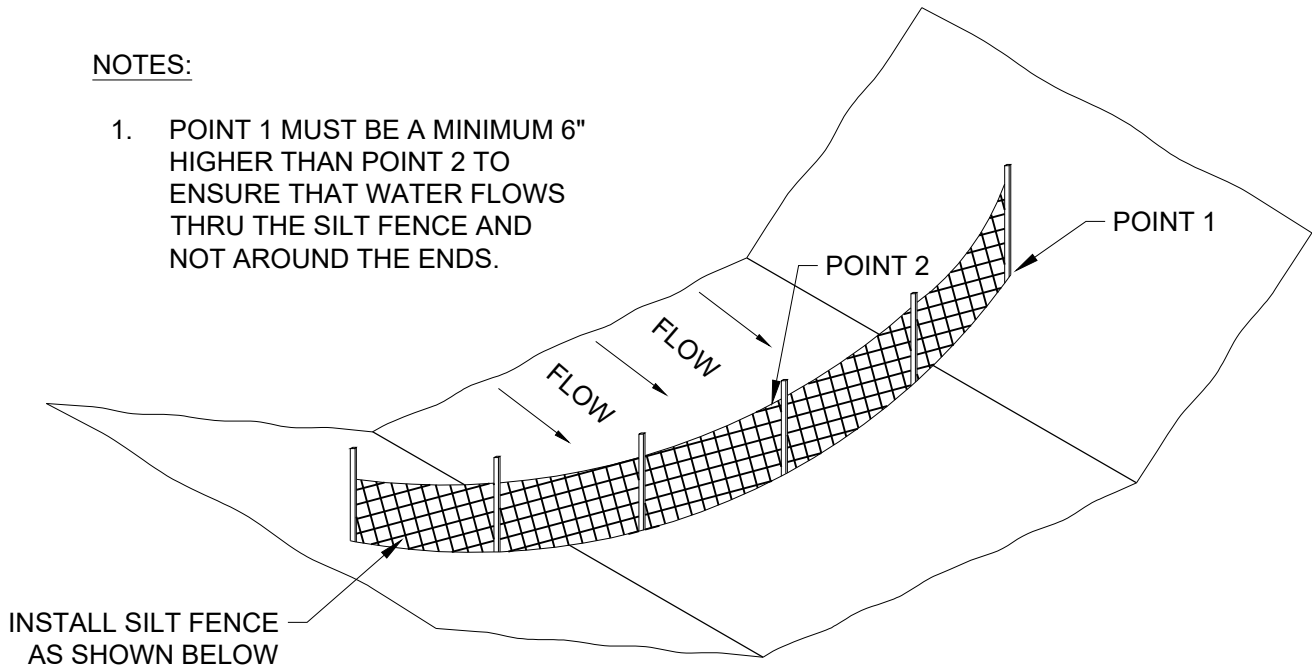
STANDARD DETAILS

INLET PROTECTION TURF AREA DRAINS

City of Minot

NOTES:

1. POINT 1 MUST BE A MINIMUM 6" HIGHER THAN POINT 2 TO ENSURE THAT WATER FLOWS THRU THE SILT FENCE AND NOT AROUND THE ENDS.



STEEL FENCE POST (T-POST)
MINIMUM 5' LONG
4' MAXIMUM SPACING

POST NOTCHES TO FACE
AWAY FROM FABRIC

ATTACH FABRIC TO POSTS WITH
MINIMUM 3 ZIP TIES (50 LB TENSILE) PER
POST IN TOP 8" OF FABRIC

MONOFILAMENT GEOTEXTILE FABRIC

MACHINE SLICE 8" - 12" DEPTH
(PLUS 6" FLAP) TRENCH MUST BE
COMPACTED BY LIGHT EQUIPMENT
PRIOR TO PLACEMENT OF STEEL POSTS

DIRECTION OF
SURFACE FLOW

20" MIN. POST EMBEDMENT
24" FOR SLOPES 3:1 OR GREATER

City Plate No.:

ERO-9

Last Revision:

12/18/2020

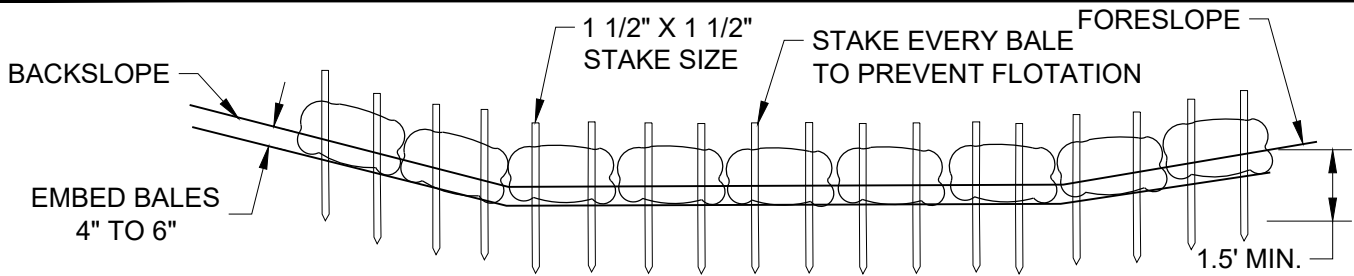
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1200

STANDARD DETAILS

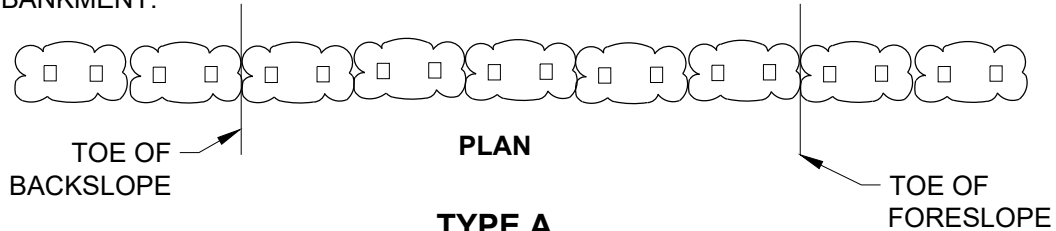
**DITCH CHECK
MACHINE SLICED SILT FENCE**

City of Minot



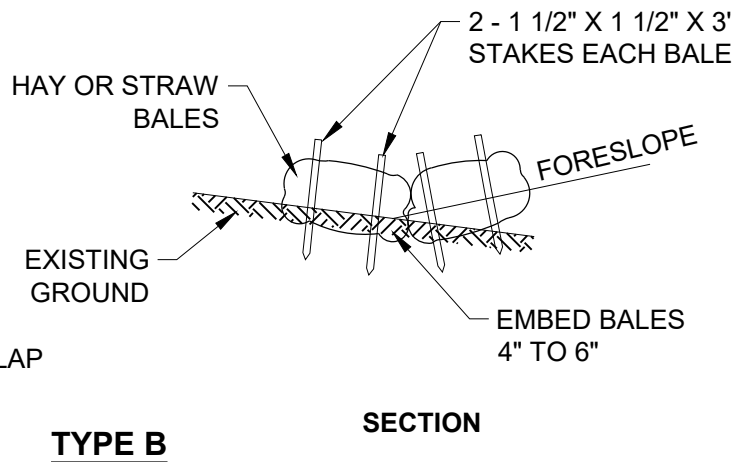
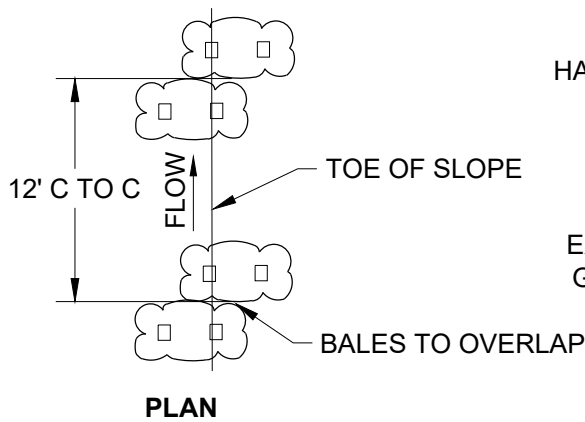
TYPE A TO BE USED WHEN EXISTING
GROUND SLOPES TOWARDS THE
HIGHWAY EMBANKMENT.

SECTION

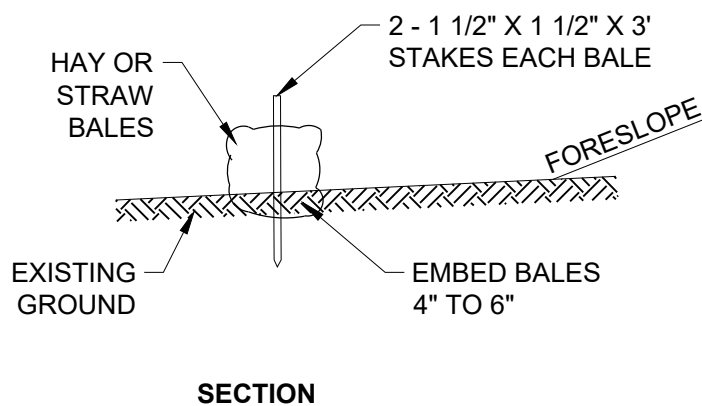


TYPE A

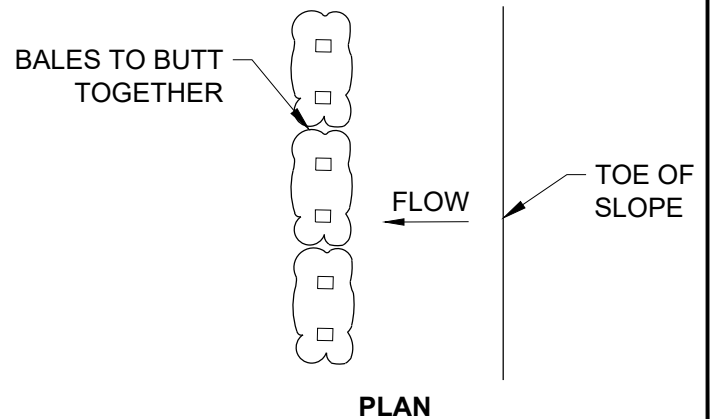
TYPE B TO BE USED WHEN EXISTING
GROUND SLOPES AWAY FROM THE
ROAD EMBANKMENT.



TYPE B



TYPE C



M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\ERO-10. EROSION CHECKS BALED HAY OR STRAW.dwg

City Plate No.:

ERO-10

Last Revision:

12/18/2020

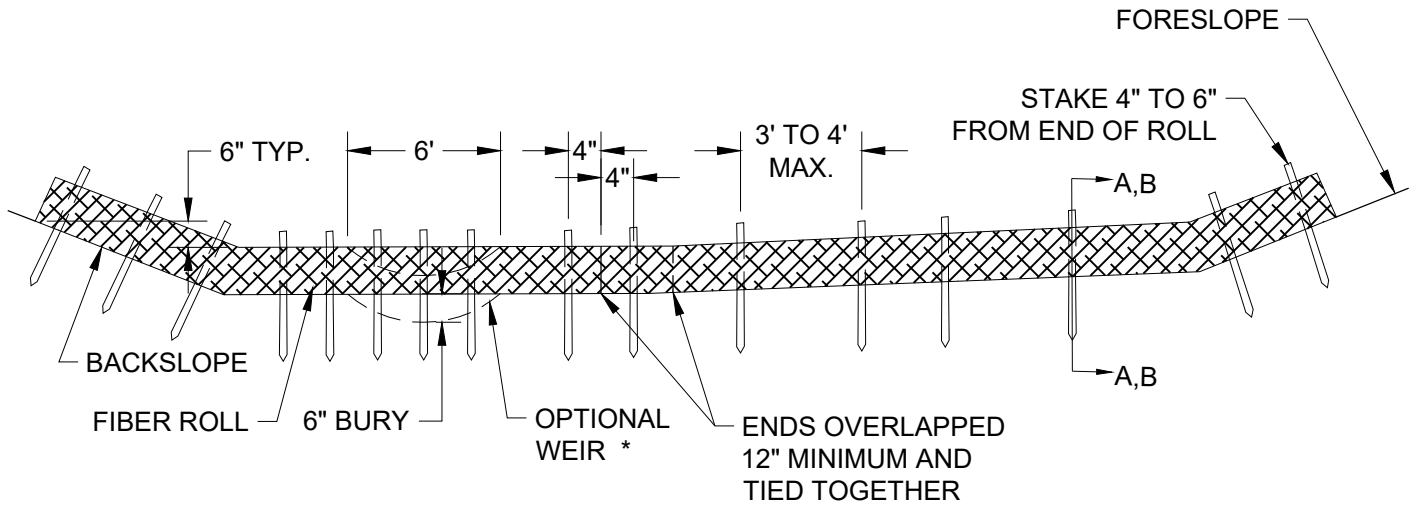
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STANDARD DETAILS

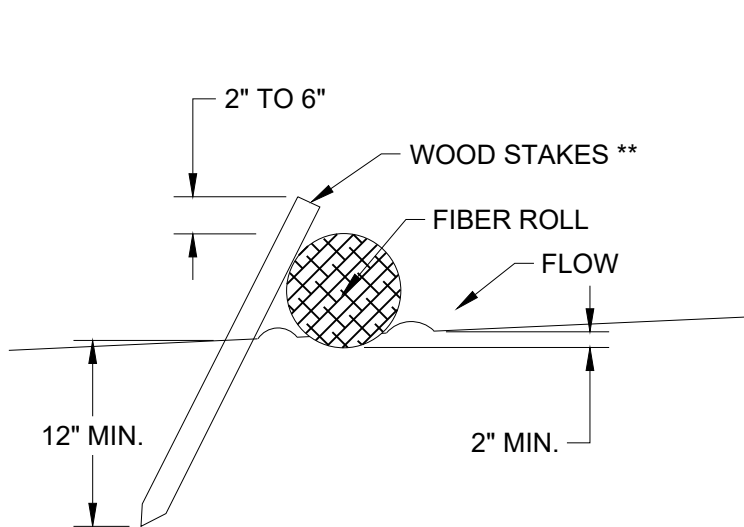
EROSION CHECKS BALED HAY OR STRAW

City of Minot

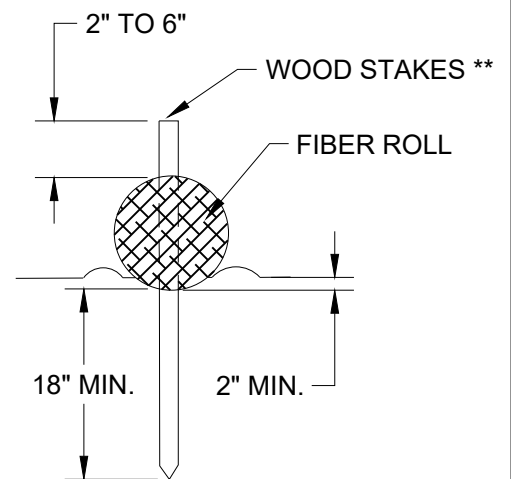


* OPTIONAL WEIR - USE IN FLAT AREAS
WHERE THERE IS POTENTIAL FOR WATER TO
BE BACKED UP ON ADJACENT PROPERTY.

FIBER ROLL - DITCH BOTTOM



SECTION A-A



SECTION B-B

** STAKES SPACED EVERY 3-4 FEET MAX.
MANUFACTURER MAY REQUIRE STAKE THROUGH CENTER OF FIBER ROLL.
THE FIBER ROLL MANUFACTURER'S STAKING DETAILS SUPERSEDE THIS STAKING DETAIL.

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\ERO-11_ EROSION CHECKS FIBER ROLLS.dwg

City Plate No.:

ERO-11

Last Revision:

12/18/2020

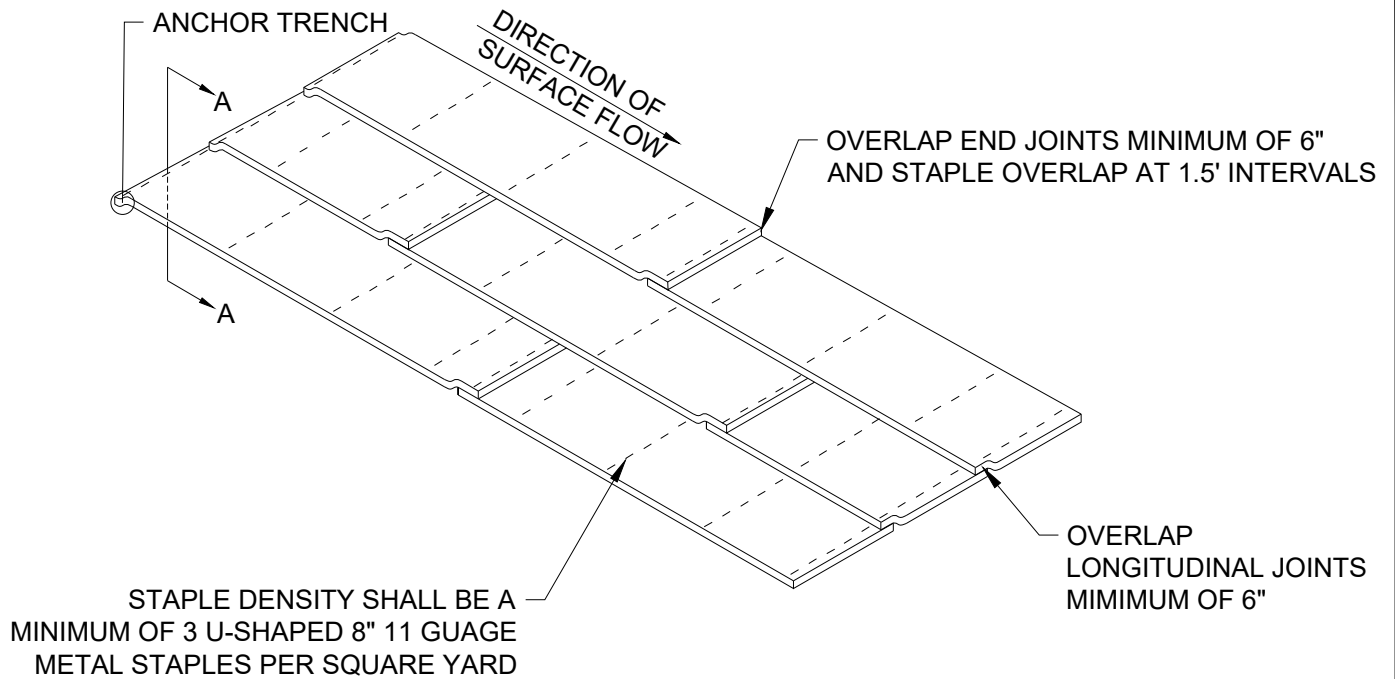
Section:

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STANDARD DETAILS

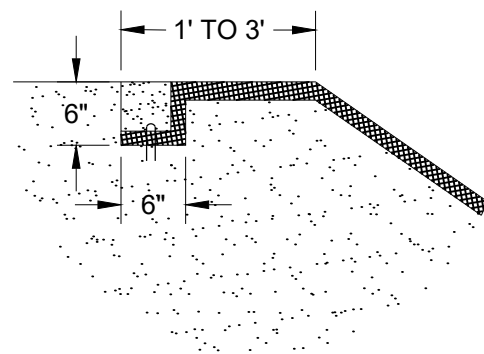
EROSION CHECKS FIBER ROLLS

City of Minot



NOTES:

1. DIG 6" X 6" TRENCH.
2. LAY BLANKET IN TRENCH.
3. STAPLE AT 1.5' INTERVALS MAX. IN ANCHOR TRENCH.
4. BACKFILL WITH NATURAL SOIL AND COMPACT.
5. BLANKET LENGTH SHALL NOT EXCEED 100' WITHOUT AN ANCHOR TRENCH.



SECTION A-A

City Plate No.:

ERO-12

Last Revision:

12/18/2020

Section:

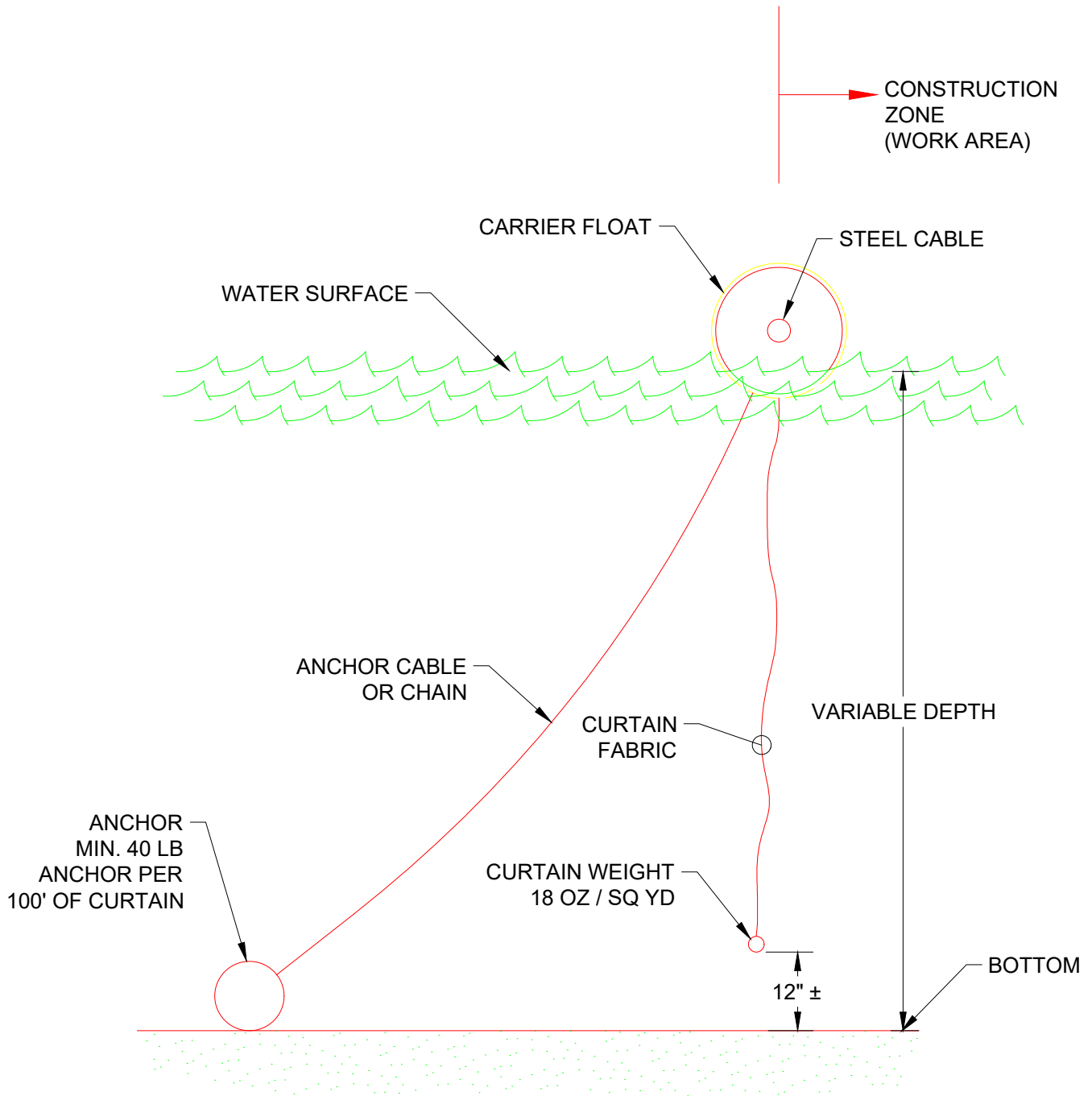
1200

STANDARD DETAILS

**EROSION CONTROL BLANKET
INSTALLATION**

City of Minot

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\ERO-13_Floating Silt Curtain.dwg



NOTES:

1. DOUBLE SILT CURTAINS SHOULD BE SPACED 10' APART.

City Plate No.:

ERO-13

Last Revision:

12/18/2020

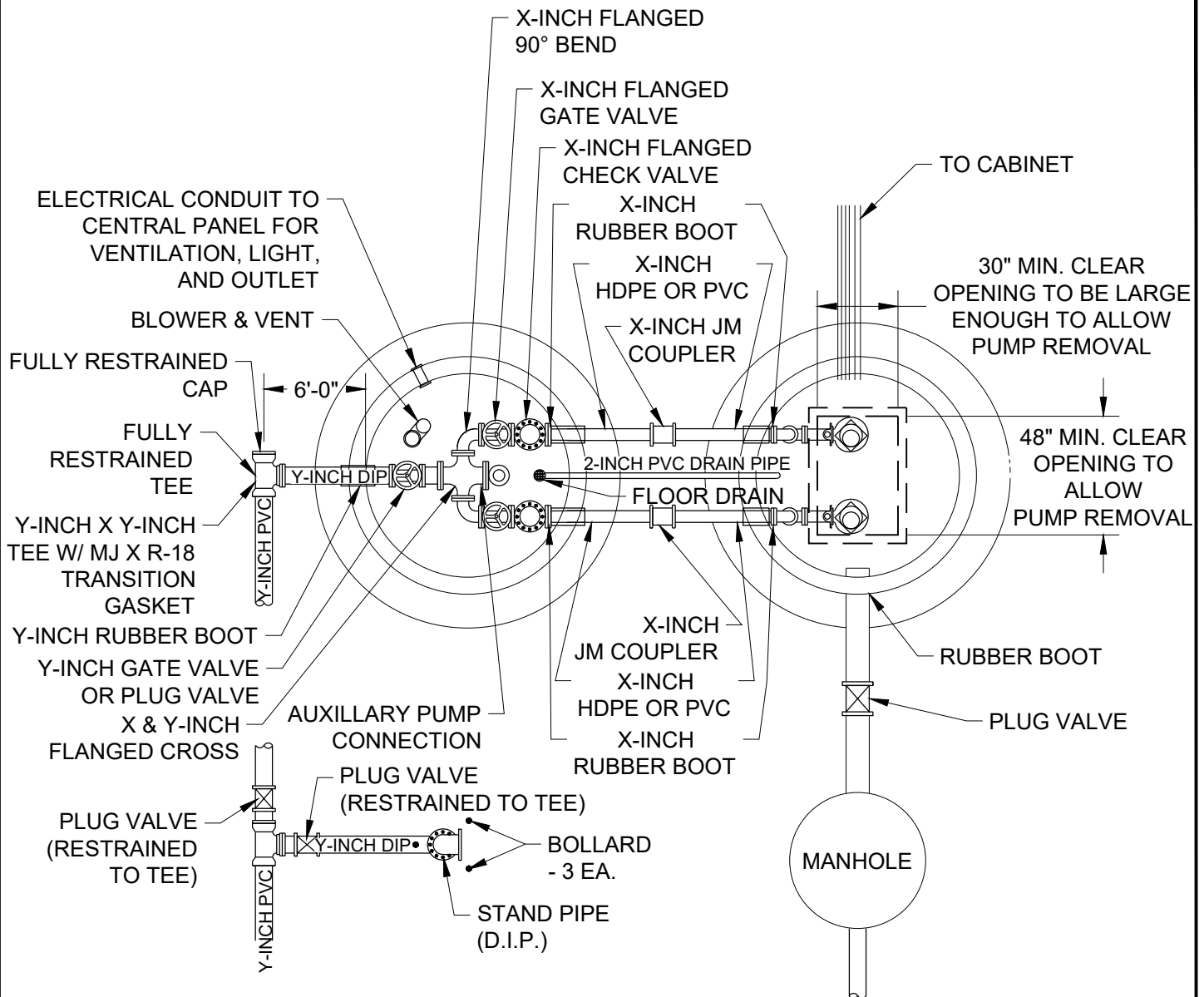
Section:

1200

STANDARD DETAILS

FLOATING SILT CURTAIN

City of Minot



STAND PIPE DETAIL

NOTES:

1. ALL HARDWARE SHALL BE 316 STAINLESS STEEL (NUTS, BOLTS, BRACKETS, BANDING, RESTRAINTS, MOUNTS, ETC).
2. FLOOR DRAIN SHALL BE ZURN Z450B-V.
3. UPSTREAM MANHOLE AND STAND PIPE SHALL BE LAID OUT AS CLOSE TO EACH OTHER AS POSSIBLE AT A DISTANCE FROM LIFT STATION THAT ALLOWS LIFT STATION TO BE EXCAVATED WITHOUT DISTURBING BYPASS OPERATION.

City Plate No.:

P-01A

Last Revision:

02/14/2022

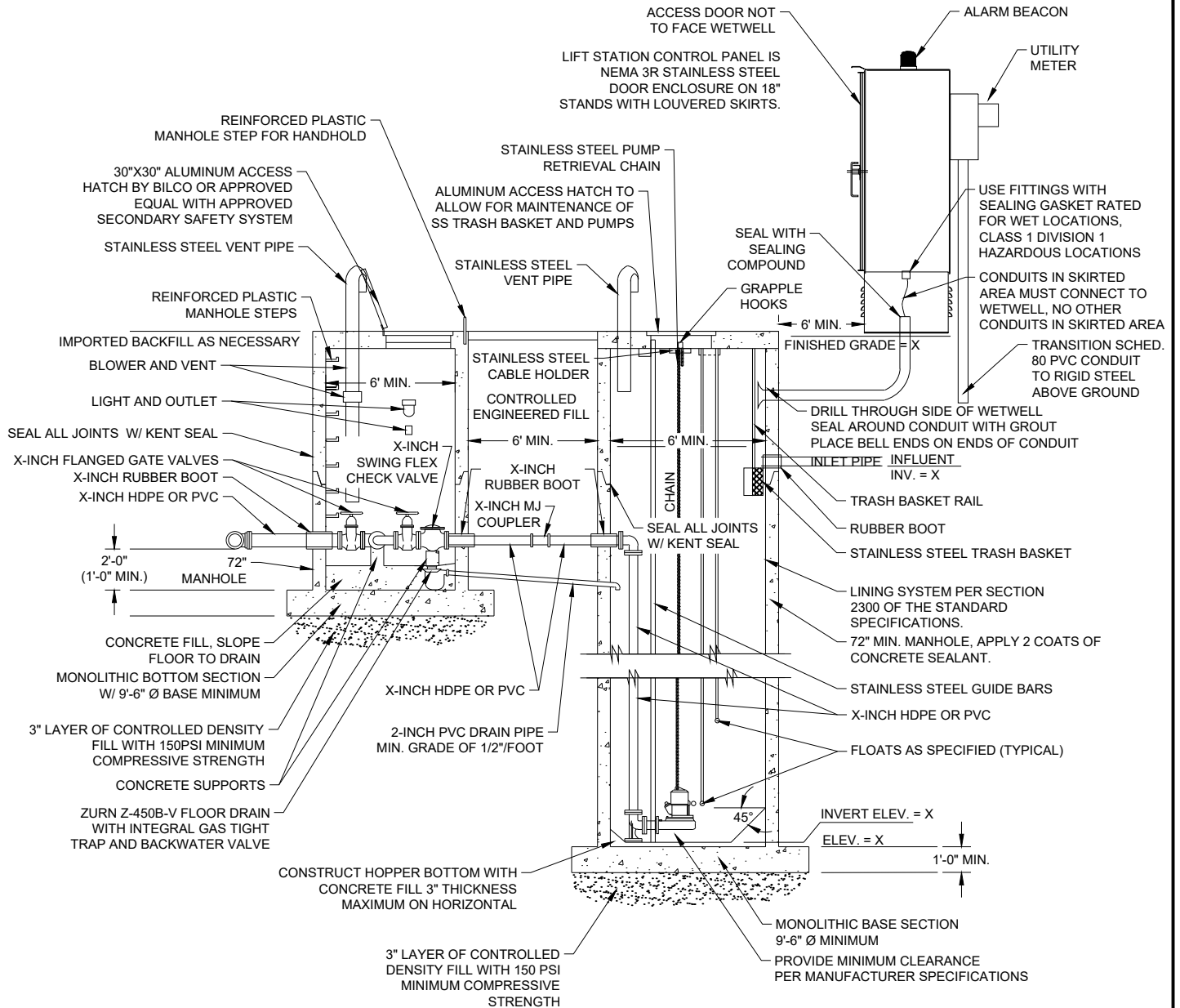
Section:

4000

STANDARD DETAILS

LIFT STATION PLAN

City of Minot



City Plate No.:

P-01B

Last Revision:

02/14/2022

Section:

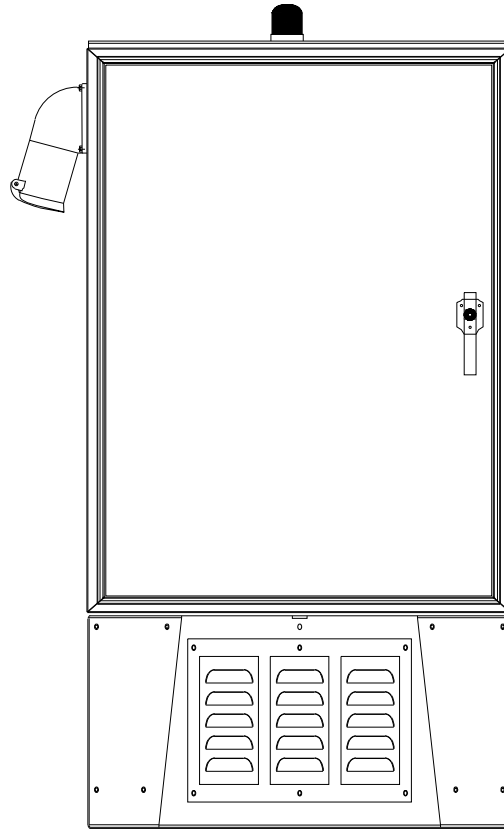
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STANDARD DETAILS

LIFT STATION ELEVATION

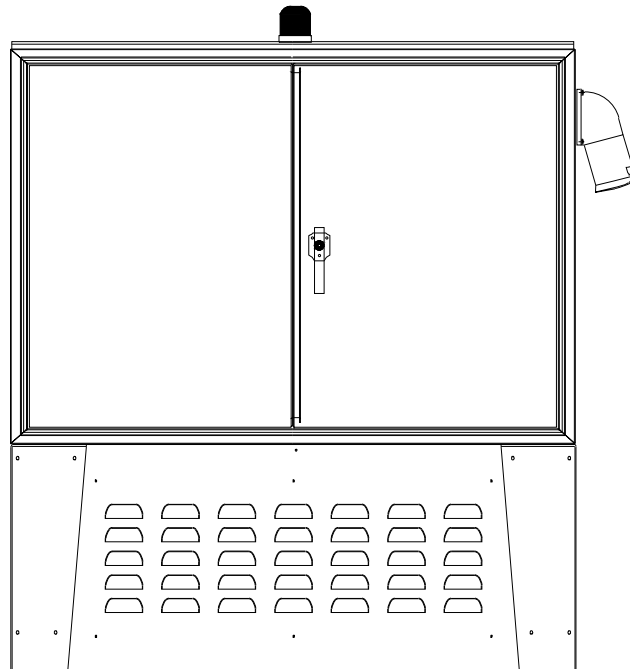
City of Minot

SINGLE DOOR VERSION



NEMA 3R PANEL - STAINLESS STEEL

TWO DOOR VERSION



M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\IP-02_LIFT STATION CONTROL PANEL.dwg

City Plate No.:

P-02

Last Revision:

12/18/2020

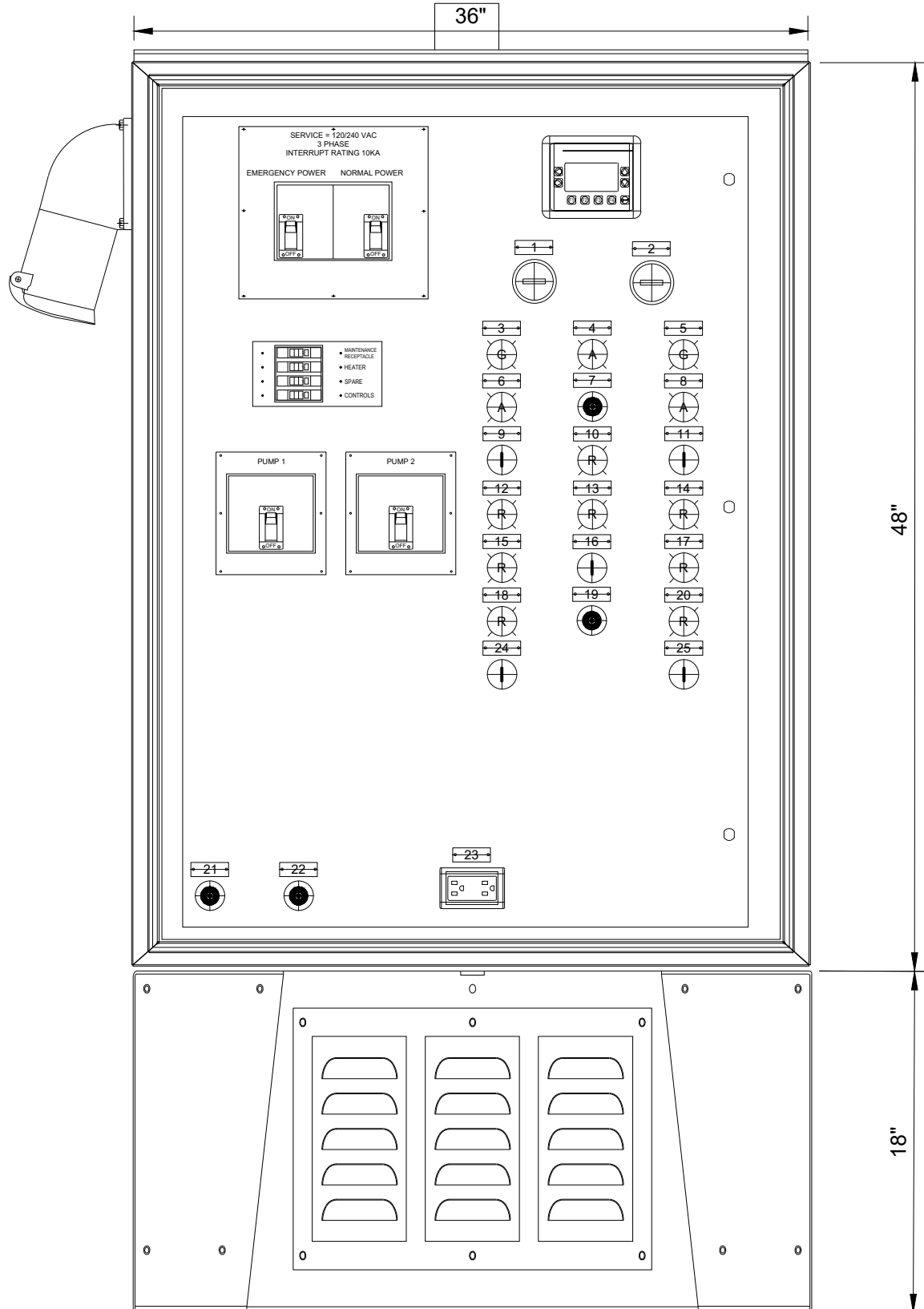
Section:

4000

STANDARD DETAILS

LIFT STATION CONTROL PANEL

City of Minot



FRONT VIEW WITH OUTER DOOR OPEN

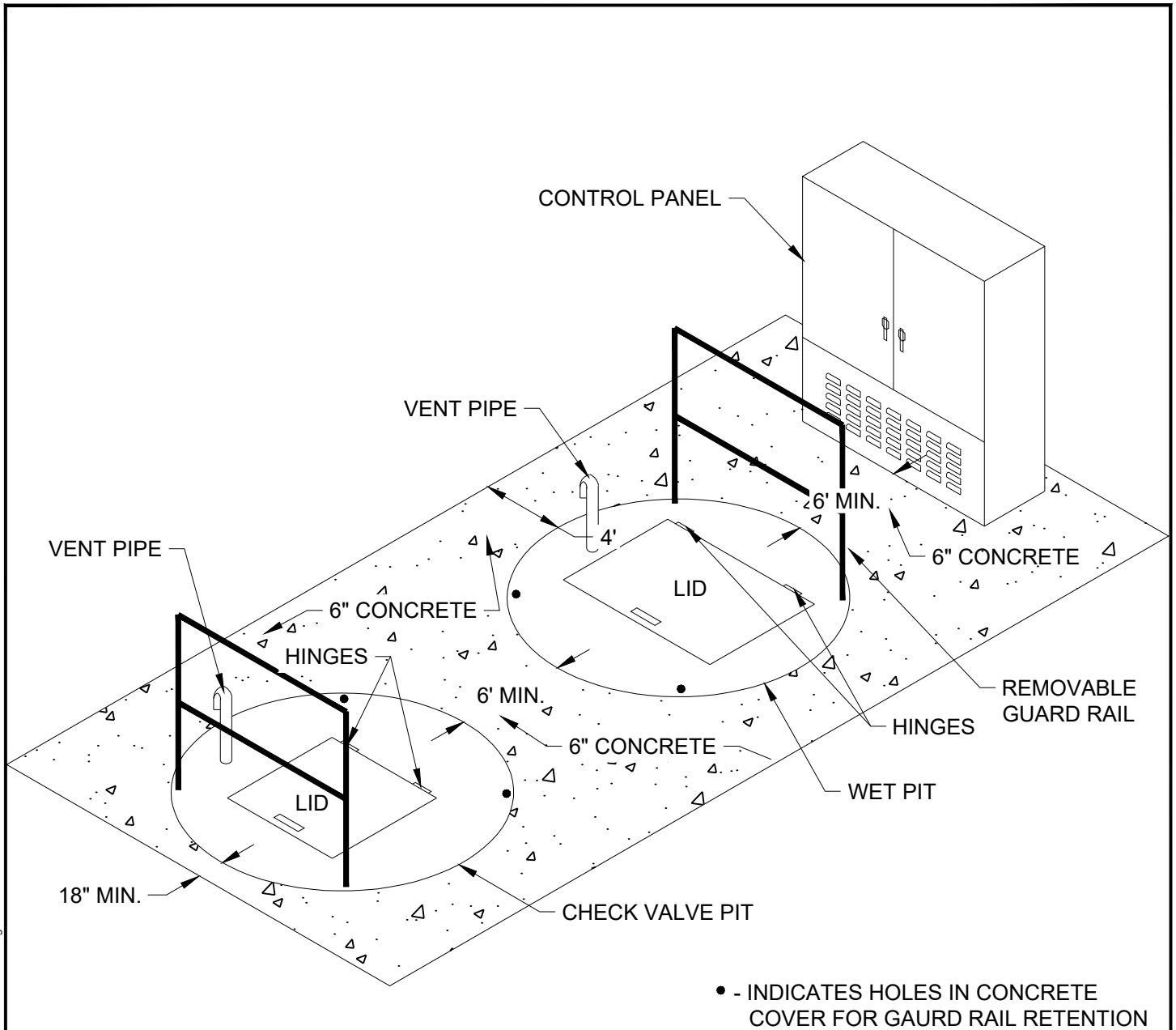
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City Plate No.:
P-03
Last Revision:
12/18/2020
Section:
4000

STANDARD DETAILS

LIFT STATION CONTROL PANEL





• - INDICATES HOLES IN CONCRETE COVER FOR GAURD RAIL RETENTION

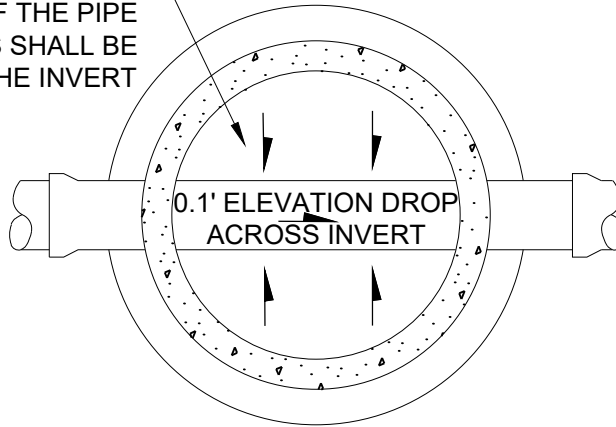
NOTES:

1. INSTALL REMOVABLE GUARD RAILS CAPABLE OF BEING UTILIZED ON ALL FOUR SIDES OF THE WELL. CAST SLEEVES INTO COVERS ACCORDINGLY.
2. ACCESS LID SHALL HINGE TOWARD THE GUARD RAIL ON WET PIT SETTING AS SHOWN.
3. GUARD RAIL SHALL BE 2-INCH DIAMETER GALVANIZED PIPE.
4. ALL CONCRETE SHALL BE POURED FLUSH WITH THE TOP ELEVATION OF THE WET WELL / DRY WELL COVERS.

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\IP-04_LIFT STATION CONTROL PANEL - ISOMETRIC.dwg

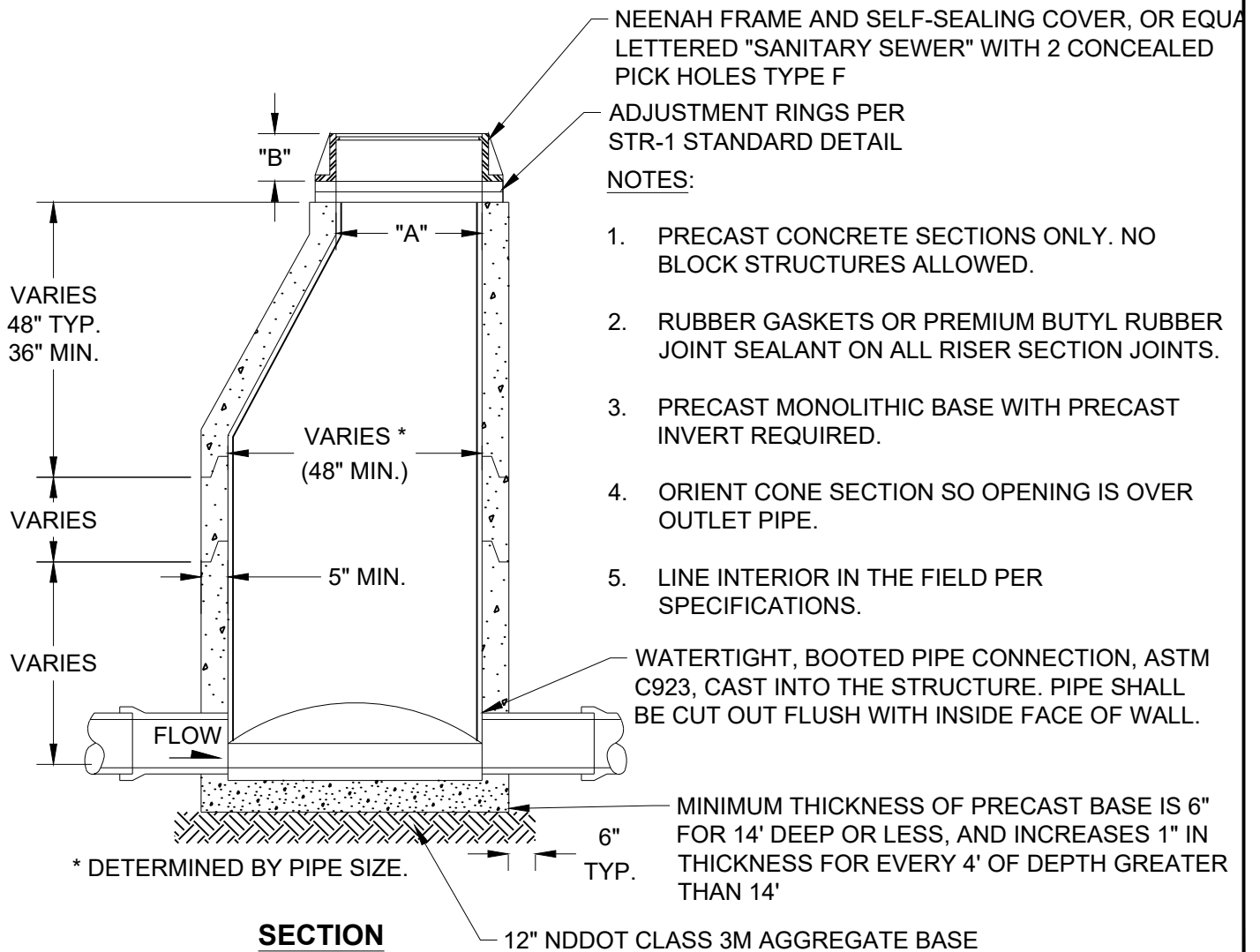
City Plate No.: P-04	STANDARD DETAILS LIFT STATION	
Last Revision: 12/18/2020		
Section: 4000		

PRECAST INVERT SHALL BE 1/2
DIAMETER OF THE PIPE
AND BENCHES SHALL BE
SLOPED 2" TOWARD THE INVERT



PLAN

CASTING	LID TYPE	A	B
1642	B	27"	7"



SECTION

NOTES:

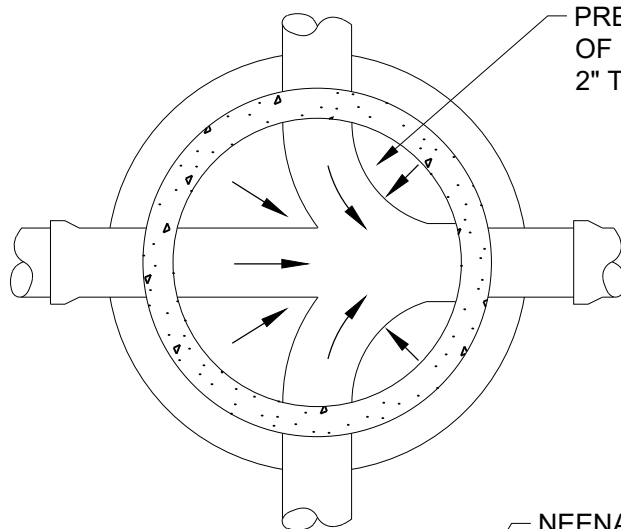
1. PRECAST CONCRETE SECTIONS ONLY. NO BLOCK STRUCTURES ALLOWED.
2. RUBBER GASKETS OR PREMIUM BUTYL RUBBER JOINT SEALANT ON ALL RISER SECTION JOINTS.
3. PRECAST MONOLITHIC BASE WITH PRECAST INVERT REQUIRED.
4. ORIENT CONE SECTION SO OPENING IS OVER OUTLET PIPE.
5. LINE INTERIOR IN THE FIELD PER SPECIFICATIONS.

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\SAN-1 - SANITARY SEWER MANHOLE.dwg

City Plate No.:	SAN-1
Last Revision:	12/18/2020
Section:	2300

STANDARD DETAILS
SANITARY SEWER MANHOLE

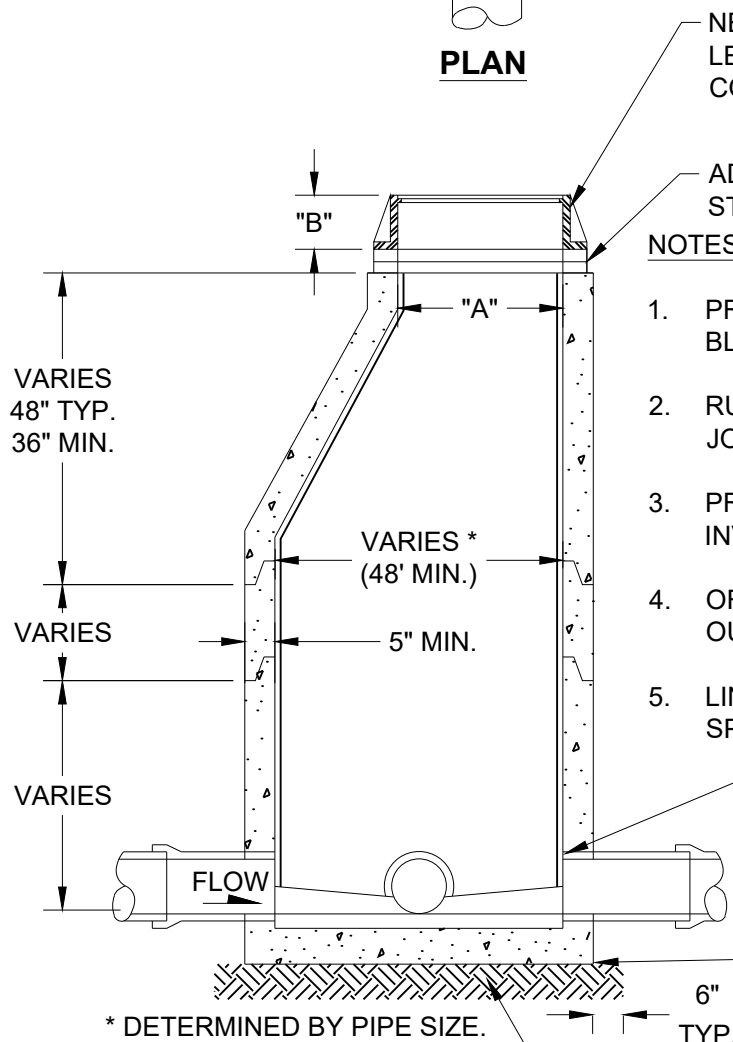




PLAN

PRECAST INVERT SHALL BE 1/2 DIAMETER OF PIPE AND BENCHES SHALL BE SLOPED 2" TOWARD INVERT

CASTING	LID TYPE	A	B
1642	B	27"	7"



SECTION

NEENAH FRAME AND TYPE B COVER OR EQUAL, LETTERED "SANITARY SEWER" WITH 2 CONCEALED PICK HOLES TYPE F

ADJUSTMENT RINGS PER STR-1 STANDARD DETAIL

NOTES:

1. PRECAST CONCRETE SECTIONS ONLY. NO BLOCK STRUCTURES ALLOWED.
2. RUBBER GASKETS OR PREMIUM BUTYL RUBBER JOINT SEALANT ON ALL RISER SECTION JOINTS.
3. PRECAST MONOLITHIC BASE WITH PRECAST INVERT REQUIRED.
4. ORIENT CONE SECTION SO OPENING IS OVER OUTLET PIPE.
5. LINE INTERIOR IN THE FIELD PER SPECIFICATIONS.

WATERTIGHT, BOOTED PIPE CONNECTION, ASTM C923, CAST INTO THE STRUCTURE. PIPE SHALL BE CUT OUT FLUSH WITH INSIDE FACE OF WALL.

MINIMUM THICKNESS OF PRECAST BASE IS 6" FOR 14' DEEP OR LESS, AND INCREASES 1" IN THICKNESS FOR EVERY 4' OF DEPTH GREATER THAN 14'.

* DETERMINED BY PIPE SIZE.

12" NDDOT CLASS 3M AGGREGATE BASE

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\SAN-2, SANITARY SEWER JUNCTION MANHOLE.dwg

City Plate No.:

SAN-2

Last Revision:

12/18/2020

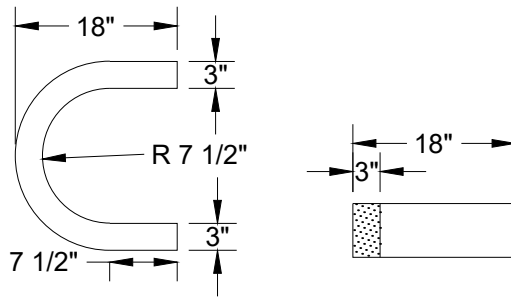
Section:

2300

STANDARD DETAILS

**SANITARY SEWER
JUNCTION MANHOLE**

City of Minot



PLAN

SECTION

HORSESHOE DETAILS

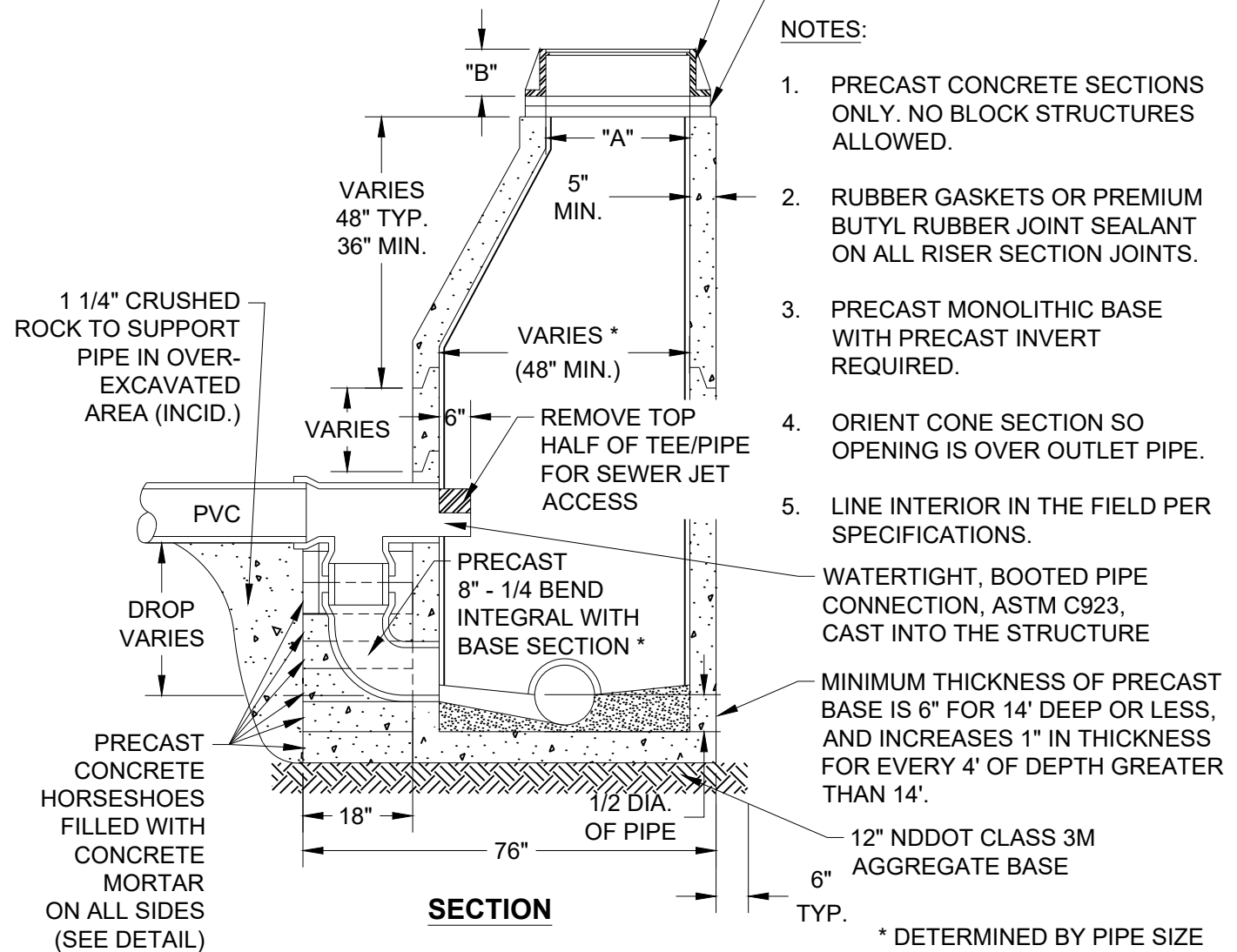
CASTING	LID TYPE	A	B
1642	B	27"	7"

NEENAH FRAME AND SELF-SEALING COVER OR EQUAL, LETTERED "SANITARY SEWER" WITH 2 CONCEALED PICK HOLES TYPE F

ADJUSTMENT RINGS PER STR-1 STANDARD DETAIL

NOTES:

1. PRECAST CONCRETE SECTIONS ONLY. NO BLOCK STRUCTURES ALLOWED.
2. RUBBER GASKETS OR PREMIUM BUTYL RUBBER JOINT SEALANT ON ALL RISER SECTION JOINTS.
3. PRECAST MONOLITHIC BASE WITH PRECAST INVERT REQUIRED.
4. ORIENT CONE SECTION SO OPENING IS OVER OUTLET PIPE.
5. LINE INTERIOR IN THE FIELD PER SPECIFICATIONS.



