Standard Supplemental Specifications For The Construction of Public Infrastructure In The City of Minneapolis

2012 Edition

Prepared by: City of Minneapolis Department of Public Works

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DIVISION S – GENERAL SPECIAL PROVISIONS

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S-1 (1305) Requirement of Contract Bond

For the purpose of these Supplemental Provisions Mn/DOT 1305 shall govern, except with the following modifications and amendment(s):

For SIDEWALK BONDS-ONLY

The contractor shall furnish and present in person a bond with good and sufficient surety satisfactory to the City Engineer's and the City Attorney's offices, in the penal sum of not less than $15,000.00 as is required by the ordinance for all persons performing work on the public sidewalks, among other things indemnifying the City against all claims for damages arising by reason of negligence of the contractor in the construction of the sidewalk, or from obstruction of the streets or from any other cause, and guaranteeing to maintain their work free from defects for a period of two (2) years, all as provided in Ordinance 437.30 of the City of Minneapolis passed January 28, 1898, as amended.

For all other bonds, Minneapolis Code of Ordinance 429 applies

S-2 (1404) Maintenance of Traffic

For the purpose of these Supplemental Provisions Mn/DOT 1404 shall govern, except with the following modifications and amendment(s):

Bus Passenger Waiting Shelters

If a bus passenger waiting shelter will be disturbed, the contractor shall notify both the owner of the shelter and the City of Minneapolis Public Works Traffic and Parking Services Division (Traffic and Parking Services) (612) 673-2411.

Two types of bus passenger waiting shelters exist on the right-of-way in Minneapolis. CBS Outdoor (612) 919-5923 owns bus shelters with advertising panels. Bus shelters without advertising are owned by Metro Transit (612) 349-7310.

At least ten days advance notice to Traffic and Parking Services and the owner of the shelter is required if a shelter is to be moved.

When the sidewalk is to be replaced under a shelter, there should be no expansion joints in the sidewalk under the shelter whenever possible. All CBS Outdoor bus shelters and most Metro Transit bus shelters are connected to an electrical service point by buried conduit. The service point may be a City ornamental street light, an Excel Energy service point, or a private third party source. The owner of the shelter will inform the City of the location of this conduit when requested. The cost for repairing or replacing damaged conduit shall be charged to the contractor and/or the property owner.

City Code provides that if a CBS Outdoor shelter must be temporarily removed for construction done by any governmental unit or its contractor, then CBS Outdoor shall, at its own cost, remove the shelter when requested to do so by the City Engineer. The City may also order CBS Outdoor to temporarily remove a shelter for an abutting property owner's construction at the property owner's expense.

Protection of the work site

The contractor shall erect and continuously maintain barricades to protect each job site immediately upon removal of the existing concrete. In a location where section(s) of the public sidewalk have been removed, two barricades will be required, one on each end of each work location. The number and placement of barricades required will be subject to the approval of the City Sidewalk Inspector, and may also be subject to the approval of the City Lane Use Administrator, (612) 673-5755.

Mid block pedestrian ramps

The Traffic and Parking Services Division, Room 233, City Hall, 350 South Fifth Street, phone (612) 673-2411, and the Sidewalk Inspections office located at 1901 E 26th Street, phone (612) 673-2420, must approve plans for any new construction of a mid-block pedestrian ramp. The plan should show the following items:

1. The location of the ramp in relation to the address of the requesting party.
2. The property lines of the requesting party's property should be shown.
3. The ramp should be designed in accordance with the Supplemental Provisions.

In addition, the following concerns will be evaluated regarding each ramp request: The proximity of trees, hydrants, or driveways, the type of boulevard, the type of dwelling unit, any impact on the sidewalk, any existing parking restrictions or zones, and the presence of parking meters, electrical conduit, and other infrastructure or obstructions.

The plan shall be accompanied by a written statement by the requesting party describing the nature of the request and a signed statement acknowledging that the placement of the ramp does not grant any exclusive rights to the requesting party for the use of the curb space or the ramp.

The establishment of a Handicap Transfer Zone or Handicap Parking Zone along the curb adjacent to the proposed ramp is not required but may be desirable. Contact the Traffic and Parking Services Division (612)-673-2411, in Room 233, City Hall, for details.

After the City Traffic and Parking Services Division grants its approval, your plans must be submitted to the Public Works Sidewalk Inspections office, Room 201, City Hall, phone (612) 673-2441, for a "Sidewalk Construction Permit". Contractors who have submitted a bond, kept on file with the City Public Works Sidewalk Inspections office, are eligible to obtain the Sidewalk Construction Permit.

Drive Approaches, plans

No driveway approach shall be installed without first submitting plans. If a new drive Approach is to be installed on a street other than a trunk highway, four (4) copies of the plan, of Engineering quality, in a minimum size of 8 ½ inches by 11 inches, and at a scale of 1/32 inch per foot, or 20, 30, or 50 foot per inch, showing complete details of the drive approach and driveway layout, shall first be submitted to the Development Review Coordinator, Minneapolis One Stop, Room 300, 250 South Forth Street, Minneapolis,

MN, 55415-1335, (612) 673-5867, for approval. Plans must be submitted three to four weeks in advance of the actual start of construction so that the plans can be reviewed by Zoning and by Public Works staff.

Drive Approach Dimensions

	Residential	Commercial
Drive Approach Angle (Y)	60-90 Degrees	60-90 Degrees
Drive Approach Width (W)	12' Minimum	12' Minimum*
Drive Approach Width (W)	25' Maximum*	25' Maximum*
Radius of Curvature of Curb for Drive Approach (R)	2 ½' Minimum, 5' Maximum	5' Standard*
Radius of Curvature (R1) and (R2)	5'Minimum, 15'Maximum	5' Minimum, 30' Maximum
Common Frontage Clearance (F)	5' Minimum	5' Minimum
Distance Between Double Drive Approaches (G)	30' Minimum*	30' Minimum*
Corner Clearance at the Intersection of Two Major Streets (C)	30' Minimum*	30' Minimum*
Corner Clearance at all Other Intersections	20' Minimum*	20' Minimum*
Clearance from Bus Stop Zone	40' Minimum*	40' Minimum

Note: Periodic Changes in the above Dimensions Will Be Made as Necessary to Improve Traffic and Safety on the Public Streets and Sidewalks
* or as Approved by the City Engineer

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S-3 (1504) Coordination of Plans and Specifications

The State of Minnesota, Department of Transportation "Standard Specifications for Construction", 2005 edition, shall govern, except where modified or amended by these Supplemental Provisions. All reference to other Specifications of AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition available on the date of advertisement for bids. City of Minneapolis, Public Works Standard Plates are hereby incorporated into these Standard Supplemental Specifications. The Standard Plates and this Standard Supplemental Specifications for Construction of Public Infrastructure are available at the following web address:

http://www.ci.minneapolis.mn.us/public-works/plates-home.asp

Definitions/Order of Precedence

For the purpose of these supplemental provisions the following terms shall have these definitions: "City" means the City of Minneapolis, Minnesota. "City Engineer" means the City Engineer of the City of Minneapolis or any other designated representative. The order of precedence for work performed under these supplemental specifications shall be:

1. The City of Minneapolis Code of Ordinances (City Code).
2. These Standard Specifications for Construction of Public Infrastructure in the City of Minneapolis
3. City of Minneapolis, Public Works Standard Plates
4. The State of Minnesota, Department of Transportation "Standard Specifications for Construction", 2005 edition, shall govern, except where modified or amended by Special Provisions, modified or amended by supplemental Specifications.

S-4 (1507) Utility and Property Service

Work near utilities shall be in accordance with the provisions of 1507 and the following:
The Plan contains information relative to the location of existing utilities to the extent this information is available from the respective utility owners. The City does not guarantee the locations as shown in the Plan. It shall be the Contractor's responsibility to contact Gopher State One Call and to ascertain the actual location of these utilities prior to commencing construction. The Contractor shall be solely responsible for verifying the exact location of each of these facilities.

It will be the Contractor's responsibility to contact the owners of all utilities in any area prior to the construction in the area so that he can be informed of the exact locations of all the utilities in the area including any that are not shown in the plans. It will also be the Contractor's responsibility to: (1) report any existing damage or faulty condition (i.e. sand in manholes, damaged valve boxes, etc.) to the owners prior to construction, as once excavation has commenced it will be assumed that all damage to underground installations has been caused by the Contractor's operations and it will be its responsibility to make the necessary repairs; and (2) upon completion of the project, contact all utility owners and make arrangements for a

field inspection trip by a representative of the Contractor and representatives of the utility owners to confirm that all damages caused by the Contractor's operations have been repaired to the satisfaction of the owners.

The City shall not be held responsible for any delay that the Contractor may encounter by reason of the utility company involved failing to promptly do their necessary work. It shall be the Contractor's responsibility to meet with the affected utility companies as soon as possible to coordinate timely relocations. It shall be the Contractor's responsibility to coordinate work with the utility companies to accomplish utility relocations and to preserve the existing condition of any utilities to remain in their current location. Additionally, the Contractor shall provide for the continuance of service of such utilities where such service may be disrupted as a result of the Contractor's operations. It shall be the Contractor's responsibility to ensure all excavations are thoroughly backfilled and compacted according to these specifications to prevent any displacement or settlement of the utility facility. No deviation from the approved line or grade of any proposed City utility work (sewer, storm drain or water main, etc.) due to conflicts with existing utilities shall be made without first obtaining the written consent of the City Engineer.

Any utilities to be abandoned by the utility owners shall be removed by the Contractor in accordance with Mn/DOT standard specification 2104 and S-21 of these Standard Supplemental Specifications.

No sewer or storm drain work performed on the City's system shall commence before an extension permit or connection permit has been applied for and approved by the Surface Water and Sewers Division of Public Works (SWS). The contractor shall comply with all terms of the permit. Until the Contractor receives written notice from SWS of acceptance of the work covered by the permit, the Contractor will be responsible for any sewer or storm drain related problems.

The Contractor shall notify the Maintenance Supervisor of SWS Operations Office 48 hours prior to commencing any work on, inspection of or access to any part of the SWS Sewer or Storm Drain system. Contact telephone number for the Maintenance Supervisor is (612) 673-5625. All work on City sewer and storm drain system shall be inspected by a designated representative of SWS. All laboratory tests shall be submitted to SWS and approved prior to restoration of the work area subject to testing. SWS Operations will determine the need to have representatives on site to observe utility testing.

All design changes and all field modifications that change pipe clearance or change the size, grade or alignment of an SWS sewer or storm drain shall be approved by SWS prior to commencing work on those changes. All design changes shall be submitted 72 hours before work is to commence

The Contractor shall provide record drawings of all sewer and storm drain work in electronic format to the SWS Design, 309 2nd Avenue S, Room 300 regardless of ownership of work.

Section S-31 of this document outlines the requirements for sewer and storm drain record drawings.

S-5 (1514) Maintenance During Construction

The Contractor's requirements for sweeping as required under Mn/DOT 2051 shall mean that the City Engineer may require additional street sweeping of the Haul Roads and the roads adjacent to the construction site to provide safe conditions for the traveling public, to prevent environmental damage, or to comply with local regulatory requirements. The Contractor shall maintain drainage for all temporary roadways and work sites at all times. When existing drainage facilities are severed or otherwise rendered inoperable, the Contractor shall construct as much of the designed drainage system as may be necessary to maintain adequate drainage. Temporary grading and/or ditching may also be required to maintain drainage. Any temporary grading and ditching that is required shall be completed as an incidental expense unless it is part of the designed project earthwork. All temporary drainage work shall be completed to the satisfaction of the Engineer and the Agency. All side slopes adjacent to temporary bypasses shall be effectively maintained against erosion and stabilized 7 days after the end of active work. In the event erosion occurs, the Contractor shall reshape the slope to its original elevations and cross section in accordance with Article 52.290 of City Code. The side slope maintenance is required to ensure the integrity and traffic carrying ability of the adjacent temporary bypass.

S-6 (1515) Control of Haul Roads

If the Contractor's use of City roads, other than the roads agreed to by the City, result in damage or decrease in the recorded Pavement Condition Index, it shall be the Contractor's responsibility to provide restitution to the City for repairs or replacement of the roads. Repairs will be determined based on Minneapolis Code of Ordinances 429 and 430.

S-7 (1702) Permits, Licenses, and Taxes

For the purpose of these Standard Supplemental Specifications Mn/DOT 1702 shall govern, except with the following modifications and amendment(s):

A "Sidewalk Construction Permit" shall be obtained for each and every job done under the required $15,000.00 Sidewalk Contractor's bond. All permits must be obtained before any demolition or actual construction work begins. Each job will consist of the work done adjacent to a single property, unless other arrangements are made with the Sidewalk Inspections Office. Application for the Sidewalk Construction Permit shall be submitted online at: www.sidewalk.mpls.mn.roway.net by the contractor.

The City Code pertaining to Sidewalk Construction Permit fees reads as follows:

> *"437.20. Permit required fees. No person shall construct any sidewalk, curb, curb and gutter, or other pavement within the public right of way without first obtaining a permit from the city engineer and paying a permit fee of ten (10) percent, based upon the value*

of the work as established annually by the district sidewalk contractor's accepted bid prices and by the City of Minneapolis unit prices list for such work"

All work within the public right of way must be done by a bonded contractor under the supervision of the City Engineer, or their designated representative, who will see that these Standard Supplemental Specifications are rigidly followed. The contractor shall obtain a "Sidewalk Contractor's Bond" in the amount of $15,000 in order to perform work in the Public Right of Way. The bond shall be held on file at the Department of Pubic Works, Sidewalk Inspections office. The Sidewalk Inspections office maintains a listing of all contractors who are properly bonded. To obtain a list of bonded Contractors contact the City at 612-673-3000.

The Sidewalk Inspector is to be notified at least three (3) days in advance of any construction. The Sidewalks Inspector's name and telephone number appear on the Contractor's copy of the Sidewalk Construction Permit.

Please make all checks payable to: City of Minneapolis Finance Department Sidewalk Construction Permits as issued by the Sidewalk Inspections office will be in the contractor's possession, on site, while the work is being performed. Any City licenses and permits required to perform electrical, sewer or water work on this project shall be obtained from the appropriate City of Minneapolis office by the Contractor at its cost.

STREET USE PERMIT
From City Transportation Division
300 Border Avenue North
Telephone # (612) 673-5750

EXCAVATION, UTILITY CONNECTION & EROSION CONTROL PERMITS
Public Health Center, Room 222
250 South 4th Street
Telephone # (612) 673-2451

WATER DEPARTMENT FIRE HYDRANT PERMIT
Hydrant taps can be obtained and water purchased at residential rates at hydrants designated by the City. Hydrant Permits are available through the City of Minneapolis Water Department
Telephone # (612)-673-2865

AFTER HOURS WORK PERMIT AND/OR NOISE PERMIT
Available from the City of
Minneapolis, Inspections Department
Telephone # (612) 673-2635

or visit:

http://www.ci.minneapolis.mn.us/environment/permits.asp

The City of Minneapolis reserves the right to withhold the issuing of any future permits to any Contractor until any current problems or failures to meet these special provisions are resolved, to the satisfaction of all parties.

S-8 (1710) Traffic Control Devices
Section 1710 is hereby supplemented to include the following:
Traffic control devices shall be provided in accordance with the provisions of 1710 and the latest edition of the Minnesota Manual on Uniform Traffic Control Devices (MMUTCD) and Part IV, Field Manual for Temporary Traffic Control Zone Layouts, except as modified as herein:

The first paragraph of 1710.2 is revised to read as follows:

The Contractor shall furnish, install, maintain and remove all traffic control devices in accordance with these Standard Supplemental Specifications and the Minnesota Manual on Uniform Traffic Control Devices (MMUTCD) - including the Field Manual for "Temporary Traffic Control Zone Layouts", latest edition. The Engineer will have the right to modify the requirements for traffic control as deemed necessary due to existing field conditions. The Contractor's responsibilities under this section include, but are not limited to, the following:

Subparagraph (b) of the first paragraph of 1710.2 is revised to read as follows:

(b) To control and guide traffic through the project and over any temporary bypasses.

The provisions of 1710.5 including all supplements thereto are hereby deleted from the Contract.

All temporary metal orange warning signs shall be fabricated with Type DGC (Diamond Grade Cubed) sheeting and metal orange regulatory guide signs shall be fabricated with Type HIP (High Intensity Prismatic) Sheeting.

Long term traffic control devices shall be inspected on a daily basis and maintained for the duration of use. Inspections of the traffic control devices shall be documented and presented to the City of Minneapolis upon request. Appendix A contains a sample of the traffic control log

S-9 (1717) National Pollutant Discharge Elimination System (NPDES) Permit
Pollution of natural resources of air, land and water by operations under this Contract shall be prevented, controlled, and abated in accordance with the rules, regulations, and standards adopted and established by the Minnesota Pollution Control Agency (MPCA), and in accordance with the provisions of Mn/DOT 1717, these Special Provisions, and the following:

The Contractor is a co-permitee with the City to ensure compliance with the terms and conditions of the General Storm Water Permit (MN R100001) and is responsible for those

portions of the permit where the operator is referenced. This Permit establishes conditions for discharging storm water to waters of the State from construction activities that disturb 0.4 hectares [1 acre] or more of total land area. A copy of the "General Permit Authorization to Discharge Storm Water Associated with a Construction Activity under the National Pollutant Discharge Elimination System (NPDES)/State Disposal System Permit Program" is available at:

http://www.pca.state.mn.us/water/stormwater/stormwater-c.html

or by calling 651-296-3890

The Contractor shall apply and pay for the NPDES Permit on this Project. The Contractor shall fill out the Contractor's portion (Section 4 and Section 15), complete the application process, and post the Permit and MPCA's letter of coverage onsite. Some work in waters of the state may require additional permits from the Minnesota Department of Natural Resources and may require additional permits from the U.S. Army Corps of Engineers even if not required in these specifications.

No work which disturbs soil and/or work in waters of the state will be allowed on this Project until the NPDES Permit is in effect and the Department has received the required documentation.

The Contractor shall be solely responsible for complying with the requirements listed in Part II.B and Part IV of the General Permit.

The Contractor shall be responsible for providing all inspections, documentation, record keeping, maintenance, remedial actions, and repairs required by the permit. All inspections, maintenance, and records required in the General Permit Paragraphs IV.E, shall be the sole responsibility of the Contractor. The word "Permitee" in these referenced paragraphs shall mean "Contractor". Standard forms for logging all required inspection and maintenance activities shall be used by the Contractor. All inspection and maintenance forms used on this Project shall be turned over to the Engineer every two weeks for retention in accordance with the permit. The Contractor shall have all logs, documentation, inspection reports on site for the Engineer's review and shall post the permit and MPCA's letter of coverage on site. The Contractor shall immediately rectify any shortcomings noted by the Engineer. All meetings with the MPCA, Watershed Management Organization (WMO), or any local authority related to General Permit compliance shall be attended by both the Engineer and the Contractor. No work required by regulatory agencies, for which the Contractor would request additional compensation from Mn/DOT, shall be started without proper approval from the Engineer. No work required by regulatory agencies, where the changes will impact the design or requirements of the Contract documents or impact traffic shall be started without proper approval from the Engineer.

The Contractor shall immediately notify the Engineer of any site visits by Local Permitting Authorities performed in accordance with Part V.H.

Emergency Best Management Practices must be enacted to help minimize turbidity of surface waters and relieve runoff from extreme weather events. It is required to notify the MPCA Regional Contact Person within 2 days of an uncontrolled storm water release. The names and phone numbers of the MPCA Regional Contract personnel can be found at: http://www.pca.state.mn.us/water/stormwater/stormwater-c.html. The Contractor is reminded that during emergency situations involving uncontrolled storm water releases that the State Duty Officer must be contacted immediately at 1-800-422-0798 or 1-651-649-5451.

The Contractor shall review and abide by the instructions contained in the permit package. The Contractor shall hold the City harmless for any fines or sanctions caused by the Contractor's actions or inactions regarding compliance with the permit or erosion control provisions of the Contract Documents.

The Contractor is advised that Section 1 of the NPDES application form makes reference to a Storm Water Pollution Prevention Plan (SWPPP). This Projects' SWPPP is addressed throughout Mn/DOT's Standard Specifications for Construction, as well as this Project's Plan and these Special Provisions. The following table identifies NPDES permit requirements and cross-references where this Contract addresses each requirement.

NPDES Permit Requirements	**Cross-Reference within this Contract**
Obtain NPDES Permit; Permit Compliance; Submit Notice of Termination	Mn/DOT 1701, 1702; Special Provisions: 1717 (Air, Land & Water Pollution), 1717 (National Pollutant Discharge Elimination System (NPDES) Permit)
Certified Personnel in Erosion / Sediment Control Site Management Develop a Chain of Command	Mn/DOT 1506; Special Provisions: 1717 (Air, Land & Water Pollution), 1717 (National Pollutant Discharge Elimination System (NPDES) Permit); and 2573 (Erosion Control Supervisor).
Project / Weekly Schedule (for Erosion / Sediment Control) Completing Inspection / Maintenance Log / Records	Special Provisions: 1717 (Air, Land & Water Pollution), 1717 (National Pollutant Discharge Elimination System (NPDES) Permit); and 2573 (Erosion Control Supervisor)
Project Specific Construction Staging	The Plans; Special Provisions: 1717 (Air, Land & Water Pollution), 1717 (National Pollutant Discharge Elimination System (NPDES) Permit); and1806

	(Determination and Extension of Contract Time)
Temporary Erosion / Sediment Control	The Plans; Mn/DOT 2573 Special Provisions: 2573 (Rapid Stabilization Specifications), and 2573 (Inlet Protection)
Maintenance of Devices / Sediment removal Removal or Tracked Sediment Removal of Devices	The Plans; Mn/DOT 2573.3; Special Provisions:1514 (Maintenance During Construction); 1717 (Air, Land & Water Pollution), 1717 (National Pollutant Discharge Elimination System (NPDES) Permit), and 2573 (Inlet Protection)
Dewatering	Mn/DOT 2105.3B and 2451.3C; May also require DNR Permit
Temporary work not shown in the Plans Grading areas (unfinished acres exposed to erosion)	Special Provisions: 1717 (Air, Land & Water Pollution), 1717 (National Pollutant Discharge Elimination System (NPDES) Permit); 2573 (Erosion Control Supervisor), 2573 (Inlet Protection) and 2573 (Rapid Stabilization Methods).
Permanent Erosion / Sediment Control and Turf Establishment	The Plans; Mn/DOT 2573 and 2575; Special Provisions: 1717 (Air, Land & Water Pollution), 1717 (National Pollutant Discharge Elimination System (NPDES) Permit), and 2575 (Turf Establishment)

Appendix B outlines Chapter 52 in the City of Minneapolis's Code of Ordinances-Erosion and Sediment Control for Land Disturbance Activities. Appendix B also contains samples of: Inspector's Logs, Maintenance Record's Logs, and the NPDES Construction Site Permit Holder Inspection Form.

S-10 (1803) Prosecution of Work

The second paragraph of Section 1803.3 is hereby deleted and the following substituted therefore:

> The hours of operations shall be limited to 7:00 a.m. until 6:00 p.m. Monday through Friday and from 8:00 a.m. until 6:00 p.m. on Saturday except when provisions of a

Noise Permit further limit work hours. The Contractor shall contact Regulatory Services at 612-673-2635 to determine whether a Noise Permit is required and whether the Noise Permit will limit work hours. No work will be allowed on Sundays or outside these hours, unless an emergency situation exists and requires immediate correction.

S-11 (2104) Removing Pavement & Miscellaneous Structures
The provisions of Mn/Dot Specification 2104 shall govern as amended below:
2104.3BAdd the following:

Pipe sewers and drainage pipes which are to be abandoned shall be bulk-headed with brick or concrete block masonry eight inches (8") thick at the upstream ends, at downstream ends that connect to catch basins, manholes, or pipes 36 inches or greater in diameter, and at locations noted on the approved plans. Mainline sewer pipe (excluding catch basin leads) to be abandoned having a 12-inch or larger inside diameter, shall be filled with material specified on the approved plans. A site verification of the abandonment work will be made by the Maintenance Supervisor of SWS Operations Office prior to backfilling the abandonment work on any part of the SWS Sewer or Storm Drain system. Contact telephone number for the Maintenance Supervisor is (612) 673-5625. The Contractor shall supply Record Drawings of the abandoned facilities in the Record Drawing Format specified above in the supplemental addition to **(1507) Utility And Property Service** above.

Prior to restoring the trench area, the edges of the trench shall be trimmed back to a vertical face on a straight line which is parallel with the centerline of the trench.

S-12 (2105) EXCAVATION AND EMBANKMENT
Section 2105 is hereby supplemented to include the following:

All excavations for this project must be adequately sloped, or sheeted and braced, in accordance with applicable Occupational Safety and Health Administration (OSHA) regulations. It is the sole responsibility of the Contractor to provide safe working conditions during all phases of construction on this project.

All excess material generated by the project shall become the property of the Contractor and shall be disposed of off the project site.

The contractor shall dispose of the excess material in conformance with the NPDES permit requirements for specific set backs for stock piles from direct conveyances to waters of the state.

S-13 (2112) Subgrade Preparation
For the purpose of these Standard Supplemental Specifications Mn/DOT 2112 shall govern, except with the following modifications and amendment(s):

In the event that it is required to provide fill material, select granular fill conforming to Mn/DOT 3149.2B2 shall be used. In no case will river dredge sand be used.

Unless otherwise stated in the Contract all density measurements shall be made using the Specified Density Method outlined in Mn/DOT 2105. The maximum density shall be determined in accordance with procedures described in AASHTO T-99 and ASTM D698.

All tests shall conform to MNDOT Grading and Base random method and number of tests will be determined by the Paving Engineer.

Paving Engineer

Larry Matsumoto
1901 E 26th St, Minneapolis MN 55404
Phone: 612-919-1148
E-mail: larry.matsumoto@ci.minneapolis.mn.us

In the event any privately owned below grade structure within the public right of way, also known as an areaway, is uncovered during this work, then all areaway improvements, modifications, or any areaway abandonment shall conform to City of Minneapolis Ordinance 95. Additional building permits may be required due to affects on the structure of a building. The Contractor should contact the Chief Building Official for the City of Minneapolis at (612) 673-5800, for additional information on the requirements.

S-14 (2211) Aggregate Base

Section 2211 is hereby supplemented to include the following:
The use of recycled materials (Class 7) consisting primarily of crushed bituminous and concrete will be permitted only upon written acceptance from the Paving Engineer. The Paving Engineer may require that the quality of each source be demonstrated prior to any acceptance.

The material will be required to meet all requirements of specifications 2211 and 3138.

Section 3138.2A2a is modified to have a maximum bitumen content of 2.0 percent by weight.

Section 3138.2A2c is amended to not allow reclaimed glass in this material.

Section 3138.2D is amended to apply to all aggregate used in this material (virgin plus salvage/recycle).

Density tests shall conform to Mn/DOT Dynamic Cone Penetrometer method. All tests shall conform to Mn/DOT Grading and Base random method and number of tests will be determined by the Paving Engineer.

S-15 (2301) Concrete Pavement

For the purpose of these Standard Supplemental Specifications Mn/DOT 2301 shall govern, except with the following modifications and amendment(s):

(2301.3K) Joint construction

2301.3K shall be modified to include:

1. All tooled joints shall have a depth of 1/3 the thickness of the structure.
2. All 8 inch thick pavements (alley, driveway, street pavement) have tooled joints 2-inches deep.
3. All expansion felt, including expansion felt at 30' intervals in the sidewalk area, shall be placed as shown in shown in the City Standard Plates under Standard Plate Number ROAD-2003.
4. All joints shall be evenly spaced, or as approved by the City Engineer.

(2301.3M) Concrete curing and protection

1. (2301.3M (3)) shall state, "Continue curing and protecting the concrete for at least 28 days."

2. Concreting in cold weather: During cold weather, concrete may be placed when the natural air temperature in the shade is 33 Degrees F. and rising. Concrete shall not be placed on frozen subgrade and/or base and materials containing frost, lumps or crusts of hardened materials. All concrete to be installed after October 1 will require an approved cold weather concrete plan prior to any work. This plan must be approved by the City of Minneapolis Paving Engineer.

3. For any concrete installed after October 1, the City of Minneapolis reserves the right to require the following items:

   A. Electronic thermocouple(s) to be installed in the concrete, to record the temperature of the concrete and evaluate the possibility of any damage due to frozen concrete. The placement of the thermocouple(s) shall be at the rate of one thermocouple per 50 cubic yards of concrete and/or one thermocouple per each different type of concrete structures (sidewalk, pavement, curb and gutter, or drive approach). Placement, inspection and testing of thermocouples shall be performed by the City of Minneapolis, or by others if approved by the City of Minneapolis Paving Engineer. All costs for thermocouple work performed by the City shall be paid for as part of the issuance of the Sidewalk Construction Permit, or by other means. Failure to maintain concrete temperatures above 32 degrees Fahrenheit during the initial 28 days of curing may result in a determination of failure and rejection of the

work, unless other terms for the cold weather concreting plan are accepted by the City of Minneapolis Paving Engineer.

B. Concrete test cylinders to be cured on site, companion compressive strengths will be performed and failing compressive strengths of the test cylinder cured on site will governed for acceptance of material.

4. Ready mixed concrete delivery trucks shall have portable washout systems on the truck and it is prohibited within the public right of way to washout mixer trucks in the public right of way or into the public storm sewer. No wash out of cement material will be allowed in the public right of way. Approved containment and disposal must be provided for any cement work performed.

(2301.3P2) Thickness Requirements
If the measured thickness of the concrete work is less than that given in the plan, and the deficient thickness is one half (1/2) inch or greater, then the deficient portion of the work shall be considered defective, and shall be removed and replaced, or a deduction will be made in the payment for the defective work. In areas where there is deficient thickness the contractor may elect to saw cut the pavement at the closest contraction or expansion joint for replacement. Upon the direction of the Engineer, the contractor may be required to provide dowel bars as a part of the concrete replacement work.

Alley thickness shall be 6 inches for residential alleys and 8 inches for commercial alleys. If the alley thickness is not shown in the plans, or alley is not designated for either residential or commercial use, then the 8 inch alley pavement thickness shall be used.

S-16 (2356) BITUMINOUS SEAL COAT
The provisions of Mn/DOT 2356 are supplemented with the following:

Prior to performing any seal coating operations, the Contractor shall make saw cuts as necessary to perform transverse crack control joint construction as specified in these Special Provisions.

During seal coating operations the Contractor shall prevent excess seal coat aggregates from entering storm or sanitary sewer structures in accordance with the applicable provisions of Mn/DOT 1717, 1803.5, and 2573. The Contractor shall contact the Maintenance Supervisor of SWS Operations Office 48 hours prior to commencing any seal coat work, the Contractor may inspect manholes and catch basins in the work area to document conditions prior to the start of seal coat operations. The contact telephone number for the Maintenance Supervisor is (612) 673-5625. The removal of any seal coat chips found in the storm or sanitary sewer systems after final sweep will be the responsibility of the Contractor. All costs associated with the control of excess aggregates shall be incidental to the seal coating as a whole and no direct compensation will be made.

The bituminous material for seal coating shall be CRS-2 asphalt emulsion.

The rate of CRS-2 application shall be between 1.10 liters per square meter (.24 gals/SY) and 1.50 liters per square meter (.33gals/SY).

The rate of application of seal coat chips shall be between .00977 metric tons per square meter (18 lbs. /SY) and .01410 metric tons per square meter (26 lbs. /SY).

No payment shall be made for quantities used in excess of .015 metric tons per square meter of aggregate or 1.60 liters per square meter of emulsion.

The seal coat aggregate to be used on <u>non-Parkway roadways</u> shall be a 100% crushed

Class A **granite or trap rock** aggregate with the following modified FA-3 gradation:

Sieve Size		Percent Passing
12.5mm	(1/2”)	100
9.5mm	(3/8”)	85-100
4.75mm	(# 4)	0-40
2.00mm	(# 10)	0-5
75um	(# 200)	0-1.0

The seal coat aggregate to be used on <u>Parkways</u> shall be **New Ulm Quartzite** 3/8” seal coat chips meeting the following gradation specification:

Sieve Size	Percent Passing
12.5 mm	100
9.5 mm	95-100
4.75mm	0-30
75u	0-1.0

At such time as determined by the Engineer that seal coating aggregates have properly set, the Contractor shall remove all excess aggregates from roadways, adjacent sidewalks, and property. Removal shall be accomplished by means of shoveling or sweeping, not by street washing. All costs due to maintenance of public roadways shall be incidental to the seal coating as a whole and no direct compensation will be made therefore.

The City of Minneapolis shall retain all reclaimed seal coat aggregates. Therefore, the Contractor shall be required to haul and deposit seal coat chips to a designated location within the City of Minneapolis.

The Contractor shall provide all necessary traffic control for seal coating operations as required by Mn/DOT 1404 and modified by these special provisions. Traffic control devices for seal coating shall include, but not be limited to, centerline markers and reflectorized barrels that clearly delineate the traffic lanes during seal coating operations and until such time as determined by the Engineer that seal coating aggregates have set sufficiently to permit painting of lane striping and pavement markings by the City of Minneapolis Traffic Department.

S-17 (2360) Plant-mixed Bituminous Pavement (Superpave)
Sections 2360.1 through 2360.7, inclusive, are hereby deleted and replaced with Section 2360 Plant Mixed Asphalt pavement included in the Appendix, and the following:

Section 2360.5.F is hereby modified to require all cold joints (transverse and longitudinal) to be cut vertically for the full depth of the matching asphalt thickness placed previously. All longitudinal joints are to be matched with adjacent passes as much as practical and the maximum length of each adjacent pass shall not exceed 800 feet during paving. At the end of the day's paving no more than 800 feet (longitudinal) shall be created and prior to the next paving activity this longitudinal shall be cut vertically to match the next pass.

Section 2360.6B4 is hereby modified to state that there will be no reduction in payment for asphalt failing to meet minimum specified density. Any individual asphalt cores failing to meet minimum specified density will be considered failure for the entire lot and asphalt placed that day shall be removed and replaced, unless there is a negotiated agreement that is approved by the City Engineer, or their designee, and agreed to, in writing, by all involved parties to mitigate the failure to meet the density specification. .

Section 2360.7C1A, 2360.7C1, 2360.7C2 and 2360.7C3 are modified so that the International Roughness Index (IRI) and Inertial Profiler (IP) are not required.

Section 2360.7C6 is hereby modified so that no incentive payments will be applied.

Section 2360.7A is hereby modified to state that any individual core in a lot failing to meet the thickness requirements shall constitute a failure for the entire lot and all asphalt paving performed that day shall be removed and replaced, unless there is a negotiated agreement that is approved by the City Engineer, or their designee, and agreed to, in writing, by all involved parties to mitigate the failure to meet the thickness specification.

The bituminous mixture designations to be used in the City of Minneapolis shall be as follows:

Commercial wearing course mixture:	SPWEB540L*
Residential wearing coarse mixture:	SPWEB440L
Non-wearing course mixture	SPNWB430L

* In no case will recycled materials be allowed in this mix.

Bituminous Placement
The pavement shall be swept clean prior to placement of bituminous wear course. This work shall be considered incidental to the Contract with no direct compensation made therefore.

S-18 (2461) Structural Concrete
For the purpose of these Standard Supplemental Specifications Mn/DOT 2461 shall govern, except with the following modifications and amendment(s):

(2461.3B) Mix Requirement for all concrete used in these special provisions shall be:

Mix	Type of Use
3A22, ¾	machine curb placement
3A32, ¾-	machine placement
3A42, ¾-	hand placement

(2461.4D6) Delivery requirements
The time interval for ready mix delivery shall be from point of adding air entraining agent to final discharge is 60 minutes, concrete place after this time shall be considered unacceptable and rejected. Signed inspector or field foreman signature and time of final discharge are required on all certification of compliance from the ready mix producer.

S-19 Excavation and Preparation of Trench
Description
This work shall consist of the excavation, backfilling, and restoration of existing surface improvements for the purposes of installing new and/or relocating or adjusting existing underground utilities.

Operational Limitations and Requirements
Excavating operations shall proceed only so far in advance of pipe lying as will satisfy the needs for coordination of work and permit advance verification of unobstructed line and grade as planned. Where interference with existing structures is possible or in any way indicated, and where necessary to establish elevation or direction for connections to in-place structures, the excavating shall be done at those locations in advance of the main operation so actual conditions will be exposed in sufficient time to make adjustments without resorting to extra work or unnecessary delay.

Wherever possible, excavated materials shall be placed in areas that will not block existing vehicle and pedestrian traffic. No excavated material shall be placed in any drainage way in the City. The Contractor shall review proposed methods of operation with the Engineer prior to beginning the work. All installations shall be accomplished by open trench construction except for short tunnel sections approved by the Engineer and with the exception that boring and jacking or tunnel construction methods shall be employed where so specifically required by the Plans, Specifications, or Special Provisions.

Installation of pipe through tunnel excavations will be allowed only where the surface structure can be properly supported and the backfill restored to the satisfaction of the Engineer. The excavating operations shall be conducted so as to carefully expose all in-place underground structures without damage. Wherever the excavation extends under or approaches so close to an existing structure as to endanger it in any way, precautions and protective measures shall be taken as necessary to preserve the structure and provide temporary support. Hand methods of excavating shall be utilized to probe for and expose such critical or hazardous installations as gas pipe and power or communication cables.

The Engineer shall be notified of any need for blasting to remove materials which cannot be broken up mechanically, and there shall be no blasting operations conducted until the Engineer's approval has been secured. Blasting will be allowed only when proper precautions are taken to protect life and property, and then shall be restricted as the Engineer directs. The hours of blasting operations shall be set by the Owner. The Contractor shall assume full responsibility for any damages caused by blasting, regardless of the requirements for notification and approval. The Contractor shall secure any required permits for blasting and shall conduct blasting operations in conformance with all applicable local, state and federal laws, regulations, and ordinances.

Classification and Disposition of Materials

Excavated materials will be classified for payment only to the extent that the removal of materials classified by the Engineer as Rock will be paid for as provided in the Special Provisions or shown in the Proposal. All other materials encountered in the excavations, with the exception of items classified for payment as structure removals, will be considered as Unclassified Excavation and unless otherwise specified in the Plans, Specifications, and Special Provisions, no additional compensation shall be provided for their removal.

Unclassified materials shall include muck, rubble, wood debris, and boulder stone, masonry or concrete fragments less than one cubic yard in volume, together with other miscellaneous matter that can be removed effectively with power operated excavators without resorting to drilling and blasting.

Rock excavation shall be defined to include all hard, solid rock in ledge formation, bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; and any boulder stone, masonry or concrete fragments exceeding one cubic yard in volume. Materials such as shale, hard pan, soft or disintegrated rock which can be dislodged with a hand pick or removed with a power operated excavator will not be classified as Rock Excavation.

Excavated materials will be classified for reuse as being either Suitable or Unsuitable for backfill or other specified use, subject to selective controls. All suitable materials shall be reserved for backfill to the extent needed, and any surplus remaining shall be utilized for other

construction on the project as may be specified or ordered by the Engineer. To the extent practicable, granular materials and topsoil shall be segregated from other materials during the excavating and stockpiling operations so as to permit best use of the available materials at the time of backfilling. Unless otherwise specified in the Plans, Specifications, and Special Provisions, material handling as described above shall be considered incidental with no additional compensation provided.

All excavated materials reserved for backfill or other use on the project shall be stored at locations approved by the Engineer that will cause a minimum of inconvenience to public travel, adjacent properties, and other special interests. The material shall not be deposited so close to the edges of the excavations as this would create hazardous conditions, nor shall any material be placed so as to block the access to emergency services. All materials considered unsuitable by the Engineer, for any use on the project, shall be immediately removed from the project and be disposed of as arranged for by the Contractor at no extra cost to the Contract.

Excavation Limitations and Requirements

Trench excavating shall be to a depth that will permit preparation of the foundation as specified and installation of the pipeline and appurtenances at the prescribed line and grade, except where alterations are specifically authorized. Trench widths shall be sufficient to permit the pipe to be laid and joined properly and the backfill to be placed and compacted as specified. Extra width shall be provided as necessary to permit convenient placement of sheeting and shoring and to accommodate placement of appurtenances.

Excavations shall be extended below the bottom of structure as necessary to accommodate any required Granular Foundation material. When rock or unstable foundation materials are encountered at the established grade, additional materials shall be removed as specified or ordered by the Engineer to produce an acceptable foundation. Unless otherwise indicated or directed, rock shall be removed to an elevation at least six inches below the bottom surface of the pipe barrel and below the lowest projection of joint hubs. All excavations below grade shall be to a minimum width equal to the outside pipe diameter plus two feet. Rock shall be removed to such additional horizontal dimensions as will provide a minimum clearance of six inches on all sides of appurtenant structures such as valves, housings, access structures, etc.

Where no other grade controls are indicated or established for the pipeline, the excavating and foundation preparations shall be such as to provide a minimum cover over the top of the pipe as specified. Trench widths shall allow for at least six inches of clearance on each side of the joint hubs. The maximum allowable width of the trench at the top of pipe level shall be the outside diameter of the pipe plus two feet, subject to the considerations for alternate pipe loading set forth below. The width of the trench at the ground surface shall be held to a minimum to prevent unnecessary destruction of the surface structures. Under no circumstances shall the trench with shoring be so narrow that it does not conform to OSHA Standard -29 CFR 1926.

The maximum allowable trench width at the level of the top of pipe may be exceeded only by approval of the Engineer, after consideration of pipe strength and loading relationships. Any alternate proposals made by the Contractor shall be in writing, giving the pertinent soil weight data and proposed pipe strength alternate, at least seven days prior to the desired date of decision. Approval of alternate pipe designs shall be with the understanding that there will be no extra compensation allowed for any increase in material or construction costs.

If the trench is excavated to a greater width than that authorized, the Engineer may direct the Contractor to provide a higher class of bedding and/or a higher strength pipe than that required by the Plans, Specifications, and Special Provisions in order to satisfy design requirements, without additional compensation.

Sheeting and Bracing Excavations

All excavations must comply with the requirements of OSHA Standard CFR 1926. The excavations shall be sloped, benched, sheeted, shored, or braced or any combination of these protective measures so that the excavation will meet all requirements of the applicable safety codes and regulations; comply with any specific requirements of the Contract; and prevent disturbance or settlement of adjacent surfaces, foundations, structures, utilities, and other properties. Any damage to the work under contract or to adjacent structures or property caused by settlement, water or earth pressures, slides, cave-ins, or other causes due to failure or lack of sheeting, shoring, or bracing or through negligence or fault of the Contractor in any manner shall be repaired at the Contractor's expense and without delay.

Where conditions warrant extreme care, the Plans, Specifications, and Special Provisions may require special precautions to protect life or property, or the Engineer may order the installation of sheet piling of the interlocking type or direct that other safety measures be taken as deemed necessary. Failure of the Engineer to order correction of improper or inadequate sheeting, shoring, or bracing shall not relieve the Contractor's responsibilities for protection of life, property, and the work.

The Contractor shall assume full responsibility for proper and adequate placement of sheeting, shoring, and bracing, wherever and to such depths that soil stability may dictate the need for support to prevent displacement. The Contractor shall be responsible for obtaining the services of a Professional Engineer, registered in Minnesota, to design bracing that will provide ample working space while not placing any stress or strain on the in-place structures to any extent that may cause damage.

Sheeting, shoring and bracing materials shall be removed only when and in such manner as will assure adequate protection of the in-place structures and prevent displacement of supported grounds. Sheeting and bracing shall be left in place only as required by the Plans, Specifications, and Special Provisions or ordered by the Engineer. Otherwise, sheeting and bracing may be removed as the backfilling reaches the level of respective support. Wherever

sheeting and bracing is left in place, the upper portions shall be cut and removed to an elevation of three feet or more below the established surface grade as the Engineer may direct.

All costs of furnishing, placing and removing sheeting, shoring, and bracing materials, including the value of materials left in place as required by the Contract, shall be included in the prices bid for pipe installation and will not be compensated for separately. When any sheeting, shoring, or bracing materials are left in place by written order of the Engineer, in the absence of specific requirements of the Contract to do so, payment will be made for those materials as an Extra Work item, including waste material resulting from upper cut-off requirements.

Preparation and Maintenance of Foundations

Foundation preparations shall be conducted as necessary to produce a stable foundation and provide continuous and uniform pipe bearing between bell holes. The initial excavating or backfilling operations shall produce a subgrade level slightly above finished grade as will permit hand shaping to finished grade by trimming of high spots and without the need for filling of low spots to grade. Final subgrade preparations shall be such as to produce a finished grade at the centerline of the pipe that is within 0.03 foot of a straight line between pipe joints and to provide bell hole excavation at each joint as will permit proper joining of pipe and fittings.

In excavations made below grade to remove rock or unstable materials, the backfilling to grade may be made with available suitable materials approved by the Engineer, unless placement of Granular Foundation or Bedding material is specified or is ordered by the Engineer. Placement of the backfill shall be in relatively uniform layers not exceeding 8 inches in loose thickness. Each layer of backfill shall be compacted to the density required for the restoration surfacing, by means of approved mechanical compaction equipment, as will produce uniform pipe support throughout the full pipe length and facilitate proper shaping of the pipe bed.

Where placement of foundation materials will not provide an adequate foundation for laying pipe due to the instability of the existing materials and where ordered by the Engineer, the Contractor shall place Geotextile Type I fabric on top of the unstable materials prior to placing foundation materials. Sufficient geotextile fabric shall be used to completely enclose the foundation materials and pipe.

It shall be the Contractor's responsibility to notify the Engineer of changing soil conditions which may be of poor bearing capacity and when organic soils are encountered. Where utilities are placed on unstable soils without notification of the Engineer, the Contractor shall be responsible for all repairs and correction of the installation without further compensation.

Where the foundation soil is found to consist of materials that the Engineer considers to be so unstable as to preclude removal and replacement to a reasonable depth to achieve solid support, a suitable foundation shall be constructed as the Engineer directs in the absence of special

requirements in the Plans, Specifications, and Special Provisions. The Contractor may be required to furnish and drive piling and construct concrete or timber bearing supports or other work as may be ordered by the Engineer.

Care shall be taken during final subgrade shaping to prevent any over-excavation. Should any low spots develop, they shall only be filled with approved material, which shall have optimum moisture content and be compacted thoroughly without additional compensation to the Contractor. The finished subgrade shall be maintained free of water and shall not be disturbed during pipe lowering operations except as necessary to remove pipe slings. The discharge of trench dewatering pumps shall be directed to natural drainage channels or storm water drains after being filtered to remove suspended solids in accordance with the State of Minnesota NPDES General Permit. Draining trench water into sanitary sewers or combined sewers is normally not permitted.

The Contractor shall install and operate a dewatering system of wells or points to maintain pipe trenches free of water wherever necessary or as directed by the Engineer to meet the intent of these specifications. Unless otherwise specified in the Plans, Specifications, and Special Provisions, such work shall be considered incidental.

All costs of excavating below grade and placing foundation or bedding aggregates as shown on the details for bedding shall be included in the bid prices for pipe items to the extent that the need for such work is shown on the plans or indicated in these Supplemental Specifications and the Proposal does not provide for payment under separate Contract Items. Any excavation below the grade of the bedding and any foundation or bedding aggregates required by order of the Engineer in the absence of Contract requirements will be compensated for separately.

If examination by the Engineer reveals that the need for placement of foundation aggregate was caused by the Contractor's manipulation of the soils in the presence of excessive moisture or lack of proper dewatering, the cost of the corrective measures shall be borne by the Contractor.

Non-Open Cut and Special Pipe Installation

A Jacking / Boring

The terms "auger", "boring", "jack", "jacking", and "tunneling" in the proposal, specifications, and plans refers only to non-open cut construction. The Contractor shall inspect and verify soil conditions to his own satisfaction in order to determine the type of construction to employ. During the construction, the Contractor shall be responsible for protecting all existing utilities above the pipe invert.

The minimum diameter of the casing pipe shall be four (4) inches greater than the outside diameter of the bell of the carrier pipe. For any installation beneath a railroad, the top of the casing pipe shall not be closer than the specified dimensions indicated in the permit.

If the Contractor elects to install steel casing, the minimum wall thickness shall be as specified on the Plans, in the Special Provisions, or in the applicable Permit. Where required by the Engineer, two 17-pound anode packs shall be attached to the casing for corrosion protection.

A 1-1/2 inch pipe shall be forced along the top of the casing pipe. The front end of this pipe shall be 18 inches behind the front end of the casing pipe. A mixture of water and bentonite clay shall be forced through this pipe at all times during the casing installation to fill any voids that may be present above the casing pipe. Upon completion of the casing installation, this pipe shall be slowly withdrawn while bentonite is forced through the pipe to fill any remaining voids.