WATERTIGHT, BOOTED PIPE CONNECTION, ASTM C923, CAST INTO THE STRUCTURE

MINIMUM THICKNESS OF PRECAST BASE IS 6" FOR 14' DEEP OR LESS, AND INCREASES 1" IN THICKNESS FOR EVERY 4' OF DEPTH GREATER THAN 14'.

12" NDDOT CLASS 3M AGGREGATE BASE

TYP.

* DETERMINED BY PIPE SIZE

SECTION

City Plate No.:

SAN-3

Last Revision:

12/18/2020

Section:

2300

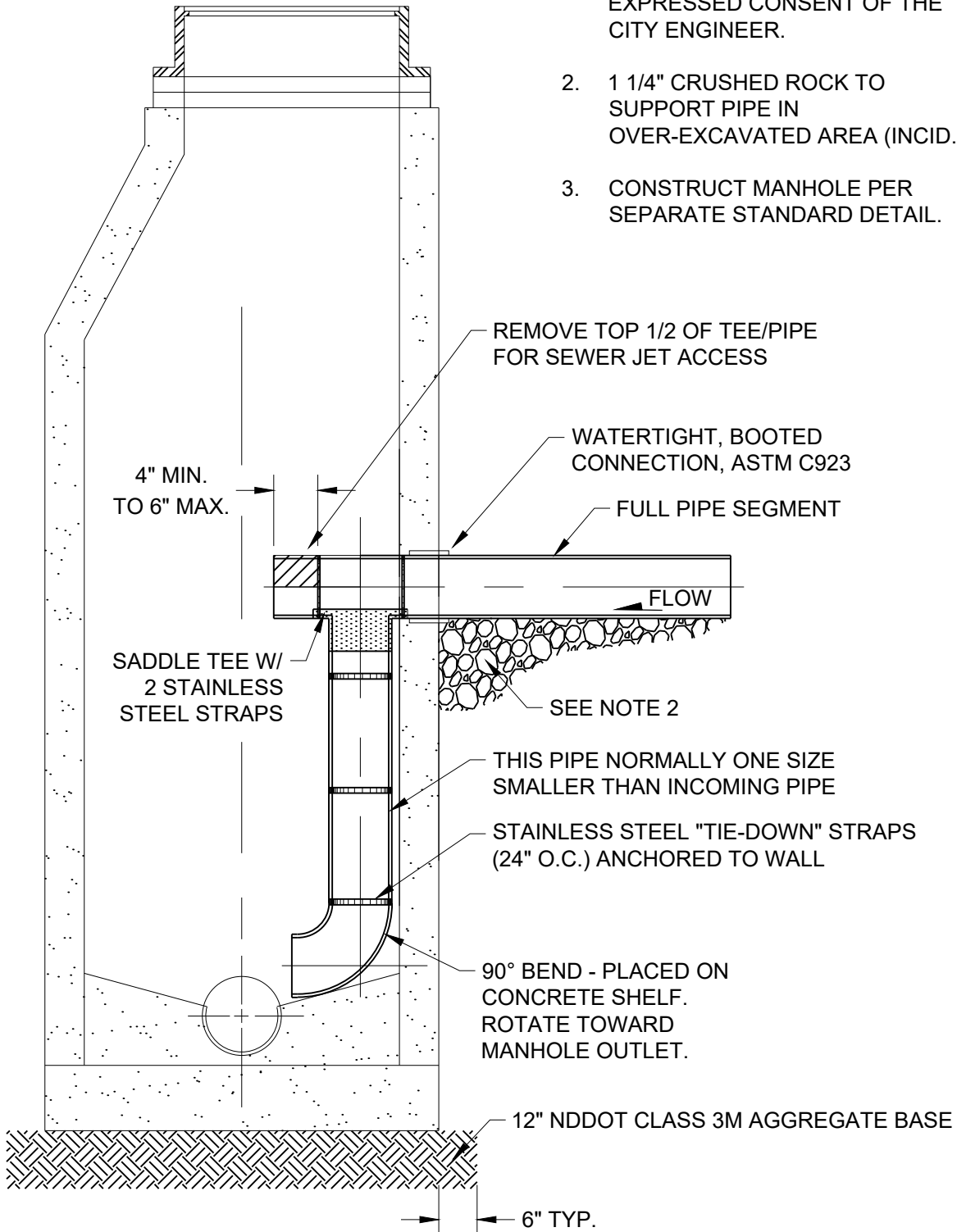
STANDARD DETAILS

SANITARY SEWER DROP INLET MANHOLE

City of Minot

NOTES:

1. THE INTERIOR DROP CONNECTION AS SHOWN WILL ONLY BE USED WITH THE EXPRESSED CONSENT OF THE CITY ENGINEER.
2. 1 1/4" CRUSHED ROCK TO SUPPORT PIPE IN OVER-EXCAVATED AREA (INCID.)
3. CONSTRUCT MANHOLE PER SEPARATE STANDARD DETAIL.



M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\SAN-4. SANITARY SEWER INSIDE DROP CONNECTION.dwg

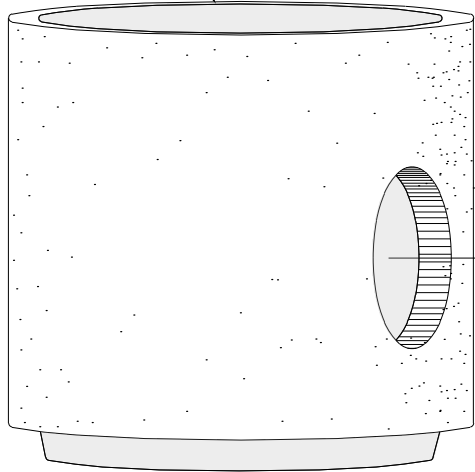
City Plate No.:	SAN-4
Last Revision:	12/18/2020
Section:	2300

STANDARD DETAILS

**SANITARY SEWER
INSIDE DROP CONNECTION**

City of Minot

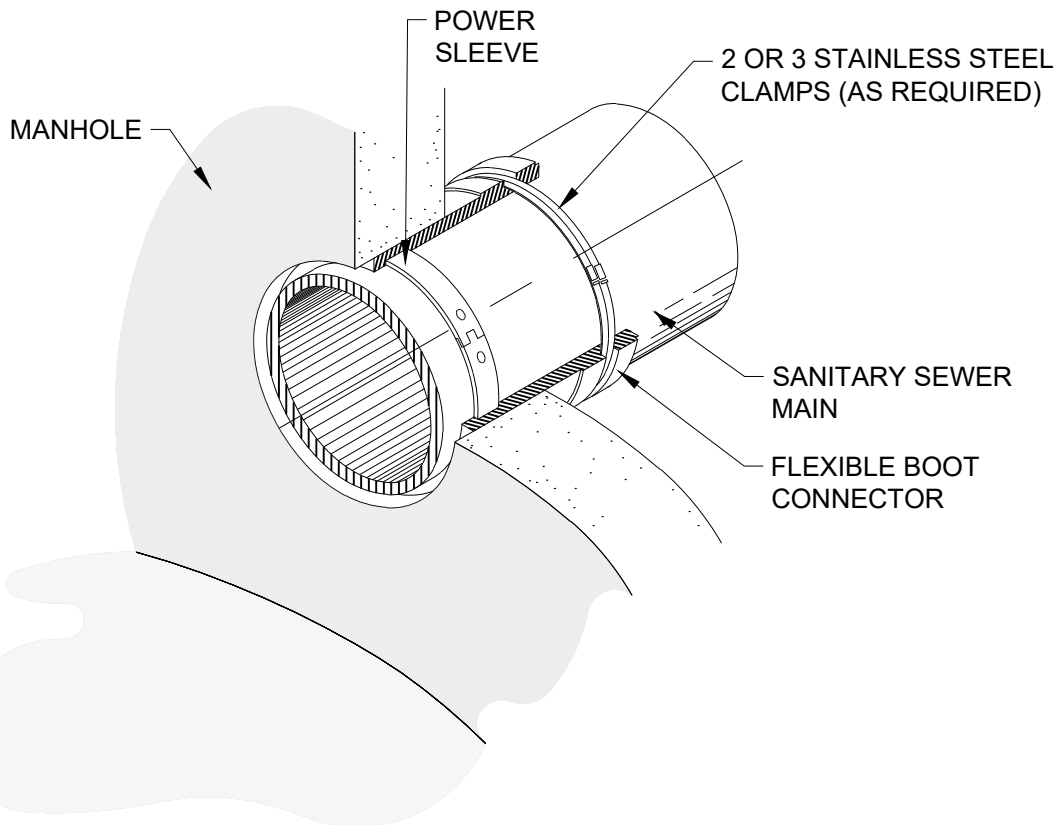
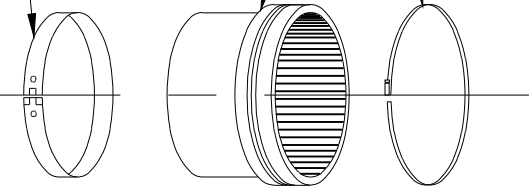
MANHOLE



POWER
SLEEVE

STAINLESS
STEEL CLAMP

FLEXIBLE BOOT
CONNECTOR



POWER
SLEEVE

2 OR 3 STAINLESS STEEL
CLAMPS (AS REQUIRED)

MANHOLE

SANITARY SEWER
MAIN

FLEXIBLE BOOT
CONNECTOR

City Plate No.:

SAN-5

Last Revision:

12/18/2020

Section:

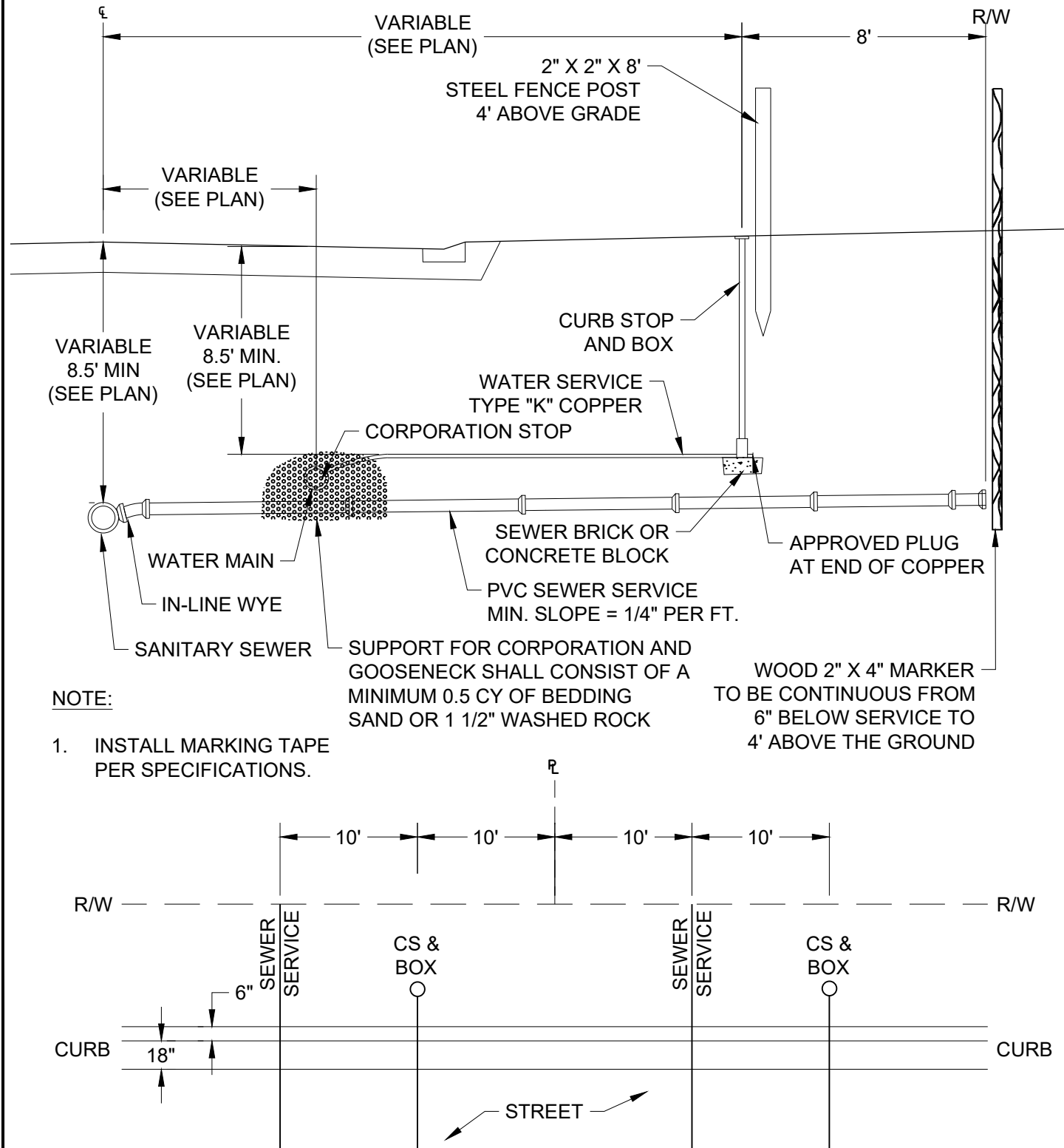
2300

STANDARD DETAILS

CORED MANHOLE CONNECTION

City of Minot

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\SER-1 - RESIDENTIAL PROPERTY SEWER & WATER SERVICE CONNECTIONS.dwg



City Plate No.:

SER-1

Last Revision:

12/18/2020

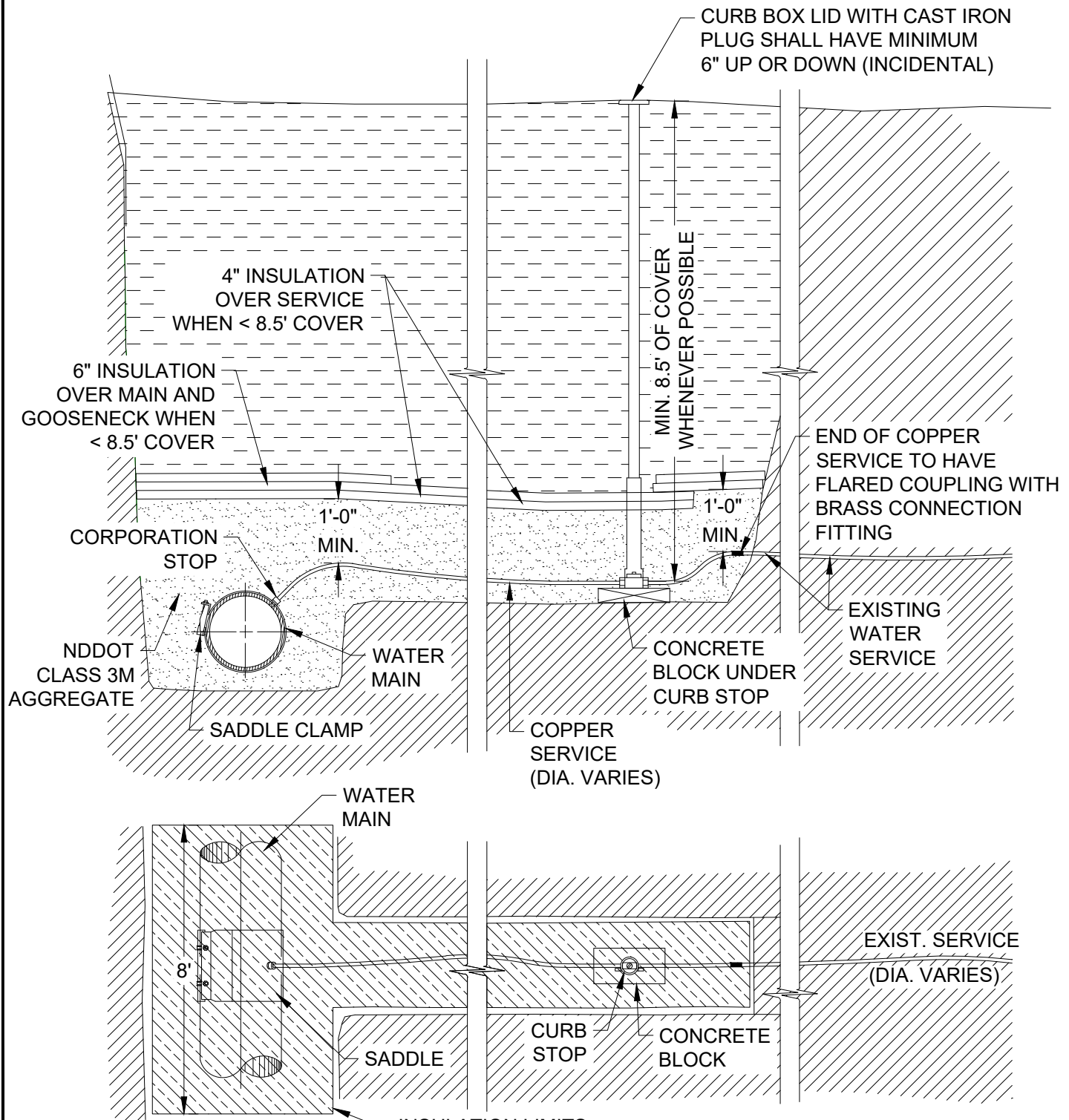
Section:

2200 & 2400

STANDARD DETAILS

RESIDENTIAL PROPERTY SEWER & WATER SERVICE CONNECTIONS

City of Minot



NOTES:

1. CURB STOP TO BE PLACED ON A CONCRETE BLOCK.
2. ALL INSULATION BOARDS SHALL BE 2" THICK, STACKED TO ACHIEVE TOTAL THICKNESS DESIRED.

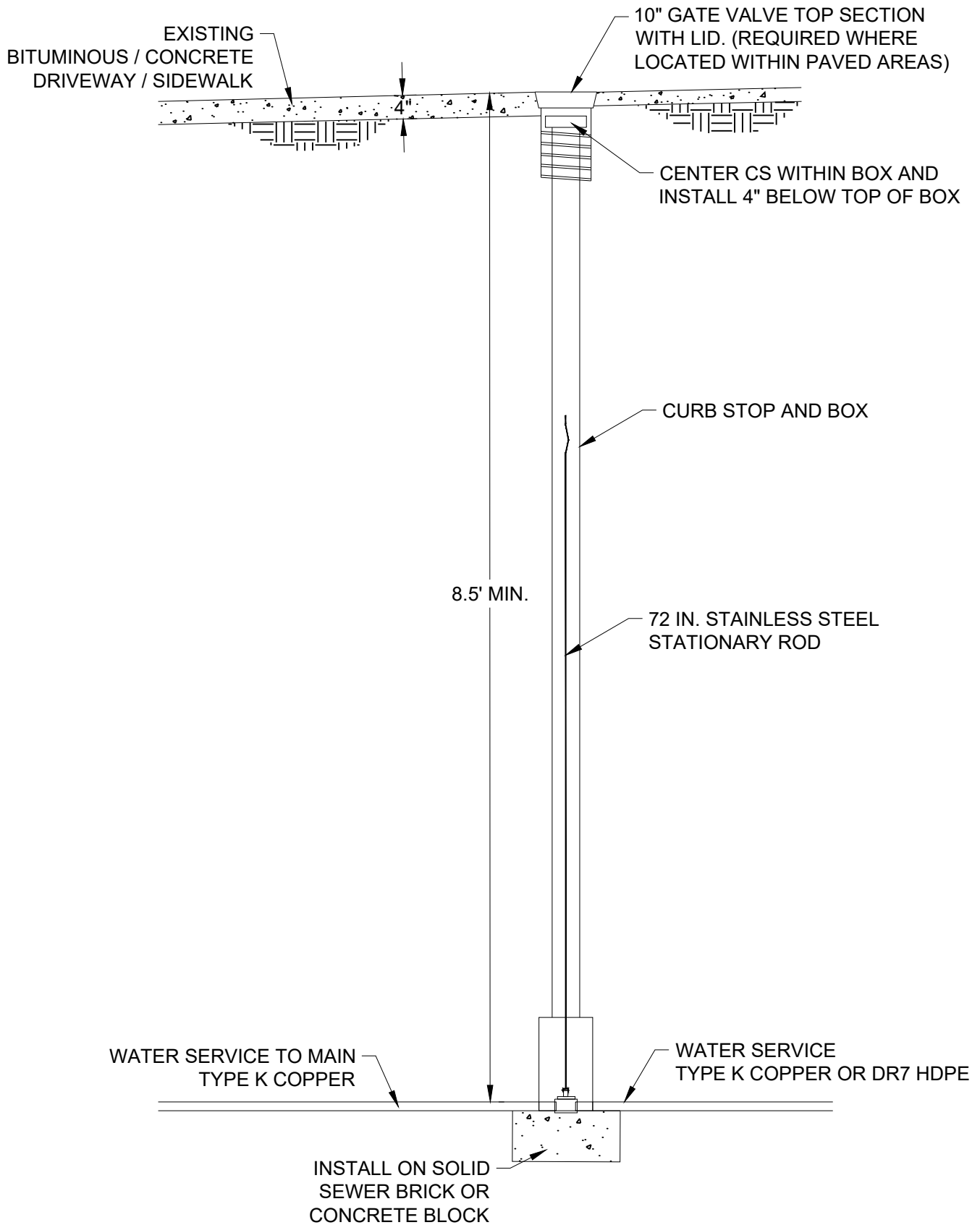
INSULATION LIMITS.
INSTALL TO TRENCH WALL.

City Plate No.:	SER-2
Last Revision:	12/18/2020
Section:	2200

STANDARD DETAILS

**WATER SERVICE FOR
REPLACEMENT PROJECTS**

City of Minot



City Plate No.:

SER-3

Last Revision:

2/22/2024

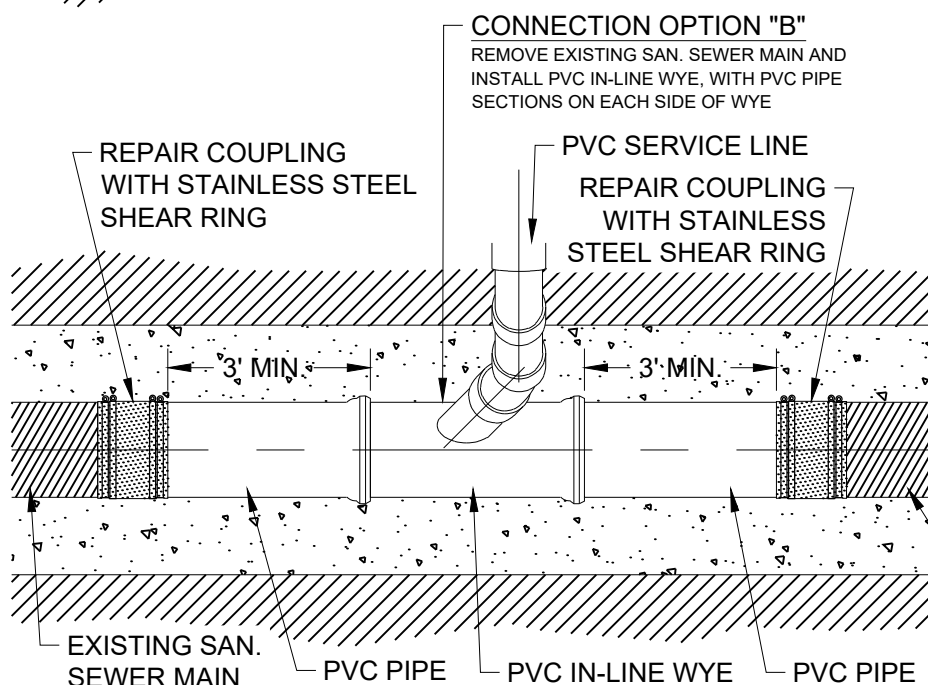
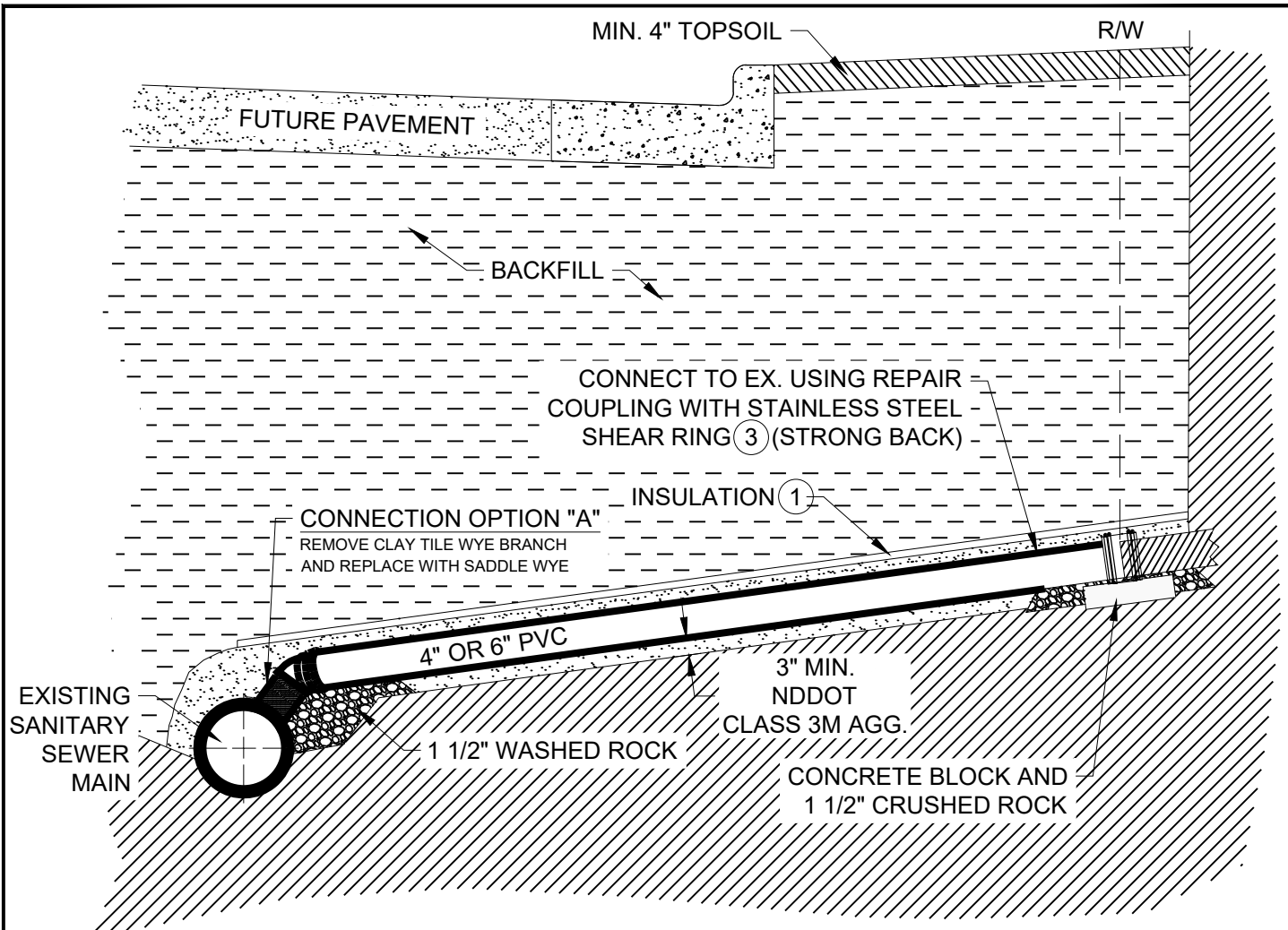
Section:

2200

STANDARD DETAILS

CURB BOX PROTECTION

City of Minot



NOTES:

1. INSULATION REQUIRED WHERE SERVICE IS LESS THAN 8.5' DEEP PER DETAIL BED-5.
 2. USE CONNECTION OPTION "A" IF EX. WYE BELL IS GOOD, "B" WHEN EX. WYE BELL IS BROKEN.
 3. PIPES SHALL BE BUTTED TOGETHER WITH REPAIR COUPLING CENTERED ON BUTT-JOINT.
- EXISTING SAN. SEWER MAIN

City Plate No.:

SER-4

Last Revision:

02/24/2022

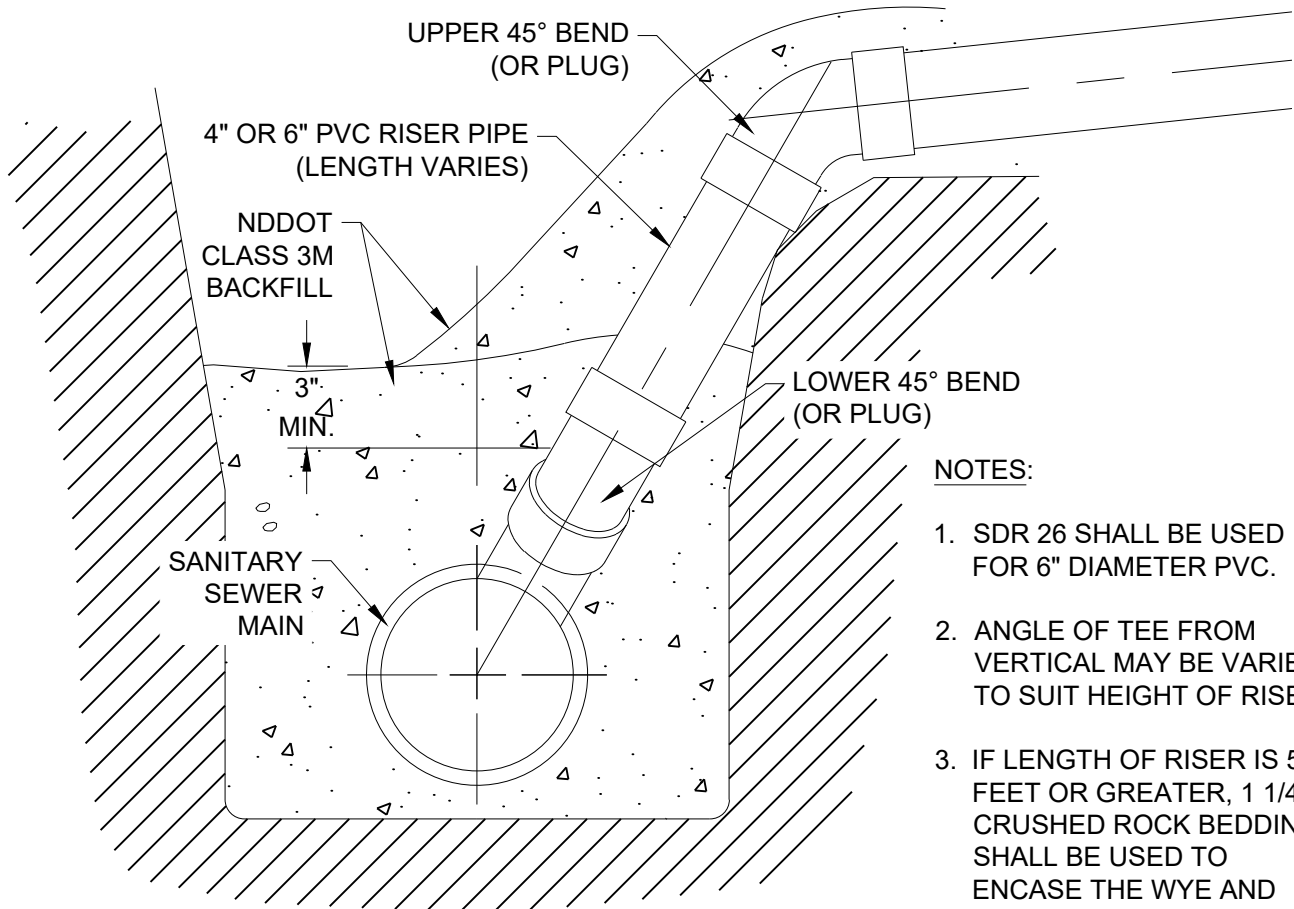
Section:

2400

STANDARD DETAILS

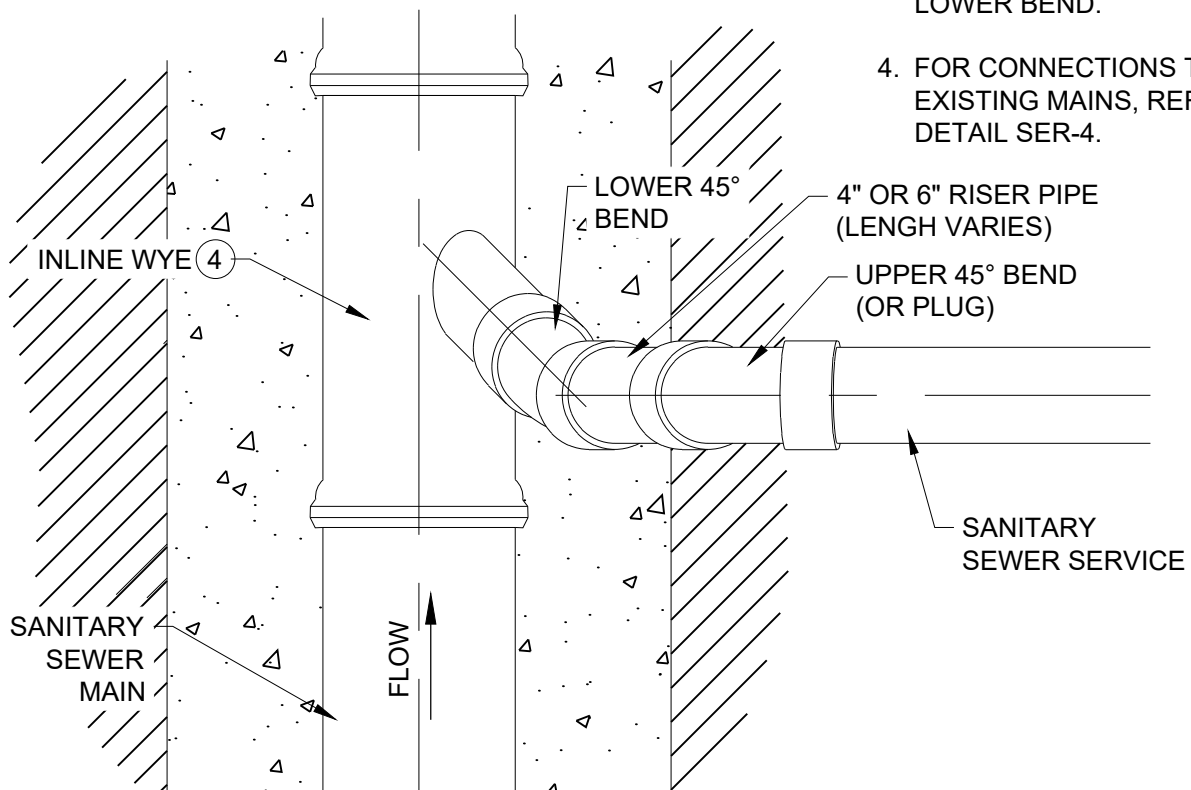
SEWER SERVICE FOR REPLACEMENT PROJECTS

City of Minot



NOTES:

1. SDR 26 SHALL BE USED FOR 6" DIAMETER PVC.
2. ANGLE OF TEE FROM VERTICAL MAY BE VARIED TO SUIT HEIGHT OF RISER.
3. IF LENGTH OF RISER IS 5 FEET OR GREATER, 1 1/4" CRUSHED ROCK BEDDING SHALL BE USED TO ENCASE THE WYE AND LOWER BEND.
4. FOR CONNECTIONS TO EXISTING MAINS, REFER TO DETAIL SER-4.



City Plate No.:

SER-5

Last Revision:

12/18/2020

Section:

2400

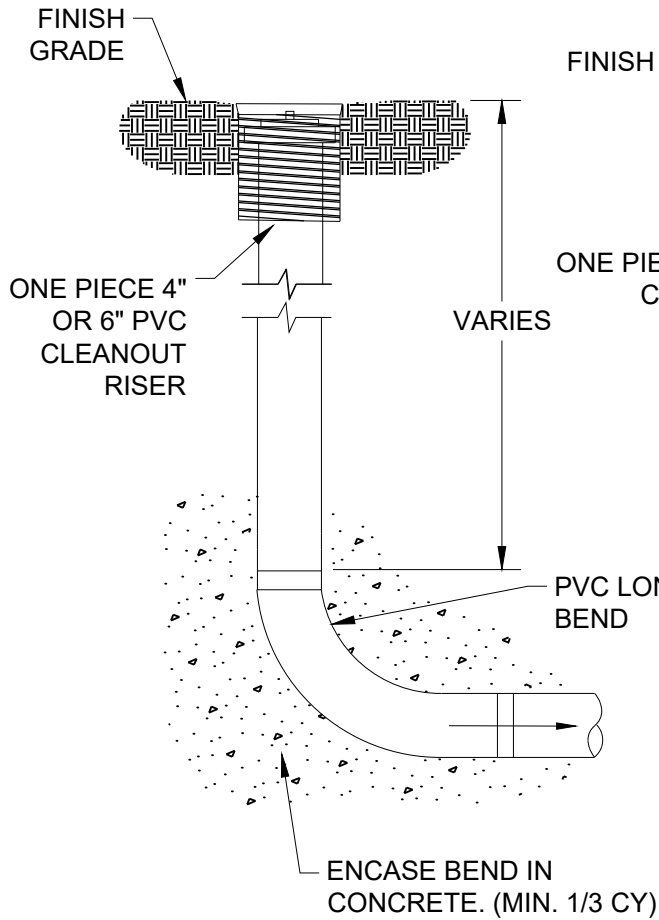
STANDARD DETAILS

SEWER SERVICE RISER

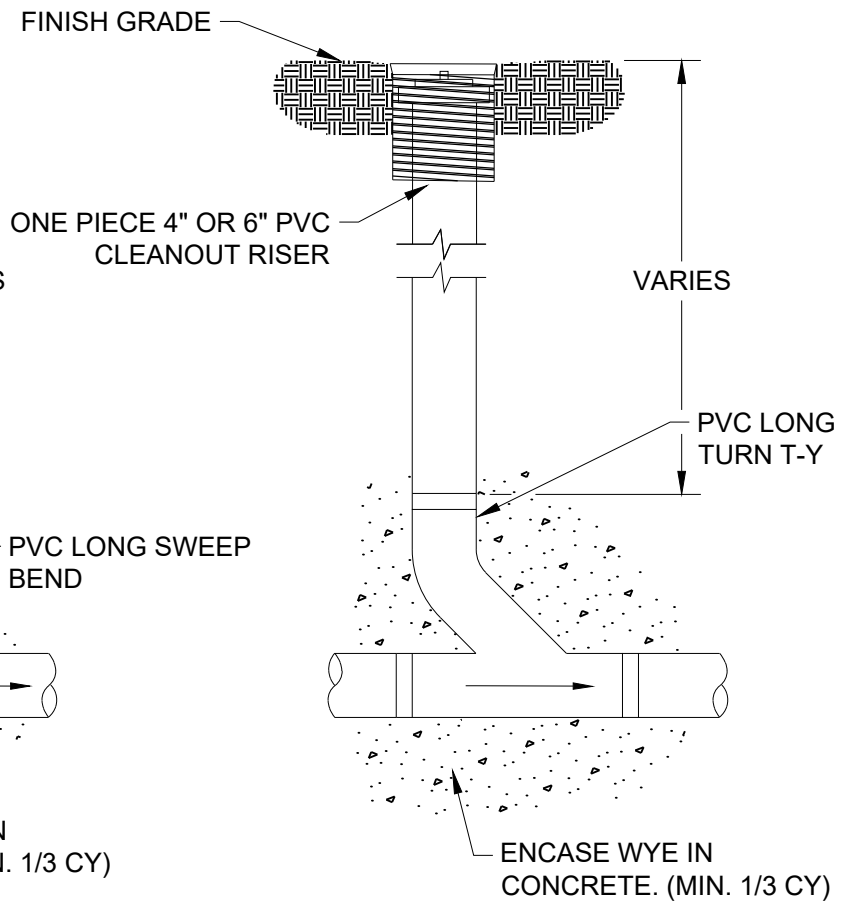
City of Minot

NOTES:

1. THREADED PVC PLUG. DO NOT GLUE.
2. FOR 4" CLEANOUTS, USE A 10" GV TOP SECTION WITH LID.
3. FOR 6" CLEANOUTS, USE PROSELECT ASSEMBLED CAST IRON CLEANOUT BODY WITH COVER, MODEL NUMBER PSVBM1007SWR OR APPROVED EQUAL.
4. SDR 26 SHALL BE USED FOR 6" PVC.



END OF LINE CLEANOUT



IN-LINE CLEANOUT

M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\SER-6_SANITARY SERVICE LINE CLEANOUTS.dwg

City Plate No.:

SER-6

Last Revision:

12/18/2020

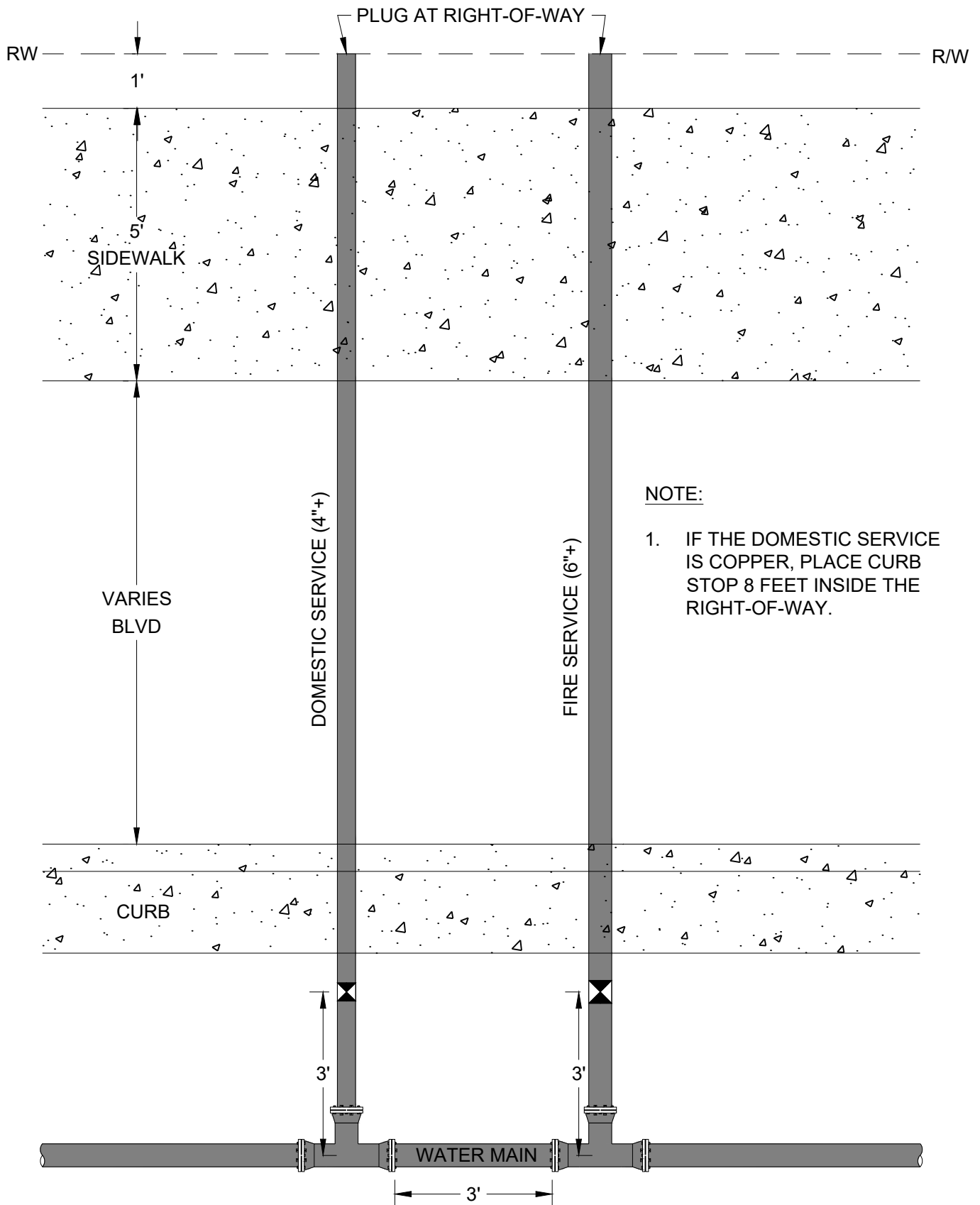
Section:

2400

STANDARD DETAILS

**SANITARY SERVICE LINE
CLEANOUTS**

City of Minot



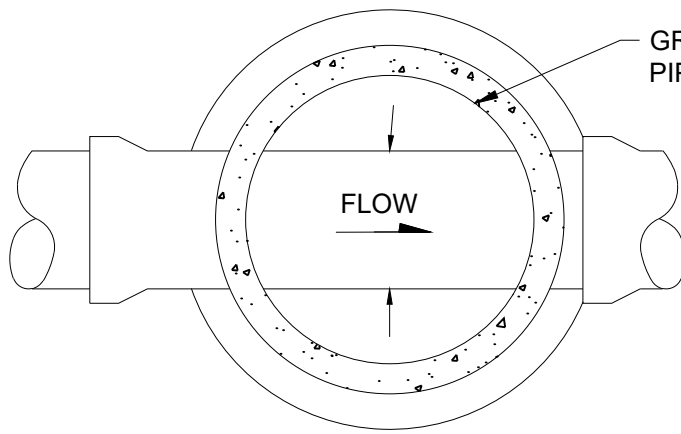
M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\SER-7 - COMMERCIAL PROPERTY WATER SERVICE CONNECTIONS.dwg

City Plate No.:	SER-7
Last Revision:	12/18/2020
Section:	2200

STANDARD DETAILS

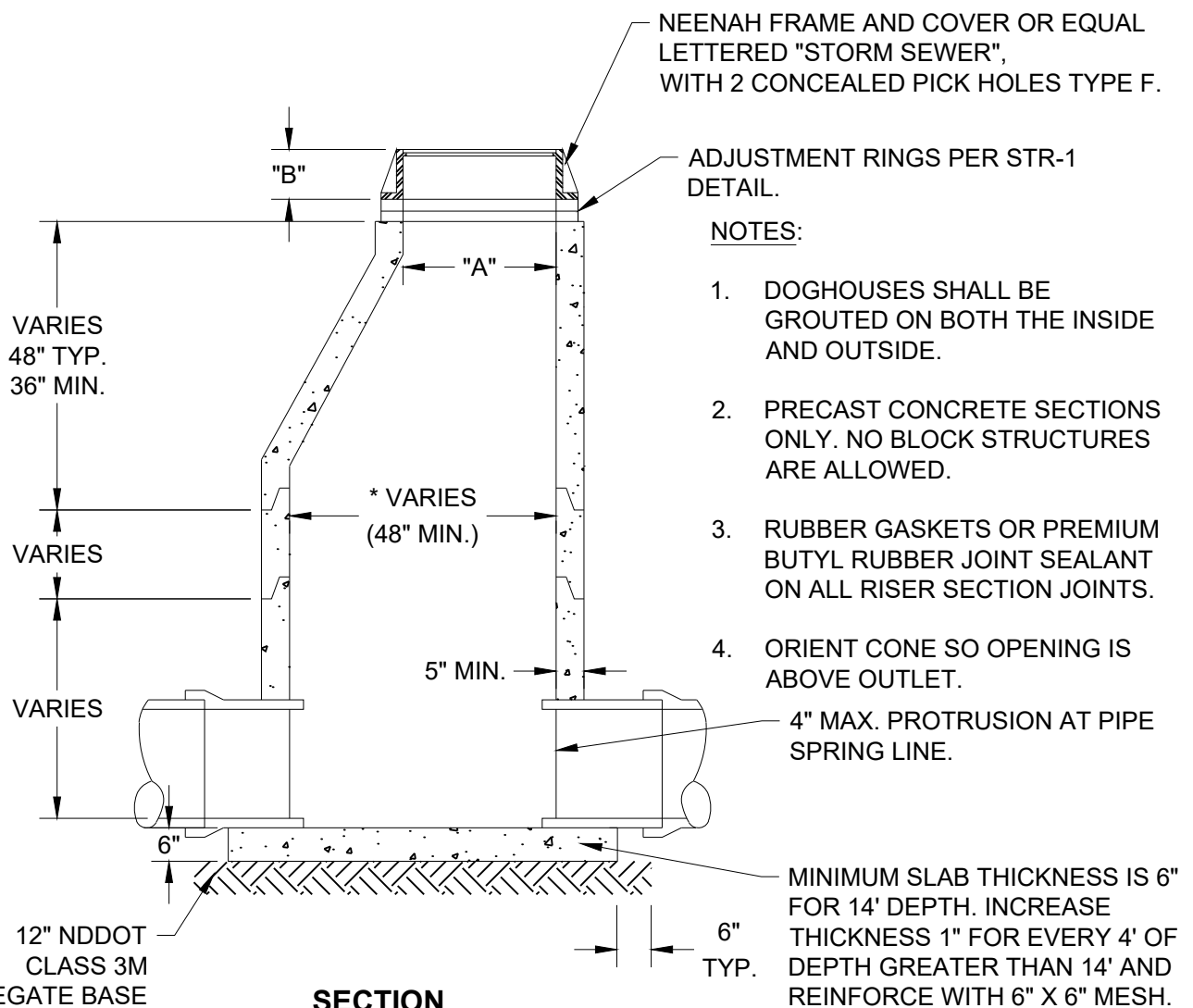
**COMMERCIAL PROPERTY
WATER SERVICE CONNECTIONS**





CASTING	LID TYPE	A	B
1642	B	27"	7"

PLAN



SECTION

*DETERMINED BY PIPE

City Plate No.:

STO-1

Last Revision:

12/18/2020

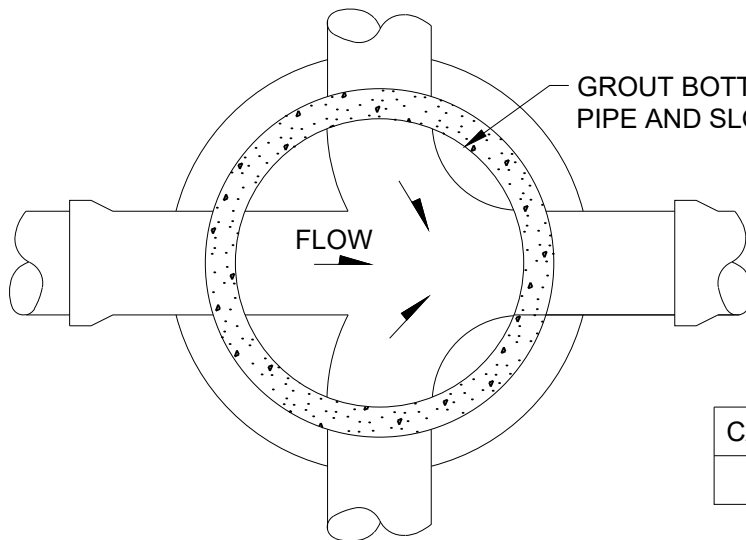
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2700

STANDARD DETAILS

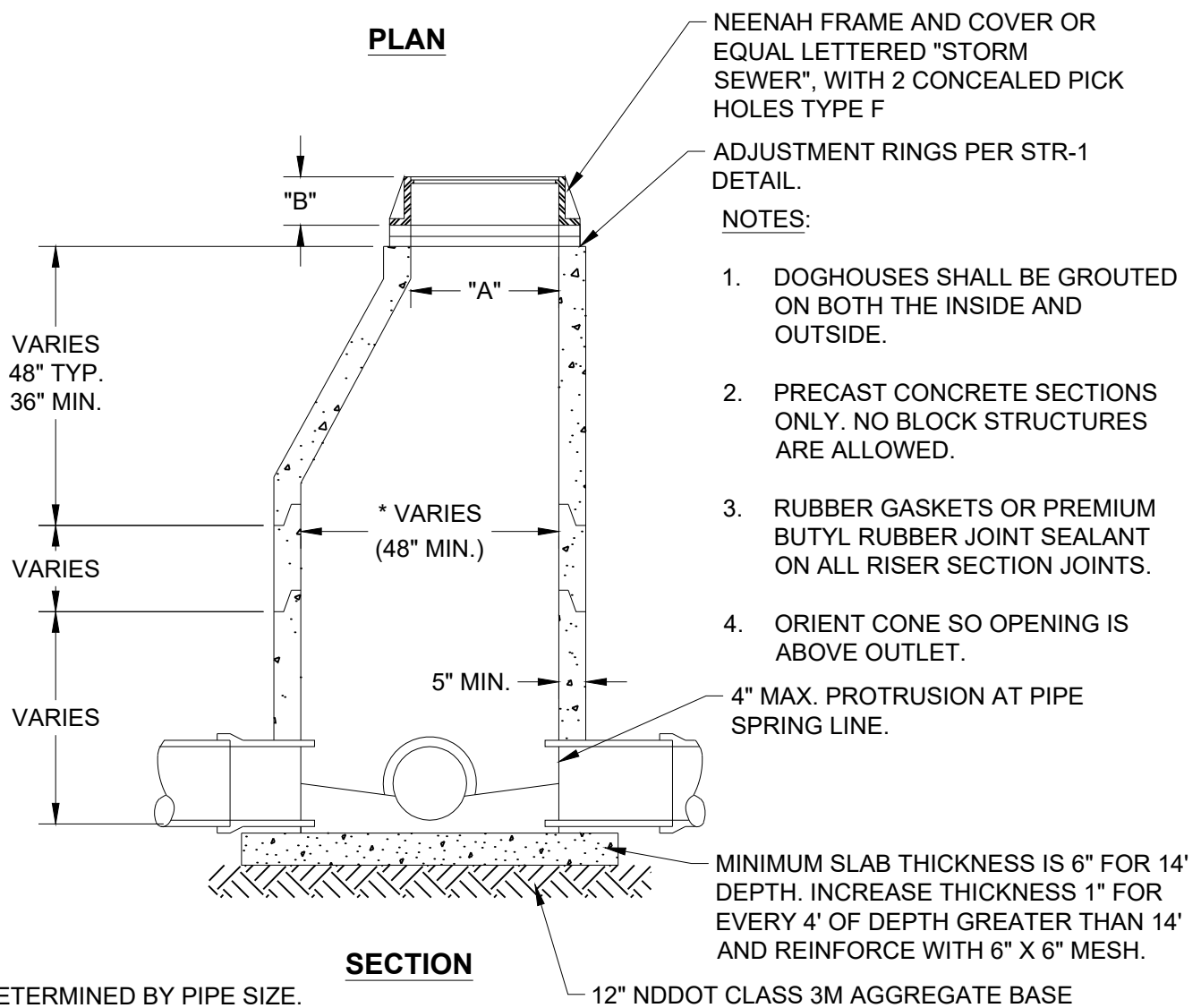
STORM SEWER MANHOLE

City of Minot



PLAN

CASTING	LID TYPE	A	B
1642	B	27"	7"



SECTION

*DETERMINED BY PIPE SIZE.

City Plate No.:

STO-2

Last Revision:

12/18/2020

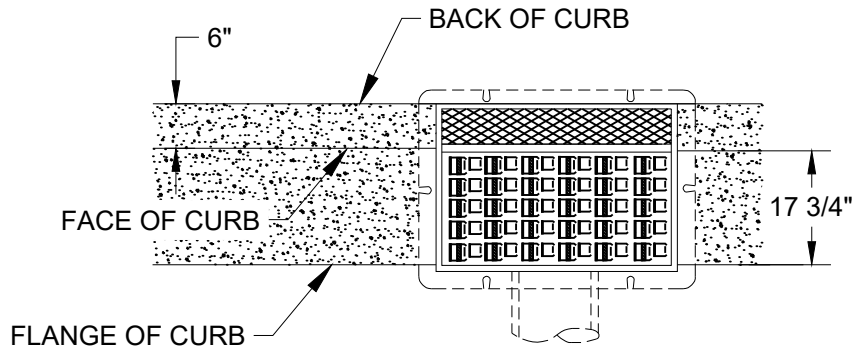
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2700

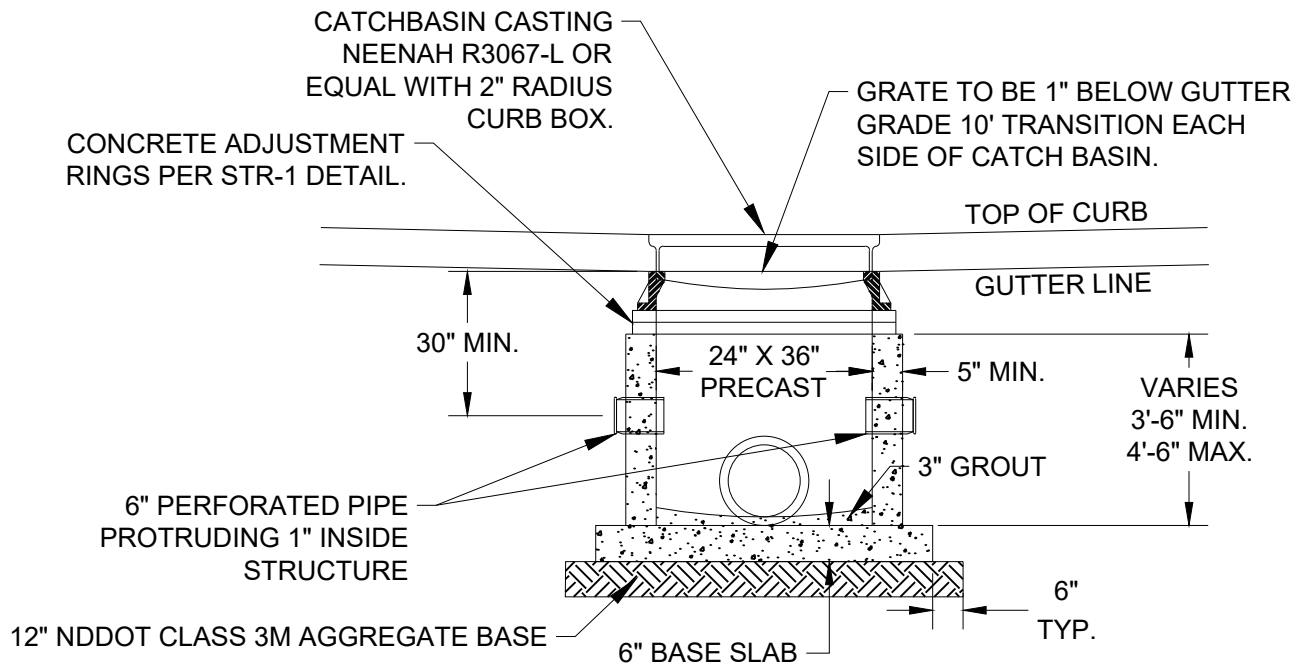
STANDARD DETAILS

STORM SEWER JUNCTION MANHOLE

City of Minot



PLAN



NOTES:

SECTION

1. DOGHOUSES SHALL BE GROUTED ON BOTH THE INSIDE AND OUTSIDE.
2. PRECAST CONCRETE SECTIONS ONLY. NO BLOCK STRUCTURES ARE ALLOWED.
3. DRAIN TILE HOLES TO BE PRECAST OR CORE DRILLED.
4. WHEN DRAIN TILE LOCATION CONFLICTS WITH OTHER PIPE CONNECTIONS, CORE DRILL HOLES IN THE FIELD ELSEWHERE IN THE CATCH BASIN. FLOW MUST BE MAINTAINED.

City Plate No.:

STO-3

Last Revision:

12/18/2020

Section:

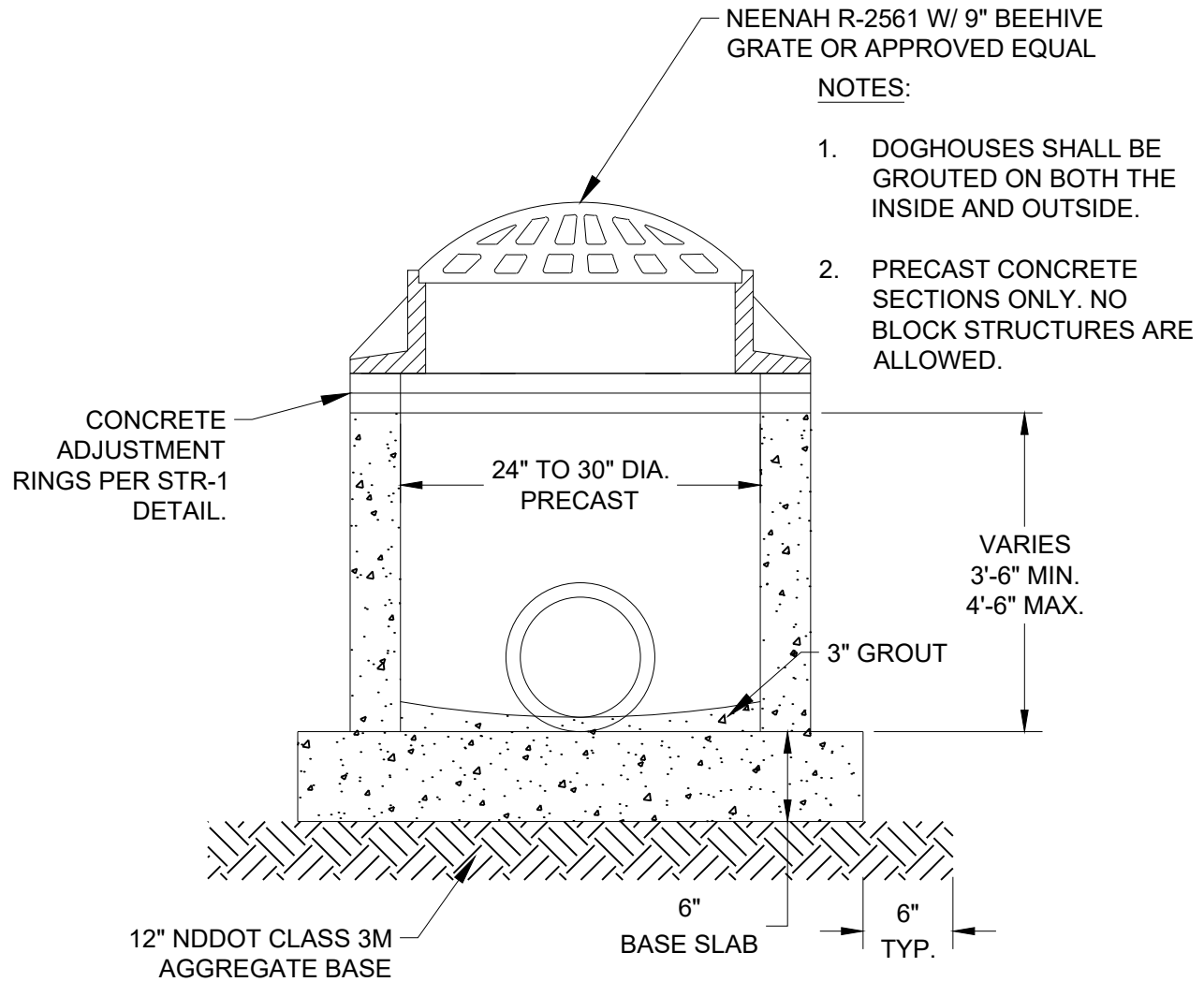
2700

STANDARD DETAILS

CATCH BASIN CURB & GUTTER INSTALLATION

City of Minot

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SECTION

City Plate No.:

STO-4

Last Revision:

12/18/2020

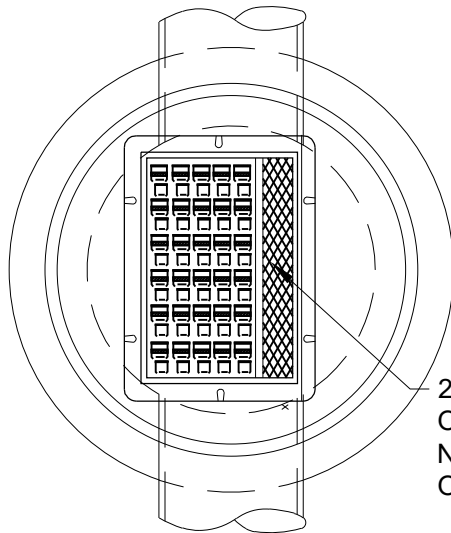
Section:

2700

STANDARD DETAILS

**ROUND INLET
TURF INSTALLATION**

City of Minot



24" X 36" SLAB
OPENING FOR
NEENAH R3067-L
OR EQUAL.

PLAN

DIMENSION FROM BACK OF CURB TO CENTER OF
PIPE WHERE CONE SECTION IS USED

MANHOLE DIAMETER	MEASUREMENT
4'	9" IN FROM BACK OF CURB
5'	3" IN FROM BACK OF CURB
6'	3" BEHIND BACK OF CURB
7'	9" BEHIND BACK OF CURB
8'	15" BEHIND BACK OF CURB

PAVE 1/4" TO 1/2"
ABOVE FRAME

PAVEMENT

6"

VARIES

VARIES

GROUT BOTTOM

6" MIN.

R2"

30" MIN.

VARIES *
48" MIN.

SECTION

5" MIN.



NEENAH R3067-L CASTING OR EQUAL

CONCRETE ADJUSTMENT RINGS
PER STR-1 DETAIL

6" MIN. PRECAST REINFORCED
CONCRETE SLAB (OR CONE
SECTION). TOP OF BARREL SECTION
UNDER TOP SLAB TO HAVE FLAT TOP
EDGE SEALED WITH 2 BEADS OF
PREMIUM BUTYL RUBBER SEALANT.

6" PERFORATED PVC PIPE
PROTRUDING 1" INSIDE
STRUCTURE (BOTH SIDES)

NOTES:

1. DOGHOUSES SHALL BE GROUTED ON BOTH THE INSIDE AND OUTSIDE.
2. PRECAST CONCRETE SECTIONS ONLY. NO BLOCK STRUCTURES ARE ALLOWED.
3. RUBBER GASKETS OR PREMIUM BUTYL RUBBER JOINT SEALANT ON ALL RISER SECTION JOINTS.
4. DRAIN TILE HOLES TO BE PRECAST OR CORE DRILLED.
5. WHEN DRAIN TILE LOCATION CONFLICTS WITH OTHER PIPE CONNECTIONS, CORE DRILL HOLES IN THE FIELD ELSEWHERE IN THE CATCH BASIN. FLOW MUST BE MAINTAINED.

MINIMUM SLAB THICKNESS, 6" FOR
14' DEPTH. INCREASE THICKNESS 1"
FOR EACH 4' OF DEPTH GREATER
THAN 14' AND REINFORCE WITH 6" X
6" 10/10 MESH.

12" NDDOT CLASS 3M AGGREGATE BASE

* DETERMINED BY PIPE SIZE.

City Plate No.:

STO-5

Last Revision:

12/18/2020

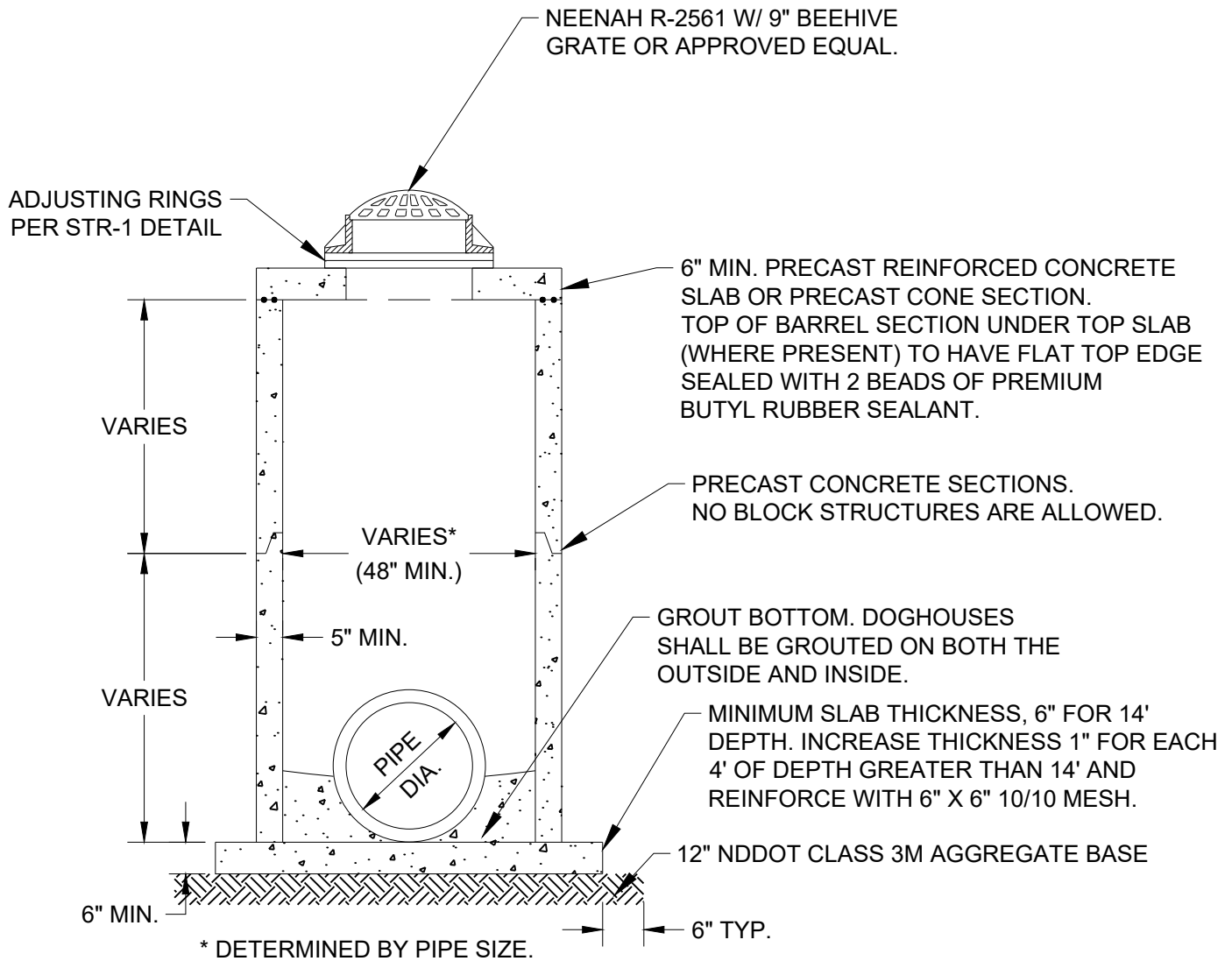
Section:

2700

STANDARD DETAILS

CATCH BASIN MANHOLE CURB & GUTTER INSTALLATION

City of Minot



City Plate No.:

STO-6

Last Revision:

12/18/2020

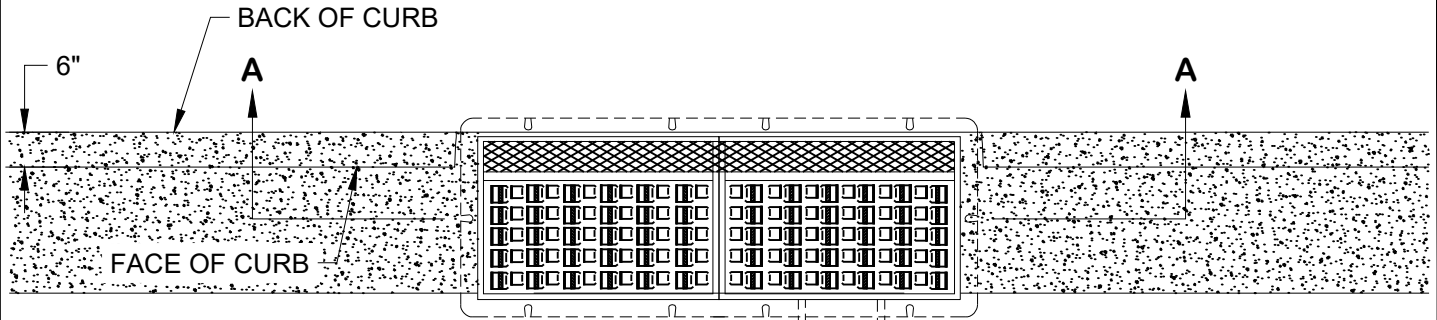
Section:

2700

STANDARD DETAILS

CATCH BASIN MANHOLE TURF INSTALLATION

City of Minot

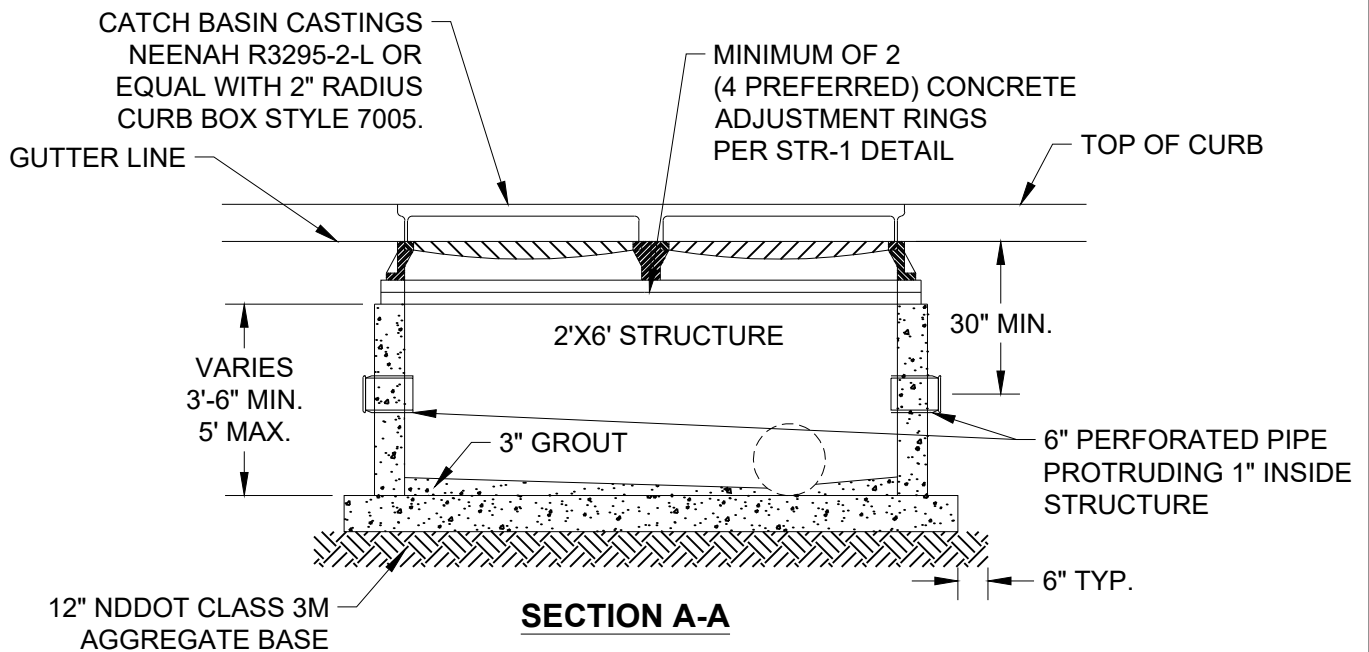


NOTE:

NO CONCRETE BEHIND OR ON TOP OF CATCH BASIN CASTING.

PLAN

PIPE LOCATION VARIES



SECTION A-A

NOTES:

1. DOGHOUSES SHALL BE GROUTED ON BOTH THE INSIDE AND OUTSIDE.
2. PRECAST CONCRETE SECTIONS ONLY. NO BLOCK STRUCTURES ALLOWED.
3. CATCH BASIN MANHOLE IF BUILD IS GREATER THAN 5' OR IF REQUIRED TO ACCOMMODATE OUTLET PIPE SIZE/ALIGNMENT.
4. AT SAG LOCATIONS, CATCH BASIN RIM TO BE DEPRESSED 1" BELOW DESIGN GUTTER LINE GRADE.
5. 4" VERTICAL HOOD OPENING MAX.
6. DRAIN TILE HOLES TO BE PRECAST OR CORE DRILLED.
7. WHEN DRAIN TILE LOCATION CONFLICTS WITH OTHER PIPE CONNECTIONS, CORE DRILL HOLES IN THE FIELD ELSEWHERE IN THE CATCH BASIN. FLOW MUST BE MAINTAINED.

City Plate No.:

STO-7

Last Revision:

12/18/2020

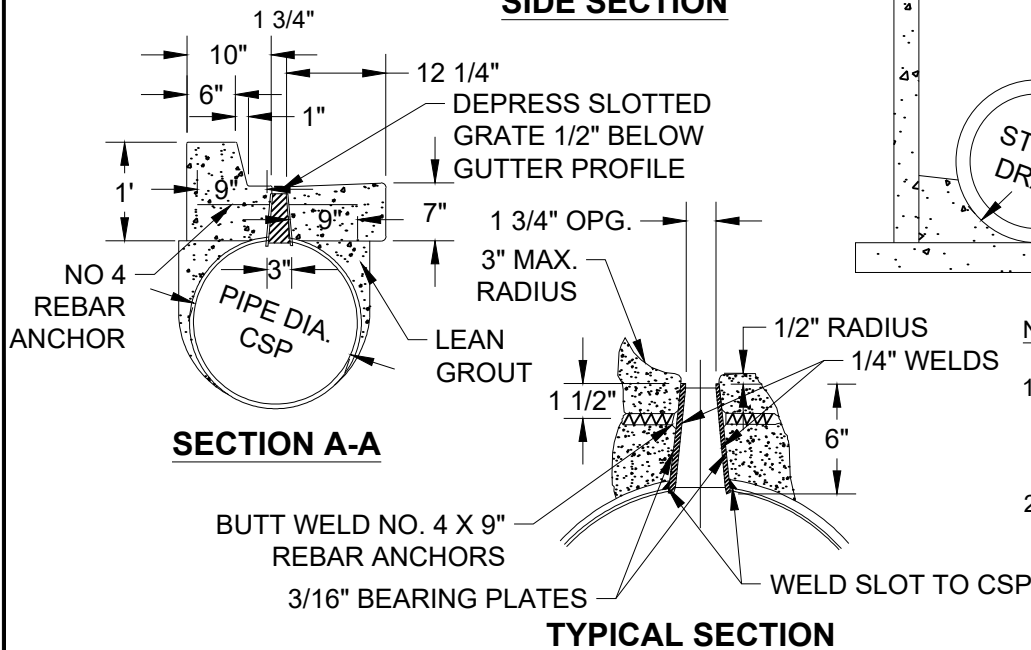
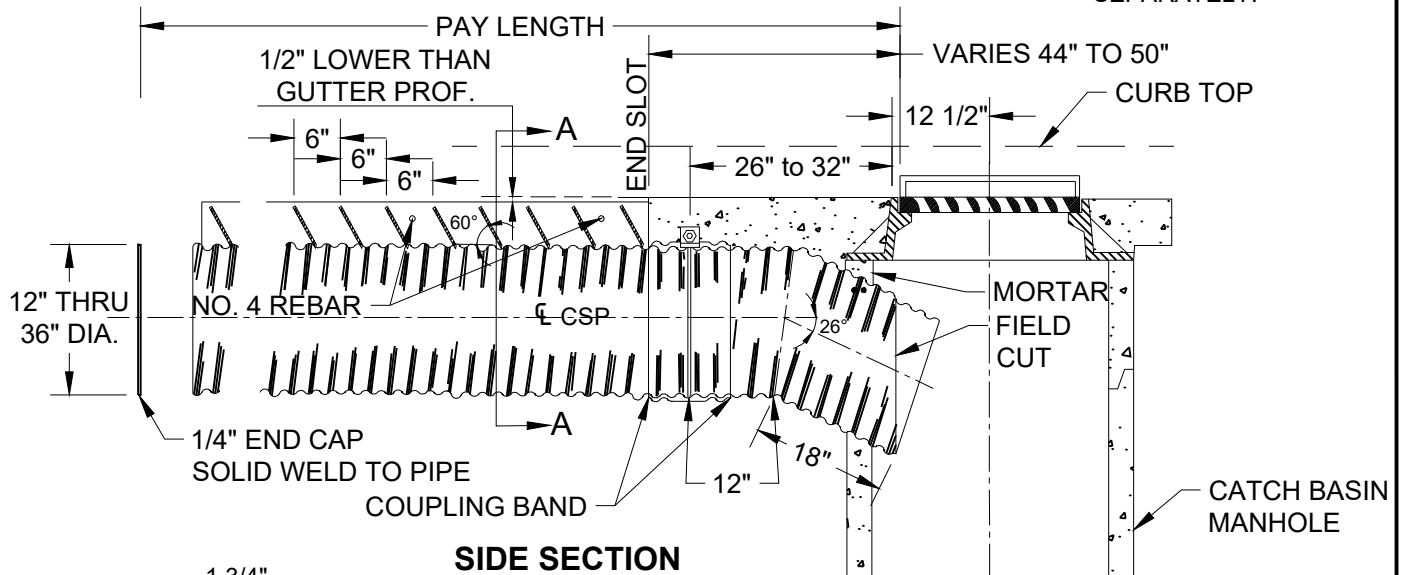
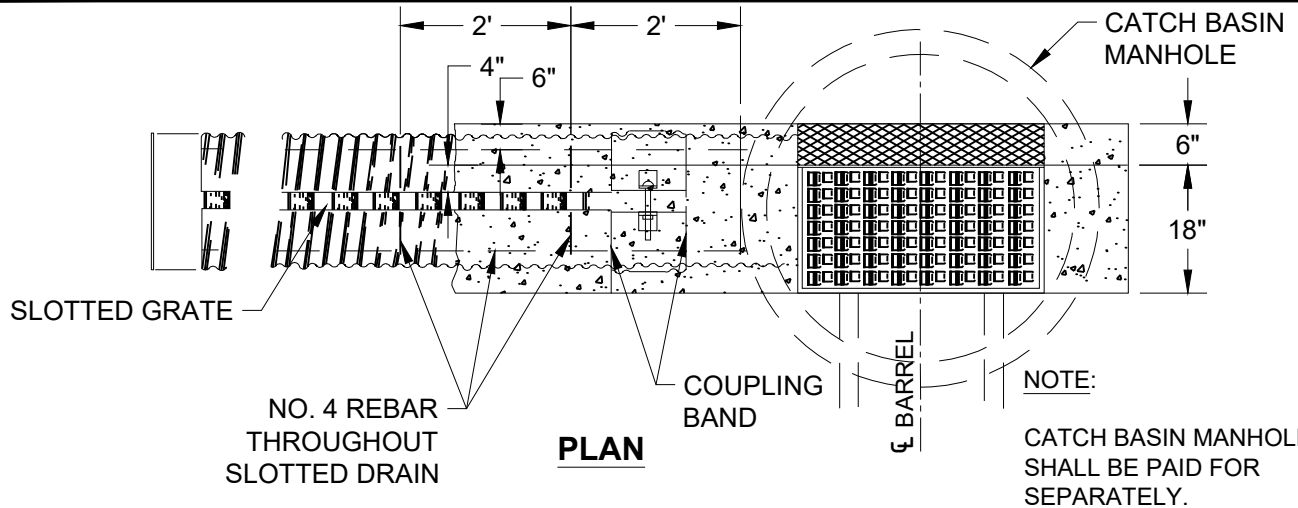
Section:

2700

STANDARD DETAILS

**DOUBLE CATCH BASIN
CURB & GUTTER INSTALLATION**

City of Minot



- NOTES:**
1. ALL SLOTTED DRAINS MUST CONNECT TO A CATCH BASIN MANHOLE.
 2. CONNECTION TO MANHOLE MUST BE NEATLY GROUTED AND ALL VOIDS SEALED.

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\STO-8 - INLET-SLOTTED DRAIN.dwg

City Plate No.:

STO-8

Last Revision:

12/2/2025

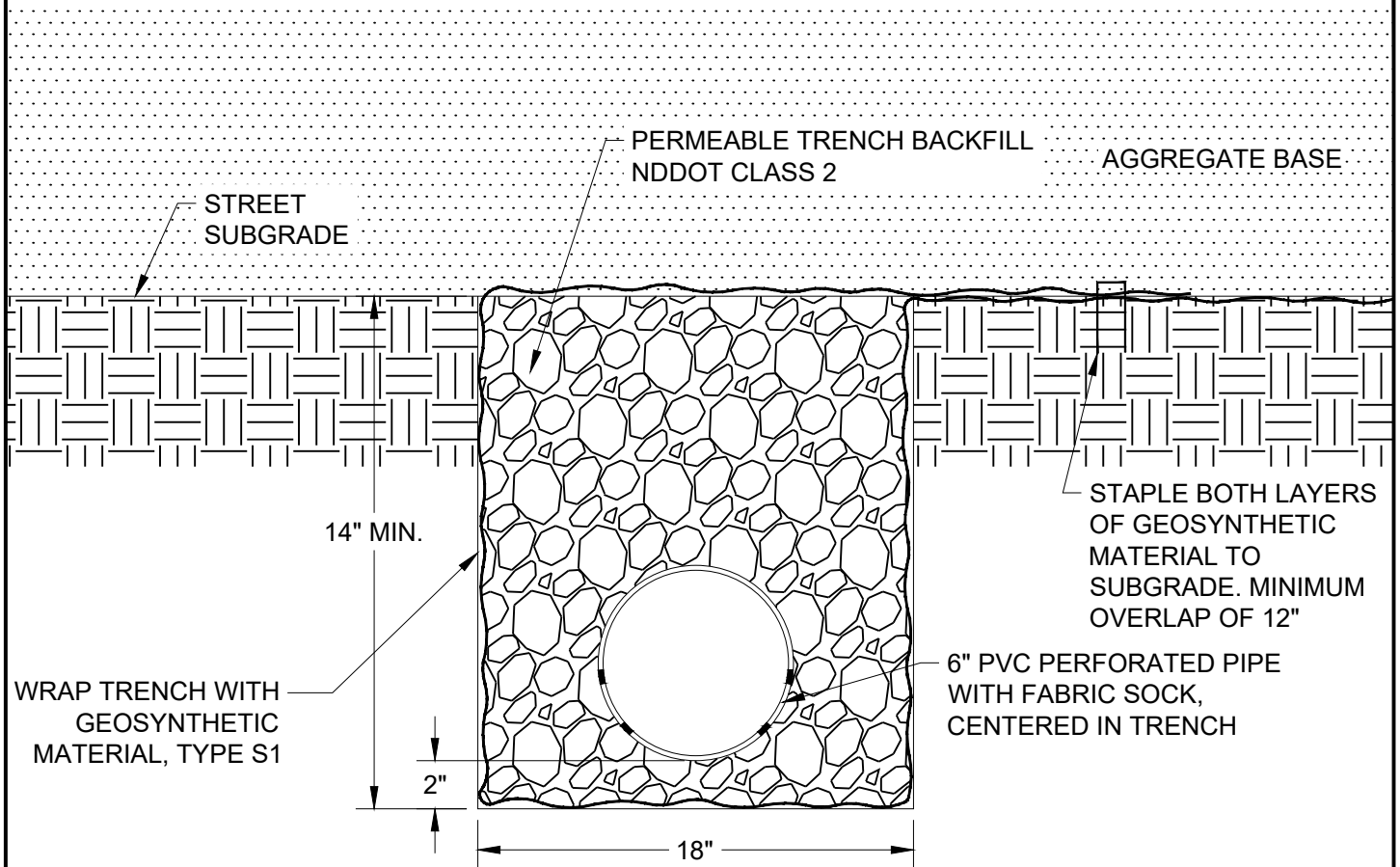
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2700

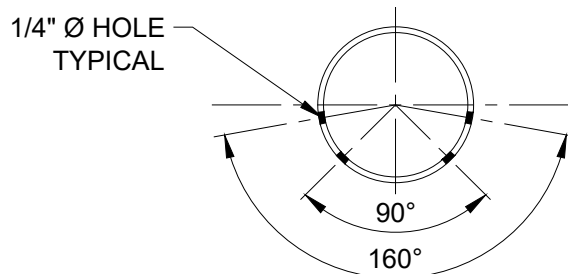
STANDARD DETAILS

INLET - SLOTTED DRAIN

City of Minot



TRENCH DETAIL



PIPE DETAIL

M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\STO-9_DRAIN TILE.dwg

City Plate No.:

STO-9

Last Revision:

12/18/2020

Section:

2800

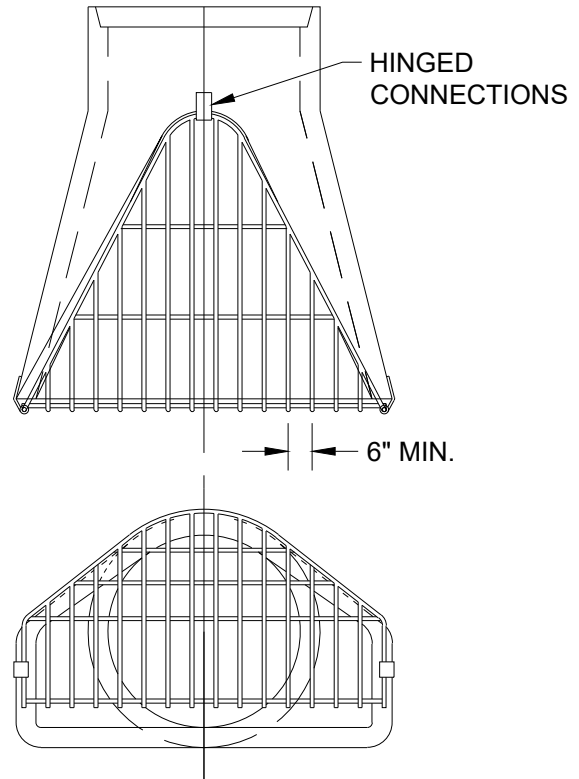
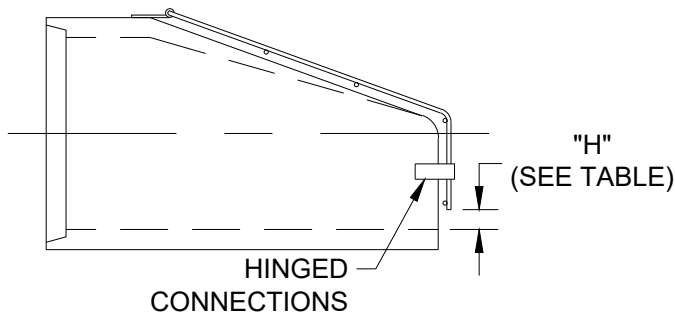
STANDARD DETAILS

DRAIN TILE

City of Minot

NOTES:

1. ALL TRASH GUARDS TO HAVE (1) CROSS BAR 60" DIA. AND UP TO HAVE (2) BARS EQUALLY SPACED.
2. HOT DIP GALVANIZED PER ASTM-A153.
3. TIE LAST 3 PIPE JOINTS. USE 2 BOLT FASTENERS PER JOINT. INSTALL AT 60° FROM TOP OF BOTTOM OF PIPE.



BAR SIZES									
STANDARD DESIGN					HEAVY DESIGN				
	PIPE SIZE	HOLE DIA. REQ'D	BOLT DIA.	BAR SIZE		PIPE SIZE	HOLE DIA. REQ'D	BOLT DIA.	BAR SIZE
ROUND	12" - 24"	3/4"	5/8"	5/8"	ROUND	12" - 18"	3/4"	5/8"	3/4"
	27" - 48"	7/8"	3/4"	3/4"		21" - 42"	7/8"	3/4"	1"
	54" - 90"	1 1/8"	1"	1"		48" - 90"	1 1/8"	1"	1 1/4"
ARCH	22" - 29"	3/4"	5/8"	5/8"	ARCH	22"	3/4"	5/8"	3/4"
	36" - 59"	7/8"	3/4"	3/4"		29" - 51"	7/8"	3/4"	1"
	65" - 88"	1 1/8"	1"	1"		59" - 88"	1 1/8"	1"	1 1/4"
BOLT LG. = PIPEWALL THICKNESS + 2 1/2"									

VALUES FOR "H"			
ROUND PIPE		ARCH PIPE	
PIPE SIZE	H	PIPE SIZE	H
12"	2 1/2"	22" - 29"	4"
15"	3"	36" - 44"	5"
18" - 24"	4"	51" - 55"	6"
27" - 36"	5"	73" - 88"	7"
42" - 54"	6"	-	-
60" - 72"	7"	-	-
78" - 90"	8"	-	-

City Plate No.:

STO-10

Last Revision:

12/18/2020

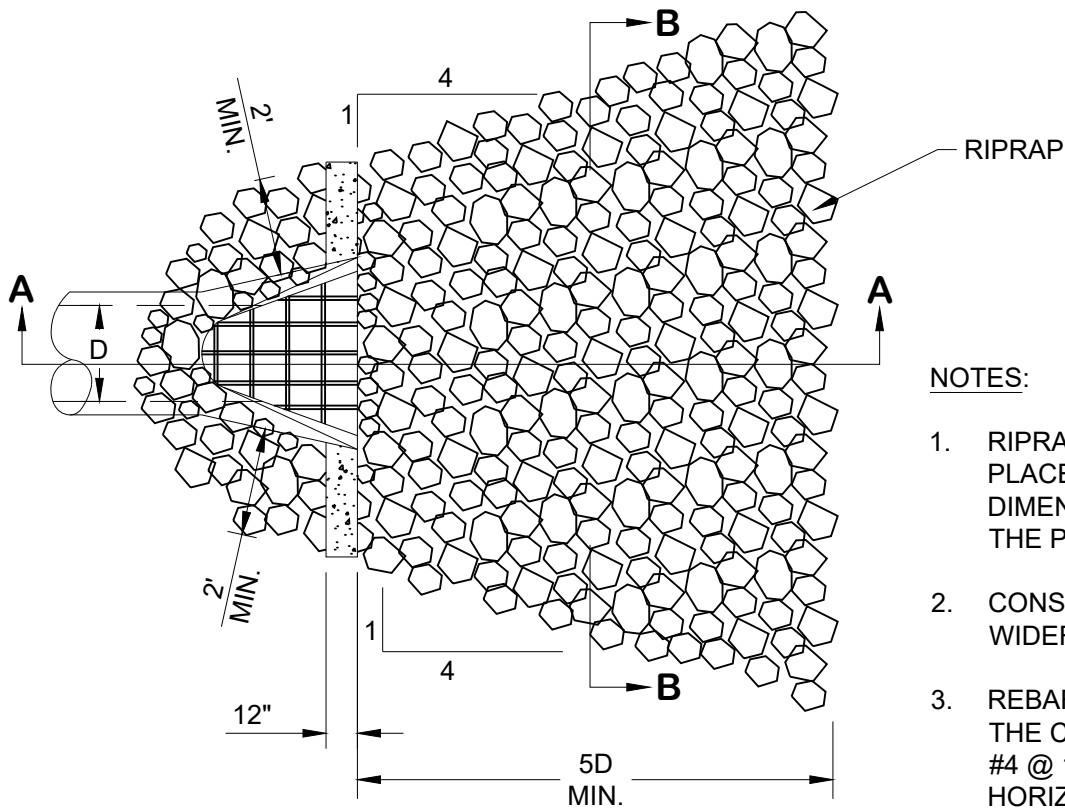
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2700

STANDARD DETAILS

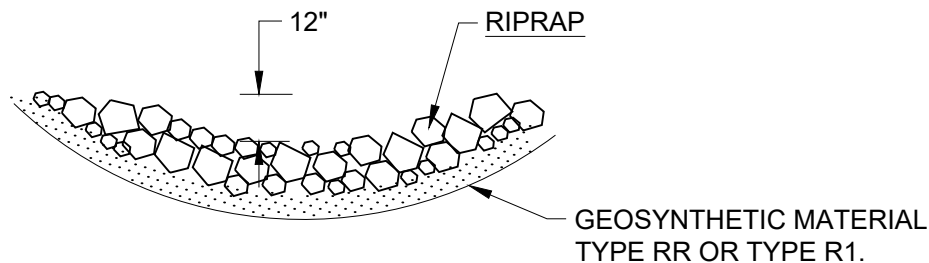
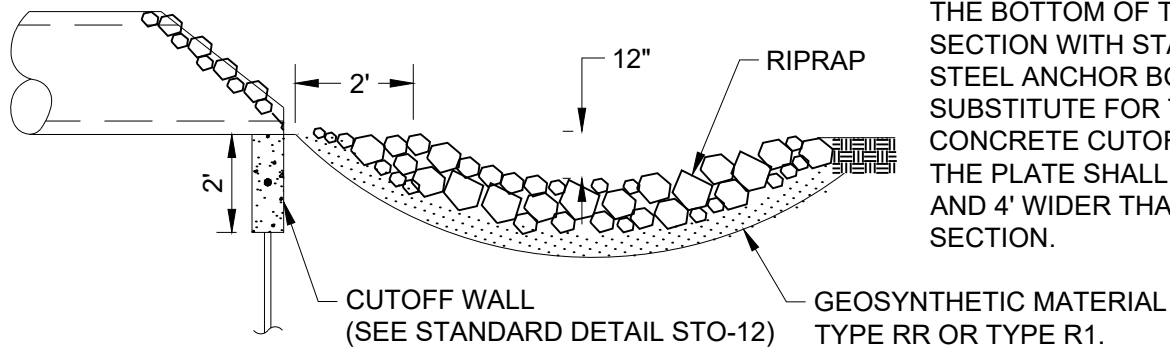
**FLARE END SECTION
& TRASH RACK**

City of Minot



NOTES:

1. RIPRAP SIZE, QUANTITY, PLACEMENT, AND DIMENSIONS SHALL BE PER THE PLANS.
2. CONSTRUCT CUTOFF WALL 4' WIDER THAN END SECTION.
3. REBAR CENTERED WITHIN THE CUTOFF WALL SHALL BE #4 @ 12" O.C. BOTH HORIZONTAL AND VERTICAL.
4. A 1/4" MIN. STEEL PLATE MAY BE BOLTED TO THE FACE OF THE BOTTOM OF THE END SECTION WITH STAINLESS STEEL ANCHOR BOLTS AS A SUBSTITUTE FOR THE CONCRETE CUTOFF WALL. THE PLATE SHALL BE 4' DEEP AND 4' WIDER THAN THE END SECTION.



City Plate No.:

STO-11

Last Revision:

12/18/2020

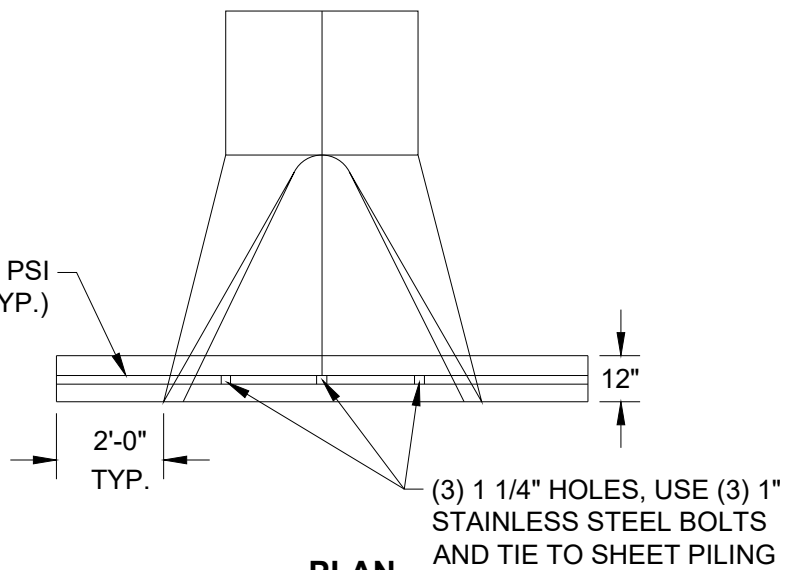
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2700

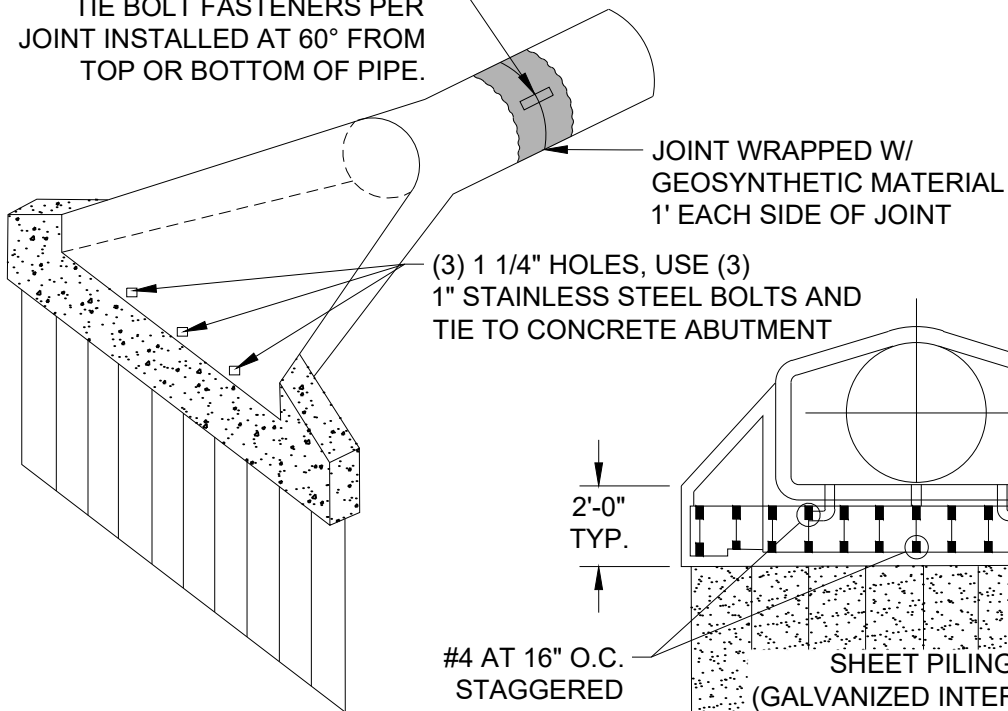
STANDARD DETAILS

STABILIZED OUTFALL

City of Minot



TIE LAST 3 PIPE JOINTS. USE 2
TIE BOLT FASTENERS PER
JOINT INSTALLED AT 60° FROM
TOP OR BOTTOM OF PIPE.



LEAVE TRASH
GUARD TABS
EXPOSED

#4 EACH SIDE

#4 EACH
FACE

City Plate No.:

STO-12

Last Revision:

12/18/2020

Section:

2700

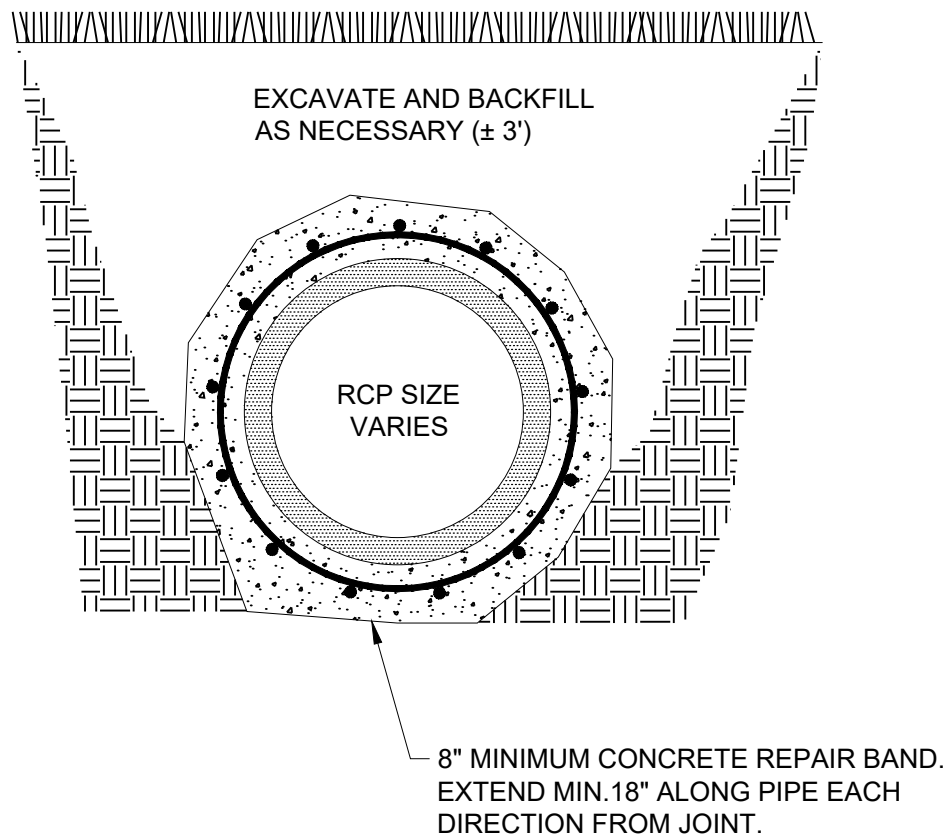
STANDARD DETAILS

F.E.S CUTOFF WALL

City of Minot

REINFORCING:

5 (MIN.) - NO. 4 DEFORMED BARS EVENLY SPACED (CIRCUMFERENTIAL)
NO. 4 DEFORMED BARS 12" O.C. (TRANSVERSE ACROSS JOINT)

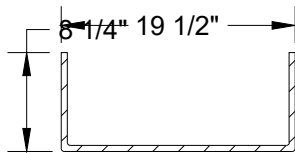


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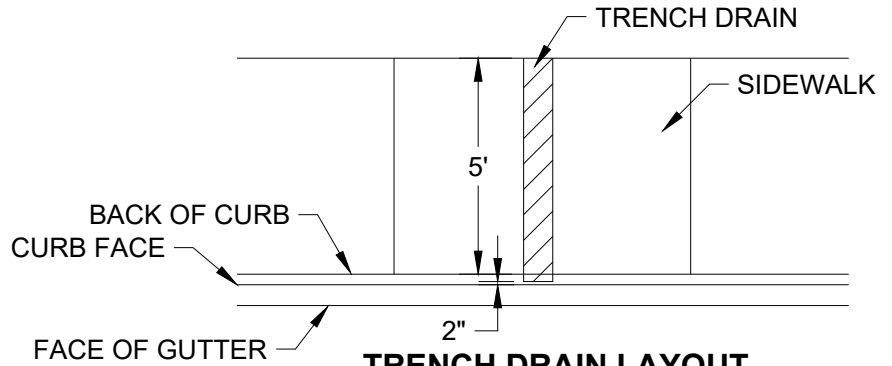
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STO-13
Last Revision:
12/18/2020
Section:
2700

STANDARD DETAILS
PIPE JOINT REPAIR BAND

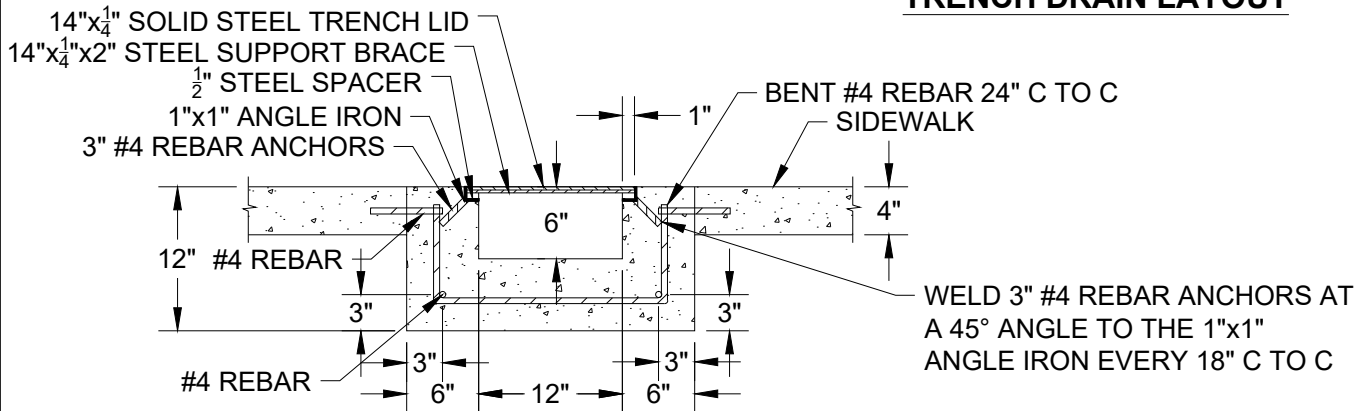
City of Minot



BENT REBAR DETAIL

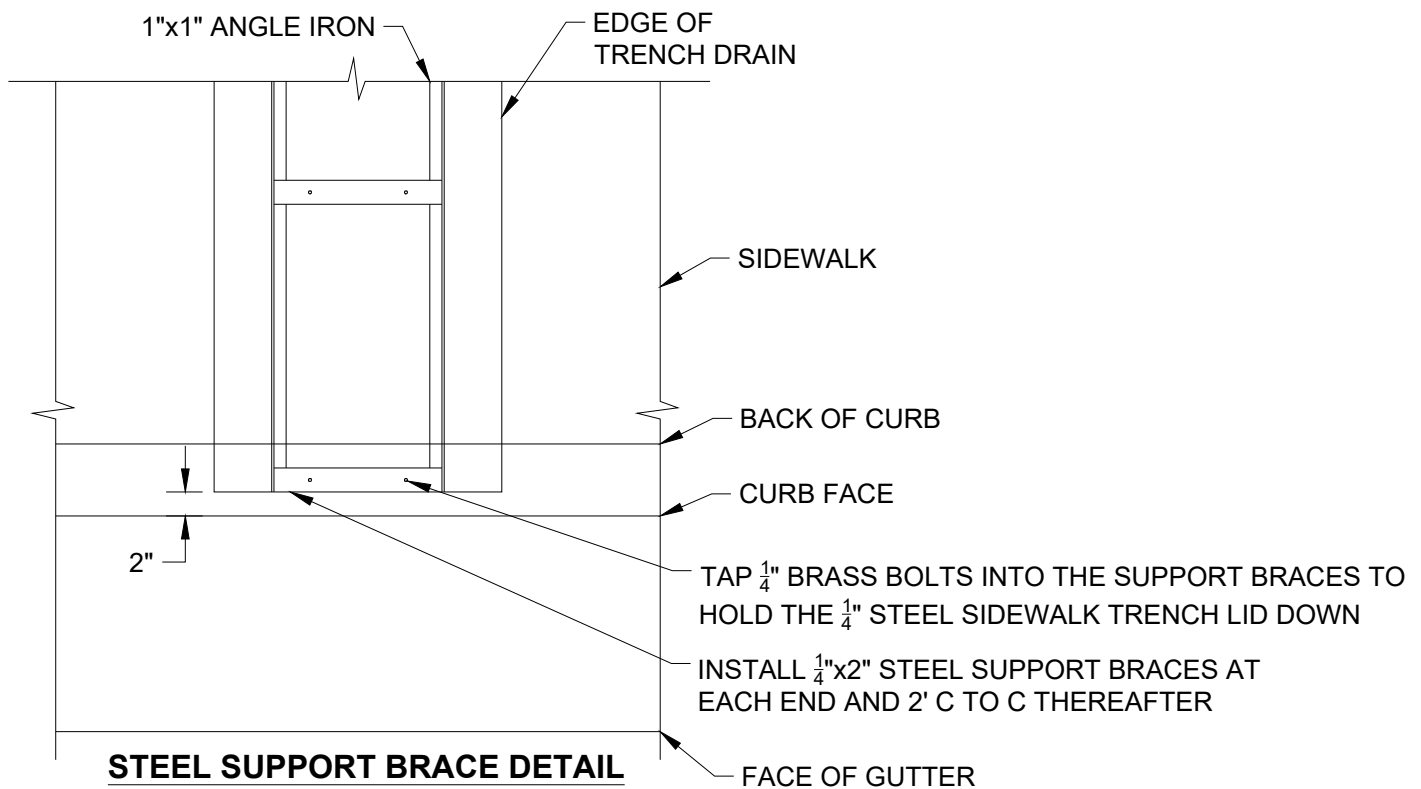


TRENCH DRAIN LAYOUT



SIDEWALK TRENCH DRAIN DETAIL

NOTE: WELD $\frac{1}{4}$ "x2" STEEL SUPPORT BRACES AND $\frac{1}{2}$ " STEEL SPACERS TO THE 1"x1" ANGLE IRON



STEEL SUPPORT BRACE DETAIL

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\STO-14_TRENCH DRAIN.dwg

City Plate No.:

STO-14

Last Revision:

03/21/2024

Section:

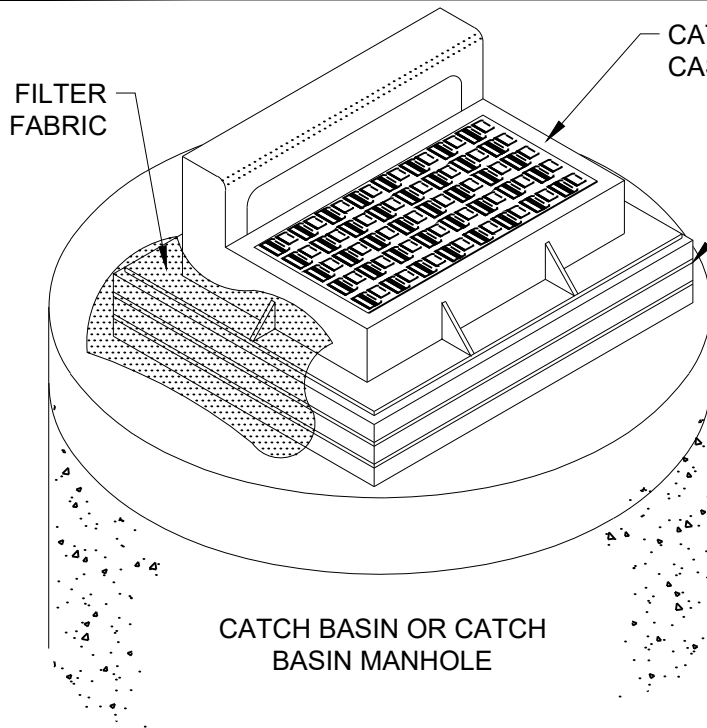
2800

STANDARD DETAILS

TRENCH DRAIN

City of Minot

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\STR-1 CASTING STRUCTURE ADJUSTMENT.dwg



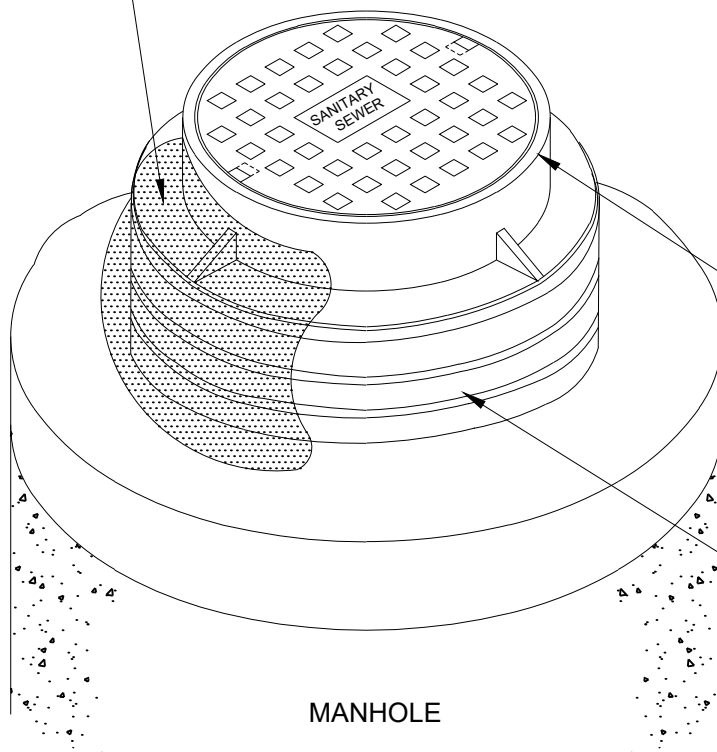
CATCH BASIN OR CATCH BASIN MANHOLE
CASTING PER STANDARD DETAILS

CONCRETE ADJUSTMENT RINGS.
NO ENGINEERED POLYMER RINGS
ALLOWED ON CATCH BASINS AND
CATCH BASIN MANHOLES.

NOTES:

1. INSTALL RINGS TO ALLOW FOR MIN. 4",
MAX. 12" OF ADJUSTMENT.
(RECOMMEND 8" OF ADJUSTMENT.)
2. CONCRETE ADJUSTING RINGS SHALL
BE 2" UNITS AND SHALL HAVE 3/8"
MORTAR $\pm$ 1/8". NO WOODEN SHIMS OR
OTHER ORGANIC SHIMS ARE
ALLOWED.
3. INTERIOR OF ADJUSTING RINGS SHALL
BE NEATLY MORTARED. THE VOID
UNDERNEATH THE CASTING SHALL BE
SEALED WITH MORTAR. RINGS SHALL
BE WIPED CLEAN.
4. RINGS MAY BE INSTALLED WITH A
TOTAL OFFSET FROM VERTICAL OF UP
TO 2" PER STRUCTURE.
5. WHEN USING ENGINEERED POLYMER
RINGS, USE AT LEAST 2 RINGS TO
MAKE ADJUSTMENT. USE SLOPED
RINGS, NO SHIMS ALLOWED.
6. TOP OF FRAME SHALL BE DOWN 1/4"
TO 3/8" FROM FINISHED PAVEMENT
EXCEPT 1" BELOW GUTTER GRADE.