The Contractor shall prevent excavated materials from flowing back into the excavation during the non-open cut construction. This shall include the use of a shield conforming to the size and shape of the casing that will prevent materials from flowing into the leading edge of the casing. The machine used shall be capable of controlling line and grade and shall conform to the size and shape of the casing pipe.

No jacking/auguring of pipe will be allowed below the water table unless the water table has been lowered sufficiently to keep the water below the pipe being installed. The use of water under pressure (jetting) or puddling will not be permitted to facilitate jacking/auguring operations.

If any installation is augured, the head shall be approved by the Engineer and the auger shall be located six (6) inches behind the lead edge of the casing or carrier pipe.

If a void develops, the jacking/auguring shall be stopped immediately and the void shall be filled by pressure grouting. The grout material shall consist of sand-cement slurry of at least two sacks of cement per cubic yard and a minimum of water to assure satisfactory placement.

Skids and blocking shall be used as necessary to install the carrier pipe to the proper line and grade inside the casing pipe. Voids between carrier and casing pipes shall be filled with sand and the casing pipe sealed at both ends with a suitable material to prevent water or debris from entering the casing pipe.

B Directional Boring

Direction boring/drilling installation shall be accomplished where required on the Plans or in the Special Provisions to minimize disturbance of existing surface improvements. The installer shall have a minimum of three years of experience in this method of construction and have installed at least 1,000 feet of 8-inch or larger diameter pipe to specified grades. The field supervisor employed by the Contractor shall have at least three years of experience, be responsible for all of the boring/drilling work and shall be at the site at all times during the boring/drilling installation.

The Contractor shall submit boring/drilling pit locations and dimensions to the Engineer before beginning construction.

The drilling equipment shall be capable of placing the pipe as shown on the plans. The installation shall be by a steerable drilling tool capable of installing continuous runs of pipe, without intermediate pits, a minimum distance of 200 feet. The guidance system shall be capable of installing pipe within 1-1/2 inch of the plan vertical dimensions and 2 inches of the plan horizontal dimensions. The Contractor shall be required to remove and reinstall pipes which vary in depth and alignment from these tolerances.

Pull back forces shall not exceed the allowable pulling forces for the pipe being installed. Drilling fluid shall be a mixture of water and bentonite clay. Disposal of excess fluid and spoils shall be the responsibility of the Contractor

C Placement of Insulation

Two inches of polystyrene rigid insulation board with a minimum compressive strength of 60 psi and a minimum R-value of 10.0 shall be placed within the pipe encasement zone, 6 inches above the pipe. Prior to placement of the insulation, Granular Borrow (MnDOT 3149) shall be leveled and compacted until there is no further visual evidence of increased consolidation or the density of the compacted layer conforms to the density requirements specified in the Special Provisions, then leveled and lightly scarified to a depth of 1/2 inch. Borrow material placed above and below the insulation shall be free of rock or stone fragments measuring 1-1/2 inches or greater.

Insulation boards shall be placed on the scarified material with the long dimension parallel to the centerline of the pipe. Boards shall be placed in a single layer with tight joints. No continuous joints or seams shall be placed directly over the pipe. If two or more layers of insulation boards are used, each layer shall be placed to cover the joints of the layer immediately below.

The Contractor shall exercise precaution to insure that all joints between boards are tight during placement and backfilling with only extruded ends placed end to end or edge to edge.

The first layer of material placed over the insulation shall be 6 inches in depth, free of rock or stone fragments measuring 1-1/2 inches or greater. The material shall be placed in such a manner that construction equipment does not operate directly on the insulation and shall be compacted with equipment which exerts a contract pressure of less than 80 psi. The first layer shall be compacted to conform to the density requirements specified in the Special Provisions.

Pipeline Backfilling Operations

Placement and compaction of back fill soil outside of the pipe zone shall comply with all other special provisions stated in this document or MnDOT Standards. All pipeline excavations shall be backfilled to restore preexisting conditions as the minimum requirement, and fulfill all supplementary requirements indicated in the Plans, Specifications, and Special Provisions. The backfilling operations shall be started as soon as conditions will permit on each section of pipeline, so as to provide continuity in subsequent operations and restore normal public service as soon as practicable on a section-by-section basis. All operations shall be pursued diligently, with proper and adequate equipment, as will assure acceptable results.

The backfilling shall be accomplished with the use of Suitable Materials selected from the excavated materials to the extent available and practical. Should the materials available within the trench section be unsuitable or insufficient, without loading and hauling or other measures the Engineer determines to be unreasonable, the required additional materials shall be furnished from outside sources as Extra Work under Mn/DOT Specification 1403 in the absence of any Special Provision requirements covering additional material.

Suitable Material shall be defined as a mineral soil free of foreign materials (rubbish, debris, etc.), frozen clumps, oversize stone, rock, concrete or bituminous chunks, hazardous material and other unsuitable materials, that may damage the pipe installation, prevent thorough compaction, or increase the risks of after settlement unnecessarily. Material selection shall be such as to make the best and fullest utilization of what is available, taking into consideration particular needs of different backfill zones. Material containing stone, rock, or chunks of any sort shall only be utilized where and to the extent there will be no detrimental effects. The determination of detrimental effects is subject to the review and determination by the Engineer.

Within the pipe bedding and encasement zones described as that portion of the trench which is below an elevation one foot above the top of the pipe, the materials placed shall be limited in particle size to 1-1/2 inches maximum in the case of pipe of 12 inches in diameter or less and to 2 inches maximum in the case of larger pipe. Above these zones, the placement of material containing stones, boulders, chunks, etc. greater than 6 inches in any dimension shall not be allowed.

All flexible pipe shall be bedded in accordance with ASTM Specification D2321, "Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe". This shall include placement of granular bedding and encasement materials from a point six inches below the bottom of pipe to a point twelve inches above the top of the pipe. Placement and compaction of bedding and encasement materials around the pipe shall be considered incidental to the installation of the pipe. Where existing soils do not meet the requirements of bedding and encasement materials, the Contractor shall furnish the required granular materials.

Compaction of materials placed within the pipe bedding and encasement zones shall be accomplished with portable or hand equipment methods, so as to achieve thorough consolidation under and around the pipe and avoid damage to the pipe. Above the cover zone material, the use of heavy roller type compaction equipment shall be limited to safe pipe loading.

Backfill materials shall be carefully placed in uniform loose thickness layers up to 12 inches thick spread over the full width and length of the trench section to provide simultaneous support on both sides of the pipeline. Granular backfill may be placed in 12 inch layers above an elevation one foot above the top of the pipe, and with the provision that, by authority and at the discretion of the Engineer in consideration of the demonstrated capability of special type vibrating compactors, the stated maximums may be increased.

Each layer of backfill material shall be compacted effectively, by approved mechanical or hand methods, until there is no further visual evidence of increased consolidation or the density of the compacted layer conforms to the density requirements specified in the Special Provisions. Compaction of the in-place layer shall be completed acceptably before placing material for a succeeding layer thereon. The manner of placement, compaction equipment, or procedure effectiveness shall be subject to approval of the Engineer.

All surplus or waste materials remaining after completion of the backfilling operations shall be disposed of in an approved manner within 24 hours after completing the backfill work on each particular pipeline section. Disposal at any location within the project limits shall be as specified, or as approved by the Engineer; otherwise, disposal shall be accomplished outside the project limits by the Contractor. The backfilling and surplus or waste disposal operations shall be a part of the work required under the pipeline installation items, not as work that may be delayed until final cleanup.

Compaction of backfill within Roadbed areas shall meet the density requirements of Mn/DOT Specification 2105. Compaction of backfill in all other areas shall be as required in the Special Provisions.

Until expiration of the guarantee period, the Contractor shall assume full responsibility and expense for all backfill settlement and shall refill and restore the work as directed to maintain an acceptable surface condition, regardless of location. All additional materials required shall be furnished without additional cost to the Owner.

Any settlement of road surfaces that are either placed under this Contract or by others under either public or private contract; that are in excess of one inch, as measured by a ten foot straight edge; and that are within the guarantee period shall be considered failure of the mechanical compaction. The Contractor shall be required to repair such settlement including all items placed by others.

Restoration of Surface Improvements
Wherever any surface improvements such as pavement, curbing, pedestrian walks, fencing, or turf have been removed, damaged or otherwise disturbed by the Contractor's operations, they shall be repaired or replaced to the Engineer's satisfaction, as will restore the improvement in kind and structure to the preexisting condition. Each item of restoration work shall be done as soon as practicable after completion of installation and backfilling operations on each section of pipeline.

In the absence of specific payment provisions, as separate Contract Items, the restoration work shall be compensated for as part of the work required under those Contract Items which necessitated the destruction and replacement or repair, and there will be no separate payment. If separate pay items are provided for restoration work, only that portion of the repair or reconstruction which was necessitated by the Contract work will be measured for payment. Any

improvements removed or damaged unnecessarily or undermined shall be replaced or repaired at the Contractor's expense

Turf Restoration
Turf restoration shall be accomplished by sod placement except where seeding is specifically allowed or required.

Topsoil shall be placed to a minimum depth of four inches under all sod and in all areas seeded. The topsoil material used shall be light friable loam containing a liberal amount of humus and shall be free of heavy clay, coarse sand, stones, plants, roots, sticks and other foreign matter. Topsoil meeting these requirements shall be selected from the excavated materials to the extent available and needed.

All turf establishment work shall be done in substantial compliance with the provisions of Mn/DOT Specification 2575 using seed mixtures as specified in the Special Provisions or Proposal

Pavement Restoration
The in-place pavement structure (including base aggregates) shall be restored in kind and depth as previously existed, using base aggregates salvaged from the excavated materials to the extent available and needed, and with new materials being provided for reconstruction of the concrete or bituminous surface courses.

If, through no fault of the Contractor in failing to reserve sufficient aggregate materials from the excavations, there should be insufficient quantity of suitable aggregate to reconstruct the pavement base courses, the additional materials required will be furnished by the Contractor as an Extra Work Item from outside sources. Placement of any additional aggregate materials delivered to the site by the Owner or of any additional materials furnished by the Contractor shall be an incidental expense, as will also be the disposal of any excess materials resulting there from, unless special payment provisions are otherwise agreed upon.

Reconstruction of aggregate base courses and concrete or bituminous surface courses shall be in substantial compliance with all applicable Mn/DOT Specifications pertaining to the item being restored. The materials used shall be comparable to those used in the in-place structure, and the workmanship and finished quality shall be equal to that of new construction to the fullest extent obtainable in consideration of operational restrictions.

Existing concrete and bituminous surfaces at the trench wall shall be sawed or cut with a cutting wheel to form a neat edge in a straight line before surfaces are to be restored. Sawing or cutting may be accomplished as a part of the removal or prior to restoration at the option of the Contractor. However, all surface edges will be inspected prior to restoration.

Pavement restoration shall also comply with other specifications in this document.

Restoration of Miscellaneous Items

Wherever any curbing, curb and gutter sections, pedestrian walks, fencing, driveway surfacing, or other improvements are removed or in any way damaged or undermined, they shall be restored to original condition by repair or replacement as the Engineer considers necessary. Replacement of old materials will be acceptable only to the extent that existing quality can be fully achieved, such as in the case of fencing. Otherwise new materials shall be provided and placed as the Engineer directs. Workmanship and finished quality shall be equal to that of new construction, where new materials are used, to the extent obtainable in consideration of operational restrictions.

A proper foundation shall be prepared before reconstructing concrete or bituminous improvements. Unless otherwise directed, granular material shall be placed to a depth of at least four inches under all concrete and bituminous items. No direct compensation will be made for furnishing and placing this material even though such course was not part of the original construction.

Maintenance and Final Cleanup

All subgrade surfaces shall be maintained acceptably until the start of surfacing construction or restoration work, and until the work has been finally accepted. Additional materials shall be provided and placed as needed to compensate for trench settlement and to serve as temporary construction pending completion of the final surface improvements.

Final disposal of debris, waste materials, and other remains or consequences of construction, shall be accomplished intermittently as new construction items are completed and shall not be left to await final completion of all work. Cleanup operations shall be considered as being a part of the work covered under the Contract Items involved and only that work which cannot be accomplished at any early time shall be considered as final cleanup work not attributable to a specific Contract Item.

If disposal operations and other cleanup work are not conducted properly as the construction progresses, the Engineer may withhold partial payments until such work is satisfactorily pursued or he may deduct the estimated cost of its performance from the partial estimate value.

Maintenance of sodded and seeded areas shall include adequate watering for plant growth and the replacement of any dead or damaged sod as may be required for acceptance of the work. Corrective action shall be required in accordance with Table 2575-3.

S-20 (2502) Subsurface Drains

This work specified in this section is a pilot project that uses infiltration and plant material for storm water volume reduction in a variety of soils. The work consists of providing all materials, equipment, and labor required for the installation of perforated and solid-wall subsurface drains using plant-fabricated pipe and appurtenant materials, installed to collect and discharge water accumulated in the bottom of bioretention soils.

2502.2 Materials
The materials used in construction of the subsurface drains must be in compliance with the provisions in Mn/DOT Standard Specification 2502, according to the details in the Plans and with the following.

Fine Filter Material – Fine Filter Aggregate must meet the requirements of Mn/DOT 3149.2J, with the additional requirement that not more than 35 percent shall pass the No. 10 sieve and not more than five percent shall pass the No. 40 sieve.

Perforated Drains - All perforated PE pipe drain specified in the Plans will be Corrugated Polyethylene Drainage Tubing (PE) and perforations shall be uniform slots, not drilled holes. The pipe and all fittings must meet the requirements of Mn/DOT Standard Specification 3278.

Clean Outs – The pipe used to fabricate clean outs must conform to Mn/DOT Standard Specification 3247. The ductile iron cover must conform to Mn/DOT Standard Specification 3324, as provided by Nyloplast or equivalent.

Inspection Risers – Must conform to Nyloplast Drain Basin, (as supplied by Advanced Drainage Systems, Inc., 17904 Susan Lane, Minnetonka, MN 55345, 952-473-3497) or approved equal. The cover must conform to Mn/DOT Standard Specification 3324, as provided by Nyloplast or approved equal.

2502.3 Construction
A. Subsurface Drains – Construction of the subsurface drains must be in accordance with Mn/DOT Standard Specification 2502 and according to the details in the Plans. This includes, but is not limited to, the pipes, filter material, fittings, couplings, and clean outs.

The CONTRACTOR must coordinate work with completion of final basin grading.

The CONTRACTOR must provide record drawings with coordinates and elevations of the subsurface drainage system after installation in accordance with the SWS Record Drawing Standards approved by the Surface Waters and Sewers Division of Public Works.

B. Fine Filter Material - Prevent mixing of dissimilar materials during unloading, stockpiling, or removal from stockpile.

The Fine Filter aggregate must be placed in a manner that constructs a continuous filter for the engineered soil with no gaps or mixing of soils.

The Fine Filter aggregate must be inspected and approved by the ENGINEER prior to covering by the Bioretention Soil. If the ENGINEER deems that the Fine Filter aggregate has been contaminated, the CONTRACTOR will remove the contaminated material and replace with clean aggregate to the ENGINEER'S satisfaction at the CONTRACTOR'S expense.

The CONTRACTOR shall construct all Fine Filter, unless otherwise noted, to the correct position based on the line and grade information provided by the CITY. Additionally, the CONTRACTOR must construct the Fine Filter aggregate to the lines, grades and thickness shown on the plans. The allowable tolerances are:

0.5 feet horizontal, 0.1 feet vertical

S-21 (2503) Pipe Sewers
Delete Section 2503 in its entirety and in its place substitute the following:

(2503) Standard Specifications for Sanitary Sewer and Storm Sewer Installation

(2503.1) Description
This work shall consist of the construction of pipe sewers utilizing plant fabricated pipe and other appurtenant materials, installed for conveyance of sewage, industrial wastes, or storm water. The work includes construction of manhole and catch basin structures and other related items as specified.

Use of the term "Plans, Specifications, and Special Provisions" within this specification shall be construed to mean those documents which compliment, modify, or clarify these specifications and are accepted as an enforceable component of the Contract or Contract Documents. All references to Mn/DOT Specifications shall mean the latest published edition of the Minnesota Department of Transportation Standard Specifications for Construction as modified by any Mn/DOT Supplemental Specifications issued before the date of advertisement for bids. All references to other Specifications of AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition available on the date of advertisement for bids.

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The following specifications have been referenced in this Specification:

AASHTO M198	Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
AASHTO M294	Specification for Corrugated Polyethylene Pipe 300-to 1200-mm Diameter
ASTM A48	Specification for Gray Iron Castings
ASTM A74	Specification for Cast Iron Soil Pipe and Fittings
ASTM C76	Specification for Reinforced Concrete Pipe
ASTM C270	Mortar for Unit Masonry
ASTM C361	Specification for Reinforced Concrete Low Head Pressure Pipe
ASTM C425	Specification for Compression Joints for VCP and Fittings
ASTM C443	Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets
ASTM C478	Specification for Precast Reinforced Concrete Manhole
ASTM D543	Test Method for Resistance of Plastic to Chemicals
ASTM C564	Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C700	Specification for Vitrified Clay Pipe
ASTM D2321	Recommended Practice for Installation of Flexible Thermo-plastic Sewer Pipe
ASTM D2751	Specification for ABS Pipe and Fittings
ASTM D3034	Specification for PVC Sewer Pipe and Fittings

ASTM D3212	Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F679	Specification for Large-Diameter PVC Sewer Pipe and Fittings
ASTM F949	Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
AWWA C104	American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	American National Standard for Ductile-Iron and Gray-Iron Fittings 3 In. Through 48 In. (75 mm Through 1200 mm)
AWWA C111	American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	American National Standard for Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C150	American National Standard for Thickness Design of Ductile-Iron Pipe
AWWA C151	American National Standard for Ductile-Iron Pipe Centrifugally Case
AWWA C153	American National Standard for Ductile-Iron Compact Fittings 3 In. Through 24 In. (76 mm Through 610 mm) and 54 In. Through 64 In.
AWWA C500	Standard for Metal-Sealed Gate Valves for Water Supply Service
AWWA C502	Dry barrel fire hydrants

(2503.2) Materials

A. General

All materials required for this work shall be new material conforming to requirements of the referenced specifications for the class, kind, type, size, grade, and other details indicated in the Plans, Specifications or Special Provisions. Unless otherwise indicated, all required materials shall be furnished by the Contractor. If any options are provided for, as to type, grade, or design of the material, the choice shall be limited as may be stipulated in the Plans, Specifications, or Special Provisions.

All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Plans. Otherwise, the Owner may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

At the request of the Engineer, the Contractor shall submit in writing a list of materials and suppliers for approval. Suppliers shall submit a Certificate of Compliance that the materials furnished have been tested and are in compliance with the specifications.

All pipe furnished for main sewer and service line installations shall be of the type, kind, size, and class indicated for each particular line segment as shown in the Plans and designated in the Contract Items. Wherever connection of dissimilar materials or designs is required, the method of joining and any special fittings employed shall be products specifically manufactured for this purpose and subject to approval by the Engineer.

B. Vitrified Clay Pipe and Fittings

Vitrified clay extra strength pipe and fittings shall conform to the requirements of ASTM M-65 for the size and type and class specified, subject to the following supplementary provisions:

Unless otherwise specified, the pipe and fittings shall be non-perforated, full circular type, either glazed or unglazed.

All pipe and fittings manufactured with bell-and-spigot ends shall be furnished with factory fabricated compression joints conforming to the requirements of ASTM C-425.

In lieu of the bell-and-spigot jointing requirements, the pipe and fittings may be furnished with plain ends, in which case the jointing shall be by means of compression couplings conforming to the requirements of ASTM C-425, Type B.

All clay pipe fittings (wyes, tees, bends, plugs, etc.) shall be of the same pipe class and joint design as the pipe to which they are to be attached.

Pipe and fittings manufactured to the standards of AASHTO 52.65 may be accepted by prior approval of the Engineer.

C. Ductile Iron Pipe and Ductile Iron and Gray Iron and Fittings

The pipe furnished shall be Ductile Iron pipe and fittings furnished shall be of the Ductile Iron or Gray Iron type as specified for each particular use of installation. When Gray Iron is specified, either type may be furnished. Gray Iron may not be substituted for Ductile Iron unless specifically authorized in the Special Provisions.

Ductile iron pipe shall conform to the requirements of AWWA C115 or C151 for water and thickness design shall conform to AWWA C150. In addition, the pipe shall comply with the following supplementary provisions:

Fittings shall conform to the requirements of AWWA C110 OR 153 (Gray Iron and Ductile Iron Fittings or Ductile Iron Compact Fittings) for the joint type specified.

Unless otherwise specified, all pipe and fittings shall be furnished with cement mortar lining meeting the requirements of AWWA C104 for standard thickness lining. All exterior surfaces of the pipe and fittings shall have an asphaltic coating at least one mil thick. Spotty or thin seal coating, or poor coating adhesion, shall be cause for rejection.

Rubber gasket joints for Ductile Iron Pressure Pipe and fittings shall conform to AWWA C111.

D. Reinforced Concrete Pipe and Fittings

Reinforced concrete pipe, fittings and specials shall conform to the requirements of ASTM C-76 (Reinforced Concrete Pipe) with rubber O-ring or profile joints for the type, size, and strength class specified, subject to the following supplementary provisions:

All branch fittings such as tees, wyes, etc. shall be cast as integral parts of the pipe. All fittings and specials shall be of the same strength class as the pipe to which they are attached.

Joints shall meet the requirements of ASTM C-361.

Lift holes will not be permitted unless specifically authorized in the Plans, Specifications, and Special Provisions. If lift holes are permitted, then all lift holes shall be plugged and made water tight from the exterior prior to placement of any backfill. The lift hole plug shall be finished smooth to the interior of the pipe.

E. Corrugated Steel Pipe and Fittings

Corrugated steel pipe and fittings shall be used in sewers and drains only after first obtaining approval for its use in sewers and drains for City maintenance. Corrugated steel pipe and fittings shall conform to the requirements of Mn/DOT Specification 3226 (Corrugated Steel Pipe) for the type, size and sheet thickness specified. When specifically provided for in the Plans, Specifications, and Special Provisions, the galvanized steel pipe and fittings shall be furnished with special aramid fiber bonded, bituminous, or plastic coating or concrete lining as required.

F. Polyvinyl Chloride Pipe and Fittings

Polyvinyl chloride pipe and fittings shall be used for sewers and drains only after first obtaining approval for its use in sewers and drains for City maintenance. Smooth walled polyvinyl chloride pipe and fittings shall conform to the requirements of ASTM D-3034 and ASTM F-679 for the size, standard dimension ratio (SDR), and strength requirements indicated on the Plans, Specifications, and Special Provisions. The grade used shall be resistant to aggressive soils or corrosive substances in accordance with the requirements of ASTM D-543.

Unless otherwise specified, all pipe and fittings shall be a minimum thickness of SDR-26 and connections shall be push-on with elastomeric gasket joints which are bonded to the inner wall of the gasket recess of the bell socket.

Corrugated polyvinyl chloride pipe and fittings shall be used for sewers and drains only after first obtaining approval for its use in sewers and drains for City maintenance. Corrugated polyvinyl chloride pipe and fittings with smooth interior shall conform to the requirements of ASTM F-949 for the size and wall thickness indicated on the Plans, Specifications, and Special Provisions. Unless otherwise specified, all pipe and fittings shall be push-on with snug fit elastomeric joints meeting tightness requirements of ASTM D-3212.

G. Cast Iron Soil Pipe

Cast Iron Soil Pipe is not permitted in the public right of way. If used outside the public right of way, or unless otherwise specified in the Plans, Specifications, and Special Provisions, cast iron soil pipe shall be service weight pipe meeting the requirements of ASTM A-74 and the Plans, Specifications, and Special Provisions. Unless otherwise specified, pipe joints shall be push-on, sealed with elastomeric gaskets, meeting the requirements of ASTM C-564.

H. Acrylonitrile-Butadiene-Styrene Pipe

Acrylonitrile-Butadiene-Styrene pipe and fittings shall be used for sewers and drains only after first obtaining approval for its use in sewers and drains for City maintenance. Acrylonitrile-Butadiene-Styrene (ABS) solid wall pipe and fittings shall conform to the requirements of ASTM D-2751 for 4 inch and 6 inch diameter and shall be gasket seal joints, assembled as recommended by the pipe manufacturer. Solvent cemented joints, assembled as recommended by the pipe manufacturer, shall be provided only where specifically indicated in the Plans, Specifications, and Special Provisions.

I. Dual-Wall Corrugated Polyethylene Pipe

Dual-Wall Corrugated Polyethylene Pipe, where permitted in the plans shall conform to the requirements of AASHTO M-294 and Design 18 of the AASHTO Standard Specifications for Highway Bridges for storm sewer pipe sizes 12-inch through 36-inch. Joints shall be water-tight unless the engineer approves a soil-tight joint. Pipe manufacture, water-tight joint testing, and installation shall conform to current Mn/DOT requirements and/or as indicated in the Plans, Specifications, and Special Provisions.

J. Metal Sewer Castings

Metal castings for sewer structures such as manhole frames and covers, catch basin frames, grates and curb boxes, shall conform to the requirements of ASTM A-48 (Gray Iron Castings), subject to the following supplementary provisions:

Casting assemblies or dimensions, details, weights, and class shall be as indicated in the detailed drawings for the design designation specified. Unless otherwise specified, the castings shall be Class 30 or better.

Lid-to-frame surfaces on round casting assemblies shall be machine milled to provide true bearing around the entire circumference.

Casting weight shall be not less than 95 percent of theoretical weight for a unit cast to exact dimensions, based on 442 pounds per cubic foot.

A Certificate of Compliance shall be furnished with each shipment of castings stating that the materials furnished have been tested and are in compliance with the specification requirements.

Storm sewer manhole covers shall conform to City Standard Plate SEWR-2000

Unless otherwise specified, sanitary sewer manholes in areas subject to flooding by surface water shall have self-sealing covers and recessed pick holes and conform to City Standard Plate SEWR-2001.

Unless otherwise specified, sanitary sewer manhole covers shall have recessed pick holes and conform to City Standard Plate SEWR-2001.

K. Precast Concrete Manhole and Catch Basin Sections

Precast concrete riser sections and appurtenant units (grade rings, top and base slabs, special sections, etc.) used in the construction of manhole and catch basin structures shall conform with the requirements of ASTM C-478, Minneapolis Public Works Standard Plates, Mn/DOT 2506 and the following supplementary provisions:

(1) The precast sections and appurtenant units shall conform to all requirements as shown on the detailed drawings.
(2) Joints of manhole riser sections shall be tongue and groove with rubber "O" ring or profile joints provided on sanitary sewer manholes. Sanitary sewer inlet and outlet pipes shall be joined to the manhole with a gasket, flexible, watertight connection or any watertight connection arrangement that allows differential settlement of the pipe and manhole wall to take place.
(3) Air-entrained concrete shall be used in the production of all units. Air content shall be maintained within the range of 5 to 7 percent.
(4) A Certificate of Compliance shall be furnished with each shipment of precast manhole and catch basin sections stating that the materials furnished have been tested and are in compliance with the specification requirements.
(5) Only keyed lift holes will be permitted in precast manholes.

L. Concrete

Concrete for cast-in-place masonry construction shall be produced and furnished in accordance with the requirements of Mn/DOT Specification 2461 for the mix designation indicated in the Plans. The requirements for Grade B concrete shall be met where a higher grade is not specified. Type 3 (air-entrained) concrete shall be furnished and used in all structures having weather exposure.

M. Mortar

Mortar for use in masonry construction shall be an air-entrained mixture of one part Masonry cement, Type N, and two parts mortar sand, with sufficient water to produce proper consistency, and with sufficient air-entraining agent added to maintain an air content within the range of 7 to 10 percent. Mortar shall meet the requirements of ASTM C-270.

(2503.3) Construction Requirements for Pipe and Fittings

A. Inspection and Handling

Proper and adequate implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. During the process of unloading, all pipe and accessories shall be inspected by the Contractor for damage. The Contractor shall notify the Engineer of all material found to have cracks, flaws or other defects. The Engineer shall inspect the damaged materials and have the right to reject any materials found to be unsatisfactory. The Contractor shall promptly remove all rejected material from the site. All materials shall be handled carefully, as will prevent damage to protective

coatings, linings, and joint fillings; preclude contamination of interior areas; and avoid jolting contact, dropping, or dumping.

All work and materials are subject to tests by the Owner at such frequency as may be determined by the Engineer.

While suspended and before being lowered into laying position, each pipe section and appurtenant unit shall be inspected by the Contractor to detect damage or unsound conditions that may need corrective action or be cause for rejection. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective actions or order rejection.

Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, coating blisters, rough edges or projections, and any imperfections so detected shall be corrected by cleaning, trimming, or repair as needed.

B. Pipe Laying Operations

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper laying and joining of the units at the prescribed grade and alignment without unnecessary deviation or hindrance.

All foreign matter or dirt shall be removed from the inside of the pipe and fittings before they are lowered into position in the trench and they shall be kept clean by approved means during and after laying. The sewer materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped into the trench.

At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than would be adequate to support the pipe throughout its length. No pipe material shall be laid in water or when the trench or bedding conditions are otherwise unsuitable or improper.

When placement or handling precautions prove inadequate, in the Engineer's opinion, the Contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before the pipe is lowered into laying position. The pipe ends shall remain so covered until removal is necessary for connection of an adjoining unit.

Unless otherwise permitted by the Engineer, bell and spigot pipe shall be laid with the bell ends facing upgrade and the laying shall start on the downgrade end and precede upgrade. As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material, which shall be thoroughly compacted by tamping around the pipe to a height of at least 12 inches above the top with hand operated mechanical tamping devices or by hand. The joint areas shall remain exposed and precautions shall be taken to

prevent the soil from entering the joint space, until the joint seal is affected. Backfill in the bell area shall be left loose.

Connection of pipe to existing lines or previously constructed manholes or catch basins shall be accomplished as shown in the Plans or as otherwise approved by the Engineer. Where necessary to make satisfactory closure or produce the required curvature, grade or alignment deflections at joints shall not exceed that which will assure tight joints and comply with any limitations recommended by the pipe manufacturer.

Entrance of foreign matter into pipeline openings shall be prevented at all times to the extent that suitable plugs or covering can be kept in place over the openings without interfering with the installation operations.

Installation of thermoplastic pipe shall conform to ASTM D-2321.

C. Connection and Assembly of Joints

All pipe and fitting joints shall fit tightly and be fully closed. Spigot ends shall be marked as necessary to indicate the point of complete closure. All joints shall be soil tight, as the minimum requirement, and shall be watertight in all sanitary sewer pipe lines and in all storm sewer pipe lines installed within the limits of a paved street or highway traffic lanes. Where specified, the joints in certain assemblies shall be made structurally integral by being completely encased in concrete to form a rigid watertight unit as indicated in the standard drawings.

All joints shall be sealed as follows, subject to such other approved method as the Engineer may authorize as being an acceptable alternative:

1. Concrete pipe and fittings shall have compression type joints with rubber gasket seals conforming to the requirements of Minneapolis Public Works Standard Plates, ASTM C-443, ASTM C-361 and AASHTO M-198 for circular pipe, or as otherwise approved by the Engineer in the case of non-circular pipe sections.
2. PVC pipe, and ABS solid wall pipe and fittings assembled gasket seal joints.
3. Corrugated smooth wall PVC and corrugated-double wall HDPE pipe and fittings - assembled push-on gasket joints shall pass performance tests as listed in ASTM D-3212. Solvent welds shall not be permitted.
4. Vitrified clay pipe and fittings - factory fabricated compression seals or compression type couplings.
5. Corrugated steel pipe and fittings - sealed with approved type compression seals.

D. Bulkheading Open Pipe Ends

All pipe and fitting ends, left open for future connection, shall be bulkheaded by approved methods prior to backfilling. Unless otherwise specified or approved, all openings of 24 inches in diameter or less shall be closed off with prefabricated plugs or caps and all openings larger than 24 inches in diameter shall be closed off with masonry bulkheads.

Prefabricated plugs and caps shall be of the same material as the pipe material, or an approved alternate material, and they shall be installed with watertight seal as required for the pipeline joints. Masonry bulkheads shall be constructed with clay or concrete brick to a wall thickness of eight inches.

Bulkheads installed for temporary service during construction may be constructed with two- inch timber planking securely fastened together and adequately braced, as an alternate to the masonry construction.

E. Appurtenance Installations

Appurtenance items such as aprons, trash guards, gates and castings shall be installed where and as required by the Plans and in accordance with such standard detail drawings or supplementary requirements as may be specified.

Casting assemblies installed on manhole or catch basin structures shall be set in a full mortar bed and be adjusted to the specified elevation without the use of shims or blocking. Mortar shall be applied to the outside of the casting between casting and structure as well as around any adjusting rings according to Public Works Standard Plates.

Sewer aprons shall be subject to all applicable requirements for installation of pipe. All aprons and outfall end sections shall have the last three sections tied. Two tie bolt fasteners shall be placed in each of the last three joints, one on each side of top center at the 60 degree point (from vertical). Tie bolt diameter shall be: 1/2 inch for 12" to and including 21" pipe; 5/8 inch for 24" to and including 36" pipe; 3/4 inch for 42" to and including 54" pipe; and 1" for 60" and larger pipe. The tie bolts shall be of a design approved by the Engineer.

F. Sewer Service Installations

Main sewer service connections and building service sewer pipe shall be installed as provided for in the Contract and as may be directed by the Engineer. The sewer service connections and pipe lines shall be installed in conformance with all applicable requirements of the main sewer installation and as more specifically provided for herein.

The Engineer, with the assistance of the Contractor, shall keep accurate records of all service installations as to type, location, elevation, point of connection and termination, etc. This service record shall be maintained by the Contractor on forms provided by the Engineer and approved by the SWS Design. The service installations shall not be backfilled until all required information has been obtained and recorded. A copy of the service record shall be given to the City at the time of the inspection.

The main sewer service connection shall consist of installing a Branch Tee or Wye section in the main sewer line at designated locations or providing an insert type Saddle Tee in a pipe cutout where and as permitted or required in lieu of the built-in fitting. Orientation of service connection fitting shall be as shown in the standard drawings unless otherwise directed by the Engineer.

Unless otherwise specified, service pipe shall be installed at right angles to the main sewer and at a straight line grade to the property line. The standard and minimum grades shall be a uniform rise of one inch in four feet for sanitary service lines and one inch in eight feet for storm service lines. These minimum grades may be reduced (by not more than one-half pitch) where the Engineer so approves in the case of restrictive elevation differences.

Building service pipe lines shall generally be kept as deep as required to serve the building elevation and maintain the specified minimum pipe grades. Pipe bends shall be provided as necessary to bring the service lines to proper location and grade. Pipe bends in the right of way shall not exceed 22-1/2 degrees without approval of the Engineer.

Unless otherwise indicated, service pipe installation shall terminate at property line or as designated on the Plans, with a gasket plug placed in the end, at which point the Contractor shall furnish and set a 4 x 4 inch wooden timber 6 feet to 8 feet in length embedded 4 feet below grade, or approved steel post to mark the exact end of pipe. The timber or post shall be set vertically, with the top 2 feet painted green.

Wherever service line connections to the main sewer are permitted or required to be made by the open cut-out method in the absence of a built-in Tee or Wye fitting, the connection shall be made by using an approved type of Saddle Tee fitting. The pipe cut-out shall be made with an approved type coring machine or by other approved methods producing a uniform, smooth circular cut-out as required for proper fit. The cut-out discs shall be retrieved and shall not be allowed to remain within the main sewer pipe. The Saddle Tee shall be securely fastened to the main sewer pipe by means of epoxy resin or other approved adhesive. The entire connection fitting shall be encased in concrete to a minimum thickness of six inches and as may be shown in the standard drawings. No part of the saddle may protrude into the main sewer.

Wherever service line connections to the main sewer are required to be made by means of built-in Branch Tee or Wye fittings, the Contractor shall, in the absence of such fitting, remove a section of the main sewer pipe and replace it with the required Branch Tee or Wye section connected by means of an approved sleeve coupling.

Sanitary sewer service lines shall not be connected to a manhole at an elevation more than 24 inches above the crown of the outgoing sewer. Where the elevation difference is greater than 24 inches, the connection shall be made by means of an Outside Drop Connection in accordance with the details shown in the standard drawings.

All pipe and fitting openings at temporary terminal points shall be fitted with suitable plugs or shall be bulk headed as required for the main sewer pipe.

G. Manhole and Catch Basin Structures

Manholes, catch basins, and other special access structures shall be constructed at designated locations as required by the Plans and in accordance with any standard detail drawings or special design requirements given therefore.

Unless otherwise specified or approved, manholes and catch basins shall be constructed or modified with a precast or cast-in-place concrete base and the barrel riser sections, cone section and top adjusting rings shall all be of precast concrete. All units shall be properly fitted and sealed to form a completely watertight structure. Barrel and cone height shall be such as to permit placement of at least one and not more than three standard two-inch precast concrete adjusting rings immediately below the casting assembly in accordance with the Public Works Standard Plates or as shown on the approved plans. The adjustment shall be a minimum 3-inches and a maximum of 8-inches under the casting assembly. The casting and the adjusting rings must be encased in a concrete collar as shown on the standard plates.

Unless otherwise specified or approved, manholes and catch basin manholes shall have an inside barrel diameter at the bottom of 48-inches minimum and standard catch basins shall have an inside barrel diameter of 30-inches.

Inside diameter at the top of the cone section and all adjusting rings shall be of the same size and shape as the casting frame. Casting assemblies shall be as specified in the Plans. Catch basin grate elevation shall be adjusted as necessary to maintain the required dip below normal gutter grade.

Concrete cast-in-place base shall be poured on undisturbed or firmly compacted foundation material which shall be trimmed to proper elevation. The bottom riser section shall be set in fresh concrete or mortar and all other riser section joints of the tongue and groove design shall be sealed with rubber gaskets. The concrete base under an outside drop connection shall be monolithic with the manhole base.

Wherever special designs so require or permit, and as otherwise may be approved by the Engineer, a precast concrete base may be used or the structure may be constructed with solid sewer brick or block units or with cast-in-place concrete. Any combination of cast-in-place concrete and brick or block mortar construction will be allowed and may be required where it is impossible to complete the construction with standard precast manhole sections.

Connections made to manholes with sewer main require waterproof connections. For precast sections that are monolithic, a waterproof boot shall be used to provide such connection. As shown on the plans or directed by the Engineer, all other connections made to manholes or catch basins that are constructed with sewer brick or block require the use of a rubber water-stop that shall be placed on the pipe at the area where the constructed connection is made.

In the case where the cover of the top of the pipe is less than 24 inches from the pavement surface, Ductile Iron Pipe, Class 52, shall be substituted for the entire length of the run of identical diameter.

All annular wall space surrounding the in-place storm sewer pipes shall be completely filled with mortar or concrete, and the inside bottom of each manhole and catch basin shall be shaped with fresh concrete to form a power flow through invert troughs as shown on the Public Works Standard Plates approved by the City. A 4-inch thick collar of mortar or ready-mix concrete shall be rough finished on the outside of manholes and catch basins where the connections are made.

H. Abandonment and Reconnecting Existing Facilities

Disposition of abandoned facilities and reconnection of existing facilities shall be as provided for in the Plans, Specifications, and Special Provisions. Unless otherwise covered in the aforementioned documents abandonment of storm sewer lines and manholes shall be as follows:

All sanitary and storm sewer lines abandoned as part of a project within the City right-of-way are to be completely removed by the Contractor. Bulkheads shall be installed at both the inlet and outlet of the pipe to be removed at the correlating manholes. Bulkheads shall be constructed by methods described in section D of 2503.3. If approved by the Engineer in lieu of removals, pipes must be completely filled with a cement slurry material approved by the Engineer. Before placement of the cement slurry, the inlet and outlet of the line to be abandoned shall have bulkheads constructed by previously described methods.

All sanitary and storm manholes abandoned as part of a project within the City right of way are to be completely removed by the Contractor. In lieu of completely removing the structure, the Contractor may abandon the structure in place if approved by the Engineer. Proper abandonment of a manhole includes installing bulkheads in all inlet and outlet pipes in the structure by previously described methods, and removal of the bottom of the manhole. In addition, the top five (5) feet of the structure from finished grade must be removed. Any part of the structure that remains below the top five (5) feet must be filled with an approved material and compacted to meet density requirements of Mn/DOT Specification 2105.

I. Sanitary Sewer Leakage Testing

All sanitary sewer lines, including service connections, shall be substantially watertight and shall be tested for excessive leakage upon completion and before connections are made to the service by Others. Each test section of the sewer shall be subjected to exfiltration testing, either by hydrostatic or air test method as described below and at the Contractor's option. The requirements set forth for maximum leakage shall be met as a condition for acceptance of the sewer section represented by the test.

If the ground water level is greater than three feet above the invert elevation of the upper manhole and the Engineer so approves, infiltration testing may be allowed in lieu of the exfiltration testing, in which case the allowable leakage shall be the same as would be allowed for the Hydrostatic Test.

All testing shall be performed by the Contractor without any direct compensation being made therefore, and the Contractor shall furnish all necessary equipment and materials, including plugs and standpipes as required.

J. Air Test Method

The pipeline shall be sealed with plug whose sealing length is greater than the diameter of the pipe and constructed in such a nature that it will not require external blocking or bracing and maintain a seal against the line's test pressure.

All wyes, tees, outlets or ends of lateral streets shall be suitably capped and braced to withstand the internal pressures. Such caps or plugs shall be easily removable.

One plug shall be tapped for the air supply hose and the return air pressure hose. The air supply hose, connected from the compressor to the plug shall be a throttling valve, bleeding valve and shut off valve for control. The air pressure tap shall have a sensitive pressure gauge, 0 to 10 psi range, protected by a gauge cock and a pressure relief valve set at 10 psi.

In performing the test, air is added slowly to the pipeline until pressure inside the pipeline reaches 4.0 psi. If air is added too rapidly, the test accuracy will decrease because a change in temperature also has an effect on the change in pressure. When the air pressure inside the pipeline reaches 4.0 psig above external hydrostatic pressure, the supply air is stopped. A minimum two-minute time interval is allowed for the temperature difference to stabilize before the actual test is performed. If the air pressure drops below 3.5 psig during this time interval, more air will be supplied to the pipeline and throttled to maintain a pressure between 3.5 psig and 4.0 psig for a minimum of two minutes after which time the supply air will be shut off.

The portion of line being tested shall be accepted if the portion under test does not lose air at a rate greater than 0.0015 cfm per square foot (for PVC) or 0.003 cfm per square foot (for RCP) per internal pipe end area at an average pressure of 3.0 psig greater than any back pressure exerted by groundwater that may be over the pipe at the time of test.

The test shall be accomplished by determining the time in minutes for the pressure to decrease from 3.5 psig to 3.0 psig greater than the average groundwater that may be over the pipe for PVC and RCP pipe. Test times are for a 3.5 to 2.5 psi pressure drop for VCP. Testing for VCP shall be in accordance with ASTM C828.

That time shall not be less than the time shown on the given diameter in the following table:

Pipe Diameter in Inches	**Minutes for PVC**	**Minutes for RCP**	**Minutes for VCP**
4	1.9	1.0	0.3
6	2.8	1.4	0.7
8	3.8	1.9	1.2
10	4.7	2.4	1.5
12	5.7	2.9	1.8
15	7.1	3.4	2.1
18	8.5	4.3	2.4
21	9.9	5.0	3.0
24	11.3	5.7	3.6

If the pipeline fails to meet the requirements of the test, the Contractor shall, at their own expense, determine the source of leakage and then repair or replace all defective material and/or workmanship.

In determining the pressure greater than the average groundwater, the groundwater height in feet above the pipeline must be measured.

When the water elevation has been established, the height in feet above the pipeline shall be divided by 2.31 and that pressure added to gauge pressure of test.

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A table for converting water height to gauge pressure is as follows:

Groundwater Level over Top of Pipeline	Added Pressure to be Applied to Gauge Pressure Readings
1 foot	0.43 psig
2 feet	0.86 psig
3 feet	1.29 psig
4 feet	1.72 psig
5 feet	2.16 psig
6 feet	2.59 psig
7 feet	3.01 psig
8 feet	3.44 psig
9 feet	3.87 psig
10 feet	4.30 psig

K. Hydrostatic Test Method

After bulk heading the test section, the pipe shall be subjected to a hydrostatic pressure produced by a head of water at a depth of three feet above the invert elevation of the sewer at the manhole of the test section. In areas where ground water exists, this head of water shall be three feet above the existing water table.

The water head shall be maintained for a period of one hour during which time it will be presumed that full absorption of the pipe body has taken place, and thereafter for an extended period of one hour the water head shall be maintained as the test period. During the one hour test period, the measured water loss within the test section, including service stubs, shall not exceed the Maximum Allowable Loss (in Gallons Per Hour per 100 Feet of Pipe) given below for the applicable Main Sewer Diameter.

Main Sewer Diameter (In Inches)	Maximum Allowable Loss (In Gallons per Hour Per 100 Feet)
6	0.5
8	0.6
10	0.8
12	1.0
15	1.2
18	1.4
21	1.7
24 & Larger	1.9

*Based on 100 Gallons per Day per Pipe Diameter Inch per Mile

If measurements indicate exfiltration within a test action section is not greater than the allowable maximum, the section will be accepted as passing the test.

L. Test Failure and Remedy

In the event of test failure on any test section, testing shall be continued until all leakage has been detected and corrected to meet the requirements. All repair work shall be subject to approval of Maintenance Supervisor of SWS Operations at (612) 673-5625. Introduction of sealant substances by means of the test water will not be permitted.

Unsatisfactory repairs or test results may result in an order to remove and replace pipe as the Engineer considers necessary for test conformance. All repair and replacement work shall be at the Contractor's expense.

M. Deflection Test

Deflection tests shall be performed on all plastic gravity sewer pipes. The test shall be conducted after the sewer trench has been backfilled to the desired finished grade and has been in place for 30 days.

The deflection test shall be performed by pulling a rigid ball or nine-point mandrel (Mn/DOT Technical Memorandum 98-24-B-01 or latest revision) through the pipe without the aid of mechanical pulling devices. The ball or mandrel shall have a minimum diameter equal to 95% of the actual inside diameter of the pipe. The maximum allowable deflection shall not exceed five percent of the pipe's internal diameter. The line will be considered acceptable if the mandrel can progress through the line without binding. The time of the test, method of testing, and the equipment to be used for the test shall be subject to the approval of the Engineer.

All testing shall be performed by the Contractor at his expense without any direct compensation being made therefore, and he shall furnish all necessary equipment and materials required.

N. Test Failure and Remedy

In the event of test failure on any test section, the section shall be replaced, with all repair work subject to approval of the Maintenance Supervisor of SWS Operations at (612) 673-5625. The replaced section shall be retested for leakage and deflection in conformance with the specifications contained herein. All repairs, replacement, and retesting shall be at the Contractor's expense.

O. Televising

Sewer line televising may be required by the Engineer, at the cost of the Contractor, if visual inspection, leakage testing, or deflection testing indicate the sewer has not been constructed in accordance with these specifications and the requirements of the Plans, Specifications, and Special Provisions.

S-22 (2506) Manholes and Catch Basins

Joints and all manhole riser sections shall be gasketed in accordance with ASTM Specification C-443.

Adjusting Rings - A maximum of three (3) and a minimum of one (1) concrete adjusting ring will be permitted. All rings shall have a minimum ½ inch of Type N mortar placed in between the casting, the adjusting ring(s) and the top of the structure. No dry stacking shall be permitted.

All manholes, catch basins, and drop inlets shall be precast reinforced concrete. Shallow structures may require that the structure be precast with an over depth and the over depth sump filled in with cement grout to satisfy this requirement. This over depth and grout shall be considered incidental.

Steps shall not be provided in any City drainage structure.

A 100 mm [4 inch] thick concrete encasement shall be placed around the outside of the manhole or catch basin adjusting rings as detailed in current Public Works Standard Plates. This encasement shall be placed at the time of final casting placement and shall be incidental for which no payment will be made.

The shaped concrete fill invert for all manhole types shall be a Power Flow according to Public Works Standard Plates and extend up to two thirds of the diameter of the connecting pipe.

Inlet and outlet pipes shall extend through the walls of the structure being connected to and shall be trimmed flush with the inside wall, or as otherwise directed. Masonry blocks shall not be set with a joint width less than 3/8 inch to assure that vertical joints are completely filled with mortar.

The locations shown on the plan sheets for new catch basin construction are approximate. The City Surveyor shall stake the exact location in the field.

Private utility company manholes, where encountered, shall be adjusted to grade by the appropriate utility company. The Contractor shall allow the utility company access to the project and time to do this adjustment.