STORM SEWER: FILTER FABRIC
SANITARY SEWER: EXTERNAL CHIMNEY SEAL



MANHOLE CASTING PER STANDARD DETAILS

CONCRETE OR ENGINEERED POLYMER
ADJUSTING RINGS ON MANHOLES

City Plate No.:

STR-1

Last Revision:

12/18/2020

Section:

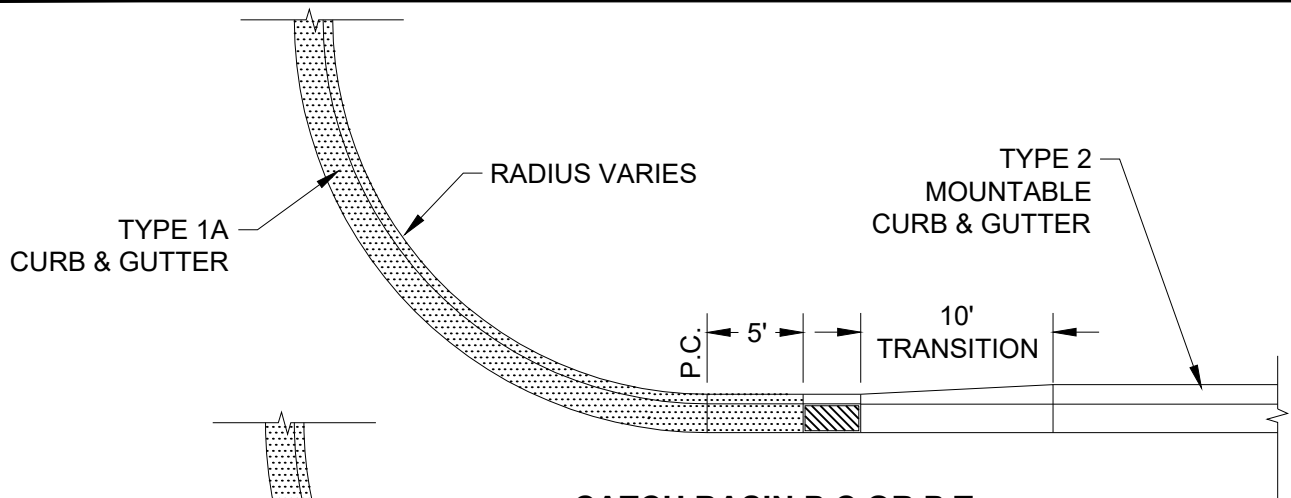
1700

STANDARD DETAILS

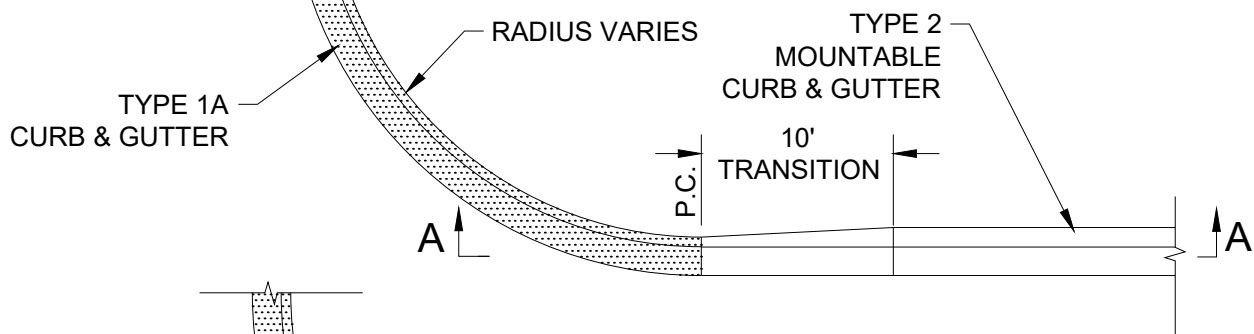
CASTING STRUCTURE ADJUSTMENT

City of Minot

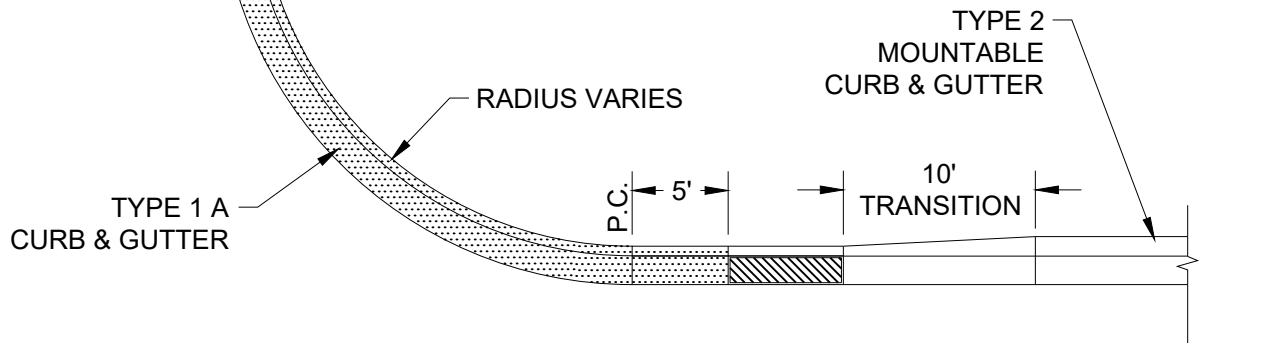
M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\STR-3. MOUNTABLE CURB & GUTTER TRANSITION.dwg



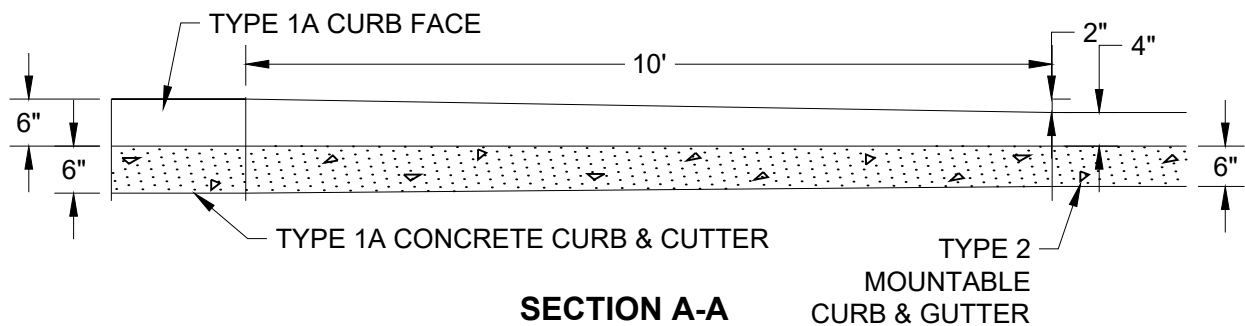
CATCH BASIN P.C. OR P.T.



TRANSITION AT RADIUS



DOUBLE CATCH BASIN



SECTION A-A

City Plate No.:

STR-3

Last Revision:

02/15/2022

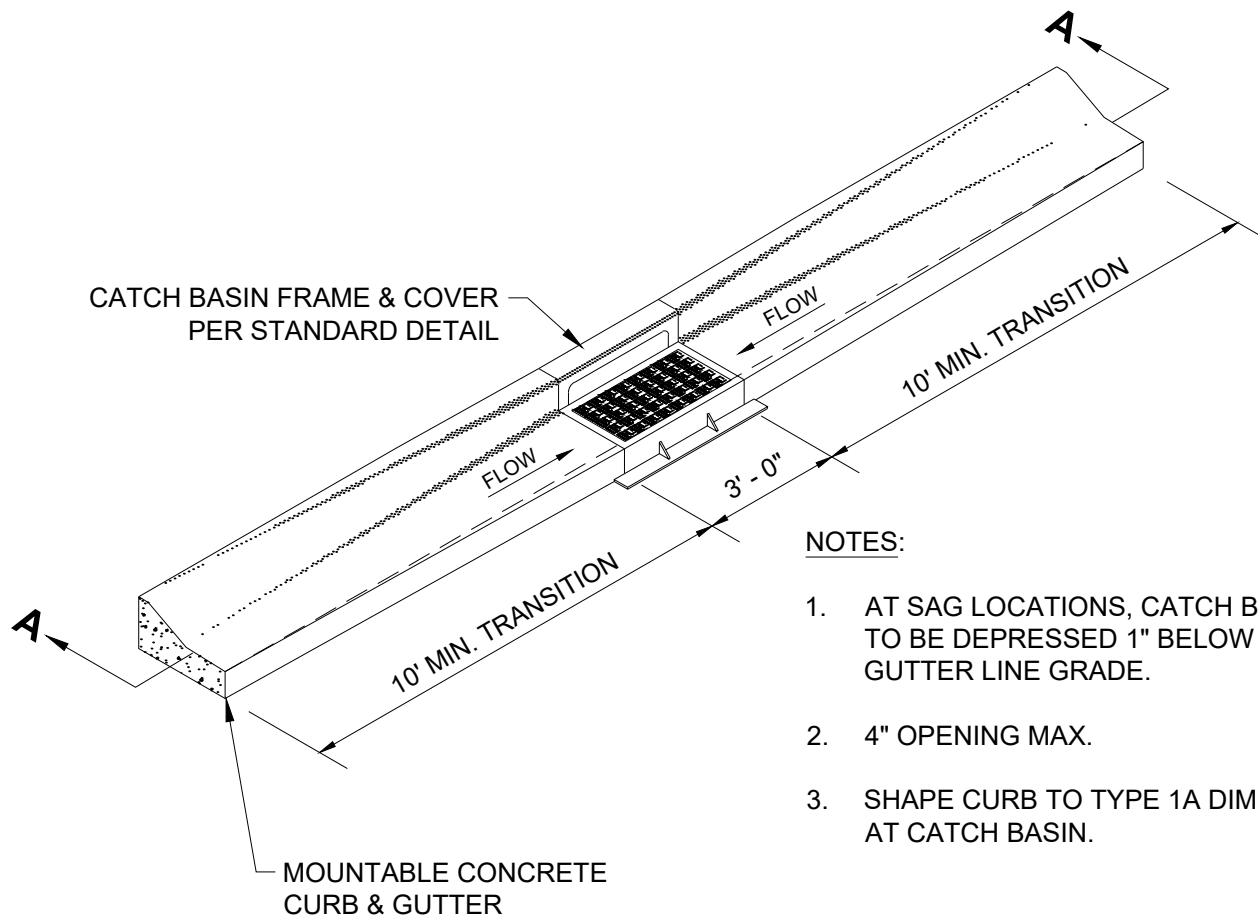
Section:

3200

STANDARD DETAILS

MOUNTABLE CURB & GUTTER TRANSITION

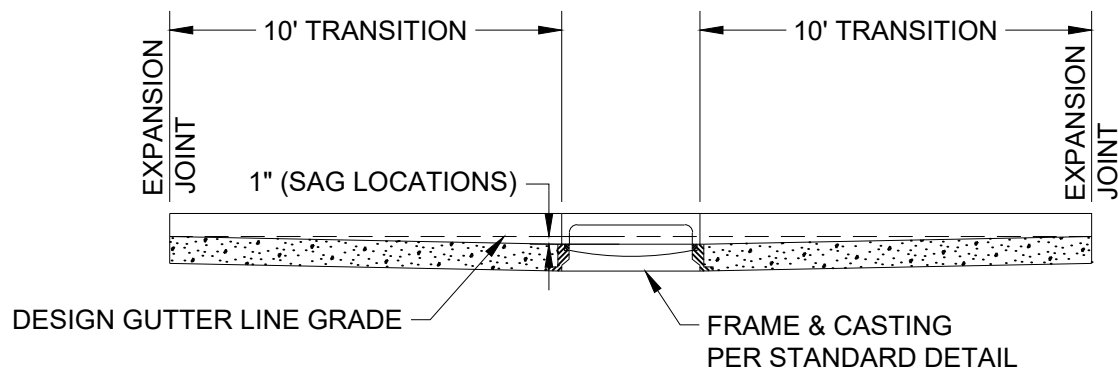
City of Minot



NOTES:

1. AT SAG LOCATIONS, CATCH BASIN RIM TO BE DEPRESSED 1" BELOW DESIGN GUTTER LINE GRADE.
2. 4" OPENING MAX.
3. SHAPE CURB TO TYPE 1A DIMENSIONS AT CATCH BASIN.

ISOMETRIC



SECTION A-A

City Plate No.:

STR-4

Last Revision:

12/18/2020

Section:

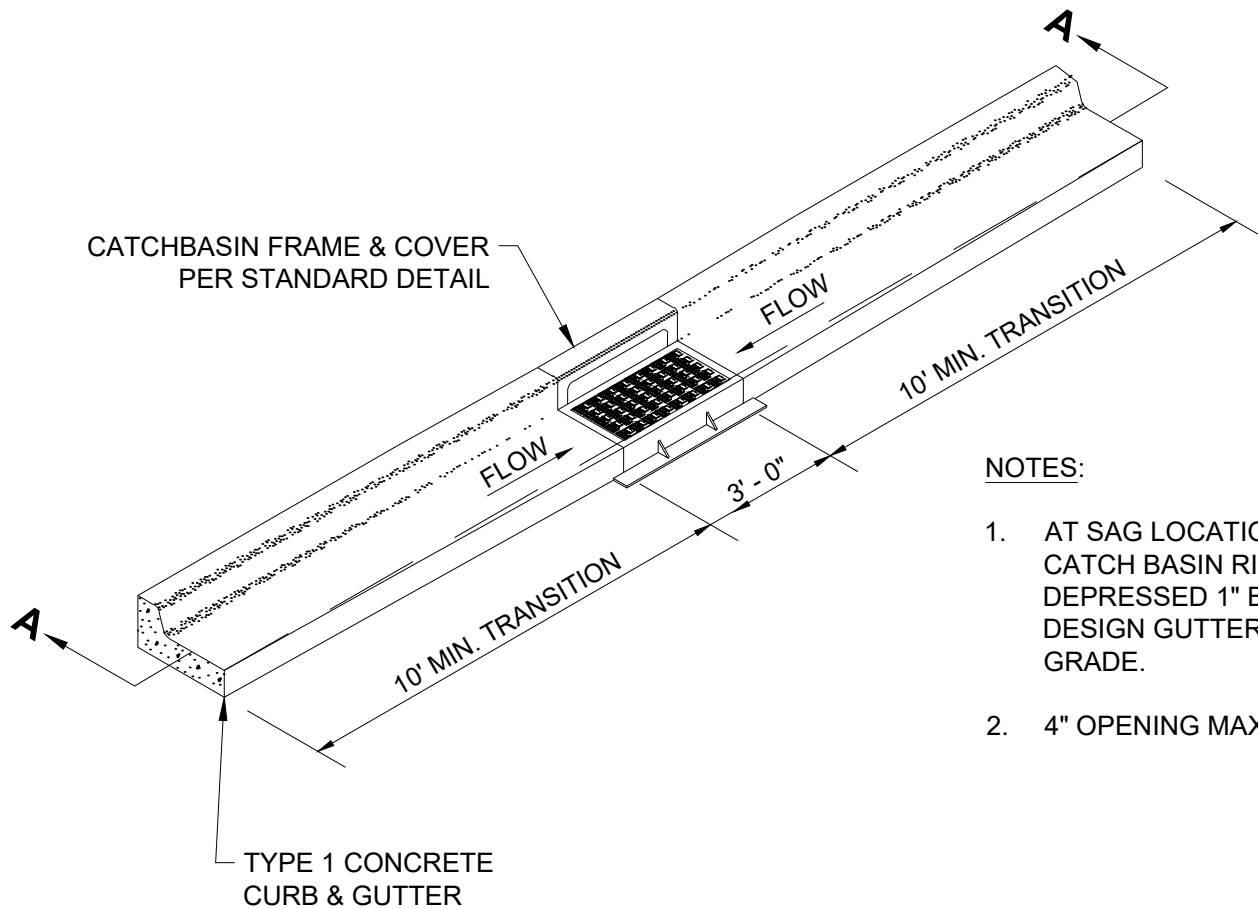
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STANDARD DETAILS

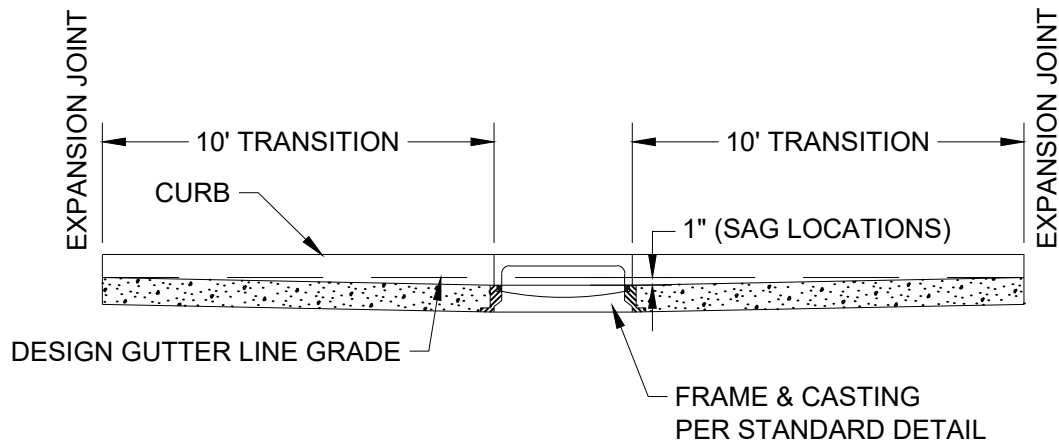
**MOUNTABLE CURB & GUTTER
AT CATCHBASINS**

City of Minot

M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\STR-5_Type I CURB AND GUTTER AT CATCHBASINS.dwg



ISOMETRIC



SECTION A-A

City Plate No.:

STR-5

Last Revision:

12/18/2020

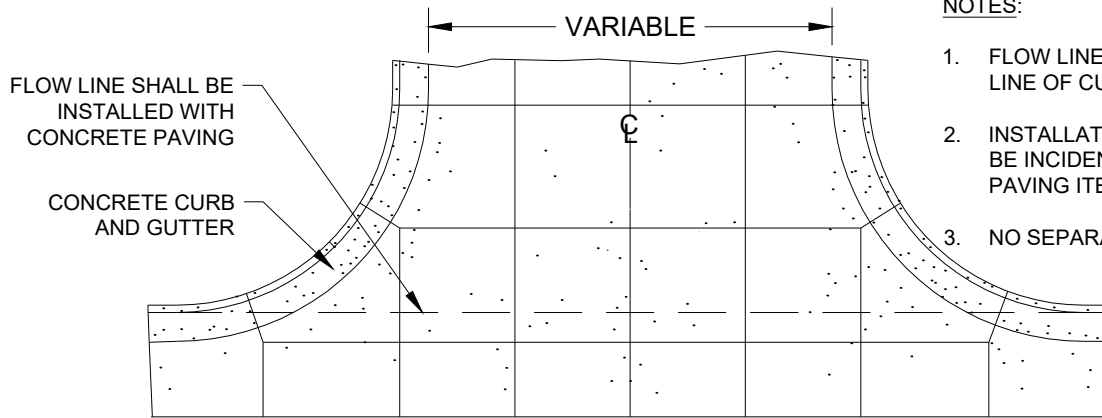
Section:

3200

STANDARD DETAILS

**TYPE I CURB & GUTTER
AT CATCHBASINS**

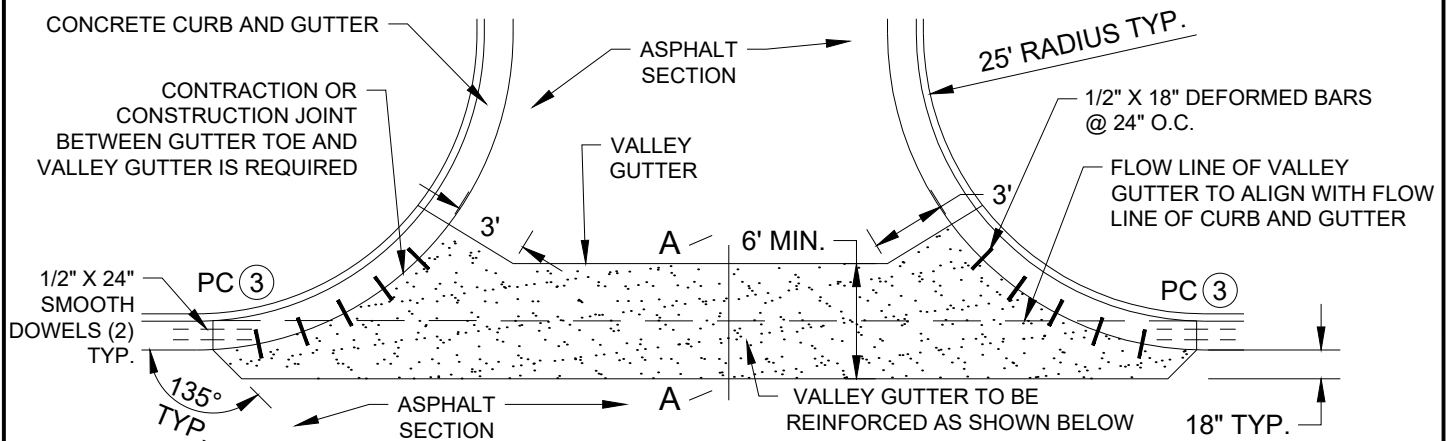
City of Minot



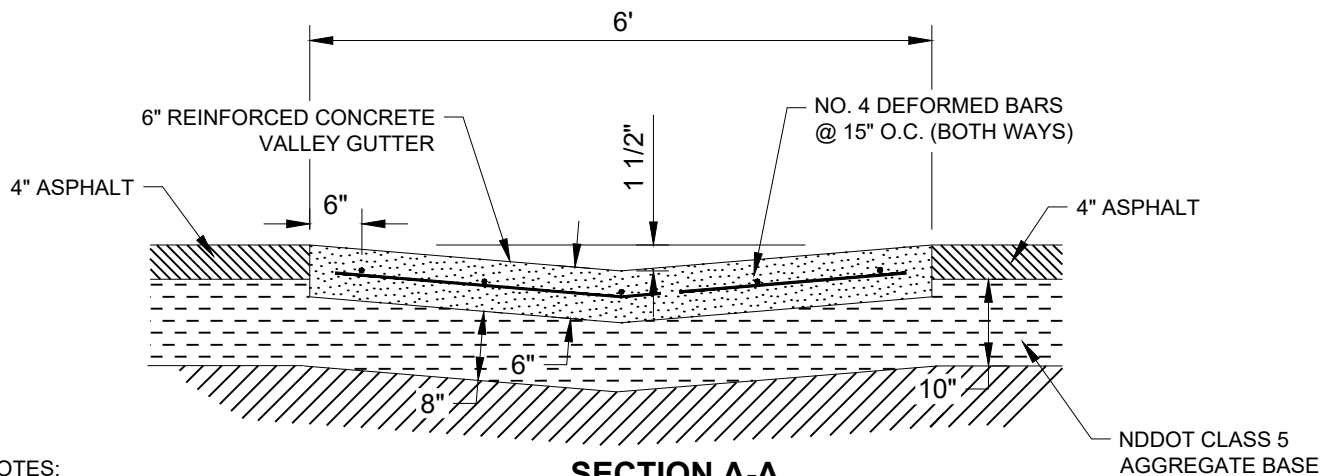
NOTES:

1. FLOW LINE TO ALIGN WITH FLOW LINE OF CURB AND GUTTER.
2. INSTALLATION OF FLOW LINE TO BE INCIDENTAL TO CONCRETE PAVING ITEM.
3. NO SEPARATE PAY ITEMS.

CONCRETE STREET



ASPHALT STREET



NOTES:

1. AGGREGATE BASE REQUIRED UNDER ENTIRE VALLEY GUTTER.
2. REFER TO PLANS FOR LENGTH OF VALLEY GUTTER.
3. CONSTRUCT EXPANSION JOINTS AT PC's.
4. SPACE CONTRACTION JOINTS AT APPROX. INTERVALS EQUAL TO WIDTH OF VG.

SECTION A-A

M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\STR-6 VALLEY GUTTER.dwg

City Plate No.:

STR-6

Last Revision:

12/2/2025

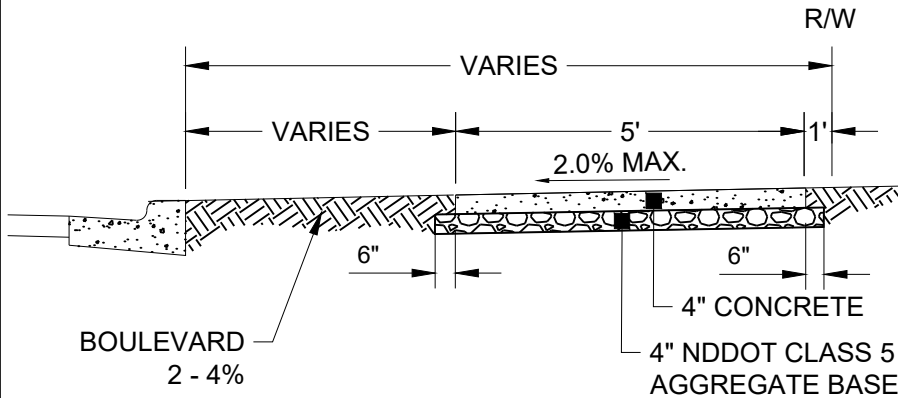
Section:

3200

STANDARD DETAILS

VALLEY GUTTER

City of Minot

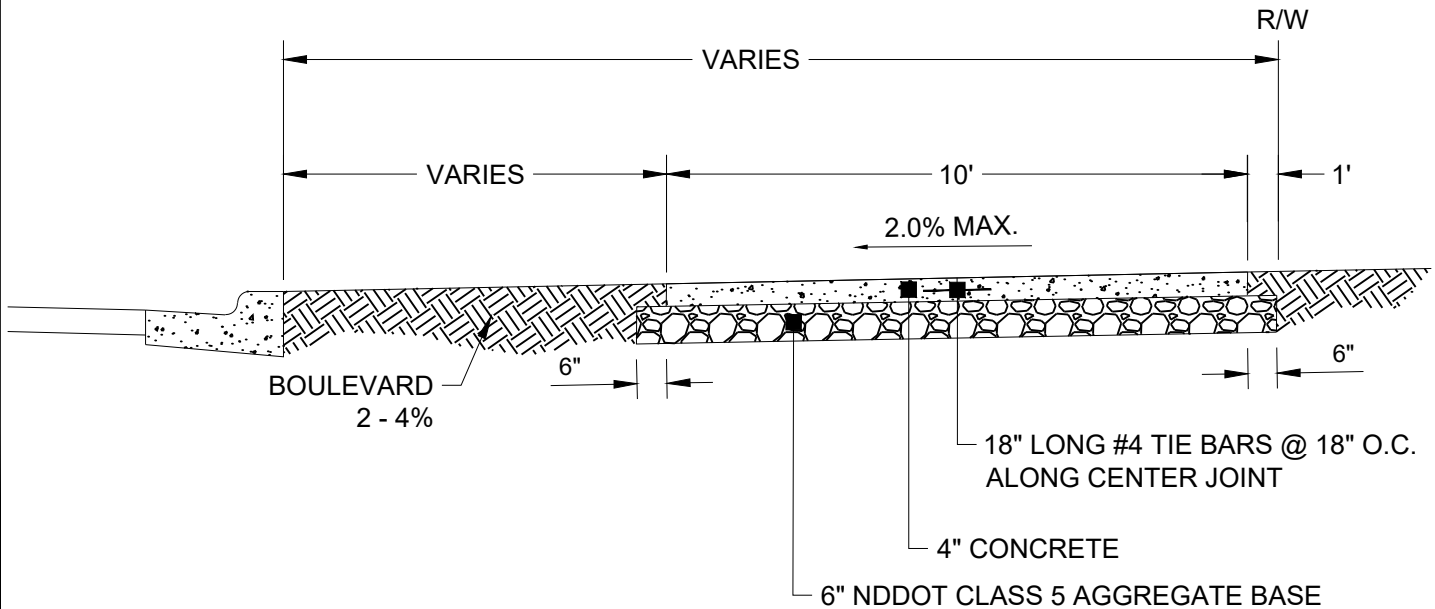


TYPICAL CONCRETE SIDEWALK

NOTES:

1. LIGHT BROOM FINISH PERPENDICULAR TO CURB.
2. TOOLED OR SAWED JOINTS TO MIN. DEPTH OF 3/4". NO TOOLED JOINTS ALLOWED ON 8' AND 10' SIDEWALKS/PATHS.
3. RECOMMENDED CROSS-SLOPE IS 1.5%. 2% IS THE MAXIMUM.
4. JOINT SPACING:

SIDEWALK/PATH WIDTH	L x W
5'	5' x 5'
6'	5' x 6'
8'	4.5' x 4'
10'	5' x 5'



TYPICAL CONCRETE SHARED USE PATH

City Plate No.:

STR-7

Last Revision:

12/18/2020

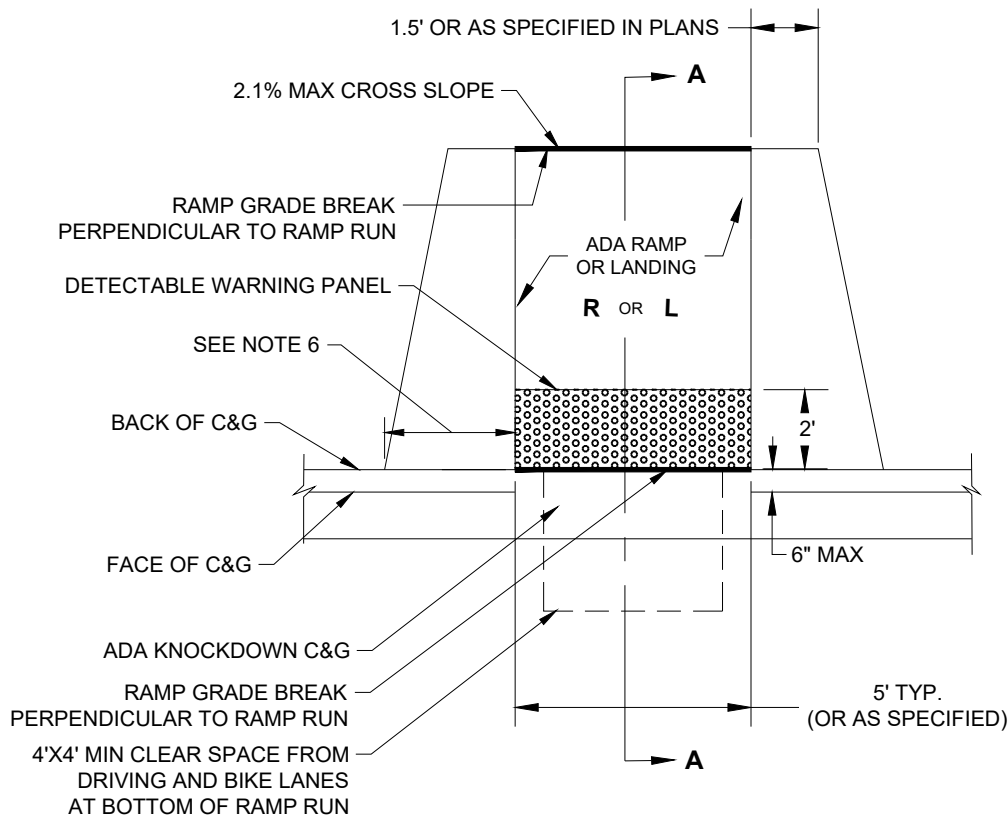
Section:

3300

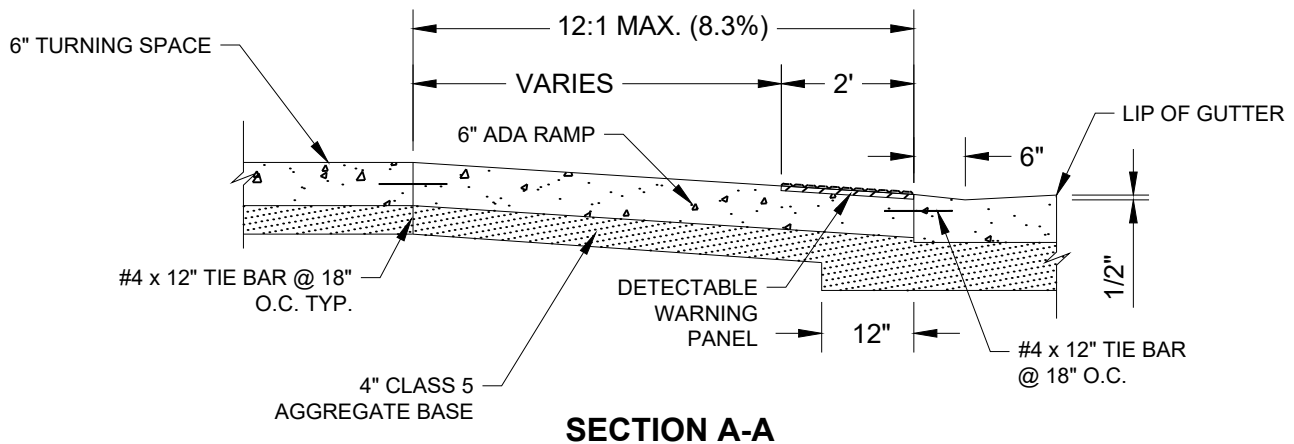
STANDARD DETAILS

SIDEWALKS & PATHWAYS

City of Minot



1. DETECTABLE WARNING PANELS SHALL BE INSTALLED TO MATCH THE RAMP WIDTH (THE USABLE PORTION OF RAMP).
2. CURB RAMPS SHALL BE CONSTRUCTED IN ACCORDANCE WITH NDDOT STANDARD DRAWING D-750-03.
3. REFER TO NDDOT STANDARD DRAWING D-750-03 FOR ADDITIONAL CURB RAMP TYPES.
4. DESIRABLE TURNING SPACE IS 5' BY 5' OR LARGER WITH A MINIMUM SIZE OF 4' BY 4'. MAXIMUM SLOPE FOR TURNING SPACES IS 2.0% IN ANY DIRECTION.
5. CONCRETE FOR SIDEWALK SECTION IMMEDIATELY BEHIND CURB SHALL BE INSTALLED 6" THICK. THIS APPLIES TO BOTH RAMPS AND TURNING SPACES IMMEDIATELY BEHIND CURB.
6. PROVIDE FLARES AS SPECIFIED IN PLANS. IF NOT SPECIFIED IN PLANS, PROVIDE 1:10 FLARES WHEN ADJACENT TO A CONCRETE PEDESTRIAN CIRCULATION PATH OR 3 FT FLARES WHEN NOT ADJACENT TO A PEDESTRIAN CIRCULATION PATH



SECTION A-A

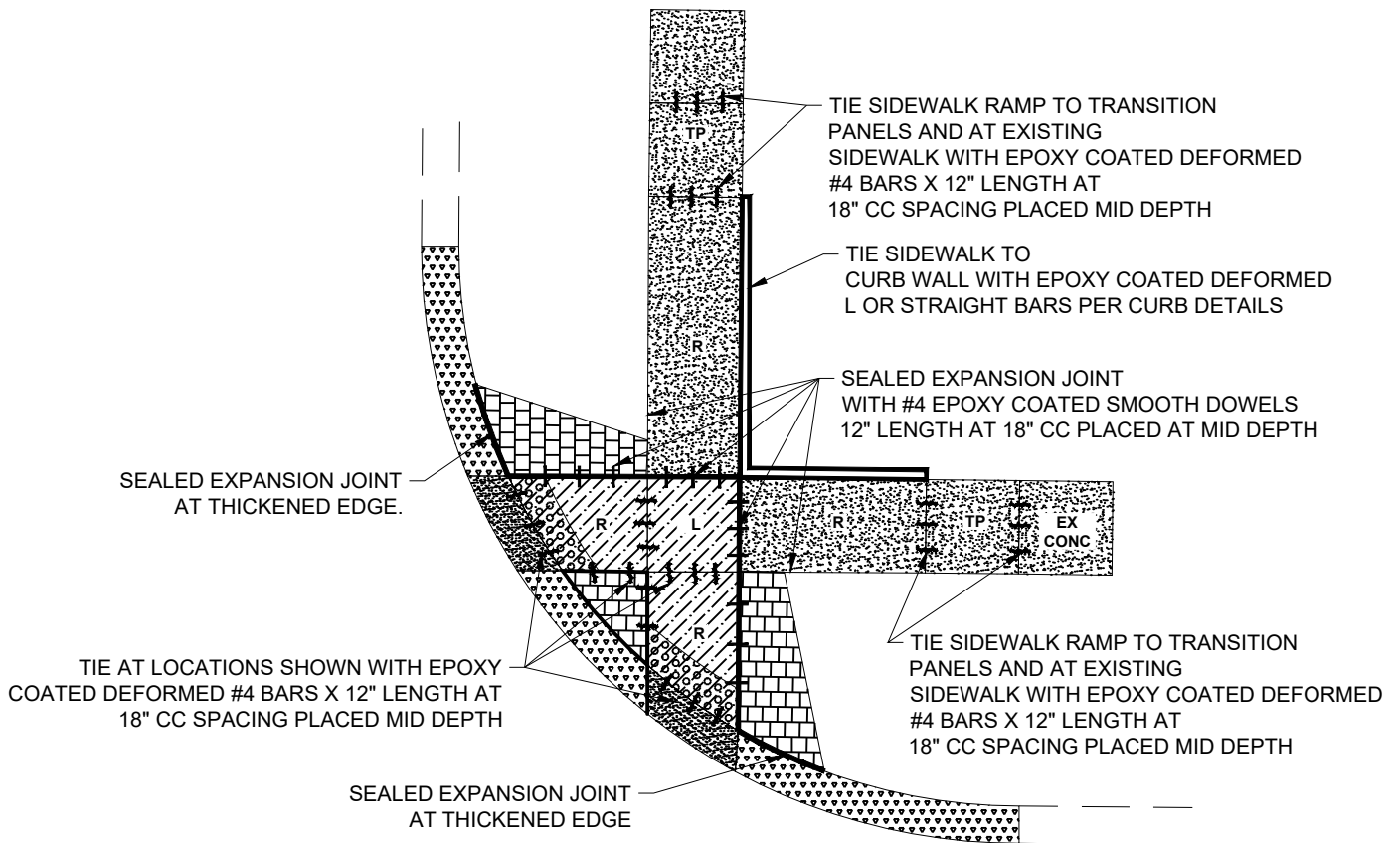
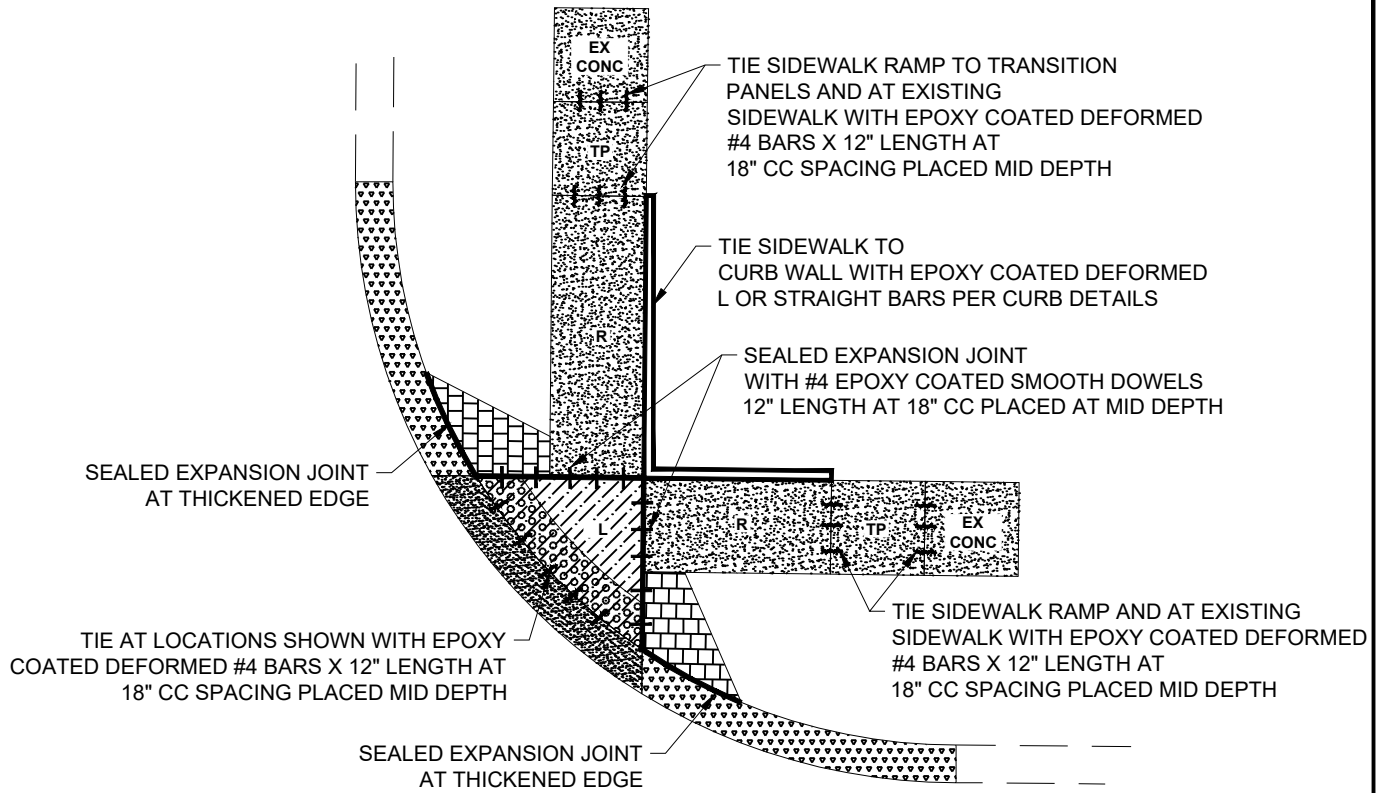
City Plate No.:	STR-8
Last Revision:	12/3/2025
Section:	3300

STANDARD DETAILS

PEDESTRIAN CURB RAMP PATHWAY / SIDEWALK



M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\STR-8A_PEDESTRIAN CURB RAMP JOINTING DETAIL.dwg



City Plate No.:

STR-8A

Last Revision:

12/3/2025

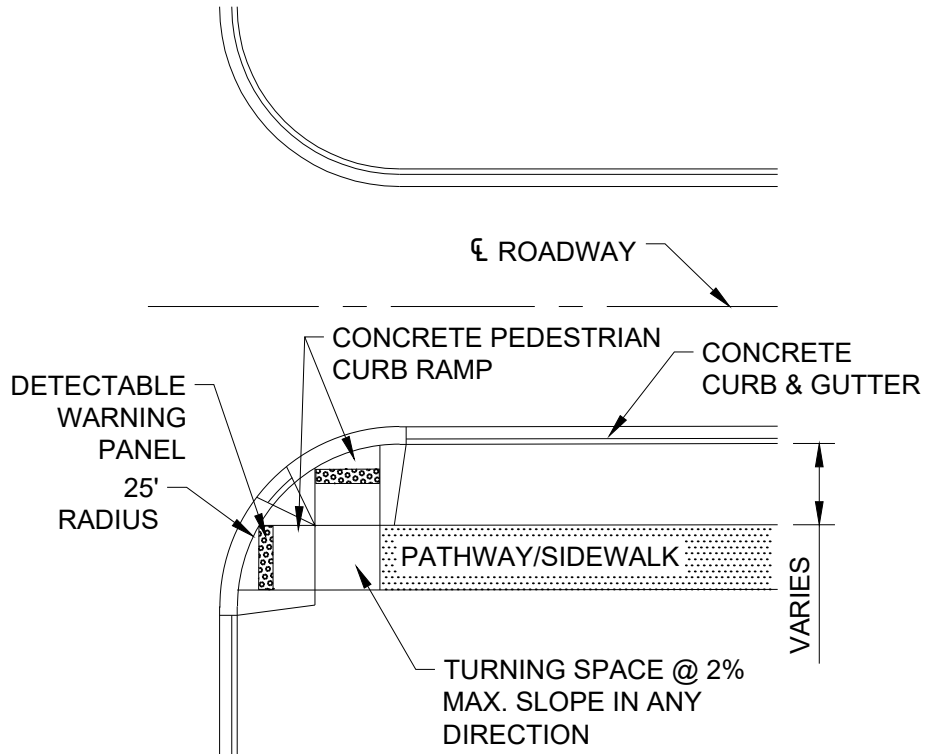
Section:

3300

STANDARD DETAILS

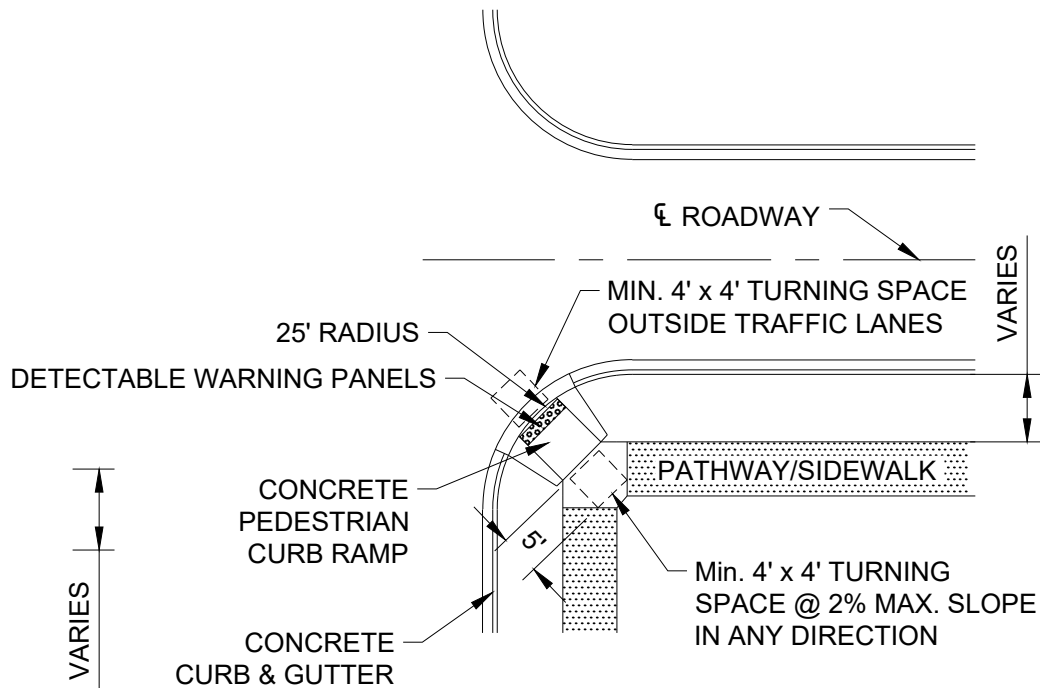
PEDESTRIAN CURB RAMP JOINTING DETAIL

City of Minot



STANDARD CURB RAMP LOCATION

NOTE: REFER TO NDDOT STANDARD DRAWING D-750-03 FOR ADDITIONAL CURB RAMP TYPES.



DIAGONAL CURB RAMP AS APPROVED BY CITY ENGINEER

M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\STR-9_PEDESTRIAN CURB RAMP GENERAL LOCATION.dwg

City Plate No.:

STR-9

Last Revision:

12/3/2025

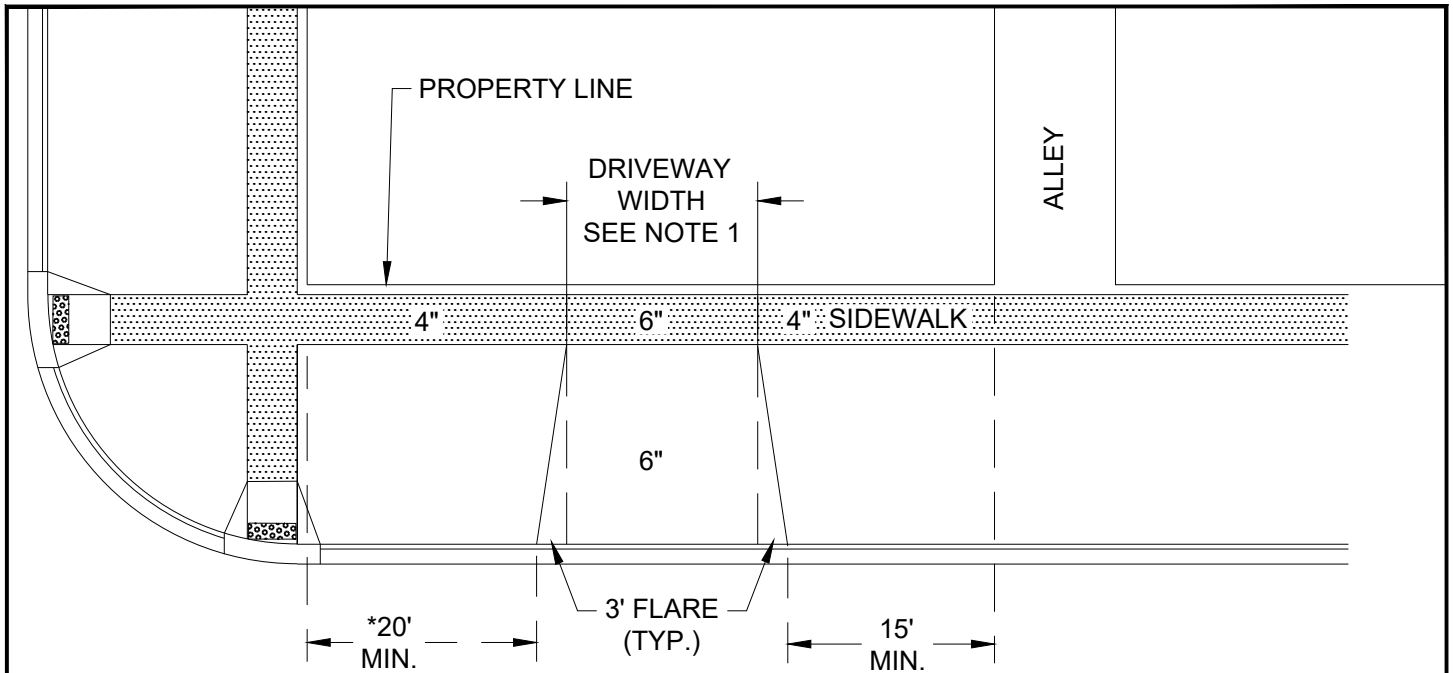
Section:

3300

STANDARD DETAILS

PEDESTRIAN CURB RAMP GENERAL LOCATION

City of Minot



NOTES:

1. IF IN A RESIDENTIAL ZONE, 30 FEET IS THE MAXIMUM WIDTH. IF IN A COMMERCIAL OR INDUSTRIAL ZONE, 40 FEET IS THE MAXIMUM WIDTH.
2. MAXIMUM WIDTH OF RESIDENTIAL DRIVEWAYS CAN EXCEED 30 FEET UP TO EQUAL THE WIDTH OF THE OVERHEAD GARAGE DOORS. THIS EXCEPTION HAS AN ABSOLUTE MAXIMUM OF 40 FEET, OR 50% OF THE FRONT FOOTAGE OF THE LOT, WHICHEVER IS GREATER.
3. THIS MAXIMUM WIDTH IS MEASURED ALONG THE PROPERTY LINE. THE WIDTH SHOULD BE MEASURED AT THE SIDE CLOSER TO THE PRIVATE PROPERTY, AND NOT AT THE SIDE ADJACENT TO THE STREET.
4. ALL CONCRETE LOCATED IN THE DRIVEWAY APRON, INCLUDING THE SIDEWALK SECTION, SHALL BE 6 INCHES THICK.
5. ALL DRIVEWAYS LOCATED ON CLASSIFIED ROADWAYS (COLLECTORS & ARTERIALS) SHALL BE APPROVED BY THE ENGINEERING DEPARTMENT
6. REFER TO CITY OF MINOT ORDINANCE 28-211 FOR REQUIREMENTS ON DISTANCE BETWEEN DRIVEWAYS AND DRIVEWAY APRONS.
7. SOME EXCEPTIONS MAY APPLY. CONTACT THE ENGINEERING DEPARTMENT.

* 20' FROM CORNER OR PER ACCESS MANAGEMENT POLICY, WHICHEVER IS GREATER.

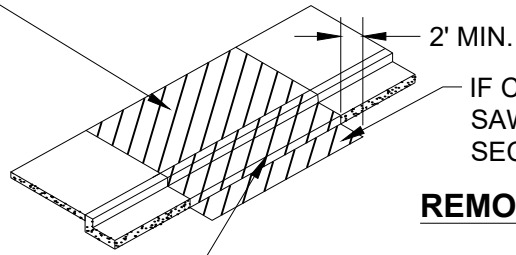
City Plate No.:
STR-10
Last Revision:
12/20/2025
Section:
3300

STANDARD DETAILS

DRIVEWAY PLACEMENT LOCAL STREET



REMOVE CONCRETE FOR DRIVEWAY CONSTRUCTION WHERE REQUIRED. SAW CUT TO FULL DEPTH PRIOR TO REMOVAL.



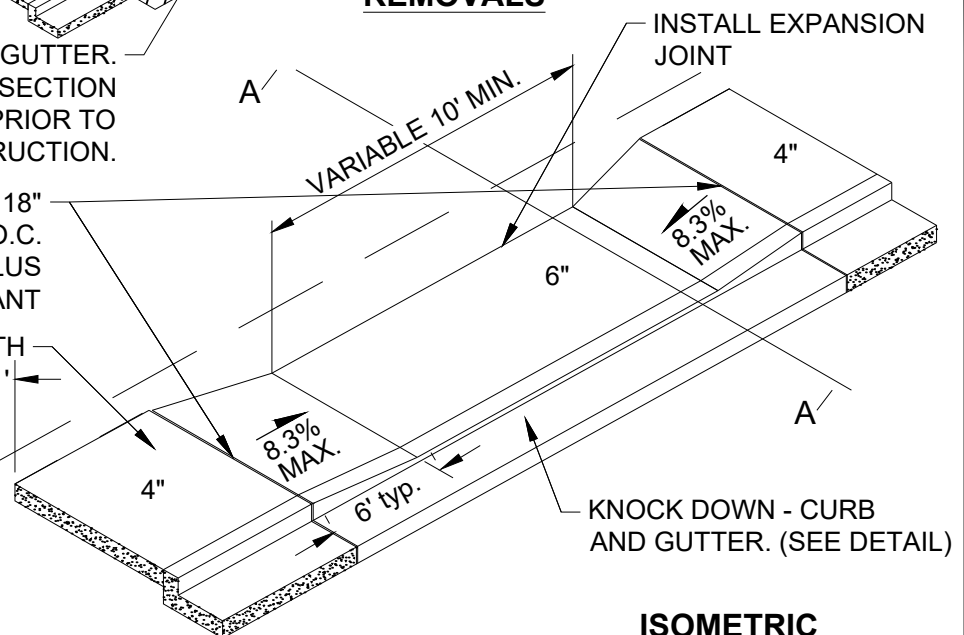
REMOVALS

REMOVE CURB AND GUTTER. ENTIRE CURB AND GUTTER SECTION SHALL BE REMOVED PRIOR TO DRIVEWAY CONSTRUCTION.

EXPANSION JOINT W/ 1/2" x 18" SMOOTH DOWELS @ 24" O.C. SEAL WITH GRAY LOW-MODULUS SELF-LEVELING SILICONE SEALANT

SIDEWALK/PATH 1'

PROPERTY CORNER SHALL BE IDENTIFIED

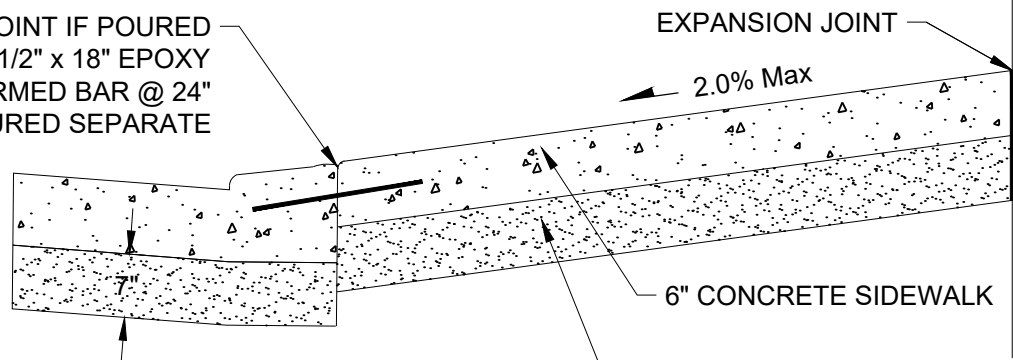


ISOMETRIC

NOTES:

1. WHERE CONNECTING TO EXISTING CONCRETE, INSTALL EXPANSION JOINT W/ MIN. TWO 1/2" x 18" SMOOTH DOWELS @ 24" O.C.
2. DRIVEWAYS GREATER THAN 10' WIDE SHALL HAVE CONTRACTION JOINTS PERPENDICULAR TO CURB WITH MAXIMUM 10' SPACING. MATCH CURB JOINTS.
3. FORMS ARE REQUIRED ON ALL EDGES.
4. ALL HMA PATCHES SHALL BE NDDOT FAA 43 HMA PAVEMENT, PG 58S-28.
5. MAX. CROSS-SLOPE OF SIDEWALK/PATH SHALL BE 2% AT ALL LOCATIONS.

CONTRACTION JOINT IF POURED MONOLITHIC OR 1/2" x 18" EPOXY COATED DEFORMED BAR @ 24" O.C. IF POURED SEPARATE



SECTION A-A

City Plate No.:

STR-11A

Last Revision:

12/20/2025

Section:

3300

STANDARD DETAILS

CONCRETE DRIVEWAY APRON
BOULEVARD 0 TO 1.5 FT

City of Minot

REMOVE CONCRETE FOR DRIVEWAY CONSTRUCTION WHERE REQUIRED. SAW CUT TO FULL DEPTH PRIOR TO REMOVAL.

REMOVE CURB AND GUTTER. ENTIRE CURB AND GUTTER SECTION SHALL BE REMOVED PRIOR TO DRIVEWAY CONSTRUCTION.

REMOVALS

INSTALL EXPANSION JOINT W/ 1/2" x 18" SMOOTH DOWELS @ 24" O.C.
SEAL WITH GRAY LOW-MODULUS SELF-LEVELING SILICONE SEALANT

SIDEWALK/PATH

2' Min.
IF CURB CANNOT BE REMOVED CLEAN, SAWCUT PAVEMENT AND PATCH PER SECTION 3010

INSTALL EXPANSION JOINT

2-4% BLVD. SLOPE

MIN. 53°

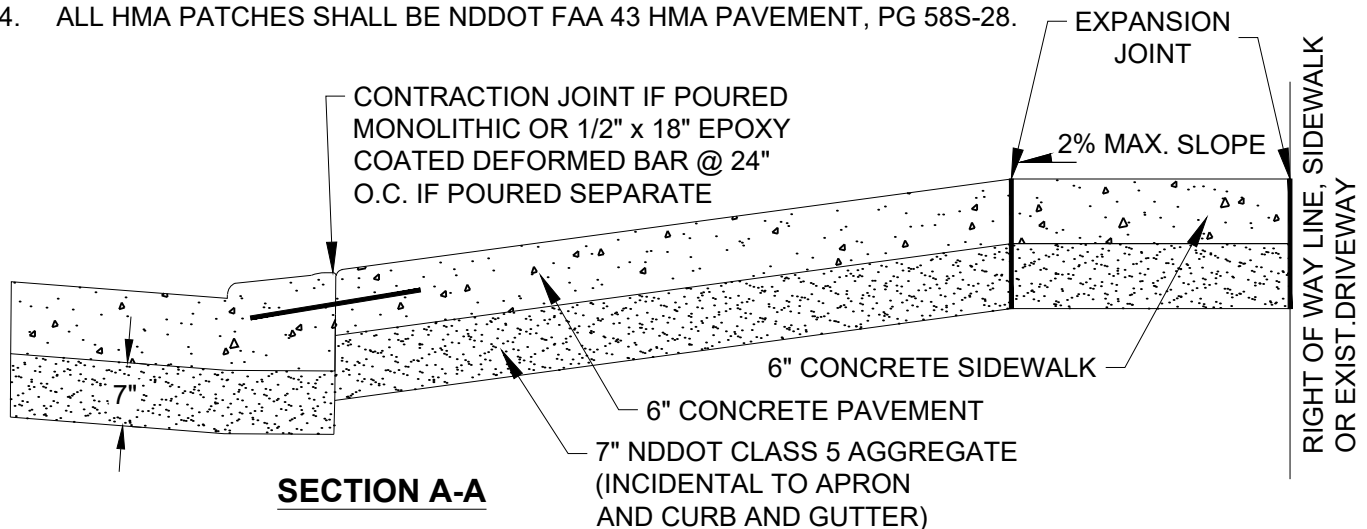
KNOCK DOWN - CURB AND GUTTER. (SEE DETAIL)

3' FLARE TYP.

NOTES:

ISOMETRIC

- WHERE CONNECTING TO EXISTING CONCRETE, INSTALL EXPANSION JOINT W/ MIN. TWO 1/2" x 18" SMOOTH DOWELS @ 24" O.C
- DRIVEWAYS GREATER THAN 10' WIDE SHALL HAVE CONTRACTION JOINTS PERPENDICULAR TO CURB WITH MINIMUM 10' SPACING. MATCH CURB JOINTS.
- FORMS ARE REQUIRED ON ALL EDGES.
- ALL HMA PATCHES SHALL BE NDDOT FAA 43 HMA PAVEMENT, PG 58S-28.



SECTION A-A

City Plate No.:

STR-11B

Last Revision:

12/20/2025

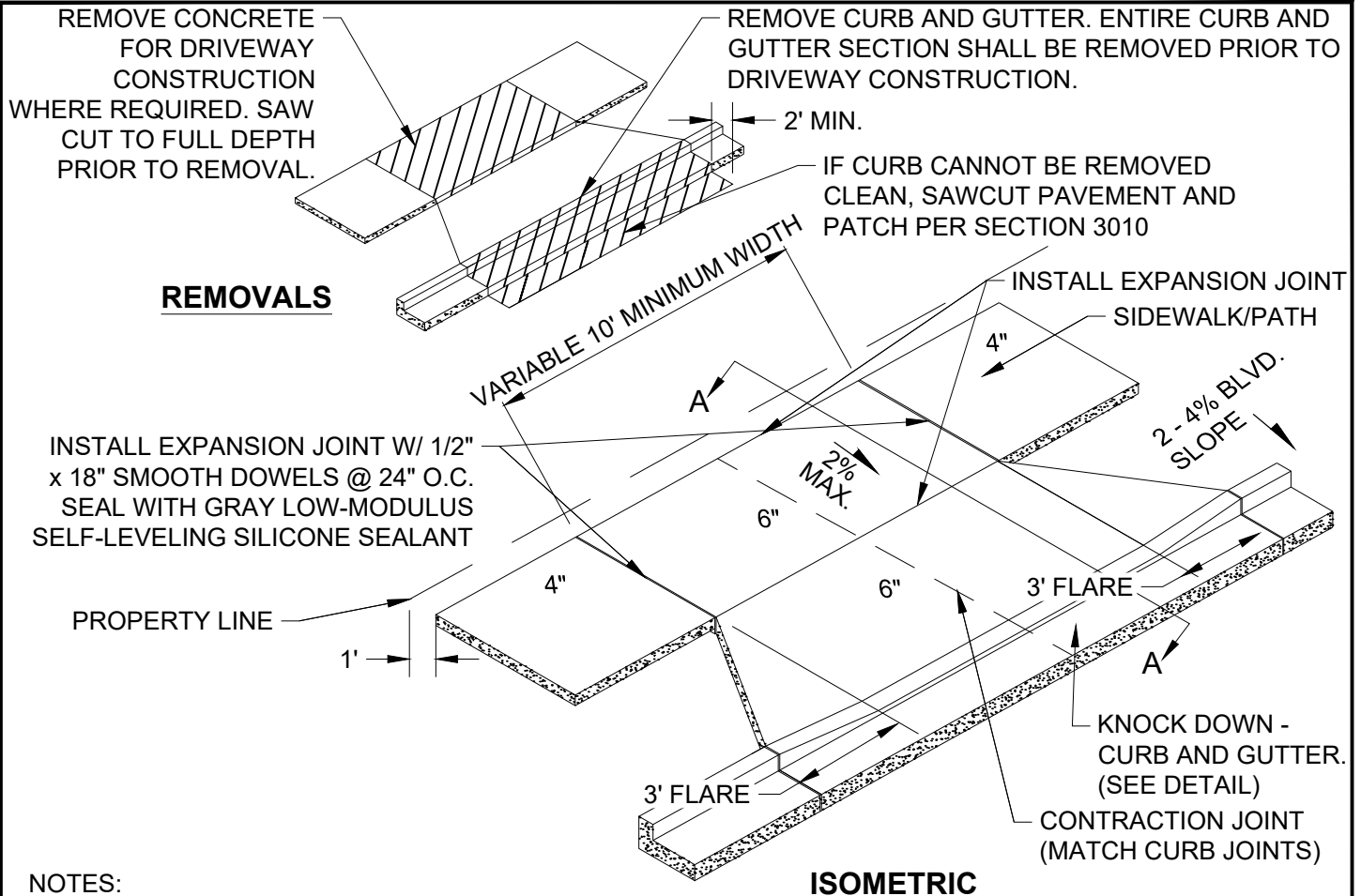
Section:

3300

STANDARD DETAILS

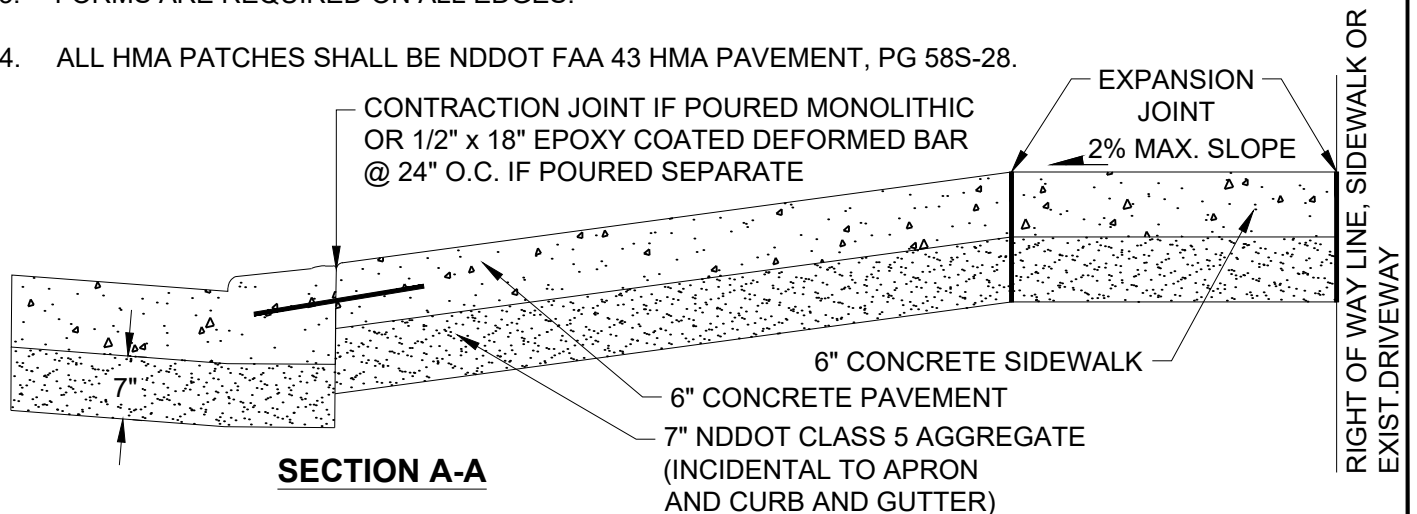
CONCRETE DRIVEWAY APRON
BOULEVARD 1.5 FT TO 4 FT

City of Minot



NOTES:

- WHERE CONNECTING TO EXISTING CONCRETE, INSTALL EXPANSION JOINT W/ MIN. TWO 1/2" X 18" SMOOTH DOWELS @ 24" O.C
- DRIVEWAYS GREATER THAN 10' WIDE SHALL HAVE CONTRACTION JOINTS PERPENDICULAR TO CURB WITH MINIMUM 10' SPACING. MATCH CURB JOINTS.
- FORMS ARE REQUIRED ON ALL EDGES.
- ALL HMA PATCHES SHALL BE NDDOT FAA 43 HMA PAVEMENT, PG 58S-28.



City Plate No.:
STR-11C

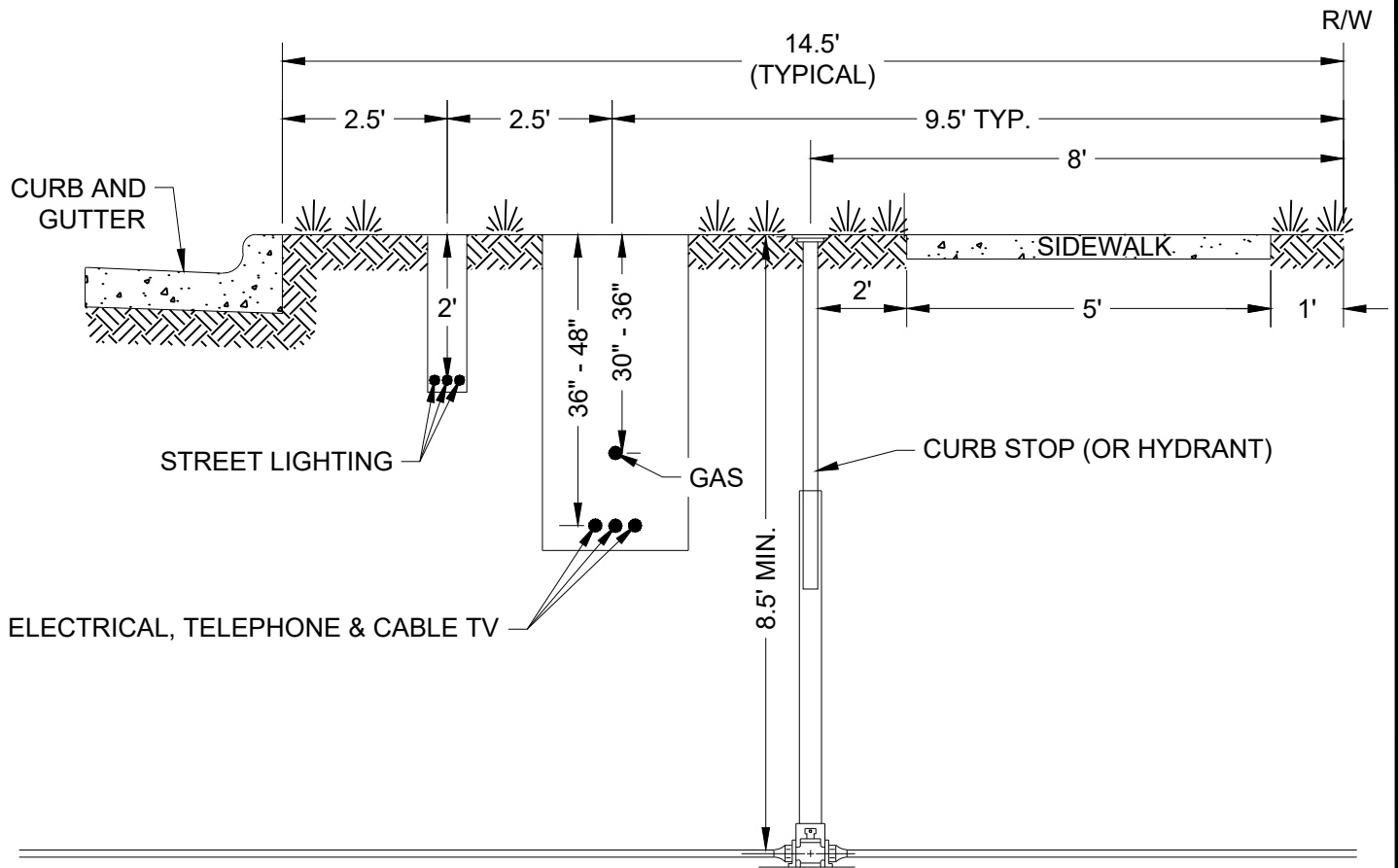
Last Revision:
03/21/2024

Section:
3300

STANDARD DETAILS

**CONCRETE DRIVEWAY APRON
BOULEVARD GREATER THAN 4 FT**

City of Minot



NOTES:

1. PLACEMENT IN NARROWER BOULEVARDS SHALL BE APPROVED BY THE CITY ENGINEER.
2. ALL UTILITY TRENCHES SHALL BE COMPACTED TO A MINIMUM OF 95% OF MAXIMUM DENSITY (AASHTO T-99).
3. THE HORIZONTAL PLACEMENT SHOWN ABOVE IS SPECIFIC TO BOULEVARDS.
4. THE VERTICAL PLACEMENT (DEPTHS) SHOWN ABOVE IS APPLICABLE TO ALL AREAS WITHIN CITY RIGHT-OF-WAY.
5. NOTIFY NORTH DAKOTA ONE CALL SYSTEM (811) BEFORE STARTING WORK.
6. MUST OBTAIN CITY OF MINOT ROW PERMIT PRIOR TO BEGINING WORK IN RIGHT-OF-WAY.
7. ELECTRICAL, TELEPHONE & CABLE TV UTILITIES ARE TO BE LOCATED OUTSIDE THE ROW AND WITHIN UTILITY EASEMENTS WHENEVER POSSIBLE.

City Plate No.:

STR-12

Last Revision:

12/18/2020

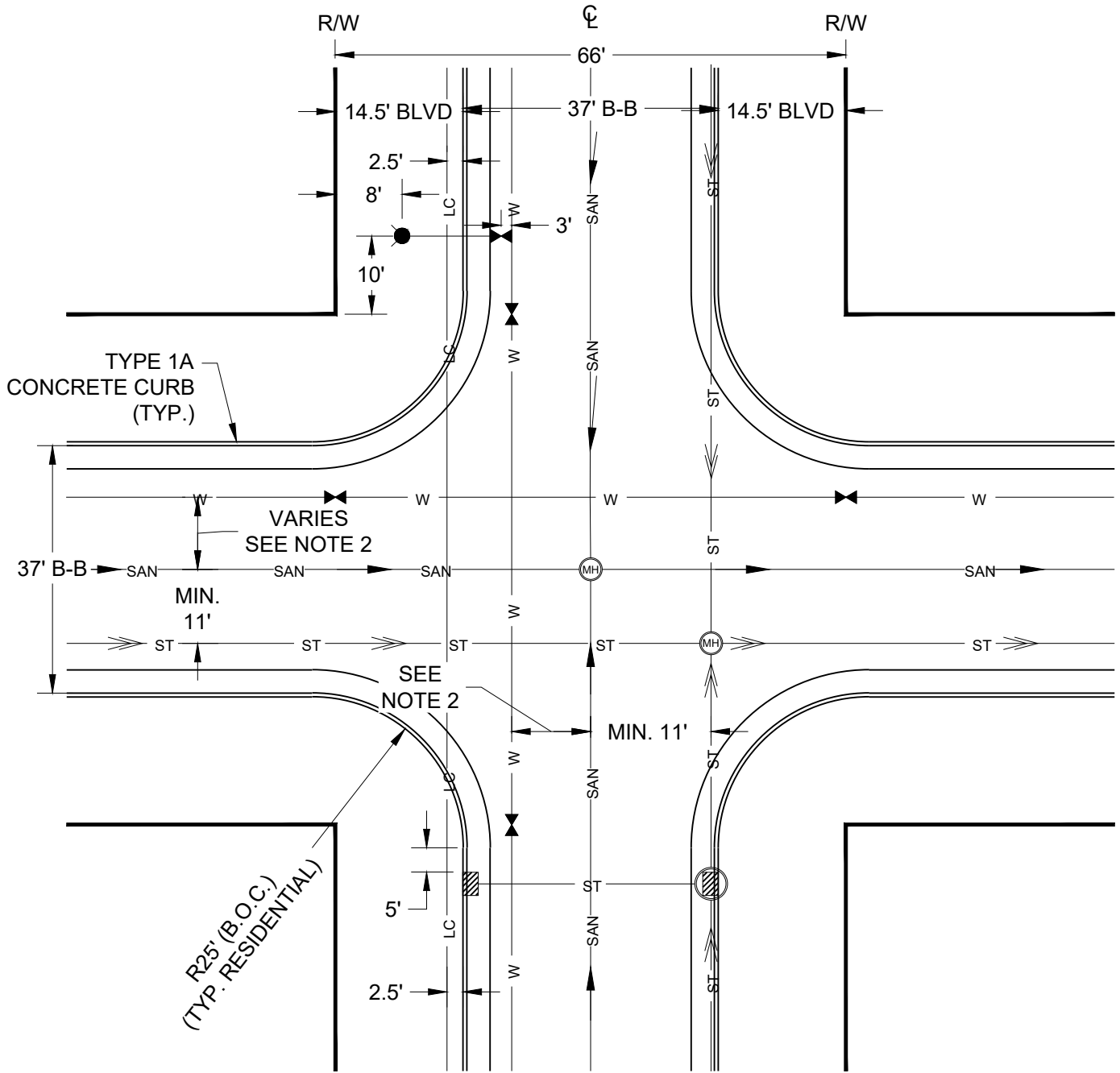
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100

STANDARD DETAILS

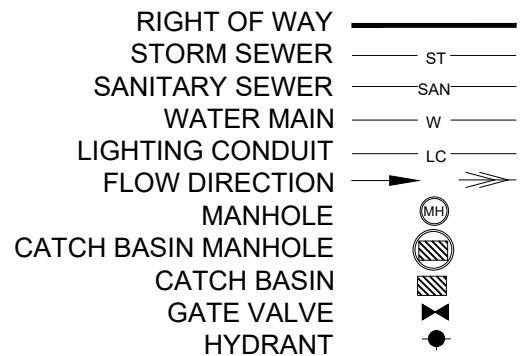
TYPICAL UTILITY PLACEMENT

City of Minot



NOTES:

1. IN INTERSECTIONS, VALVES SHALL BE PLACED AT THE EXTENSIONS OF PROPERTY LINES.
2. MAINTAIN 10' HORIZONTAL FROM OUTSIDE OF WATERMAIN PIPES TO OUTSIDE OF SEWER PIPES.



City Plate No.:

STR-13

Last Revision:

12/18/2020

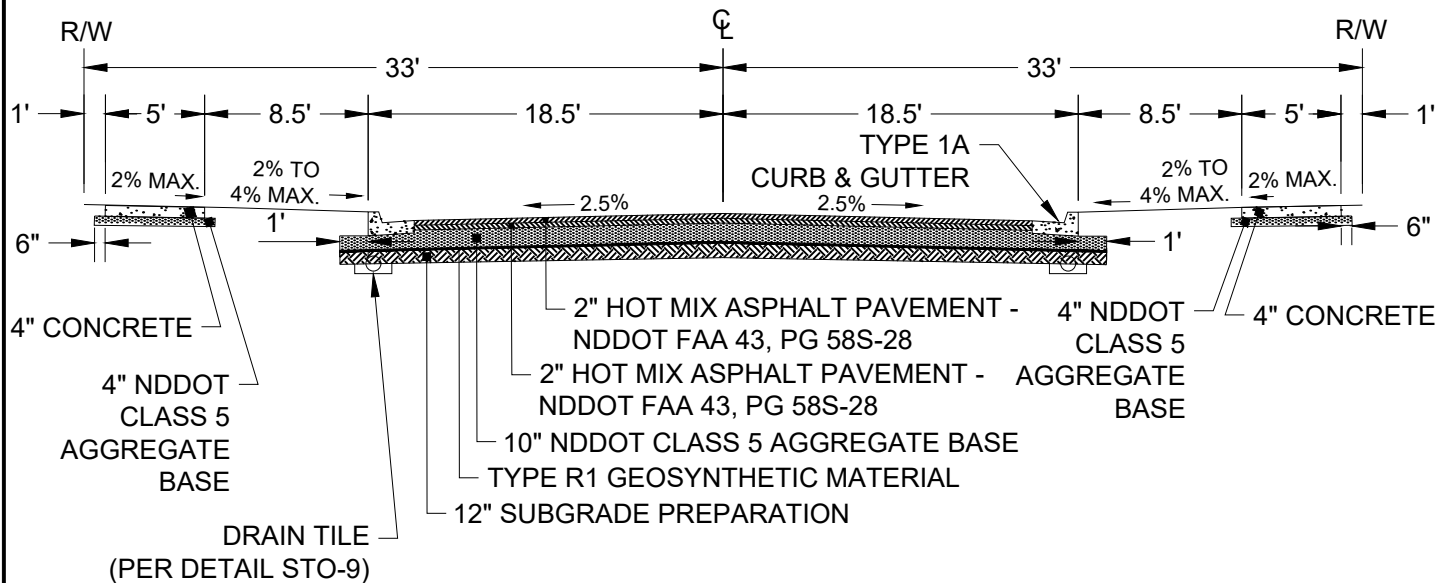
Section:

100

STANDARD DETAILS

**TYPICAL INFRASTRUCTURE
PLACEMENT**

City of Minot



NOTES:

1. R/W LINE TO BE MINIMUM 0.30', MAXIMUM 0.50' ABOVE DESIGN CENTERLINE ELEVATION.
2. TOP OF TYPE-1 CURB IS LEVEL WITH DESIGN CL GRADE.
3. SECTION SHOWN ABOVE IS THE MINIMUM RESIDENTIAL SECTION FOR TYPICAL SOILS. IF POOR SOIL CONDITIONS ARE ENCOUNTERED, THE ENGINEER SHALL DESIGN AN ALTERNATE SECTION AS APPROVED BY THE CITY ENGINEER, AND WHERE APPROPRIATE INCLUDE DRAIN TILE.

City Plate No.:

STR-14

Last Revision:

12/18/2020

Section:

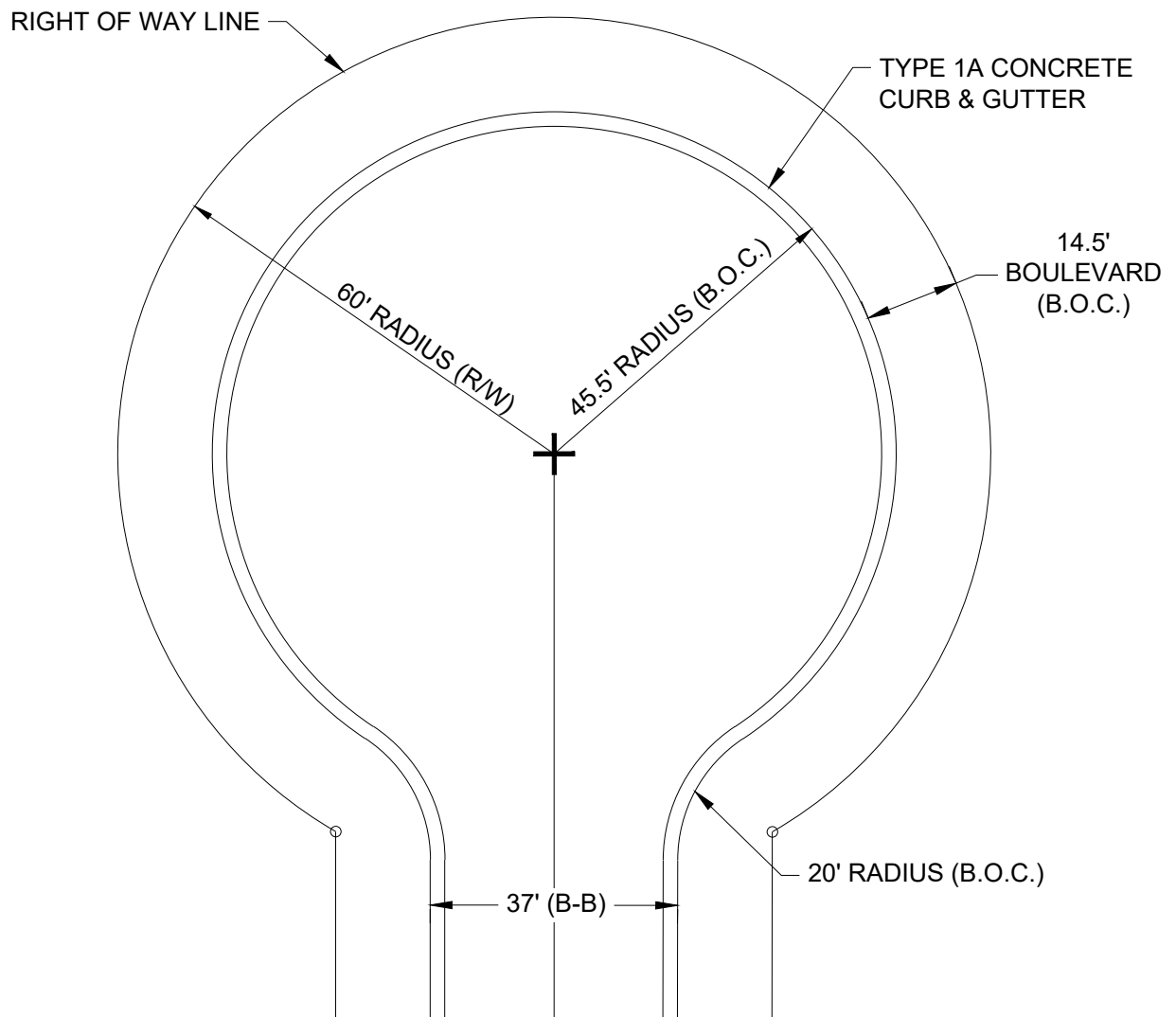
3000

STANDARD DETAILS

TYPICAL PUBLIC STREET SECTION RESIDENTIAL

City of Minot

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City Plate No.:

STR-15

Last Revision:

12/18/2020

Section:

3000

STANDARD DETAILS

TYPICAL CUL-DE-SAC RESIDENTIAL

City of Minot

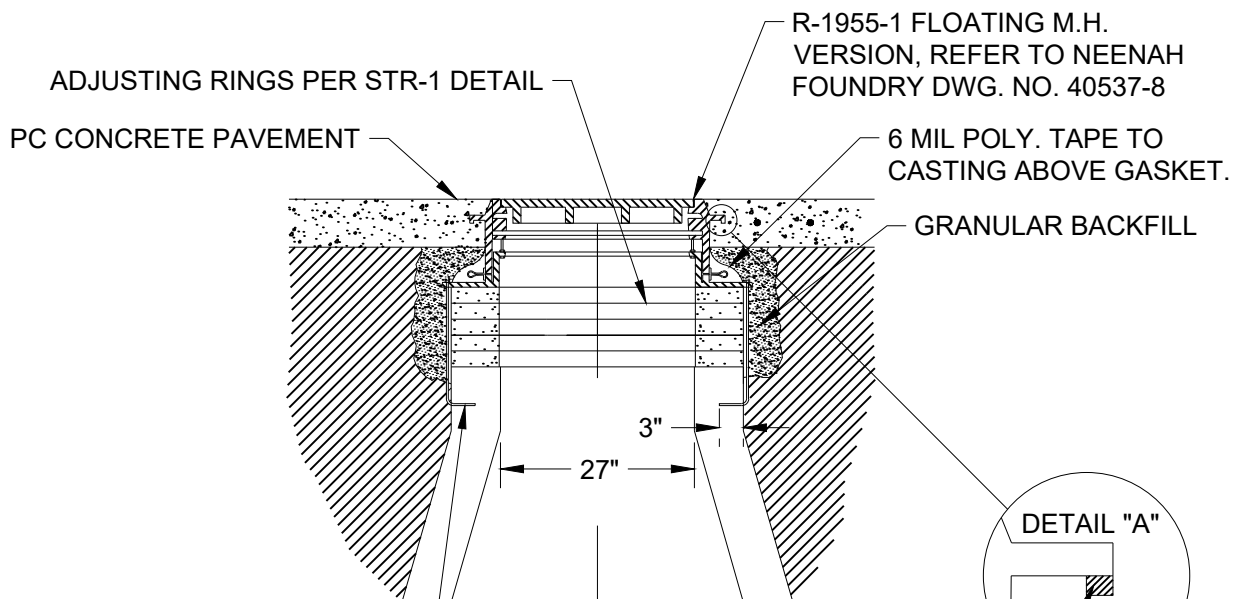
MANHOLE CASTING
PLACED ON JOINT
(SEE DETAIL "A")

TRANSVERSE JOINT

MANHOLE CASTING
(MID-SLAB)

CASTING SHALL BE
ROTATED AND PLACED
AS SHOWN

LONGITUDINAL
JOINT



3/4" DIA. S.S ANCHOR BOLTS
W/ NUTS, TO EXTEND 5" BELOW
ADJUSTING RINGS, 4 PER
CASTING, LENGTH TO VARY WITH
NUMBER OF ADJUSTING RINGS

FLOATING MANHOLE NEENAH FOUNDRY TYPE

NOTES:

1. THIS DETAIL APPLIES TO ALL MH'S LOCATED WITHIN THE CONCRETE PAVING SECTION.
2. CASTING IS INCIDENTAL TO MANHOLE.

DETAIL "A"

WHEN CASTING IS
PLACED ON TRANSVERSE
JOINTS, REMOVE ALL (4)
HOOK PORTIONS FROM
THE FLANGES AND COAT
OUTER SURFACE OF
CASTING W/ APPROVED
RELEASING AGENT.

City Plate No.:

STR-16

Last Revision:

12/18/2020

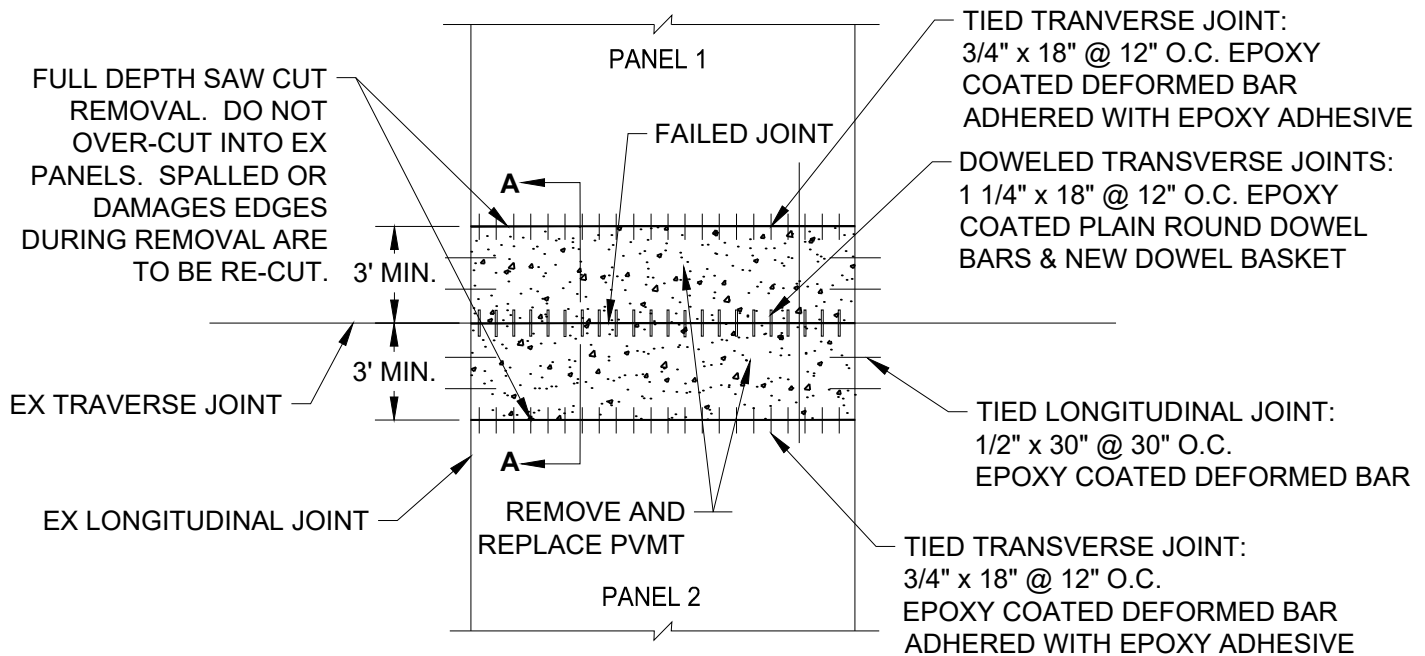
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3100

STANDARD DETAILS

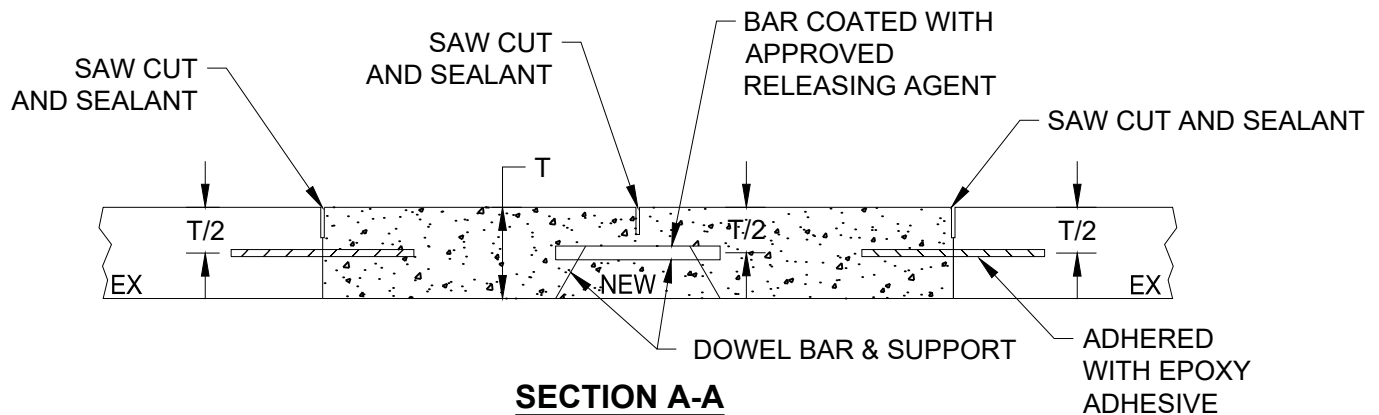
FLOATING MANHOLE CASTING

City of Minot



JOINT REPAIR - PCC PAVEMENT

NOT TO SCALE



NOTES:

1. T = PAVEMENT THICKNESS
2. ALL JOINTS TO BE SEALED.
3. ALL TIE BARS TO BE GRADE 40 STEEL.
4. ALL DOWEL, TIES, REINFORCING STEEL TO BE EPOXY COATED.
5. MAINTAIN 3" CONCRETE COVER AROUND ALL METALS.
6. PAVEMENT REPAIRS SHALL MATCH EXISTING DEPTHS.
7. ALL SUB-CUT AREAS OF BASE, SUB-BASE, AND SUBGRADE MUST BE APPROVED BY THE ENGINEER. CONTRACTOR SHALL NOT BE PAID FOR SUB-CUT QUANTITIES UNLESS APPROVAL BY THE ENGINEER IS GRANTED BEFORE WORK BEGINS.
8. PAVEMENT JOINTS SHALL NOT HAVE MORE THAN TWO SETS OF DOWEL BARS.
9. DO NOT SATURATE THE SUBGRADE DURING SAWING OPERATIONS.
10. DOWEL BARS RELEASE AGENTS SHALL BE MULTIPURPOSE LITHIUM GREASE (NLGI GRADE #2), TECTYL 506 OR APPROVED EQUAL.

City Plate No.:

STR-17A

Last Revision:

12/18/2020

Section:

3110

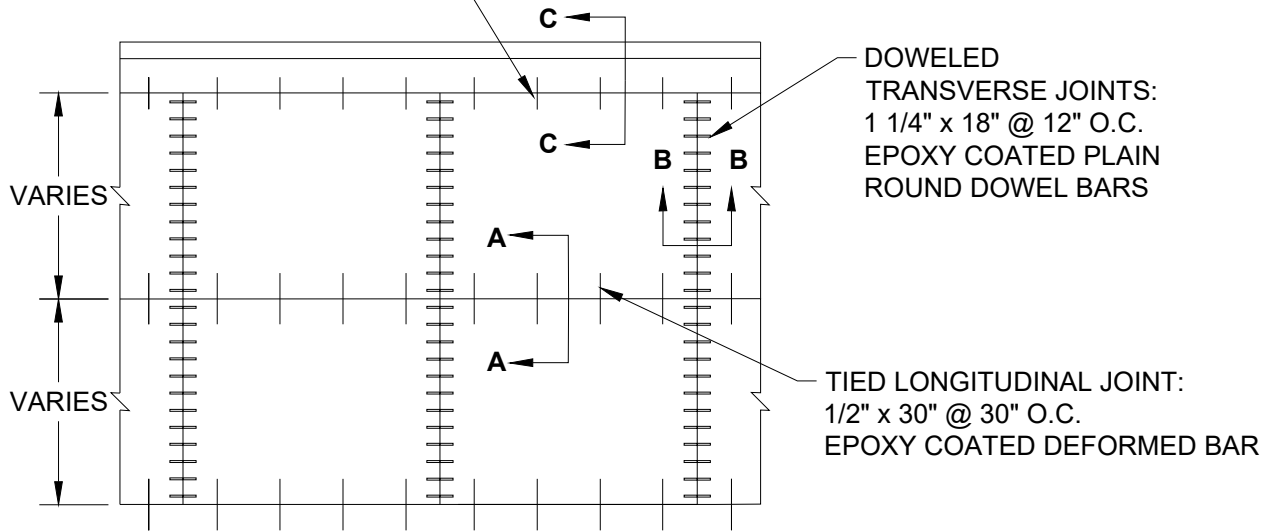
STANDARD DETAILS

CONCRETE PAVEMENT REPAIR TRANSVERSE JOINT REPLACEMENT

City of Minot

TIED CURB & GUTTER JOINT:
1/2" x 18" @ 30" O.C.
EPOXY COATED DEFORMED BARS

REFER TO STR-17C FOR
SECTIONS VIEWS A-A, B-B,
AND C-C.



FULL PANEL REPAIR - PCC PAVEMENT (8" TO 10" THICK)
NOT TO SCALE

NOTES:

1. T = PAVEMENT THICKNESS
2. ALL JOINTS TO BE SEALED.
3. ALL TIE BARS TO BE GRADE 40 STEEL.
4. ALL DOWEL, TIES, REINFORCING STEEL TO BE EPOXY COATED.
5. MAINTAIN 3" CONCRETE COVER AROUND ALL METALS.
6. PAVEMENT REPAIRS SHALL MATCH EXISTING DEPTHS.
7. ALL SUB-CUT AREAS OF BASE, SUB-BASE, AND SUBGRADE MUST BE APPROVED BY THE ENGINEER. CONTRACTOR SHALL NOT BE PAID FOR SUB-CUT QUANTITIES UNLESS APPROVAL BY THE ENGINEER IS GRANTED BEFORE WORK BEGINS.
8. PAVEMENT JOINTS SHALL NOT HAVE MORE THAN TWO SETS OF DOWEL BARS.
9. DO NOT SATURATE THE SUBGRADE DURING SAWING OPERATIONS.
10. DOWEL BARS RELEASE AGENTS SHALL BE MULTIPURPOSE LITHIUM GREASE (NLGI GRADE #2), TECTYL 506 OR APPROVED EQUAL.

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City Plate No.:

STR-17B

Last Revision:

12/18/2020

Section:

3110

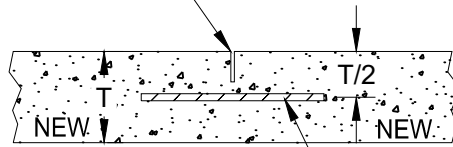
STANDARD DETAILS

**CONCRETE PAVEMENT REPAIR
FULL PANEL REPLACEMENT**

City of Minot

SAW CUT AND SEALANT

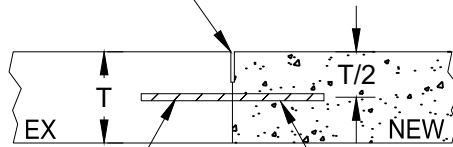
REFER TO STR-17B FOR NOTES.



TIE BAR & SUPPORT

SECTION A-A LONGITUDINAL JOINT - NEW TO NEW

SAW CUT AND SEALANT



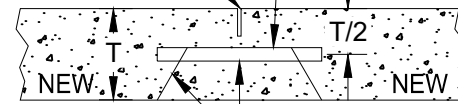
ADHERED WITH EPOXY ADHESIVE

TIE BAR

SECTION A-A LONGITUDINAL JOINT - NEW TO EX

SAW CUT AND SEALANT

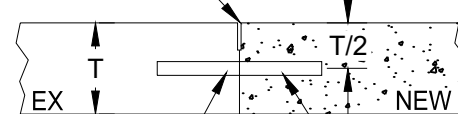
BAR COATED WITH APPROVED
RELEASING AGENT



DOWEL BAR & SUPPORT

SECTION B-B TRANSVERSE JOINT - NEW TO NEW

SAW CUT AND SEALANT

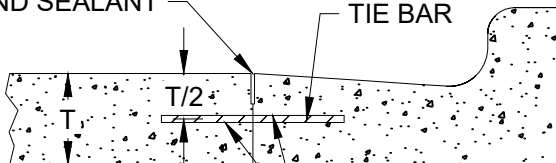


ADHERED WITH EPOXY ADHESIVE

DOWEL BAR WITH APPROVED
RELEASING AGENT

SECTION B-B TRANSVERSE JOINT - NEW TO EX

SAW CUT AND SEALANT



TIE BAR

ADHERE INTO EX CONC WITH EPOXY
ADHESIVE WHERE APPLICABLE

SECTION C-C CURB AND GUTTER JOINT

City Plate No.:

STR-17C

Last Revision:

12/18/2020

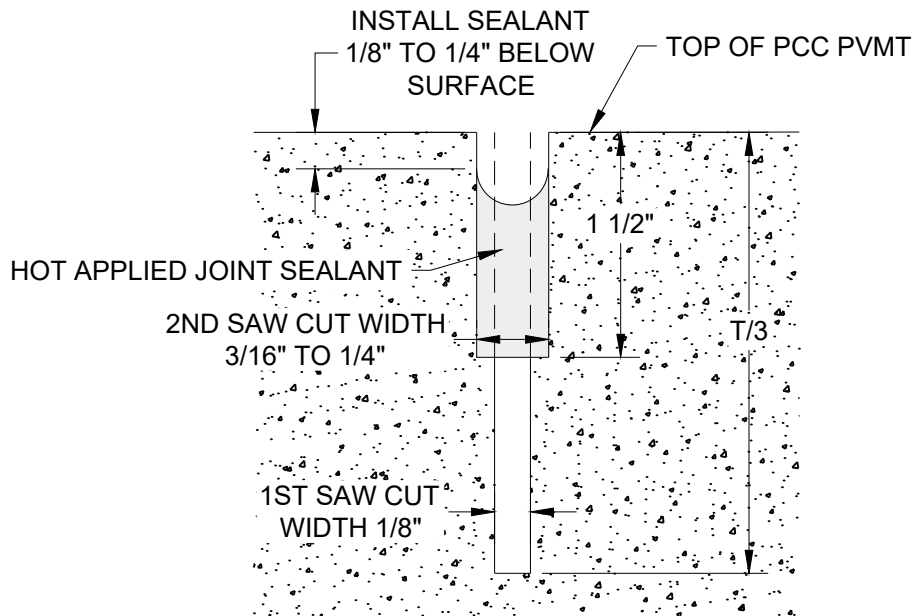
Section:

3110

STANDARD DETAILS

CONCRETE PAVEMENT REPAIR

City of Minot



SAW CUT AND SEALANT - PCC PAVEMENT

NOTES:

1. T = PAVEMENT THICKNESS.
2. THE SAW CUT AND SEALANT DETAIL APPLIES TO BOTH TRANSVERSE AND LONGITUDINAL JOINTS.
3. THE 1ST & 2ND SAW CUT SHALL BE COMPLETED ON ALL CONTRACTION JOINTS. ONLY A CUT CONFORMING TO THE 2ND CUT SHALL BE REQUIRED ON CONSTRUCTION JOINTS.
4. SAW CUT & SEALANT IS AN INCIDENTAL COST AND NOT A PAY ITEM.

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City Plate No.:

STR-17D

Last Revision:

12/18/2020

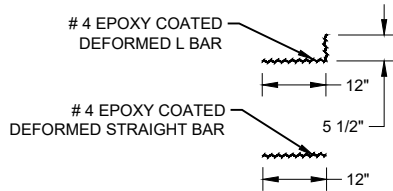
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3100

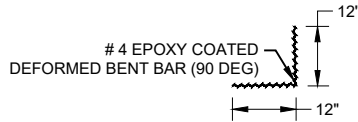
STANDARD DETAILS

CONCRETE PAVEMENT SAW CUT AND SEALANT

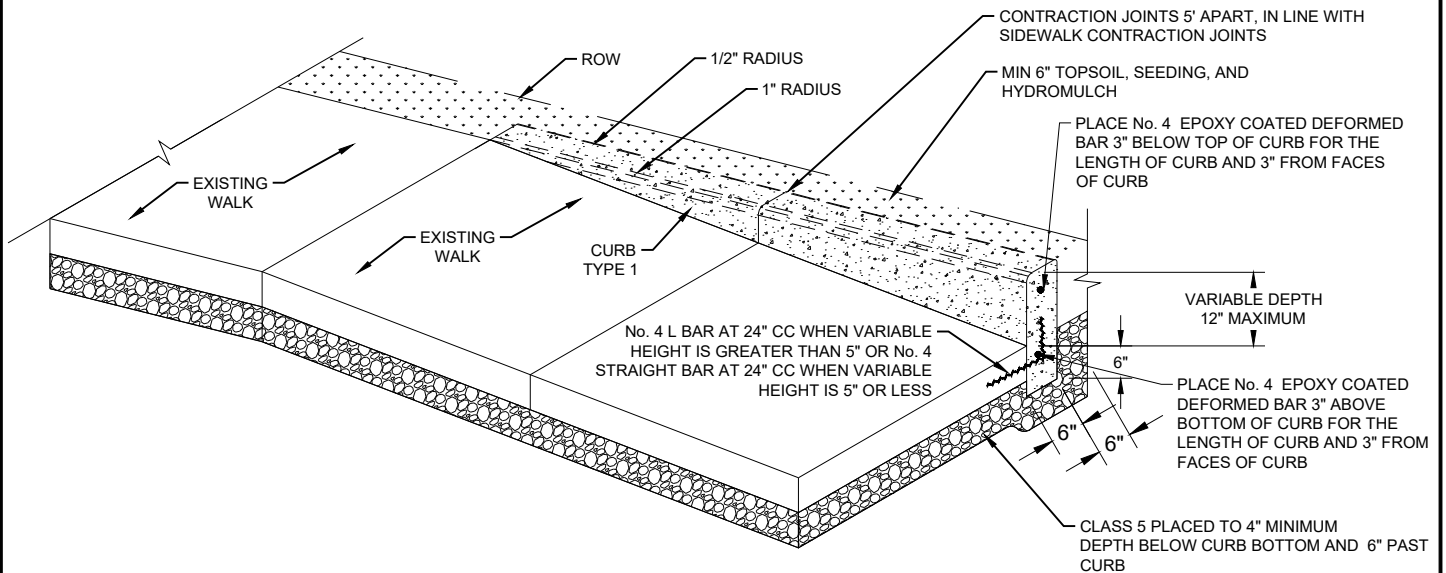
City of Minot



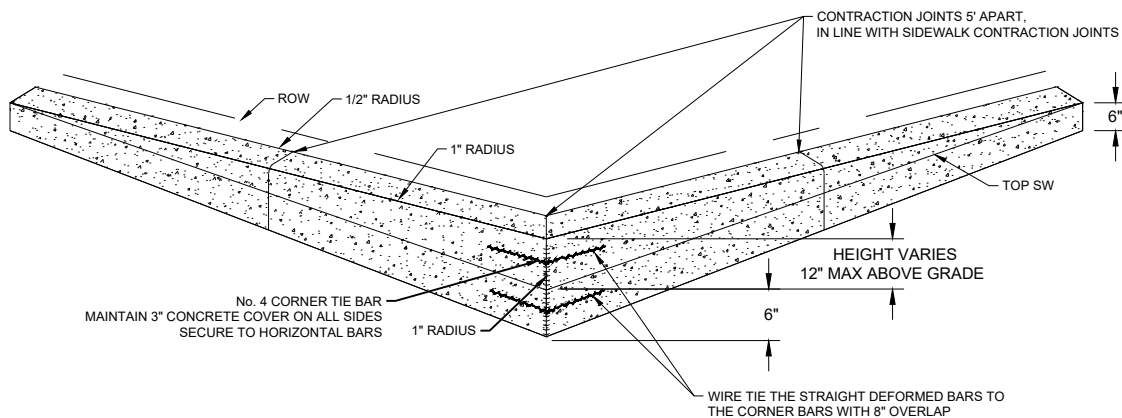
CURB TYPE 1 - L OR STRAIGHT BARS



CURB TYPE 1 - CORNER BARS



**CURB TYPE 1 ADJACENT TO LANDSCAPE
(ISOMETRIC VIEW)**



**CURB TYPE 1 INTERSECTION
(ISOMETRIC VIEW)**

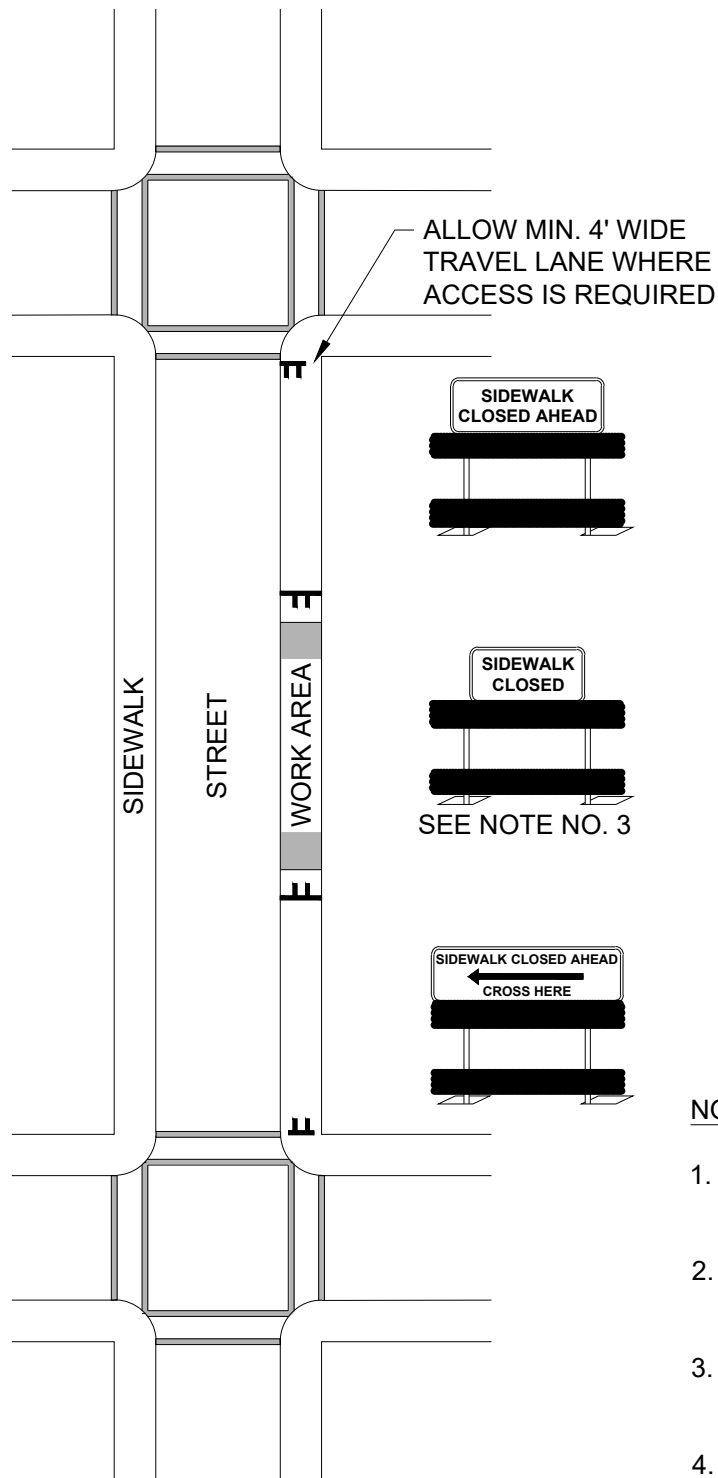
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City Plate No.:	STR-18
Last Revision:	3/24/2024
Section:	3200

STANDARD DETAILS

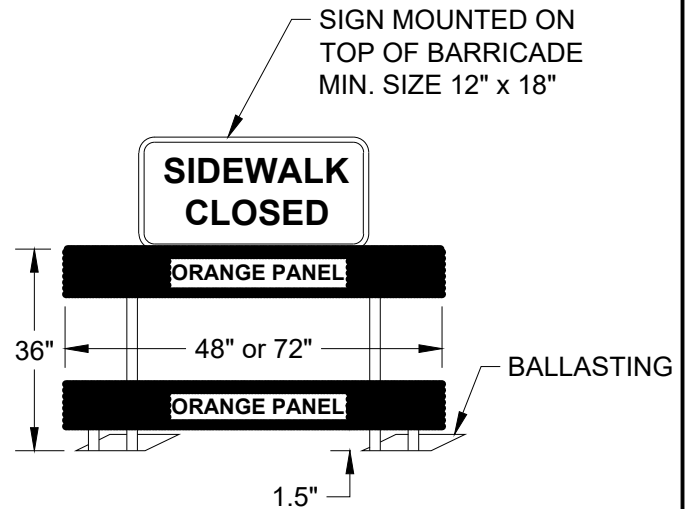
CURB TYPE 1

City of Minot



NOTE:

ADA COMPLIANT ORANGE HIGH DENSITY UV STABILIZED POLYETHYLENE INTERLOCKING WALL PANELS ARE AN ACCEPTABLE ALTERNATIVE TO TRADITIONAL BARRICADES.



NOTES:

1. BARRICADES SHALL BE ORANGE AND ARE NOT REQUIRED TO BE REFLECTORIZED.
2. ALL BALLASTING SHALL BE DONE BEHIND THE BARRICADE.
3. BARRICADE WIDTH SHALL BE SUFFICIENT TO COVER THE WIDTH OF THE SIDEWALK.
4. MINIMUM OF 2 BARRICADES SHALL BE USED AT ALL SIDEWALK CLOSURES.
5. FOR CHANNELIZING, ADA COMPLIANT ORANGE HIGH DENSITY UV STABILIZED POLYETHYLENE INTERLOCKING WALL PANELS SHALL BE USED.