Segmental concrete masonry units (block, brick, adjusting rings) used in the construction of the catch basins, manholes, and other drainage structures shall conform to ASTM C139, except that the cement used shall be Type II (moderate sulfate resistant), the compressive strength (average of three units) shall be 5,000 psi with the minimum of any one block being 4,500 psi, and the maximum absorption (average three units) shall be 5.5% by weight with the maximum of any one block being 6.0% by weight. Class C fly ash or other approved pozzolan shall be substituted for 15% on a pound for pound basis by weight of the designed Portland Cement. In lieu of the Type II cement with 15% Type C fly ash, Type 1.P cement may be used.

Gray Iron castings shall be supplied by foundries that have been approved by the State Materials Engineer.

The maximum total height of adjustment on any newly constructed manhole shall be eight (8") inches. Adjustments over eight (8") inches shall not be permitted.

The Contractor shall comply with Erosion Control Specifications and/or with the Erosion Control Plan. That compliance does not relieve the Contractor from their responsibility for cleaning the sewer system should any soil be washed into it.

Manhole castings shall be removed from structures prior to the full depth bituminous paving operation and the structure openings covered with rigid steel plates. Before the wearing course is placed, the castings shall be set in mortar to the final road elevation. Asphalt pavement removed for the adjustment shall be replaced with asphalt material to the same elevation and density of that removed.

Manhole castings in a bituminous overlay project shall be adjusted prior to placement of the wearing course. The Contractor may use cast iron adjusting rings where appropriate. Should the adjustment require, or the Contractor chooses removal of the pavement section around the casting, the pavement shall be replaced in kind. The cut around the casting shall be neat and the edges tacked prior to placing the asphalt. Should the adjustment prior to placement of the wearing course produce an unacceptable adjustment, the Contractor shall readjust the casting.

Manholes, catch basins, and other special access structures shall be constructed at designated locations as required by the Plans and in accordance with any standard detail drawings or special design requirements given therefore.

Unless otherwise specified or approved, manholes and catch basins shall be constructed on a precast or cast-in-place concrete base and the barrel riser sections, cone section and top adjusting rings shall all be of precast concrete. All units shall be properly fitted and sealed to form a completely watertight structure. Barrel and cone height shall be such as to permit placement of at least one (1) and not more than three (3) standard two-inch precast concrete adjusting rings or as shown on the approve Public Works Standard Plates immediately below the casting assembly.

Unless otherwise specified or approved, manholes and catch basin manholes shall have an inside barrel diameter at the bottom of 48 inches minimum and the inside diameter at the top of the cone section and all adjusting rings shall be the same size and shape as the casting frame. Catch basins shall have an inside diameter of 30-inches and all adjusting rings shall be the same diameter of the casting frame. Casting assemblies shall be as specified in the Plans. Catch basin grate elevations shall be adjusted as necessary to maintain the required dip below normal gutter grade. As shown on the plans.

Concrete cast-in-place base shall be poured on undisturbed or firmly compacted foundation material which shall be trimmed to proper elevation. The bottom riser section shall be set in fresh

concrete or mortar and all other riser section joints of the tongue and groove design shall be sealed with rubber gaskets. The concrete base under an outside drop connection shall be monolithic with the manhole base.

Wherever special designs so require or permit, and as otherwise may be approved by the Engineer, a precast concrete base may be used or the structure may be constructed with solid sewer brick or block units or with cast-in-place concrete. Any combination of cast-in-place concrete and brick or block mortar construction will be allowed and may be required where it is impossible to complete the construction with standard precast manhole sections.

All annular wall space surrounding the in-place storm sewer pipes shall be completely filled with mortar or concrete, and the inside bottom of each manhole and catch basin shall be shaped with a Power Flow as shown on Public Works Standard Plates to form a free flow through invert troughs.

Backfilling operations will not commence until all mortar has a minimum of 24 hours for curing. Any exception to this specification needs to be approved by the City in advance of the work being done.

S-23 (2511) Riprap
Section 2511 is hereby supplemented and amended by the following:

Filter fabric shall be Type III or Type IV, Mn/DOT Specification 3733, as appropriate

S-24 (2521) Walks
For the purpose of these Supplemental Specifications, Mn/DOT 2521 shall govern, except with the following modifications and amendment(s):

(2521.3C1) ADA pedestrian ramps
American With Disabilities Act (ADA) pedestrian ramps shall be installed to the required Minnesota Department of Transportation American With Disabilities Act Requirements, for the Use of Truncated Domes/Detectable Warning Systems for Pedestrian Curb Ramps. Proper used of approved materials is also required meeting current MNDOT Materials for this work. ***Pedestrian ramps will be constructed at all sidewalk intersections.*** The Engineer will determine the location of pedestrian ramps.

The entire truncated dome area **shall be a dark gray** when the adjacent sidewalk is a light gray color.

The acceptable materials used shall conform to those items on the MNDOT material web site:
http://www.mrr.dot.state.mn.us/materials/ApprovedProducts/appchart.asp#trdomes

Name and date stamp marks

A stamp mark showing the name of the contractor and the full date (month, day, and year) of concrete placement is required. The stamp mark shall be impressed into the sidewalk, curb, curb and gutter, drive approach or alley. The stamp mark shall be made in at least one place in every fifty (50) lineal feet, or at the beginning and the end of the work if a lesser amount is constructed, or, in one place if only one section of concrete is constructed. Each drive approach shall be stamped in at least one place. The City Engineer shall approve the style, size of lettering and the manner of stamping.

Concrete work around existing trees
Concrete work around existing trees shall follow this guideline listed below:
Trees are a valuable resource in Minneapolis. As much care as possible must be taken to minimize the negative impact of construction activities to trees.

Tree Roots: No living trees shall be removed without written permission of the Minneapolis Park and Recreation Board (612) 370-4900, with the exception that any roots of such living trees that interfere with installing the sidewalk on proper grade shall be removed as part of the grading work. The contractor shall remove all roots within the area defined as six and one half (6-1/2) inches below the top of the new finished sidewalk grade, by severing them off cleanly with a sharp axe, or by grinding them off using a root grinding machine. Root removal is subject to inspection and approval by the Park Board Forester.

Tree Rings: When trees exist within the boulevard or at the back of the sidewalk tree rings must be installed in the public sidewalk in accordance with the following parameters. See Standard Plate 4005, Tree Ring Installation Guide for more details.

Tree Size:	Small	less than 8" Diameter
	Medium	8" to 20" in Diameter
	Large	Greater than 20" in Diameter

Tree size is measured at 4.5' above the ground level (MNDOT specification 2572.3 A)

Tree Size	**Distance from Sidewalk Edge, Measured from nearest point of the base of tree to the normal sidewalk edge, at ground level**	**Ring Depth**
Small Tree	Greater than 18”	No ring
	Less than 18”	1’ ring
Medium Tree	Greater than 18”	Breakout ring
	12” to 18”	1’ ring
	Less than 12”	1’ to 1.5’ ring
Large tree	Greater than 18”	1’ ring
	12” to 18”	1.5’ to 2’ ring
	Less than 12”	2’ ring

Ring Depth: The distance measured from the normal sidewalk edge to the point of the ring arc perpendicular to the base of the tree.

All ring depth dimensions assume that the remaining width of the sidewalk will be at least four feet.

Ring Arcs: All ring arc lengths will be a minimum of six times the depth of the ring. Maximum ring arc length will be 18' (approximately three typical sidewalk section lengths) for a large tree, or greater, if approved by the Sidewalk Inspector.

Breakout Rings: Breakout rings will be formed by a tool joint depth of at least one third the thickness of the concrete sidewalk, or at least 1-1/4' in depth for a 3.5" thick sidewalk. Two transverse tool joint cuts will be made in the breakout ring in order to divide the ring into approximately three equal size parts.

S-25 (2564) Traffic Signs and Devices

For the purpose of these Standard Supplemental Specifications Mn/DOT 2564 shall govern, except with the following modifications and amendment(s):

(2564.3I) Stop boxes, cables, signs, and meter collars

If a contractor finds, when repairing or constructing a public sidewalk, that a "water stop box" is not at the proper grade or that the cap is missing, the contractor shall notify the City of Minneapolis Public Works Water Department at (612) 673-5600 or the City of Minneapolis Public Works Sidewalk Inspections office at (612) 673-2420. All stop boxes must be located and adjusted to grade by the contractor before placement of any concrete within the public right of way.

When sidewalks are to be poured adjacent to the curb, the City of Minneapolis Public Works Traffic and Parking Services Division shall be notified at (612) 673-5750 a minimum of twenty four hours before pouring. The Traffic and Parking Services Division will furnish all parking meter and sign collars. Parking meters, signs, and/or posts damaged or destroyed during construction shall be charged to the contractor at the City's unit cost. The collars shall be placed by the contractor to the original location or as designated by the Traffic and Parking Services Division. All collars shall be placed in a true vertical "plumb" position and flush with the top of the sidewalk. Adequate clearance shall be provided for access to the collar set screws. If the collars are missed, the contractor will be responsible for the cost of installing these collars. See the detail drawing in the appendix to these Standard Supplemental Specifications for further information.

S-26 (2573) Storm Water Management

This work will be done in accordance with the applicable Standard Specifications, these Special Provisions and the following:

The following is hereby added to Mn/DOT 2573.3 A:

When erosion or sediment control practices are installed, a certified installer shall be on the Project to install the practices or direct the installation. Certified installer requirements shall apply to the following operations:

1. Seeding
2. Sodding
3. Mulching
4. Silt fence or other perimeter sediment control device installations
5. Erosion control blanket installation
6. Hydraulic Soil Stabilizer installation
7. Silt curtain installation
8. Ditch check installation
9. Inlet protection
10. Riprap placement
11. Compost installation
12. Erosion Stabilization Mat installation

At least one certified installer shall be provided by each Contractor or subcontractor installing erosion or sediment control practices.

The certification is obtained by completing a one day Erosion/Sediment Control Inspector/Installer training course and passing the exam, all provided by the University of Minnesota, Department of Biosystems and Agricultural Engineering.

If the Contractor or subcontractor(s) fails to provide the required certified installer(s), the Erosion Control Supervisor shall notify the Engineer. If either the Erosion Control Supervisor or the Engineer determines that one or more required certified installers have not been provided, the Contractor shall respond to the Engineer's notification within 2 days with the appropriately certified person(s) or provisionally certified person(s) or be subject to a $500.00 per required installer per calendar day deduction for noncompliance.

The Contractor shall provide a certified Erosion Control Supervisor to direct the Contractor and subcontractor(s) operations and insure compliance with Federal, State and Local ordinances and regulations. The certification is obtained by completing a two (2) day Erosion/Sediment Control Site Management training class and passing the required test, all provided by the University of Minnesota, Department of Biosystems and Agricultural Engineering. The certification is valid for three years.

The Erosion Control Supervisor shall conduct the Contractor's erosion/sediment quality control program described in these Special Provisions. In addition, the Erosion Control Supervisor shall be available to be on the Project within 24 hours at all times from initial disturbance to final stabilization as well as perform the following duties:

1. Coordinate and schedule the work of subcontractors so that erosion and sediment control measures are fully executed for each operation and in a timely manner over the duration of the Contract.
2. Oversee the work of subcontractors so that appropriate erosion and sediment preventive measures are undertaken at each stage of the work.
3. Prepare the required weekly erosion control schedules described in Section S-1717.5 (NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT) of these Special Provisions and present it to the Engineer.
4. Attend all weekly construction meetings to discuss the findings of the NPDES inspection log and other related issues.
5. Provide for erosion/sediment control methods for Contractors temporary work not shown on the plans, such as work platforms, temporary construction, pumping operations, plant and storage yards, and cofferdams.
6. Ensure that applicable permits are acquired and complied with for borrow pits, dewatering and any temporary work conducted by the Contractor in rivers, lakes and stream.
7. Ensure that all erosion/sediment control work is conducted in a timely workmanlike manner.
8. Ensure that erosion/sediment control work is installed to the fullest extent prior to suspension of the work.
9. Coordinate with Federal, State and Local Regulatory agencies on resolution of erosion/sediment control issues due to the Contractor's operations.
10. Ensure that proper cleanup occurs from vehicle tracking on paved surfaces and/or any location where sediment leaves the right of way.

If the Contractor fails to provide a certified Erosion Control Supervisor for the Project, the Engineer shall issue a written order to the Contractor. The Contractor shall respond within 24 hours and provide the required Erosion Control Supervisor or be subject to a $1,000.00 per calendar day deduct for noncompliance.

The Erosion Control Supervisor shall be aware of all the requirement of these Special Provisions, especially any involving (1717) National Pollutant Discharge Elimination System (NPDES) Permit and/or (2573) Temporary Erosion Control.

S-27 (2575) Controlling Erosion and Establishing Vegetation

For the purpose of these Standard Supplemental Specifications Mn/DOT 2575 shall govern, except with the following modifications and amendment(s):

<u>(2575.3B) Grading Preparation Prior to Seeding</u>

Soil preparations shall include placement of four (4) inches of Topsoil borrow (MnDOT 3877.2A) and use of salt resistant sod (MnDOT 3878.2C)

S - 28 (2582) Permanent Pavement Marking

For the purpose of these supplemental provisions, MnDOT 2582 shall govern, except with the following modifications and amendments:

Crosswalk Markings
These markings include traverse, parallel solid white lines as well as crosswalk blocks that are installed parallel to the direction of travel on the roadway. Crosswalk blocks are installed in a pattern that is transverse to the direction of travel.

Pavement markings, as shown on the plan sheets, shall be paint, epoxy resin or preformed plastic.

1. White and yellow painted pavement markings shall be as described in Mn/DOT Specification 3591 high solids water-based traffic paint with drop-on glass beads per Mn/DOT Specification 3592.

2. Epoxy resin markings shall comply with Mn/DOT Specification 3590, epoxy resin pavement markings (free of toxic heavy metals).

3. The preformed plastic pavement marking material shall be in accordance with Mn/DOT Specification 3354 except as described below:

   - Durable, conformable to pavement and retro reflective
   - Contains embedded net to increase tear resistance
   - Pressure sensitive adhesive on bottom surface
   - Retro reflective layer of glass beads bonded in a highly durable polyurethane topcoat
   - Manufactured without the use of heavy metals, lead chromate pigments or other similar, lead-containing chemicals
   - Nominal thickness of 0.065 in.
   - Initial minimum retro reflectance values shown below when measured in accordance with ASTM-D4061. The photometric quality to be measured is coefficient of retro reflected luminance and shall be expressed as: millicandelas per square foot per foot-candle.

	White	Yellow
Entrance Angle	88.76°	88.76°
Observation Angle	1.05°	1.05°
Retro reflected Luninance	300	250

The patterned surface of the retro reflective pliant polymer shall provide an initial average skid resistance value of 45 BPN when tested according to ASTM E 303 except values will be taken in one direction and at 45 degree angle from that direction. These two values will then be averaged to find the skid resistance of the patterned surface.

The 3M Pavement Marking Tape Series 270 has met these specifications in the past.

The preformed plastic markings shall be installed so the surface of the marking material is below the surface of the adjacent pavement. This is accomplished by cutting grooves in the pavement to accept the preformed plastic markings.

GROOVING BITUMINOUS PAVEMENT SURFACES FOR PREFORMED PAVEMENT MARKINGS.

The preformed pavement markings are to be grooved into the existing bituminous pavement surfaces. **GRINDER-TYPE CUTTING HEADS CANNOT BE USED.** The goal of the grooving process is to protect the pavement markings from snowplow damage and ultimately extend the service life of the pavement markings. Grooving operations are incidental to permanent pavement marking operations.

The Contractor has the option to dry or wet groove the pavement while the roadway is open or closed to traffic. The groove must be cleaned completely prior to pavement marking application, using an air compressor with at least 185 CFM air flow and 120 PSI air pressure. The compressor must be equipped with a moisture and oil trap, and cannot have more than 50 feet of ¾ inch ID hose between the compressor and the air nozzle. The air nozzle must have an inside diameter of ½ inch or greater.

1. Grooving Equipment

The grooving shall be performed by a self-propelled machine equipped with gang stacked diamond cutting blades mounted on a floating head with controls capable of providing uniform depth and alignment.

The cutting heads shall consist of stacked 1/8 inch to 3/8 inch wide diamond tipped cutting blades. The spacers between each blade must be such that the raise in the bottom of the finished groove between the blades is less than 25 percent of the groove depth. The resulting bottom of the groove shall have a fine corduroy finish. If a course tooth pattern is present, the Contractor shall increase the number of blades and/or decrease the thickness of the spacers on the cutting head.

The equipment shall be capable of grooving the total width of the groove in one pass or be capable of grooving uniform depths with multiple passes. The maximum number of passes is detailed below. If multiple passes are used, the ridge between passes shall be mechanically removed prior to groove cleaning and pavement marking application.

The equipment shall be capable of grooving double lines simultaneously or parallel lines to a uniform depth with two passes.

The equipment shall be self-vacuuming and leave the cut groove ready for pavement marking installation. Dry cut grooving, without a vacuum will only be allowed if markings run perpendicular to the roadway, such as Stop Bars. The pavement marking manufacturer shall approve the equipment and method used.

2. Grooves

The grooving shall be performed within the following tolerances. Failure to meet these tolerances will result in the suspension of work until the Contractor can demonstrate that these tolerances can be met to the satisfaction of the Engineer.

GROOVE WIDTH AND MAXIMUM NUMBER OF PASSES

MARKING WIDTH	GROOVE WIDTH	MAX NUMBER OF PASSES
4 INCHES	5” ± 1/8”	1
6 INCHES	7” ± 1/8”	1
8 INCHES	9” ± 1/8”	1
12 INCHES	13” ± 1/8”	2
24 INCHES	25” ± 1/8”	3

Since pavements are irregular, the depth of the groove across the width may vary. To compensate for this the depth of the groove shall be measured from the bottom of the groove to a straight edge extended over the groove from the pavement surface opposite the pavement joint.

FULL DEPTH GROOVE LENGTHS

Full Depth Groove Length (broken line)	10 feet ± 3 inches
Tapers at end of each line	6 inches – 9 inches
Space between Double lines	4 inches ± ¼ inch

The groove shall be placed 2 inches ± 1 inch from the edge of joints or seams along edge or centerlines.

The contractor shall provide any required interim markings that are necessary. These interim markings shall be in compliance with the requirements contained in the Minnesota Manual on Uniform Traffic Control Devices. Field measuring, spotting and interim markings shall be considered to be incidental and no direct compensation shall be made.

Performed Markings Shall Be Placed in Strict Compliance with Manufacturer's Instructions.

Payment for pavement markings installed at Contract prices per unit of material shall be compensation in full for all costs incurred in materials, traffic control, marking, installation, surface preparation, use of primers, in accordance to Contract documents or as approved by the Engineer.

S-29 (3138) Aggregate for Surface and Base Courses
For the purpose of these Standard Supplemental Specifications Mn/DOT 3138 shall govern, except with the following amendments(s):

(3138) Aggregate
The only acceptable aggregate for use under this special provision shall be Class 5, 100% virgin material, unless written approval is granted by the City Engineer allowing the use of other aggregate materials.

S-30 (3149) Granular Material
The provisions of MnDOT Spec 3149 are amended with the following:
Salvage Bituminous shall not be used in any granular material.

S-31 Record Drawing Requirements

Record drawings are required for all construction projects that alter public infrastructure within the City of Minneapolis. These record drawings are used to update public infrastructure data in the City's Enterprise Spatial Database. This data is used by government agencies and private sector entities to guide them in subsequent planning, maintenance and design processes.

The cost for preparing record drawings shall be incidental, unless otherwise stated in the form of a pay item in the Project Contract Documents or in an Inter Agency Agreement. No infrastructure shall be accepted by the City until record drawings have been submitted to and approved by the City.

GENERAL

The Record Drawing Plans should consist of the design plans submitted, approved, and permitted for the construction project. The information shown shall reflect the actual construction completed under the permit with any and all deviations from the design plans.

Record drawings shall conform to Minneapolis Public Works CADD standards.

For further information contact the Public Works CADD Manager @ 612-673-3623
or email @ jim.cleary@minneapolismn.gov

The following Electronic Map data is available from the City upon request:

- Building Numbers
- Centerlines/Street Names
- LIDAR
- Survey Monuments
- Orthophotos
- Planimetric
- Sewer
- Traffic
- Water

The specific record drawing requirements for each type of public infrastructure are outlined below.

ROADWAY FACILITIES

Record drawings for roadway facilities shall be submitted to Transportation Planning and Engineering, 309 2nd Ave S, Room 300.

Record drawings shall at minimum include, but are not limited to the following items:

A. Horizontal changes in the right-of way; particularly sidewalk and roadway geometry including tapers, widths & alignment shifts
B. Vertical changes in the right-of way; particularly sidewalk and roadway geometry (profile changes)
C. Radii of driveways, alleys and intersections
D. Pavement section (pavement thickness) within the right-of way; particularly sidewalk and roadway
E. Materials (changes in mix design or base materials) within the right-of way; particularly sidewalk and roadway
F. Locations of any property irons, or survey control monuments altered during the project

SEWER (STORM DRAIN & SANITARY) FACILITES

The Contractor shall provide record drawings which accurately depict what was constructed for all sewer and storm drain facilities that the project installs, relocates, removes, or replaces to Surface Water and Sewer Design, 309 2nd Avenue S, Room 300 regardless of ownership of the facility. Record drawings shall include at minimum include, but are not limited to the following items:

A. The horizontal location of all work
B. The existing curb lines
C. The type of existing soil encountered
D. All invert elevations, structure elevations and finished grade
E. Pipe size, materials and pipe grades
F. Manhole types, materials, size, depth below invert, rim elevation
G. Special details of work not covered by City Standard Plates
H. Prior location of removed facilities, and
I. Location and method of facilities abandoned in place

Samples of the Record Drawing format may be obtained by contacting the Surface Water and Sewer Design group at 612-673-3617.

No infrastructure shall be accepted until record drawings have been submitted and approved by Surface Water and Sewer Design. The Contractor shall not be relieved of locating and/or Gopher State One Call responsibility on the project until after all record drawings have been provided to, reviewed and accepted by the City.

STREET LIGHTING, TRAFFIC SIGNALS, TRAFFIC SIGNAL INTERCONNECT & FIBER OPTIC FACILITIES

A. Above and below ground conduit / structure tolerances. All above and below ground electrical facilities shall be accurately surveyed and recorded in accordance with the following tolerances.

- Above ground structures and supporting facilities shall be accurately located by the survey to within 0.5 ft.
- Below ground facilities shall be accurately located by the survey to within 1.0 ft.
- All facilities shall be shown schematically correct on the newly created record drawing.
- Existing electrical facilities not removed as part of construction must be recorded and shown on the newly created record drawing.
- The Contractor shall work with the City of Minneapolis Traffic Division to ensure that all of the City of Minneapolis's Computer Aided Design and Drafting **(**CADD) Standards and Standard Detail Plates are adhered to.
- The Traffic Division upon request will supply a sample record drawing. This drawing will depict the Traffic's Division's final drawing format and must be followed in creating all record drawings.
- Before construction begins, Contractor must contact the City of Minneapolis – Traffic Division – Darryn Proch 612-673-5516 or darryn.proch@minneapolismn.gov

B. Recording and creation of record drawings

The Contractor shall have two options available for field survey and recording of field notes and the creation of record drawings.

- The first option is to hire the City of Minneapolis Traffic Division to perform the work. The Traffic Division will provide a cost estimate upon request, and bill the Contractor upon completion of the record drawings.
- The second option is to hire a City pre-approved Engineering firm to provide such services.

No infrastructure shall be accepted until record drawings have been submitted and approved by the Traffic Division. The Contractor shall not be relieved of locating and/or Gopher State One Call responsibility on the project until after all record drawings have been provided to, reviewed and accepted by the City.

All record drawings shall be submitted to the City for review and approval no later than two weeks following construction activity completion.

C. Electrical facility locating during construction

Locating of newly installed underground electrical facilities or existing underground electrical facilities that are abandoned or designated for reuse, whether or not they have been documented or recorded, will be the electrical contractor's responsibility until final project acceptance.

D. Payment for record drawing creation

Payment shall be compensation in full for all costs of materials and labor to perform the necessary field survey, record the field notes, draft all record drawings to City Standards, and all incidentals thereto as described above to create record drawings of final installed electrical facilities in accordance with the above schedule. Record drawing creation shall be paid for as "**Electrical Record Drawings", Lump Sum.**

S-32 **UTILITY AGREEMENTS, PERMITS AND ORDERS**

A. The City makes no warranty, express or implied; that the utility companies will relocate their facilities in accordance with the terms of any applicable Agreements, Permits or Orders .

B. The Contractor may be required to work in and around utility properties and has considered this fact when preparing their proposals and estimates.

C. The above shall not be construed as being a modification of any of the Provisions of 1507.

END OF DIVISION S-GENERAL SPECIAL PROVISIONS

DIVISION SL - LIGHTING

ELECTRICAL LIGHTING SYSTEM
UPDATED: December 8, 2011

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DIVISION SL - LIGHTING

SPECIAL PROVISIONS
ELECTRICAL LIGHTING SYSTEM

FOR THE CONSTRUCTION OF:

PERMANENT STREET LIGHTING SYSTEMS

SL-1 (2545) ELECTRICAL SYSTEM

This work shall be done in accordance with the applicable Minnesota Department of Transportation "Standard Specifications for Construction", 2000 Edition.

The provisions of Mn/DOT 2471, 2545, and 2565 shall apply in addition to the following: bidders are advised that compliance with the provisions of Mn/DOT 1702, Mn/DOT 2545.2A, and the first paragraph of Mn/DOT 2545.3A will be particularly enforced in conjunction with the construction of any kind or type of electrical system, conduit or conduit system for the conveyance of the electrical conductors, or the required portions thereof, as specified in the Contract. The Minnesota Electrical Act requires that a permit be obtained for the performance of all such work, including the installation of conduits.

SL-1.1 SCOPE OF WORK

The Contractor shall furnish all labor, equipment and materials for the installation and connection of separate underground distribution circuits in conduit to a street lighting system. These materials shall be as shown in the Plan or described within the special provisions and include but shall not be limited to the following items:

Electric Lighting System:

- street lighting poles and luminaires
- rigid steel and non-metallic conduits
- street light foundations (light bases)

- electrical handholes (pull boxes)– Minneapolis Standard
- street lighting pole wire
- in-the-line fuse holders and fuses
- service cabinets pad mounted, and service laterals
- service cabinet foundations
- end caps
- bus shelter feeds and circuitry
- lighting and bus shelter conductors

The electrical contractor is responsible for coordinating the turn on of all permanent electrical services with the City of Minneapolis Traffic and Parking Services Division (TPS) and Xcel Energy. After State of Minnesota electrical inspection and approval of each metered electrical service location and after notification is provided to the TPS Electrical General Foreman (612-673-5759), the City will submit an application for electrical connection and meter installation to Xcel Energy.

SL-1.2 GENERAL

The distribution circuits of the lighting system shall be of the multiple types consisting of four conductors installed in conduit. Three of the conductors shall constitute two 120-volt circuits and the fourth conductor shall be used as an equipment ground.

Power supply to the lighting system is metered 120/240 volt, single phase, alternating current, and shall be distributed from separate service cabinets regularly spaced throughout the project.

Reference to “the City” or “the City of Minneapolis” in these Special Provisions shall be interpreted to mean “the City of Minneapolis Traffic and Parking Services” or its designated representative.

The Contractor for this Contract shall be responsible for locating all Contractor-installed underground facilities within or outside the project limits until acceptance of the completed project by the City.

The City shall review and approve all work performed by the Contractor prior to the Contractor requesting acceptance by the Engineer.

SL-1.3 SHOP DRAWINGS AND SUBMITTALS

The Contractor shall submit to the Engineer for approval a complete list of electrical system components. This list shall include the names of all suppliers and manufacturers and catalog numbers for the various components. This list must be approved by the Engineer prior to initiating any work on the Electrical Systems.

The Contractor shall furnish to the Engineer, for preliminary review, four (4) complete sets of shop detail drawings, in accordance with the provisions of Mn/DOT 2471.3B. The shop detail drawings shall be identified by "City of Minneapolis" and the fabricator. Three sets of drawings shall be returned to the Contractor showing any necessary corrections.

The Contractor shall furnish and obtain approval of templates used for setting anchor bolts and verifying concrete workmanship for all light and cabinet bases.

The Contractor shall furnish to the Engineer, for final approval, five (5) complete sets of shop detail drawings. The five sets of drawings shall be distributed, after approval to the following:

(1) Contractor
(2) Contractor's Fabricator
(3) Project Engineer (two sets)
(4) City of Minneapolis Traffic and Parking Services

Approval of shop drawings and submittals shall neither relieve the Contractor from the responsibility for deviations from the drawings or specifications unless he has, in writing, called the Engineer's attention to the deviations at the time of submission, and secured written approval, nor shall it relieve him from the responsibility for errors in shop drawings or submittals.

Provide certification by a registered engineer in the State of Minnesota that the lighting units have been designed to the loading requirements of the most current AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals.

Submittals specifically for any proposed alternate lighting units must be delivered to the Engineer no later than 4:00 p.m. sixteen (16) calendar days prior to bid opening. Only lighting units as shown in Contract drawings or pre-approved prior to Bid Opening will be accepted. A

submittal for an alternate lighting unit and banner pole shall include the following:

(1) Complete catalog cuts sheets for pole, arm, luminaire, and accessories. All sizes, weights, styles, functionality, certifications, and colors shall conform to the Plans and specifications. Provide detailed color submittal with a sample.

(2) Provide for evaluation by the Engineer one sample of the Special 1 Lighting Unit (Luminaire, Pole and Arm). Samples must be delivered to the City of Minneapolis office at 300 Border Avenue.

(3) Paint process information.

(4) Photometric analysis in AGI32 format that demonstrates the luminaires proposed will provide illumination levels, uniformity and veiling luminance levels per City of Minneapolis guidelines for the adjacent roadway(s). Upon request, the Engineer will provide an electronic AGI32 file with all parameters set up. All submittals shall use the geometries, settings (LLF =.72), calculation grids, light locations, light heights and other parameters contained in the file obtained from the Engineer. The Proposer shall only change the fixture, re-compute the analysis, and submit the electronic file to the Engineer for evaluation.

(5) Provide manufacturers warranty information.

SL-1.4 MATERIALS

The Engineer reserves the right to sample, test, inspect, and accept or reject any of the materials used for the Lighting Systems based on Mn/DOT or City of Minneapolis tests. However, the Engineer may, at his option, accept materials on the basis of listing by Underwriters Laboratories, Inc.

Fabrication and inspection of structural metals used for the Lighting Systems shall be in accordance with the applicable provisions of Mn/DOT 2471.

A. Conduit

1. NMC Conduit: NMC conduit and conduit fittings shall be Type II heavy-wall rigid PVC Schedule 40 plastic conduit and conduit fittings per Mn/DOT 3803. NMC MUST be UL Listed, Labeled, and Marked per the NEC.

2. Metallic Conduit: Metal conduit shall be Rigid Steel Conduit (RSC) and conduit fittings per Mn/DOT 3801. Intermediate Metal Conduit (IMC) and conduit fittings are not permitted. RSC MUST be UL Listed, Labeled, and Marked per the NEC.

B. Handholes (Pull Boxes)

All hand holes shall be Minneapolis Electrical Hand holes which have high density polymer concrete frames and covers as shown in Minneapolis Standard Plate Nos. TRAF-1725 and TRAF-1730 in the Plans and shall conform to the City of Minneapolis standards. Frame & Cover shall meet Tier 22 rating requirements (ANSI/SCTE 77-2007). A drain field shall be provided with each hand hole. Concrete for supporting the high density polymer concrete frame and cover shall be Mix No. 3A32 or equal.

Hand holes rings and covers shall be constructed from high density polymer concrete with a City of Minneapolis approved Green Exterior coloring additive.

Existing metal handhole rings and covers that are to be relocated shall be cleaned and primed and finish painted.

C. Anchor Rods

Anchor rods, nuts, and washers shall be galvanized in accordance with the provisions of Mn/DOT 3392 and the details shown in the Lighting Plan.

Threaded portions of all anchor rods above the concrete cabinet foundations and pole foundations (light bases) shall be coated with an approved rust inhibitor before installation of street light poles, or service cabinets.

D. Electrical Cables and Conductors

All electrical cables and conductors shall conform to the requirements of Mn/DOT 2545.2D amended as follows.

The single conductor feeder wires, control wires, and distribution wires shall have Class B stranded annealed uncoated copper conductors and be listed by UL as Type RHW-2/USE-2, 90 degree C, crosslinked polyethylene, insulation rated 600 volts in accordance with Article 338 of the National Electrical Code. Cable shall meet requirements of ICEA Publication No. S-66-524,

NEMA Pub. No. WC7 for crosslinked-polyethylene-insulated wire and cable, and UL standard 854 for service entrance cables. Wire shall bear UL label for Type USE-2, have footage markings every meter, and surface-marking indicating manufacturer's ID, conductor size and metal, voltage rating, UL symbol and type designations**. The insulation on each conductor shall be colored red, black, green or white in accordance with the color-coding shown in the construction plan.**

Single conductor pole wires connecting the luminaire to the distribution circuits shall be 1/C #12 stranded wire with THHN/THWN rating.

E. Service Cabinet

The service cabinet shall be the City of Minneapolis standard street light and signal service cabinet; shall be no bigger than that shown on the Plans; and shall be a pad-mounted, weatherproof control cabinet. See Equipment Pad details for specific service cabinet requirements at each service point.

1. Pad Mount Signal/Lighting Service Cabinet Non-CBD

The service cabinet shall be constructed in accordance with City of Minneapolis Standard Plate Nos. Traf-3463 and Traf-3635 and the following:

a. The cabinet enclosure (physical enclosure only) shall be UL listed with the UL label affixed to the inside of the cabinet, and shall carry a NEMA 3R rating to provide a degree of protection against rain, sleet, snow, and dripping water.

b. Each cabinet shall be free of flaws, cracks, dents and other imperfections.

c. All surfaces shall be smooth and clean.

d. All seams and joints shall be smooth and even, without cracks, air leaks or pinholes with no sharp or jagged edges.

e. All interior attachments to the cabinet exterior sheet metal shall be welded (i.e. no through bolts).

f. There shall not be any sheet metal attached externally to the cabinet shell.

g. The design, workmanship and attachment of the one-piece panel boards and dead fronts shall be a secure and aligned containment for the circuit breakers. The one-piece panel board and dead fronts shall be stamped with easily removable blank breaker cutouts to match the full capacity of the breaker panel. The panel board breaker cutouts shall precisely match the containment provisions of the breakers.

h. The screws for attaching the cabinet dead fronts shall be of a permanent capture design to prevent lost and misplaced screws. Attachment of the dead fronts to the cabinet shall be accomplished using threaded inserts and offset cam cylinder latches.

i. Contactors shall be normally open, NEMA rated, AC lighting contactors rated 277/480 volts with a 120-volt, 60 Hz coil, and contacts rated for 60 ampere tungsten filament load. Contactors shall be double lugged with the double lugs on the contactors installed such that field wires shall be connectable on the front lugs of the contactor. Contactors shall be installed vertically in the cabinet. Contactors shall have a positive gravity release. Contactors shall have an (off or on) condition display mechanism.

j. The service cabinet shall have one 100 amp two-pole thermo-magnetic circuit breaker as a main breaker and single pole thermo-magnetic circuit breakers as branch breakers on each circuit panel.

k. The Vendor shall furnish and install the following in each service cabinet:
- Two (2) **<u>200 amp meter sockets</u>** with disconnect.
- One (1) bracket mounted single pole test switch rated 15 amperes at 125 volts.
- Two (2) 60 amp two pole contactors.
- 15 amp and 60 amp circuit breakers as indicated on details.
- One (1) photoelectric cell.

- Two (2) 12 circuit panels.

l. The photoelectric cell shall have normally open contacts rated 15 amperes. The photo control shall be installed within the lighting service cabinet. It shall be bracket mounted immediately behind a Plexiglas covered hole. The hole shall be located on the side of the cabinet. The hole size and location shall be as shown on the service cabinet detail. Mounting shall be as directed by the Engineer. The photoelectric control shall be in accordance with the MN/DOT 3812 and have a minimum 30-second time delay capability.

m. The electric meters shall be installed within the service cabinet as shown in the details. The electric meter sockets shall be suitable for single phase, 3 wire, 120/240 volt service with a utility approved manual bypass switch. The Utility Company will provide the electric meters. Sockets shall be provided and installed by the vendor. The placement of the meter socket and meter, door lock, and the viewing window shall permit the door to be closed, and the meter to be read electronically from outside the cabinet.

n. Each cabinet shall have an anodized etched finish (Aluminum Association C22) with an Architectural Class 1 (Aluminum Association A42) hard coat finish of at least 0.7 mil. Finish color shall be either dark bronze or 30 minute clear aluminum as directed by the City.

o. Locks shall be furnished and installed by vendor. Locks shall be keyed for a standard No. 2 traffic signal key.

p. No company logo's and/or advertising shall be placed on any part of the cabinet exterior.

2. Pad Mount Signal/Lighting Service Cabinet CBD

The service cabinet shall be constructed in accordance with City of Minneapolis Standard Plate Nos. Traf-3455 and Traf-3631 and the following:

a. The cabinet enclosure (physical enclosure only) shall be UL listed with the UL label affixed to the inside of the cabinet, and shall carry a NEMA 3R rating to provide a degree of protection against rain, sleet, snow, and dripping water.

b. Each cabinet shall be free of flaws, cracks, dents and other imperfections.

c. All surfaces shall be smooth and clean.

d. All seams and joints shall be smooth and even, without cracks, air leaks or pinholes with no sharp or jagged edges.

e. All interior attachments to the cabinet exterior sheet metal shall be welded (i.e. no through bolts).

f. There shall not be any sheet metal attached externally to the cabinet shell.

g. The design, workmanship and attachment of the one-piece panel boards and dead fronts shall be a secure and aligned containment for the circuit breakers. The one-piece panel board and dead fronts shall be stamped with easily removable blank breaker cutouts to match the full capacity of the breaker panel. The panel board breaker cutouts shall precisely match the containment provisions of the breakers.

h. The screws for attaching the cabinet dead fronts shall be of a permanent capture design to prevent lost and misplaced screws. Attachment of the dead fronts to the cabinet shall be accomplished using threaded inserts and offset cam cylinder latches.

i. Contactors shall be normally open, NEMA rated, AC lighting contactors rated 277/480 volts with a 120-volt, 60 Hz coil, and contacts rated for 60 ampere tungsten filament load. Contactors shall be double lugged with the double lugs on the contactors installed such that field wires shall be connectable on the front lugs of the contactor. Contactors shall be installed vertically in the

cabinet. Contactors shall have a positive gravity release. Contactors shall have an (off or on) condition display mechanism.

j. The service cabinet shall have one 100 amp two-pole thermo-magnetic circuit breaker as a main breaker and single pole thermo-magnetic circuit breakers as branch breakers on each circuit panel.

k. The Vendor shall furnish and install the following in each service cabinet:
- Two (2) **200 amp meter sockets** with disconnect.
- One (1) bracket mounted single pole test switch rated 15 amperes at 125 volts.
- Two (2) 60 amp two pole contactors.
- 15 amp and 60 amp circuit breakers as indicated on details.
- One (1) photoelectric cell.
- Two (2) 12 circuit panels.
- Power distribution terminal block.
- Current limiting protector.

l. The photoelectric cell shall have normally open contacts rated 15 amperes. The photo control shall be installed within the lighting service cabinet. It shall be bracket mounted immediately behind a Plexiglas covered hole. The hole shall be located on the side of the cabinet. The hole size and location shall be as shown on the service cabinet detail. Mounting shall be as directed by the Engineer. The photoelectric control shall be in accordance with the MN/DOT 3812 and have a minimum 30-second time delay capability.

m. The electric meters shall be installed within the service cabinet as shown in the details. The electric meter sockets shall be suitable for single phase, 3 wire, 120/240 volt service with a utility approved manual bypass switch. The Utility Company will provide the electric meters. Sockets shall be provided and installed by the vendor. The placement of the meter socket and meter, door lock, and the viewing window shall permit the door to be

closed, and the meter to be read electronically from outside the cabinet.

n. Each cabinet shall have an anodized etched finish (Aluminum Association C22) with an Architectural Class 1 (Aluminum Association A42) hard coat finish of at least 0.7 mil. Finish color shall be either dark bronze or 30 minute clear aluminum as directed by the City.

o. Locks shall be furnished and installed by vendor. Locks shall be keyed for a standard No. 2 traffic signal key.

p. No company logo's and/or advertising shall be placed on any part of the cabinet exterior.

F. Lighting Unit General Specifications

Poles and fixtures used for street lighting must be approved for use by the City of Minneapolis. Approval is based on operation, maintenance, and cost criteria. The following web site links provide information on the City of Minneapolis Street Lighting Policy.

http://www.minneapolismn.gov/streetlighting/docs/mpls-street-lighting-policy.pdf

http://www.minneapolismn.gov/streetlighting/docs/mpls-street-lighting-policy-highlights.pdf

Contact Minneapolis Traffic and Parking Services for current lighting unit specifications.

Finishes

The luminaires, poles, arms, fitters, and all other exposed hardware shall be finished with polyester powder paint to insure maximum durability.

All painted metal parts shall go through an alkaline cleaning process, receive microcrystalline phosphate pretreatment, a sealing treatment, then the prepared metal surface shall be thoroughly rinsed with high purity deionized water to remove unwanted chemicals. A controlled drying process shall be completed prior to

applying the electrostatic polyester powder paint. Color shall be per architectural specification.

Warranty

All material for lighting units and banner poles shall come with a 5-year manufacturer's warranty. This warranty shall cover defects in material and workmanship for the paint finish, mechanical, optical, and electrical components. The manufacture shall either repair or replace any lighting unit or banner pole components due to these defects.

Interchangeability of Parts

All major assembly items (pole, arm, fitter, luminaire) for lighting units shall be interchangeable with lights currently approved by the City.

G. Fuses

Street Light Standards in the 120/240-volt system shall be fused in accordance with Plan details. Fuses and fuse holders shall be "UL" listed. Fuse holders shall be Ferraz-Shawmut in-the-line FEB-11-11 with a FSB-1 waterproof boot and a Bussman BAF-10 single element fuse, or approved equal.

H. Light Base Design (Foundations)

Light pole bases and anchor rods shall be in accordance with City of Minneapolis Standard Plates. Contact Minneapolis Traffic and Parking Services for the current Standard Plate.

I. Equipment Pad (M)

Anchor rods, nuts and washers in each lighting service cabinet concrete foundation shall be Type A Anchor Rods in accordance with Mn/DOT 3385; shall be galvanized full length in accordance with MN/DOT 3392; and shall be four (4) sets in quantity for each cabinet (anchor rod, two hex head nuts, and washer). Each anchor rod shall be ¾ inch diameter by 20 inches long before bending a 2-inch "L" on one end and the other end shall be threaded a minimum of 8 inches. Each anchor shall be provided with two (2) galvanized nuts and one galvanized washer. Service cabinet

foundations shall be constructed in accordance with City of Minneapolis Standard Plate No's. Traf-3094 or Traf-3088 as shown on the Plans.

J. Availability of Material

Handhole (pull box) rings and covers, which meet the requirements of these Special Provisions may be able to be purchased depending upon availability from the Minneapolis Public Works Department, Traffic and Parking Services at the option of the Contractor. Contact Traffic Stores at (612) 673-5750.

SL-1.5 CONSTRUCTION REQUIREMENTS

A. Conduit Placement

Conduit size throughout the lighting project shall be 2-inch NMC unless otherwise noted on the Plans.

Conduits shall be installed underground a maximum of 12 inches from the back of the curb, except through bridges, approach slabs, and under railroad facilities, to a depth of 2 feet, as shown in the Plans or as directed by the Engineer. All conduits installed beneath surfaced streets shall be installed with a minimum cover of 2 feet. Cover material shall not contain rock or other debris that could damage the conduit. The cover material shall be firmly tamped into place in 6-inch lifts to minimize uneven settlement above or below the conduit.

The Contractor shall install red City of Minneapolis Traffic and Parking Services marking tape for marking underground Traffic utilities at a distance of 6 inches above all new conduit placed by the trenching method. Installation of the marking tape by the Contractor will be considered to be incidental work to installing the conduit and no direct payment will be made therefore. The required marking tape shall be purchased from the City of Minneapolis Traffic and Parking Services at 300 Border Avenue North.

1. Extension of Conduits:

The Contractor shall provide a continuous length of conduit of size and type noted on the Plans between the specified terminal points.

2. Installation of Conduit into handholes (pull boxes):

   Conduits shall be installed entering handholes (pull boxes) through the sidewalls of the handholes (pull boxes), not through the bottom gravel foundation. Conduits shall be installed into handholes (pull boxes) by use of a hole saw to cut through the handhole (pull box) wall. Areas surrounding conduit entrances shall be sealed by filling them with mortar. Conduits installed by the Contractor shall extend a minimum of 2 inches and no more than 3 inches into any handhole (pullbox).

3. Installation of Conduits Under Driving Surface and Sidewalk:

   All conduits that are to be placed under driveways, streets and sidewalk that are not scheduled for removal shall be directional bored, or other method approved by the Engineer that will not damage or disturb the integrity of the driveway, street or sidewalk. All conduits that are to be placed under driveways, alleys, streets, or sidewalk that are scheduled for removal must be placed during the time between the removal of the existing surface and the commencement of pavement operations. The Contractor is responsible for coordination with the paving operation.

4. Extension of Conduit into Handholes (pull boxes) at Traffic Signal Locations:

   The signal assemblies with street light fixtures will have conduit stub outs. These stub outs shall be extended by the Contractor into handholes (pull boxes) installed under the lighting construction Plans and specifications. The Contractor shall be responsible for verifying and coordinating the locations of these handholes (pull boxes) with signal construction prior to placing lighting conduits. Lighting and signals are not to share any conduit unless directly stated in the Plan or directed to do so by the Engineer in writing.

5. Connection to Existing Conduits:

   The Contractor shall locate the ends of existing conduits as shown in the Plans and extend the conduit to handhole (pull box), luminaire pole base, etc. which is to be built by the

Contractor. Existing conduits exterior surface shall be cleaned to form a secure connection to the extension.

6. In general, all conduit runs shall be straight and true, and all offsets and bends shall be uniform and symmetrical**. Field bends of conduit shall not be permitted unless performed with an approved heating / bending unit designed for that purpose.** The Contractor shall adjust the elevations of the conduit assembly, for its full length, to approximately the same gradient as the finished roadway, and shall furnish and install, in the trench, such suitable spacers and framing as may be necessary to maintain the correct grade and alignment.

B. Handholes (Pull Boxes)

Frames and covers shall be set in a bed of mortar and leveled to the finished surrounding grade. High density polymer concrete frame and covers constructed in accordance with City of Minneapolis Standard Plate No. Traf-1725 shall be furnished and installed by the Contractor. Handholes (pullboxes) shall be constructed in accordance with Minneapolis Standard Plate No. Traf-1730. A drain field shall be provided with each hand hole (pullbox).

Existing relocated and reused or new metal handhole (pullbox) frames and covers constructed in accordance with City of Minneapolis Standard Plate No. Traf-1715 shall be furnished and installed by the Contractor and electrically grounded. Handholes (pullboxes) shall be constructed in accordance with Minneapolis Standard Plate No. Traf-1710. A drain field shall be provided with each hand hole (pullbox). Frames and covers for new or relocated hand holes shall be prepared for grounding prior to installation. Grounding shall be accomplished by attaching ground lugs for connecting both a 30 inch long #6 solid copper ground wire to the underside of the hand hole ring and a 12 inch long #2 braided ground cable between the underside of the hand hole ring and the underside of the hand hole cover. Handhole (pullbox) frame shall be connected with a ground clamp to a 1/2 inch by 8 ft ground rod sunk inside of the hand hole.

Conduits shall be installed by the use of a hole saw to cut through the handhole (pullbox) wall. The area surrounding the conduit entrance shall be sealed with a mortar filling. Conduits shall extend a minimum of 2 inches and not more than 3 inches into the handhole (pullbox).

The Contractor shall remove to the bottom of the handhole (pullbox), any excess material inside of the handhole (pullbox).

The Contractor shall salvage in place handholes (pullboxes) not reused as part of a revised permanent signal system unless otherwise directed by the Engineer.

Salvaged and reused metal frames and covers shall be painted before reuse. Metal frames and covers shall be pretreated prior to concrete placement such that the concrete does not adhere to exposed surfaces. Frames and covers shall be cleaned free of adhering concrete after placement. Painting of the metal frames and covers shall be as specified elsewhere in these Special Provisions.

High density polymer concrete frames and covers shall be covered during sidewalk and concrete pad placement to protect them from adhering concrete. Failure to do so will require the ring and/or cover to be replaced by the Contractor if concrete adherence occurs.