City Plate No.:

TRA-1

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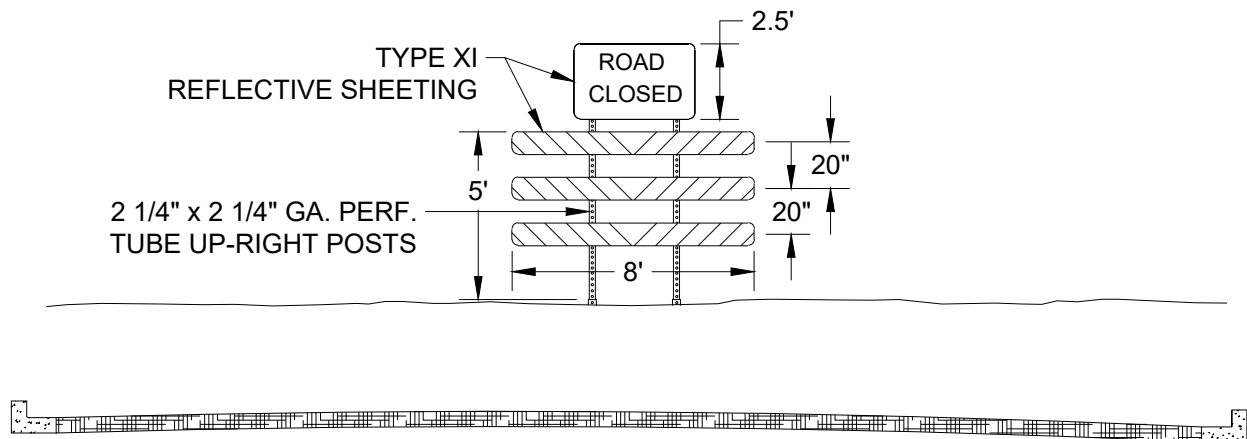
Section:

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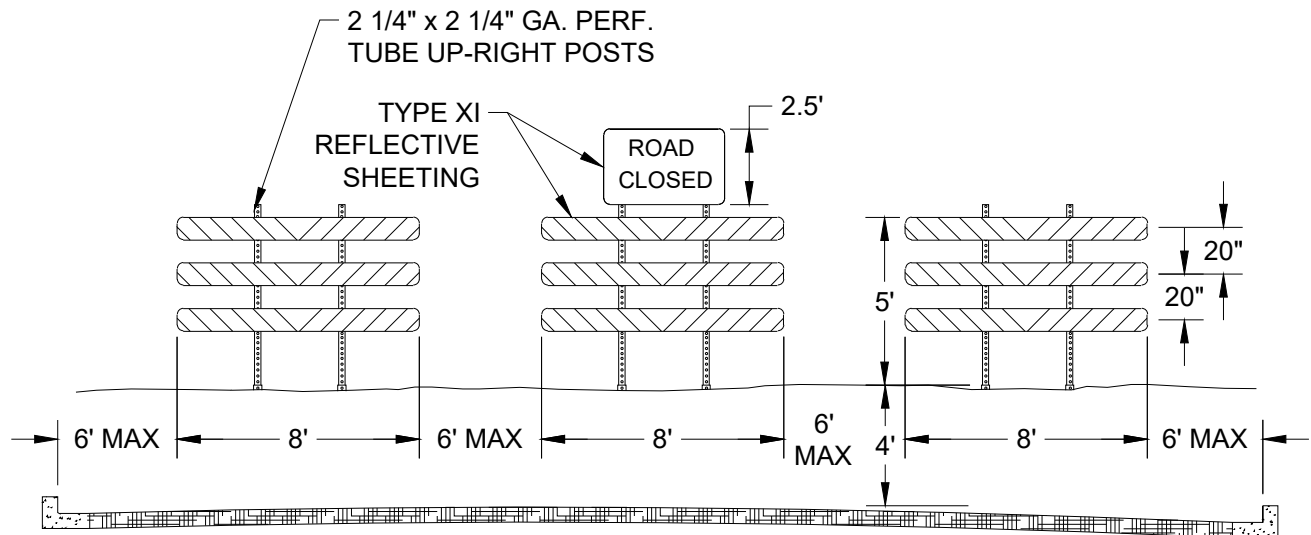
STANDARD DETAILS

WORK ZONE ADA COMPLIANT TEMP PEDESTRIAN BARRICADES

City of Minot



SINGLE BARRICADE



TRIPLE BARRICADE

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STANDARD DETAILS

ROAD CLOSED TYPE III BARRICADES

City of Minot

TRAFFIC SIGNAL STANDARD FOUNDATION SELECTION TABLE				
SIGNAL STANDARD DESCRIPTION	24" DIAMETER FOOTING DEPTH	30" DIAMETER FOOTING DEPTH	36" DIAMETER FOOTING DEPTH	42" DIAMETER FOOTING DEPTH
TYPE I, II, V, VI, VII STANDARD				
10' - 14' HEIGHT	4'	4'	3'	-
15' - 17' HEIGHT	6'	6'	5'	-
TYPE IV SIGNAL STANDARD				
0' - 25' MAST ARM	-	11'	11'	11'
26' - 30' MAST ARM	-	12'	12'	12'
31' - 35' MAST ARM	-	12'	12'	12'
36' - 39' MAST ARM	-	13'	13'	13'
40' - 45' MAST ARM	-	15'	15'	15'
46' - 50' MAST ARM	-	16'	15'	15'
51' - 55' MAST ARM	-	16'	16'	16'
56' - 60' MAST ARM	-	17'	17'	17'
61' - 65' MAST ARM	-	18'	18'	18'
COMBO SIGNAL STANDARD 30' MT HEIGHT				
0' - 25' MAST ARM	-	11'	11'	11'
26' - 30' MAST ARM	-	12'	12'	12'
31' - 35' MAST ARM	-	13'	13'	13'
36' - 39' MAST ARM	-	14'	14'	14'
40' - 45' MAST ARM	-	16'	15'	15'
46' - 50' MAST ARM	-	16'	16'	16'
51' - 55' MAST ARM	-	17'	16'	16'
56' - 60' MAST ARM	-	18'	17'	17'
61' - 65' MAST ARM	-	19'	18'	18'
COMBO SIGNAL STANDARD 40' MT HEIGHT				
0' - 25' MAST ARM	-	12'	12'	12'
26' - 30' MAST ARM	-	13'	13'	13'
31' - 35' MAST ARM	-	13'	13'	13'
36' - 39' MAST ARM	-	14'	14'	14'
40' - 45' MAST ARM	-	16'	15'	15'
46' - 50' MAST ARM	-	16'	16'	16'
51' - 55' MAST ARM	-	17'	16'	16'
56' - 60' MAST ARM	-	18'	17'	17'
61' - 65' MAST ARM	-	19'	18'	18'
COMBO SIGNAL STANDARD 50' MT HEIGHT				
0' - 25' MAST ARM	-	12'	12'	12'
26' - 30' MAST ARM	-	13'	13'	13'
31' - 35' MAST ARM	-	13'	13'	13'
36' - 39' MAST ARM	-	14'	14'	14'
40' - 45' MAST ARM	-	16'	16'	16'
46' - 50' MAST ARM	-	16'	16'	16'
51' - 55' MAST ARM	-	17'	17'	17'
56' - 60' MAST ARM	-	18'	18'	17'
61' - 65' MAST ARM	-	19'	19'	18'

FOUNDATION REINFORCING TABLE	
FOORING DEPTH	LONGITUDINAL REINFORCING
12' OR LESS	8 - #5
13' - 14'	8 - #6
15' - 16'	8 - #7
17' - 19'	8 - #8

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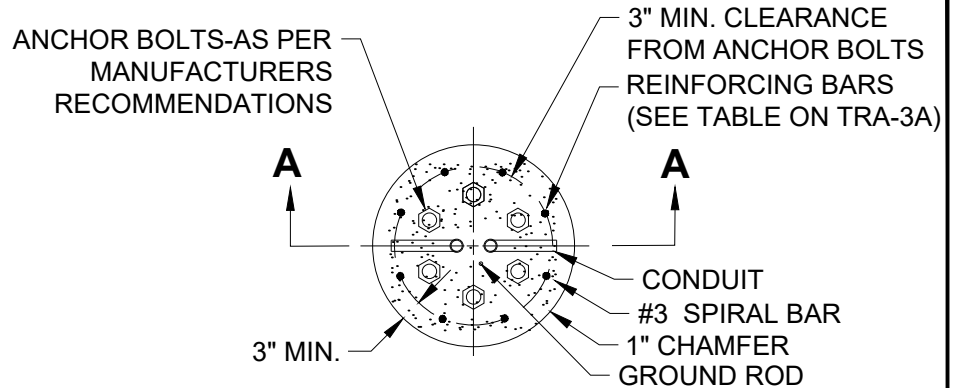
STANDARD DETAILS

**TRAFFIC SIGNAL STANDARD
FOUNDATION SELECTION TABLE**

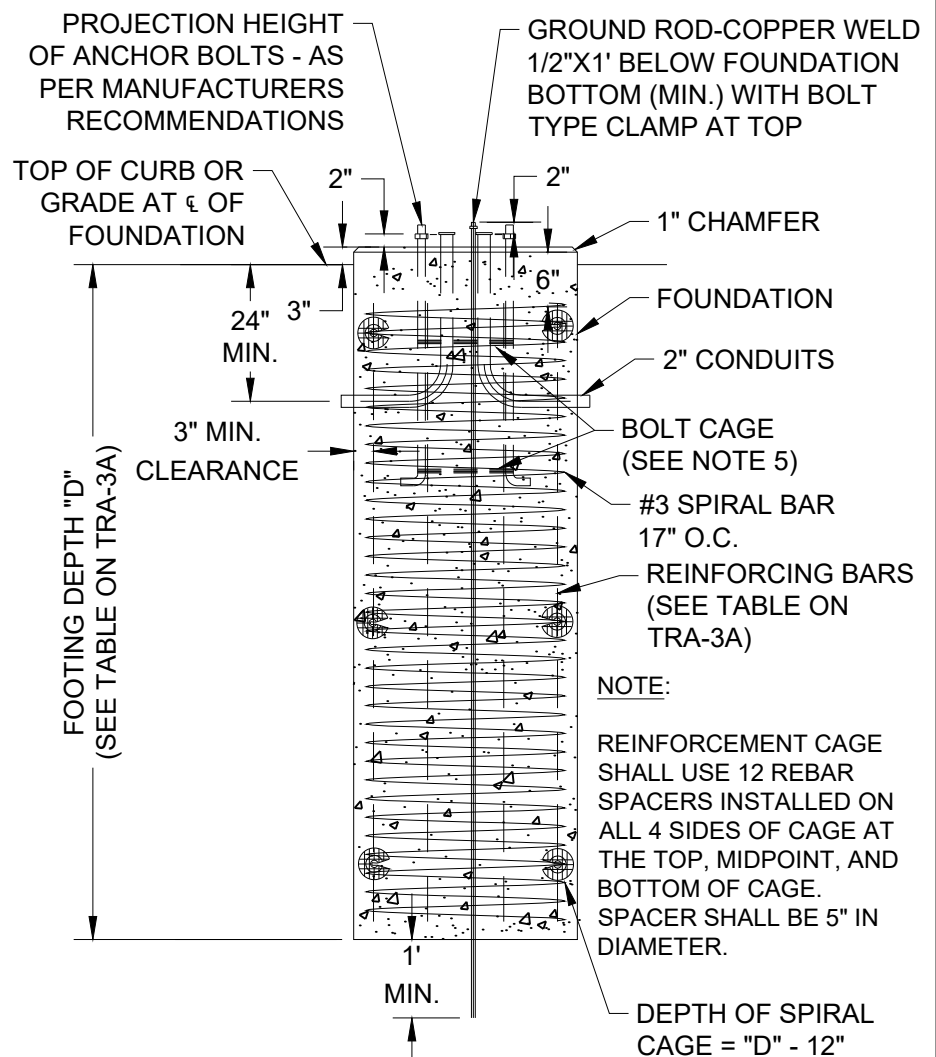


NOTES:

1. SEE PLANS FOR CORRECT LOCATION OF FOUNDATION. THE GRADE AND EXACT LOCATION SHALL BE ESTABLISHED BY THE ENGINEER IN THE FIELD.
2. CONCRETE USED IN THE WORK SHALL BE CLASS AE PORTLAND CEMENT CONCRETE MIXED AND PROPORTIONED AS SPECIFIED IN NDDOT STANDARD SPECIFICATIONS SECTION 802.
3. ALL REINFORCING STEEL SHALL BE GRADE 40 OR 60.
4. SEE PLANS FOR CONDUIT SIZE, NUMBER OF BENDS, AND CORRECT POSITIONING FOR EACH FOUNDATION.
5. THE FOUNDATION SHALL PROVIDE A MINIMUM OF 3" OF CONCRETE COVER FROM THE ANCHOR BOLTS TO THE REBAR CAGE AND A MINIMUM OF 3" OF CONCRETE COVER OVER THE REBAR CAGE TO THE OUTSIDE OF THE FOUNDATION. THE DIAMETER OF THE FOUNDATION SHALL BE INCREASED TO ACCOMMODATE A LARGER BOLT CIRCLE.
6. AN ANCHOR BOLT CAGE SHALL BE SHOP FABRICATED FROM #6 BAR CIRCLE OR $\frac{3}{4}$ " SQUARE STOCK OR APPROVED EQUAL WELDED TO THE INSIDE OF THE ANCHOR BOLT TO HOLD ALIGNMENT.
7. GROUND ROD SHALL BE PLACED PRIOR TO CONCRETE PLACEMENT. THE ROD SHALL PROJECT 4" ABOVE THE FINISHED FOUNDATION AND SHALL EXTEND AT LEAST 12" BELOW THE FOUNDATION BOTTOM.
8. CONDUIT BENDS SHALL BE 90°. CONDUIT SHALL BE LOCATED 24" MINIMUM BELOW GROUND LEVEL. A SPARE 2" CONDUIT SHALL BE INSTALLED IN EACH FOUNDATION WITH BOTH ENDS PLUGGED AS PER SPARE CONDUIT SPECIFICATION.
9. THE TOP OF THE FOUNDATION SHALL BE CIRCULAR. IF APPROVED BY THE ENGINEER A SQUARE CASING MAY BE USED. PRIOR TO FINAL GRADING OR SIDEWALK PLACEMENT THE CASING TUBES SHALL BE REMOVED TO A POINT 6" BELOW GRADE.



PLAN



SECTION A-A

NOTE:

REINFORCEMENT CAGE SHALL USE 12 REBAR SPACERS INSTALLED ON ALL 4 SIDES OF CAGE AT THE TOP, MIDPOINT, AND BOTTOM OF CAGE. SPACER SHALL BE 5" IN DIAMETER.

DEPTH OF SPIRAL CAGE = "D" - 12"

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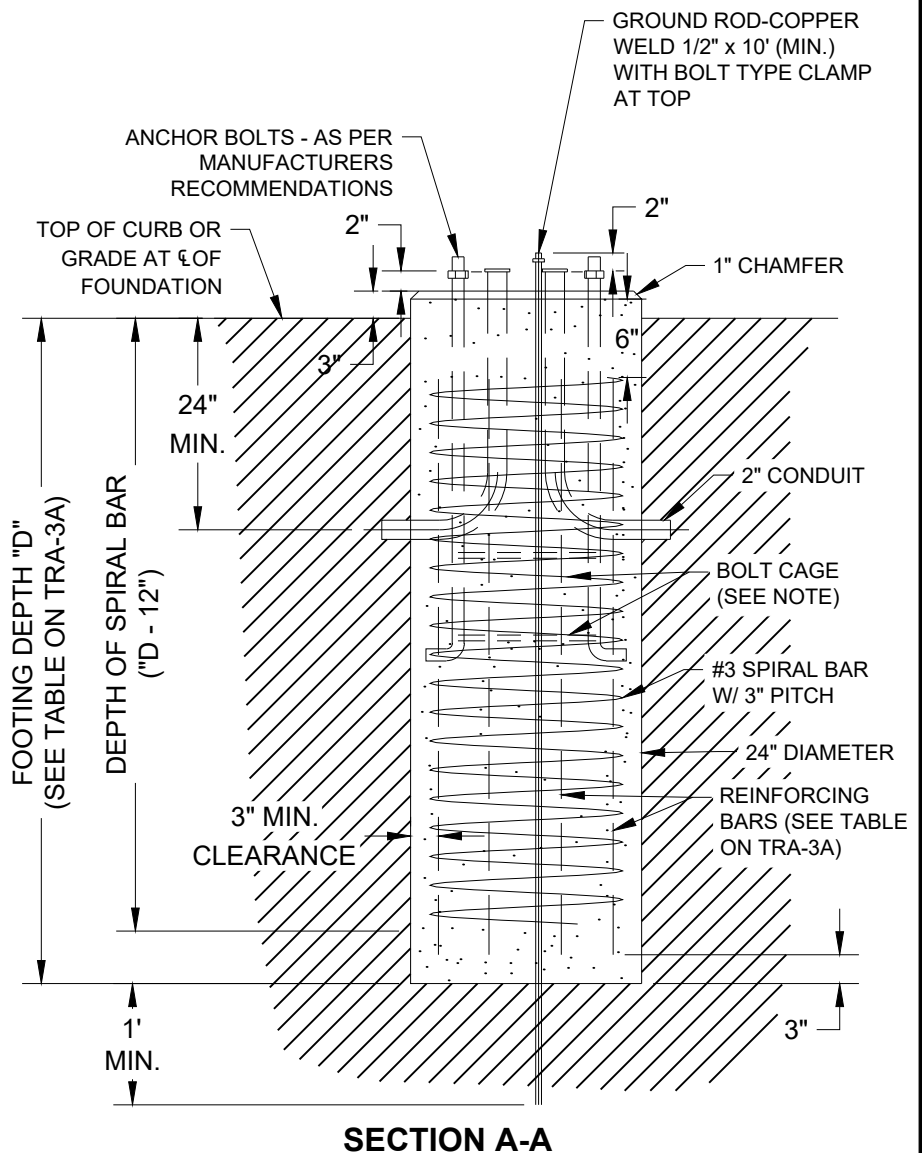
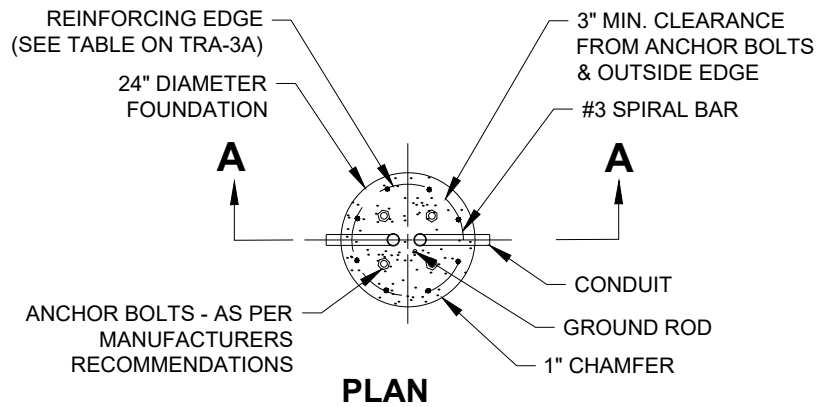
STANDARD DETAILS

**TRAFFIC SIGNAL FOUNDATION
30/36/42 INCH DIAMETER**

City of Minot

NOTES:

1. SEE PLANS FOR CORRECT LOCATION OF FOUNDATION. THE GRADE AND EXACT LOCATION SHALL BE ESTABLISHED BY THE ENGINEER IN THE FIELD.
2. CONCRETE USED IN THE WORK SHALL BE CLASS AE PORTLAND CEMENT CONCRETE MIXED AND PROPORTIONED AS SPECIFIED IN NDDOT STANDARD SPECIFICATIONS SECTION 802.
3. ALL REINFORCING STEEL SHALL BE GRADE 40 OR 60.
4. SEE PLANS FOR CONDUIT SIZE, NUMBER OF BENDS, AND CORRECT POSITIONING FOR EACH FOUNDATION.
5. THE FOUNDATION SHALL PROVIDE A MINIMUM OF 3" OF CONCRETE COVER FROM THE ANCHOR BOLTS TO THE REBAR CAGE AND A MINIMUM OF 3" OF CONCRETE COVER OVER THE REBAR CAGE TO THE OUTSIDE OF THE FOUNDATION. THE DIAMETER OF THE FOUNDATION SHALL BE INCREASED TO ACCOMMODATE A LARGER BOLT CIRCLE.
6. AN ANCHOR BOLT CAGE SHALL BE SHOP FABRICATED FROM #6 BAR CIRCLE OR $\frac{3}{4}$ " SQUARE STOCK OR APPROVED EQUAL WELDED TO THE INSIDE OF THE ANCHOR BOLT TO HOLD ALIGNMENT.
7. GROUND ROD SHALL BE PLACED PRIOR TO CONCRETE PLACEMENT. THE ROD SHALL PROJECT 4" ABOVE THE FINISHED FOUNDATION AND SHALL EXTEND AT LEAST 12" BELOW THE FOUNDATION BOTTOM.
8. CONDUIT BENDS SHALL BE 90°. CONDUIT SHALL BE LOCATED 24" MINIMUM BELOW GROUND LEVEL. A SPARE 2" CONDUIT SHALL BE INSTALLED IN EACH FOUNDATION WITH BOTH ENDS PLUGGED AS PER SPARE CONDUIT SPECIFICATION.
9. THE TOP OF THE FOUNDATION SHALL BE CIRCULAR. IF APPROVED BY THE ENGINEER A SQUARE CASING MAY BE USED. PRIOR TO FINAL GRADING OR SIDEWALK PLACEMENT THE CASING TUBES SHALL BE REMOVED TO A POINT 6" BELOW GRADE.
10. IF THE CONTRACTOR ELECTS TO USE A 24" SQUARE FOUNDATION, THE NEXT SIZE SMALLER REINFORCEMENT BARS MAY BE SUBSTITUTED FOR THOSE SHOWN IN THE TABLE. NO SUBSTITUTIONS MAY BE MADE FOR A 36" SQUARE FOUNDATION. #4 TIE BARS MAY BE SUBSTITUTED FOR THE SPIRAL, WITH THE BARS SPACED AT EQUAL SPACE TO A MAXIMUM OF 12" C. TO C., STARTING WITH THE FIRST AT THE TOP OF THE REINFORCING AND THE LAST AT THE BOTTOM OF THE REINFORCING. ROUND TIE BARS SHALL HAVE A MIN. OF 12" OVERLAP.
11. NO REINFORCEMENT IS REQUIRED IF THE ANCHOR BOLTS EXTEND TO WITHIN 3" TO 6" ABOVE THE BOTTOM OF THE 24" DIAMETER FOUNDATION.



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STANDARD DETAILS

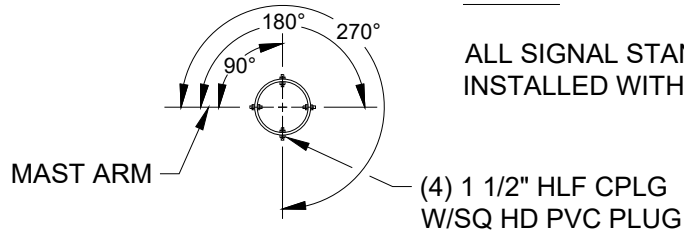
TRAFFIC SIGNAL FOUNDATION

24 INCH DIAMETER

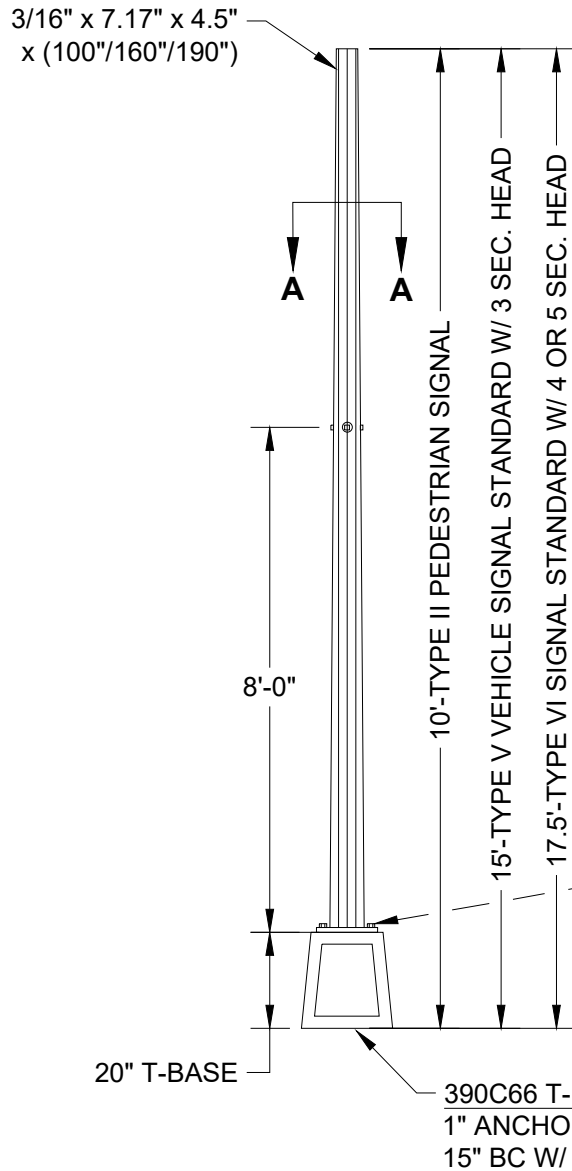
City of Minot

POLES:

ALL SIGNAL STANDARDS ARE TO BE
INSTALLED WITH A TRANSFORMER BASE.



SECTION A-A



POLE BASE PLATE

NOTES:

1. POLES SHALL BE GALVANIZED AND COLORED BLACK PER STANDARD SPECIFICATIONS.

(4) 1-8NC x 3 1/2" LG HVY
HX HD BOLT, HVY HX NUT &
LOCKWASHER (ASTM A325-GV)
(INSTALL HD UP)

ELEVATION

City Plate No.:

TRA-4A

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STANDARD DETAILS

SIGNAL STANDARDS

City of Minot

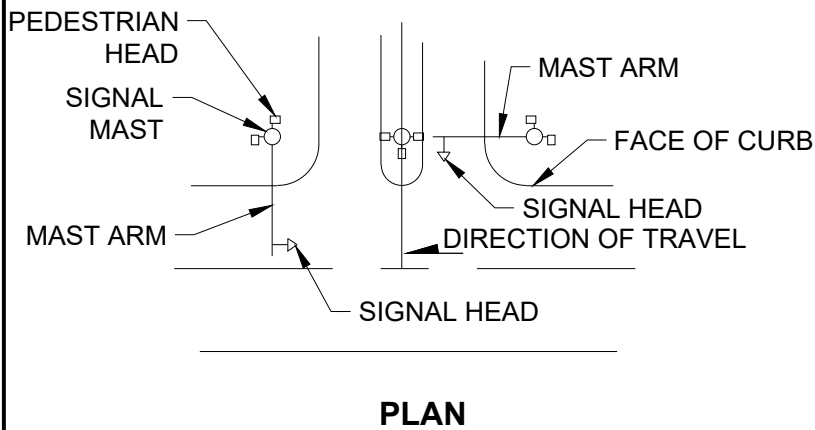
1. EXTENSION BASE ASSEMBLY AND LUMINAIRE EXTENSION APPLY TO COMBINATION SIGNAL AND LIGHT STANDARD.
2. WHEN A LUMINAIRE EXTENSION IS NOT USED, A REMOVABLE CAP SHALL BE INSTALLED.
3. MAST ARM MATERIAL AND FINISH SHALL MATCH SIGNAL STANDARDS.



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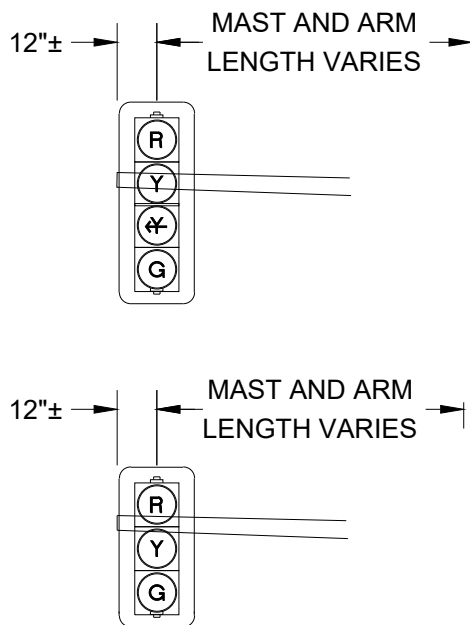
TYPE IV SIGNAL STANDARD WITH MAST ARM AND COMBINATION





NOTES:

1. THIS IS A TYPICAL PLAN LAYOUT.
2. HEADS MOUNTED ON SIGNAL STANDARDS SHALL NOT PROTRUDE OVER THE FACE OF THE CURB.
3. 4-SECTION FLASHING YELLOW ARROW HEAD SHALL BE MOUNTED TO THE MAST ARM AT THE CENTER OF THE SOLID YELLOW ARROW HEAD.
4. 3-SECTION BALL HEAD SHALL BE MOUNTED TO THE MAST ARM BETWEEN THE RED AND YELLOW BALL.



SIDE VIEW

City Plate No.:

TRA-4C

Last Revision:

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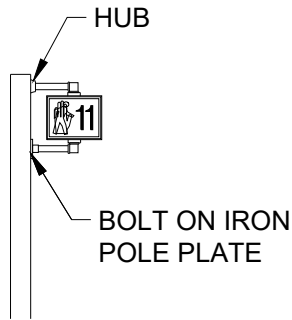
Section:

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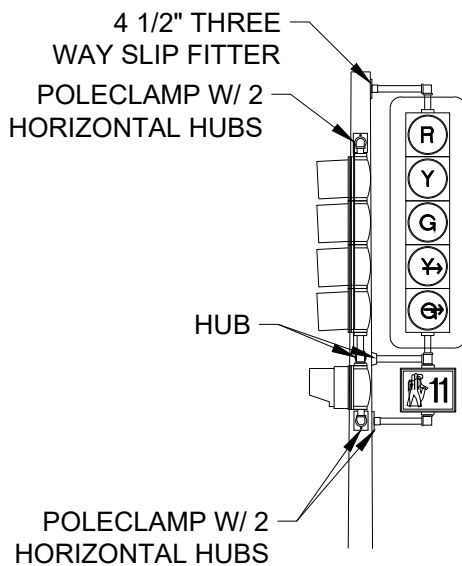
STANDARD DETAILS

**SIGNAL MAST ARM
HEAD MOUNTING**

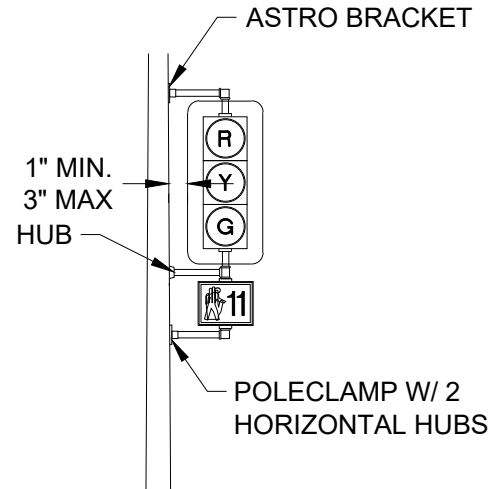
City of Minot



TYPE II - 10' HEIGHT
PEDESTAL MOUNTED - PEDESTRIAN



TYPE VI - 17.5' HEIGHT
POST MOUNTED - PEDESTRIAN
POST MOUNTED - VEHICULAR



TYPE V - 15' HEIGHT
POST MOUNTED - PEDESTRIAN
POST MOUNTED - VEHICULAR

NOTES:

CLEARANCE

CLEARANCE FROM GROUND LINE OR SIDEWALK TO THE BOTTOM OF POST OR PEDESTAL MOUNTED VEHICULAR SIGNAL HEADS SHALL BE 10'. MINIMUM FROM PEDESTRIAN SIGNAL SHALL BE 8'.

SIGNAL HEADS

SEE PLANS FOR CORRECT MOUNTING POSITION, NUMBERS, SIZE, AND ARRANGEMENT OF LENSES.

POLE CLAMPS

A POLE PLATE WITH SUITABLE BANDING MATERIAL AS APPROVED BY THE ENGINEER SHALL BE USED.

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City Plate No.:	TRA-4D
Last Revision:	12/18/2020
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STANDARD DETAILS
SIGNAL POLE HEAD MOUNTING



CABLE TERMINATIONS

TERMINAL T1: PRE-EMPTION 1 AND 2-SHRINK WRAP GROUND WIRE

TERMINAL T2: PRE-EMPTION 1 AND 2-ORANGE WIRE-TOP TUBE

TERMINAL T3: PRE-EMPTION 1-TOP TUBE-BLUE WIRE

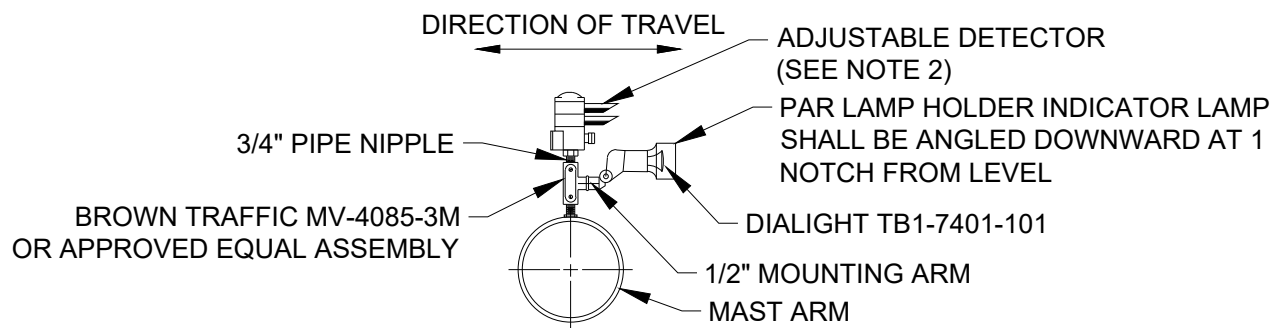
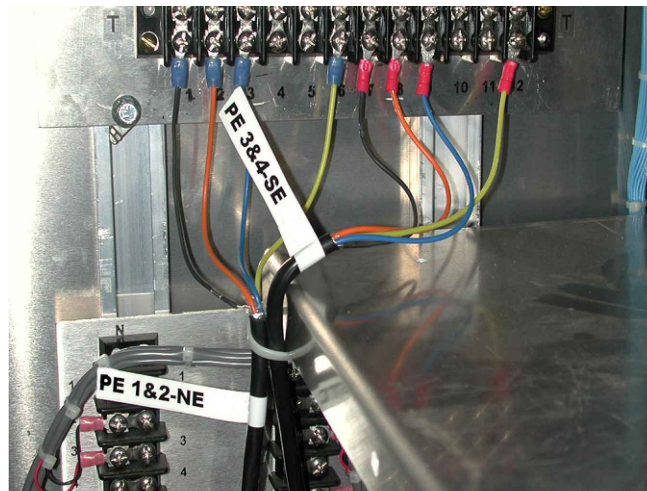
TERMINAL T6: PRE-EMPTION 2-BOTTOM TUBE-YELLOW WIRE

TERMINAL T7: PRE-EMPTION 3 AND 4-SHRINK WRAP GROUND WIRE

TERMINAL T8: PRE-EMPTION 3 AND 4-ORANGE WIRE-BOTTOM TUBE

TERMINAL T9: PRE-EMPTION 3-TOP TUBE-BLUE WIRE

TERMINAL T12: PRE-EMPTION 4-BOTTOM TUBE-YELLOW WIRE



NOTES:

(ONE WAY DETECTION)

1. TWO-WAY DETECTOR SHALL HAVE TYPE X UNILET WITH ONE PAR LAMP HOLDERS AND LAMP.
2. TWO-WAY DETECTOR SHALL HAVE THE DETECTOR LENS ROTATED TO FACE THE DIRECTIONS OF TRAVEL.

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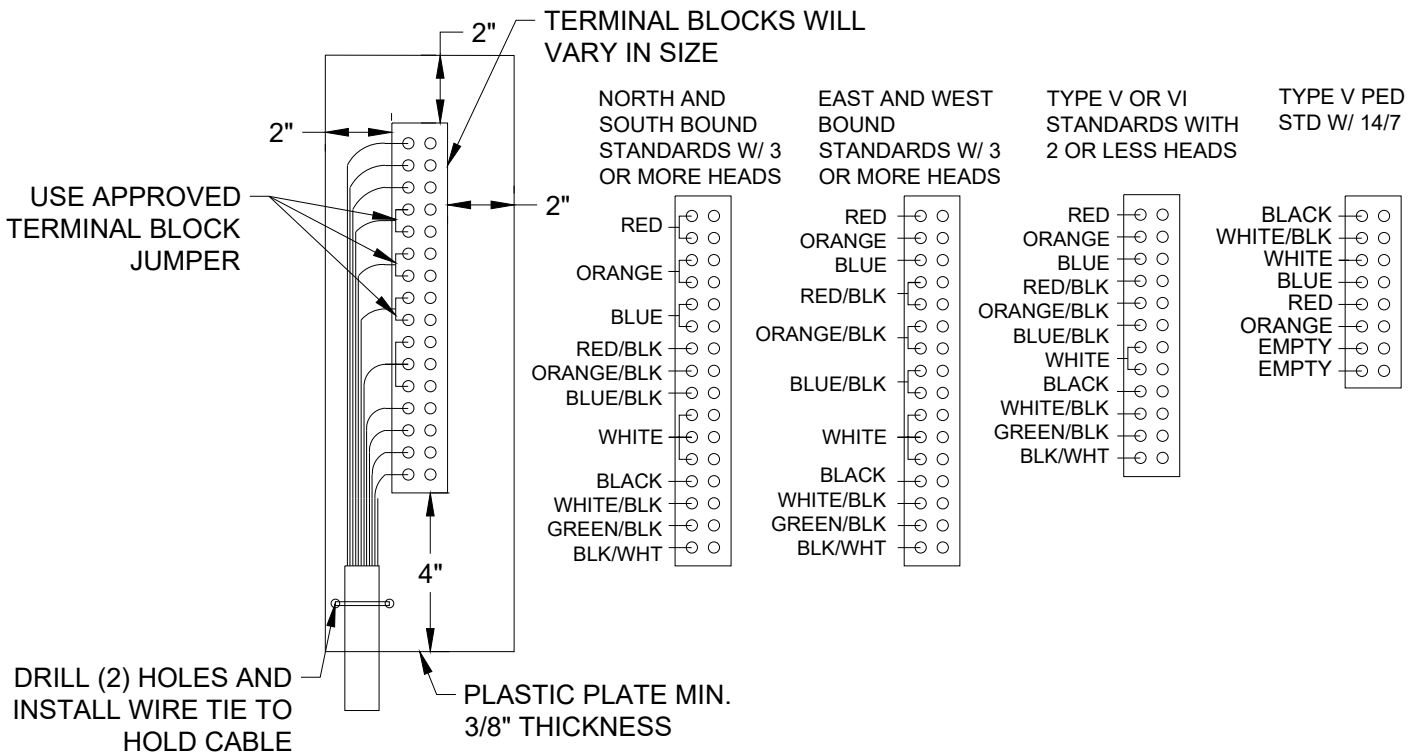
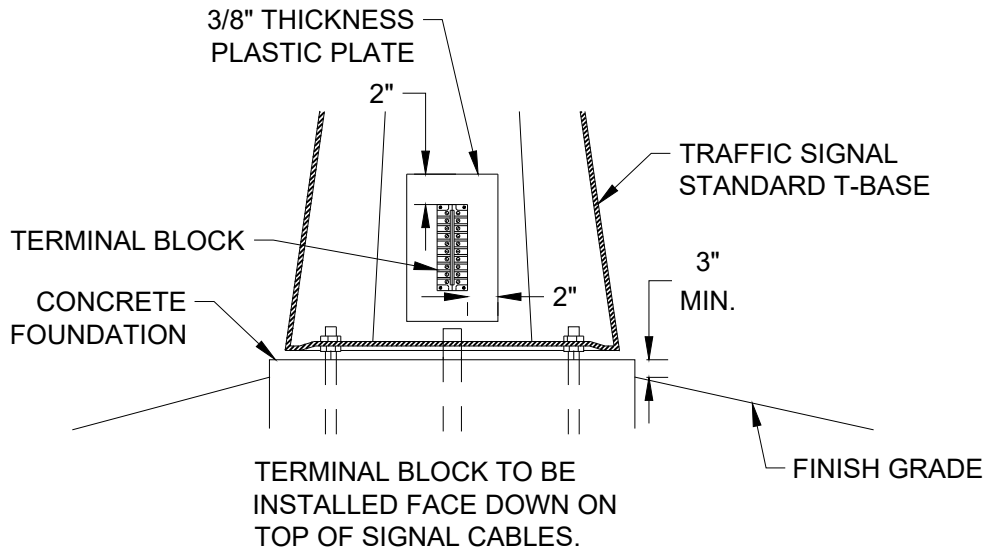
Section:

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STANDARD DETAILS

EMERGENCY VEHICLE PRE-EMPTION

City of Minot



TERMINAL BLOCK

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TRA-5B

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Section:

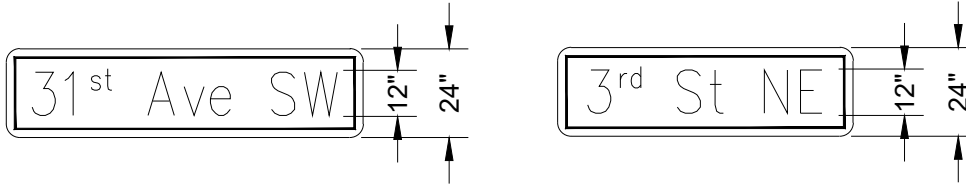
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STANDARD DETAILS

SIGNAL STANDARD BASE ANCHORING & TERMINAL BLOCK

City of Minot

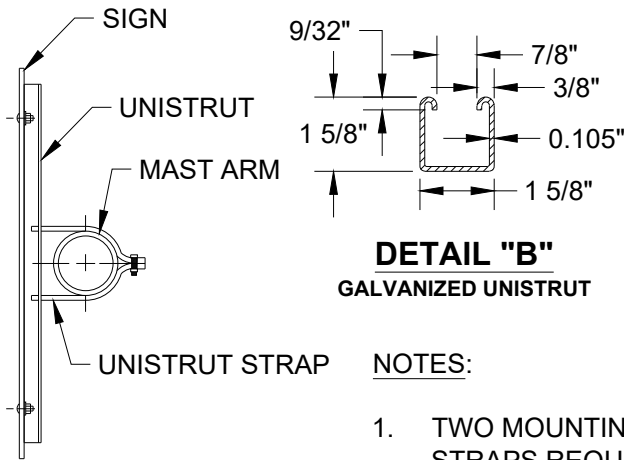
THE FOLLOWING ARE EXAMPLES OF THE SIGN FORMAT.



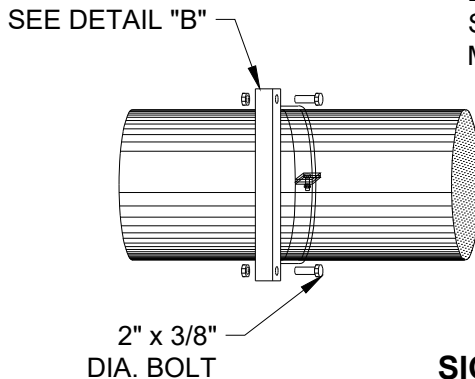
NOTES:

1. ALL MAST ARM MOUNTED STREET DESIGNATION SIGNS SHALL UTILIZE 24" 100 GUAGE FLAT ALUMINUM, 48" OR LONGER, DEPENDING ON THE SPACE NEEDED.
2. THE SIGNS SHALL HAVE MODIFIED "E" SERIES LETTERS WITH A 12" UPPER AND 9" LOWERCASE FORMAT AND A 1" SIGN BORDER. THE SUPERSCRIPTS SHALL BE 6" (HALF SIZE) LOWERCASE LETTERS AND WILL LINE UP WITH THE TOP OF THE OTHER LETTERS AND NUMBERS.
3. THE SIGN SHEETING SHALL BE 3M SERIES DG3 SHEETING, AND ANY PROCESSED COLORS, INKS, OR ELECTRONIC CUTTABLE FILM SHALL BE A MATCHED COMPONENT SYSTEM.
4. SIGNS MOUNTED ON THE SIGNAL STANDARD VERTICAL POST, EXCLUDING THE MAST ARMS, SHALL BE INSTALLED BY DRILLING, TAPPING AND DIE THE POLE AND INSTALLING SIGNS WITH A 3/8" X1" STAINLESS STEEL HEX BOLT USING A 3/8" STAINLESS STEEL FLAT WASHER AND A NYLON WASHER.

STREET DESIGNATION SIGNS



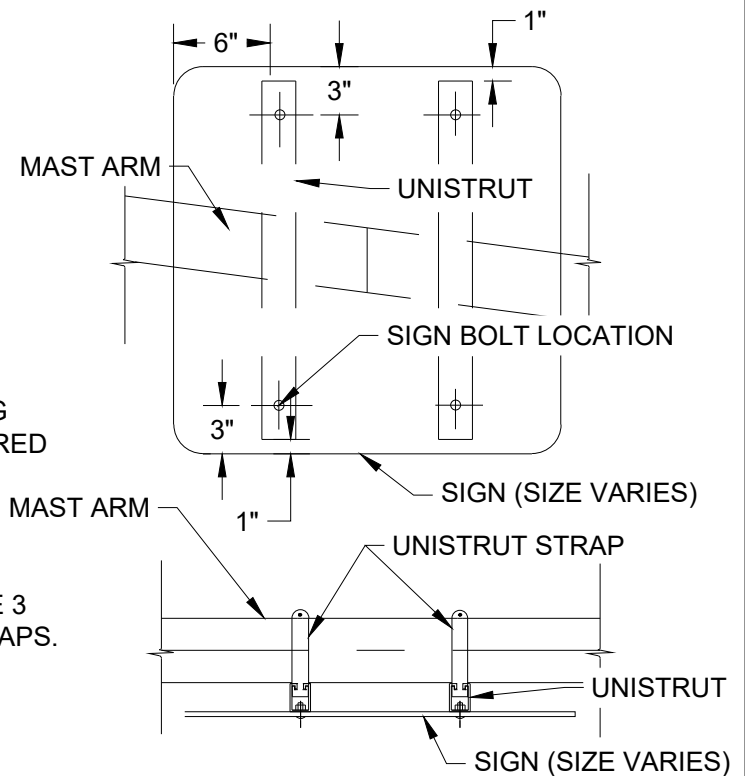
HORIZONTAL MOUNTING



NOTES:

1. TWO MOUNTING STRAPS REQUIRED PER SIGN.
2. STREET DESIGNATION SIGNS REQUIRE 3 MOUNTING STRAPS.

SIGN MOUNTING

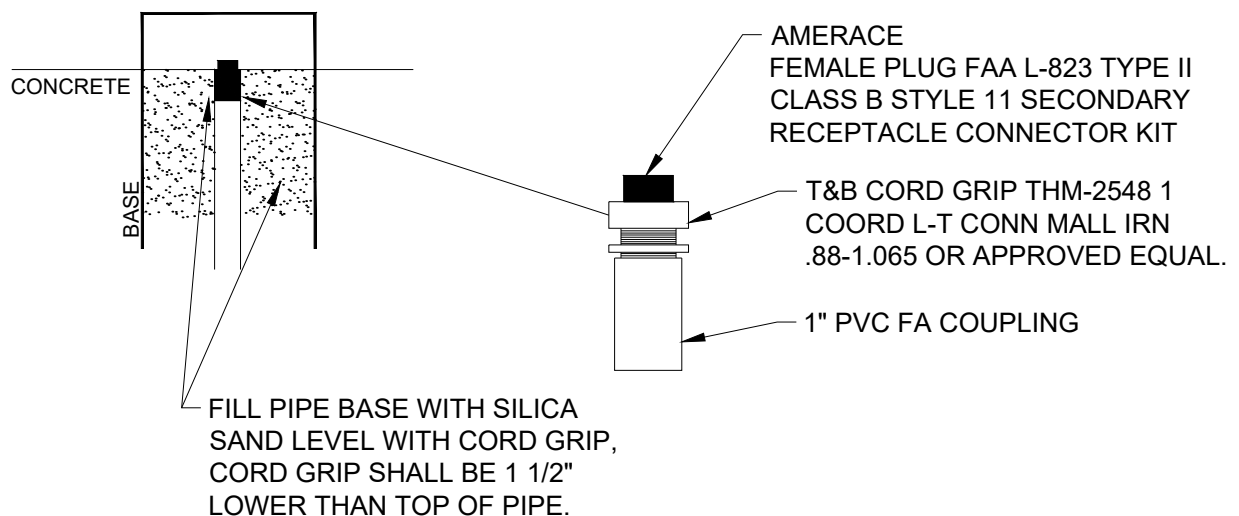
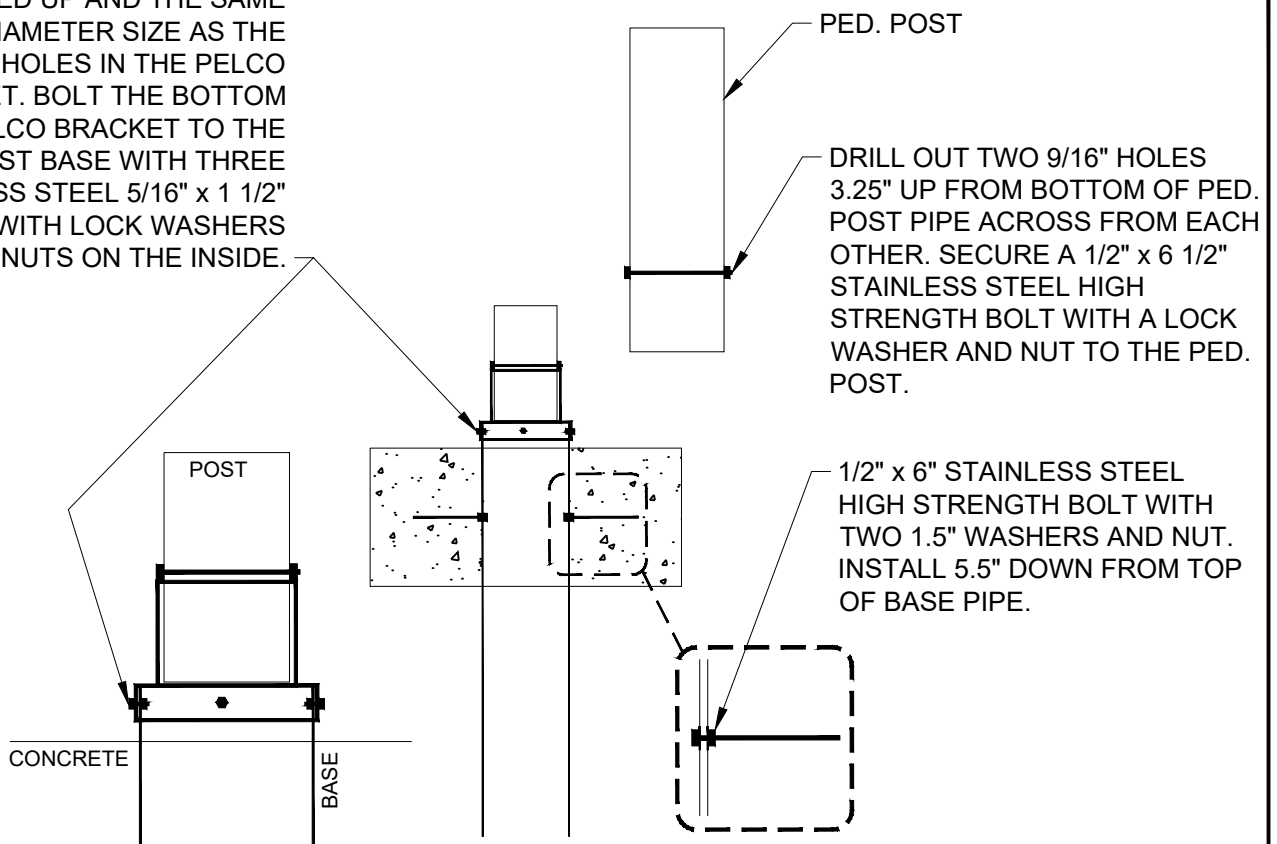


METAL WASHERS AND NYLON WASHERS USED ON SIGN FACE SHALL HAVE A MINIMUM OUTSIDE DIAMETER OF 15/16" ± 1/16" AND A 10 GA. THICKNESS.

STANDARD DETAILS

MAST ARM MOUNTED SIGNS

PELCO PB-5325 THREE PIECE
POLE & BASE COLLAR
ASSEMBLY. DRILL OUT 3 HOLES
IN THE PED. POLE BASE THAT
ARE LINED UP AND THE SAME
DIAMETER SIZE AS THE
FACTORY HOLES IN THE PELCO
BRACKET. BOLT THE BOTTOM
OF THE PELCO BRACKET TO THE
PED. POST BASE WITH THREE
STAINLESS STEEL 5/16" x 1 1/2"
BOLTS WITH LOCK WASHERS
AND NUTS ON THE INSIDE.



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City Plate No.:

TRA-6A

Last Revision:

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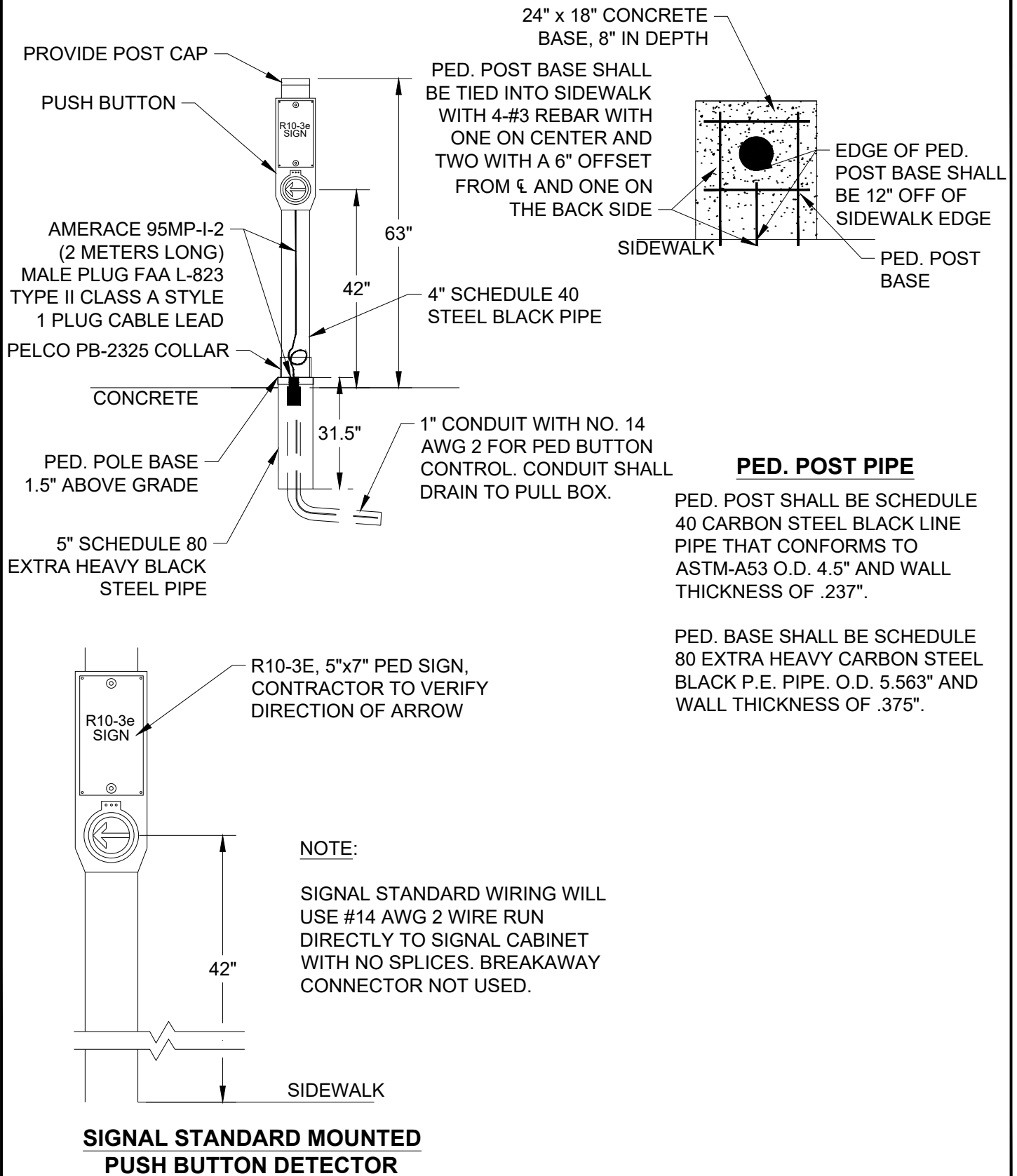
Section:

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STANDARD DETAILS

PEDESTRIAN PUSH BUTTON POST AT BASE

City of Minot



City Plate No.:

TRA-6B

Last Revision:

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STANDARD DETAILS

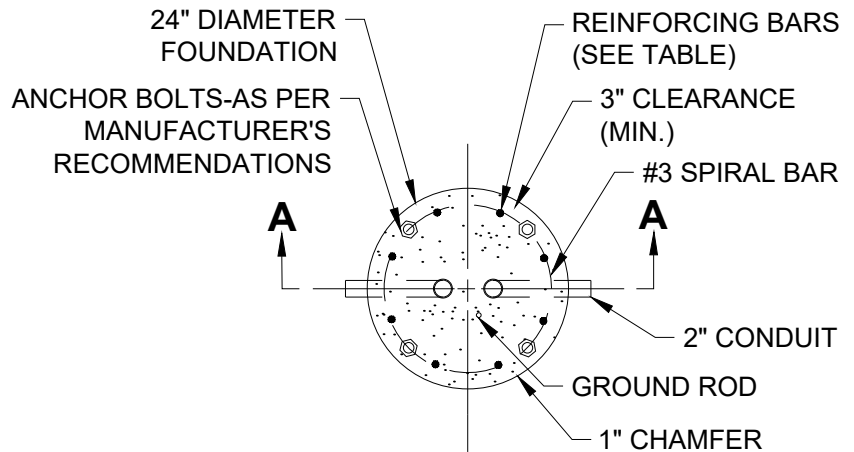
PEDESTRIAN PUSH BUTTON POST MOUNTING

City of Minot

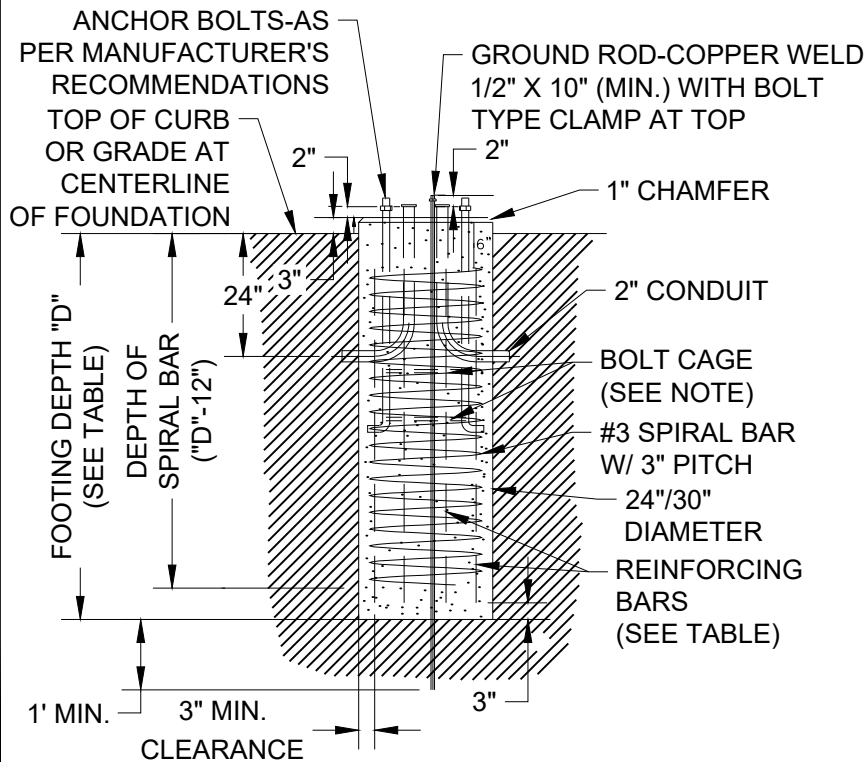
NOTES:

1. CONCRETE USED IN THE WORK SHALL BE CLASS AE PORTLAND CEMENT CONCRETE MIXED AND PROPORTIONED AS SPECIFIED IN NDDOT STANDARD SPECIFICATIONS SECTION 802.
2. THE TOP OF THE FOUNDATION SHALL BE CIRCULAR.
3. NO REINFORCEMENT IS REQUIRED IF THE ANCHOR BOLTS EXTEND TO WITHIN 3" TO 6" ABOVE THE BOTTOM OF THE FOUNDATION.
4. ALL REINFORCING STEEL TO BE GRADE 40 OR 60.
5. SEE PLANS FOR CONDUIT SIZE, NUMBER OF BENDS AND CORRECT POSITIONING FOR EACH FOUNDATION.
6. WHEN CONDUIT DOES NOT CONTINUE BEYOND THE FOUNDATION, CONDUIT WITH A 105° BEND AND BUSHINGS ON BOTH ENDS MAY BE SUBSTITUTED FOR THE 90° BENDS SHOWN.
7. SEE PLANS FOR CORRECT LOCATION OF FOUNDATIONS. THE GRADE AND EXACT LOCATION SHALL BE ESTABLISHED BY THE ENGINEER IN THE FIELD.
8. MAXIMUM BOLT CIRCLE FOR THE 24" FOUNDATION SHALL NOT EXCEED 18".

TRAFFIC SIGNAL STANDARD FOUNDATION SELECTION TABLE		
DESCRIPTION	24" DIA. REINFORCING BARS REQUIRED	24" DIA. FOOTING DEPTH "D"
TYPE V PED. FLASHER	4 - #5 ①	4'

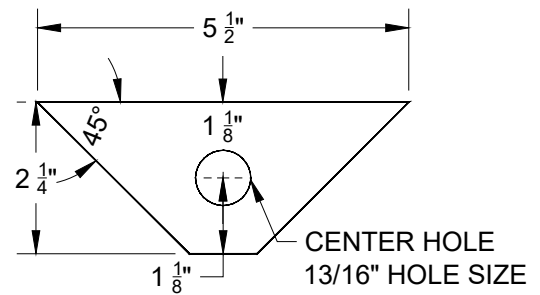


PLAN



ELEVATION
24" DIA. FOUNDATION

SECTION A-A



NOTES:

1. CUT FROM 1/4" WIDE GALVANIZED STEEL.
2. THIS PLATE SHALL BE INSTALLED BETWEEN THE BASE AND THE ANCHOR BOLT NUT IN ALL 4" TYPE V SIGNAL STANDARD BASES.

**4" SIGNAL STANDARD
BASE ANCHOR BOLT PLATE**

City Plate No.:

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STANDARD DETAILS

TYPE 'V' PEDESTRIAN FLASHER FOUNDATION

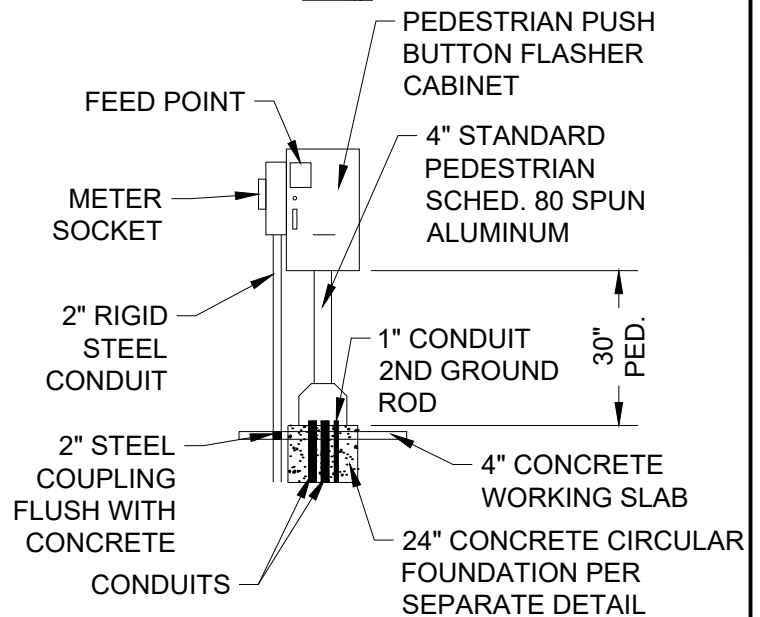
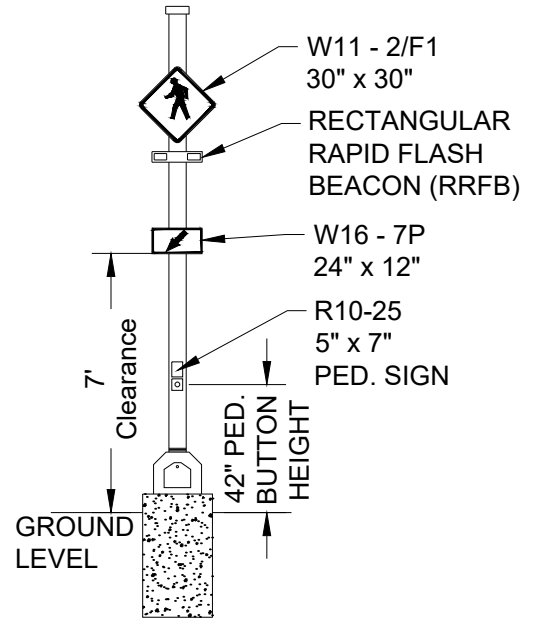
City of Minot

NOTES:

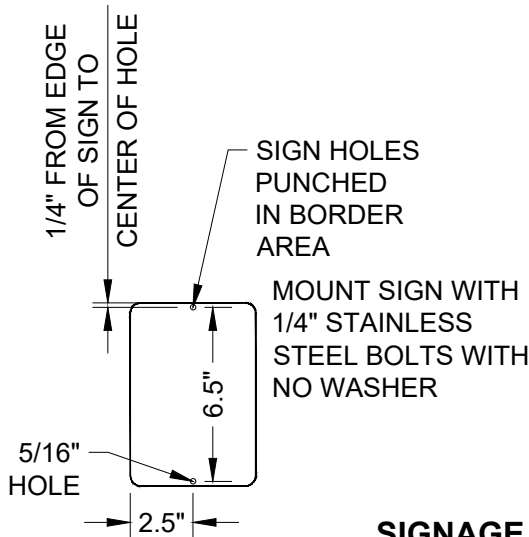
1. DRILL, TAP AND DYE THE POLE AND INSTALL SIGNS WITH A 3/8" x 1" STAINLESS STEEL HEX BOLT USING A 3/8" STAINLESS STEEL FLAT WASHER AND A NYLON WASHER.
2. RUN NO. 12 AWG 2 CONDUCTOR FROM EACH HEAD TO THE TERMINAL BLOCK INSIDE THE T-BASE.
3. INSTALL A NO. 12 AWG 5 CONDUCTOR FROM EACH PEDESTRIAN FLASHER TERMINAL BLOCK TO THE FLASHER CABINET CONNECTIONS.
4. ALL CENTER MEDIAN ISLAND TYPE V FLASHERS SHALL HAVE 2 LED RRFB'S AND 2 PEDESTRIAN SIGNS ON TYPE V POLE, ONE SET FACING EACH DIRECTION OF TRAFFIC.
5. INSTALL A NO. 12 AWG 2 CONDUCTOR FROM PEDESTRIAN PUSH BUTTON TO THE FLASHER CABINET CONNECTIONS.

CABINET NOTES:

1. CABINET SHALL BE A PUSH BUTTON ACTIVATED FLASHER CABINET W/ HOA SWITCH, WITH A FLASHING CIRCUIT PANEL, A GENERAL PURPOSE RELAY, FLASHER RELAY AND MULTIFUNCTION TIME DELAY RELAY.
2. CABINET SHALL HAVE ITS OWN 15 AMP CIRCUIT BREAKER.



PEDESTAL MOUNTED CABINET



SIGNAGE



R10-25
5" x 7"
PED. SIGN

City Plate No.:

TRA-7B

Last Revision:

12/18/2020

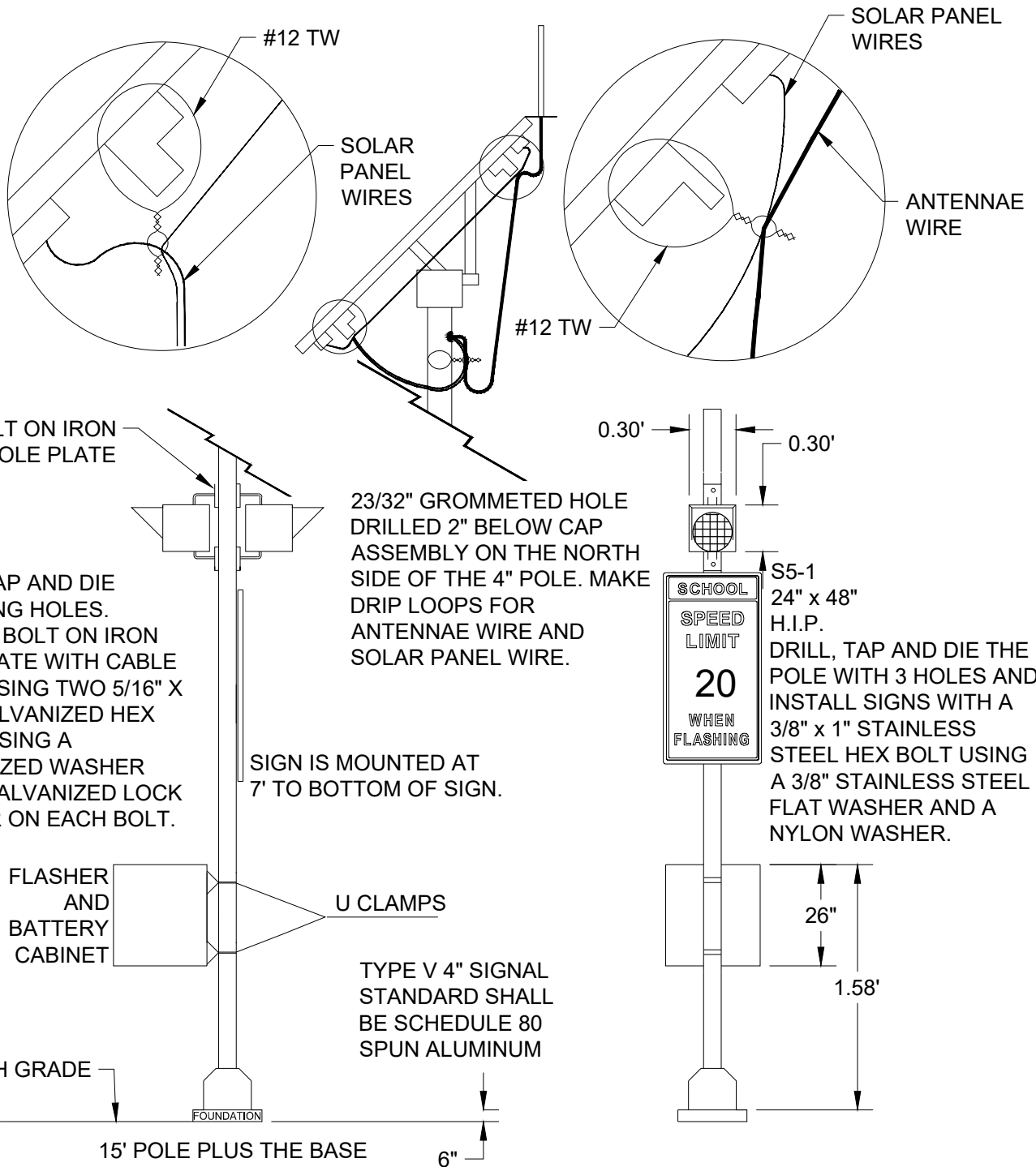
Section:

3800

STANDARD DETAILS

TYPE 'V' PEDESTRIAN FLASHER

City of Minot



City Plate No.:

TRA-8A

Last Revision:

12/18/2020

Section:

3800

STANDARD DETAILS

SOLAR SCHOOL ZONE FLASHER

City of Minot

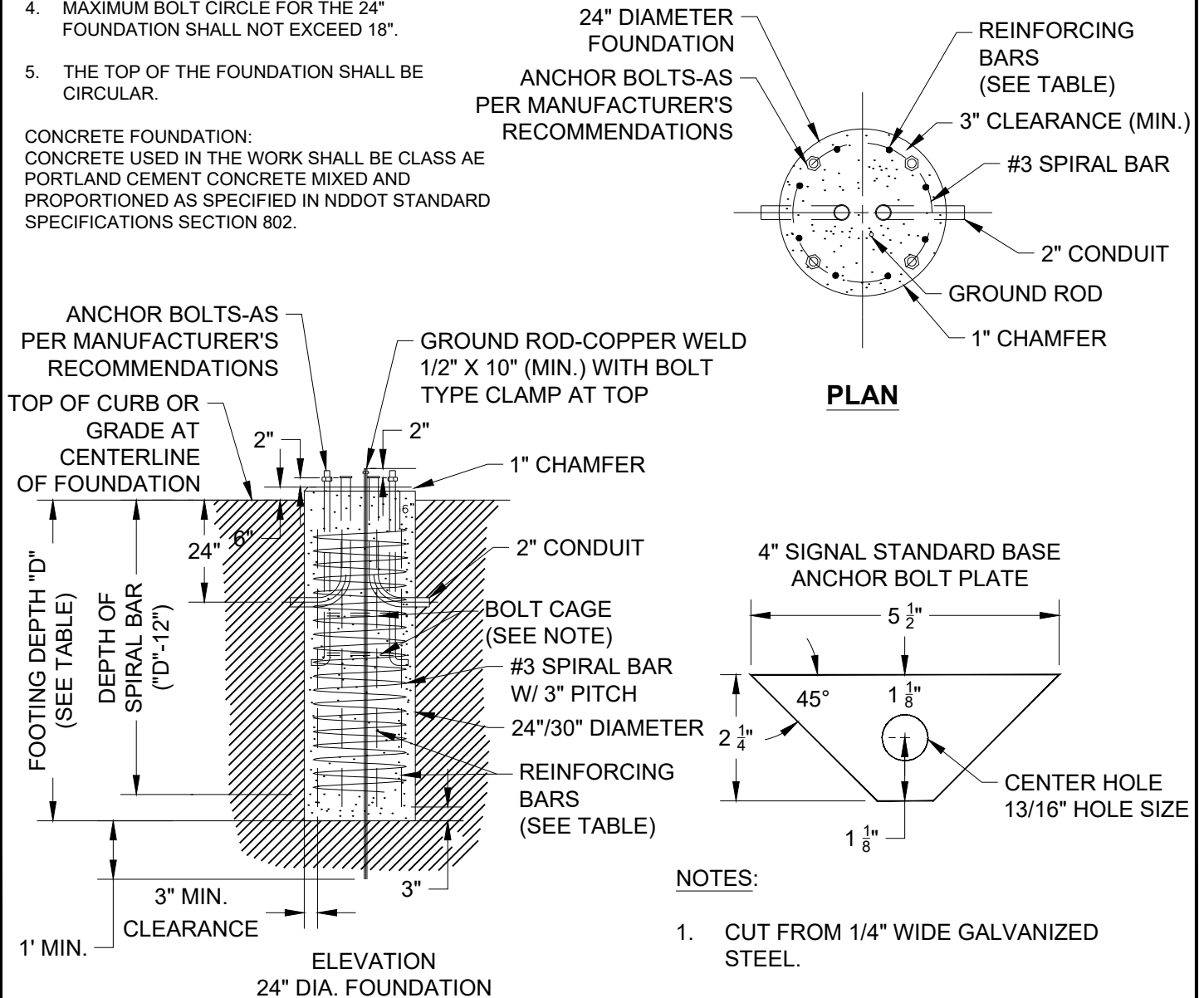
NOTES:

1. NO REINFORCEMENT IS REQUIRED IF THE ANCHOR BOLTS EXTEND TO WITHIN 3" TO 6" ABOVE THE BOTTOM OF THE FOUNDATION.
2. ALL REINFORCING STEEL TO BE GRADE 40 OR 60.
3. SEE PLANS FOR CORRECT LOCATION OF FOUNDATIONS. THE GRADE AND EXACT LOCATION SHALL BE ESTABLISHED BY THE ENGINEER IN THE FIELD.
4. MAXIMUM BOLT CIRCLE FOR THE 24" FOUNDATION SHALL NOT EXCEED 18".
5. THE TOP OF THE FOUNDATION SHALL BE CIRCULAR.

CONCRETE FOUNDATION:
CONCRETE USED IN THE WORK SHALL BE CLASS AE PORTLAND CEMENT CONCRETE MIXED AND PROPORTIONED AS SPECIFIED IN NDDOT STANDARD SPECIFICATIONS SECTION 802.

TRAFFIC SIGNAL STANDARD FOUNDATION SELECTION TABLE

DESCRIPTION	24" DIA. REINFORCING BARS REQUIRED	24" DIA. FOOTING DEPTH "D"
TYPE V PED. FLASHER	4 - #5	4'



NOTES:

1. CUT FROM 1/4" WIDE GALVANIZED STEEL.
2. THIS PLATE SHALL BE INSTALLED BETWEEN THE BASE AND THE ANCHOR BOLT NUT IN ALL 4" TYPE V SIGNAL STANDARD BASES.

City Plate No.:

TRA-8B

Last Revision:

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Section:

3800

STANDARD DETAILS

SOLAR SCHOOL ZONE FLASHER FOUNDATION

City of Minot

FIBER OPTIC BUFFER TUBE COLOR CODE

MULTIMODE FIBERS 1-24/SINGLE MODE FIBERS 25-84

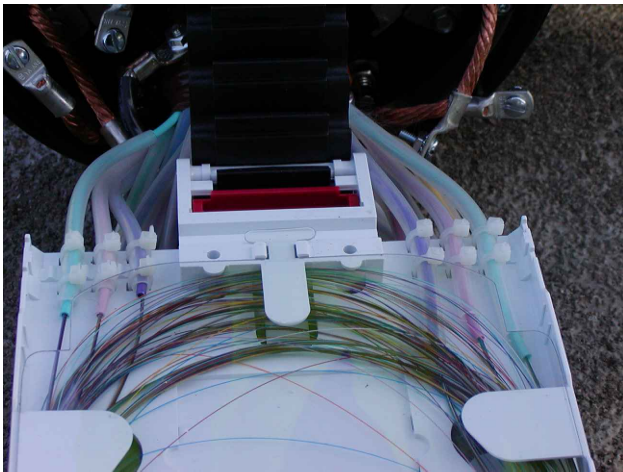
1. BLUE
2. ORANGE
3. GREEN
4. BROWN
5. SLATE
6. WHITE
7. RED
8. BLACK
9. YELLOW
10. VIOLET
11. ROSE
12. AQUA

INSTALL FAN OUT KIT ON ALL TERMINATED OR FIBER STRANDS WHEN TERMINATING THE FIBER OPTIC CABLE.

FIBER OPTIC CABLE:

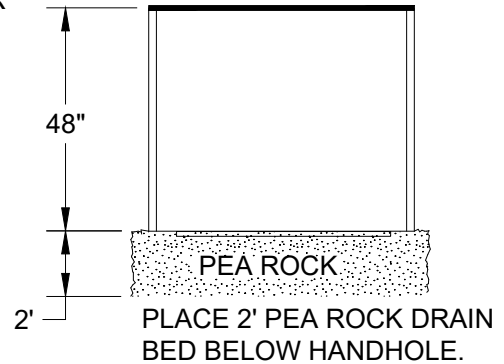
TUBE 1 = BLUE TUBE 1-12 MM FIBERS
TUBE 2 = ORANGE TUBE 13-24 MM FIBERS
TUBE 3 = GREEN TUBE 25-36 SM FIBERS
TUBE 4 = BROWN TUBE 37-48 SM FIBERS
TUBE 5 = SLATE TUBE 49-60 SM FIBERS
TUBE 6 = WHITE TUBE 61-72 SM FIBERS
TUBE 7 = RED TUBE 73-84 SM FIBERS

INSTALL PROTECTIVE TUBE SLEEVE AND TIE WRAP EACH TUBE TO SPLICE CASE.

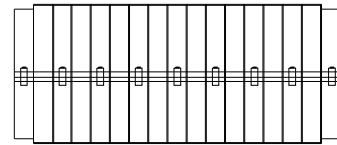


QUAZITE PULL BOX

30" x 48" x 48"

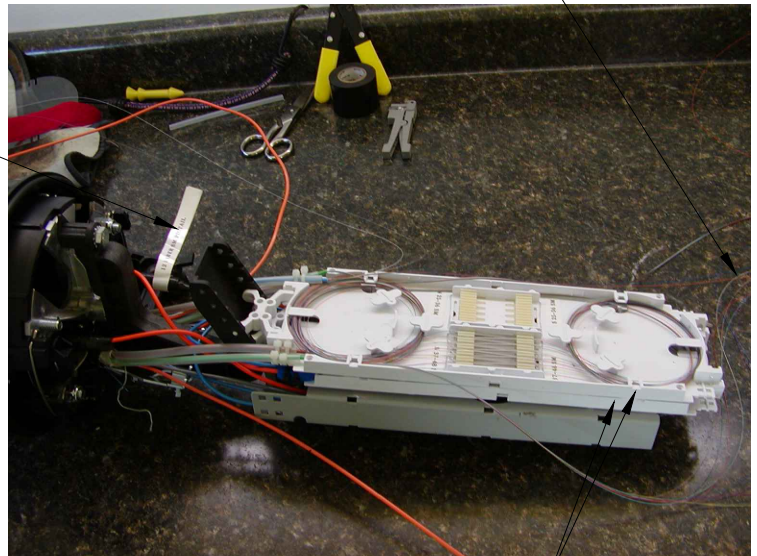


TYCO ENCLOSURE



FIBER OPTIC ENCLOSURE SHALL BE A TYCO CLOSURE. FIBER OPTIC CABLES SHALL BE INSTALLED IN THE TYCO AS PER MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS. SEE COMMUNICATION CABLE SPECIFICATION NOTES FOR FURTHER INSTRUCTIONS.

LABEL FIBER



SEPARATE SPLICE TRAY FOR EVERY 2 TUBES OF FIBER INCLUDING NON-SPLICED FIBER TUBES

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TRA-9A

Last Revision:

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STANDARD DETAILS

FIBER OPTIC DETAIL

City of Minot

FIBER DISTRIBUTION PANEL

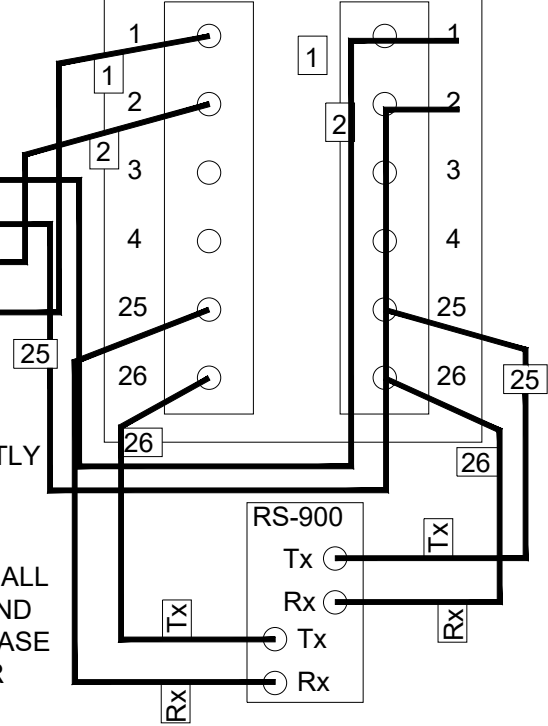
ECONOLITE COBALT CONTROLLER



Rx ○
Tx ○
Rx ○
Tx ○

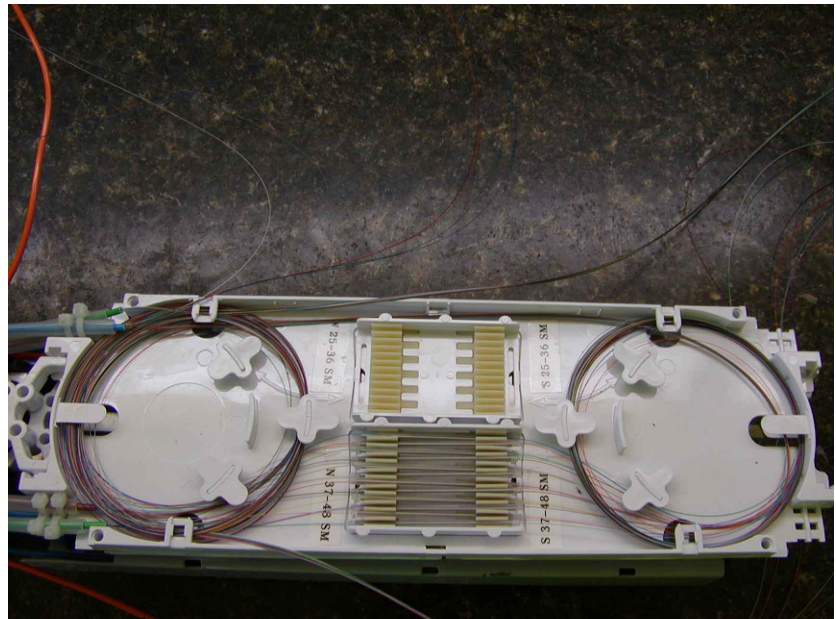
Rx
Tx
Rx
Tx

UNIV & 1 AVE S PG2 UNIV & MAIN AVE PG1



FIBER SHALL BE NEATLY INSTALLED IN SPLICE CASE AND LABELED

ALL FIBER CABLES SHALL BE LABELED INSIDE AND OUTSIDE THE TYCO CASE AND SHALL BE COLOR CODE AS FOLLOWS:
NORTH=ORANGE
EAST=GREEN
SOUTH=BROWN
WEST=SLATE



HEAT TUBE FUSION SPLICE HOLDERS SHALL BE MANUFACTURED BY TYCO ELECTRONICS PART # SMOUV-1120-01-US.

City Plate No.:

TRA-9B

Last Revision:

12/18/2020

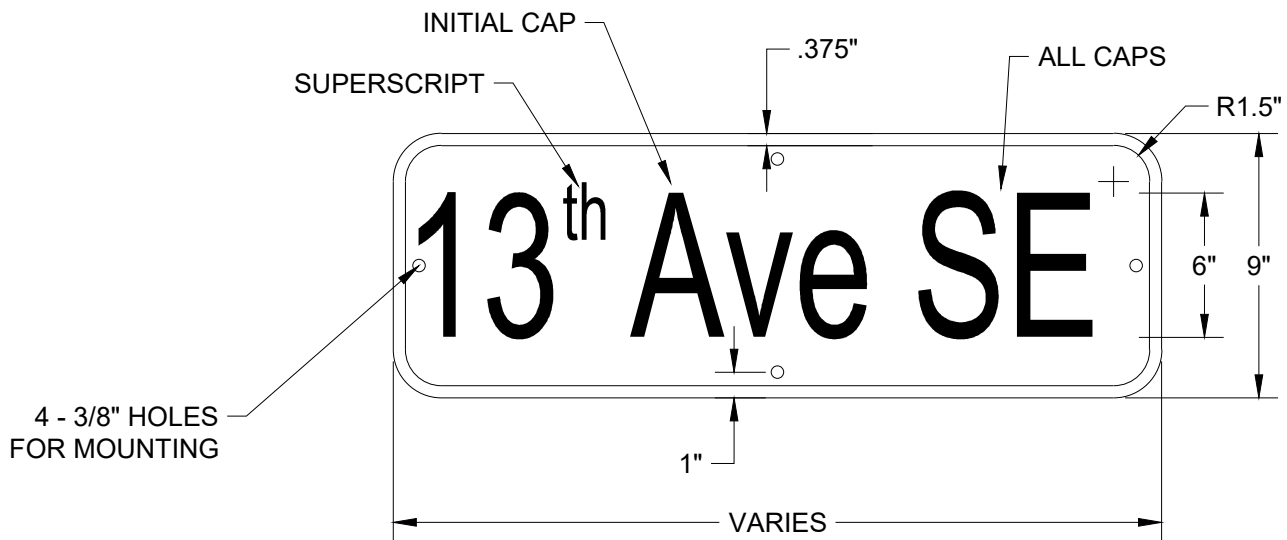
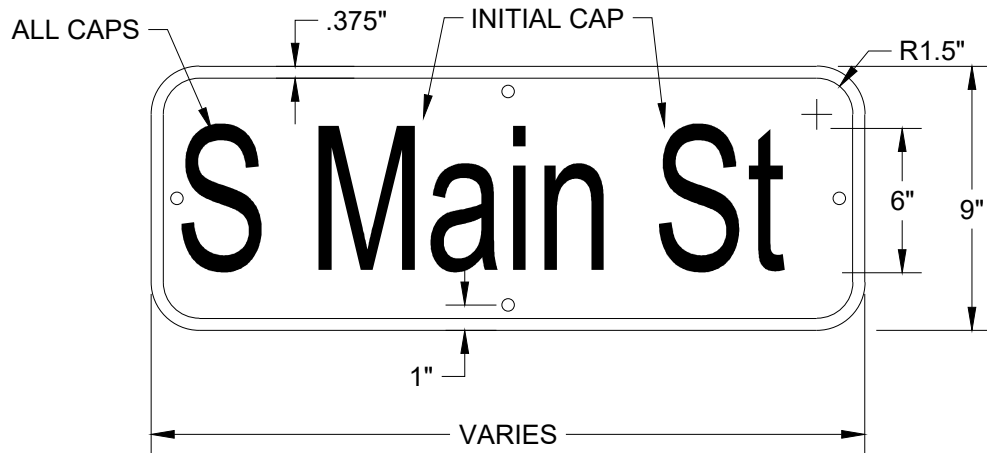
Section:

3800

STANDARD DETAILS

FIBER OPTIC DETAIL

City of Minot



NOTES:

1. SERIES B FONT
2. 9" TALL BLANK
3. 6" TALL LETTERING
4. DIRECTIONS (NE, NW, SE, SW) IN CAPS
5. ST., AVE., INITIAL LETTER CAP REST LOWER CASE
6. NAMED STREETS FIRST LETTER CAP REST LOWER CASE
7. NUMBERED STREETS (I.E. 3RD, 5TH) RD & TH SUPERScript
8. WHITE LETTERS ON GREEN BACKGROUND
9. WHITE BORDER 0.375 INCH
10. MOUNTING HOLES SHALL BE CENTERED ON ALL FOUR SIDES

City Plate No.:

TRA-10

Last Revision:

12/18/2020

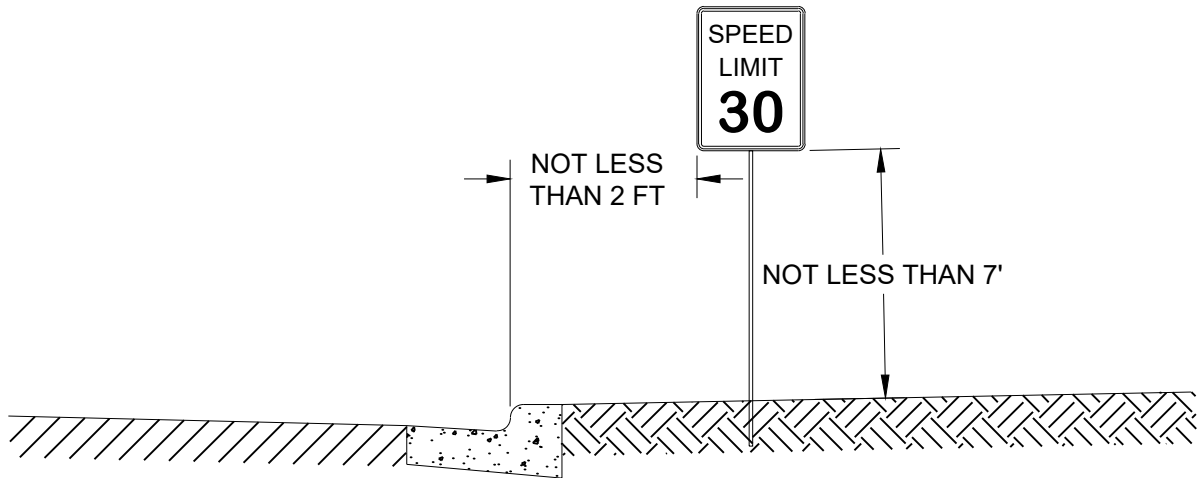
Section:

3400

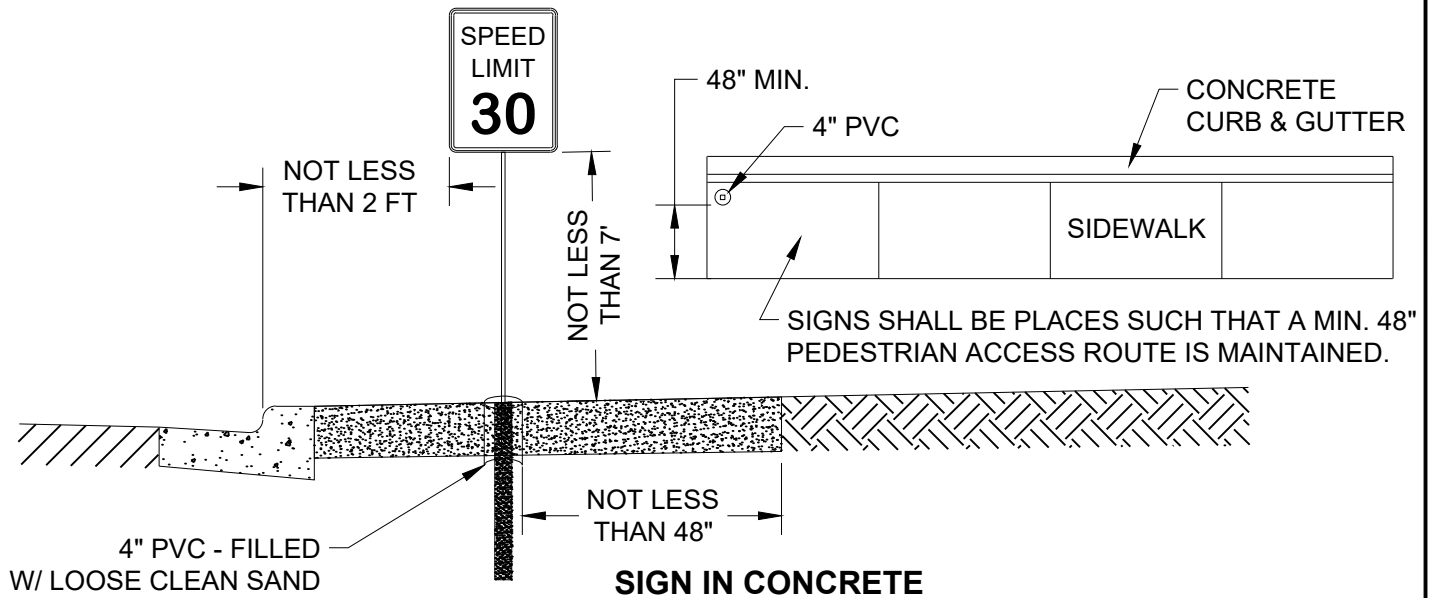
STANDARD DETAILS

STREET SIGNS

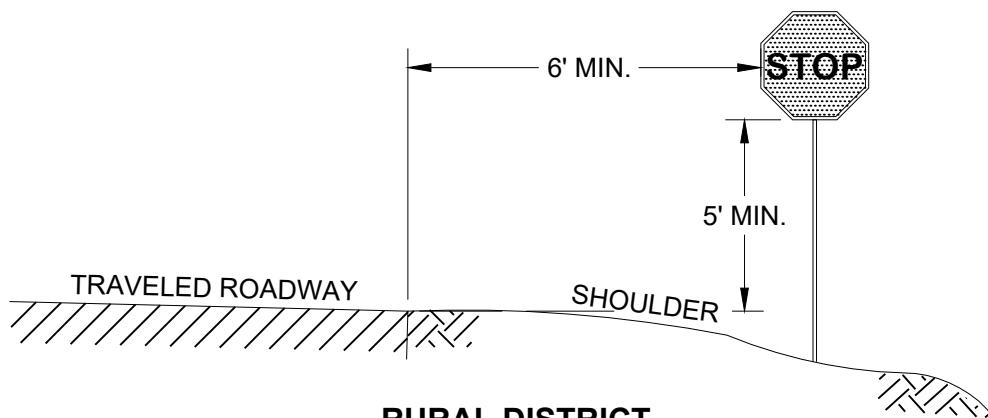
City of Minot



SIGN IN GRASS BOULEVARD



SIGN IN CONCRETE



RURAL DISTRICT

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\TRA-11_TYPICAL SIGN INSTALLATION LATERAL LOCATIONS.dwg

City Plate No.:

TRA-11

Last Revision:

12/18/2020

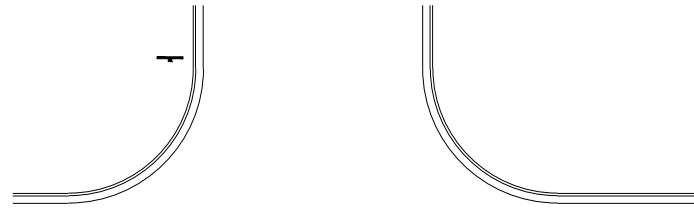
Section:

3400

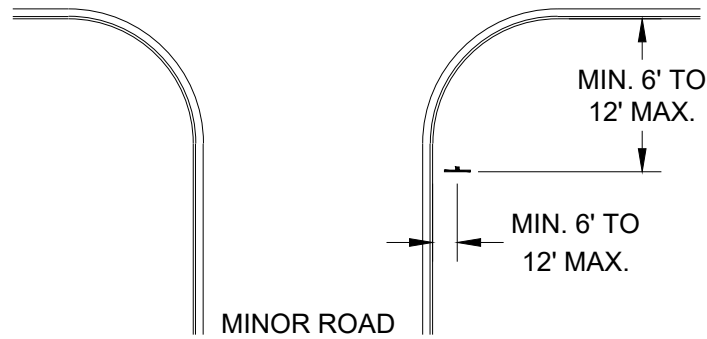
STANDARD DETAILS

TYPICAL SIGN INSTALLATION LATERAL LOCATIONS

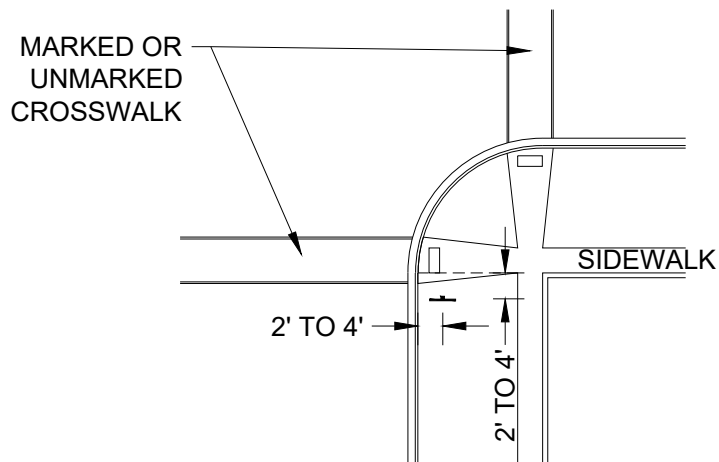
City of Minot



MAJOR ROAD



MINOR CROSSROAD



URBAN INTERSECTION

City Plate No.:

TRA-12

Last Revision:

12/18/2020

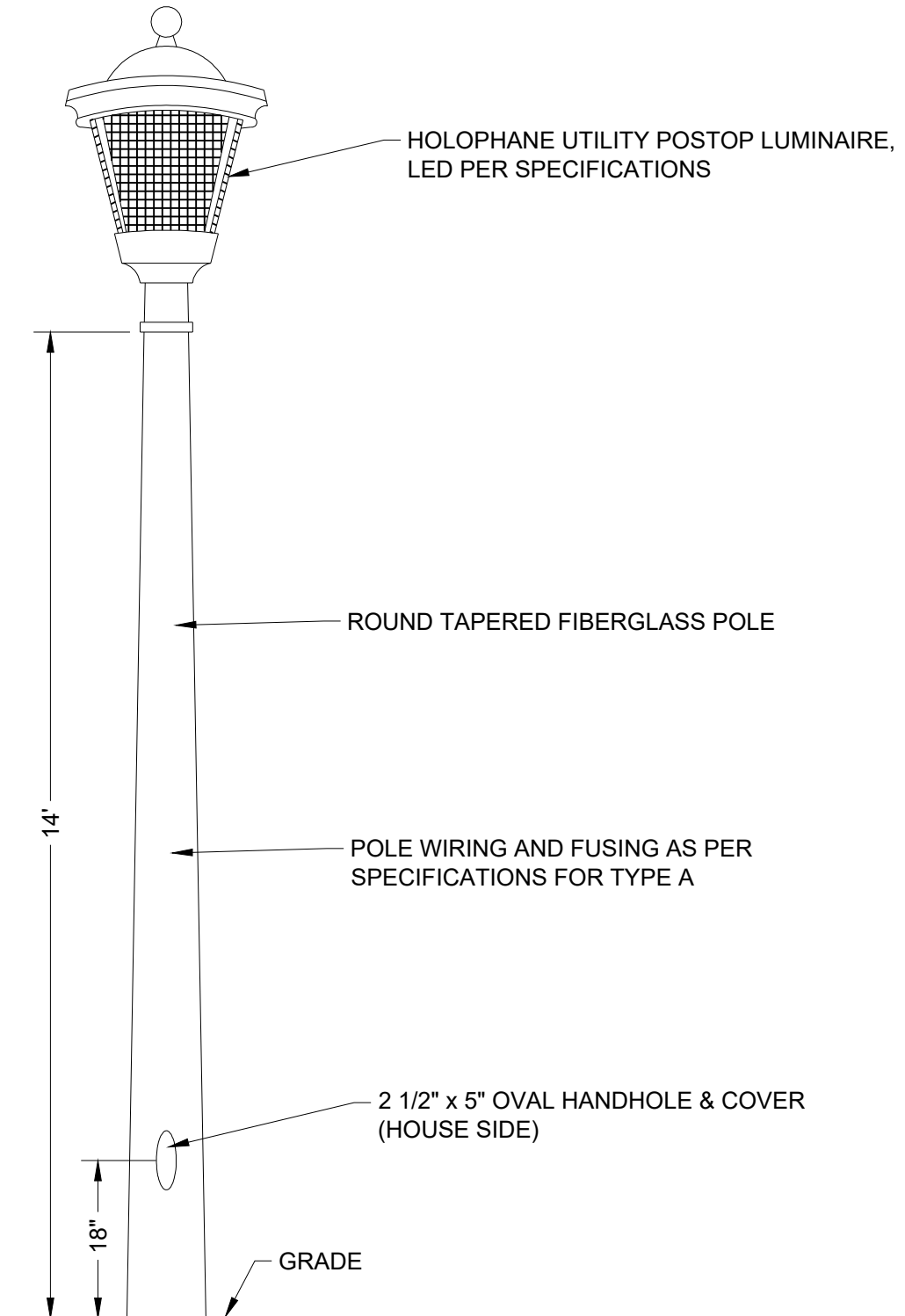
Section:

3400

STANDARD DETAILS

TYPICAL SIGN INSTALLATION AT INTERSECTIONS

City of Minot



M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\TRA-13_Type A Pole.dwg

City Plate No.:

TRA-13

Last Revision:

12/18/2020

Section:

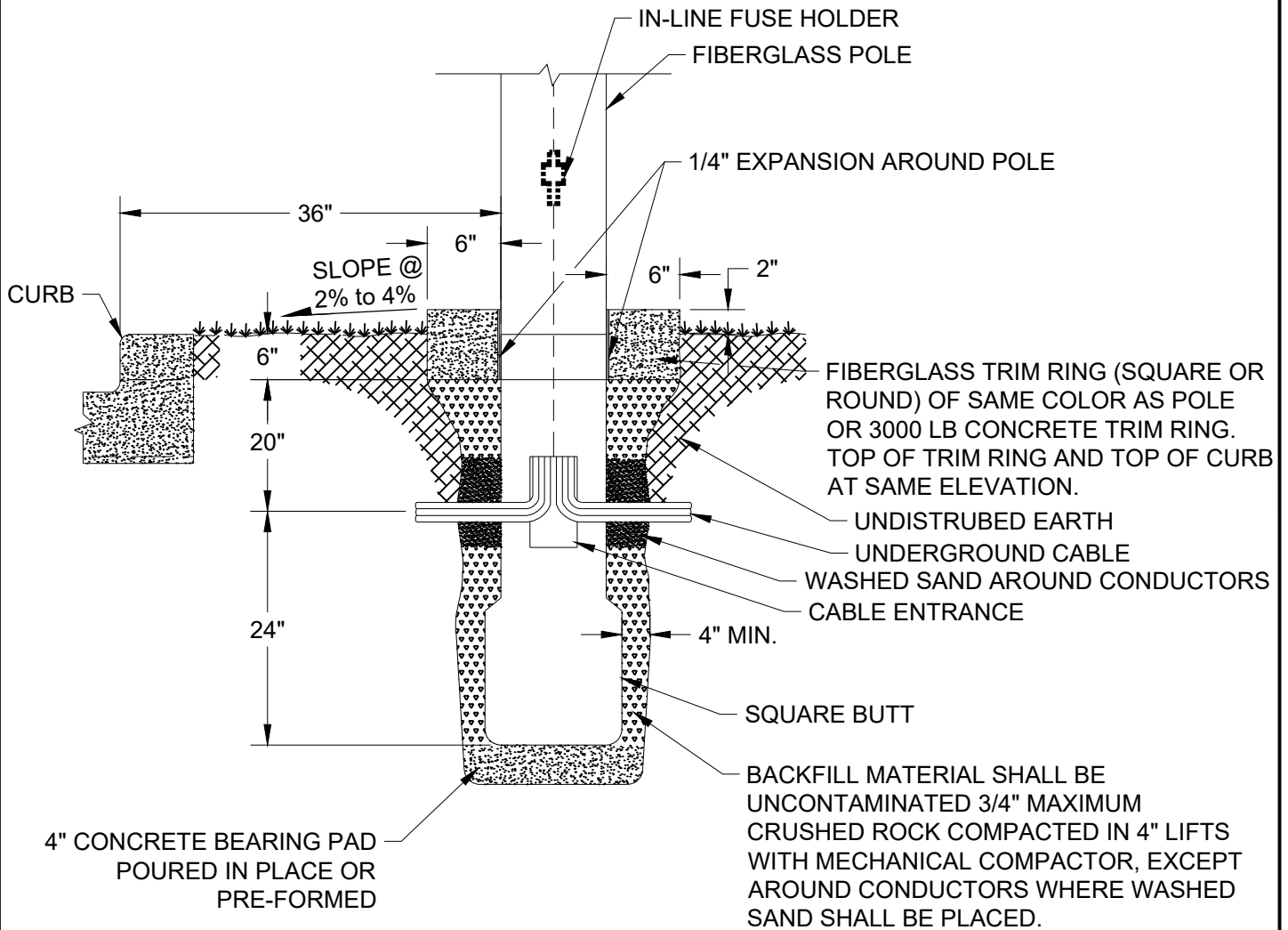
3600

STANDARD DETAILS

TYPE A POLE

City of Minot

M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\TRA-14_Type A Pole Base.dwg



City Plate No.:

TRA-14

Last Revision:

12/18/2020

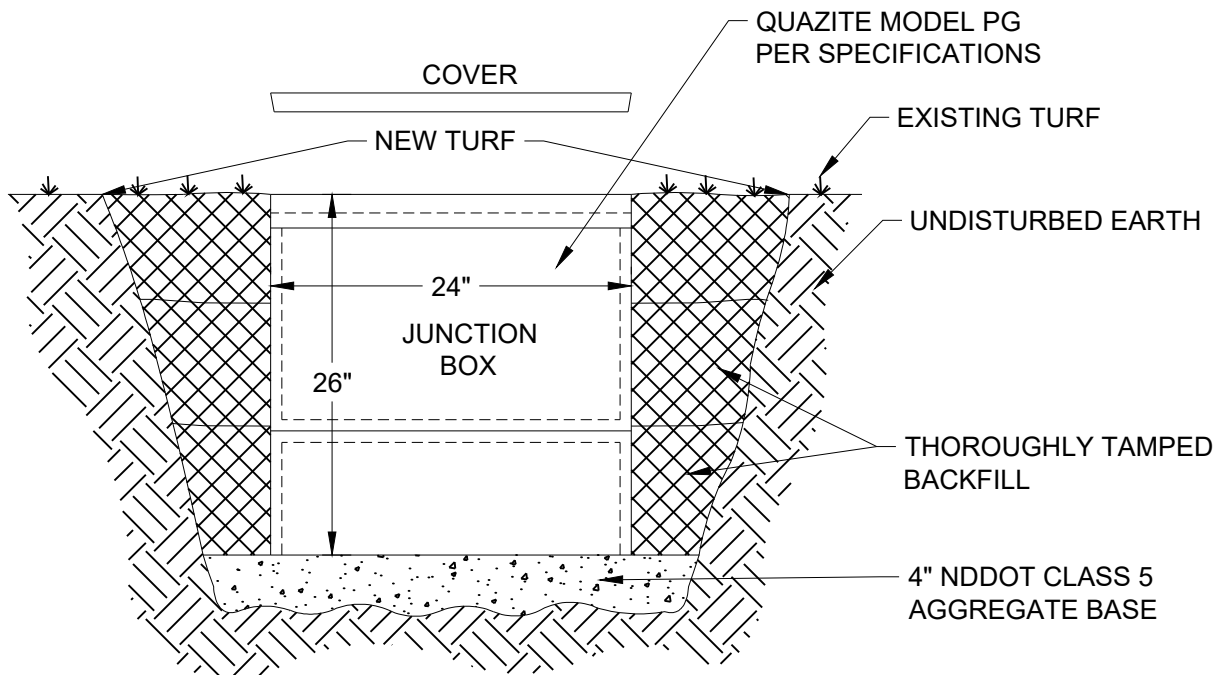
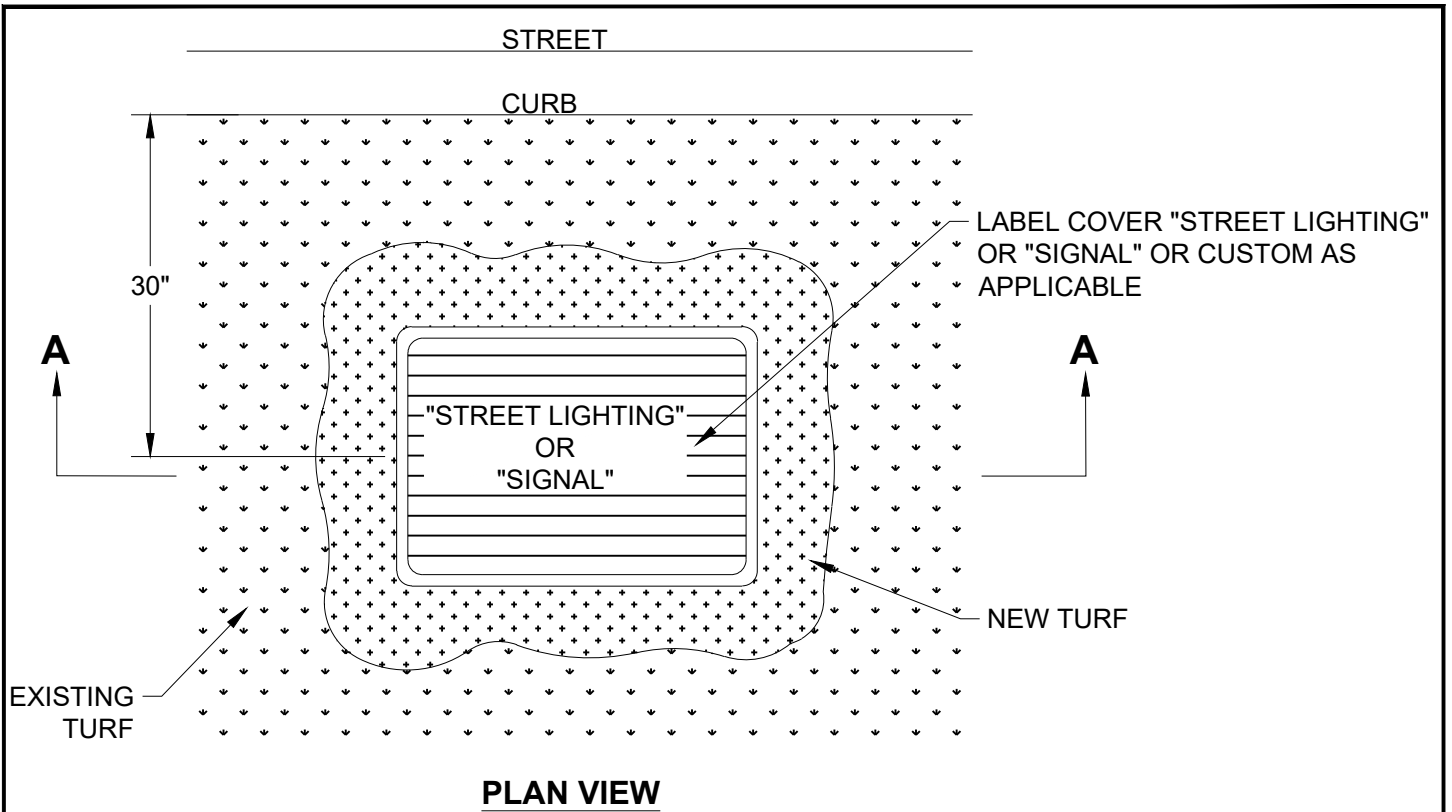
Section:

3600

STANDARD DETAILS

TYPE A POLE BASE

City of Minot



NOTE:

1. PROVIDE MOUSE HOLES AS
REQUIRED FOR EXISTING AND
NEW CONDUCTORS.

SECTION A-A

M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\TRA-15_PULL BOX IN GRASS BOULEVARD.dwg

City Plate No.:

TRA-15

Last Revision:

12/18/2020

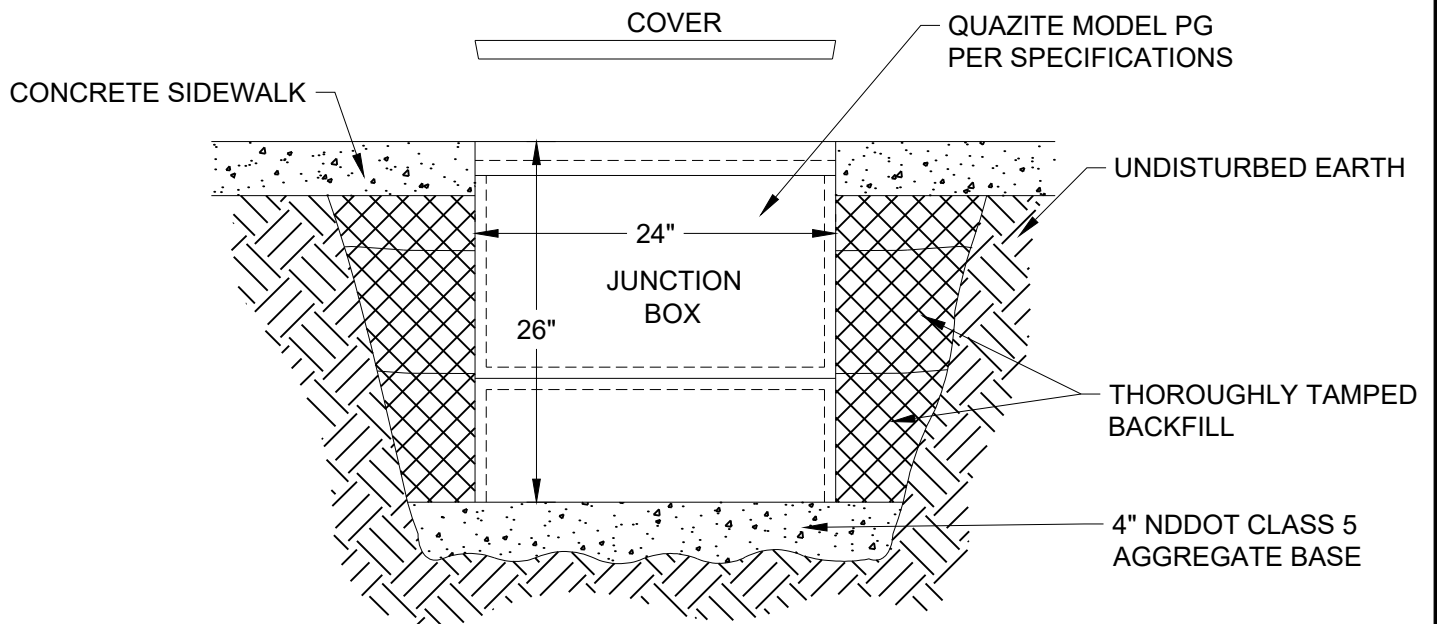
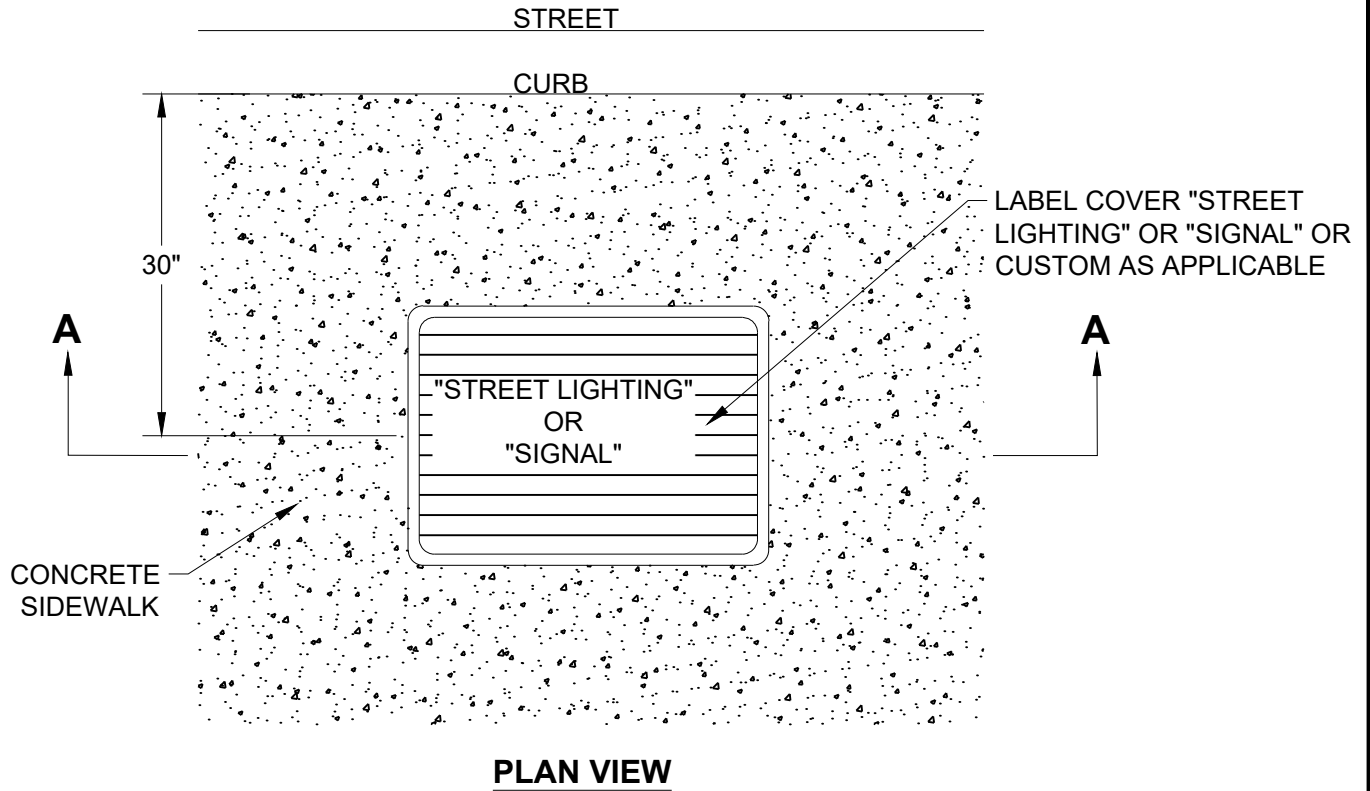
Section:

3600

STANDARD DETAILS

**PULL BOX
IN GRASS BOULEVARD**

City of Minot



NOTE:

1. PROVIDE MOUSE HOLES AS REQUIRED FOR EXISTING AND NEW CONDUCTORS.

SECTION A-A

City Plate No.:

TRA-16

Last Revision:

12/18/2020

Section:

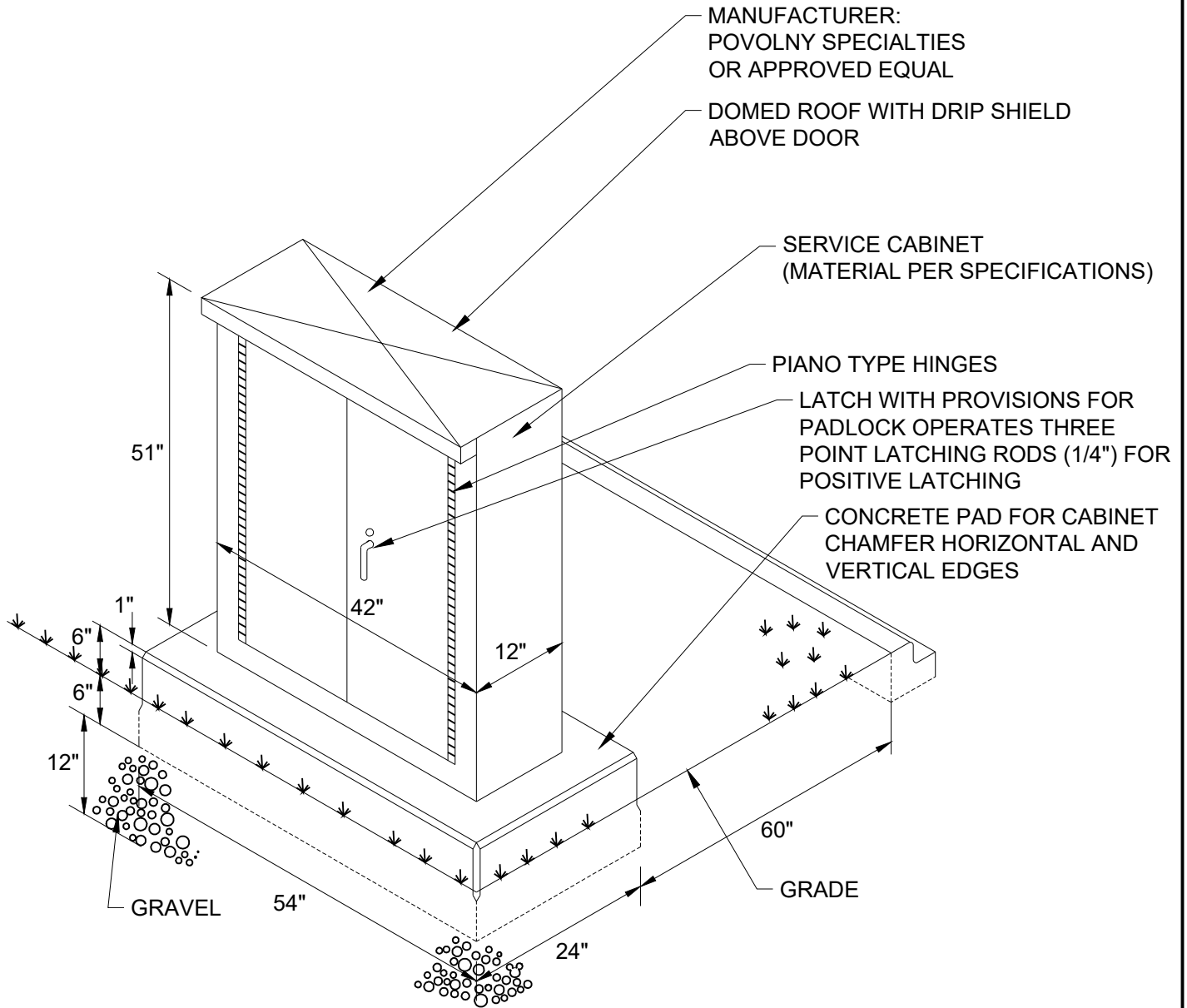
3600

STANDARD DETAILS

**PULL BOX
IN CONCRETE**

City of Minot

M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\TRA-17_FEEDPOINT ENCLOSURE.dwg



City Plate No.:

TRA-17

Last Revision:

12/18/2020

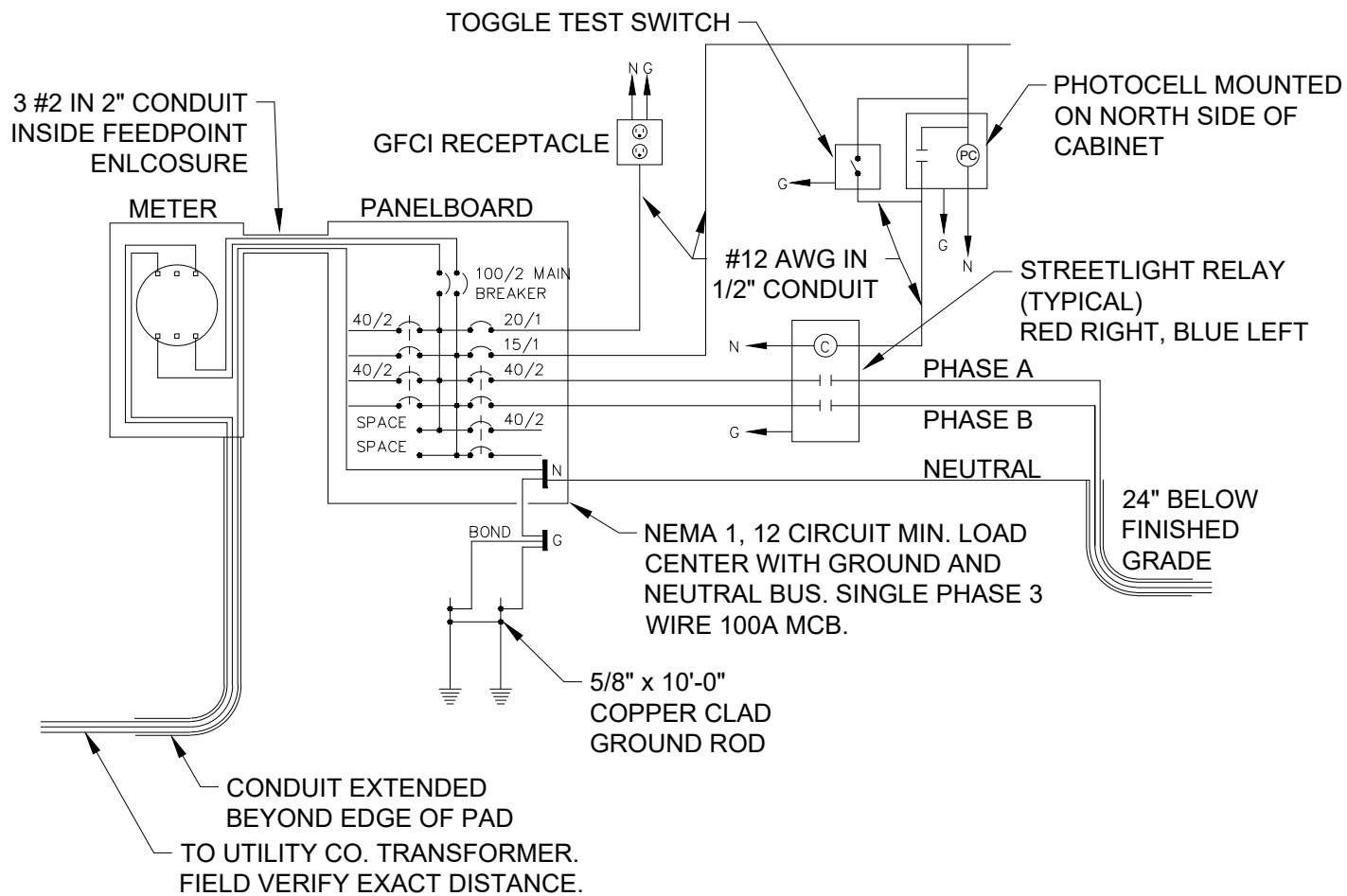
Section:

3600

STANDARD DETAILS

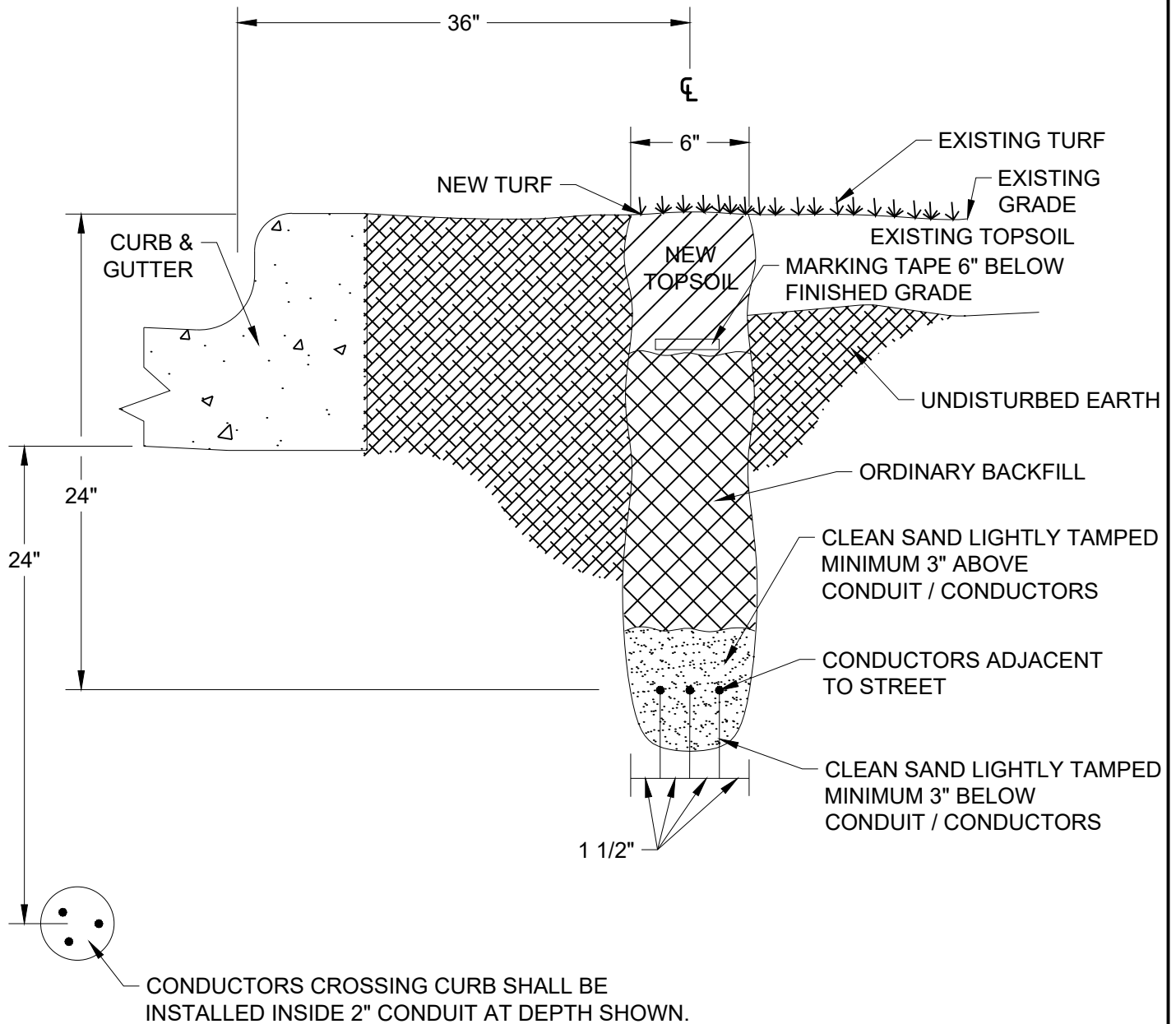
FEED POINT ENCLOSURE

City of Minot



City of Minot

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\TRA-19_UNDERGROUND CABLE STREET LIGHTING.dwg



City Plate No.:

TRA-19

Last Revision:

12/18/2020

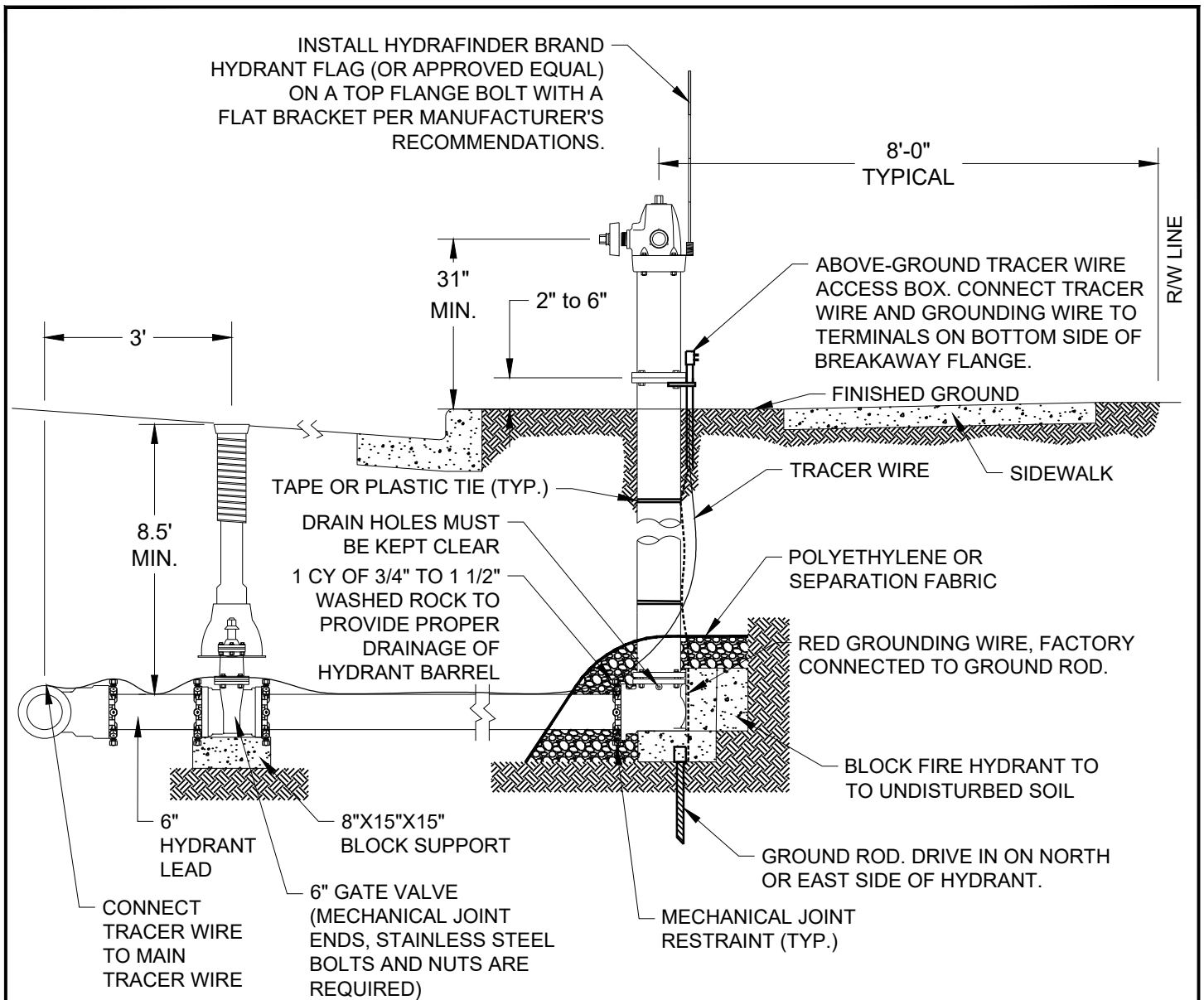
Section:

3600

STANDARD DETAILS

UNDERGROUND CABLE STREET LIGHTING

City of Minot



NOTES:

1. PUMPER CONNECTION SHALL FACE THE STREET.
2. HYDRANTS SHALL BE 9'-0" BURY
3. ENCASE HYDRANT BARREL WITH 8 MIL POLY.
4. GATE VALVE BOX PER SEPARATE STANDARD DETAIL.

City Plate No.:

WAT-1

Last Revision:

1/21/2025

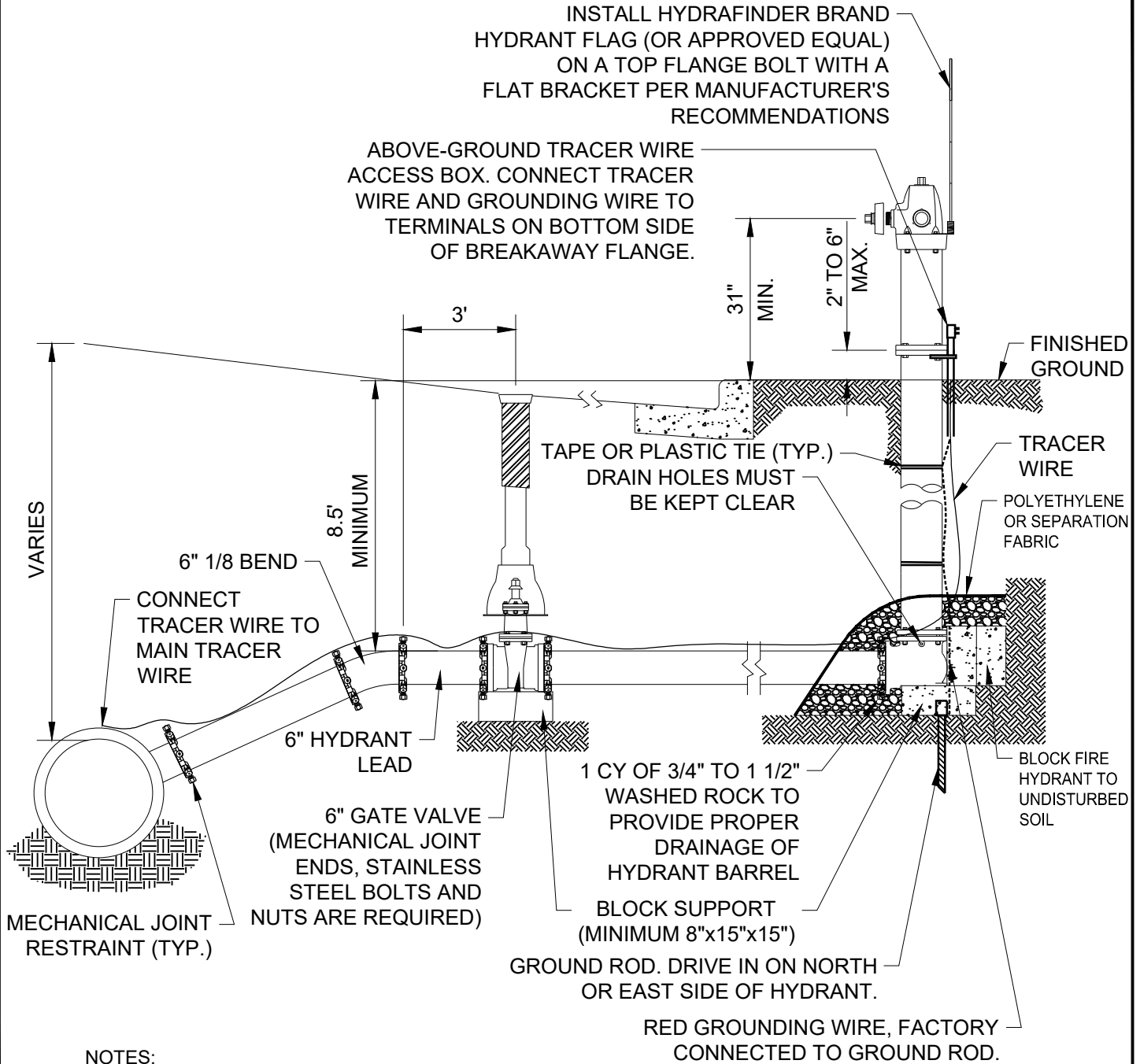
Section:

2100

STANDARD DETAILS

HYDRANT

City of Minot



NOTES:

1. PUMPER CONNECTION SHALL FACE THE STREET.
2. HYDRANT SHALL BE 9'-0" BURY.
3. ENCASE HYDRANT BARREL IN 8 MIL POLY.
4. GATE VALVE BOX PER SEPARATE STANDARD DETAIL.

City Plate No.:

WAT-2

Last Revision:

1/21/2025

Section:

2100

STANDARD DETAILS

**HYDRANT
WITH VERTICAL BEND**

City of Minot



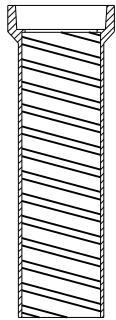
DROP LID



TYLER NO. 6860
MUELLER NO. H-10361

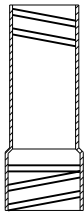


DROP-IN RISER - 2"



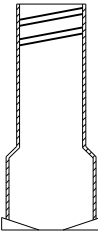
TOP

TYLER NO. 6860 26"



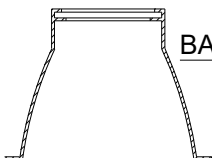
EXTENSION

TYLER NO. 58 14"
NO. 59 18"
NO. 60 24"



BOTTOM

TYLER NO. 6860 65"



BASE

NOTES:

1. 8.5' MINIMUM COVER REQUIRED OVER TOP OF WATER MAIN.
2. BOX TO BE SET TO PROVIDE 12" OF ADJUSTMENT.

GRADE

1/4" TO 3/8"

TYLER NO. 6860 OR APPROVED
EQUAL GATE VALVE BOX, SCREW
TYPE, 3 PIECE, 5 1/4" SHAFT, SIZE
G BOX, 8'-6" EXTENDED, #6
ROUND BASE

WRAP GATE VALVE & BOX
WITH POLYETHYLENE PIPE
ENCASEMENT MATERIAL

RESILIENT WEDGE VALVE
CONFORMING TO AWWA C515

GATE VALVE ADAPTOR

NDDOT CLASS 3M
AGGREGATE BACKFILL

8" CONCRETE BLOCK

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\WAT-3_GATE VALVE AND BOX INSTALLATION.dwg

City Plate No.:

WAT-3

Last Revision:

12/18/2020

Section:

2100

STANDARD DETAILS

GATE VALVE AND BOX INSTALLATION

City of Minot



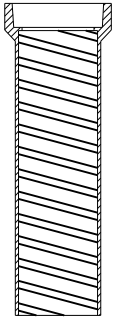
DROP LID



TYLER NO. 6860
MUELLER NO. H-10361

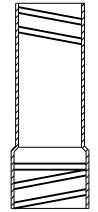


DROP-IN RISER - 2"



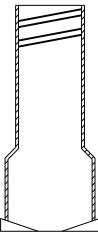
TOP

TYLER NO. 6860 26"



EXTENSION

TYLER NO. 58 14"
NO. 59 18"
NO. 60 24"



BOTTOM

TYLER NO. 6860 65"

BASE

BUTTERFLY VALVE ADAPTOR

NDDOT
CLASS 3M
AGGREGATE

8" CONCRETE BLOCK

8.5' MINIMUM COVER REQUIRED
OVER TOP OF WATER MAIN.

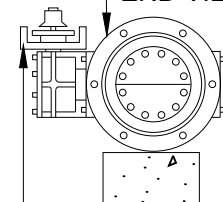
1/4" TO 3/8"

TYLER NO. 6860 OR
APPROVED EQUAL GATE
VALVE BOX, SCREW TYPE, 3
PIECE, 5 1/4" SHAFT, SIZE G
BOX, 8'-6" EXTENDED.

WRAP GATE VALVE & BOX
WITH POLYETHYLENE PIPE
ENCASEMENT MATERIAL

BUTTERFLY VALVE
(18" OR LARGER)
CONFORMING TO
AWWA C504

END VIEW



BUTTERFLY VALVE
ADAPTOR

City Plate No.:

WAT-4

Last Revision:

12/2/2025

Section:

2100

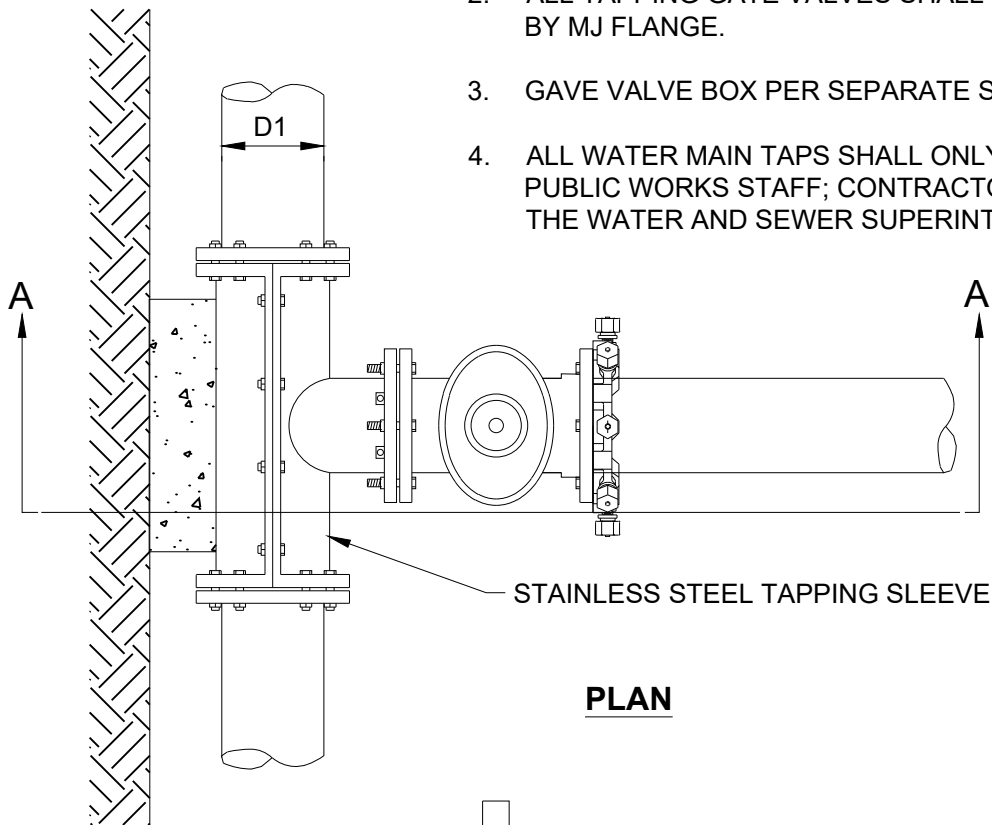
STANDARD DETAILS

BUTTERFLY VALVE AND BOX INSTALLATION

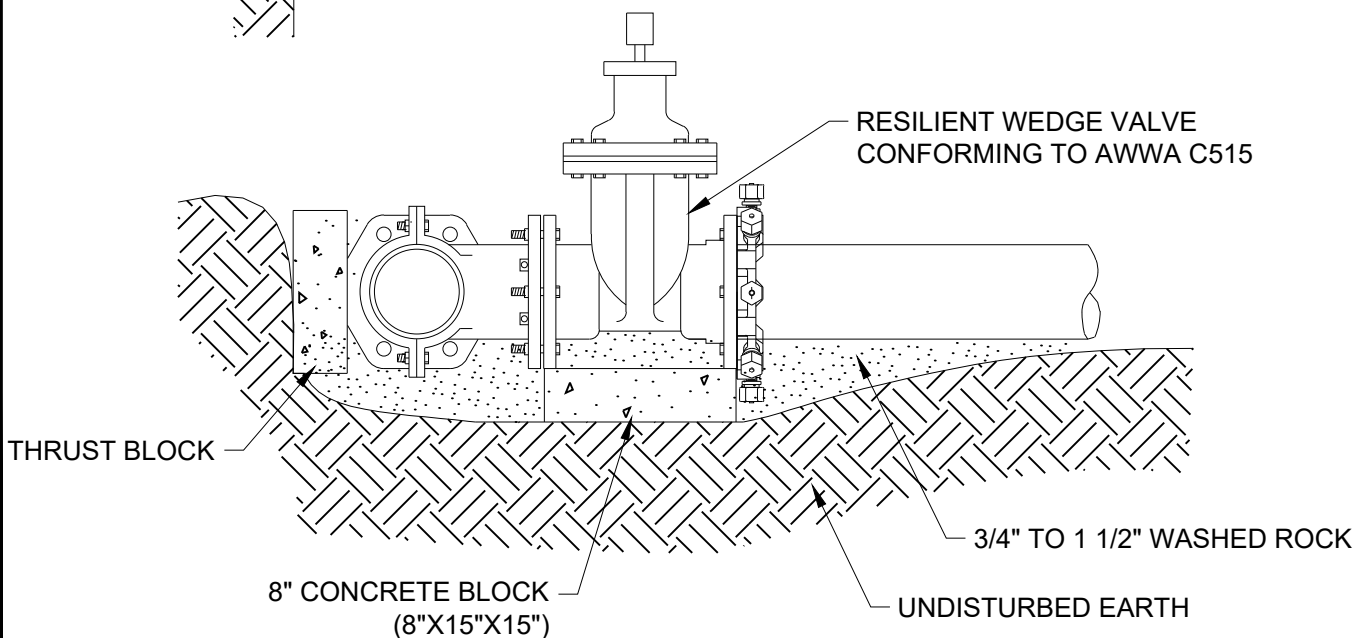
City of Minot

NOTES:

1. 8.5' MINIMUM COVER REQUIRED OVER TOP OF WATER MAIN.
2. ALL TAPPING GATE VALVES SHALL BE STRAIGHT FLANGE BY MJ FLANGE.
3. GAVE VALVE BOX PER SEPARATE STANDARD DETAIL.
4. ALL WATER MAIN TAPS SHALL ONLY BE OPERATED BY PUBLIC WORKS STAFF; CONTRACTOR MUST CONTACT THE WATER AND SEWER SUPERINTENDENT.



PLAN



SECTION A-A

M:\STANDARD SPECS & DETAILS\2026 Standard Details\Combined\WAT-5 - WATERMAIN WET TAP.dwg

City Plate No.:

WAT-5

Last Revision:

12/18/2025

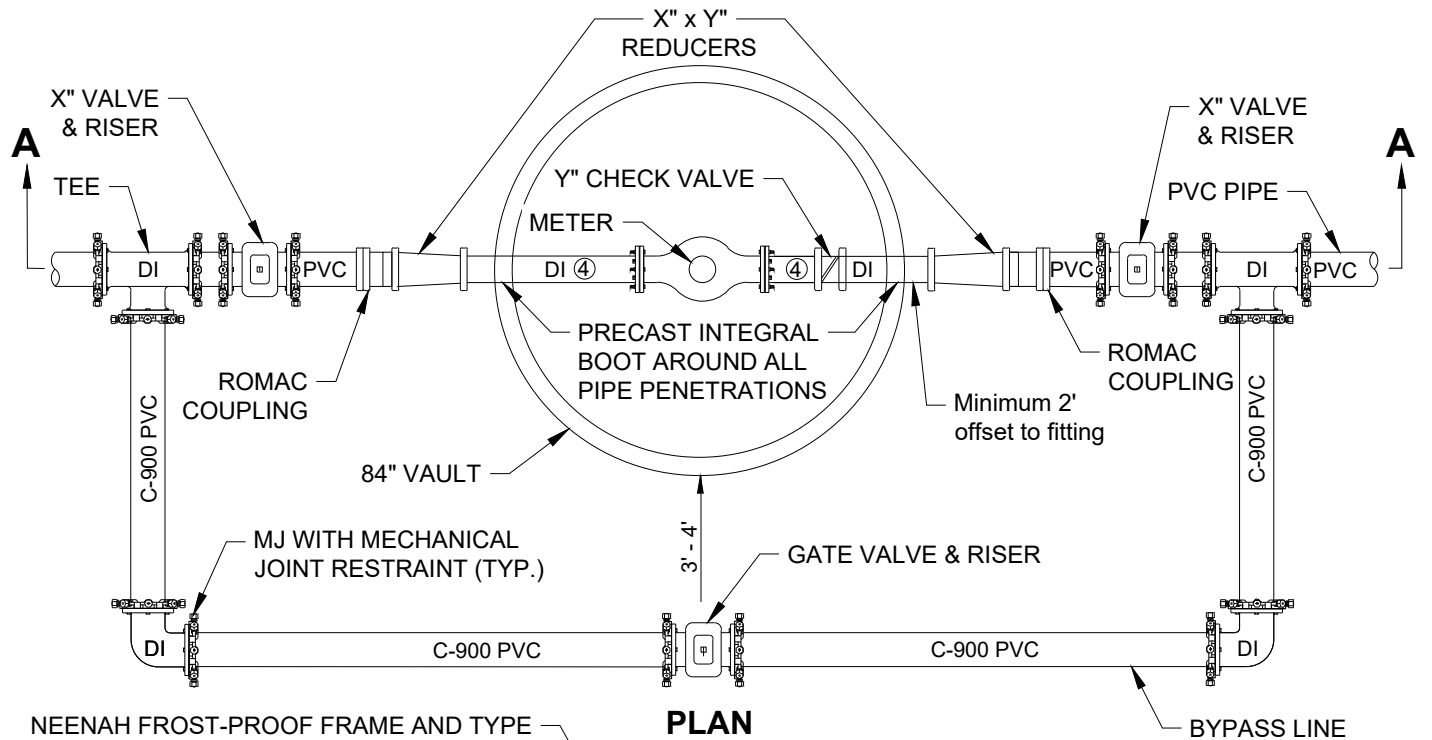
Section:

2100

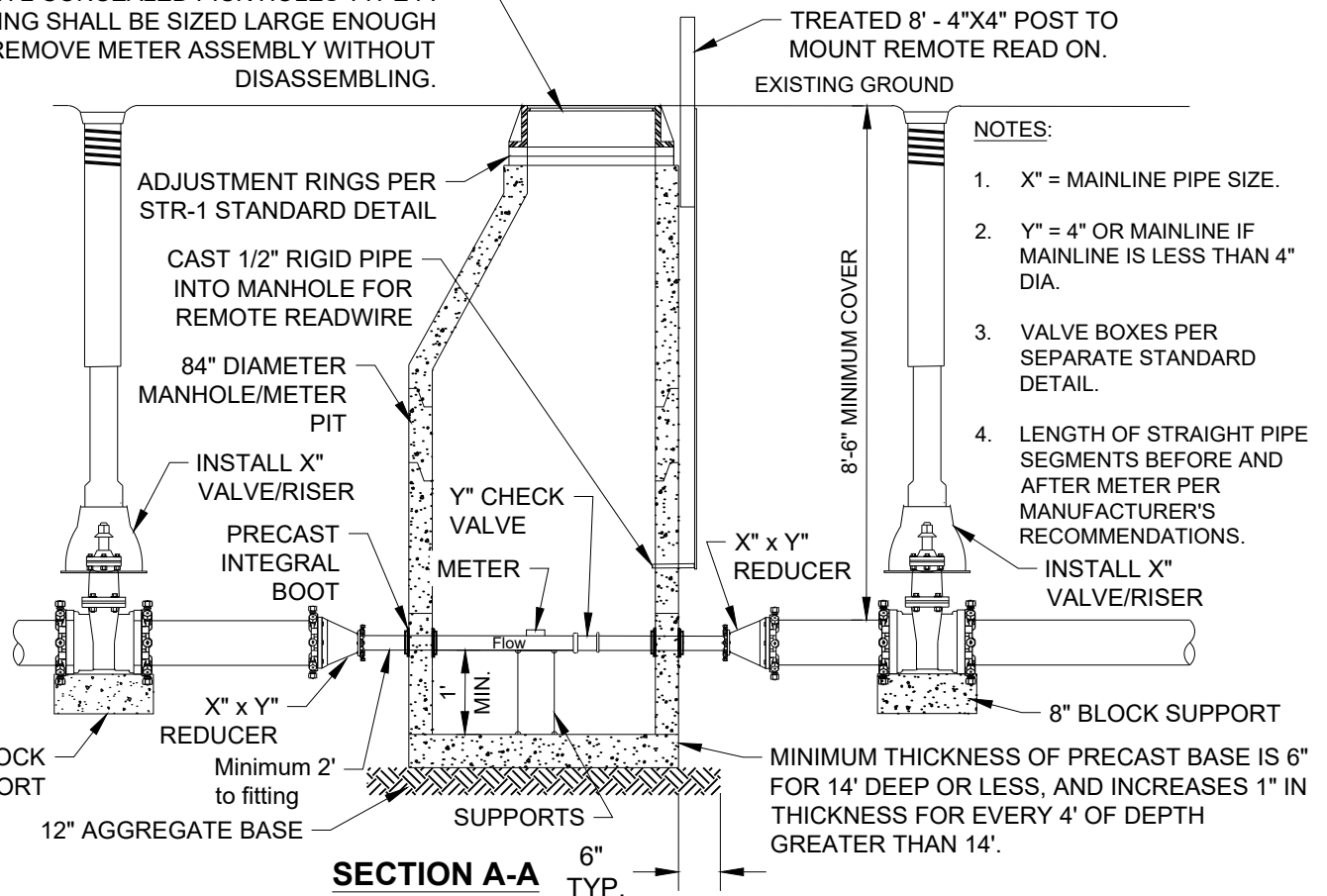
STANDARD DETAILS

**WATER MAIN
WET TAP**

City of Minot



NEENAH FROST-PROOF FRAME AND TYPE B COVER OR EQUAL, LETTERED "WATER" WITH 2 CONCEALED PICK HOLES TYPE F. CASTING SHALL BE SIZED LARGE ENOUGH TO REMOVE METER ASSEMBLY WITHOUT DISASSEMBLING.

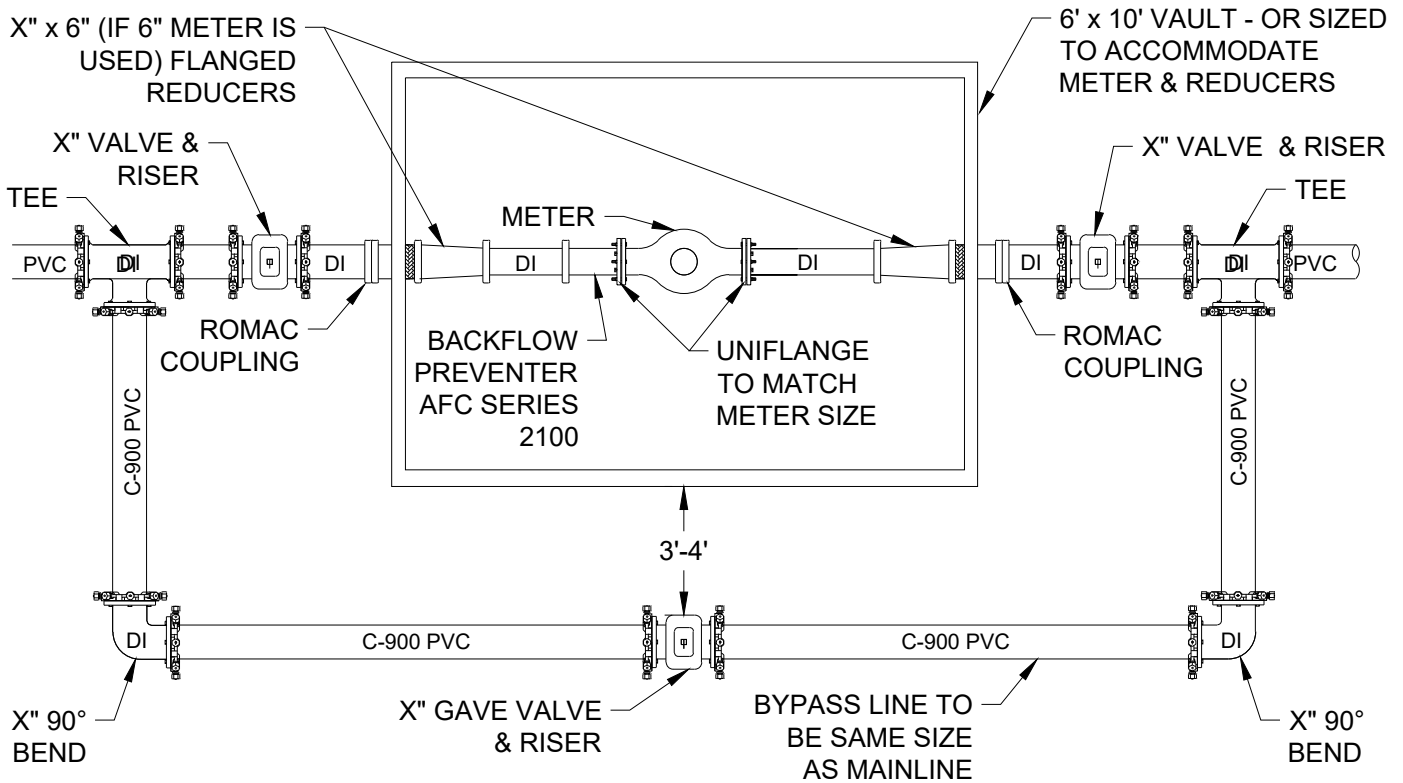


City Plate No.:	WAT-6A
Last Revision:	12/18/2020
Section:	2100

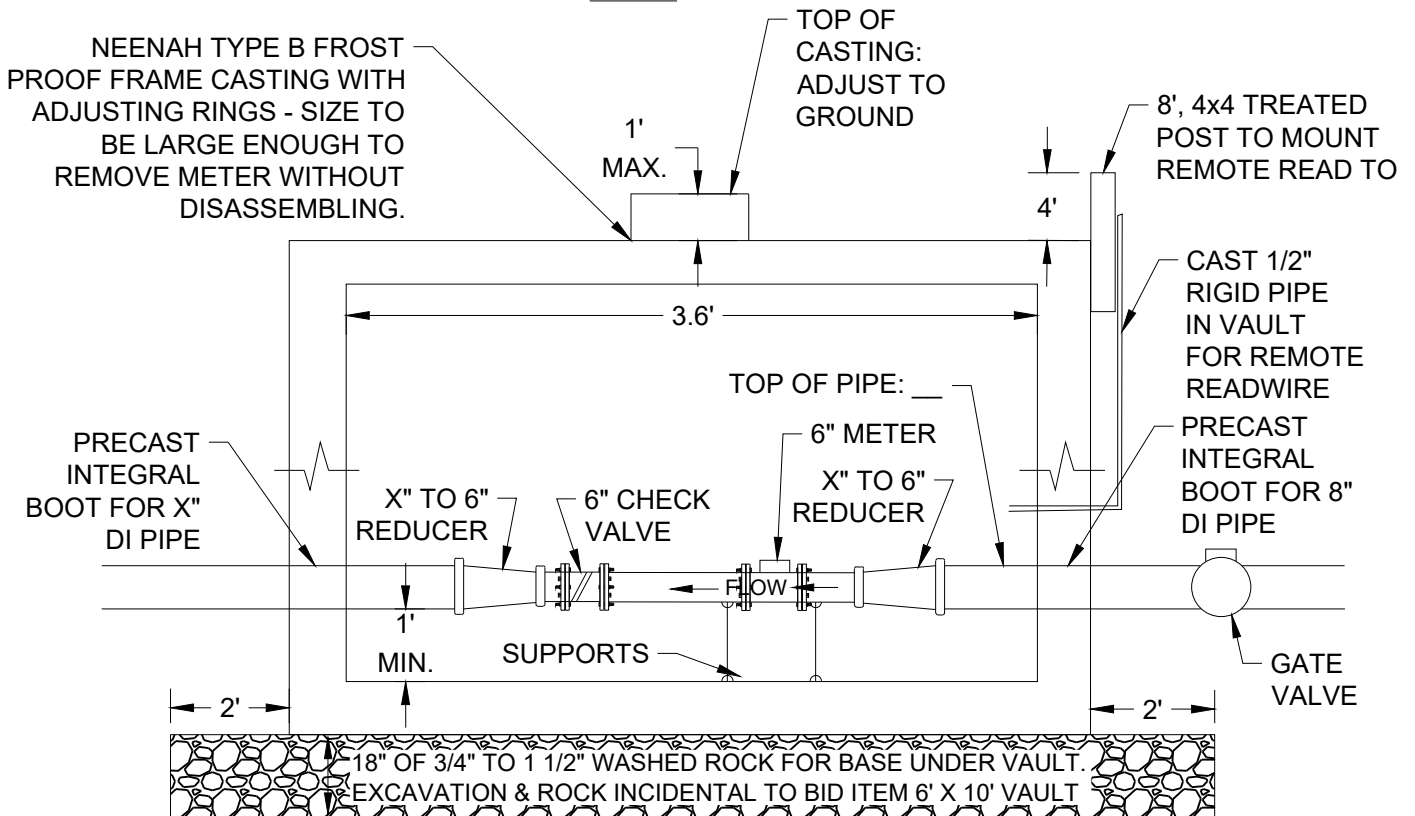
STANDARD DETAILS

METER PIT
UP TO 4"

City of Minot



PLAN



SECTION A-A

City Plate No.:

WAT-6B

Last Revision:

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Section:

2100

STANDARD DETAILS

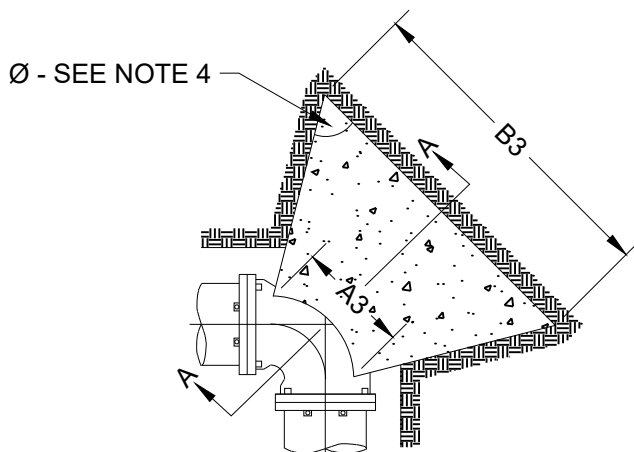
**METER PIT
6" - 8"**

City of Minot

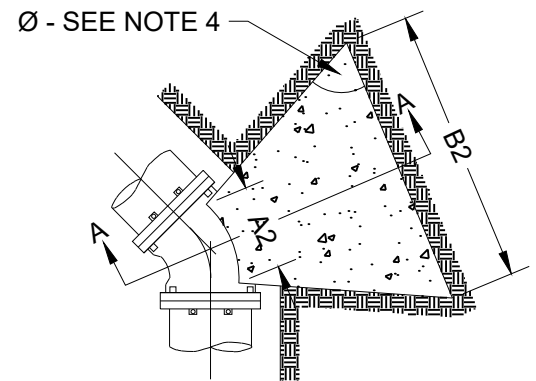
NOTES:

1. SHAPE OF BACK OF BUTTRESS MAY VARY AS LONG AS POURED AGAINST FIRM UNDISTURBED EARTH.
2. DIMENSION C1, C2, & C3 SHOULD BE LARGE ENOUGH TO MAKE ANGLE $\emptyset$ EQUAL TO OR LARGER THAN 45° .
3. DIMENSION A1, A2, & A3 SHOULD BE AS LARGE AS POSSIBLE WITHOUT INTERFERING WITH MJ BOLTS.
4. $\emptyset = 45^{\circ}$ MINIMUM.
5. PLACE POLYETHYLENE BETWEEN CONCRETE & PIPE.

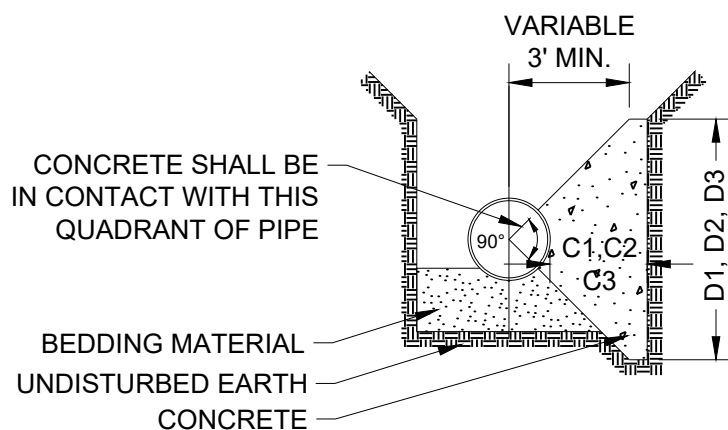
PIPE SIZE	22.5° BEND		45° BEND		90° BEND	
	B1	D1	B2	D2	B3	D3
6"	1' - 5"	1' - 5"	1' - 5"	1' - 5"	1' - 5"	1' - 5"
8"	1' - 5"	1' - 5"	2' - 1"	1' - 6"	2' - 8"	2' - 0"
12"	1' - 10"	1' - 10"	3' - 4"	2' - 0"	4' - 9"	2' - 6"
16"	3' - 0"	2' - 0"	3' - 10"	3' - 0"	6' - 2"	3' - 6"
20"	3' - 6"	2' - 8"	5' - 6"	3' - 4"	8' - 4"	4' - 0"
24"	4' - 4"	3' - 0"	6' - 10"	3' - 10"	6' - 2"	3' - 6"
30"	-	-	9' - 3"	6' - 0"	17' - 0"	6' - 0"



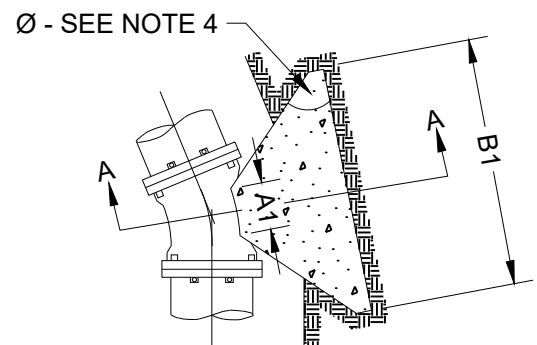
PLAN 90° BENDS



PLAN 45° BENDS



SECTION A-A



PLAN 22.5° BENDS

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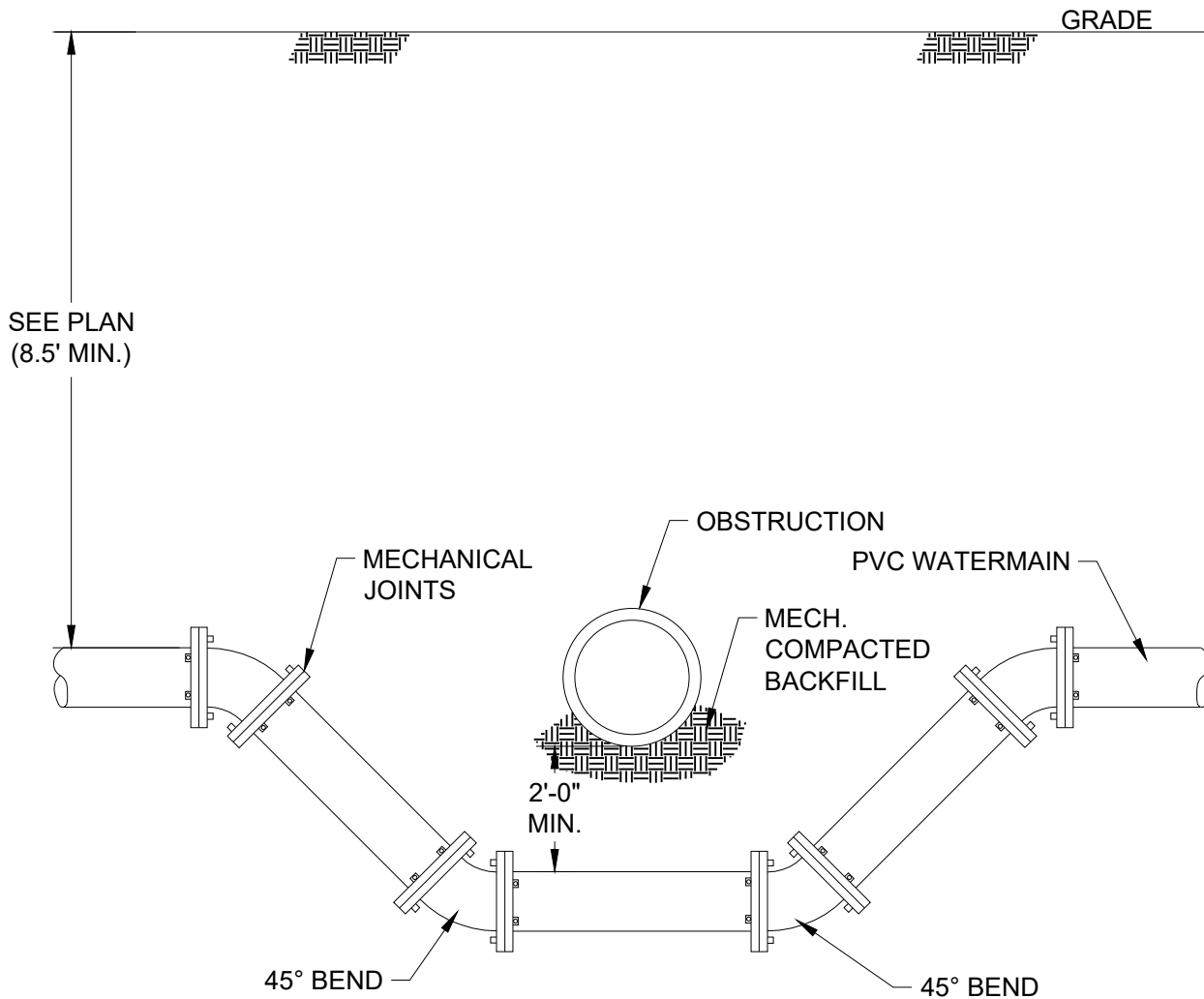
Section:

2100

STANDARD DETAILS

CONCRETE THRUST BLOCKING

City of Minot



NOTES:

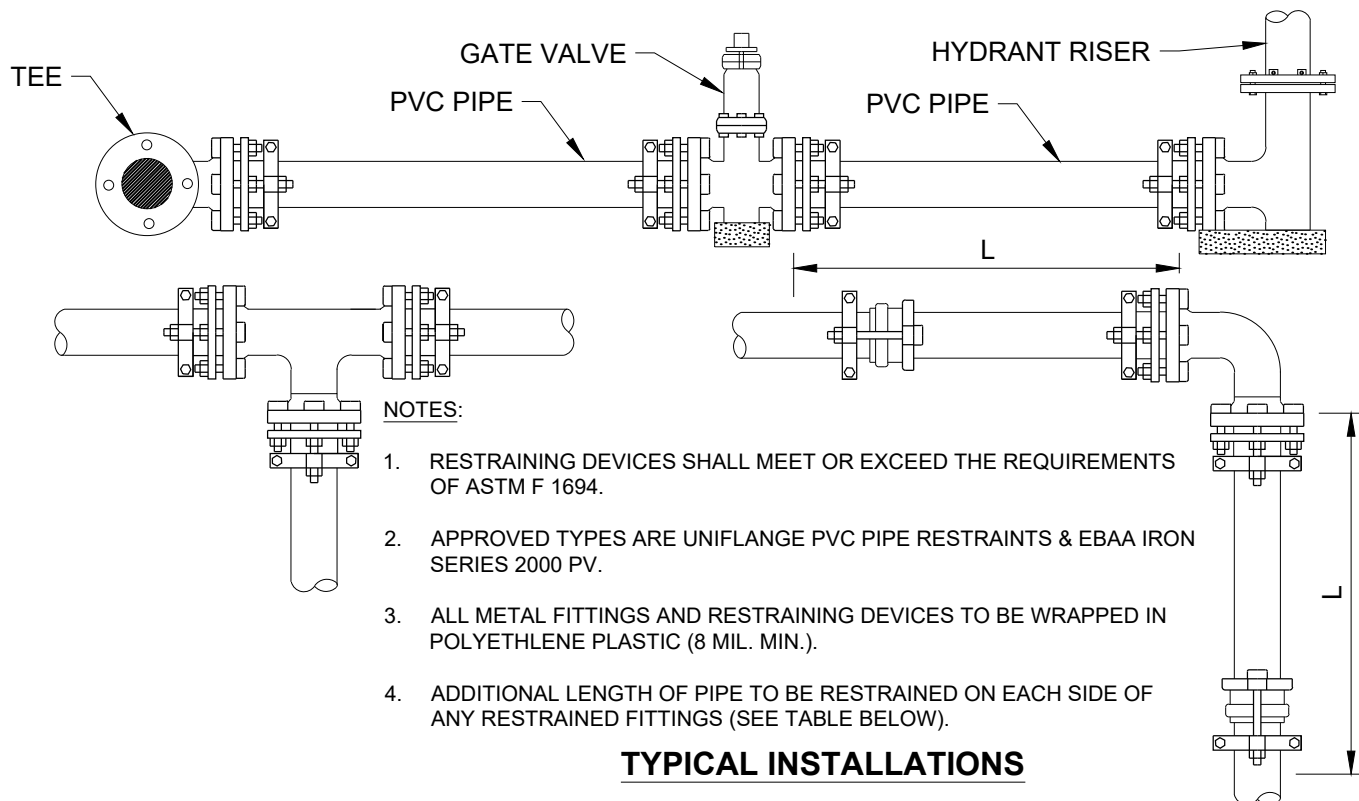
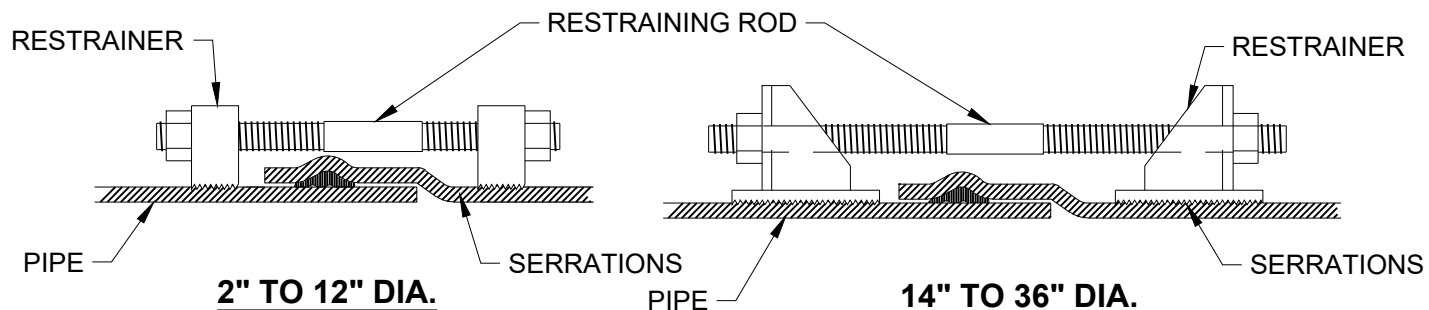
1. IF INSULATION IS REQUIRED REFER TO BED-6.
2. TIE RODS SHALL BE ALLOWED IN PLACE OF MECHANICAL JOINT RESTRAINTS.
3. MINIMUM SEPARATION SHOWN.

M:\STANDARD SPECS & DETAILS\2026\Standard Details\Combined\WAT-8_WATER MAIN OFFSET.dwg

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STANDARD DETAILS
WATER MAIN OFFSET

City of Minot



TYPICAL INSTALLATIONS

RESTRAINED LENGTHS OF PVC PIPE						
NOM. PIPE SIZE	90° BEND (L)	45° BEND (L)	22.5° BEND (L)	11.25° BEND (L)	SIZE ON SIZE TEE (L)*	VALVE DEAD-END (L)
6"	19'	8'	4'	2'	2'	35'
8"	25'	11'	5'	3'	13'	45'
10"	31'	13'	6'	3'	23'	55'
12"	36'	15'	8'	4'	33'	65'
16"	47'	20'	10'	5'	52'	84'

SIZE	45° VERT. OFFSET* (L)	22.5° VERT. OFFSET* (L)
6"	15'8"	7'4"
8"	19'11"	9'5"
10"	23'13"	11'6"
12"	27'15"	13'8"
16"	35'20"	17'10"

* FIRST NUMBER IS THE RECOMMENDED RESTRAINED LENGTH ON EACH SIDE OF THE DOWN BEND. THE SECOND NUMBER IS THE LENGTH FOR EACH SIDE OF THE UP BEND.

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STANDARD DETAILS

RESTRAINT DEVICE FOR PVC PIPE BELL JOINTS

City of Minot