C. Foundations (Light Bases)

All street light foundations (light bases) shall be constructed as shown on the Plan details and shall be located in the field by the Engineer. In general, the foundations (light bases) shall be placed with the centerline of the foundation (light base) 24 inches from the backside of the curb at the appropriate elevation relative to the surrounding terrain. The Contractor is responsible for obtaining the location of existing utilities and for identifying any possible conflicts. Any such conflicts shall be reported immediately to the Engineer.

Concrete for all foundations (light bases) shall be Mix. No. 3Y43 free of chloride additives, placed and consolidated using vibratory equipment and be finished <u>smooth, flat and level</u> in accordance with the provisions of Mn/DOT 2565.3F. Edges shall not be beveled or chamfered. Concrete shall be allowed to cure for a minimum of seven (7) days before being placed into use unless otherwise permitted by the Engineer.

Concrete base finishing shall be smooth, flat, and level. No more than 0.25 inches of variability compensated by shims will be allowed. Variability in excess of this will require resurfacing or replacement at the direction of the Engineer. Inspections will be performed using a Contractor supplied City approved ½" thick

steel template manufactured to match the lights bolt circle and foot print dimensions. The first base shall be inspected in detail, approved and used as the standard for finish and workmanship. All foundations shall be installed utilizing approved templates. All templates required are incidental to the project.

Improperly constructed foundations shall be removed and replaced when directed to do so by the Engineer or corrected by the City Forces at the expense of the contractor.

Provide an additional conduit sweep when the base is for the last light on a circuit.

D. Installation of Lighting Units

The Contractor shall mount light standards directly on the foundation (light base). The use of leveling nuts is not permitted. Any light standards that are not plumb shall be corrected up to 0.25 inches using stainless steel washers. **The Contractor, at the Contractor's expense, shall recap or replace foundations (light bases) that are incorrectly installed.**

E. Wiring of Luminaires

The four conductor lighting distribution circuits shall pass through the transformer base of each street light luminaire pole, and traffic signal light pole as shown on Plans. The lighting circuits share a common ground. The conductors shall be fused with the fuses installed in the phase wire to the luminaire-mounted ballast at the base of the light standards as directed by the Plans, specifications herein, and the Engineer. Fuse holders shall be installed in such a manner that the fuse stays with the load side when the holder is separated. Suitable solderless connectors shall be used. All splices must take place in pole bases unless approved by the Engineer. All splices shall be weather tight and use Burndy Multi-Tap BIBS-4-3 or 4-4 connectors as noted in City of Minneapolis Standard Plate Nos. Traf-3623 and Traf-3627.

Sufficient excess conductor length shall be provided for maintenance purposes. In addition, the Contractor shall form loops in the leads on each side of the fuse holders and so position the fuse holders so that they may be easily removed or inserted through the access hole. The grounding conductor shall not be fused.

The 120 VAC conductor to the luminaires shall be alternately connected to the red or the black conductor of the street lighting distribution circuit. No two loads shall be wired on the same phase consecutively.

The Contractor shall submit a sample of the fuse holder and splice connectors they will be installing BEFORE any installations are made.

F. Grounding

The grounding conductor shall be bonded to the grounding lug and the foundation (light base) ground rod at every street light. A No. 12 AWG bare copper conductor shall be used.

G. Painting

All lighting units shall be factory painted by the manufacturer as described in the lighting unit section.

Painting of all other equipment shall be in accordance with the provisions of Mn/DOT 2565.3, except that finish coat paint for all items shall be two coats.

New metal handhole (pullbox) or existing metal handhole (pullbox) rings and covers that are scheduled for use or reuse shall be primed with a red oxide primer and finished with a City approved Green Exterior Enamel. If field painting is required, it shall be approved in advance and be accepted by approval of the Engineer.

Paint samples must be submitted to the Engineer for approval prior to painting. The Contractor shall furnish all paint required after confirmation of the exact paints and colors.

All lighting units shall be shop or factory painted as required except for providing any necessary repairs of damage to paint coats that occur during unloading and erection at the site.

H. Wiring of Service Cabinets

Where service equipment is supplied from the Utility Company's overhead circuits, lightning surge arrestors shall be installed in the cabinets on the supply side of the service equipment.

At the pad mounted service cabinets, the Contractor shall establish a 25-ohm ground by the use of copper clad ground rods.

A No. 6 AWG bare copper wire shall be extended from the ground rods and be bonded to the pad mounted service cabinet. The ground rods shall be cast into the service cabinet pad and be inside the service cabinet frame.

When called for in the Plans, two (2) No. 2 AWG lighting conductors and one No. 2 AWG neutral conductor shall be extended underground from the pad mounted service cabinet in 2 inch RSC conduit to the utility company service vault or transformer.

When called for in the Plans, two (2) No. 2 AWG lighting conductors and one No. 2 AWG neutral conductor shall be extended underground, in conduit, from the pad mounted service cabinet to the utility companies pole and up the pole in 2 inch rigid galvanized steel conduit to a weather head located below the utility distribution circuits as directed by the utility and as shown on City of Minneapolis Standard Plate No. Traf-3510 and in the Plans.

The ground conductor shall be terminated in and be bonded to the pad mounted control cabinet. The neutral conductor shall be bonded to the ground conductor in the pad mounted control cabinet.

Feeder conductors shall be color-coded in the control cabinet and at the weather head or service vault.

The utility will make the final service connections after the Contractor has filed a Certificate-Affidavit of Inspection, with the utility.

I. Cabinet Pads

Concrete pad finishing shall be smooth, flat, and level. No more than 0.125 inches of variability compensated by shims will be allowed. Variability in excess of this will require resurfacing or replacement at the direction of the Engineer. Inspections will be performed using a Contractor supplied City approved ½” thick steel template manufactured to match cabinet dimensions. The first pad shall be inspected in detail, approved and used as the standard for finish and workmanship. All templates required are incidental to the project.

J. Removing and Salvaging Existing Systems

When directed by the Engineer, the Contractor shall remove and salvage all items of the existing street lighting systems, underground cable, conduit, service equipment, cabinet and street light foundations (light bases), and handholes (pull boxes), in accordance with the applicable provisions of Mn/DOT 2104; with the applicable provisions of Mn/DOT 2565.3T, and the following:

1. Underground conduit shall be removed unless otherwise directed by the Engineer.

2. The salvaged lighting units and handhole (pullbox) rings and covers shall be delivered to the City of Minneapolis Traffic and Parking Services at 300 Border Avenue North in Minneapolis. The salvaged material shall be deposited where and as directed by the Engineer.

   The Contractor shall notify Mr. Larry Mountjoy at 612-673-5514 at least three working days in advance of hauling any material to storage.

   Any damage to the salvaged materials resulting from the salvage operation shall be repaired and replaced at the Contractor's expense.

3. Salvaged Luminaires shall be removed from the luminaire mast arms before being delivered to the City of Minneapolis.

4. Concrete pole foundations (light bases), conduit, and other items, deemed nonsalvagable by the Engineer, of the existing street lighting systems shall be removed and disposed of outside the right of way in any manner that the Contractor may elect subject to the provisions of Mn/DOT 2104.3C3 and as noted elsewhere in these Special Provisions.

5. Removal of Existing Underground Facilities

   All existing underground street light facilities will be removed under the site work activities. The Contractor shall perform removal of existing conduit, handholes, (pull boxes), cabinet foundations and pole foundations (light

bases) during pavement and sidewalk removal. Removal of existing cable between lighting units shown on the Plans shall be performed by the Contractor prior to pavement and sidewalk removal. The removal of cable and handholes (pull boxes) shall be considered incidental to the lighting unit and conduit removal activity and no direct compensation shall be paid for this work.

6. The concrete pole foundations (signal and light bases) and the underground signal and lighting conduits include asbestos containing electrical conduits (Transite). The 3' x 18" vertical pipe in handholes may also contain asbestos (Transite). Underground signal and lighting conduits that contains asbestos will have been encased in concrete at the time of installation. Hennepin County has developed a procedure for handling and disposal of these asbestos-containing materials that shall be followed by the Contractor. For procedure, see the Appendix for the "Technical Specifications for the Excavation of Asbestos Containing Electrical Conduit".

7. The removal and salvage of in-place lighting units shall be measured on an each basis.

8. The provisions on Mn/DOT 1903 are modified such that no price adjustment will be made in the event of increased or decreased quantities for removing and salvaging existing systems.

K. Final Lighting Systems Inspection

The Contractor shall not receive full payment for the installation of the lighting systems nor will the City take over maintenance responsibility for the lighting system until the City of Minneapolis performs a punch list inspection of the installed facilities and all noted discrepancies are corrected by the Contractor to the satisfaction of the City.

DIVISION SS - SIGNALS

SIGNAL SPECIFICATION
UPDATED: December 8, 2011

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Standard Supplemental Specifications For The Construction of Public Infrastructure In The City of Minneapolis
DIVISION SS - SIGNALS

SS-1 (2565) TRAFFIC CONTROL SIGNALS

A. This work shall consist of furnishing and installing all materials and electrical equipment to provide a new pre-timed, or semi traffic actuated, traffic control signal system at the following locations:

System A –
System B –
System C –
System D –
System E –
System F –
System G –

B. This work shall consist of removal and salvage of all or portions of in place traffic signal control systems from the following locations:

System A –
System B –
System C –
System D –
System F –
System G –

Removal and disposal of conduit and handholes with asbestos containing conduits (Transit) shall be paid for under separate bid item, see lighting specifications.

C. This Contract also includes work which consists of furnishing and installing an interconnect system between traffic control systems:

Interconnection of Systems "A-G" to each other, and removing and reinstalling interconnect to others signal systems as shown on the plans.

D. The following work to be completed by the "City of Minneapolis" shall consist of furnishing and installing, and removing and salvaging all materials and electrical equipment to provide temporary traffic signal control systems and modifications to systems "A", "B", "C", "D", "E", "F" and "G".

The Contractor shall notify the "City of Minneapolis" at least thirty (30) working days before the above work needs to be completed. The Contractor shall also notify the "City of Minneapolis" at least five (5) working days before any modifications to the temporary traffic signals are needed.

Standard Supplemental Specifications For The Construction of Public Infrastructure In The City of Minneapolis
DIVISION SS - SIGNALS

This work shall be done in accordance with the applicable Minnesota Department of Transportation "Standard Specifications for Construction," 2005 Edition.

SS-1.1 GENERAL

A. All applicable provisions of the current edition of the National Electrical Code shall apply in constructing the traffic control signal systems.

B. Reference to "the City" or "the City of Minneapolis" in these Special Provisions shall be interpreted to mean "the City of Minneapolis Traffic and Parking Services" or its designated representative.

C. City forces shall make all field lead connections in the City of Minneapolis furnished traffic signal cabinet at each System. The Contractor for this Contract shall label all cables and conductors in accordance with the field-wiring diagram at each System.

D. The City shall approve all foundation and loop detector locations before construction is commenced.

E. The Contractor for this contract shall be responsible for locating all Contractor installed underground facilities within or outside the project limits until acceptance of the completed project by the City.

F. The City shall review and approve all work performed by the Contractor prior to the Contractor requesting acceptance by the Engineer.

G. The Contractor's attention is specifically directed to the requirements of 2565.2A5 regarding the required in service warranty period for workmanship and materials.

SS-1.2 MATERIALS

A. Metal Conduit

Metal conduit shall be Rigid Steel Conduit (R.S.C.) and conduit fittings per Mn/DOT 3801 Intermediate Metal Conduit (I.M.C.) and conduit fittings are not permitted.

B. Non-Metallic Conduit

Non-metallic conduit (N.M.C.) and conduit fittings shall be Type II heavy-wall rigid PVC Schedule 40 plastic conduit and conduit fittings per Mn/DOT 3803.

C. Handholes

All hand holes shall be Minneapolis Electrical Hand holes which have high density polymer concrete frames and covers as shown in Minneapolis Standard Plate Nos. TRAF-1725 and TRAF-1730 in the Plans and shall conform to the City of Minneapolis standards. Frame & Cover shall meet Tier 22 rating requirements (ANSI/SCTE 77-2007). A drain field shall be provided with each hand hole. Concrete for supporting the high density polymer concrete frame and cover shall be Mix No. 3A32 or equal.

Hand holes rings and covers shall be constructed from high density polymer concrete with a City of Minneapolis approved Green Exterior coloring additive.

Existing handhole rings and covers that are to be relocated shall be cleaned and primed with a red oxide primer, and finished with City of Minneapolis approved Green Exterior Enamel.

D. Anchor Rods

The Contractor shall furnish all required anchor rods, nuts, and washers in traffic signal pedestal concrete foundations and in mast arm pole foundations.

1. Minneapolis Mast Arm Foundation: Anchor rods, nuts, and washers in each mast arm pole standard concrete foundation shall conform to the City of Minneapolis standards; shall be galvanized at least the top half of each anchor rod in accordance with the provisions of Mn/DOT 3392; and shall be four (4) sets in quantity (anchor rod, two nuts, and two washers) of the dimensions and configuration in accordance with the "Minneapolis Overhead Signal Foundation" (Minneapolis Standard Plate Nos. Traf-1120 and Traf-1130) in the Plans. All anchor rods required in each mast arm pole standard concrete foundation shall be either size 1.75 inches diameter by 71 inches long or 1.5 inches diameter by 68 inches long, as specified. See

Minneapolis Standard Plate Nos. Traf-1072 and Traf-1074 in Plans.

2. Traffic Signal Pedestals: Anchor rods, nuts, and washers in each traffic signal pedestal concrete foundation shall conform to the City of Minneapolis standards; shall be galvanized at least the top 28 inches of each anchor rod in accordance with the provisions of Mn/DOT 3392; and shall be three (3) sets in quantity (anchor rod, nut, and washer) of the dimensions and configurations in accordance with the "Minneapolis Signal Base Anchor Rod" detail in the Plans. All anchor rods required in each traffic signal pedestal concrete foundation shall be size 5/8 inches diameter by 40 inches long before bending. See Minneapolis Plate No. Traf-1140.

3. Rust Inhibitor: Threaded portions of all anchor rods above the concrete foundations shall be coated with an approved rust inhibitor before installation of the mast arm pole standards, and traffic signal pedestals on the anchor rods.

E. Traffic Signal Electrical Cables And Conductors

1. The provisions for electric cables and conductors of Mn/DOT 2565.3J and Mn/DOT 3815 are modified as follows. The required electrical cables to Xcel's feed points shall be furnished and installed by the Contractor and shall be the size as required by the power company.

2. Detector Lead-in Cable: Detector lead-in cable shall meet the requirements of the International Municipal Signal Association (IMSA) Specifications 50-2, latest revision thereof for polyethylene insulated, polyethylene jacketed loop detector lead-in cable. All conductors shall be #14 A.W.G. unless otherwise specified on the Plans.

3. Signal Control Cable: The multiple conductor control cables for traffic control signals shall meet the following specification. This specification describes multi-conductor Type TC Tray Cable insulated with FR-XLP flame-retardant cross-linked polyethylene and PVC jacketed overall, for use on circuits rated 600 volts at 90 degrees C maximum continuous conductor temperature in wet or dry locations. The cables shall be approved for installation in

cable trays in accordance with Article 340 of the NEC and also for use in Class 1 remote control and signaling circuits per Article 725-11(b) of the Code. Cable shall be approved for installation in open air, in ducts or conduits, in tray or trough, and be suitable for direct burial.

Applicable Standards

a. The following standards shall form a part of this specification to the extent specified herein:

- Underwriters Laboratories Standard 1277 for Type TC Power and Control Tray Cables.
- Underwriters Laboratories Standard 44 for Rubber Insulated Wires and Cables.
- ICEA Pub. No. S-66-524, NEMA Pub. No. WC7, Cross-linked-polyethylene-insulated Wire and Cable.
- ICEA Pub. No. S-73-532, NEMA Pub. No. WC57, Control Cables
- IEEE Standard 1202 - Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies.

b. Conductors

Conductors shall be Class B stranded uncoated soft copper conforming to Part 2 of ICEA. Conductor sizes shall be 14 AWG. A nonhygroscopic separator may be used over the conductors at the option of the manufacturer.

c. Insulation Compound:

Each conductor shall be insulated with FR-XLP flame-retardant chemically cross-linked polyethylene, meeting the requirements of ICEA S-66-524, Par. 3.6, ICEA S-73-532, Table 3-2 (Type I-XLPE) and Type XHHW-2, VW-1 requirements of Underwriter's Laboratories.

- Thickness: The average thickness of insulation shall be 30 mils. The minimum thickness at any point shall be not less than 90 percent of the specified average thickness.

d. Circuit Identification

Circuit identification shall consist of Method 1 color coding for National Electrical Code applications in accordance with ICEA S-73-532, Appendix E, Table E-2. Cables shall contain the following color coding for individual conductors: 1-Black, 2-White, 3-Green, 4-Red, 5-Blue, 6-Orange, 7-Yellow, 8-Red w/Black tracer, 9-Blue w/Black tracer, 10-Orange w/Black tracer, 11-Yellow w/Black tracer, 12-Black w/White tracer. Tracers shall be either spiral bands or hash marks on opposite sides of each conductor.

e. Assembly

The insulated color-coded conductors shall be cabled together with nonhygroscopic fillers, when necessary to make round. The cable assembly shall be covered with a suitable tape applied with a 10 percent minimum lap.

f. Overall Jacket

- Compound: Each cable shall have a PVC protective jacket applied over the assembly. The jacket shall meet the requirements of Part 4 of ICEA S-73-532, Table 4-2, and the Sunlight Resistant requirements of UL Standard 1277.

- Thickness: The average jacket thickness shall be in accordance with UL Standard 1277. The minimum thickness at any point shall be not less than 80 percent of the specified average thickness.

g. Surface Marking

Cables shall be clearly identified by means of surface ink printing indicating: Manufacturer, Type TC, (UL), 600V, 12 conductors, #14, XHHW-2 (or

90 degrees C) Conductors, Sunlight Resistant, Direct Burial, E57349, and have length markings approximately every meter.

h. Tests

- Individual conductors and completed cables shall be tested in accordance with UL requirements for Type TC Power and Control Tray Cables having XHHW-2 VW-1 insulated conductors.

- Cables shall be capable of passing the ribbon burner cable tray flame test requirements of UL and IEEE Standard 1202.

4. Signal Head Wire: All circuit wiring from the signal base or transformer base to the traffic signal vehicle and pedestrian indications in pedestal and mastarm poles shall be 1/C#14 AWG solid copper wires with XHHW rating. The conductors shall have insulation color coded in accordance with Minneapolis Plate No's. Traf-1560, Traf-1566, Traf-1578 and Traf-1584.

5. Mast Arm Head Cable: All circuit wiring from the transformer base to the traffic signal vehicle indications mounted on the mastarm of a mastarm pole shall be a Type-TC 90 degree 600 volt cable composed of 7-1/C#14 AWG THHN/THWN stranded copper wires in a sunlight resistant direct burial jacket. The conductors shall have insulation color coded in accordance with Minneapolis Standard Plate Nos. Traf-1560 and Traf-1566.

6. Loop Wire: Wire used for inductive loops shall be single conductor No. 14 AWG standard copper insulated with filled chemically cross-linked polyethylene (XLP) and be constructed in accordance with IMSA Specification 511 with a polyvinyl chloride tube.

   Roadway loop detector conductors shall be one of the following or approved equal.

   - Model DSI-116S Loop Detector Wire as manufactured by Detector Systems, Inc., 11650 Seaboard Circle, Stanton, California 90680;

- Model 1419-XLP-TUBE as manufactured by Kris-Tech Wire Co., Inc. 921 Seneca Street, P.O. Box 4377, Rome, New York 13440-4377;

- Model 320095 Power Loop as manufactured by Tamaqua Cable Products Corporation, P.O. Box 347, Schuylkill Haven, Pennsylvania 17972.

The roadway loop detector conductors shall be approved by the Engineer before procurement.

7. Single Conductor Wires: The single conductor feeder wires, and control wires shall have Class B stranded annealed uncoated copper conductors and be listed by UL as Type RHW-2/USE-2, 90 degree C, crosslinked polyethylene insulation rated 600 volts in accordance with Article 338 of the National Electrical Code. Cable shall meet the requirements of ICEA Publication No. S-66-524, NEMA Pub. No. WC7 for Crosslinked Polyethylene-Insulated Wire and Cable, and UL Standard 854 for Service Entrance Cables. Wires shall bear UL label for Type USE-2, have footage markings approximately every meter, and surface marking indicating manufacturer's ID, conductor size and metal, voltage rating, UL symbol and type designations. **The insulation on each conductor shall be colored red, black, green, or white in accordance with the color-coding shown in the construction plan and/or standard plates.**

7. EVP Confirmation Light Cable: Wire used for powering EVP confirmation lights shall be 2/c #14 W/GRD conforming to the requirements of International Municipal Signal Association, Inc., Specification No. 50-2 1984, Polyethylene Insulated, Polyethylene Jacketed Loop Detector Lead-In Cable.

8. Optical Detector Cable:

   Optical detector cable shall be in accordance with the provisions of Mn/DOT 3815.2C5.

F. Mast Arm Pole Standards

The provisions of Mn/DOT 3831 are modified as follows for Minneapolis Style Equipment:

Each mast arm pole standard shall consist of a transformer base, a vertical pole shaft, a traffic signal upper cantilever mast arm, provisions for a lower mast arm for sign support, and (if specified in the Plans) a luminaire vertical pole shaft extension with davit-type mast arm and a lower sign arm.

Each mast arm pole standard shall be designed and constructed in accordance with the requirements of the 1994 edition of the "Standard Specifications for Structural Support for Highway Signs, Luminaires and Traffic Signals" as published by the American Association of State Highway and Transportation Officials."

The transformer base shall be stainless steel, constructed in accordance with details shown in the Plans, and be a square transformer base style complete with access hole and door. The access hole shall provide an opening of at least 100 square inches on one side of the base and shall be provided with a door having positive closure. The locking mechanism shall be an integral part of the door.

The extended end of each traffic signal mast arm shall have a 2-3/8 inch outside diameter slipfitter and signal mounting plate welded to the end in accordance with the details in Mn/DOT Standard Plate No. 8123E for attaching one-way or two-way mast arm signal head mounts.

Attachment of the traffic signal upper and/or lower cantilever mast arm to the vertical pole shaft shall be by high strength bolts and nuts.

Each mast arm pole standard shall be the City of Minneapolis design, as shown in the detail section of the Plans.

Each individual mast arm pole standard shall be constructed to the traffic signal mast arm length, luminaire mast arm length, and luminaire mounting height as specified in the Plans.

The Contractor shall furnish to the Engineer, for approval, seven (7) complete sets of shop detail drawings of each type of mast arm pole standard in accordance with the provisions of Mn/DOT 2471.3B. The shop detail drawings shall indicate all member materials and dimensions, section modulus of all main component parts, and other pertinent data and calculations. The shop detail drawings shall be identified by "City of Minneapolis"

and the fabricator. The City of Minneapolis Traffic and Parking Services shall approve shop drawings.

A shop coat of primer and finish paint shall be applied to the outside surfaces of each mast arm pole standard, mast arm, luminaire extension and transformer base.

G. Traffic Signal Pedestals

The provisions of Mn/DOT 3832 are modified as follows:

Each traffic signal pedestal shall consist of a pedestal base with access door opening; pedestal shaft; three tie rods; and a pedestal slipfitter collar with signal bracketing and pipe fittings in accordance with City of Minneapolis standards. Each pedestal slip fitter collar shall have four (4) 1.5 inches diameter threaded side openings spaced 90 degrees apart with unused openings plugged with gasketed, threaded caps.

The overall length of each installed traffic signal pedestal shall be 10 feet.

For assembly information for the City of Minneapolis traffic signal pedestal, see Minneapolis Plate No. Traf-1266 in the Plans.

H. Pedestrian Push Button Stations, Pedestrian Push Buttons, and Pedestrian Instruction Signs

Each pedestrian push button station shall consist of a concrete foundation with bumper post collar, a 4-inch diameter standard black steel pipe with standard threaded pipe cap on top, and a flasher - push button base, all conforming to the City of Minneapolis standards. See Minneapolis Standard Plate No's. Traf-1269, Traf-1082, Traf-1160 and Traf-1210 in the Traffic Signal Detail Sheets in the Plans. A non-metallic cap approved by the Engineer may be used on top of the pedestrian push button station.

All pedestrian push buttons required by the Plans shall be in accordance with the provisions of Mn/DOT 3833 and the following:

1. The Contractor shall furnish to the Engineer, for approval, three (3) sets of shop drawings and specifications. The proposed push button assemblies shall be ADA-compliant

and subject to approval by the City of Minneapolis Traffic and Parking Services. The three copies shall be distributed by the Engineer as follows:

- City of Minneapolis Traffic Division (3 copies)

2. A pedestrian instruction sign shall be furnished to the Contractor by the City for installation with each pedestrian push button installation in accordance with the provisions of Mn/DOT 3833.

I. Accessible Pedestrian Push Buttons and Signs

Pedestrian push button installation shall be in conformance with the Mn/DOT Standard Specifications for Construction 3833 modified as follows:

1. Pedestrian push buttons shall be installed on mast arm pole shafts, pedestal shafts, light pole shafts or be a separate mounting in conformance with Mn/DOT APS Push Button Mounting Detail or ADA Pedestrian Station Detail. These Details can be found on the Office of Traffic, Safety, and Operations (OTSO) WEB site for Traffic Signals:

   http://www.dot.state.mn.us/trafficeng/signals/signaldetails.html

2. Each push button shall be located by the engineer in the field to allow easy access for the pedestrian.

3. The Contractor shall supply the APS system in full, including push buttons, control boards, central control units, configurators, and any other equipment needed to provide the APS system. Approved APS systems are listed on the Mn/DOT Approved/Qualified Products Lists WEB site for Signals:

   http://www.dot.state.mn.us/products/index.html

   The Contractor shall insure the order form below is presented to the Accessible Pedestrian Signal (APS) manufacturer so the appropriated Braille message will be added to the pedestrian information sign and the correct voice messages will be programmed in the pedestrian push button stations.

Accessible Pedestrian System (APS)

ORDER FORM
(Fill out one form per intersection)

Intersection:

Total Qty of Pedestrian Push Buttons:_____

Control Board: One needed for each intersection **Qty_____**

CCU: (Central Control Unit) One needed for each intersection **Qty_____**

CONFIG: (Configurator) One needed for each intersection **Qty_____**

Push Button and Sign Braille Information

Button	**Arrow Direction R/L**		**Street Name** (Street Being Crossed)
PB2-1		PB2-1	
PB2-2		PB2-2	
PB4-1		PB4-1	
PB4-2		PB4-2	
PB6-1		PB6-1	
PB6-2		PB6-2	
PB8-1		PB8-1	
PB8-2		PB8-2	

Custom Voice Message Details

Voice on Location and Walk Message(s) Please give phonetic pronunciation on difficult street names so that the message will be recorded correctly.

*Note that unless Street, Drive, Avenue etc…are absolutely necessary for intersection identification, it is recommended to not include them in the verbal message.

PB2-1

Wait Message:

Wait to Cross _____ **at** _____
(Street Being Crossed) (Intersecting Street)

Walk Message:

_____ **Walk sign is on to cross** _____
(Street Being Crossed) (Street Being Crossed)

PB2-2

Wait Message:

Wait to Cross _____ **at** _____
(Street Being Crossed) (Intersecting Street)

Walk Message:

_____ **Walk sign is on to cross** _____
(Street Being Crossed) (Street Being Crossed)

PB4-1

Wait Message:

Wait to Cross _____ **at** _____
(Street Being Crossed) (Intersecting Street)

Walk Message:

_____ **Walk sign is on to cross** _____
(Street Being Crossed) (Street Being Crossed)

PB4-2

Wait Message:

Wait to Cross _____ **at** _____
(Street Being Crossed) (Intersecting Street)

Walk Message:

_____ **Walk sign is on to cross** _____
(Street Being Crossed) (Street Being Crossed)

PB6-1

Wait Message:

	at	
(Street Being Crossed)		

Walk Message:

	Walk sign is on to cross	
(Street Being Crossed)		(Street Being Crossed)

PB6-2

Wait Message:

Wait to Cross	**at**	
(Street Being Crossed)		(Intersecting Street)

Walk Message:

	Walk sign is on to cross	
(Street Being Crossed)		(Street Being Crossed)

PB8-1

Wait Message:

Wait to Cross	**at**	
(Street Being Crossed)		(Intersecting Street)

Walk Message:

	Walk sign is on to cross	
(Street Being Crossed)		(Street Being Crossed)

PB8-2

Wait Message:

Wait to Cross	**at**	
(Street Being Crossed)		(Intersecting Street)

Walk Message:

	Walk sign is on to cross	
(Street Being Crossed)		(Street Being Crossed)

J. Service Equipment for Signal System

The electrical service point for each signal system is shown on the Plans. The service points shown are approximate; the exact locations will be determined in the field by the Power Company and the City. See signal plan Equipment Schedule for specific service cabinet requirements at each service point.

The electrical contractor is responsible for coordinating the turn on of all permanent electrical services with the City of Minneapolis Traffic and Parking Services Division (TPS) and Xcel Energy. After State of Minnesota electrical inspection and approval of each metered electrical service location and after notification is provided to the TPS Electrical General Foreman (612-673-5759), the City will submit an application for electrical connection and meter installation to Xcel Energy.

1. Pad Mount Signal/Lighting Service Cabinet Non-CBD
The service cabinet shall be constructed in accordance with City of Minneapolis Standard Plate Nos. Traf-3463 and Traf-3635 and the following:

a. The cabinet enclosure (physical enclosure only) shall be UL listed with the UL label affixed to the inside of the cabinet, and shall carry a NEMA 3R rating to provide a degree of protection against rain, sleet, snow, and dripping water.

b. Each cabinet shall be free of flaws, cracks, dents and other imperfections.

c. All surfaces shall be smooth and clean.

d. All seams and joints shall be smooth and even, without cracks, air leaks or pinholes with no sharp or jagged edges.

e. All interior attachments to the cabinet exterior sheet metal shall be welded (i.e. no through bolts).

f. There shall not be any sheet metal attached externally to the cabinet shell.

g. The design, workmanship and attachment of the one-piece panel boards and dead fronts shall be a secure and aligned containment for the circuit breakers. The one-piece panel board and dead fronts shall be stamped with easily removable blank breaker cutouts to match the full capacity of the breaker panel. The panel board breaker cutouts shall precisely match the containment provisions of the breakers.

h. The screws for attaching the cabinet dead fronts shall be of a permanent capture design to prevent lost and misplaced screws. Attachment of the dead fronts to the cabinet shall be accomplished using threaded inserts and offset cam cylinder latches.

i. Contactors shall be normally open, NEMA rated, AC lighting contactors rated 277/480 volts with a 120-volt, 60 Hz coil, and contacts rated for 60 ampere tungsten filament load. Contactors shall be double lugged with the double lugs on the contactors installed such that field wires shall be connectable on the front lugs of the contactor. Contactors shall be installed vertically in the cabinet. Contactors shall have a positive gravity release. Contactors shall have an (off or on) condition display mechanism.

j. The service cabinet shall have one 100 amp two-pole thermo-magnetic circuit breaker as a main breaker and single pole thermo-magnetic circuit breakers as branch breakers on each circuit panel.

k. The Vendor shall furnish and install the following in each service cabinet:
- Two (2) **<u>200 amp meter sockets</u>** with disconnect.
- One (1) bracket mounted single pole test switch rated 15 amperes at 125 volts.
- Two (2) 60 amp two pole contactors.
- 15 amp and 60 amp circuit breakers as indicated on details.
- One (1) photoelectric cell.
- Two (2) 12 circuit panels.

l. The photoelectric cell shall have normally open contacts rated 15 amperes. The photo control shall be installed within the lighting service cabinet. It shall be bracket mounted immediately behind a Plexiglas covered hole. The hole shall be located on the side of the cabinet. The hole size and location shall be as shown on the service cabinet detail. Mounting shall be as directed by the Engineer. The photoelectric control shall be in accordance with the MN/DOT 3812 and have a minimum 30-second time delay capability.

m. The electric meters shall be installed within the service cabinet as shown in the details. The electric meter sockets shall be suitable for single phase, 3 wire, 120/240 volt service with a utility approved manual bypass switch. The Utility Company will provide the electric meters. Sockets shall be provided and installed by the vendor. The placement of the meter socket and meter, door lock, and the viewing window shall permit the door to be closed, and the meter to be read electronically from outside the cabinet.

n. Each cabinet shall have an anodized etched finish (Aluminum Association C22) with an Architectural Class 1 (Aluminum Association A42) hard coat finish of at least 0.7 mil. Finish color shall be either dark bronze or 30 minute clear aluminum as directed by the City.

o. Locks shall be furnished and installed by vendor. Locks shall be keyed for a standard No. 2 traffic signal key.

p. No company logo's and/or advertising shall be placed on any part of the cabinet exterior.

2. Pad Mount Signal/Lighting Service Cabinet CBD

The service cabinet shall be constructed in accordance with City of Minneapolis Standard Plate Nos. Traf-3455 and Traf-3631 and the following:

a. The cabinet enclosure (physical enclosure only) shall be UL listed with the UL label affixed to the inside of the cabinet, and shall carry a NEMA 3R rating to provide a degree of protection against rain, sleet, snow, and dripping water.

b. Each cabinet shall be free of flaws, cracks, dents and other imperfections.

c. All surfaces shall be smooth and clean.

d. All seams and joints shall be smooth and even, without cracks, air leaks or pinholes with no sharp or jagged edges.

e. All interior attachments to the cabinet exterior sheet metal shall be welded (i.e. no through bolts).

f. There shall not be any sheet metal attached externally to the cabinet shell.

g. The design, workmanship and attachment of the one-piece panel boards and dead fronts shall be a secure and aligned containment for the circuit breakers. The one-piece panel board and dead fronts shall be stamped with easily removable blank breaker cutouts to match the full capacity of the breaker panel. The panel board breaker cutouts shall precisely match the containment provisions of the breakers.

h. The screws for attaching the cabinet dead fronts shall be of a permanent capture design to prevent lost and misplaced screws. Attachment of the dead fronts to the cabinet shall be accomplished using threaded inserts and offset cam cylinder latches.

i. Contactors shall be normally open, NEMA rated, AC lighting contactors rated 277/480 volts with a 120-volt, 60 Hz coil, and contacts rated for 60 ampere tungsten filament load. Contactors shall be double lugged with the double lugs on the contactors installed such that field wires shall be connectable on the front lugs of the contactor.

Contactors shall be installed vertically in the cabinet. Contactors shall have a positive gravity release. Contactors shall have an (off or on) condition display mechanism.

j. The service cabinet shall have one 100 amp two-pole thermo-magnetic circuit breaker as a main breaker and single pole thermo-magnetic circuit breakers as branch breakers on each circuit panel.

k. The Vendor shall furnish and install the following in each service cabinet:
- Two (2) **200 amp meter sockets** with disconnect.
- One (1) bracket mounted single pole test switch rated 15 amperes at 125 volts.
- Two (2) 60 amp two pole contactors.
- 15 amp and 60 amp circuit breakers as indicated on details.
- One (1) photoelectric cell.
- Two (2) 12 circuit panels.
- Power distribution terminal block.
- Current limiting protector.

l. The photoelectric cell shall have normally open contacts rated 15 amperes. The photo control shall be installed within the lighting service cabinet. It shall be bracket mounted immediately behind a Plexiglas covered hole. The hole shall be located on the side of the cabinet. The hole size and location shall be as shown on the service cabinet detail. Mounting shall be as directed by the Engineer. The photoelectric control shall be in accordance with the MN/DOT 3812 and have a minimum 30-second time delay capability.

m. The electric meters shall be installed within the service cabinet as shown in the details. The electric meter sockets shall be suitable for single phase, 3 wire, 120/240 volt service with a utility approved manual bypass switch. The Utility Company will provide the electric meters. Sockets shall be provided and installed by the vendor. The placement of the meter socket and meter, door lock,

and the viewing window shall permit the door to be closed, and the meter to be read electronically from outside the cabinet.

n. Each cabinet shall have an anodized etched finish (Aluminum Association C22) with an Architectural Class 1 (Aluminum Association A42) hard coat finish of at least 0.7 mil. Finish color shall be either dark bronze or 30 minute clear aluminum as directed by the City.

o. Locks shall be furnished and installed by vendor. Locks shall be keyed for a standard No. 2 traffic signal key.

p. No company logo's and/or advertising shall be placed on any part of the cabinet exterior.

3. Temporary Pole Mount Signal/Lighting Service

The pole mount signal/lighting service shall be as shown on City of Minneapolis Standard Plate No. Traf-3520.

4. Service Lateral

Service laterals shall be as shown on City of Minneapolis Standard Plate No. Traf-3510. Conduit type & size shall be as shown on the plans.

In addition to the above the following requirements for electrical service connections to each signal system as detailed below shall apply:

- Power shall be obtained from a service lateral on a power company wood pole, ground mounted transformer, or other source as noted in the Plans (Contractor shall field verify power source).

- All service equipment, conduit, and power conductor wiring shall be replaced for all locations where signal systems previously existed and are being revised.

- When service feeds for Signal Systems are to be provided from an existing signal/street light service cabinet, the Contractor

shall provide a connection to the service cabinet and all necessary cable, conduit and install any necessary circuit breakers.

- Service feeds for operating temporary signal systems shall not be disrupted until the newly constructed systems are ready to be made operational.

K. Terminal Blocks

The provisions for terminal blocks of Mn/DOT 2565.3J5 are modified as follows. The referenced terminal block terminals and screws shall be **nickel-plated brass** and be Kulka 603 series or equivalent.

L. Vehicle Signal Faces – Polycarbonate

1. Signal Indications:

All "Red", "Yellow", and "Green" signal indications shall utilize light-emitting diode (LED) units. Mn/DOT approved LED units are listed on the Mn/DOT Qualified Products List on the Office of Traffic, Safety, and Operations (OTSO) WEB site for Traffic Signals:

http://www.dot.state.mn.us/products/index.html

2. The provisions of Mn/DOT 3834 (ITE Vehicle Signal Faces) are modified as follows:

The housings, housing doors, tunnel-type visors, lenses, and background shields of new vehicle signal indications and faces mounted on the traffic signal upper cantilever mast arms shall be fabricated from polycarbonate resin material in accordance with the latest issue of the ITE standard for Adjustable Face Vehicular Traffic Control Signal Heads. The housings shall be one piece with the front, sides, top, and bottom integrally molded. Each vehicle signal face shall be sectional with separate adjustable housing for each vehicle signal indication. The housings, housing doors, visors, and background shields on overhead mast arms and on vertical pole shaft and pedestal-mounted signals shall be black in color. The color shall be

completely impregnated in the resin material and scratches shall not expose uncolored material.

a. The LED unit shall be sealed with a one-piece neoprene or EPDM (Ethylene, Propylene, Diene Monomers) gasket and shall be watertight.

b. A.C. or D.C. voltages at the input terminals of the LED indication shall be below 15 volts within 200mS after removing power. The indication shall work with a conflict monitor utilizing NEMA plus functions, specifically DUAL INDICATION.

All vehicle signal faces with LED indications shall be approved by the City prior to procurement.

Support plates shall be furnished with each overhead mast arm mounted vehicle signal face to distribute stresses evenly over the ends of the vehicle signal face. Also, a plumbizer adapter in conformance with Mn/DOT Standard Plate No. M8124E shall be furnished with each overhead mast arm mounted vehicle signal face. Support plates and plumbizer adapters shall be black in color.

For each LED signal indication, the Contractor shall submit to the Engineer, for approval, four copies of all warranty information indicating the required 6-year warranty period **(from date of installation)**, product invoice, and documentation indicating name of manufacturer, model number, and serial number . The four copies shall be distributed by the Engineer as follows:

- City of Minneapolis Traffic Division (2 copies)

For all LED signal indications, the manufacturer shall provide the following warranty provisions:

a. Replacement or repair of an LED signal module that exhibits a failure due to workmanship or material defects within the first 72 months of field operations.

b. Replacement or repair of "RED", YELLOW and "GREEN" LED signal modules that fall below the requirements for ITE

The Contractor shall, to the satisfaction of the Engineer, affix to the back of each "LED" signal indication a permanent label, or permanently marked (utilizing a "oil based paint marker") with the actual date of installation. The oil based paint marker shall be a contrasting color to ensure that the date can be easily read.

M. Electronically Programmable Vehicle Signal (Special Signal Faces)

This defines minimum standards for product performance and composition relating to 12 inch LED Electroncially Programmable Vehicle Signal Heads, hereinafter referred to as EPSH.

1. General

The EPSH shall provide an indication to the field of view through the use of an electronic steerable beam providing a visibility zone of red, yellow and green, without requiring louvers or other external blocking devices to achieve the end result. No indication shall result from external illumination nor shall one section illuminate another. In order to achieve the long life objectives, the signal housings shall accommodate a thermal transfer device.

All EPSH major components shall be manufactured from glass reinforced polycarbonate material. The housing/sections shall be weatherproof and dust-tight. The signal shall display indications of red, yellow, and green - balls or arrows. The EPSH when configured shall operate directly from 120-volt, 60 Hz power source. All EPSH components including lenses, reflectors, wiring, and materials used in the construction of EPSH assemblies shall meet or exceed all applicable ITE Specifications with exceptions outlined in these specifications.

Each EPSH shall be provided with a black single piece polycarbonate back ground shield.

2. Construction

a. Material

All major signal components shall be one-piece molded and manufactured from Ultra-Violet

stabilized, Makrolon 9417 or approved equivalent. The material formulation used in the manufacture of the major signal components shall meet or exceed the minimum standards listed below:

Property	Required	Method
Tensile stress, yield	0.125" 9400 psi	ASTM D638
Flexural stress, yield	0.125" 15,000 psi	ASTM D790
Flexural Modulus	0.125" 500,000 psi	ASTM D790
Impact strength, Notched izod, 73 degrees Fahrenheit	2.0 ft-lb/inch	ASTM D256
Heat Deflection Temperature 264 psi, 0.250", unannealed	284°F	ASTM D648

b. Color

The exterior of each signal housing shall be colored BLACK with a lusterless finish. External color of the housing shall be completely impregnated in the resin material so that scratches will not expose uncolored material.

c. Housing

Each housing section shall be one-piece molded and manufactured from Ultra-Violet stabilized Makrolon 9417 or equivalent. Housings containing electronic components shall be made of UL94VO flame retardant materials. The Lens/Door of the signal shall be excluded from this requirement.
The housing shall utilize ribbing to enhance the structural strength while reducing weight. The top and bottom exterior of the housing shall be parallel to ensure alignment of assembled section, and shall have a common vertical centerline. The top and bottom of the housing shall have an opening to permit the entrance of 1-1/2 inch (38.1 mm) N.P.T. fittings and standard traffic signal mounting hardware. The top opening of each housing section shall have a raised serrated type boss integrally molded to allow proper joining of stacked sections and to marry with a recessed serrated type boss. The bottom opening of each housing section shall have a

recessed serrated type boss integrally molded to allow proper joining of stacked sections and to marry with a raised serrated type boss.

The dimensions of the boss shall be:

Outside diameter:	2.625 inches
Inside diameter:	1.970 inches
Number of teeth:	72
Angle of teeth:	60 degrees
Depth of teeth:	0.050 inches

The teeth shall be clean and sharp. The radial angular grooves of the serrated fittings shall provide positive positioning of the entire signal head to eliminate rotation or misalignment.

d. Door Assembly

The door shall be a single molded piece with integrated dome and shall be manufactured from Ultra-Violet stabilized new polymer resin. The door shall have two evenly spaced latch slots. The door shall pivot from the left side on stainless steel hinge pins. The door shall latch at the right side using stainless steel hardware. The door shall have four stainless steel threaded inserts for retaining the visor. The door shall be fitted with a gasket that will form a dust and moisture resistant seal between the door and housing.

e. Optic Lens

The integrated dome shall be clear, circular, convex, scratch resistant, hard coated and UV stabilized. The 12 inch dome shall have a diameter between 11-15/16 (11.9375) inches and 12 1/32 (12.03125) inches. The lens shall diffuse the light emanating from the LED's to provide light disbursement across the outer dome. In no instance shall individual LED's be visible in the field of vision when the signal section is energized. The EPSH shall be designed to allow the light output through the lens to be directed or steered into a specific viewing zone. Steering shall be accomplished

electronically, the need for mechanical devices or tape shall not be allowed. The design of the EPSH shall accommodate light output steering in both the vertical and horizontal direction.

3. Electrical

a. General

All wiring and terminal blocks shall meet the requirements of the ITE VTSCH specification. The EPSH shall operate from 120V AC source voltage. The EPSH shall operate from a 60hz cycle AC line power over a voltage range from 80 VAC RMS to 135 VAC RMS. The current draw shall be sufficient to ensure compatibility and proper triggering and operation of load switches and conflict monitors in signal controller units: NEMA (TS-1 or later), Model 170 (1989 or later) and model 2070 (all). The nominal operating voltage shall be 120 volts rms. Fluctuations in line voltage over the range of 80VAC to 135 VAC shall not affect luminous intensity by more than + 10 percent. The EPSH circuitry shall prevent flicker at less than 100 Hz over the voltage range of 80 VAC RMS to 135 VAC RMS.

b. Transient Voltage Protection

The EPSH shall include voltage surge protection to withstand high repetition noise transients and low-repetition, High-Energy Transients as stated in section 2.1.6,and Non Destruct Transient Immunity section 2.1.8 NEMA Standard TS-2, 1998.In addition, the EPSH shall comply with the following:

- The EPSH shall withstand at least 10 strikes of 6kV 1.2/50uS as defined in IEEE/ANSI C62.41 Category “C” exposure Level 2.
- The EPSH shall meet a one time strike at both polarities at 4KV as cited in NEMA TS-2, 1998, Section 2.1.8.

c. LED Drive Circuitry

The individual LED light sources shall be wired so that a catastrophic failure of one LED light source will result in the loss of not more than 10 percent of the signal light output.

d. Ambient Light Adjustment

Ambient Light Adjustment shall be provided and shall be designed to adjust the intensity of the light output in response to ambient light levels. Adjustments shall be accomplished in a smooth manner in response to ambient light levels and corresponding to at least two internal levels.

e. Electronic Noise

The LED signal and associated onboard circuitry shall meet Federal Communications Commission (FCC) Title 47, Sub Part B, Section 15 regulations concerning the emission of electronic noise.

f. AC Power Factor (PF)

The LED signal shall provide a power factor of 0.90 or greater when operated at nominal operating voltage, and 77 degrees “F” (25 degrees “C”).

g. AC Harmonics

The total harmonic distortion induced into an ac power line by an LED signal, operated at nominal operating voltage, with power consumption equal to or greater than 15 watts at 77 degrees “F” (25 degrees “C”) shall not exceed 20 percent. Total harmonic distortion induced into an ac power line by an LED signal, operated at nominal operating voltage; with power consumption less than 15 watts at 77 degrees “F” (25 degrees “C”) shall not exceed 40 percent.

h. Predictive Failure Analysis

Circuitry shall be provided within each section of the traffic signal that will continuously monitor the LEDs in each traffic signal section. It shall be possible to communicate with each traffic signal section and be capable of obtaining the following information: the LED color, ID number of the LED module, number of hours the LEDs have been in operation, and the operating temperature of the LEDs; this information is to be used to generate a report indicating when the LEDs will go below specifications for light output.

i. Communications

Two way communication shall be provided between all signal indications and the traffic controller cabinet. The communications shall also be available to provide command and feedback information from each signal indication.

j. Wiring

Each signal section shall be supplied with 2 (two) color-coded wires. Wires shall be #18 AWG, stranded, type AIA, 600 volt with 2/64 inch, 105 degree centigrade rating thermoplastic insulation and color-coded in assemblies as follows:

- White – Common
- Red - Red section
- Yellow - Yellow section
- Yellow Arrow – Yellow with White tracer
- Green Ball - Brown
- Green Arrow – Brown with White tracer

Each wire shall terminate in a spade type lug for connection to the terminal block.

k. Terminal Strip

Each 3 to 5 signal section head assembly shall be provided with a terminal block in the yellow

indication compartment to provide a connection point for external wiring. Terminal block shall be barrier type, capable of accommodating up to 14 AWG wire on each terminal. Terminal block hardware shall be #8-32 x 5/16 (.3125) inch long binder head stainless steel screws.

4. Programming

Each electronically programmable signal head shall be capable of being individually addressed and programmed from the traffic signal controller cabinet. Communication with each electronically programmable signal head shall be accomplished through use of a portable communication kit. The kit design shall be such that software residing on a laptop computer, PDA or SmartPhone can be utilized to communicate with the portable communication kit wirelessly over an 802.11g network connection. Provided software shall be capable of supporting all programming features of the electronically programmable signal head and displaying status information receivable from the signal head. One complete programming kit in a carrying case and one PDA with software shall be included with this procurement. All required electronics, cabling, and pluggable components shall be included.

5. Environmental

The EPSH, when assembled, shall be weather-proof and dust tight. The EPSH shall operate over the temperature range of -40 degrees “F” to +165 degrees “F” (-40 degrees “C” to +74 degrees “C”).

6. Hardware

All materials used in hardware for traffic control equipment shall be BEST QUALITY first run material. Recycled materials, in part or in full, shall not be used in the manufacture of hardware for mounting traffic control equipment. All hardware, including but not limited to, pins, bolts, screws, threaded inserts, clips, etc., shall be type 304 or 316 stainless steel.

7. Door Latch Hardware

The door assembly shall attach to the housing assembly and shall pivot from the left side using stainless steel hinge pins. The door assembly shall be retained such that it is not able to accidentally become detached from the housing assembly. The door assembly shall latch to the housing assembly utilizing 2 (two) stainless steel eye-bolts, with washers and wing nuts permanently attached to the housing. The washers and wing nuts on the eye bolts shall be retained on the eye bolt and shall not be able to become detached from the eyebolt itself.

8. Identification

Each EPSH shall be marked with the manufacturer's name. Each EPSH LED module shall be identified by a manufacturer's serial number for warranty purposes.

9. Warranty

Manufacturer shall warrant the EPSH, to be free from defects in material and workmanship for a minimum of 7 (seven) years from date of shipment from the manufacturer. Warranty shall cover repair or replacement of defective parts only, and shall be at the discretion of the manufacturer.

N. Pedestrian Signal Faces with Countdown Timers - Polycarbonate

Each pedestrian signal indication of each pedestrian signal face shall be a single section. The size shall be nominal 16 inch x 18 inch as called for in the Plans and the indication shall utilize the international hand and walking person illuminated message and countdown timer. Each pedestrian signal face housing, housing door, and visor shall be black in color. The color shall be completely impregnated in the resin material and scratches shall not expose uncolored material. The pedestrian signal face with countdown timers shall be listed on the Mn/DOT Qualified Products List on the Office of Traffic, Safety, and Operations (OTSO) WEB site for Traffic Signals:

http://www.dot.state.mn.us/products/index.html

The pedestrian indications with countdown timer shall utilize light-emitting diode (LED) units from the Mn/DOT Qualified Products List on the Office of Traffic, Safety, and Operations (OTSO) WEB site for Traffic Signals:

http://www.dot.state.mn.us/products/index.html

1. Housing

Unused mounting holes shall be plugged to provide a watertight seal. A plug shall be provided for the bottom-mounting hole which the pedestrian signal shall have mountings to properly fit brackets made of 1.5-inch pipe. The openings shall have a common vertical centerline through the housing to permit 360-degree rotation of the mounted pedestrian signal. The bottom and top opening shall be provided with a serrated ring, which shall permit indexing and locking of the signal in 5-degree increments throughout the entire 360 degrees of rotation when used with serrated brackets or fittings. The mounting brackets shall serve as the electrical conduit for the pedestrian signal.

A terminal block shall be mounted to the internal bosses at the bottom of the single section head assembly. The terminal block shall be a six position, twelve terminal barrier type strip and shall be secured on both ends. Jumpers shall be installed on the lower row of terminal screws between adjacent pairs of terminals. The following terminal designations shall be used in terminating LED leads: Walk (LED), Walk (field), DW (LED), DW (field), N (LED), N (field) on the upper row of terminal screws.

2. Visor

Each signal head shall have a removable tunnel type visor for each signal indication. The visor shall be fabricated from black polycarbonate resin material and shall encompass the entire top and sides (bottom open) of the pedestrian signal face. The visor shall be designed to fit tightly against the door so as to prevent any perceptible filtration of light between the door and the visor. The top of the visor shall have a downward tilt of approximately 3-1/2 degrees. The length of the visors shall be a minimum of 9 inches with all sides of the visor approximately the

same length. Visors shall be secured by at least six stainless steel screws.

3. Optical Unit

2.

3. a. Module shall be constructed for installation within the signal housing assembly without any modification to either the housing assembly or the LED module.

4.

5. b. Each unit shall be labeled with the manufacturers trademark, identification number, voltage rating and up arrow indication.

6.

7. c. Insulation displacement connectors shall not be used.

8.

9. d. Under no circumstances shall a "Walk" indication supersede a "Don't Walk" indication when any amount of voltage is applied to both inputs.

10.

11. e. The LED unit shall include a one piece neoprene or EPDM (Ethylene, Propylene, Diene Monomers) gasket which shall make an assembled housing and LED module watertight.

12.

13. f. A.C. or D.C. voltages at input terminals of the L.E.D. shall be below 15 volts within 200ms after removing power. The indication shall work with a conflict monitor utilizing N.E.M.A. plus functions, specifically DUAL INDICATION.

14.

15. g. Each module shall have one opening located in each of the four corners to secure the module to the housing assembly door.

16.

17. h. Each LED module shall:

18.

Be wired to the terminal strip located in the housing. The "Walk" input wire to the module shall be connected to the 1st terminal on the terminal strip, the "Don't Walk" input wire to the module

shall be connected to the 3rd terminal on the terminal strip and the neutral wire for the module shall be connected to the 5th terminal on the terminal strip.

19. i. The manufacturer shall provide the following warranty provisions:

- Housing Assemblies furnished shall be guaranteed to be free from electrical, mechanical, or structural defects for a period of 18 months from the date of delivery, and any such defects developing within warranty period shall be remedied free of all expense to the City.

- LED modules shall have a minimum 6-year (72-month) warranty period from the date of installation. The warranty shall cover the replacement cost including the price of the unit and shipping. This warranty shall cover the replacement or repair of any LED signal module that exhibits a failure due to workmanship or material defects or falls below the minimum intensity levels.

- The Contractor shall, to the satisfaction of the Engineer, affix to the back of each pedestrian signal indication a permanent label or permanently marked (utilizing an "oil based paint marker") with the actual date of installation. The oil based paint marker shall be a contrasting color to ensure that the date can be easily read.

4. Painting

All surfaces of the pedestrian signal housing and housing door shall be black in color. All surfaces of the visor shall have a dull non-reflective black finish.

The color shall be completely impregnated in the polycarbonate resin material of the molded parts such that scratches will not expose uncolored material. Color to be approved by the City prior to manufacture.

5. Manufacturer's Drawings, Specifications, and Sample Unit

The Contractor shall submit to the Engineer for approval by the City one (1) module and four sets of manufacturer's drawings and specifications of the pedestrian signal face. The supplier shall also provide at the time of submission of unit for approval written certification in the form of independent test results that the pedestrian indication equipment to be supplied meets or exceeds ITE performance requirements for intensity and color.

20. The Contractor shall also submit to the Engineer, for approval by the City, four copies of all warranty information, a Manufacturers' Certificate of Conformance to this specification, and all other pertinent manufacturer data. As part of the pertinent manufacturer data, the Contractor shall include the product invoice.

The Engineer shall distribute two copies of the above documents as follows:

- City of Minneapolis Traffic and Parking Services

6. Inspection

The pedestrian signal shall be approved by the Engineer prior to procurement by the Contractor.

O. Luminaires on Signal Poles

The luminaires located on the luminaire extension on mast arm signal poles shall be furnished and installed under the signal portion of the Contract. All work related to luminaires installation on street light poles shall be furnished and installed under the street lighting portion of the contract. The luminaire fixture and slipfitter are described in the Lighting portion of the Special Provisions.

All circuit wiring to streetlight poles that are utilized as traffic signal standards shall be furnished and installed under the lighting portion of the Contract. Wiring from the transformer base to the luminaire (2-1/c#12 AWG stranded wires with THHN/THWN rating) shall be furnished and installed under the signal portion of the Contract. One conductor shall have insulation colored black, and the other shall have white colored insulation.

P. Concrete Foundations/Bases

Concrete for all foundations shall be Mix No. 3Y43 free of chloride additives, placed and consolidated using vibratory equipment and be finished all in accordance with the provisions of Mn/DOT 2565.3F except that edges **shall not** be chamfered or beveled, but shall be neat and straight. Concrete shall be allowed to cure for a minimum of seven (7) days before being placed into use unless otherwise permitted by the Engineer.

Q. Intersection Controller and Cabinet

The City will furnish and install all traffic signal controllers and cabinets complete with all internal control equipment, including Contractor furnished EVP & Video Detection equipment (if required in the plans), for use on this project at each system.

R. Availability of Materials

Push button collars and bases and Minneapolis Standard fluted pedestal signal poles and bases that meet the requirements of these Special Provisions are available and may be purchased at the option of the Contractor from the Minneapolis Traffic and Parking Services, depending upon the timeliness of the order, and availability of the material in City stock. Contact the Traffic Stores office at 612-673-5750.

SS-1.3 CONSTRUCTION REQUIREMENTS

A. Staging

The Contractor shall review the roadway construction phasing plan and shall plan his work accordingly.

B. Conduit Placement

Where N.M.C. conduits are required to be placed underground below roadway surface areas that are to be reconstructed with bituminous or concrete pavement, the N.M.C. conduit shall be placed and backfilled (if trenching method used) and compacted to the satisfaction of the Engineer before any new pavement is placed.

Exposing existing utilities and surface restoration shall be considered incidental to the work required to provide a complete conduit system installation.

The Contractor shall install red City of Minneapolis Traffic and Parking Services marking tape for marking underground transportation utilities at a distance of 6 inches above all new conduit placed by the trenching method. The required marking tape shall be purchased by the Contractor at the City of Minneapolis Traffic and Parking Services Office, 300 Border Avenue North. Provision and installation of the marking tape by the Contractor shall be considered incidental work to furnishing and installing the conduit.

Existing conduit to be reused as part of a revised permanent signal system (as shown in the Plans) shall be reused in accordance with the provisions of Mn/DOT 2565.3D5.

1. Extension of Conduits: The Contractor shall provide a continuous length of conduit of size and type noted on the Plans between the specified terminal points.

2. Installation of Conduit into Handhole: Conduits shall be installed into handholes by use of a hole saw to cut through the handhole wall. Areas surrounding conduit entrances shall be sealed by filling them with mortar. Conduits shall be installed entering handholes through the sidewalls of the handholes, not through the bottom gravel foundation. Conduits shall extend a minimum of 2 inches and no more than 3 inches into the handhole.

3. Connection to Existing Conduits: The Contractor shall locate the ends of existing conduit as shown on the Plans and extend the conduit to handhole, signal base, etc., which is to be built by the Contractor. Existing conduit shall be cut perpendicular to conduit and exterior surface cleaned to form secure connection to extension.

4. Installation of Conduits: The conduits shall be installed a maximum of 12 inches from the back of the curb, as shown in the Plans or as directed by the Engineer. Except as required to bypass foundations, the base on which the curb is placed shall not be disturbed. All conduits installed across newly surfaced streets shall be installed at a minimum depth of 24 inches or as directed by the Engineer.

Where existing sidewalks, pavement, or streets are opened, the opening shall be refilled to the original thickness using material equal to that removed, and the surface restored. In sidewalk areas whole panels shall be removed and replaced unless a utility joint exists in which case only the portion of the walk above the installation up to the joint need be removed and replaced.

In general, all conduits shall be straight and true, and all offsets and bends shall be uniform and symmetrical. Field bends of conduit shall only be accomplished with the use of an approved conduit heating/bending mechanism designed for that purpose. The Contractor shall adjust the elevations of the conduit assembly for its full length to approximately the same gradient as the finished roadway, and shall furnish and install, in the trench such suitable spacers and framing as may be necessary to maintain the correct grade and alignment. The cover material shall be firmly tamped into place in 6-inch lifts to minimize uneven settlement above or below the conduit.

5. Installation of Conduits Under Driving Surface and Sidewalk: All conduits that are to be placed under driveways, streets and sidewalk that are not scheduled for removal shall be directional bored, or installed by another method approved by Engineer that will not damage or disturb the integrity of the driveway, street or sidewalk. All conduits that are to be placed under driveways, alleys, streets, or sidewalk that are scheduled for removal must be placed during the time between the removal of the existing surface and the commencement of pavement operations. The Contractor is responsible for coordination with the paving Contractor.

6. Installation of Conduits Under Driving Surface and Sidewalk Outside Paving Limits: All conduits that are placed under driveways, streets and sidewalk that are not scheduled for removal as part of the street or sidewalk paving shall be placed either by directional boring, surface removal or other approved methods. Any required surface removal and restoration shall be considered incidental to the work required to provide a complete conduit system installation. Damage to pavement or sidewalk shall be remedied at the Contractor's expense.

7. Conduit Attached to Wood Poles (Service): All conduits terminating near the top of a wood pole shall utilize a metal weatherhead service entrance type fitting with knockouts (knockouts shall not be opened if not used). Conduit shall be attached to a wood pole by galvanized RSC straps spaced 3 feet apart, or as directed by the Engineer.

8. Duct Seal: Duct seal or other Engineer approved material shall be furnished and installed to seal all controller cabinet and service cabinet conduit entrances as necessary in accordance with Mn/DOT 2565.3D2b.

9. Conduit Ends in Handholes: All ends of non-metallic conduit entering a handhole shall be trimmed by the Contractor, on the inside and outside of cut ends to remove rough edges. Conduits shall extend a minimum of 2 inches and no more than 3 inches into the handhole.

C. Concrete Traffic Signal Pole and Cabinet Foundations

All foundations shall be cast in place. Use of precast foundations is not permitted

The concrete traffic signal cabinet foundations for the City furnished and installed traffic signal cabinets shall be installed in accordance with the details as shown on the detail sheets in the Plans. All foundation locations shall be approved by the City before construction.

Concrete pad finishing shall be smooth, level, and flat. No more than 0.125 inches of variability compensated by shims will be allowed. Variability in excess of this will require resurfacing or replacement at the direction of the Engineer. Inspections will be performed using a Contractor supplied City approved ½" thick steel template manufactured to match cabinet dimensions. The first pad shall be inspected in detail, approved and used as the standard for finish and workmanship. All templates required are incidental to the project.

D. Loop Detector Installation

Where loop detectors are required to be installed in roadways surfaced with new bituminous pavement, the loop detectors shall be installed before paving forces place the bituminous wearing course.

Detector locations identified as sampling detectors shall be constructed using standard loop detector installation procedures.

All loop detectors shall be NMC except that they may be saw cut at specific locations if so authorized by the City.

1. NMC Conduit
   The Contractor shall install loop detectors in accordance with the applicable provisions of Mn/DOT 2565.3G and Mn/DOT Standard Plate No. 8132A "Preformed Rigid PVC Conduit Loop Detector.

   After completion of the installation, the loop shall be final tested, as described below. The completed sealed loop must pass frequency, inductance, and resistance tests prior to being accepted.
   The Contractor shall splice roadway loop detector conductors in accordance with the procedure outlined below to loop detector lead-in cable conductors in the handhole or junction box adjacent to the loop detector and shall make each new loop detector operational. Lead in cable shall be installed in a continuous run from handhole to the controller cabinet with no intermediate splices permitted.

   Slack loop detector lead-in cable, 10-feet in length, shall be left in each handhole through which a run of cable passes. All other applicable provisions for wiring in accordance with Mn/DOT 2565.3J shall apply.

   The loop detector roadway conductors and the loop detector lead-in cable conductors shall be properly prepared and cleaned before splicing.

   Prior to installing the approved loop detector splice kit, the Contractor shall solder the ends of the loop detector lead-in conductors to the roadway loop detector conductors, and shall furnish and install an appropriate sized wire nut to the soldered ends prior to installation of the splice kit.

   Splice kits shall be installed in handholes in such a manner as to ensure that each splice kit is suspended and/or secured near the top of the handhole to the satisfaction of the

Engineer **(placing splice kits on top of the electrical cables and conductors is NOT acceptable).**

2. Saw Cut

Saw cut loops shall be saw cut in the roadway in accordance with City of Minneapolis Standard Plate No. Traf-1760; with the Plans; with the provisions of Mn/DOT 2565.3G as directed by the Engineer and the following:

Loops shall be installed by saw cutting a slot in the pavement, installing the loop wires in the saw cut, sealing the wires and filling the saw cut with loop sealant and extending the wires under the curb into a handhole in accordance with City of Minneapolis Standard Plate No. Traf-1760.

The saw shall be equipped with a depth gauge and horizontal guide to assure proper depth and alignment of the slot. The blade used for the saw cut shall provide a clean, straight, well-defined 0.4-inch wide saw cut without damage to adjacent areas. The depth of the saw cut shall be a minimum of 2 inches, and deep enough to provide 1.5 inches of cover above the conductors. Where the loop changes direction, the saw cuts shall be overlapped to provide full depth at all corners. Corners shall be drilled with a 1 ¾-inch diameter drill, and drilled to a depth of ¼ inch deeper than the saw cut.

Before installing the loop wire, the saw cuts shall be checked for the presence of jagged edges or protrusions. Should these exist, they must be removed. The slots must be cleaned and dried to remove cutting dust, grit, oil, moisture or other contaminants. Cleaning shall be achieved by flushing clean with a stream of water under pressure, and following this, the slots shall be cleared of water and dried using oil free compressed air.

Loop detector conductors shall be installed using a 1/5 inch to ¼-inch thick wood paddle. If the wire does not lie close to the bottom of the saw cut, it shall be held down by means of a material such as tape or Styrofoam.

Each loop shall have its wire coiled clockwise and the beginning conductor banded in the terminating handhole with a symbol to denote start of conductor. Each loop shall be further identified by number with durable tags, or as directed by the Engineer.

The field loop conductors installed in the pavement shall run continuously with no splices permitted.

After obtaining satisfactory test results, the loop shall be sealed with a flexible embedding sealer. The sealer shall be used strictly in accordance with the manufacturer's instructions. The sealer shall be poured into the slot to half depth. When both the loop and lead-in slots are half filled, check for air bubbles, for material pile-up, and then proceed to fill the slots to roadway level. Excess sealant shall be removed by means of the "squeegee." In all cases, there shall be neither a trough nor a mound formed. The sealer, when poured into a saw-cut, should completely surround the wires, displace all air therein and completely fill the area of the slot, except for that portion filled with the wire hold down material. Allow sufficient time for the sealer to harden in accordance with manufacturer's instructions before allowing traffic to move over the area.

After completion of the sealing, the loop shall be final tested, as described. The completed sealed loop must pass frequency, inductance, and resistance tests prior to being accepted.

All lengths of loop wires that are not imbedded in the pavement shall be twisted with at least five (5) turns per foot, including lengths in conduits and handholes.

Each loop shall terminate individually in the handhole and shall be taped to exclude moisture.

The saw cut configuration, depth, width, number of turns and labeling of wire ends shall be done in conformance with the City of Minneapolis Standard Plate No. Traf-1760.

The City will mark with spray paint the location and orientation of each loop to be installed on the pavement. The location of the handhole will also be identified.

Each loop detector of size 6 ft. x 6 ft. shall have 3 turns of wire.

Loop sealant shall be the black colored Detector Loop Sealant manufactured by 3M, Traffic Control Devices Safety and Security Systems Division, St. Paul, Minnesota. Material, which has exceeded the label expiration date, shall not be used.

Non-metallic conduit and fittings shall be Type II heavy-wall rigid PVC Schedule 40 and shall bear the Underwriters Laboratories, Inc. (UL) label.

The Contractor shall splice roadway loop detector conductors to loop detector lead-in cable conductors in the handhole or junction box adjacent to the loop detector and shall make each new loop detector operational. Lead in cable shall be installed in a continuous run from handhole to the controller cabinet with no intermediate splices permitted.

Slack loop detector lead-in cable, 10-feet in length, shall be left in each handhole through which a run of cable passes. All other applicable provisions for wiring in accordance with Mn/DOT 2565.3J shall apply.

E. Loop Detector Splice

The following splice procedure shall be utilized in connecting the loop lead and the lead-in conductors. This connection shall be made only in a detector handhole, signal base, or cabinet as shown on the Plans.

The electrical splice between the lead-in cable to the controller and the loop wire shall be soldered using resin core solder and provided with a watertight protective covering which covers the spliced wire, the shielding on the loop lead-ins and the end of the tubing containing the loop wires. The use of open flame to heat the wire connection will not be permitted. The Contractor shall use a soldering iron, gun, or torch equipped with a soldering tip. The splice shall be made by the following method:

1. Remove all lead-in coverings leaving 4 inches of insulated wire exposed.

2. Remove the insulation from each conductor of a pair of lead-in cable conductors and scrape both copper conductors with knife until bright.

3. Remove the insulation from the loop wires and scrape both copper conductors with knife until bright.

4. The conductors shall be connected by a soldered pigtail-type splice, wrapped with waterproof tape, and encapsulated in a splice encapsulation kit.

5. The Contractor shall use a **3M Company DBR 6 Kit** for splices.

6. Splices in handholes shall have the splice kit suspended vertically and secured near the top of the handhole with loop and lead-in conductors at the lower end of the kit. Splicing and placement shall be to the satisfaction of the Engineer.

   Conductors for inductive loop installations shall be individually identified and banded in pairs by lane, in the handhole adjacent to the loops. The loop detector lead in conductors shall be similarly identified at the cabinet.

F. Loop Detector Test Report

The Contractor shall furnish to the Engineer, in triplicate, a signed and dated "Loop Detector Test Report" for each loop detector and lead in cable system furnished and installed as part of this Contract with the following information.

1. Project Numbers and Intersection location.

2. Loop Detector Number (as shown in the Plans) Dimensions of Loop Detector (Length and Width in feet) as installed, and Number of Turns of wire in Loop Detector as installed.

3. <u>Continuity Test:</u> Each loop detector circuit shall be tested for continuity at two (2) locations: (1) Loop detector at the handhole prior to splicing with the loop detector lead-in cable (shall have a value less than 0.5 ohms), and (2) Loop detector and lead-in cable system at the traffic signal cabinet after splicing in the handhole (shall have a value less than 5 ohms). The continuity test ohm reading at the

traffic signal cabinet shall be greater than the ohm reading measured at the loop detector adjacent handhole.

4. Inductance Test: Each loop detector and lead-in cable system shall have an inductance test measured at the traffic signal cabinet. The inductance shall be in the range of from 50 to 200 microhenries, depending upon loop size, number of turns, lead-in length, etc. Field-measured inductance readings shall not vary by more than ±20 percent from theoretical calculated inductance.

5. Insulation Resistance Test: An insulation resistance test at 500 volts direct current shall be made at the traffic signal cabinet between one loop detector lead-in conductor and the "Equipment Ground Buss" in the cabinet. The insulation resistance shall have a value of not less than 100 megohms.

6. Resonant Frequency Test: The resonant frequency of the loop shall be determined by the use of a loop frequency tester. The resonant frequency shall remain stable when there is no vehicle activity in the area and shall not drift more than plus or minus one hertz per minute.

NOTE: The Continuity Test, Inductance Test, Insulation Resistance Test, and Resonant Frequency Test to be conducted at the traffic signal cabinet shall be performed before the loop detector lead-in conductors are terminated on the terminal facilities provided in the cabinet. The tests shall be performed in the presence of the Engineer and a designated City of Minneapolis Traffic and Parking Services representative.

All loop detector tests shall be made by the Contractor, at his own expense, to demonstrate that the materials and installation of each loop detector and lead-in cable system are in accordance with the requirements of the Plans and these Special Provisions. The tests shall be conducted in the presence of and to the satisfaction of the Engineer. The Contractor shall provide such electrical instruments, apparatus, tools, and labor as may be necessary to make the required loop detector tests on each loop detector and lead-in cable system. Such electrical instruments, apparatus, and

tools shall remain the property of the Contractor after the tests are completed.

In the event that a loop detector and/or lead-in cable system "fails," any one of the above-mentioned loop detector tests, the Engineer may direct the Contractor to replace any part of or the entire loop detector and lead-in cable system at the Contractor's own expense. No Supplemental Agreement will be written for replacing any part of or the entire loop detector and lead-in cable system. All of the above-mentioned loop detector tests shall be repeated and recorded for the "revised" loop detector and lead-in cable system.

Each loop detector and lead-in cable system furnished and installed as part of this Contract shall "pass" the above-mentioned loop detector tests.

A suggested format for the "Loop Detector Test Report" is shown below. A blank Test Report is included in Appendix C.

--- S A M P L E ---

LOOP DETECTOR TEST REPORT

STATE PROJECT NO. S.A.P. 27-681-11; 27-681-12; S.A.P. 141-020-098; 141-020-102

INTERSECTION West Broadway at Penn Avenue North

LOCATION I.D. Minneapolis

No.	Loop Detector Number	Dimensions (in feet)		Number of Turns	Continuity (in Ohms)		Inductance (microhenries)	Insulation Resistance (megohms)	Resonant Frequency (Hertz)
		Length	Width		Loop	Cabinet			
1	D1-1	6 6 6 6	6 6 6 6	3	0.1 0.1 0.1 0.1	2.5	80	180	25K
2	D5-1	6 6 6 6	6 6 6 6	3	0.1 0.1 0.1 0.1	2.5	80	180	30K
3	D4-1	6	6	3	0.1	1.8	150	200	25K
4	D4-2	6	6	3	0.1	1.8	150	200	25K
5	D8-1	6	6	3	0.1	1.5	150	150	25K
6	D8-2	6	6	3	0.1	1.5	1.50	150	25K

--- E. T. C. ---

NOTES:

1. No. 3, 4, 5, and 6 in the above sample report, are an example of a single loop detector and lead-in cable system.
2. Nos. 1 and 2, in the above sample report, are an example of a multiple loop detector and lead-in cable system.

   The Project Engineer shall distribute the three (3) final loop detector test reports as follows:

   (01) Original report to the official project file
   (02) Copy to the traffic signal cabinet
   (03) Copy to the City of Minneapolis

G. Video Detection System Type 1

The Contractor shall furnish, install and make operational all VIVDS ("Video Imaging Vehicle Detection System") components for the new permanent signal systems as shown in the Plans and as follows. The Contractor shall furnish and install all cables and conductors, mounting hardware, and each video detection device as per the Plans and to the satisfaction of the Engineer.

All equipment necessary as well as the equipment in each controller cabinet to operate each video detection system shall be new devices furnished and installed by the Contractor.

At least 14 days prior to when the applicable traffic signal cabinet is required on the project, all necessary materials and electrical equipment required in the traffic signal cabinet, and all documentation, maintenance and operation manuals, and wiring diagrams shall be delivered to Larry Mountjoy at the City of Minneapolis Signal Shop at 300 Border Avenue North, Minneapolis, MN 55405.

1. General

This specification sets forth the minimum requirements for a system that uses only video images.

a. System Hardware

The video detection system shall consist of one or two wide-angle video cameras, a shelf mounted video detection processor (VDP), an Ethernet communication module, a shelf mount video monitor, and a pointing device.

b. System Software

The system shall include software that detects using only the video image. Detection zones shall be defined using only an on board video menu and a pointing device to place the zones on a video image. Up to 24 (TS1) or 64 (TS2) detection zones shall be available. A separate computer shall not be required to program the detection zones.

2. Functional Capabilities

The VDP shall have the capability to process different video sources. The source can be a video camera or stored images. The video shall be input to the VDP in MJPEG format and shall be digitized and analyzed in real time.

Detection zones shall be programmed via an on board menu displayed on a video monitor and a pointing device connected to the VDP. A typical detection zone shall be approximately the width and length of three cars.

The menu shall facilitate placement of detection zones and setting of zone parameters or to view system parameters. A separate computer shall not be required for programming detection zones or to view system operation.

The VDP shall store at least three different detection zone patterns. The VDP shall be able to switch to any one of the different detection patterns within 1 second of user request via menu selection with the pointing device.

The VDP shall detect vehicles in real time as they travel across each detection zone.

The VDP shall have an Ethernet port for communications with an external computer.

The VDP shall accept new detector patterns from an external computer through the Ethernet port. A Windows™-based software designed for local or remote connection and providing video capture, real-time detection indication and detection zone modification capability shall be provided with the system.

The VDP shall be able to send its detection patterns to an external computer through the Ethernet port.

The camera system shall be able to transmit a MJPEG video signal, with minimal signal degradation, up to 1000 feet under ideal conditions.

The associated Video Detection Processor (VDP) shall default to a safe condition, such as a constant call on each

active detection channel, in the event of loss of video signal.

The system shall be capable of automatically detecting a low-visibility condition such as fog and respond by placing all defined detection zones in a constant call mode. A user-selected output shall be active during the low-visibility condition that can be used to modify the controller operation if connected to the appropriate controller input modifier(s). The system shall automatically revert to normal detection mode when the low-visibility condition no longer exists.

3. Vehicle Detection

A minimum of 24 detection zones shall be supported and each detection zone shall be able to be sized to suit the site and the desired vehicle detection region.

A single detection zone shall be able to replace multiple inductive loops and the detection zones shall be OR'ed as the default to indicate vehicle presence on a single phase of traffic movement.

Placement of detection zones shall be done by using only a pointing device, and a graphical interface built into the VDP and displayed on a video monitor, to draw the detection zones on the video image from the video camera.

Sampling detectors shall not be used during the operation of the detection zones.

A minimum of 3 detection zone patterns shall be saved within the VDP memory. The VDP's memory shall be non-volatile to prevent data loss during power outages.

The selection of the detection zone pattern for current use shall be done through a menu. It shall be possible to activate a detection zone pattern for a camera from VDP memory and have that detection zone pattern displayed within 1 second of activation.

When a vehicle is detected crossing a detection zone, an on screen indication shall be provided such as the flashing of

the detection zone on the video overlay display screen to confirm the detection of the vehicle.
Detection shall be at least 98% accurate in good weather conditions and at least 96% accurate under adverse weather conditions (rain, snow, or fog).
Detector placement will typically not be more distant from the camera than a distance of ten times the mounting height of the camera.

The VDP shall provide up to 24 (TS1) outputs of vehicle presence detection or 64 (TS2) outputs of vehicle detection. The 24 outputs may also be wired directly to the terminal facility on the back panel.

The VDP shall provide dynamic zone reconfiguration (DZR) to enable normal detector operation of existing channels. The VDP shall operate normally while modifying a zone plan and place a constant call only during the learning cycle.

The VDP shall output a constant call for each enabled detector output channel if a loss of video signal occurs. The VDP shall output a constant call during the background learning period.

The VDP shall output a constant call in the case of a catastrophic system failure.

Each of the detection zone outputs shall be configurable to allow the selection of presence and delay outputs. Timing parameters of pulse and delay outputs shall be user definable between 0.1 to 300.0 seconds.

All detection zones shall be capable of counting the number of vehicles detected per camera input. The count value shall be internally stored in at least 15 minute and 60 minute bins for later retrieval through the Ethernet port.

4. VDP Hardware

The VDP shall be designed to mount on a standard shelf. No adapters shall be required to mount the VDP.

The VDP shall operate satisfactorily in a temperature range from -37°C to +74°C and a humidity range from 0%RH to 95%RH, non-condensing.

The VDP shall be powered by 110 or 220 volts AC and not exceed 1.5 amps of power consumption.

The VDP shall include an Ethernet port for communications with a remote computer. The VDP Ethernet port shall accept a 568B patch cable and connect to the front of the VDP.

The VDP shall utilize flash memory technology to enable the loading of modified or enhanced software and firmware through the USB port without modifying the VDP hardware.

The VDP shall include detector output pin out compatibility with industry standard TS1 or TS2 cabinets.

The front of the VDP shall include detection indications, such as LED's, for each channel of detection that displays detector outputs in real time when the system is operational.

The front of the VDP shall include one VGA video output providing real time video output that can be routed to other devices.

Video inputs shall be made via CAT5e burial grade cable terminating with a lock ring connector to ensure secure connections. RCA or other straight friction plug-in type connections shall not be allowed.

The VDP unit shall interface with up to two cameras using RJ-45 interface connectors.

The interface unit shall support the use of USB pointing devices. The unit shall support either a USB mouse or trackball. Pointing devices shall not require vendor specific pointing device software drivers.

The VDP shall allow real-time video to be transported via VGA to independent streaming video players simultaneously in CIF or other optimal resolution.

The VDP shall provide digital pan-tilt-zoom functionality within the fixed video image to view the entire intersection.

5. Access/Communication Module

The interface device shall provide capabilities to enable multiple video detection processors (VDP's) to be locally and remotely accessed from a single point via one set of user interface devices. User interface devices are defined as a pointing device and video monitor, laptop or remote desktop.

The device shall allow the operator to view video output display for all video detection processors via the video monitor or by using the remote access software.

All local programming and setup parameters for vehicle detection shall be user accessible through the interface devices without requiring the user to swap interface cables.

Remote access to the device shall be through the built-in Ethernet port via access software running on a Windows™-based personal computer.

Remote access over a WAN or LAN shall also be available for remote setup and diagnostics of the interface unit.

The interface unit shall support streaming video technology using MPEG4, Motion JPEG or H.264 standards to allow the user to monitor video detection imagery over the Ethernet interface.

By default, the user shall be able to view all detection zones simultaneously on the output video monitor.

Access to the VDP via the interface unit shall be under password control and the client interface shall allow the user to change the password.

A unique IP address shall be assignable to view the live video from a secure, remote location.

The interface device shall be specifically designed to mount on a standard TS-1 and TS-2 shelf. No adapters shall be required to mount the interface device in a standard shelf.

An Ethernet port shall be integrated within the interface unit. The Ethernet port shall conform to 802.3 Ethernet specifications and shall auto-sense between 10 and 100 Mbps data rates. Industry standard TCP/IP (UDP and TCP packets) protocol shall be supported. The Ethernet connection shall be made through a RJ-45 connector.

6. Video Detection Camera

The video cameras used for traffic detection shall be furnished by the VDP supplier and shall be qualified by the supplier to ensure proper system operation.

The camera shall produce a useable video image of the bodies of vehicles under all roadway lighting conditions, regardless of time of day. The minimum range of scene luminance over which the camera shall produce a useable video image shall be the minimum range from nighttime to daytime, but not less than the range 1.0 lux to 10,000 lux.

The camera shall use a CMOS sensing element and shall output color video with resolution of not less than 1920 lines horizontal.

The camera shall include an electronic shutter control based upon average scene luminance.

The camera shall include a fixed focal length lens with fixed focus that shall not need adjustment to suit the site geometry. The horizontal field of view shall be a fixed 180 degrees. A single camera shall be capable of providing detection coverage of all approaches of an intersection.
The camera electronics shall include AGC to produce a satisfactory image at night.

The camera shall be housed in a weather-tight sealed enclosure. The housing shall be field rotatable to allow

proper alignment between the camera and the traveled road surface.

The camera enclosure shall be equipped with an integrated sun shield. The sunshield shall include a provision for water diversion to prevent water from flowing in the camera's field of view.

The camera enclosure shall include a thermostatically controlled heater to assure proper operation of the lens shutter at low temperatures and prevent moisture condensation and ice buildup on the optical faceplate of the enclosure.

When mounted outdoors in the enclosure, the camera shall operate satisfactorily in a temperature range from -35 °C to +74 °C and a humidity range from 0% RH to 100% RH.

The camera shall be powered via Power Over Ethernet (POE) from the VDP. Power consumption shall be 55 watts or less under all conditions.
Camera placement shall be on the horizontal portion of the street lighting davits above or adjacent to the roadway as shown in the plans. The camera shall provide reliable detection within the height to distance ratio of 10:100. Camera placement and field of view (FOV) shall be unobstructed and as noted in the installation documentation provided by the supplier.

The camera enclosure shall be equipped with weather-tight cable connections. Video and power shall be transmitted via the CAT 5e burial grade cable and connected within the same connector to the VDP.

7. Cat 5e Cable:

The Cat-5E cable shall be industrial grade, have sunlight and flame resistant jacketing and be suitable for outdoor and underground applications. This specification describes an unshielded twisted pair data communications cable with 4-pair 24 AWG solid-bare copper conductors with (HD-PE) high density polyethylene insulation, a non-gel water block core filler and a (FR-PE) flame retardant black

polyethylene jacket overall. The cable shall possess the following electrical and physical characteristics:

- Rating: 60 degree C 300V
- Conductor Resistance: Max 92.8 ohms/km @ 20 degrees C
- Potential Withdraw: DC 500V/1 min or AC 350V/1 min
- Insulation Resistance: 1500MO/km DC 500V (between wire and ground)
- Spark Test: 2.5KV

The cable shall be approved for installation in open air, in ducts or conduits, and be suitable for direct burial and possess the following features:

- High-Performance Data Communications Cable
- Suitable for 350MHZ High-Speed Data Applications
- Suitable for Gigabit Ethernet, Fast Ethernet and 155MBPS TP-PMD/CDDI
- Suitable for Outdoor Installations
- Category-5E Unshielded Twisted Pair (UTP) Cable
- 4-Pair – Easily Identified Color-Striped Pairs
- AWG24 Solid Copper Conductors
- FRPE Jacket (CMX) for Outdoor Use with Flooded Core
- Excellent Attenuation and Crosstalk Characteristics

Applicable Standards

a. The following standards shall form a part of this specification to the extent specified herein:
   - Underwriters Laboratories Subject 444
   - EIA/TIA 568 specifications
   - ISO/IEC 11801 specifications

8. Installation

The CAT 5e burial grade cable to be used between the camera and the VDP in the traffic cabinet shall be designed for direct burial installations. This cable shall be suitable for installation in conduit or overhead with appropriate span wire. All connections shall be made in accordance with the manufacturer's instructions.

The cabling shall comply with the National Electric Code, as well as local electrical codes.

The Contractor shall install the cameras on luminaire mast arms at the location directed by the Engineer; in accordance with the manufacturer's guidelines; and to the satisfaction of the Engineer. If, in the opinion of the Engineer, it is necessary to install extension brackets in order for the luminaire mast arm mounted cameras to obtain satisfactory operation the Contractor shall provide and install them as part of the intersection detection. The cameras shall be mounted and secured in an aimed position by the Contractor. The Contractor shall mount and level the camera per manufacturer's instruction. Drip loops shall be provided for the camera cable.

The video detection system shall be installed by supplier factory certified installers and as recommended by the supplier and documented in installation materials provided by the supplier. Proof of factory certification shall be provided.

a. CAT-5E Cable Installation

The contractor shall test all Cat-5E cables installed in the controller cabinet with a tester specifically designed for testing continuity through an RJ-45 connection. The contractor shall provide a test report – typed or handwritten – for the Cat-5E cables in each cabinet. The test shall state the date of the test, individuals who performed test, identify each cable tested, and state whether the cable passed. All non-passing cables shall be corrected by the contractor.

9. Limited Warranty

The supplier shall provide a limited three-year warranty on the video detection system.

During the warranty period, technical support shall be available without charge from the supplier via telephone within 4 hours of the time a call is made by a user, and this

support shall be available from factory-certified personnel or factory-certified installers.

Updates to the Video Detector Processor software shall be available from the supplier without charge for the life of the product.

10. Maintenance and Support

The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the video detection system. These parts shall be available for delivery within 30 days of order placement.

The supplier shall maintain an ongoing program of technical support for the video detection system. This technical support shall be available via telephone, or via personnel sent to the installation site upon placement of an acceptable order.

Installation and training support shall be provided by a factory authorized representative without charge.

All product documentation shall be written in the English language.

11. Deliverables

One video detection system including all necessary cabling for connection within the cabinet shall be provided for each location to be installed as shown in the plans. One manufacturer approved industrial hardened color video monitor and pointing device shall be provided per intersection. A Windows™-based software package designed for local or remote connection and providing video capture, real-time detection indication and detection zone modification capability shall also be provided with the system.

Upon proper orientation and connection of the various video detection cameras by the contractor, the factory authorized representative shall assist and train City of Minneapolis personnel in utilizing all software, setting up detection zones and channel assignments as well as

establishing the other necessary parameters for a properly performing detection system.

One new spare Video Detection Processor (VDP) module and one new spare video camera shall be provided to the City of Minneapolis for maintenance purposes upon acceptance of the video detection systems.

The video detection systems shall be a GridSmart Spectra 360 Vehicle Detection System as manufactured by Aldis, Inc., 10545 Hardin Valley Rd., Knoxville, TN, 37932; phone number (865)482-2112 or City of Minneapolis approved equal.

Each video detection system shall be complete and in operation. The cost of furnishing all materials and labor to perform the work described above at each identified intersection shall be paid for as **"Video Detection System Type 1 Intersection (n)", Each**.

H. Video Detection System Type 2

The Contractor shall furnish, install and make operational all video detection devices for Signal Systems as shown in the Plans and as follows. The Contractor shall furnish and install all cables and conductors, mounting hardware, and each video detection device as per the Plans and to the satisfaction of the Engineer.

All equipment necessary as well as the equipment in each controller cabinet to operate each video detection system shall be new devices furnished and installed by the Contractor.

At least 14 days prior to when the traffic signal cabinet is required on the project, all necessary materials and electrical equipment required in the traffic signal cabinet, and all documentation, maintenance and operation manuals, and wiring diagrams shall be delivered to Larry Mountjoy at the City of Minneapolis Signal Shop at 300 Border Avenue North, Minneapolis, MN 55405.

1. General

This specification sets forth the minimum requirements for a system that detects vehicles on a roadway using only video images of vehicle traffic.

a. System Hardware

The video detection system shall consist of one or more video cameras, one or more 2-video input video detection processors (VDP) modules which mount in a standard detector rack; a detector rack mounted extension module (EM), a detector rack mounted Ethernet communication module, a shelf mount video monitor, and a pointing device.

b. System Software

The system shall include software that detects vehicles in multiple lanes using only the video image. Detection zones shall be defined using only an on board video menu and a pointing device to place the zones on a video image. Up to 24 detection zones per camera shall be available. A separate computer shall not be required to program the detection zones.

2. Functional Capabilities

Each VDP shall have the capability to process video different sources. The source can be a video camera or video tape player. The video shall be input to the VDP in NTSC format and shall be digitized and analyzed in real time.

The VDP shall detect the presence of vehicles in up to 24 detection zones per camera. A typical detection zone shall be approximately the width and length of one car.

Detection zones shall be programmed via an on board menu displayed on a video monitor and a pointing device connected to the VDP. The menu shall facilitate placement of detection zones and setting of zone parameters or to view system parameters. A separate computer shall not be required for programming detection zones or to view system operation.

The VDP shall store at least three different detection zone patterns. The VDP shall be able to switch to any one of the

different detection patterns within 1 second of user request via menu selection with the pointing device.

The VDP shall detect vehicles in real time as they travel across each detection zone.

The VDP shall have an RS232 port for communications with an external computer. The VDP RS232 port shall be multi-drop compatible.

The VDP shall accept new detector patterns from an external computer through the RS-232 port. A Windows™-based software designed for local or remote connection and providing video capture, real-time detection indication and detection zone modification capability shall be provided with the system.

The VDP shall be able to send its detection patterns to an external computer through the RS-232 port.

The extension module (EM) shall be available to avoid the need of rewiring the detector rack, by enabling the user to plug an extension module into the appropriate slot in the detector rack. The extension module shall be connected to the VDP by a 10-wire cable with modular connectors, and shall output contact closures in accordance with user selectable channel assignments.

The camera system shall be able to transmit an NTSC video signal, with minimal signal degradation, up to 1000 feet under ideal conditions.

The associated Video Detection Processor (VDP) shall default to a safe condition, such as a constant call on each active detection channel, in the event of loss of video signal.

The system shall be capable of automatically detecting a low-visibility condition such as fog and respond by placing all defined detection zones in a constant call mode. A user-selected output shall be active during the low-visibility condition that can be used to modify the controller operation if connected to the appropriate controller input modifier(s). The system shall automatically revert to

normal detection mode when the low-visibility condition no longer exists.

3. Vehicle Detection

A minimum of 24 detection zones shall be supported and each detection zone shall be able to be sized to suit the site and the desired vehicle detection region.

A single detection zone shall be able to replace multiple inductive loops and the detection zones shall be OR'ed as the default or may be AND'ed together to indicate vehicle presence on a single phase of traffic movement.

Placement of detection zones shall be done by using only a pointing device, and a graphical interface built into the VDP and displayed on a video monitor, to draw the detection zones on the video image from the video camera. No separate computer shall be required to program the detection zones.

A minimum of 3 detection zone patterns shall be saved within the VDP memory. The VDP's memory shall be non-volatile to prevent data loss during power outages.

The selection of the detection zone pattern for current use shall be done through a menu. It shall be possible to activate a detection zone pattern for a camera from VDP memory and have that detection zone pattern displayed within 1 second of activation.

When a vehicle is detected crossing a detection zone, an on screen indication shall be provided such as the flashing of the detection zone on the video overlay display screen to confirm the detection of the vehicle.

Detection shall be at least 98% accurate in good weather conditions and at least 96% accurate under adverse weather conditions (rain, snow, or fog).

Detector placement will typically not be more distant from the camera than a distance of ten times the mounting height of the camera.

The VDP shall provide up to 24 outputs of vehicle presence detection per video input. Four outputs shall be available through the detector rack edge connector and the remaining outputs through the detector rack edge connectors of one or more extension modules.

The VDP shall provide dynamic zone reconfiguration (DZR) to enable normal detector operation of existing channels except the one where a zone is being added or modified during the setup process. The VDP shall output a constant call on any detection channel corresponding to a zone being modified.

Detection zone setup shall not require site-specific information such as latitude, longitude, date and time to be entered into the system in order for the detector to operate properly.

The VDP shall output a constant call for each enabled detector output channel if a loss of video signal occurs. The VDP shall output a constant call during the background learning period.

Each of the detection zone outputs shall be configurable to allow the selection of presence, pulse, extend, and delay outputs. Timing parameters of pulse, extend, and delay outputs shall be user definable between 0.1 to 25.0 seconds.

At least six detection zones shall be capable of counting the number of vehicles detected per camera input. The count value shall be internally stored for later retrieval through the RS-232 port. The data collection interval shall be user definable in periods of 5, 15, 30 or 60 minutes.

4. VDP and EM Hardware

The VDP and EM shall be specifically designed to mount in a standard detector rack, using the edge connector to obtain power and provide contact closure outputs. No adapters shall be required to mount the VDP or EM in a standard detector rack. Detector rack rewiring shall not be required.

The VDP and EM shall operate satisfactorily in a temperature range from -37°C to +74°C and a humidity range from 0%RH to 95%RH, non-condensing.

The VDP and EM shall be powered by 24 volts DC.

VDP power consumption shall not exceed 300 milliamps. The EM power consumption shall not exceed 150 milliamps.

The VDP shall include an RS232 port for serial communications with a remote computer. The VDP RS232 port shall be multi-drop compatible. This port shall be a 9-pin "D" subminiature connector on the front of the VDP.

The VDP shall utilize flash memory technology to enable the loading of modified or enhanced software through the RS232 port without modifying the VDP hardware.

The VDP and EM shall include detector output pin out compatibility with industry standard detector racks.

The fronts of the VDP and the EM shall each include detection indications, such as LED's, for each channel of detection that display detector outputs in real time when the system is operational.

The front of the VDP shall include two BNC video input connections suitable for RS170 video inputs. The video input shall include a switch selectable 75-ohm or high impedance termination to allow camera video to be routed to other devices, as well as input to the VDP for vehicle detection.

The front of the VDP shall include one BNC video output providing real time video output that can be routed to other devices.

The front panel of the VDP shall have a detector test switch to allow the user to place calls on each channel. The test switch shall be able to place either a constant call or a momentary call depending on the position of the switch.

5. Access/Communication Module

The access device shall be specifically designed to mount in a standard TS-1, TS-2, and 170 type detector rack, using the edge connector to obtain power. No adapters shall be required to mount the access device in a standard detector rack.

The access device shall occupy no more than two slots in the detector rack and shall provide a loop-type handle for easy installation and removal.

The access device shall be powered by 12 or 24 volts DC and shall not consume more than 6.25 watts. The unit shall automatically compensate for the different input voltages and shall be hot-swappable.

The access device shall operate in a temperature range from -35°C to +74°C and a humidity range from 0% RH to 95% RH, non-condensing.

Video Ports - The access unit shall accommodate a maximum of four composite video inputs and one video output.

Video inputs and video output shall be made via BNC connectors to ensure secure connections. RCA or other straight friction plug-in type connections shall not be allowed. Video inputs can use a vendor supplied "octopus" cable to accommodate the four video inputs. Provisions shall be made to accommodate the mating cable to utilize jack screws for securing the octopus cable.

The access unit shall accommodate either monochrome or color video signals conforming to NTSC video standards.

The access unit shall automatically sense the video input signal and configure the video output port to the NTSC standard. Each video input signal shall be separately sensed to allow mixed video signals.

The access unit shall interface with up to four video detection processors using RJ-45 interface connectors.

The access unit shall support the use of USB pointing devices. The unit shall support either a USB mouse or trackball. Pointing devices shall not require vendor specific pointing device software drivers.

An EIA-232 communications port shall be provided for local and remote access. The connector for this port shall be a 9-pin "D" subminiature connector on the front of the access unit. Provisions shall be made to accommodate mating cables to utilize jack screws for securing cables.

Hi-intensity LED status lights shall be provided to facilitate system monitoring. Indicators shall be provided to show the status of the internal processor, video lock and indication of which video input is being monitored.

An Ethernet port shall be provided with the access unit. External serial-to-Ethernet converters are not allowed. The Ethernet port shall conform to 802.3 Ethernet specifications and shall auto-sense between 10 and 100 Mbps data rates. Industry standard TCP/IP (UDP and TCP packets) protocol shall be supported. The Ethernet connection shall be made through a RJ-45 connector.

6. Video Detection Camera

The video cameras used for traffic detection shall be furnished by the VDP supplier and shall be qualified by the supplier to ensure proper system operation.

The camera shall produce a useable video image of the bodies of vehicles under all roadway lighting conditions, regardless of time of day. The minimum range of scene luminance over which the camera shall produce a useable video image shall be the minimum range from nighttime to daytime, but not less than the range 1.0 lux to 10,000 lux.

The camera shall use a CCD sensing element and shall output color video with resolution of not less than 470 lines horizontal.

The camera shall include an electronic shutter control based upon average scene luminance and shall be equipped with an auto iris lens.

The camera shall include a variable focal length lens with variable focus that can be adjusted, without opening up the camera housing, to suit the site geometry by means of a portable interface device (lens adjustment module) designed for that purpose and manufactured by the detection system supplier. The horizontal field of view shall be adjustable from 6 to 50 degrees. A single camera configuration shall be used for all approaches in order to minimize the setup time and spares required by the user.

The camera electronics shall include AGC to produce a satisfactory image at night.

The camera shall be housed in a weather-tight sealed enclosure. The housing shall be field rotatable to allow proper alignment between the camera and the traveled road surface.

The camera enclosure shall be equipped with an integrated sun shield. The sunshield shall include a provision for water diversion to prevent water from flowing in the camera's field of view. The camera enclosure with sunshield shall be less than 6" diameter, less than 18" long, and shall weigh less than 6 pounds when the camera and lens are mounted inside the enclosure.

The camera enclosure shall include a thermostatically controlled heater to assure proper operation of the lens shutter at low temperatures and prevent moisture condensation and ice buildup on the optical faceplate of the enclosure.

When mounted outdoors in the enclosure, the camera shall operate satisfactorily in a temperature range from -35 °C to +60 °C and a humidity range from 0% RH to 100% RH.

The camera shall be powered by 120-240 VAC 50/60 Hz. Power consumption shall be 45 watts or less under all conditions.

Camera placement shall be on the traffic signal mastarms or vertical street lighting davits above or adjacent to the roadway as shown in the plans. For optimum detection the camera should be centered above the roadway over the

traveled way on which vehicles are to be detected. The camera shall view approaching vehicles and provide reliable detection within the height to distance ratio of 10:100. Camera placement and field of view (FOV) shall be unobstructed and as noted in the installation documentation provided by the supplier.

The camera enclosure shall be equipped with separate, weather-tight connections for power and setup video cables at the rear of the enclosure. These connections may also allow diagnostic testing and viewing of video at the camera while the camera is installed on a mast arm or pole using a lens adjustment module (LAM) supplied by the VDP supplier. Video and power shall not be connected within the same connector.

The video signal output by the camera shall be NTSC color format.

The video signal shall be fully isolated from the camera enclosure and power cabling.

7. Installation

The coaxial cable to be used between the camera and the VDP in the traffic cabinet shall be Belden 8281 or a 75 ohm, precision video cable with 20 gauge solid bare copper conductor (9.9 ohms/M), solid polyethylene insulating dielectric, 98% (min) tinned copper double-braided shield and black polyethylene outer covering. The signal attenuation shall not exceed 0.78 dB per 100 feet at 10 MHz. Nominal outside diameter is 0.304 inches. The coax cable shall be a continuous unbroken run from the camera to the VDP. This cable shall be suitable for installation in conduit or overhead with appropriate span wire. 75-ohm BNC plug connectors should be used at both the Camera and Cabinet ends. The coaxial cable, BNC connector, and crimping tool shall be approved by the supplier of the video detection system. All connections shall be made in accordance with the manufacturer's instructions.

The power cabling shall be 16 AWG three conductor cable. The cabling shall comply with the National Electric Code, as well as local electrical codes.

The Contractor shall install the cameras on traffic signal mast arms or luminaire mast arms at the location directed by the Engineer; in accordance with the manufacturer's guidelines; and to the satisfaction of the Engineer. If, in the opinion of the Engineer, it is necessary to install extension brackets on the mast arm mounted cameras to obtain satisfactory operation the Contractor shall provide and install them as part of the intersection detection. The cameras shall be aimed and secured in an aimed position by the Contractor. The Contractor shall employ a Video Monitor and lens adjustment module approved by the manufacturer. The cameras shall be aimed so that the field of view is as directed by the Engineer. Drip loops shall be provided for the camera power and video cables.

The video detection system shall be installed by supplier factory certified installers and as recommended by the supplier and documented in installation materials provided by the supplier. Proof of factory certification shall be provided.

8. Limited Warranty

The supplier shall provide a limited three-year warranty on the video detection system.

During the warranty period, technical support shall be available without charge from the supplier via telephone within 4 hours of the time a call is made by a user, and this support shall be available from factory-certified personnel or factory-certified installers.

Updates to VDP software shall be available from the supplier without charge for the life of the product.

9. Maintenance and Support

The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the video detection system. These parts shall be available for delivery within 30 days of order placement.

The supplier shall maintain an ongoing program of technical support for the video detection system. This

technical support shall be available via telephone, or via personnel sent to the installation site upon placement of an acceptable order.

Installation and training support shall be provided by a factory authorized representative without charge.

All product documentation shall be written in the English language.

10. Deliverables

One video camera shall be provided for each signalized intersection approach to be equipped with detection as shown in the plans. One two-input video detection processor (VDP) module shall be provided for each two video cameras. One extension module (EM) and one Ethernet communication module shall be provided per intersection. One manufacturer approved color video monitor shall be provided per intersection. A Windows™-based software package designed for local or remote connection and providing video capture, real-time detection indication and detection zone modification capability shall also be provided with the system.

One lens adjustment module (LAM) shall be provided for use during installation of video detection system which shall become the property of the City of Minneapolis upon acceptance of the system if the provided lens adjustment module is different from that which the City of Minneapolis presently utilizes.

Upon proper orientation and connection of the various video detection cameras by the contractor, the factory authorized representative shall assist and train City of Minneapolis personnel in utilizing all software, setting up detection zones and channel assignments as well as establishing the other necessary parameters for a properly performing detection system.

One new spare two-input video detection processor (VDP) module, one Ethernet communication module, and one new spare video camera shall be provided to the City of Minneapolis for maintenance purposes upon acceptance of the system.

Each video detection system shall be complete and in operation. The cost of furnishing all materials and labor to perform the work described above at each identified intersection shall be paid for as **"Video Detection System Type 2 Intersection (n)", Each**.

I. Video Detection System Type 3

The Contractor shall furnish, install and make operational all PTZ ("point-tilt-zoom") video detection devices for the signal systems as shown in the Plans and as follows. The Contractor shall furnish and install all cables and conductors, mounting hardware, and each video detection device as per the Plans and to the satisfaction of the Engineer.

All equipment necessary as well as the equipment in each controller cabinet to operate each video detection system shall be new devices furnished and installed by the Contractor.

At least 14 days prior to when the applicable traffic signal cabinet is required on the project, all necessary materials and electrical equipment required in the traffic signal cabinet, and all documentation, maintenance and operation manuals, and wiring diagrams shall be delivered to Larry Mountjoy at the City of Minneapolis Signal Shop at 300 Border Avenue North, Minneapolis, MN 55405.

1. General

This specification sets forth the minimum requirements for a system that detects vehicles on a roadway using only video images.

a. System Hardware

The video detection system shall consist of one or more integrated camera with video detection processor (VDP), one or more interface communication controller (ICC) modules which mount in a standard detector rack; a shelf mount video monitor, and a pointing device.

b. System Software

The system shall include software that detects using only the video image. Detection zones shall be defined using only an on board video menu and a pointing device to place the zones on a video image. Up to six detection zones per camera shall be available. A separate computer shall not be required to program the detection zones.

2. Functional Capabilities

The VDP shall process video from the integrated camera. The video shall be in NTSC composite video format and shall be digitized and analyzed in real time.

The VDP shall detect the presence of vehicles in up to six detection zones per camera. A typical detection zone shall be approximately the width and length of one car.

Detection zones shall be programmed via an on board menu displayed on a video monitor and a pointing device connected to the ICC. The menu shall facilitate placement of detection zones and setting of zone parameters or to view system parameters. A separate computer shall not be required for programming detection zones or to view system operation.

The VDP shall store at least three different detection zone patterns. The VDP shall be able to switch to any one of the three different detection patterns within one second of user request via menu selection with the pointing device.

The VDP shall detect vehicles in real time as they travel across each detection zone.

The ICC shall have an RS-232 port for communications with an external computer for diagnostic and remote management applications.

The VDP shall accept new detector patterns from an external computer through the RS-232 port on the ICC. A Windows™-based software designed for local or remote connection and providing video capture, real-time detection

indication and detection zone modification capability shall be provided with the system.

The VDP shall be able to send its detection patterns to an external computer through the RS-232 port on the ICC upon request.

VDP and ICC communications shall be accommodated by methods using differential signals to reject electrically coupled noise.

The VDP shall be able to transmit the composite video signal, with minimal signal degradation, up to 1000 feet under ideal conditions.

The associated VDP shall default to a safe condition, such as a constant call on each active detection channel, in the event of loss of video signal.

The system shall be capable of automatically detecting a low-visibility condition such as fog and respond by placing all defined detection zones in a constant call mode. The system shall automatically revert to normal detection mode when the low-visibility condition no longer exists.

3. Vehicle Detection

A minimum of six detection zones shall be supported and each detection zone shall be able to be sized to suit the site and the desired vehicle detection region.

A single detection zone shall be able to replace multiple inductive loops and the detection zones shall be OR'ed as the default or may be AND'ed together to indicate vehicle presence on a single phase of traffic movement.

Placement of detection zones shall be done by using only a pointing device, and a graphical interface built into the VDP and displayed on a video monitor, to draw the detection zones on the video image from the video camera. No separate computer shall be required to program the detection zones.

A minimum of three detection zone patterns shall be saved within the VDP memory. The VDP's memory shall be

non-volatile to prevent data loss during power outages. The VDP shall continue to operate using the existing zone configurations even when the operator is defining/modifying a zone pattern. The new zone configuration shall not go into effect until the configuration is saved by the operator.

The selection of the detection zone pattern for current use shall be done through a local menu or remote computer via RS-232 port on the ICC. When a new configuration pattern is selected it becomes active within one second.

When a vehicle is detected crossing a detection zone, an on screen indication shall be provided such as the flashing of the detection zone on the video overlay display screen to confirm the detection of the vehicle.

Detection shall be at least 98% accurate in good weather conditions and at least 96% accurate under adverse weather conditions (rain, snow, or fog).

Detector placement will typically not be more distant from the camera than a distance of ten times the mounting height of the camera.

The VDP shall provide two channels of vehicle presence detection per system through a standard detector rack edge connector.

The VDP shall provide dynamic zone reconfiguration (DZR) to enable normal detector operation of existing channels except the one where a zone is being added or modified during the setup process. The VDP shall output a constant call on any detection channel corresponding to a zone being modified.

Detection zone setup shall not require site-specific information such as latitude, longitude, date and time to be entered into the system in order for the detector to operate properly.

The VDP shall output a constant call for each enabled detector output channel if a loss of video signal occurs.

The VDP shall output a constant call during the background learning period.

Each of the detection zone outputs shall be configurable to allow the selection of presence, pulse, extend, and delay outputs. Timing parameters of pulse, extend, and delay outputs shall be user definable between 0.1 to 25.0 seconds.

At least six detection zones shall be capable of counting the number of vehicles detected per camera input. The count value shall be internally stored for later retrieval through the RS-232 port. The data collection interval shall be user definable in periods of 5, 15, 30 or 60 minutes.

4. ICC Module

The ICC shall be specifically designed to mount in a standard NEMA TS-1 and TS-2 detector rack using the edge connector or AC power input on front to obtain power and provide contact closure outputs. No adapters shall be required to mount the ICC in a standard detector rack. Detector rack rewiring shall not be required.

The ICC shall operate satisfactorily in a temperature range from -37°C to +74°C and a humidity range from 0%RH to 95%RH, non-condensing.

The ICC shall be powered by 100 to 240 volts AC, 50 or 60Hz. This module shall automatically compensate for the different input voltages/frequencies.

System power consumption shall not exceed 25 watts within the specified input voltage range.

The VDP shall utilize non-volatile memory technology to enable the loading of modified or enhanced software through the RS-232 port on the ICC without modifying the VDP hardware.

The ICC shall include detector output pin out compatibility with industry standard detector racks.

The front of the ICC shall each include detection indications, such as LED's, for each channel of detection

that display detector outputs in real time when the system is operational.

The front of the ICC shall include one BNC video output connection providing real time video output that can be routed to other devices.

The front panel of the ICC shall have a detector test switch to allow the user to place calls on each channel. The test switch shall be able to place either a constant call or a momentary call depending on the position of the switch.

5. Video Detection Processor Module

The camera shall produce a useable video image of the bodies of vehicles under all roadway lighting conditions, regardless of time of day. The minimum range of scene luminance over which the camera shall produce a useable video image shall be the minimum range from nighttime to daytime, but not less than the range 1.0 lux to 10,000 lux.

The imager luminance signal to noise ratio (S/N) shall be more than 50 dB.

The VDP electronics shall include automatic gain control (AGC) to produce a satisfactory image at night.

The camera shall use a CCD sensing element and shall output color video with resolution of not less than 470 lines horizontal.

The camera shall include an electronic shutter control based upon average scene luminance and shall be equipped with an auto iris lens.

The horizontal field of view shall be adjustable from 6 to 50 degrees. A single camera configuration shall be used for all approaches in order to minimize the setup time and spares required by the user.

The VDP shall be housed in a weather-tight sealed enclosure. The housing shall be field rotatable to allow proper alignment between the VDP and the traveled road surface.

The VDP enclosure shall be equipped with an integrated sun shield. The sunshield shall include a provision for water diversion to prevent water from flowing in the camera's field of view. The camera enclosure with sunshield shall be less than 5" diameter, less than 18" long, and shall weigh less than six pounds when the camera and lens are mounted inside the enclosure.

The VDP enclosure shall include a proportionally controlled heater, where the output power of the heater varies with temperature, to assure proper operation of the lens functions at low temperatures and prevent moisture condensation and ice buildup on the optical faceplate of the enclosure.

The front of the enclosure shall be made from glass and shall have an anti-reflective coating to minimize light and image reflections.

When mounted outdoors in the enclosure, the VDP shall operate satisfactorily in a temperature range from -35 °C to +60 °C and a humidity range from 0% RH to 100% RH.

The VDP enclosure shall be equipped with a single, weather-tight connector.

Camera placement shall be on the traffic signal mast arms or vertical street lighting davits above or adjacent to the roadway as shown in the plans. For optimum detection the camera should be centered above the roadway over the traveled way on which vehicles are to be detected. The camera shall view approaching vehicles and provide reliable detection within the height to distance ratio of 10:100. Camera placement and field of view (FOV) shall be unobstructed and as noted in the installation documentation provided by the supplier.

6. Installation

The cable to be used between the VDP and the ICC in the traffic signal cabinet shall be 19AWG three (3) twisted pairs. The cabling shall comply with the National Electric Code, as well as local electrical codes. The cable shall be a continuous unbroken run from the VDP to the ICC. This

cable shall be suitable for installation in conduit. Pluggable connectors supplied should be used at both the VDP and ICC ends. The cable and installation tools shall be approved by the supplier of the video detection system, and the manufacturer's instructions must be followed to ensure proper connection.

The VDP and ICC shall be furnished by the same supplier and shall be qualified by the supplier to ensure proper system operation.

The Contractor shall install the cameras on traffic signal mast arms or luminaire mast arms at the location directed by the Engineer; in accordance with the manufacturer's guidelines; and to the satisfaction of the Engineer. If, in the opinion of the Engineer, it is necessary to install extension brackets on the mast arm mounted cameras to obtain satisfactory operation the Contractor shall provide and install them as part of the intersection detection. The cameras shall be aimed and secured in an aimed position by the Contractor. The Contractor shall employ a Video Monitor approved by the manufacturer. The cameras shall be aimed so that the field of view is as directed by the Engineer. Drip loops shall be provided for the camera cabling.

The video detection system shall be installed by supplier factory certified installers and as recommended by the supplier and documented in installation materials provided by the supplier. Proof of factory certification shall be provided.

7. Limited Warranty

The supplier shall provide a limited three-year warranty on the video detection system.

During the warranty period, technical support shall be available without charge from the supplier via telephone within 4 hours of the time a call is made by a user, and this support shall be available from factory-certified personnel or factory-certified installers.

Updates to VDP and ICC software shall be available from the supplier without charge for the life of the product.

8. Maintenance and Support

The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the video detection system. These parts shall be available for delivery within 30 days of order placement.

The supplier shall maintain an ongoing program of technical support for the video detection system. This technical support shall be available via telephone, or via personnel sent to the installation site upon placement of an acceptable order.

Installation and training support shall be provided by a factory authorized representative without charge.

All product documentation shall be written in the English language.

9. Deliverables

One integrated camera with video detection processor shall be provided for each location to be equipped with detection as shown in the plans. One interface communication controller module shall be provided for each video camera. One manufacturer approved color video monitor shall be provided per intersection. A Windows™-based software package designed for local or remote connection and providing video capture, real-time detection indication and detection zone modification capability shall also be provided with the system.

Upon proper orientation and connection of the various video detection cameras by the contractor, the factory authorized representative shall assist and train City of Minneapolis personnel in utilizing all software, setting up detection zones and channel assignments as well as establishing the other necessary parameters for a properly performing detection system.

One new spare integrated camera with video detection processor and one interface communication controller

module shall be provided to the City of Minneapolis for maintenance purposes upon acceptance of the system.

Each video detection system shall be complete and in operation. The cost of furnishing all materials and labor to perform the work described above at each identified intersection shall be paid for as **"Video Detection System Type 3 Intersection (n)", Each**.

J. Detection System Type 4

The Contractor shall furnish and install a radio frequency wireless detection system at each intersection if shown in the Plans. The detection system shall consist of a sensor, a communication access point, a communication repeater if required by the plans, and cabinet interface electronics.

1. Wireless Detector

Contractor shall furnish and install a radio frequency wireless detector (sensor). Sensors shall consist of a small enclosure containing a radio and a magnetometer designed to collect vehicle counts. Each Sensor shall consist of a magnetometer, a microprocessor with software, a wireless transmitter, a wireless receiver and a battery. The electronics shall be encased in a single housing compliant with NEMA 6P and IP68 standards and shall be fully encapsulated. The sensor, shall be rated for operation at temperature ranges from a minus thirty seven (-37) to plus one hundred seventy six (+176) degrees Fahrenheit. Sensors shall be marked for the directionality of operation, rejecting vehicles that traverse the detector in the incorrect direction, when selected. The battery life of the sensor shall be a minimum design life of seven years. The sensor shall transmit the detection event to an access point or repeater within 125 ms of the detection event.

Prior to installation, the contractor shall create a wireless detection installation map. The installation map shall show the communication identifier label of each communication device: repeater, access point and sensor. Prior to installation, all wireless detector components shall be pre-programmed to associate as defined in the installation map.

Contractor shall core drill the road surface and secure the sensor into the road surface following the manufacturer's recommended guidelines. The sensor shall be placed into a plastic clam shell type enclosure prior to placement to accommodate potential future removal. Preliminary proposed sensor locations are shown in the plans.

Prior to any installation, two field verifications shall occur. The City shall field verify the locations. Contractor shall provide a field representative from the manufacturer who shall verify that the proposed sites meet the typical communication restrictions of the radio receivers of the sensor system. No sensor shall be installed until final approval of the sensor locations is given. The City shall make all final detector location decisions.

Contractor shall provide all traffic control needed to install the proposed sensors in the final detector pattern. No contract adjustment will be made for the sites chosen for sensor locations differing from the preliminary sites shown in the plans. No payment will be made for sensors installed in locations that had not been approved by the City.

2. Wireless Access Point

Contractor shall furnish and install a radio frequency wireless access point as shown in the Plans. Access points shall consist of a radio antenna enclosed in a weatherproof housing. Access point shall be mounted as stated in the plans. Mounting shall allow access point to be rotated in 360 degrees horizontally as well as allow angling forward to back and side to side. Access point shall be powered from the traffic signal controller cabinet by a cable recommended by the manufacturer. Access point shall communicate to the traffic signal cabinet equipment through that same cable. Preliminary proposed access point locations are shown in the plans. Prior to any installation, contractor shall provide a field representative from the manufacturer to verify that the proposed sites meet the typical communication restrictions of the radio receivers of the sensor system. No access point shall be installed until final approval of the access point locations is given by the City who shall make all final detector location decisions.

Contractor shall provide all traffic control needed to install the proposed access points. No contract adjustment will be made for the sites chosen for access point locations differing from the preliminary sites shown in the plans. Contractor shall expect to field adjust the access point orientation and perhaps relocate the access point more than once to determine an acceptable mounting arrangement. Preferred access point mounting situations provide unblocked line of sight situations between access point, sensors, and repeaters and maintain shorter communication lengths than the distance recommended by the manufacturer. No payment will be made for access points installed in locations that had not been pre-approved by the City. No payment adjustment will be made for relocating access points to improve communication quality. The Contractor shall measure the quality of each communication link and report the reading to the City.

3. Wireless Repeater

Contractor shall furnish and install radio frequency wireless repeaters if called for in the Plans. Repeaters shall consist of a radio antenna enclosed in a weatherproof housing. Repeater shall be mounted as stated in the plans. Mounting shall allow repeater to be rotated in 360 degrees horizontally as well as allow angling forward to back and side to side. Repeater shall be powered by a battery rated for four year life. Batteries shall be replaced using common tools. Repeater shall communicate to the access point and to the sensors by radio transmission. Preliminary proposed repeater locations are shown in the plans. Prior to any installation, contractor shall provide a field representative from the manufacturer to verify that the proposed sites meet the typical communication restrictions of the repeater. No repeater shall be installed until final approval of the repeater locations is given by the City.

Contractor shall provide all traffic control needed to install the proposed repeaters in the final detector pattern. No contract adjustment will be made for the sites chosen for repeater locations differing from the preliminary sites shown in the plans. Contractor shall expect to field adjust the repeater orientation and perhaps relocate the repeater more than once to determine an acceptable mounting

arrangement. Preferred repeater mounting provides unblocked line of sight between access point, sensors, and repeaters and maintain shorter communication lengths than the distance recommended by the manufacturer. No payment will be made for repeaters installed in locations that had not been pre-approved by the City. No payment adjustment will be made for relocating repeaters to improve communication quality. The Contractor shall measure the quality of each communication link and report the reading to the City.

4. Wireless Interface

Contractor shall furnish a radio frequency wireless interface to the City for installation in each of the controller cabinets called for in the Plans. Interface shall consist of all components installed inside the traffic signal controller cabinet to provide the functionality described. Interface shall provide NEMA TS2 Type 1 detector inputs into the traffic signal controller. Interface hardware shall provide visible confirmation of a detection to a technician at the cabinet in real-time via a visual output such as an LED lighting to represent a vehicle detection. All hardware necessary to establish the NEMA TS2 Type 1 interface in a NEMA TS2 Type 1 cabinet shall be provided. Interface shall allow connection by a technician to a laptop with software for communication with RF Wireless components. The interface shall have an Ethernet port that will permit remote communication connection to the device to allow status information as well as vehicle count data to collected directly through the interface as well as allow remote software upgrades to be performed.

5. Payment

Each Rf Wireless Detection system shall be complete and in operation. The cost of furnishing all materials and all labor to perform the work described above at each identified intersection shall be paid for as **"Detection System Type 4 Intersection (n)", Each**.

K. Handholes

Frames and covers shall be set in a bed of mortar and leveled to the finished surrounding grade. High density polymer concrete frame and covers constructed in accordance with City of Minneapolis Standard Plate No. Traf-1725 shall be furnished and installed by the Contractor. Hand hole shall be constructed in accordance with Minneapolis Standard Plate No. Traf-1730. A drain field shall be provided with each hand hole.

Existing relocated and reused or new metal hand hole frames and covers shall be electrically grounded. Frames and covers for new or relocated hand holes shall be prepared for grounding prior to installation. Grounding shall be accomplished by attaching ground lugs for connecting both a 30 inch long #6 solid copper ground wire to the underside of the hand hole ring and a 12 inch long #2 braided ground cable between the underside of the hand hole ring and the underside of the hand hole cover. Hand hole frame shall be connected with a ground clamp to a 1/2 inch by 8 ft ground rod sunk inside of the hand hole.

Conduits shall be installed by the use of a hole saw to cut through the handhole wall. The area surrounding the conduit entrance shall be sealed with a mortar filling. Conduits shall extend a minimum of 2 inches and not more than 3 inches into the handhole.

Signal interconnect conduit runs passing through handholes shall have both entering conduits placed in direct horizontal alignment.

The Contractor shall remove to the bottom of the handhole, any excess material inside of the handhole.

The Contractor shall salvage in place handholes not reused as part of a revised permanent signal system unless otherwise directed by the Engineer.

Salvaged and reused metal frames and covers shall be painted before reuse. Metal frames and covers shall be pretreated prior to concrete placement such that the concrete does not adhere to exposed surfaces. Frames and covers shall be cleaned free of adhering concrete after placement. Painting of the metal frames and covers shall be as specified elsewhere in these Special Provisions.

High density polymer concrete frames and covers shall be covered during sidewalk and concrete pad placement to protect them from adhering concrete. Failure to do so will require the ring and/or cover to be replaced by the Contractor if concrete adherence occurs.

L. Remove Existing Hand hole

The Contractor shall remove the existing hand hole while leaving the existing cables and the conduits intact. Typically the Plans shall have directed the Contractor to install another structure in its place.

Removal procedure may take one of two forms. Method one: The contractor may excavate around existing conduits around hand hole, leaving existing cables in operation inside hand hole. Contractor may break handhole body, leaving conduits and internal cables intact. Method two: Contractor may remove existing cables from the hand hole. This may require removal of cables from multiple directions and may require turning off power to some traffic signals. If existing detector loops are disconnected at the splice, the contractor shall remake the splice in accordance with the splice procedure listed elsewhere in these special provisions.

In all cases, the contractor must preserve the integrity of the conduit system and of the existing electrical cables meeting at the removed hand hole unless otherwise directed in the Plans.

M. Installation of Mast Arm Poles

The Contractor shall mount all transformer bases directly on the foundation. The use of the lower anchor rod nuts for leveling is not permitted. The lower anchor rod nut shall be tightened snug against the upper plate of the transformer base after leveling. Any pole that is not plumb shall be correctable up to ½-inch using stainless steel washers. The Contractor, at the Contractor's expense, shall recap foundations that are incorrectly installed.

N. Signal Out Requirements

During the period when each existing or temporary signal system is de-energized, traffic signs will be required to inform motorists that the signal indications are not operating. The Contractor shall furnish, erect, and maintain "Stop Ahead" and "Stop" signs and

barricades. The quantity and size of the temporary signs and barricades as well as their placement in the field shall be as directed by the Engineer. The Contractor shall furnish and install materials to keep these signs upright and stationary. The signs, barricades, etc., shall remain the property of the Contractor. The Contractor shall notify the Engineer five (5) days in advance of de-energizing the system. The Engineer shall approve the day and time and duration of these events.

O. Vehicle And Pedestrian Signal Face Installation

1. Pedestal Mounted: The provisions of Mn/DOT 2565.3L1 are modified to include the following:

   Vehicle and pedestrian signal faces required to be mounted at the top of traffic signal pedestals shall be mounted in accordance with the "Minneapolis Standard Plate No. Traf-1340 shown in the Plans.

2. Vertical Pole Shaft Mounted: The provisions of Mn/DOT 2565.3L2 are modified to assure that vehicle and pedestrian signal faces required to be mounted on a vertical pole shaft of a mast arm pole standard shall be mounted in accordance with the Minneapolis Standard Plate No. Traf-1330 shown in the Plans.

   The pedestrian indications Type 30A(R) and Type 30A(L) shall have no lower bracket and banding as shown.

   The one-way pole mounted vehicle indications Type 10A shall have the upper mounting bracket attached to the vertical pole shaft by the use of knurled steel threaded inserts and not by banding.

   The two-way pole mounted vehicle indications Type 20A shall have the upper mounting bracket attached to the vertical pole shaft by the use of knurled steel threaded inserts and not by banding.

3. Pedestrian Signal Attachment: Pedestrian signals shall be attached to the signal assembly plumbing using 1 ½" X 2" galvanized steel nipples to connect the signal to the 90-degree elbow at the top of the pedestrian signal. The pedestrian signal assembly shall be held in place on the 1 ½" plumbing through the use of a 2" – 10 gauge plated steel bushing and a 1 ½" by ½" galvanized steel lock nut.

P. Placing Traffic Control Signals In Operation

All vehicle signal faces and pedestrian indications shall be bagged or turned away from traffic immediately after erection to clearly indicate that the signal is not in operation. All bagging shall be gunnysacks or other like material approved by the Engineer and shall be maintained by the Contractor to the satisfaction of the Engineer. Bagging shall be of a grey or light brown color so as to clearly indicate that the signal face is not in use. Orange, red, or black bagging will not be permitted.

When the signal system is to be placed in operation, all vehicle signal faces and pedestrian indications shall be unbagged and aimed as directed by the Engineer.

At the time of controller cabinet connection by the City and at turn on, the Contractor shall have on hand and available at the location: spare lamps of each size, workers and equipment to reach overhead indications, and shall perform such work as may be required to correct such incidents as may be revealed in the connection and/or energization process. Only the City shall place the signal system in operation.

Q. Pedestrian Push Button And Pedestrian Instruction Sign Installation

Pedestrian push buttons shall be installed on vertical mast arm poles and on traffic signal pedestal shafts in conformance with Mn/DOT Standard Plate No. 8115D. Where pedestrian push buttons are to be installed as a separate mounting, the installation shall conform to the City of Minneapolis Standard Plate No. Traf-1259 and be approved by the Engineer before installation.

A pedestrian instruction sign shall be purchased by the Contractor from the City and installed by the Contractor with each pedestrian push button installation. The sign shall be provided with suitable brackets furnished by the Contractor for shaft mounting directly above the push button or shall be mounted as directed by the Engineer.

R. Control Cable Installation

At each system, before cabinet installation by the City, the Contractor for this Contract shall terminate all new electrical

cables and conductors extending above the cabinet concrete foundation as follows:

Cables:

- Shall be cut 6.5 to 10 feet above the cabinet concrete foundations, and
- Shall have the ends taped, and
- Shall be labeled with the cable number as per the field wiring diagram - (label shall be applied 12 inches above the cabinet concrete foundation), and
- Shall be coiled, tie wrapped, and left in a neat manner.

S. Completed Intersection Installation Testing

After successful installation of all items required in the Plans and Special Provisions, the City shall inspect and test each intersection prior to acceptance of the completed installation.

Each completed intersection installation shall function to the satisfaction of the Engineer and in accordance with the intent of the Plans and Special Provisions.

T. Traffic Signal Cabinet

The cabinets will be furnished and installed by the City.

1. Controller Timing: Timing settings for controller units will be furnished and installed by the City.

2. EVP & Video Detection Equipment: The Contractor shall provide cabinet located EVP electronics and any necessary additional harnessing and all cabinet located Video Detection hardware to the Engineer for delivery to the City of Minneapolis. City forces will test, and then install and connect the equipment in the traffic signal cabinet.

U. Installation And Connection Of Permanent Cabinet And Control Equipment

At each system, the City of Minneapolis will furnish, install and connect the traffic signal cabinet, complete with controller unit and all required signal control equipment, including Contractor supplied components. Contractor forces shall be on site to assist

the City during the installation process to trouble shoot issues identified during the cabinet installation/connection process.

V. Operation of Traffic Signals

1. Temporary Traffic Signal Systems: The Contractor shall not interfere with the operation of the traffic control signal system at any time at any intersection, except as may be otherwise authorized by the Engineer.

   The City will utilize temporary signals to provide temporary operation at each intersection where temporary signal operation is required.

   The Contractor shall remove and salvage all items of the existing traffic control signal systems not used in the temporary signal operation.

2. Continuous Operation: The Contractor shall ensure that a traffic control signal system is in operation at all times at those intersections where he is or has worked, except as may be otherwise directed by the Engineer.

3. Traffic Control Interconnect: The City requires that an operational traffic signal interconnect system be maintained through the project area until such time as the in place traffic signal systems are turned off. If the traffic signal interconnect system is utilized to communicate with other intersections outside of the project area a temporary interconnect system may have been installed and will need to remain in place and intact until such time as its functionality is can be replaced by a newly installed system. The Contractor shall not make any changes to or remove any part of the permanent or temporary interconnect system without first contacting and receiving the approval of the Minneapolis Traffic Division.

   If temporary interconnect facilities are shown in the Plans, the City will furnish and install all materials, equipment and labor required to maintain an operating temporary interconnect system for all signals within the project limits as well as any systems whose interconnect functions are carried on cables passing within or through the project limits.

W. Painting

The Contractor shall furnish all paint required after verification of the exact paints and colors with the City of Minneapolis Traffic and Parking Services.

At each system, all painting shall be in accordance with the provisions of Mn/DOT 2565.3T, except that finish coat paint for all traffic signal system items shall be two (2) manufacturers shop coats as modified below.

Traffic signal pedestal bases, pedestrian push button station bases, pedestrian push button assemblies and reused handhole frames and covers shall be finish painted with Exterior Enamel, Signal Green, conforming to the City of Minneapolis Specifications.

Existing or new metal handhole rings and covers shall be primed with a red oxide primer and finished with a City-approved Green Exterior Enamel. If field painting is required, it shall be approved in advance and be accepted by approval of the Engineer.

Traffic signal pedestal shafts, pedestal slipfitter collars, all signal brackets and pipe fittings and pedestrian push button stations, shall be finish painted with Exterior Enamel, Minneapolis Signal Yellow conforming to Minneapolis Specifications.

A shop coat of primer paint shall be applied to the outside surface of all poles, bases, and shafts.

Mast arm pole vertical shafts, traffic signal mast arms, auxiliary sign arms, luminaire pole shaft extensions, luminaire mast arms, mast arm pole transformer bases as well as street light pole transformer bases and street light poles which have signal heads attached thereto shall be finish painted with Exterior Enamel Thermoset Acrylic conforming to the following color requirement and specifications of the City of Minneapolis:

- Paint color shall be Minneapolis UPS Brown.

The fitter on the top of the luminaire extension that transitions from the extension to the luminaire fixture shall be UPS Brown.

Dull Non-Reflective Black enamel shall be used on visors, directional louvers and background shields.

SS-1.4 REMOVING, SALVAGING, AND STOCKPILING EXISTING MATERIALS AND ELECTRICAL EQUIPMENT

This work shall consist of the removal of all or portions of existing traffic signal control systems.

A. Removing and Salvaging Existing Systems

When directed by the Engineer, the Contractor shall remove and salvage for the City all items of the existing traffic control signal systems, signal equipment, interconnect cable, foundations, handholes, service equipment, and signs in accordance with the applicable provisions of Mn/DOT 2104; with the applicable provisions of Mn/DOT 2565.3U; and the following:

1. Underground conduit and handholes shall be removed, unless otherwise directed by the Engineer.

2. Salvaged items shall be disassembled as directed by the Engineer and shall be delivered to the City of Minneapolis Traffic and Parking Services Division at 300 Border Avenue North, Minneapolis.

   The Contractor shall contact the City Traffic and Parking Services office 24 hours in advance of delivery as follows:

   Traffic Stores

   Telephone: 612-673-5750

3. Salvaged items shall be disassembled before being delivered to the City of Minneapolis as follows:

   - Vehicle signals and pedestrian signals shall be removed and left intact.
   - Remove background shields from vehicle signal faces without damaging shields or signal faces.
   - Remove and disassemble all signal bracketing and pipe fittings without damaging signal bracketing and signal faces.
   - All signal and communication cables and conductors salvaged shall be neatly coiled and tagged with correct footage.

- Mast arm pole standards shall be disassembled by unbolting and removing mast arms, overhead signal head mounts, and signal brackets. All nuts and bolts shall be packaged and tagged.
- Luminaires shall be removed from the luminaire mast arms.
- Pedestal shafts and shaft rods shall be removed from pedestal bases. Pedestal slipfitter collars shall be removed and all set screws and plugs left intact.
- Service equipment, conduit risers, power conductors, etc., shall be removed from service wood poles and conduits disconnected from enclosures.
- Signs and sign brackets shall be removed from signal poles and mast arms.
- All other salvable items shall be removed and disassembled as directed by the Engineer.
- Existing handhole frames and covers that are not to be reused shall be salvaged and delivered to the City.
- **Where controller equipment is being replaced, the existing traffic signal cabinet electronics will be removed and salvaged by the City.**
- Traffic signal cabinets shall be disconnected from all field cabling before removal. Damage to terminal facilities resulting from the removal/transportation process shall be billed to the Contractor.

4. Concrete cabinet and pole foundations, conduit, and items deemed non-salvageable by the Engineer of each existing traffic control signal system shall be removed and disposed of outside the right-of-way in any manner that the Contractor may elect subject to the provisions of Mn/DOT 2104.3C3 and as noted elsewhere in these Special Provisions.

5. The concrete cabinet and pole foundations, and the underground signal conduits may include asbestos

containing electrical conduits (Transite). The 3′ x 18″ vertical pipe in handholes may also contain asbestos, Transite pipe. Underground signal conduits that contain asbestos will have been encased in concrete at the time of installation. For the procedure for handling and disposal of these asbestos-containing materials See the "Technical Specifications for the Excavation of Asbestos-Containing Electrical Conduit" located in the appendix of these Special Provisions.

6. Removing underground signal conduits containing asbestos shall be paid for as part of the street lighting items in this contract (see lighting specifications). The removal of traffic signal handholes and foundations containing asbestos shall be paid for as part of the lump sum cost for Salvage Signal System. Refer to the street lighting specifications for information regarding this removal.

7. All removal, disposal, and salvaging of materials of the existing traffic control signal systems, as required by the Plans and Special Provisions shall be paid for in accordance with the "Method of Measurement and Payment" included in a separate section.

SS 1.5 TYPE C AND D SIGNS

This work shall consist of furnishing and installing Type C and Type D sign panels, and installing City furnished signs as directed by the Engineer, in accordance with the applicable provisions of Mn/DOT 2564; with the details shown in the Plans; and as follows:

A. General

The Contractor shall furnish and install Type C and Type D sign panels on traffic signal mast arms, pedestal shafts, or mast arm pole shafts as indicated in the Plans.

Each Type C sign shall be in accordance with the Standard Sign Drawings of the Mn/DOT Standard Signs Manual and with the applicable provisions of Mn/DOT 3352.

B. Materials

Sign base, sign face and sign legend material for sign panels Type C and Type D shall be in accordance with the applicable provisions of Mn/DOT 2564, except the sign face and legend material shall be as follows:

Sign face material for sign panels shall be Direct Applied Wide Angle Prismatic Retroreflective Sheeting for Visual Impact Performance (VIP) manufactured by 3M Company.

Sign legend material for sign panels shall be Direct Applied Wide Angle Prismatic Retroreflective Sheeting for Visual Impact Performance (VIP) manufactured by 3M Company, except where black legend is specified the sign legend material shall be in accordance with Mn/DOT 3352.2A5c or Mn/DOT 3352.2A5d.

C. Fabrication

Type D sign panel layouts are dimensioned as follows:

1. Vertical Dimensioning

   The dimension given is for the legend component having the largest vertical dimension in the particular line of copy. Other legend components are centered on the larger legend component unless indicated otherwise.

2. Horizontal Dimensioning

   The horizontal dimensions given within the sign panel are to the tenth of an inch and are cumulative representing the distance from the left edge of panel to the extreme left edge of the legend component.

3. Sign Panel Recap

   The position of an arrow is measured in degrees counterclockwise from a right horizontal reference line. The abbreviation MOD used in the sign panel recap = Modified.

D. Mounting Sign Panels

Each pedestal pole shaft or mast arm pole shaft mounted Type C sign shall be furnished with two standard sign mounting bracket assemblies (utilizing a minimum 21 mm wide stainless steel band), or at the option of the City and at the direction of the Engineer the

Contractor shall drill and tap shaft, and each sign shall be mounted on each mast arm pole or pedestal pole at the location shown in the Plans.

Each Type C and mast arm mounted Type D sign panel shall be provided with mounting brackets as required and mounted at the location on the mast arm as specified in the Plans to the satisfaction of the Engineer and in accordance with the Mn/DOT Standard Signs Manual.

For sign panels less than 30 inches in height, the Contractor shall furnish the appropriate number of U-bolt brackets detailed on Page No. 105A of the Mn/DOT Standard Signs Manual (number of U-bolt brackets based on the sign panel length tabulated in the SIGN POST SPACING CHART in the Plan - **NOTE that maximum spacing between U-bolt brackets shall not exceed 45 inches**) and install U-bolt brackets at the appropriate spacing as specified in the SIGN POST SPACING CHART.

For sign panels greater than 24 inches in height, the Contractor shall furnish the appropriate number of pipe posts detailed on Page 105B of the Mn/DOT Standard Signs Manual (number of pipe posts based on the sign panel length tabulated in the SIGN POST SPACING CHART in the Plan - **NOTE that maximum spacing between U-bolt brackets shall net exceed 45 inches)** and install pipe posts at the appropriate spacing as specified in the SIGN POST SPACING CHART.

When attaching the U-bolts to the mast arm, the Contractor shall NOT install all U-bolts such that all "Z" brackets face the same direction as detailed in Section A-A on Page No. 105B of the Mn/DOT Standard Signs Manual. This will prevent a sign panel from "walking off" the mast arm if sign bracketing loosens in the future.

The Contractor shall furnish and install a fabrication sticker (see example) in accordance with the provisions of Mn/DOT 2564.3H.

SIGN COMPANY NAME
AND ADDRESS HERE

Month: 1 2 3 5 4 6 7
8 9 10 11 12
Year: 12 13 14 15 16 17 18 19

E. Measurement and Payment

Furnishing and installing Type C and Type D sign panels and installing City furnished signs, at the locations indicated in the Plans, and as specified herein shall be considered incidental work to each traffic control signal system and no direct compensation shall be made therefore.

SS-1.6 TRAFFIC SIGNAL PRIORITY CONTROL SYSTEM

This work shall consist of the installation at all the intersections, as shown in the Plans, a Priority Vehicle Detection and Control System (PVDCS). The PVDCS shall detect and identify priority vehicles such as emergency and non-emergency vehicles for preemptive or priority traffic signal service.

Commonly used abbreviations:

(PVDCS) Priority Vehicle Detection and Control System

(NEVP) Non-Emergency Vehicle Preemption, low priority

(EVP) Emergency Vehicle Preemption, high priority

The PVDCS shall consist of a matched system of equipment that includes optical emitters, optical detectors, optical detector cables, phase selectors and confirmation light assemblies. The system shall work with the local intersection traffic signal controller to provide an effective total system operation.

The PVDCS shall employ infrared optical communication to detect the presence of all priority vehicles and collect and record pertinent priority vehicle information.

Once operational, the PVDCS shall require no additional action from the vehicle operator to provide proper operation. The system shall provide

priority operation on a first-come, first-served basis with high priority requests overriding low priority requests.

For application in Minneapolis, the PVDCS shall interface to traffic signal controllers. It shall be the Contractors responsibility to work with the City to verify proper operation of the total system.

A. System Description

The system shall utilize infrared optical communications technology to process valid optical signals emitted from authorized vehicles, and place calls to traffic controller preempt inputs to effect preemption of normal traffic control signals.

Components of the system shall consist of infrared optical emitters mounted on authorized vehicles, infrared receivers mounted in the intersections and interfaced to traffic controllers via an optical signal processor and confirmation lights mounted at the intersections.

Optical emitters shall emit infrared optical signals on both the industry standard high-priority carrier frequency 14.035 Hz (Emergency band), or the industry standard low-priority carrier frequency 9.639 Hz (Transit band) by user programmable selection.

Receivers shall consist of infrared optical detectors, mounted to view the approaches to intersections, an optical signal processor (OSP) installed in the traffic control cabinet and wired to the preempt call inputs of the traffic controller, and detector cable connecting the optical detectors to the OSP.

As emitter equipped vehicles approach receiver equipped intersections, the optical detectors shall convert the incoming optical signal into an electronic signal. The OSP shall decode the electronic signal, delivered by the detector cable, determine the priority of the vehicle, arbitrate priority between any simultaneously approaching vehicles, place appropriate calls to controller inputs, and log vehicle detection events.

1. The OSP shall be capable of categorizing vehicles in both emergency and transit signal bands. The OSP shall be capable of the following actions, configurable on a per-band basis:

a. Local preempt – if enabled, the OSP shall place a call on the appropriate controller input in response to vehicle detection. (Default shall be enabled)

b. Logging – if enabled, the OSP shall be capable of writing a log record in non-volatile memory consisting of the following information: (Default shall be enabled)

- Signal band
- Direction
- Call duration
- Final greens at end of call
- Duration of final greens
- Event start time and end time in real time

c. Real-time announcement of vehicle detection – if enabled, the OSP shall send a short message via, RS-232 port upon the start of vehicle detection processing. The message shall consist of the following information: (Default shall be disabled)

- Signal band
- Direction

d. End of event echo – if enabled, the OSP shall echo the complete log record for a vehicle detection event immediately after the end of the event. The information included shall be those items enumerated in 1.b above. (Default shall be disabled)

System receivers shall always give precedence to emergency band vehicles over transit band vehicles.

System receivers shall be capable of detecting emitter-equipped vehicles at a range of up to 2,500 feet (762 meters), under clear atmospheric conditions.

System receivers shall be interface with all NEMA TS-1 and TS-2 and Type 2070 traffic controllers equipped with

programmable preemption routines, with no compromise to normal traffic controller functions.

Optical signal processors must be field programmable by the user, using the manufacturer's system software via computer.

B. System Components

1. Optical Emitter

Optical emitters shall generate the optical signal required to activate the receiver equipment in the intersection. The light pulses shall consist of a fixed base frequency emergency or transit band signal for standard preemption systems.

Optical emitters shall effect the range adjustment of the system by using activated optical emitters positioned at the desired distance while the optical signal processor range adjustment features are activated in the traffic cabinet.

2. Optical Detector

Infrared optical detectors shall be manufactured from black UV stabilized polycarbonate suitable for all weather use. The detector electronics shall be waterproof.

Infrared optical detectors shall sense and transform optical energy from optical emitters into electrical signals to be decoded by the optical signal processor.

Infrared optical detectors shall sense optical emitter signals over an adjustable range of 2500 feet (762m) in optimum atmospheric conditions.

Infrared optical detectors shall transmit electrical signals to the optical signal processor via up to 1000 feet of optical detector cable.

Infrared optical detectors shall have an internal terminal strip with wiring label for convenient positive connection to the detector cable.

Infrared optical detectors shall have at least a nominal conical 13-degree field of view centered about the view port normal axis.

Infrared optical detectors shall operate over a range of 12 to 30 VDC and current of up to 50ma maximum.

Infrared optical detectors shall have a ½ inch or ¾ inch FNPT mounting connection.

Infrared optical detectors shall be capable of performing a regularly occurring detector initiated diagnostic routine that tests all components used in the receipt and processing of incoming light pulses.

3. EVP Confirmation Lights

The confirmation light assembly shall be constructed from standard electrical hardware in conformance to the arrangement and configuration requirements described herein and shown on the Plans.

When the controller begins processing an EVP request, the controller shall also generate preempt confirmation outputs indicating that an EVP request is being processed (confirmation outputs shall only be generated for EVP & rail operation).

The EVP confirmation outputs shall be wire connected to unused load switches in the controller cabinet. The circuits shall be connected to EVP confirmation lights in the intersection.

The controller circuits shall be programmed to provide an illuminated solid white light to the requesting phase of EVP service and illuminated flashing white lights to all other vehicle phases.

4. Optical Detector Cable

Optical detector cable shall be in accordance with the provisions of Mn/DOT 3815.2C5.

5. Optical Signal Processor

Optical signal processors shall be installed in the traffic controller cabinet to receive the electrical signals from optical detectors. The optical signal processor shall interface directly with Type 2070 controllers with compatible software, and NEMA TS-1 and TS-2 with suitable system interface equipment and software.

Optical signal processors shall be powered from 120 VAC (95VAC to 135VAC), 60 Hz power and have an on board, regulated power supply that supports up to 10 optical detectors.

A communication module, which shall arbitrate priority between the signal processor modules, logs events, and provides RS-232 communication with the outside world for system configuration during installation, and real time communication with the traffic controller or central system during operation.

Non-volatile memory shall be included for storage of configuration parameters and event logs. Retention time for the non-volatile memory module shall be a minimum of 10 days with system power off.

The optical signal processor front panel shall have at least the following features:

- Power on/off switch with corresponding LED indicator.
- LED indicators for emergency and transit band reception status for each of four channels.
- Test switches for activating internal diagnostics.
- Optical signal processors shall have a method for enabling the setting of detection range without software interface with the RS-232 port. All available channels and bands shall be able to be armed simultaneously for range setting.

- Optical signal processors shall have an RS-232 communications port.

- Indicator lights that identify optical detectors which have failed a self test routine.

Programming the optical signal processor and retrieving data stored in it via the RS-232 port shall be accomplished using an IBM PC-compatible computer either locally or remotely via a modem.

The optical signal processor shall be capable of receiving and logging both standard emergency and transit band signals from system vehicles.

Optical signal processors shall log and store a minimum of 1,000 events in non-volatile memory. When the log is full, the oldest entry shall drop off to allow the newest entry to be logged.

6. System Software

Optical signal processor software shall be provided on CD-ROM. It shall run on IBM compatible computers with Windows 95, 98, NT 4.0, 2000, and XP software.

The software shall provide windows and menus for programming emergency and transit vehicle parameters, intersection and channel names, timing parameters, desired green signal indications during priority control operation, and for viewing and downloading logged information.

C. Environmental

All equipment supplied as part of the optical preemption traffic control system intended for use in the controller cabinet shall meet the electrical and environmental specifications spelled out in the NEMA Standards Publications TS2-1992 Part 2 where applicable.

D. Qualifications

The manufacturer or their qualified agents shall supply a list of at least five preemption system users having experience with the

various types of preemption system components available from the manufacturer for a minimum of three years.

Manufacturers shall be able to demonstrate the ability to provide on going technical and product warranty support.

Manufacturer or the manufacturer's representative shall provide responsive service before, during and after the installation of the priority control system. The manufacturer or the manufacturer's representatives shall provide training to the system installer and maintenance department of the purchasing agency. Training shall consist of proper installation and operating procedures for the system hardware and software.

E. Warranty

The manufacturer shall warrant that system components that fail due to material flaws or workmanship shall be replaced or repaired under manufacturers published warranty provisions for a period of not less then 10 full years from the date of installation.

F. Contractor Work Tasks

The Contractor shall:

- Furnish all PVDCS materials and equipment, mounting hardware, wiring, cables, optical detectors, confirmation light assemblies and bulbs, phase selectors, mounting brackets, detector connection cables, cable termination strips, communication cables, test equipment and computer software and other items as required. Install optical detectors with confirmation light assemblies at the locations shown on the Plans.
- Aim, orient, test operate and demonstrate that the optical detectors at each intersection provide effective EVP system operation as required for the conditions shown on the Plans.
- Install detector and confirmation light wiring from the detector device to a controller cabinet terminal strip.
- Provide installation assistance services and support to the City during controller cabinet hookup and connection of the Contractor furnished in-cabinet materials by the City to provide the operations and service described herein.

- Demonstrate correct operation of each properly equipped and operational intersection to serve as acceptance tests of the PVDCS system and components.
- Provide system and component documentation.
- Provide system and component application and maintenance training to support the proper installation and operation of system components.
- Provide PC-based software and interconnection cables to fully Implement all components into a complete operational system.

G. City Work Tasks

City forces shall:

- Furnish necessary qualified staff to attend application and training seminars.
- Furnish and install all controllers, controller equipment and cabinets.
- Install and connect all Contractor furnished PVDCS in-cabinet equipment.
- Connect Contractor installed optical detector wires to in-cabinet equipment.
- Connect Contractor installed confirmation light wires to in-cabinet equipment.
- Connect Contractor provided cable between the signal greens and the phase selector inputs.
- In general, install and connect all Contractor furnished in-cabinet equipment and cables.

H. Optical Detector Mounting and Confirmation Light Assembly

Combination optical detector mounting and confirmation light assemblies shall be furnished and installed at each intersection as shown on the Plans.

Each assembly shall be made up from UL listed standard electrical hardware to provide a sturdy and weatherproof assembly suitable for mounting optical detectors and confirmation lights.

Each assembly shall be designed to mount two optical detectors and two confirmation lights. When less than two optical detectors

or confirmation lights are used, the unused mountings shall be capped or plugged in an approved manner.

Each confirmation light assembly shall consist of incandescent lights that will operate in conjunction with the PVDCS to indicate the occurrence of a high priority preemption call.

Confirmation lights shall be wired to provide confirmation for each preemption phase.

An illuminated solid white light shall be displayed to the directions of traffic flow represented by the preempt phase, illuminated flashing white lights will be displayed to all other approaches.

Confirmation displays shall only be used with emergency vehicle or rail preemption.

Reflectorized outdoor type flood lamps shall be provided for each confirmation lampholder by the Contractor.

I. Priority Control Interface Software

The Contractor shall provide PVDCS PC based software to enable direct uploading and downloading of settings and control commands and the downloading of data describing priority vehicle operation.

The PVDCS interface software shall be provided on CD-ROM. It shall run on IBM compatible computers with Windows 95, 98, NT 4.0, 2000, and XP software, a touchpad and keyboard.

It shall be possible to connect a personal computer directly to the phase selector serial port to upload and download information and data. Local connection shall permit all upload and download operations to be provided in the field.

The Contractor-supplied priority control interface software shall enable:

- Setting up and presenting user-settable system parameters
- Viewing and changing settings
- Viewing activity screens
- Displaying and downloading records of previous activity showing all items of recorded information

The Contractor-supplied priority control interface software shall accommodate operation via the keyboard and touchpad.

The Contractor-supplied priority control interface software shall provide menu displays to enable:

- Establishing signal intensity thresholds (detection ranges), timing parameters, modem initialization, and intersection name.
- Resetting and/or retrieving logged data and priority vehicle activity.
- Setting of desired green signal indications during priority control operation, and upload and download capability to view.
- Addressing for each card in a multi-drop connected system.
- Confirmation light configuration when optical signal processor driven.
- NEMA control parameters.

K. Optical Detector Installation Requirements

The Contractor shall install optical detector and confirmation light assemblies and shall wire each intersection as shown on the Plans and as required herein.

The Contractor shall assemble and install the optical detectors in accordance with detector manufacturer's recommendations and these special provisions.

The Contractor shall construct each optical detector mounting and confirmation light assembly from standard UL listed electrical construction hardware. Each assembly shall consist of a steel nipple with top and bottom locknuts, a four-way steel Crouse-Hinds condulet with a gasketed, screw retained cover, a short optical detector connection nipple with top and bottom locknuts, optical detector(s) and one or two screw mount incandescent flood lamp holders with flood lamps. The condulet and each flood lamp assembly shall be designed, constructed and finished for outdoor use. The flood lamp holder shall be Carlon Model P80010-HCD Nonmetallic Weatherproof Lighting System Lampholder or approved equal. Gaskets shall be provided and installed on the condulet cover and around the flood lamp base to provide a weatherproof assembly. The assembled parts shall be arranged with both condulet and terminal compartment covers facing in

vehicle approach direction. Hardware shall be provided to allow signal mast arm, or pedestal mounting as indicated in the Plans.

The nipple length, optical detector position and flood light final alignment shall provide at least 6 inches of separation between the optical detector and the lamp. Reflectorized, outdoor type 40-watt flood lamps shall be provided.

After assembly, aiming, tightening and final mounting on the mast arm or pedestal pole, all extension hardware and exposed threads shall be painted the same color as signal framework or mast arms to which they are attached. Contractor shall secure paint to insure added components match the color of supporting facilities.

All assemblies whether for one optical detector and one conformation light or for more than one optical detector or confirmation light shall utilize a 1-inch nominal condulet and nipples.

Threaded caps or plugs shall be used to cover any unused mounting holes. Optical detector unit drain holes shall be oriented as recommended by the manufacturer.

The Contractor shall mount the optical detector mounting and confirmation light assembly on the top edge of the mast arms. Mounting hubs shall be located at 2 ft., 4 ft., and 6 ft. from the end of the mast arm as shown on the Plans or as directed by the Engineer. In any event, the final mounting position shall be adjusted to provide lateral clearance between.

Traffic signal heads and traffic signs and shall be adjusted to provide a clear line of sight for priority vehicles.

The Contractor shall either have hubs for mounting attached during pole manufacturing. If hub locations are not useable the Contractor shall mount the optical detector and confirmation light assembly using a Frey Manufacturing Model KBR- ¾-inch pipe thread hub. The Contractor shall follow the manufacturers recommended installation instructions to properly align the drilled hole. Each mast arm mounting shall be installed such that the finish detector mounting will be plumbed perpendicular to the earth.

The Contractor shall install enough cable to ensure sufficient unspliced length to connect the optical detector and confirmation light assembly fixtures at the top of signal poles or mast arms to the

controller cabinet. Strain relief shall be provided in all poles for detector and indicator cables.

All field wiring shall be furnished, installed and connected to the field units. All wiring shall run to the controller cabinet and shall be coiled at the controller cabinet as directed by the Engineer. Each lead shall be taped to exclude moisture and be tagged to indicate phase and function.

K. PVDCS System Acceptance and Testing

The Contractor shall provide information describing the proposed equipment including unit specifications and certifications that the furnished equipment conforms to the manufacturer's specifications and these special provisions. The Contractor shall also conduct tests to verify the operation of the furnished materials and equipment and to verify the proper installation of system components.

After all field connections have been completed and wiring is connected at the controller cabinet, the City shall conduct component operations and aiming verification tests.

The tests shall verify that:

- The appropriate vehicles were detected and identified and that the appropriate outputs are generated.
- The zone of detection was appropriate for each type of vehicle.
- The Contractor shall have appropriately equipped personnel on-site to correct any problems associated with the Contractors work.

L. PVDCS Training and Documentation

If the PVDCS hardware and/or software is of a different manufacture than that which is currently utilized by the City, the Contractor shall provide a training session covering installation, maintenance and repair of all PVDCS components provided under this contract. The Contractor shall provide manuals for the training activities and to support the operation of the system.

The Contractor shall provide hookup and connection details as required to enable the proper operation of the PVDCS equipment in the field.

Documentation shall also be provided describing each of the PVDCS software programs furnished to meet the requirements of this project.

It is understood that the programs provided for this project are the property of the Manufacturer or others. The programs provided shall, however, be for unlimited licensed use by the City of Minneapolis. It is also required that the City be permitted to make any number of copies of the program for use by City forces. The City shall not distribute or otherwise make available copies of the program or programs to any other party unless specifically authorized by the Manufacturer or owner of the software.

M. PVDCS Measurement and Payment

Furnishing and installing materials and electrical equipment as specified herein, all to provide an installed and successfully tested Priority Vehicle Detection and Control System at each intersection shall be considered incidental work to each new permanent traffic control signal system and no direct compensation shall be made therefore.

SS-1.7 METHOD OF MEASUREMENT AND PAYMENT

A. Purpose

This section shall define the bid items and the manner in which payment will be made to the Contractor.

B. Miscellaneous Work, Equipment, and Material

Items of miscellaneous work, equipment and material will be required to construct each system including such items as flagmen and traffic control personnel, traffic cones, markers, flashers, barricades, bolts, nuts, washers, electrical wire, etc. In each case where these items or similar miscellaneous items are necessary to the completion of the project in a safe and reliable fashion, their provision, use and installation by the Contractor shall be considered included in the various associated items of work and no direct payment will be made therefor.

The Contractor shall not receive full payment for the installation of any traffic signal system nor will the City take over maintenance responsibility for the signal system until the City of Minneapolis performs a punch list inspection of the installed facilities and all noted discrepancies are corrected by the Contractor to the satisfaction of the City.

C. Measurement

1. Furnishing and installing all materials and electrical equipment (except for an intersection traffic signal cabinet complete with controller unit and all required signal control equipment which will be furnished and installed by the City of Minneapolis); all to provide complete fully operational Traffic Control Signal Systems "A", "B", "C", "D", "E", "F" and "G" in Minneapolis as contained in these Special Provisions and in the Plans will be measured as an integral unit complete in place and operating.

2. Removing and salvaging an existing traffic control signal system at: Systems "A", "B", "C", "D", "E", "F" and "G" as contained in these Special Provisions and in the Plans will each be measured as an integral unit.

   Removal of conduit with asbestos containing electrical conduits (transite) shall be paid for under the lighting system pay items.

D. Basis of Payment

1. Payment for traffic control signal system installation shall be in accordance with Mn/DOT 2565.4 and Mn/DOT 2565.5 respectively for a Fully Operational Signal System. Payment shall be compensation in full for all costs of furnishing and installing signal equipment, poles, pedestals, luminaires, foundations, conduit, handholes, cable, signal service and equipment, and all incidentals in accordance with the following schedule at the appropriate contract bid price for the specified unit of measure.

ITEM NO.	DESCRIPTION	UNITS
2565.522	Traffic Control Signal System "A"	Signal System
2565.522	Traffic Control Signal System "B"	Signal System
2565.522	Traffic Control Signal System "C"	Signal System
2565.522	Traffic Control Signal System "D"	Signal System
2565.522	Traffic Control Signal System "E"	Signal System
2565.522	Traffic Control Signal System "F"	Signal System
2565.522	Traffic Control Signal System "G"	Signal System

Payment for removing and salvaging existing traffic control signal systems shall be in accordance with Mn/DOT 2565.4 and Mn/DOT 2565.5 respectively Salvage Signal System. Removing and disposing of traffic signal foundations and handholes containing asbestos shall **not** be paid for separately but included in the lump sum price per system. Payment shall be compensation in full for all costs of salvaging, removing and disposing of signal equipment, poles, pedestals, luminaires, foundations, conduit, handholes, cable, service cabinets, hazardous materials, and all incidentals in accordance with the following schedule at the appropriate contract bid price for the specified unit of measure.

ITEM NO.	DESCRIPTION	UNITS
2104.601	Salvage Signal System "A"	Lump Sum
2104.601	Salvage Signal System "B"	Lump Sum
2104.601	Salvage Signal System "C"	Lump Sum
2104.601	Salvage Signal System "D"	Lump Sum
2104.601	Salvage Signal System "E"	Lump Sum
2104.601	Salvage Signal System "F"	Lump Sum
2104.601	Salvage Signal System "G"	Lump Sum

SS-2 (2565) TRAFFIC CONTROL INTERCONNECTION

This work shall consist of installing all materials and equipment as shown on the Plans, to provide a complete, operating communication line between the following traffic signal control systems:

> Interconnection of Systems "A" through "G" along XXX street and XXX Avenue and to each other, and installing or removing and reinstalling interconnect to other signal systems as shown on the Plans.

The electrical system shall comprise all of the work shown in the Plans including, but not limited to, installing the conduit, handholes and interconnect cable into the controller cabinets via handholes and conduits, and removal of the inplace communication cable, all in accordance with the Specifications, except as shown or noted in the Plans and modified in these Special Provisions.

Removal and disposal of the existing interconnect conduit and handholes shall be paid for under separate bid item. Existing interconnect cable removal shall be incidental to the Traffic Control Interconnect installation bid item.

SS-2.1 ELECTRICAL (COMMUNICATIONS) SYSTEM

The inplace and new communication system within the project area shall be located in inplace or new conduit as noted in the Plans. Inplace communication cable shall remain inplace and in operation until such time as the inplace traffic signal systems are turned off, a roadway is closed and the various interconnect functions are no longer necessary.

A. Removal of Inplace Communications Cable

Prior to removal of the existing communications system, the City of Minneapolis shall be notified so that appropriate steps may be taken to disconnect communications equipment at adjacent traffic signal installations. The communications cables shall be disconnected at each control cabinet by City forces, and with the approval of the City may then be removed by the Contractor.

Salvaged cable shall be coiled and tagged in accordance with the requirements of SS-1.4.

B. (2565.603) XX Pair Conductor, Number 19

Communication cable shall be a XX Pair conductor, No. 19 AWG Cable as noted in the Plans. The cable shall be a multi-conductor,

grease-filled, telephone cable designed for conduit and direct burial application.

The cable shall be double jacketed and conform to a modified version of the requirements of Rural Utilities Service (RUS) Specification 1755.390 latest edition. The specification modification consists of provision of double jacketing with the inner and outer jackets constructed in conformance with the requirements of ANSI/ICEA S-84-608-1988 paragraph 7.1 and 7.2.

Individual conductors shall be solid and No. 19 AWG. There shall be a single shield that shall be either fully annealed solid copper, Alloy 194, or fully annealed copper-clad stainless steel.

The following summarizes the primary requirements:

1. XXX Pair No. 19 AWG.

2. The cable is fully color-coded so that each pair in the cable is distinguishable from every other pair.

3. Each conductor shall be a solid round wire of commercially pure annealed copper.

4. Each conductor shall be insulated with a colored, solid insulating grade, high-density polyethylene or crystalline propylene/ethylene copolymer.

5. The insulated conductors shall be twisted into pairs. The twisted pairs shall be assembled in such a way as to form a substantially cylindrical group (cable core).

6. A petrolatum-polyethylene filling compound shall completely coat each insulated conductor and fill the air space between the conductors.

7. The cable core shall be completely covered with a layer of nonhydroscopic and nonwicking dielectric material. The covering shall be applied with an overlap.

8. An inner jacket applied over the cable core covering. The jacketing grade material used for the inner jacket shall be low density, high molecular weight polyethylene in accordance with ANSI/ICEA S-84-608-1988 paragraph 7.1/7.2.

9. A single corrugated metal shield shall be applied longitudinally with an overlap over the inner jacket. The metal shield shall be for "Gopher Resistant Cable" and shall be either **10-mil fully annealed solid copper, 6-mil 194 Alloy, or 6-mil fully annealed copper clad stainless steel**.

10. An outer jacket shall be applied over the metal shield and inner jacket. The jacketing grade material used for the outer jacket shall be low density, high molecular weight polyethylene in accordance with ANSI/ICEA S-84-608-1988 paragraph 7.1/7.2.

11. The cable shall be marked on the outer jacket with product description, year of manufacture, and sequential footage marks at two-foot intervals.

The City of Minneapolis Traffic and Parking Services shall be provided the opportunity to review and approve or disapprove the proposed communications cable before it is installed.

C. Installation of Communications Cable

Interconnect cable runs shall be installed as continuous runs, unless splices are specified. Approximately six (6) feet of slack cable shall be provided in each handhole through which the run of interconnect cable passes. Each interconnect cable entering the controller cabinets shall provide six (6) feet of slack cable within the controller cabinet and shall be permanently labeled as "East" or "West" or "North" or "South" to identify the direction of interconnect cable run. Such identification shall be affixed immediately on installation of the cable into the cabinet foundation. **A pull rope, approved by the City, shall be installed in each conduit along with each run of communication cable.**

D. Electrical Handholes (Pull Boxes)

All hand holes shall be Minneapolis Electrical Hand holes which have high density polymer concrete frames and covers as shown in Minneapolis Standard Plate Nos. TRAF-1725 and TRAF-1730 in the Plans and shall conform to the City of Minneapolis standards. Frame & Cover shall meet Tier 22 rating requirements (ANSI/SCTE 77-2007). A drain field shall be provided with each

hand hole. Concrete for supporting the high density polymer concrete frame and cover shall be Mix No. 3A32 or equal.

Hand holes rings and covers shall be constructed from high density polymer concrete with a City of Minneapolis approved Green Exterior coloring additive.

Existing handhole rings and covers that are to be relocated shall be cleaned and primed with a red oxide primer, and finished with City of Minneapolis approved Green Exterior Enamel.

SS-2.2 METHOD OF MEASUREMENT AND PAYMENT

A. Measurement

Furnishing and installing all materials to provide a complete, useable interconnect system as contained in these Special Provisions and in the Plans will be measured as described below.

The Contractor shall not receive full payment for the installation of any traffic signal interconnection system until the City of Minneapolis performs a punch list inspection of the installed facilities and all noted discrepancies are corrected by the Contractor to the satisfaction of the City.

B. Payment

The conduit, handholes, cable system, pull rope and miscellaneous work, equipment and material required to construct each Traffic Control Interconnection System shall be paid for as listed below. Payment at the contract unit price shall be compensation in full for all costs of furnishing and installing all materials and incidentals required to provide the system as specified and as shown in the Plans.

ITEM NO.	DESCRIPTION	UNITS
2565.601	Traffic Control Interconnection	Lump Sum

SS-3 (3815) FIBER OPTIC CABLE

SS-3.1 Fiber Optic Cable and Testing

This work shall consist of furnishing and installing a fiber optic cable of the type, size and number of fibers specified.

A. General Requirements

1. Materials and Equipment
Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products.

2. Contractor Qualifications
Trained and experienced personnel shall supervise the fiber optic cable installation. Qualified technicians shall make the cable terminations and splices. The Contractor upon request of the Engineer shall provide documentation of qualifications and experience for fiber optic equipment installations. The Engineer shall determine if the Contractor is qualified to perform this work. The Contractor shall have attended a certified fiber optic training class mandated by these specifications prior to starting work.

3. Codes Requirements
The fiber optic cable installation shall be in accordance with or exceed all minimal requirements of State codes, National codes, and manufacturer codes as applicable.

4. Miscellaneous Equipment
The Contractor shall furnish and install all necessary miscellaneous connectors and equipment to make a complete and operating installation in accordance with the Plans, standard sheets, standard specifications, special provisions, and accepted good practice of the industry.

5. General Considerations
The cable shall meet all requirements stated within this specification. The cable shall be new, unused, and of current design and manufacture.

6. Fiber Cable Requirements

a. Single Mode 12 and 24 Fiber - Fiber Optic Cable
The fiber optic cable shall be OFS ALLWave, Corning or approved equal conforming to the following specifications. The fiber optic shall be manufactured utilizing Corning or OFS glass fiber conforming to the following specifications. All materials and equipment furnished shall be completely free from defects and poor workmanship. All fibers shall be glass and be manufactured by Corning, OFS or pre-approved equal. The cable shall be rated for gigabyte data bandwidth. All fiber shall be loose tube construction for both indoor and outdoor installation. Indoor cabling shall use plenum rated conduit to within less than 50 foot of point of termination eliminating the requirement to convert to indoor cable.

All fibers in the cable must be usable fibers and meet required specifications.

- Single-Mode Fiber
- Typical core diameter: 8.3um
- Cladding diameter: 125 +1.0um by fiber end measurement
- Core-to-cladding offset: <1.0um
- Coating diameter: 250 +15um
- Attenuation uniformity: No point discontinuity shall be greater than 0.1 dB, except terminations or patch cords, at either 1310nm or 1550nm. The coating shall be a layered UV cured acrylate applied by the fiber manufacturer. The coating shall be mechanically or chemically removable without damaging the fiber.
- Factory cable rating shall be 0.35 dB/KM at 1310 nM and 0.25 dB/KM at 1550 nM. Installed tolerance shall be less than 0.44 dB/KM at 1310 nM and less than 0.33 dB/KM at 1550 nM, testing tolerance.

- All fiber cables shall be Gigabyte rated, i.e. single mode shall be 28 KM for 1310 nM and 40 KM for 1550 nM based on a 10 dB power budget.
- All Single mode fiber shall be rated for multi-frequency, four frequencies, equivalent to the AllWave OFS specification and shall be rated to withstand extended aging under water impregnation conditions.

All fibers in the cable shall meet the requirements of this specification. The testing tolerance attenuation specification shall be a maximum attenuation for each fiber over the entire operating temperature range of the cable when installed.

The change in attenuation at extreme operational temperatures for single-mode fibers shall not be greater than 0.20 dB/km at 1550 nm, with 80 percent of the measured values no greater than 0.10 dB/km at 1550 nm.

Optical fibers shall be placed inside a loose buffer tube, six (6) fibers per tube.

The buffer tubes will meet EIA/TIA-598, "Color coding of fiber optic cables."

Where multimode fiber is specified, single-mode fibers shall be placed in the first buffer tubes with multimode fibers in the remaining buffer tubes following single mode. Fiber count, tubes of fiber, shall be as specified on the Plans.

Fillers shall be included in the cable core to lend symmetry to the cable cross-section where needed.

The central anti-buckling member shall consist of a glass reinforced plastic rod.

The cable shall use a completely dry cable design without the use of gels and filling compounds. Dry

water blocking material shall be used around the buffer tubes as well as internal to the tubes. Water blocking gels shall not be acceptable on this project. Gel, a.k.a. "icky-pic", shall not be acceptable for this project.

Buffer tubes shall be stranded around a central member. Acceptable techniques include the use of the reverse oscillation, or "SZ", stranding process.

All dielectric cables (with no armoring) shall be sheathed with medium density polyethylene. The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members and flooding compound. Cable jacketing shall utilize the newer designs to provide maximum flexibility without loss or appreciable dB attenuation. Cable diameter shall not exceed 0.50 inch.

The jacket or sheath shall be marked with the manufacturer's name, the words "optical cable", the year of manufacture, number of fibers, type of fiber (SM or MM) and sequential feet or meter marks. The markings shall be repeated every one-meter or three feet. The actual length of the cable shall be within –0/+1% of the length marking. The marking shall be in a contrasting color to the cable jacket. The height of the marking shall be approximately 2.5 mm. A copy of the manufacturer fiber definition and shipping sheet identifying all tests, results and fiber indexes shall be provided to the Engineer on delivery of cable to the City or shall be included with a Contractor's listing of place(s) of installation when installed by a Contractor.

Buffer tube and fiber color coding shall be as follows:

Buffer Tube/Fiber	Tube/Fiber Color
#1, 1st tube or fiber	blue
#2, 2nd tube or fiber	orange
#3, 3rd tube or fiber	green

#4, 4th tube or fiber	brown
#5, 5th tube or fiber	slate
#6, 6th tube or fiber	white
#7, 7th tube or fiber	red
#8, 8th tube or fiber	black
#9, 9th tube or fiber	yellow
#10, 10th tube or fiber	violet
#11, 11th tube or fiber	rose
#12, 12th tube or fiber	aqua

All optical fibers shall be proof tested by the fiber manufacturer at a minimum load of 100 kpsi.

All optical fibers shall be 100% attenuation tested at the manufacturer. The attenuation of each fiber shall be provided with each cable reel. The measured attenuation shall be for both 850 and 1300 frequency for multimode and 1310 or 1550 frequency for single mode. This documentation shall be provided with each spool. The Contractor shall designate on the Plans and on this documentation the location where each spool has been installed and provide this data to the Engineer.

b. Single Mode 6 Fiber Armored - Fiber Optic Cable
The Fiber Optic Cable Assemblies for Fiber Optic Cable shall comply with USDA RUS CFR 1755.900 (Specification for Filled Fiber Optic Cables) shall be shown on the Mn/DOT Qualified Products List and shall comply with the following provisions:

- Fiber Optic Cable shall be designed for outdoor use and direct bury
- Include a dielectric central strength member.
- Armored with corrugated steel tape.
- Minimum of a 1.3 mm thick Medium Density Polyethylene outer jacket;
- Include two ripcords. One ripcord under the armor and one ripcord under the inner jacket.
- Outside diameter of < 23 mm (0.906 inch).

- Indented markings on one-meter (three-foot) intervals showing the manufacturer, fiber count, Mn/DOT part number, mode, and length in meters.
- Buffer Tubes
  Filled with fibers according to the following:
  - For < 48 fibers there shall be 6 fibers per buffer tube.
  - For > 48 fibers there shall be 12 fibers per buffer tube.
  -

Constructed for direct burial applications per the above referenced USDA specification.

Color-coded per ANSI, TIA, EIA 598A, thermoplastic, and gel filled.

Have an outside diameter ranging from 1.9 mm (.075 inch) to 3.0 mm (0.118 inch).

Stranded around the dielectric central strength member using the reverse oscillation stranding process.

Covered with water blocking tape.

Dielectric strength members (yarns) woven longitudinally between the outside of the Buffer.

Tubes and the inner jacket.

- Inner Jacket
  Made of Medium Density Polyethylene.
  Minimum of 0.50 mm (0.02 inch) thickness.
  Applied directly over tensile strength members and water blocking material.
- EIA Class IV SM Fibers
  Can be mechanically stripped.
  Diameter of the cladding shall be 125 μm ± 1 μm.
  Diameter of the coating shall be 245 μm ± 10 μm.
- Coating shall be a dual layer of acrylate coating in physical contact with the cladding surface;

- SM fibers shall have a ZDW of 1300 to 1321.5 nm.
- Cutoff wavelength < 1260 nm.
- Maximum attenuation at 1310 nm shall be 0.35 dB/km and 0.25 dB/km or less at 1550 nm.
- Attenuation requirements shall be measured along the cable axis.
- Mode field diameter shall be between 8.8 and 9.8 µm at 1310 nm and between 9.9 and 10.8 µm at 1550 nm.
- Maximum dispersion shall be < 3.2 ps/nm²·km from 1285 to 1330 nm and < 18 ps/nm²·km at 1550 nm.
- Core-to-cladding offset (Core/cladding concentricity) shall be < 0.6 µm.
- Factory fusion splices shall not be allowed.

Mn/DOT approved 6 Single Mode Armored Fiber Optic Cables are listed on the Mn/DOT Qualified Products List WEB site for Fiber Optic Cables: http://www.dot.state.mn.us/products/tms-its/fibercables.html

7. Fiber Installation

a. Cable Installed in Ducts and Conduits

A suitable cable feeder guide shall be used between the cable reel and the face of the duct and conduit to protect the cable and guide it into the duct off the reel. It shall be carefully inspected for jacket defects. Fiber optic cable feeders shall be placed at all handholes where the cable must make sharp bends or hand feeding must be done, as determined best by Contractor. If defects are noticed, the pulling operation shall be stopped immediately and the Engineer notified. Precautions shall be taken during installation to prevent the cable from being "kinked" or "crushed". A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. A pulling swivel shall be used to eliminate twisting of the cable. As the cable is played off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable

manufacturer. Dynamometers or breakaway pulling swing shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed on a cable during installation shall not be such that the cable is twisted or stretched. The pulling of cable shall be hand assisted if needed at each handhole, or cabinet foundation. The cable shall not be crushed kinked or forced around a sharp corner. If a lubricant is used it shall be of water based type and approved by the cable manufacturer. Prior to fiber termination, sufficient slack shall be left at each end of the cable to allow proper cable termination, minimum of 30 feet. This cable termination slack shall be allowed for waste in fiber termination procedure. Cable installed with less than the specified slack shall be replaced for the entire length by the Contractor. If Contractor wishes, and city agrees, and short cable meets good light test measures, contactor may opt to settle for 50% payment of fiber optic cable (for the length of fiber optic cable with too little slack) in lieu of replacement of entire length and retesting and reterminating.

Upon fiber termination, all remaining slack shall be drawn into the fiber optic handhole for slack as indicated on the Plans. Slack fiber optic cable shall only be permanently stored in fiber optic handholes. Contractor shall not attempt to leave slack in existing electrical handholes (approximate 18 inch diameter). In general, the Contractor shall pull straight through existing electric handholes. Occasionally, the conduit may enter the electric handhole from the bottom. In these cases, the Contractor may safely pull the cable without exceeding the manufacturer's recommended tension bend radius, but Contractor shall take care to protect the fiber optic cable from being pulled taut to create a localized bend that exceeds the fiber optic cable bend radius. Existing electric handholes were surveyed prior to the project to identify handholes

where horizontal conduits were out of line and these were scheduled to be replaced. If a pull through alignment through an existing electric handhole is too far out of straight that the Contractor is concerned for the condition of the fiber optic cable, he shall show the location to the Project Engineer and recommend alternate solutions prior to installing the cable.

Maximum length of cable pulling tensions shall not exceed the cable manufacturer's recommendations.

b. Fiber Optic Cable Marking Conductor
Along with the fiber optic cable, one (1) #10 AWG THHN, 600 volt single conductor cable (identifier conductor), orange in color, shall be pulled with ten feet (10') slack in each handhole where slack fiber cable is required.

c. Fiber Optic Cable Labeling.
Inside each handhole and inside each cabinet, the Contractor shall place a metallic label on each fiber optic cable. The fiber optic cable label, shall indicate the direction the cable is going, cable contents [SM or SM/MM], and the abbreviated location for the other end destination. Cabling between traffic controllers and adjacent hub locations shall, typically, be Cat 5-E patch cords. Where distances are long, the cabinets will be connected by fiber optic cable, as shown in the Plans.

d. Minimum Bend Radius
For static storage, the cable shall not be bent at any location to less than ten times the diameter of the cable outside diameter or as recommended by the manufacturer. During installation, the cable shall not be bent at any location to less than twenty times the diameter of the cable outside diameter or as recommended by the manufacturer.

e. Fiber Optic Cable Testing

After fiber termination is complete, Contractor shall test all fibers. Non-terminated fibers shall be tested with an OTDR. Terminated fibers shall be tested with a power meter and with an OTDR. The Contractor may jumper termination points at controller cabinets to minimize the number of tests and run a single OTDR test between several controller cabinets, subject to the range of the OTDR. Contractor shall not jumper through hub sites. Multimode fiber, when specified, shall be tested using 1300 nm and single mode fiber shall be tested at 1310 nM. Outdoor patch cords between hubs and controller units do not need be OTDR tested. Note to Contractor: Fiber cleaning time should be low. This is a dry-fill (non-gel) cable.

Any tests which can be field identified as out of range shall be tracked down and corrected. Additional tests may be run after each correction. Splices will not be allowed to repair a damaged section. When a satisfactory light wave test results, only the final test result need be submitted. The Contractor shall record the fiber optic cable name (end to end destination), the length of the OTDR begin test cable, the physical length of each fiber optic cable, the location of temporary jumper patch cords, if used, and the length of the OTDR end test cable.

Contractor shall provide the power meter test results and the OTDR test results to the City. The results of the OTDR test shall be provided on an electronic media (disk) and paper printout. Each OTDR trace, for documented test result submittal, shall be displayed individually and not be combined with other fiber traces as overlays. The OTDR wave, pictorial diagram of dB loss over the length of fiber tested, shall be provided along with the measured data values. The printout shall contain the manufacturer's fiber optic Index of Refraction to the third decimal point for the fiber provided. The

Contractor shall provide a working copy of the program to view and set measurements of the electronic test data based on the OTDR device used for the fiber optic testing.

Documentation provided to the Engineer by Contractor shall include a written indication of every splice, termination, and patch cord for cable being measured. Power meter measurement recordings shall indicate the exact measured distance [OTDR or field measurement with cross reference for oscillation multiplier] on the sheet showing the power meter readings. Any deviations between fiber readings in the same tube shall be noted for OTDR graphs as well as deviations greater than 5% on power meter readings. Rated values for acceptable installation shall be based on the following parameters:

Patch cords/Pigtails	.60 MM & .15 SM dB each
Unicam Terminations	1.0 dB set of 2 [In and Out]
Splices	0.08 each

1 KM = 0.3077 KF where KF is 1000 feet

Data documentation shall include for each test between cabinets or between FDP sites, the length of fiber as measured by OTDR, frequency used in test on OTDR by each fiber type, distance to each splice, termination or patch cord jumper, dB loss rating by manufacture from spool documentation, index of refraction by type of fiber in section, and the dB loss of each section as measured in the final test for each fiber.

f. Cable Termination

Terminations shall be made using the method recommended by the connector manufacturer. Contractor shall provide all materials and tools. All fibers shall utilize a fan-out kit of the size and type recommended by the manufacturer and of the number of fibers provided in each fiber tube. All fibers terminated shall utilize a ceramic ferrule

(outdoor connections), ST, mechanical termination equal to Siecor UniCam connectors. All termination ST couplers shall be rated for dual fiber application, MM and SM. Contractor shall provide an enclosed terminating environment that minimizes dust and shelters the terminating operation from blowing air.

g. Breakout Kits

The breakout kits or termination boxes used to terminate each fiber cable in the cabinet shall provide for the separation and protection of the individual fibers with the buffer tubing and jacketing materials. The termination housing shall be installed within a wall or shelf mountable interconnect housing which shall provide for storing fibers, ample room for feed through cable, strain relief for multiple cables within unit, and accommodate ST compatible connectors. All fiber pigtails shall be terminated through ST connectors on the wall or shelf mounted interconnect panel. All terminations shall be ST type, ceramic core (outdoor connections), and plug into the provided controller unit internal fiber optic modem. Acceptable enclosures for combination termination/splice points shall be MIC-024 or WDC-024 enclosures or pre-approved equal. All splices, not specified to be installed external to the fiber splice tray, shall be installed in splice trays and be supported with heat shrink tubing. Acceptable splice trays include MIC-024-048 or 067 series or pre-approved equal.

Splices in handhole devices, torpedo tubes, shall be either individual fibers in normal fiber optic cable or an extended “patch cord” with a preinstalled termination block. Where a patch cord with termination block is specified, shown on the wiring diagrams, all fibers for each block utilized shall be fusion spliced from a single fiber cable, such that one block is for ‘incoming’ fibers and a second block is for ‘outgoing’ fibers. Each termination

block shall be uniquely identified in the cabinet as to the location the fiber is coming "FROM".

h. Connectors

Connectors shall be mechanical ST (ceramic ferrule-outdoor connections) compatible, field installable, and self-aligning and centering. Connectors to the special devices used for Ethernet network connections shall utilize a factory converter cable, such as a SC to ST or manufacturer specified converter patch cord. Fiber optic equipment, used for terminating fibers, shall be rated for the type of connectors used. Connectors shall be Siecor CamLite, UniCam, or Engineer approved equal.

i. Splices

The fiber-optic cable shall be installed between existing fiber vaults, cabinets, or buildings and new fiber optic hub cabinets or fiber-optic handholes installed by the Contractor, as well as between these new fiber-optic hub cabinets and nearby City of Minneapolis traffic signal cabinets. No splices shall be allowed, unless shown on the Plans or for testing. All splices shall be fusion splices. Mechanical splices, Siecor CamLite or approved equal, will be allowed only for testing of new fiber cabling or for non-terminated fibers. Splices, shall be by fusion spliced and shall be installed using an automatic fusion splicer. Splices between two fibers leaving the cabinet shall be supported in splice trays installed in splice or combination enclosures. All splices shall be protected by heat shrink tubing designed for fiber optic splicing applications. Fibers being terminated in two separate combination or splice enclosures shall be supported between enclosures by the use of buffer tubing or approved equal support material or shall be pigtail patch cords. Termination / splice enclosures shall be separated by less than 12 inches unless a supporting/protecting conduit is installed between the two enclosures. All splices shall be performed by an automated splicer device that

verifies the final splice termination quality. All splices shall be nominally .03 to .05 dB loss but shall be less than a 0.08 dB loss. Contractor shall provide an enclosed splicing environment that minimizes dust and shelters the splicing operation from blowing air. Contractor shall provide all materials and tools.

8. Payment

Payment shall be according to the payment schedule indicated in the Scope of Work.

The Contractor shall not receive full payment for the installation of any fiber optic cable system until the City of Minneapolis performs a punch list inspection of the installed facilities and all noted discrepancies are corrected by the Contractor to the satisfaction of the City.

Contractor shall bid these items as

- "12 Fiber Single Mode Fiber Optic Cable", Lineal Foot,
- "24 Fiber Single Mode Fiber Optic Cable", Lineal Foot, and
- "6 Fiber Single Mode Armored Fiber Optic Cable", Lineal Foot.

The unit price shall include the cost of furnishing and installing the fiber optic cable and the fiber optic cable marking cable, fiber pigtails, cable splicing, cable terminating, cable termination facilities, cable testing, special testing and report generation. Contract specified cable slack will be paid for at the contract unit price. Excess slack beyond contract specified amount will receive no excess payment.

SS-3.2 Fiber Optic Hub Cabinet

A. Construction

1. The fiber optic cabinet shall be weather proof, ground mounted, and of rigid construction fabricated from 0.125 inch thick aluminum conforming to the requirements of ASTMB 209 for 5052-H32 aluminum sheet. The cabinet shall be clean in design and appearance and have the following dimensions.

   HEIGHT 63 inches
   WIDTH 33 inches
   DEPTH 17 inches

   The cabinet enclosure shall be of good workmanship. All seams and joints shall be made smooth and even, without cracks, air leaks or pinholes. The cabinet vertical sides shall be of one continuous piece construction or shall have vertical edges joined with butted-formed flanges. Flanges shall be continuously welded, on the inside of the cabinet and sealed on the outside. There shall be no sharp or jagged edges. All interior and exterior seams shall be continuously welded and ground smooth. Sharp edges shall be filed.

   The cabinet enclosure top shall be slanted 2 inches to the rear to prevent standing water and shall provide an overhang above the door at least 3 inches beyond the front of the cabinet.

   Pop rivets shall not be used in the construction of the cabinet, nor in the attachment of hinges, doors, handles, or locks except as specifically permitted.

   The cabinet enclosure (physical enclosure only) shall be UL listed with the UL label affixed to the inside of the cabinet, and shall carry a NEMA 3R rating to provide a degree of protection against rain, sleet, snow, and dripping water.

2. The cabinets shall have minimum 2 1/2" flanges on the inside bottom of the unit with 7/8” holes for anchor rods in the cabinet corners, as shown on drawing A-4031B.

3. A gasket shall be provided for mounting the cabinet enclosure on a concrete pad. The gasket shall consist of four (4) strips of 3/8-inch thick solid butyl rubber, similar to that used for industrial conveyer belts. Two (2) of the strips shall be 2.5 inches wide x 17.5 inches long, with slotted holes drilled at 15 inches center to center along the length of the strip. The slotted holes shall be centered across the width of the strip, so as to line up with the mounting holes in the cabinet enclosure bottom flange. The remaining two (2) strips shall be 2.5 inches wide x 30.25 inches long, with no holes drilled.

4. The cabinet shall have a screened rain-tight vent assembly at the top front of the cabinet. The vent assembly; shall run near the top of the front panel of the cabinet from side to side; shall be baffled to resist entrance of water into the cabinet, and shall provide drainage for any water entering the vent.

5. The cabinet shall have a reinforced, hinged full size door which, when closed, makes the cabinet weather resistant and dust tight. The door shall have a tumbler lock for a Minneapolis standard No.2 traffic signal key.

   All four sides of the cabinet full size door opening shall have a formed double flange.

   The door shall be equipped with a three point locking mechanism which is operated from a single easy turning handle. The upper and lower locking points of the three point locking mechanism shall each have a pair of nylon rollers.

   The door handle shall be a removable ¾ inch diameter stainless steel L-shaped hexagon rod. The handle receiver in the 3-point lock assembly shall contain a center pin, which shall be compatible with a drilled hole in the stainless steel handle. Handles and lock assemblies shall be compatible with existing City of Minneapolis cabinets. (It shall be the responsibility of the cabinet supplier to ensure compatibility). The door shall contain a swing-away cover over the handle attachment hole in the door to prevent the entry of rain and snow.

A multi-position bar stop shall hold the door open at approximately 90, 135, and 180 degrees from a closing position. The stop shall slide in a U-shaped guide along the bottom of the inside front of the cabinet.

The cabinet door shall be mounted with three (3) separate heavy-duty gauge butt hinges and mounting bolts to allow replacement of the door if damaged. Each hinge shall have 0.25-inch minimum stainless steel hinge pin.

Hinge placement shall be such that cabinet doors are interchangeable between cabinets.

All hinges, hinge pins, and locks shall be constructed of stainless steel.

The cabinet full-size door shall open to the right. When the door is closed and latched the door shall lock. The lock shall have a swing-away cover over the lock to prevent entry of ice and snow and shall be provided with two keys.

A tinned copper braided grounding conductor, properly terminated, shall ground the cabinet main door to the cabinet enclosure.

The full size door shall be gasketed with a good grade closed cell neoprene gasket attached to the door which, when closed, provides a dust tight, weather resistant seal.

6. Vertical mounting channels shall be welded to interior cabinet walls to provide adjustable shelf and panel locations. Sufficient mounting hardware shall be included to mount city supplied panels.

The cabinet enclosure shall be equipped with four (4) channels on each sidewall and three on the back wall of the cabinet enclosure. The mounting channels shall be Unistrut A4000EA and shall extend to 2” from bottom of cabinet to 2” from the cabinet roof. Each of these channels shall be welded to the cabinet in at least 5 spots. The back wall shall include an additional 4” wide continuously welded vertical channel as a stiffener to provide rigidity to the back wall.

7. The cabinet layout of the shelves, panels and equipment for this equipment application shall allow space for placing equipment on the shelves so as to provide for ease of installation and removal of the equipment and for ease of viewing of the front panel displays of the equipment.

   All equipment mounted on the sidewalls of the cabinet shall be located in positions that will not interfere with the removal of other equipment, either shelf or rack mounted. Electrical equipment and terminal facilities mounted on the inside side walls and back wall of the cabinet shall be mounted on 0.090" aluminum panels with brass round head screws. The metal panels shall be attached such that no screws, bolts, pop rivets, or other fasteners go through the outside shell of the cabinet.

   All panels shall be mounted such that a minimum clearance of 4 inches from the bottom of the cabinet is maintained.

   Panels shall not have sharp or jagged edges or corners.

   Uninsulated 120-volt parts of any electrical equipment inside the cabinet shall be suitably covered with Lexan and a warning label to prevent electrical shock. Lexan covers shall be held in place by large plastic or nylon wing nuts.

8. The cabinet shall be provided with adjustable shelves. The shelves shall fit the full width of the cabinet and shall be at least ten and one half inches in depth.

   The shelves shall be ventilated with punched holes or fabricated from an aluminum mesh material to provide airflow. If punched holes are used each shelf shall contain twelve (12) holes, each 1.25 inches in diameter evenly distributed across the shelf in two rows.

   A documentation shelf 15 inches wide by 10 inches deep shall be hung from the bottom side of the lower shelf. The document shelf shall provide 1” of document insertion space.

9. Two LED light fixtures shall be provided. One fixture shall be mounted on the inside near the top of the cabinet

above the full-size door opening. The second fixture shall be mounted on the underside of the lower shelf. The fixture shall be centered on the long dimension of the shelf. Each fixture shall be UL listed, shall have multiple LED's and be Relume Technologies Model 796-5000, or GE Lumination Tetra Power Grid GEWHPGP6-65K or equivalent. The fixture shall be capable of being easily removed and replaced without interference with other components in the cabinet. The light fixture shall be of a rugged design.

The light fixture shall be activated by a 2 position toggle switch located on the auxiliary switch panel and labeled "LAMP ON - OFF". The power for the light fixture shall be supplied through the accessory circuit breaker.

The lamp mount position shall not interfere with the insertion or removal of equipment to be installed on the top shelf.

10. A thermostatically controlled fan assembly containing two (2) fans, a thermostat for controlling the fans, and a 4-point "Non-feed thru Terminal Block" shall be located in the top front of the cabinet in a plenum assembly and shall exhaust air out through the screened vents built into the roof door overhang of the cabinet. Each fan shall be rated for 100 cubic feet per minute air movement and a maximum noise level of less than 40 decibels. Fan guards shall be provided to prevent any one from putting their fingers into the fan. Each fan motor shall have thermal locked rotor protection or shall be impedance protected. The fan thermostat shall be located in the inside top of the cabinet adjacent to the outside wall of the plenum and be adjustable within the minimum range of from +75 degrees to +150 degrees Fahrenheit. Fan attachment hardware shall have anti-sieze compound added to the threads prior to assembly.

    The cabinet shall be supplied with a cabinet heater and cabinet heater fan, both shall be controlled by a separate thermostat with a near freezing turn on temperature range. The cabinet heater shall be 500 watts. The cabinet heater fan shall circulate cabinet air past the heating element to maintain even cabinet air temperature.

The fans shall be separately fused and powered by the auxiliary breaker on the power panel assembly. The fan assemblies shall be provided with connectorized power connections. Exposed terminals on the thermostats shall be covered by insulation to prevent accidental contact with 120 VAC circuits. If the adjustment screw of the thermostats is covered by the insulation, a hole or door shall be provided to allow adjustment of the thermostats while giving protection from accidental contact with the 120 VAC.

Louvers shall be located in the lower portion of the main cabinet door for air intake. The louvers shall be centered horizontally in the door and be placed in four (4) columns of ten (10) louvers, spaced 1-inch apart, covering a total area of approximately 22 inches wide by 10 inches high. The louvers shall be backed by a size 12 inches by 24 inches by 1-inch thick replaceable type foam panel type dust filter (Viskon-Aire, Air Filter Products, Series "55" panel filter, tacky side in: or approved equal) which shall be held in place by formed angle brackets into which the filter is dropped from above as shown on the drawing labeled "Door Stiffener/Air Filter Bracketing".

The bracket supporting the bottom of the filter shall be 11 inches from the bottom of the door. The upper movable bracket shall be equipped with a piano hinge tack welded to the cabinet door. The bracket shall be able to be rotated 90 degrees on the piano hinge for ease of filter installation and removal. The hinged bracket shall be held in place through use of a tensioning spring attached between the bracket end and a tensioning point on the cabinet door.

The upper and lower supports shall have the inner edges fitted with ¾-inch wide, ¼-inch thick bristle type fiber gaskets to insure a tight fit of the filter between the bracket and the door.

To block airflow in cold weather a metal weatherproof cover shall be provided to adequately cover the louvers on the full size door. The cover shall be gasketed and installed from the inside of the cabinet in the filter-mounting bracket, which shall force the louver against the back of the door.

11. Cabinet lifting provisions shall meet the UL requirements for the NEMA 3R cabinet. The lifting provisions shall consist of aluminum lifting ears mounted to extend above the top of the left and right sides of the cabinet enclosure, allowing a bar or hooks to be inserted through both ears for lifting the cabinet.

    The lifting ears shall have a lifting capacity equal to the weight of the completely wired cabinet plus 25 percent, 500 pound capacity minimum. Each lifting ear shall have a 1 inch hole, the bottom of which shall be flush with the top of the cabinet or above the top of the cabinet less than 1/8 inch. The top of the lifting ear shall extend no more than four (4) inches above the top of the cabinet at the point where the ear is attached. The lifting ears shall be centered on the cabinet side walls such that the cabinet will not pitch or tilt when lifted. The lifting ears shall be secured to the cabinet by means of corrosion resistant bolts, allowing the ears to be inverted to conserve space during shipping and storage. The positioning of items mounted inside the cabinet shall not restrict access to the bolts.

12. The cabinet shall have termination for incoming 120 volt AC power, grounding and neutral. The cabinet shall have a power surge suppressor and power line conditioner for cleaning stray voltage from the sine wave. Typically, the hub cabinet will receive unconditioned electrical power tapped from a nearby traffic signal. The cabinet shall include one hardwired 6 outlet power strip with internal circuit breaker.

13. One fiber enclosure shall be contained in the cabinet. Each fiber enclosure shall contain all trays and components necessary to terminate 24 single mode fibers and hold 24 single mode fiber splices.

14. Contractor shall provide three copies of computer drawn cabinet diagrams showing actual cabinet wiring in a clear, water resistant, plastic pouch.

15. Each cabinet shall have an anodized etched finish (Aluminum Association C22) with an Architectural Class 1

(Aluminum Association A42) hard coat finish of at least 0.7 mil. Finish color shall be 30 minute clear aluminum.

B. CAT-5E Cable

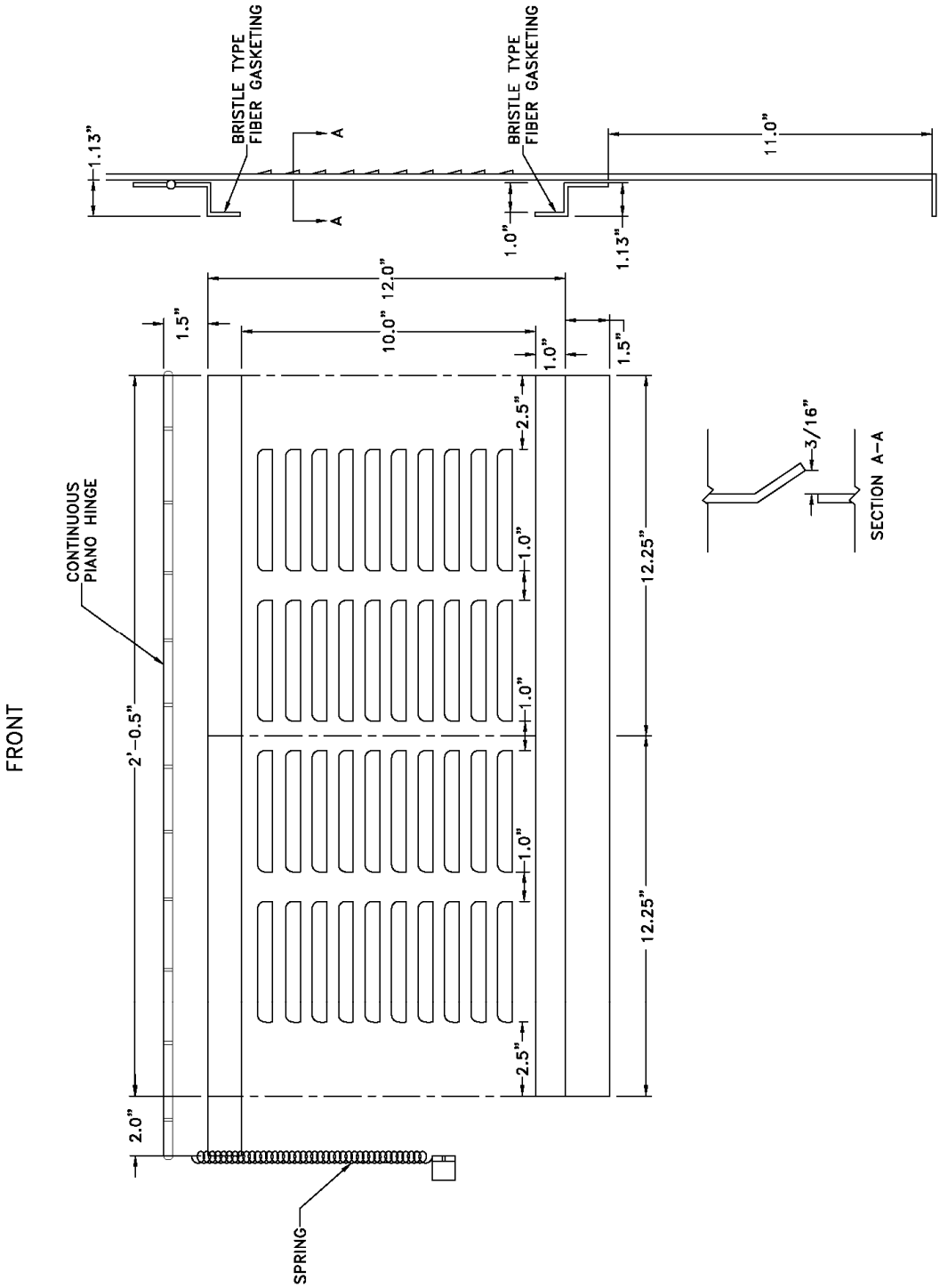
This work shall consist of furnishing and installing a category 5E cable between a traffic signal controller cabinet and a fiber optic hub cabinet. Confirming required actual length is Contractor's responsibility. Cable length shall include approximately 5 feet slack on each end to allow easy cable connection without force on the connectors. Typically the cable will be connected to an Ethernet switch at each end. The cable shall have RJ-45 connectors installed and attached at both ends. Contractor has option of installing a Cat-5E cable with pre-made connections or making connections upon installation. The Cat-5E cable shall be industrial grade, have sunlight and oil resistant jacketing and be suitable for outdoor and underground applications. The cable shall have a non-gel water block core.

The Contractor shall test all Cat-5E cables installed in the controller cabinet with a tester specifically designed for testing continuity through an RJ-45 connection. The Contractor shall provide a test report – typed or handwritten – for all Cat-5E cables in each cabinet. The test shall state the date of the test, individuals who performed test, identify each cable tested, and state whether the cable passed. All non-passing cables shall be corrected by the Contractor. Furnishing, installing, and testing of Cat-5E cables shall be incidental to the Fiber Optic Hub Cabinet pay item.

C. Payment

Fiber-optic hub cabinets shall be installed as shown in the Plans. The cost of furnishing all materials and labor necessary to perform the work described above shall be paid for as **"Fiber Optic Hub Cabinet", Each**.

DOOR STIFFENER/AIR FILTER BRACKETING



SS-3.3 Fiber-Optic Hub Cabinet Foundation

This pay item shall consist of installing a traffic signal controller foundation according to Minneapolis Detail No. A-4081 Cabinet Foundation, 17" x 33" Fiber Hub Cabinet. Contractor shall reference City standard specifications on concrete for the foundation. The Contractor may, in some cases, be placing the controller foundation over an intercepted conduit. All conduit bends shall be made with preformed conduit bends and elbows. Each foundation shall be constructed with a minimum of three 3-inch NMC conduits. At least one spare unused conduit shall be provided and each spare shall be extended 2-feet beyond the foundation and capped.

All foundation locations shall be approved by the City before construction.

Concrete pad finishing shall be smooth, level, and flat. No more than 0.125 inches of variability compensated by shims will be allowed. Variability in excess of this will require resurfacing or replacement at the direction of the Engineer. Inspections will be performed using a Contractor supplied City approved ½" thick steel template manufactured to match cabinet dimensions. The first pad shall be inspected in detail, approved and used as the standard for finish and workmanship. All templates required are incidental to the project.

Concrete for all foundations shall be Mix No. 3Y43 free of chloride additives, placed and consolidated using vibratory equipment and be finished all in accordance with the provisions of Mn/DOT 2565.3F except that edges **shall not** be chamfered or beveled, but shall be neat and straight. Concrete shall be allowed to cure for a minimum of seven (7) days before being placed into use unless otherwise permitted by the Engineer.

Fiber-optic hub cabinet foundations shall be installed as shown in the Plans. The cost of furnishing all materials and labor necessary to perform the work described above shall be paid for as "**Fiber Optic Hub Cabinet Foundation", Each**.

SS-3.4 Fiber Optic Handholes and Installation

This work shall consist of furnishing and installing fiber optic handholes as shown in the Plans.

New fiber handholes shall be Minneapolis style Fiber Optic Handholes constructed with monolithic HDPC (High Density Polymer Concrete) with cover and box meeting a Tier 22 rating (AUSI/SCTE 77-2007) as shown in the details in the Plans (Minneapolis Standard Plate No. Traf-2710) and shall conform to the City of Minneapolis standards. The handhole shall be of a straight wall design

and have an open bottom. A drain field shall be provided with each handhole. Concrete for supporting the frame and cover in non-sidewalk areas shall be Mix No. 3A32 or equal. The design of the handhole shall be such that units are stackable.

Handhole covers shall not be secured with bolts and shall weigh at least 110 pounds. Stainless steel lifting eyes shall be cast into the cover and 5 lifting tools shall be provided at no additional cost with the project. Handhole covers shall be embossed with the label "MPLS FIBER OPTIC" in 2" high lettering. If bolt holes are present in the cover, suitable plugs shall be provided.

Frames and covers shall be set in a bed of mortar and leveled to the finished surrounding grade. Handhole frames and covers shall be installed such that the lid and frame are flush with surrounding surfaces. This may require that the handhole be installed at an angle in some cases. Handholes shall be supported by an aggregate base and a concrete collar installed in accordance with that shown in Minneapolis Standard Plate No. Traf-2715.

Frames and covers shall be pretreated prior to concrete placement such that the concrete does not adhere to exposed surfaces. Frames and covers shall be cleaned free of adhering concrete after placement.

In some installations, the Contractor will have to excavate around an existing conduit and cut a slot into the vertical panels of the fiber optic handhole to allow the box to fit over the existing conduits. Prior to cutting the slot, the Contractor shall measure the location of the conduit entry point on the handhole wall and, with a hole saw, cut an entry hole into the box wall matching the conduit size. Using a saw, the Contractor shall cut an inverted narrow V slot from the bottom up to the sawed hole.

After the box is satisfactorily prepared, the Contractor shall complete the leveling process on the fiber optic handhole so it is flush with the surface. The gravel under the box shall be tamped firm and the box shall rest firmly on the gravel. All burrs shall be removed from conduits. Conduit ends shall have pre-formed conduit end bells attached.

Once the box is installed over the conduits, the cut out piece fitting the slot shall be epoxied into the wall of the box, filling the hole so that the horizontal conduit enters the box and is a snug fit in the handhole wall. The epoxy shall be one recommended by the manufacturer of the fiber optic handhole box for repairing its boxes. The area surrounding the conduit entrance shall be sealed with a mortar filling. Conduits shall extend a minimum of 2 inches and not more than 3 inches into the handhole.

If the fiber optic handhole installation contains existing cables, the cables shall be neatly ordered in the new handhole. If the handhole intercepts an existing conduit the conduit shall be cut from around the existing cables without damaging the cables.

New conduit runs passing through handholes shall have both entering conduits placed in direct horizontal alignment.

The Contractor shall salvage in place handholes not reused as part of the project unless otherwise directed by the Engineer.

All fiber-optic handholes shall be installed in accordance with the Plans. The costs of furnishing and installing fiber optic handholes including the concrete collars in boulevard areas as described and as shown in the Plans shall be paid for as "**Fiber Optic Handhole**," **Each**.

Standard Supplemental Specifications For The Construction of Public Infrastructure In The City of Minneapolis
DIVISION WM - WATERMAIN

DIVISION WM

WATER DISTRIBUTION SYSTEMS
UPDATED: December 07, 2011

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Standard Supplemental Specifications For The Construction of Public Infrastructure In The City of Minneapolis
DIVISION WM - WATERMAIN

SECTION WM-0

GENERAL

WM-0.1 SCOPE OF WORK UNDER THIS CONTRACT

1. Construction activities for watermain and related appurtenances for the municipal water distribution system.
2. Contractor shall obtain all permits, as required by the City of Minneapolis, the Minnesota Department of Health, or any other governmental entity that has jurisdiction in the work area.
3. Surveying to establish alignment and grade shall be performed by the Contractor unless otherwise indicated in the contract documents.
4. Refer to project drawings and special conditions.

WM-0.2 PROTECTION OF THE PUBLIC WATER SYSTEM

1. **Under no circumstance shall the Contractor or any other unauthorized personnel perform work on water mains currently in service.**

2. Minneapolis Water Works personnel will operate all water system valves. **Under no circumstance shall water valves be operated by others.**

3. Tampering with public water systems can be a federal offence resulting in prison sentence of up to 20 years, fines, or both. Refer to United States Code TITLE 42, Chapter 6A, Subchapter XII--Safety of Public Water Systems, Part D, Sec. 300i-1 "Tampering with public water systems," the U.S. EPA Safe Drinking Water Act, and the Bioterrorism Act.

4. Since tampering with a drinking water system is a crime under the Safe Drinking Water Act, and may involve several other felony acts, any threats received by a utility should be reported to the appropriate authorities, including law enforcement and drinking water primacy agency.

5. All water quality samples will be taken by the Minneapolis Water Works Laboratory personnel for laboratory analysis and verification of compliance with potable water standards.

6. For the replacement of water main and service piping and for the cleaning and lining of water mains and installation of hydrants, above-ground temporary water main and service piping may be required. All such piping and connections shall be supplied, installed, repaired, and removed by the Minneapolis Water Works personnel.

7. The Minneapolis Water Works will assign an on-site representative for the

installation of water main, hydrants, valves, and other water distribution system appurtenances, as well as for water main cleaning & lining. Contractor shall coordinate work in cooperation with the city representative.

WM-0.3 COORDINATION AND STAGING OF WORK

1. Other contractors and City personnel may be working in the vicinity of the proposed project work. Every contractor is responsible to communicate and coordinate with other work.

2. Water Main Shutdowns and Temporary Service Measures

   The water system work under this contract requires the shutdown of water mains and the implementation by the Water Works of temporary water supply. These processes require a significant commitment of resources and will take a substantial amount of time to perform. Therefore it is essential the Contractor must begin coordination efforts with the Water Works immediately upon award of the Contract. This initial coordination includes establishing timelines and staging of temporary water supply installation and disinfection and water main sections to be temporarily taken out of service while the water main work is performed.

   The Contractor's coordination with the Water Works should also include consideration of location of temporary piping in relation to the scheduling of other components of the project scope (i.e. if temporary piping is to be placed on the sidewalk and sidewalk removals are scheduled while the temporary water supply pipe is in place, problems will result). Therefore it is in the best interest of the Contractor to communicate early in the project with the Water Works in regard to the location of temporary water supply piping.

   Once temporary service has been established along a given segment of water main, the Contractor shall be required to stage water related work (water main installation and / or cleaning and lining activities, as well as service, gate valve, and hydrant work) to be completed before the temporary service on that segment of water main is removed and the main is returned to service.

3. Disinfection, Sampling, and Testing of Water Mains

   The Contractor shall always be aware that the health and safety of the customers served by Water Works will always be the first priority of the City of Minneapolis Water Treatment & Distribution Services. Adequate advance notification of temporary water supply and water main disinfection needs and deference to the judgment of the Superintendent of Water Distribution in matters of, and related to, disinfection and sanitary practices involving water main work and the placing into service of water mains shall at all times be required.

During flushing operations, the Contractor shall be strictly required to cooperate with the Water Works with regard to placement of hoses required to flush sections of water main that have been restored to service. The hoses must remain intact *continuously* until such time that the Water Works removes them. **Under no circumstances shall the Contractor or any other unauthorized personnel remove flush hoses or turn the water off.**

WM 0.4 GOVERNING STANDARDS

1. Products and work quality shall conform to the requirements and standards of the following agencies and organizations, except when more specific requirements are written or are required by applicable codes. In any case of conflict between the standards and this specification, the requirements of this specification shall prevail. In any case of conflict between applicable codes and this specification, request clarification from Engineer before proceeding. (The city and Internet addresses are shown for convenience, but may be subject to change by the sponsoring organization without notice.)
   a. Applicable standards (latest version at time of bid) of the American Waterworks Association (AWWA), Denver, CO. (http://www.awwa.org)
   b. Recommended Standards for Water Works, commonly called "Ten States Standards," a Report of the Water Supply Committee of the Great Lakes--Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. (www.hes.org, and http://10statesstandards.com)
   c. Safe Drinking Water Act, and other regulations and guidance from the U.S. Environmental Protection Agency.
   d. Statutes and Rules administered by the Minnesota Department of Health
   e. All other applicable state, federal, and City of Minneapolis laws and rules.

WM 0.5 DEFINITIONS

1. The following terms shall have equal meaning: "Water Works," "Minneapolis Water Works," "Division of Water Treatment and Distribution Services," "Minneapolis Water Treatment & Distribution Services," and "Water Division" and all refer to the same subdivision of the Department of Public Works of the City of Minneapolis, Minnesota.
2. The "City" refers to any division or department of the City of Minneapolis, a political subdivision of the State of Minnesota.
3. The term "Engineer" shall be interpreted as the licensed Engineer that certified the design documents or the Project Manager representing the City.

Standard Supplemental Specifications For The Construction of Public Infrastructure In The City of Minneapolis
DIVISION WM - WATERMAIN

SECTION WM-1

MATERIAL REQUIREMENTS FOR WATER SERVICE CONSTRUCTION IN MINNEAPOLIS

WM-1.1 MATERIALS FOR DUCTILE IRON WATER MAIN, FITTINGS, HYDRANTS, AND APPURTENANCES

All materials required for completion of the work as specified shall be new material conforming to the requirements referenced herein and, unless otherwise indicated herein, all of the materials used shall be furnished by the Contractor. Any options provided for herein, or in any of the referenced Specifications, shall be subject to any selection restrictions imposed by other Contract Documents and only those options which are left unspecified shall be subject of choice by the Contractor, and then only to the extent that other limitations or rights are not indicated.

The Minneapolis Water Works shall supply gate valves and deliver them to the jobsite during normal business hours per the conditions outlined in section WM-2.1.1. The Contractor shall provide all other materials as specified required for the completion of the work.

Material acceptance shall be on the basis of Certificates of Compliance furnished by the Contractor's supplier or the material manufacturer in accordance with the provisions of Mn/DOT Standard 1603, except in the case of natural materials which will be accepted on the basis of the Field and Laboratory testing.

1.1.1. DUCTILE IRON PIPE.

a. Applicable Standards
   i. AWWA C104 – Cement-Mortar Lining for Ductile Iron Pipe and Fittings
   ii. AWWA C111 – Rubber Gasket Joints for Ductile Iron Pressure Fittings
   iii. AWWA C150 – Thickness Design of Ductile Iron Pipe
   iv. AWWA C151 – Ductile Iron Pipe, Centrifugally Cast

b. Use Ductile Iron Pipe for pipe sizes 3 to 24-inches. Watermains shall have a minimum size of 8-inch. Service lines may be smaller than 6-inch. Use Steel pipe for larger sizes.

c. Pipe Wall Thickness: All Ductile Iron Pipe shall be designed for the intended trench type, bury depth, and loading conditions by a licensed Professional Engineer. All pipe shall conform to AWWA C151, with a minimum Thickness Class 52 or a minimum Pressure Class of 350.

d. Laying lengths: Nominal lengths of 20’ or 18 feet (depending on acceptable manufacturer’s standard) shall be used.

e. Joints: Unless specifically indicated in the plans, all pipe furnished under these specifications shall have AWWA C111 mechanical joints or push-on type joints.

f. Joint Conductivity
   i. All pipe and fitting joints shall have electrical conductivity between every joint, except where an individual joint is intentionally isolated due to the corrosion protection system design.
   ii. Standard Installations – option 1) conductivity straps affixed to adjoining pipe ends by means of manufacturer-furnished lugs or by cad welding, or option 2) armor tipped gaskets as manufactured by American Ductile Iron Pipe Company or equivalent.
   iii. Installations with cathodic protection systems (anodic or induced current) use double (two) conductivity straps affixed to adjoining pipe ends by means of manufacturer-furnished lugs or by cad welding.

g. Exterior Coating: Ductile Iron pipe shall be furnished with a 1 mil thick bituminous coating per AWWA C151.

h. Interior Coating / Lining: Cement mortar lining for ductile iron pipe shall be in conformance with AWWA C-104. The interior lining of the pipe shall be finished with a bituminous seal coat sprayed on the lining surface.

1.1.2. GATE VALVES - 3” TO 24”.

Unless otherwise indicated in the contract documents, gate valves will be supplied by the Minneapolis Water Works. Due to the long lead time required for the manufacture of these valves, the Minneapolis Water Works keeps valves in stock.

All valves shall be located in manholes, buried vaults, or structures to allow long-term maintenance.

Electrical conductivity shall be maintained through gate valves by armored tipped gaskets or other approved means such as conductivity straps.

For informational purposes, Minneapolis standard gate valves conform to AWWA C500, and are double disc type, parallel seat, non-rising stem, with a 2" square wrench nut that turns right (clockwise) to open.

Since the exact length of valve stem required for each valve installation varies, the Minneapolis Water Works will fabricate, furnish and install gate stems for each gate valve installation.

1.1.3. CAST OR DUCTILE IRON FITTINGS.

Compact style fittings, conforming to AWWA C153 will not be accepted.

Fittings 2-inch to 48-inch shall conform to AWWA C110, with a minimum pressure rating of 250 psi. Mechanical joints conforming to AWWA C111 with armored tipped gaskets or conductivity straps shall be used in all buried locations. Flanged fittings may be allowed inside vaults.

All cast or ductile iron fittings shall have a bituminous outside coating and be cement mortar lined inside and shall be in accordance with AWWA C104 and AWWA C110

All locations where a pipe enters a structure shall include two mechanical joints, approximately 2 feet apart longitudinally to allow for differential settlement.

Joint restraint shall be accomplished using MEGALUG® Mechanical Joint Restraints, manufactured by EBBA Iron, or equivalent USA-manufactured product. See later articles in this specification for additional provisions related to joint restraint.

1.1.4. HYDRANTS.

Hydrants shall be furnished and delivered complete and ready for installation. Electrical conductivity on mechanical joint hydrants shall be established by methods described elsewhere in this specification.

The materials used and the manufacture of these hydrants, in general, shall be in accordance with AWWA C502 except as otherwise required herein.

The hydrants shall be provided with a full five-inch diameter valve opening. No portion of the hydrant barrel or post shall have an inside diameter less than seven inches. The thickness of the metal in the barrel shall not be less than one-half inch for centrifugal cast pipe or nine-thirty-seconds of an inch for ductile iron pipe.

Hydrants to be furnished shall be the traffic model with breakable devices for the protection of the barrel, stem, and other parts, designed to break at ground level. The distance between the breakaway flange to the centerline of the steamers (hose nozzles) will be a minimum of 26 inches. This can be accomplished by a single one-foot factory installed extension if necessary. The lower barrel material shall be

ductile iron, with full body construction (no below-grade flanges).

The required hydrant lengths will vary depending upon the depth of the water main at a particular location, typically between seven and ten feet. The Contractor shall be responsible for determining the required hydrant length for each location by means of field measurement. The Contractor shall furnish the hydrant that meets the required depth without the addition of a second extension (beyond that allowed in the previous paragraph for achieving the 26" flange to steamer connection dimension).

Each hydrant shall have two steamer connections, each with a nominal opening of four and one half inches in diameter, and placed 120 degrees apart or approved exception. Minneapolis standard pattern threads which have an outside diameter of male threads of five and nine-sixteenths inches, with four threads per inch, shall be used. Nozzle cap chains shall be galvanized.

Each hydrant bottom or cup shall have a six inch mechanical joint connection for six inch diameter spigot end pipe as called for on the bid form. The bottom of the base (shoe) shall be flat to facilitate a solid, straight installation of the hydrant.

Outlet nipples shall be bronze. Hose cap nut and operating nut shall be standard Minneapolis pattern. Caps shall be cast iron or ductile iron.

The hydrant valve shall be of the compression type, opening against the pressure.

A positively operating non-corrodible drip valve shall be provided and arranged so that it will properly drain the hydrant when closed and prevent any leakage when the valve is fully open. The hydrant shall have drain openings that are not less than 5/16" in diameter in the brass seat ring of the main valve, and not less than 7/16" in diameter in the barrel.

The stuffing box with two "O" rings shall be accessible for packing and readily removable. The operating nut shall be of bronze or non-corrosive metal. Where the valve rod comes in contact with the packing, it shall be bushed with bronze or non-corrosive metal and no leakage shall be permitted under the bushed surface, thereby protecting operating threads from water pressure.

Hydrants shall be opened by turning to the left (counter-clockwise), and shall be marked with an arrow to indicate the direction of opening. Hydrants shall be marked with the name or mark of the manufacturer.

Hydrant bodies shall be red, with a long-term coating as recommended by the manufacturer. Hydrant caps shall be Reflective white.

Acceptable hydrants shall be Waterous Pacer, Mueller Centurian, Mueller Super

Centurian, or Clow Medallion.

The bidders shall state weight of hydrants complete and furnish working drawings, specifications and description of hydrants they propose to furnish.

1.1.5. WATER SERVICE PIPE AND FITTINGS.

Water service pipe of 3" or larger inside diameter shall conform to the requirements for ductile iron pipe and fittings as set forth under the provisions of this specification.

Water service pipe of 2" or less inside diameter shall conform to the requirements of ASTM B-88 for Seamless Copper Water Tube, Type K, Soft Annealed temper.

Corporation stops, service saddles, curb stops, and curb stop service boxes shall be as detailed in the Plans or approved pattern designations. All fittings for copper tubing shall be cast copper alloy conforming to AWWA C800, having uniformity in wall thickness and strength, and shall be free of defects affecting serviceability. All buried copper pipe fittings shall be flared type. All threads for underground service line fitting shall conform to the requirements of AWWA C800. Each fitting shall be permanently and plainly marked with the name or trademark of the manufacturer. All rubber components shall be EPDM.

Curb stop service boxes shall be gray iron castings conforming to the Minneapolis pattern and the requirements of ASTM A-48 for Class 20 or higher tensile strength.

Taps into watermain with less than 4 full threads shall use a service saddle conforming to AWWA C800.

1.1.6. CONCRETE.

Concrete for masonry construction shall be furnished in conformance with the requirements of Mn/DOT Standard 2461 for the mix designation shown in the Plans. The requirements for Grade A concrete shall be met where a higher grade is not specified. Type 3 concrete shall be furnished and used in all structures having weather exposure.

1.1.7. GRANULAR MATERIALS

Granular backfill materials furnished for foundation, bedding, cover, fill or other backfill construction shall consist of any natural or synthetic material aggregate such as sand, gravel, crushed rock, crushed stone, and be free of all organic materials; that shall be so graded as to meet the gradation requirements specified (reference section WM-2.13 of these specifications) for each particular use.

1.1.8. PRECAST MANHOLES

Precast manholes shall be constructed in accordance with the provisions of Mn/DOT Standard 2506 and City Standard Detail Plate for Water Manholes. They shall be equipped with a flat top section with a 24" diameter offset opening with edge of opening set at the inside wall of the manhole. The manholes shall be equipped with aluminum steps or plastic encapsulated steel steps that meet ASTM C-478, set in a vertical line 16" on center and installed in line with the offset opening. The manholes shall be set on concrete footings to prevent the manholes from settling.

Pipe penetrations in manhole walls shall be watertight and be designed to allow for differential settlement.

1.1.9. CAST IRON RING AND COVERS.

The cast iron ring and covers shall be constructed in accordance with ASTM 48, Class 35B cast iron or ASTM A536 Grade 65-45-12 ductile iron, and cast according to City Standard Detail Plate for Water Manholes.

1.1.10. PITOT TAPS FOR CHLORINATION.

Pitot-tap to be used for chlorination or flushing purposes shall be a 1"x1-1/4" corporation stop as specified:

Inlet: AWWA thread.
Outlet: Increased size iron pipe thread with inside driving thread.

Brass content shall meet AWWA Specifications C-800.

Pitot taps shall be installed per Section WM - 2.19 of these specifications and / or as directed by the Engineer.

1.1.11. CONCRETE ENCASEMENT.

The water mains shall be concrete encased as shown in the Plans and on Minneapolis Water Works Detail provided with the plan set. The concrete mix used in encasements shall conform to Mn/DOT Mix No. 3A42, -¾.

The deformed billet-steel reinforcing bars shall be manufactured in accordance with ASTM A615, Grade 60 steel; having a minimum tensile strength of 90,000 psi and a minimum yield strength of 60,000 psi.

All re-bars shall be cut and bent according to the schedule for the concrete jackets as

shown in the plans and on Minneapolis detail drawing(s). Tolerances in cutting and bending shall be within the limits established by ASTM "Code of Standard Practice for the Fabrication of Reinforcing Materials and Services."

WM 1.2 MATERIALS FOR STEEL WATERMAIN AND APPURTENANCES

1.2.1. REFERENCES

a. Design References
   i. Steel Pipe - A Guide for Design and Installation, by American Water Works Association (AWWA) Manual of Practice M11.
   ii. Welded Steel Pipe Design Manual , American Iron and Steel Institute and Steel Tank Institute and Steel Plate Fabricators Association (STI/SPFA).

b. Applicable Standards
   i. AWWA C200 Steel Water Pipe--6 In. (150 mm) and Larger
   ii. AWWA C205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe--4 In. (100 mm) and Larger--Shop Applied
   iii. AWWA C206 Field Welding of Steel Water Pipe
   iv. AWWA C207 Steel Pipe Flanges for Waterworks Service--Sizes 4 In. Through 144 In. (100 mm Through 3600 mm)
   v. AWWA C208 Dimensions for Fabricated Steel Water Pipe Fittings
   vi. AWWA C209 Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
   vii. AWWA C214 Tape Coating Systems for the Exterior of Steel Water Pipelines
   viii. AWWA C216 Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
   ix. AWWA C218 Liquid Coating Systems for the Exterior of Aboveground Steel Water Pipelines and Fittings
   x. AWWA C219 Bolted, Sleeve-Type Couplings for Plain-End Pipe

Steel water main and related appurtenances shall be manufactured and delivered complete and ready for installation in accordance with the latest revisions of AWWA and in compliance with these specifications and project drawings.

The Contractor shall submit, to the City Project Manager, an affidavit that all the materials and workmanship have complied with applicable AWWA Standards and the manufacturer's recommendations.

1.2.2. MANUFACTURER'S DRAWINGS

Upon award of the contract, the successful bidder shall submit four (4) complete sets

of Shop Drawings showing complete details of construction of each item to be furnished. Steel pipe systems shall be designed under the direction of a Professional Engineer, licensed in the State of Minnesota, and Shop Drawings shall be certified by that Engineer. One (1) set will be returned REVIEWED or with a request for changes. The pipe shall be fabricated in accordance with the drawings as REVIEWED by the Engineer. Final plans shall be submitted on CD in one of the following formats:

MicroStation (DGN) files – preferred format,
Auto-CAD (DWG) files or (DXF) files (Confirm version is compatible with MicroStation before submitting full set.).

1.2.3. MATERIALS AND WORKMANSHIP

The pipe shall fully conform to AWWA Standards C200.

All longitudinal seams, spiral seams, or girth seams shall be butt-welded. Each full length of pipe shall not have more than one (1) girth seam and two (2) longitudinal seams or one (1) continuous spiral weld.

1.2.4. PLANING, ROLLING, AND WELDING

Follow all fabrication descriptions in AWWA C200, except that Lap joints in the shop are not permitted.

1.2.5. STANDARD DIMENSIONS

a. Steel Water Main Pipe Standard Dimensions

Use Steel pipe for pipe sizes 30-inch and larger. Steel may be considered at 24-inch in lieu of Ductile Iron Pipe.

Unless specifically modified elsewhere in the contract documents and design drawings, all pipe lengths, other than closure pieces or fittings, shall be random lengths as described in AWWA C200, except with a minimum length of 30-feet, and no more than 5 percent being less than 32-feet.

Steel pipe thickness shall be designed by a Professional Engineer, licensed in a state of the United States or America, using industry standard design methods and design criteria for the specific project conditions. Add 1/8-inch extra thickness to all calculated needed thicknesses after safety factors in AWWA Manual of Practice M11 are included. Unless specifically modified elsewhere in the contract documents and design drawings, steel water main shall be of the

dimensions shown below

b. Bends

All bends shall conform to AWWA Standards C208.

The bends shown on the Drawings are dimensioned in the horizontal and vertical plane and do not necessarily show the true dimensions. All bends shall have projected centerline punch marks on the top of the pipe to show the degree of roll and the in-place vertical plane through the pipe centerline.

c. Joints

All joints shall be prepared and constructed in conformance with AWWA C200 and C206. Joints must be of the welded type, including the options of double-welded lap joints, single weld butt joints, or double weld butt joints. Butt Strap joints will be allowed for connections to existing steel pipe, and for a single final connection in each project.

d. Special Fittings

Special fittings not covered by this specification shall be detailed in the design drawings and shall be manufactured in accordance with the drawings and this specification.

1.2.6. FACTORY TESTING

Every straight pipe section shall be hydrostatically tested in accordance with Section 5.2.1 of AWWA Standards C200 at the maximum test pressure determined by the formula contained therein. Fittings shall be tested with hydrostatic pressure of 150 psi, or by Nondestructive testing in accordance with AWWA C200. Certified evidence of tests on all pipe supplied under these Specifications shall be submitted to the Engineer, prior to shipment.

1.2.7. CLEANING

Preparatory to priming and following the testing, each pipe shall be thoroughly and satisfactorily cleaned of all mill scale, oil, grease, rust, dirt, or other foreign matter on both the inside and outside surfaces.

Cleaning is to be accomplished by means of shot-blasting, sandblasting, or steel grit blasting with properly designed machines for this purpose.

1.2.8. PRIMING, COATING, AND LINING

a. Exterior

The exterior surface of the pipe shall be wrapped according to the pre-fabricated, cold-applied tape coating system which consists of three (3) layers, conforming to AWWA C214. The exterior coating shall be held back six (6) inches from the end of the pipe or fourteen (14) inches from the end of the pipe that connects to an isolation coupling. Special sections, connections, and fittings shall be wrapped in accordance with AWWA C209, cold-applied tape coating for special sections and fittings for steel water pipelines or AWWA C216 Heat-Shrinkable Cross-Linked Polyolefin Coatings. The pipe supplier shall provide all materials necessary to perform the outside wrapping of field joints and coating repair for the pipe installation.

b. Interior

The interior surface of the pipe shall be cement-mortar-lined in accordance with the AWWA Standards C205. The interior cement mortar shall be held back three (3) inches from the ends of the pipe, at welded connections. The cement mortar lining shall extend to the end of pipe at isolating coupling connections.

1.2.9. HANDLING, STORAGE AND SHIPPING

Pipe shall be braced as required to maintain roundness of +/- 1 percent during shipping and handling. Coated pipe shall be shipped on bunks and secured with nylon belt tie down straps or padded banding located approximately over braces.

Coated pipe shall be stored on padded skids, sand berms, sand bags, or other suitable means so that coating will not be damaged. Coated pipe shall be handled with the wide belt slings, padded forks, or other means that will not damage the pipe. Chains, cables or other equipment likely to cause damage to the pipe or coating shall not be used.

Prior to shipment, the pipe shall be visually inspected for damage to the coating. Any damaged areas shall be repaired in accordance with the standard to which the coating was applied.

1.2.10. COUPLINGS

a. All sleeve-type couplings shall be located in manholes, buried vaults, or structures to allow long-term access for adjustments.

b. Standard Sleeve-type Couplings

Pipe couplings shall be of a gasketed, sleeve-type conforming to AWWA C219. Metal components shall be steel with fusion bonded epoxy coating, ductile iron, or stainless steel.

The gaskets of the couplings shall be composed of EPDM rubber, with properties that will not deteriorate from age, heat, or exposure to air under normal conditions. It shall also possess the quality of resilience and ability to resist cold flow of the material so that the joint will remain sealed and tight indefinitely when subjected to shock, vibration, pulsation and temperature or other adjustment of the pipe line.

The pipe manufacturer Shop Drawings shall include pipe restraint using retaining brackets and tie rods. Other methods may be considered if they meet the design conditions.

c. Electrically Isolating Sleeve-type Couplings

Isolating-type pipe couplings shall be used in appropriate locations in cathodically protected pipe segments. These couplings shall be similar in all respects to the Standard Sleeve-type Couplings, but have the distinction of allowing no electrical continuity between the pipe segments connected by the coupling. The restraint systems must also be constructed to insure electrical continuity.

SECTION WM-2

CONSTRUCTION REQUIREMENTS FOR WATER SERVICE CONSTRUCTION IN MINNEAPOLIS

WM-2.1 GENERAL PROVISIONS

Water service construction shall be performed in accordance with the applicable requirements of Mn/DOT Standards 2451, all pertinent Minneapolis Ordinances, the Recommended Standards for Water Works (Ten States Standards) and all relevant AWWA Standards as required by the Minnesota Department of Health, and as follows:

2.1.1. DELIVERY OF NEW GATES

The Minneapolis Water Works shall furnish gate valves for this project. All delivery arrangements shall be the contractor's sole responsibility. The Minneapolis Water Works will deliver materials to the jobsite between the hours of 8:00 a.m. and 2:30 p.m. Monday through Friday. The Contractor shall notify the Water Works Warehouse (612) 673-5692, at least 24 hours in advance of the time when the materials are needed. It shall be the responsibility of the Contractor to designate a specific location for delivery at which the Water Department delivery truck can safely and legally come to a stop. If the Water Department driver is in doubt as to the safety of the delivery point, the driver will be instructed not to stop there. The Water Department truck driver will not enter private property, driveways, or alleyways. Safe unloading of the gate valves shall be the responsibility of the Contractor.

2.1.2. OPERATION OF EXISTING GATES

The Minneapolis Water Works shall open or close all gate valves as necessary for the construction and disinfection of the water main. The Contractor shall notify the Engineer two weeks in advance of any needed gate operation, so that the Engineer can determine if temporary piping is necessary or if the shut-off limits have to be extended due to a leaking valve. **The Minneapolis Water Works neither implies nor guarantees that the shut-offs will be watertight.**

2.1.3. ESTABLISHING LINE AND GRADE

The Contractor will establish the primary line and grade unless stated otherwise in the Contract. For trench installation, line and grade stakes will be set parallel to the proposed pipeline at the appropriate offset that will best serve the Contractor's operations wherever practical. Grade and line stakes will be set at 50 foot intervals along the pipeline; at each change in line or grade; and as needed for pipeline

appurtenances and service lines.

The Contractor shall arrange its operations to avoid unnecessary interference with the establishment of the primary line and grade stakes; and shall render whatever assistance may be required by the Engineer in accomplishing the staking. The Contractor shall bear the full cost of any re-staking necessitated by the Contractors negligence.

The Contractor shall be solely responsible for the correct transfer of the primary line and grade to all working points and for construction of the work to the prescribed lines and grades as established by the Engineer.

2.1.4. PROTECTION OF SURFACE STRUCTURES

All surface structures and features located outside the permissible excavation limits for underground installations, together with those within the construction areas that are shown in the Plans as being saved, shall be properly protected against damage and shall not be disturbed or removed without approval of the Engineer. Within the construction limits, as required, the removal of improvements such as paving, curbing, walks, turf, etc., shall be subject to acceptable replacement after completion of underground work. All expense of removal and replacement shall be borne by the Contractor to the extent that separate compensation is not specifically provided for in the Contract.

Obstructions such as street signs, guard posts, small culverts, and other items of prefabricated construction may be temporarily removed during construction provided that essential service is maintained in a relocated setting as approved by the Engineer and that non-essential items are properly stored for the duration of construction. Upon completion of the underground work, all such items shall be replaced in their proper setting at the sole expense of the Contractor.

In the event of damage to any surface improvement, either privately or publicly owned, the Contractor shall replace or repair the damaged property to the satisfaction of the Engineer and without cost to the Owner.

2.1.5. INTERFERENCE OF UNDERGOUND STRUCTURES

When any underground structure interferes with the planned placement of the pipeline or appurtenances to such an extent that alterations in the work are necessary to eliminate the conflict or avoid endangering effects on either the existing or proposed facilities, the Contractor shall immediately notify the Engineer of the affected structure. When any existing facilities are endangered by the Contractor's operations, the Contractor shall cease operations at the site and take such precautions as may be necessary to protect the in-place structures until a decision is made as to

how the conflict will be resolved.

Without specific authorization from the Engineer, no essential utility service shall be disrupted, nor shall any change be made in either the existing structures or the planned installations to overcome the interference. Alterations in existing facilities will be allowed only to the extent that service will not be curtailed unavoidably and then only when the encroachment or relocation will satisfy all applicable regulations and conditions.

Whenever alterations are required as a result of unforeseen underground interference's, not due to any fault or negligence of the Contractor, any alterations ordered by the Engineer will be paid for as Extra Work. Any alterations made strictly for the convenience of the Contractor shall be subject to prior approval and shall be at the Contractor's expense. No extra compensation will be made for unavoidable delays caused by the interference of existing underground structures shown in the Plans.

WM-2.2 TEMPORARY WATER SUPPLY PIPING

All temporary water supply piping required on the project shall be supplied and installed by the Minneapolis Water Works prior to taking any section of existing water main out of service. The Minneapolis Water Works will make every effort to coordinate temporary piping with the Contractors' work.

The Minneapolis Water Works reserves the right to make final determinations with regard to extent and placement of temporary water piping and services.

The amount of time required for planning and implementation of temporary water service varies greatly depending upon the location, type and number of services to receive temporary water, and workload of City forces. As such, the Contractor must make every effort to communicate as early as possible with the Water Works representatives with regard to the desired timing and sequencing of work requiring temporary water service.

The contractor shall be responsible for protecting the temporary piping and services from damage due to its activities or to its negligence.

WM-2.3 EXCAVATION AND PREPARATION OF TRENCH

2.3.1. OPERATIONAL LIMITATIONS AND REQUIREMENTS

Excavation operations shall proceed only as far in advance of pipe laying as will satisfy the needs for coordination of work and permit advance verification of unobstructed line and grade as planned. Where interference with existing structures

is possible or in any way indicated, and where necessary to establish elevation or direction for connections to in place structures, the excavating shall be done at those locations in advance of the main operation so actual conditions will be exposed in sufficient time to make adjustments without resorting to Extra Work or unnecessary delay.

All installations shall be accomplished by open trench construction except for short tunnel sections approved by the Engineer and with the exception that boring and jacking or tunnel construction methods shall be employed where specifically required by the Plans or Special Provisions. Installation of pipe through excavations will be allowed only where the surface structure can be properly supported and the backfill restored to the satisfaction of the Engineer.

The excavating operations shall be conducted so as to carefully expose all in place underground structures without damage. Wherever the excavation extends or approaches so close to an existing structure as to endanger it in any way, precautions and protective measures shall be taken as necessary to preserve the structure and provide temporary support. Hand methods of excavating shall be utilized to probe for and expose such critical or hazardous installations as gas pipes, electric power, and fiber optics or telephone cables.

The Engineer shall be notified of any need for blasting to remove materials which can not be broken up mechanically, and there shall be no blasting operations conducted until the Engineer's approval has been secured. Blasting will be allowed only when proper precautions are taken to protect life and property, and then shall be restricted as the Engineer directs. The Contractor shall assume full responsibility for any damage caused by blasting, regardless of the requirements for notification and approval. The Contractor shall secure required permits for blasting and shall conduct blasting operations in conformance with all applicable State and local laws, regulations and ordinances.

2.3.2. EXCAVATION AND DISPOSITION OF MATERIALS

Excavation will be considered to be incidental work except that the removal of materials classified by the Engineer as rock will be paid for as Extra Work, if the contract does not have a pay item for rock excavation.

Rock excavation is hereby defined to include all hard, solid rock in ledge formation, bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; and any boulder stone, masonry or concrete fragments exceeding one-half cubic yard in volume. Materials such as shale, hard pan, soft or disintegrated rock which can be dislodged with a hand pick or removed with a power operated excavator will not be classified as Rock Excavation.

Excavated materials will be classified for reuse as being either Suitable or Unsuitable for backfill or other specified use, subject to selective controls. All suitable materials shall be reserved for backfill to the extent needed, and any surplus remaining shall be utilized for other construction of the Project as may be specified or ordered by the Engineer. To the extent practicable, granular materials and topsoil shall be segregated from other materials during excavating and stockpiling operations so as to permit the best use of available materials at the time of backfilling.

All excavated materials reserved for backfill or other use on the Project shall be stored at locations approved by the Engineer that will cause a minimum of inconvenience to public travel, adjacent properties, and other special interests. The material shall not be deposited so close to the edges of the excavation as would create hazardous conditions, nor shall any material be placed so as to block access by emergency services. All material stockpiles shall be located and covered / secured in accordance with the approved Erosion / Sediment Control Plan for the project. All materials considered unsuitable by the Engineer, for any use on the Project, shall be removed from the Project and shall be disposed of as arranged for by the Contractor in accordance with the provisions of 2104.3C3.

2.3.3. EXCAVATION LIMITATIONS AND REQUIREMENTS

Trench excavating shall be to a depth that will permit preparation of the foundation as specified and installation of the pipeline and appurtenances at the prescribed line and grade, except where alterations are specifically authorized. Trench widths shall be sufficient to permit the pipe to be laid and joined properly and the backfill be placed and compacted as specified. Extra width shall be provided as necessary to permit convenient placement of sheathing and shoring and to accommodate placements of appurtenance.

Excavations shall be extended below the bottom of structure grade as necessary to accommodate any required aggregate bedding and, when rock or any unsuitable material such as clay, silt, or organic materials are encountered at the established grade, additional materials shall be removed for a minimum distance of one foot beyond the outside wall of the pipe in all directions.

2.3.4. SHEATHING AND BRACING EXCAVATIONS

All excavations shall be performed and maintained under the direct supervision of a Competent Person as defined by OSHA in 29 CFR 1926, Subpart P. All excavations shall be sheathed, shored, and braced as will meet all requirements of the applicable safety codes and regulations; comply with any specific requirements of the Contract; and prevent disturbance or settlement of adjacent surfaces, foundations, structures, utilities and other properties. Any damage to the work under Contract or to adjacent

structures or property caused by settlement, water or earth pressures, slides, cave-ins, bracing or through negligence or fault of the Contractor in any manner shall be repaired by the Contractor at its expense and without delay. Should the Contractor fail to repair damages in a timely manner, the City may at its option have the damage repaired and deduct the cost from amounts otherwise owed the Contractor.

Where conditions warrant extreme care, the Contract may require special precautions to protect life or property, or the Engineer may order the installation of sheet piling of the interlocking type or direct that other safety measures be taken, as he deems necessary. Failure of the Engineer to order corrections of improper or inadequate sheathing, shoring, or bracing shall not relieve the Contractor of his responsibility for protection of life, property, and the work.

The Contractor shall assume full responsibility for proper and adequate placement of sheathing, shoring, and bracing, wherever and to such depths that soil stability may dictate the need for support to prevent displacement. Bracing shall be so arranged as to provide ample working space and so as not to place stress or strain on the in place structures to any extent that may cause damage.

Sheathing, shoring and bracing materials shall be removed only when and in such manner as will assure adequate protection of the in place structures and prevent displacement of supported grounds. Sheathing and bracing shall be removed as the backfilling reaches the level of respective support.

All costs of furnishing, placing and removing sheathing, shoring and bracing materials, including the value of materials left in place as required by the Contract, shall be included in the prices bid for pipe installation and will not be compensated for separately. When any sheathing, shoring, or bracing materials are left in place by written order of the Engineer, in the absence of specific requirements of the Contract to do so, payment will be made for those materials as Extra Work, including waste materials resulting from upper cut-off requirements.

2.3.5. PREPARATION AND MAINTENANCE OF FOUNDATION

Pipe foundations shall be prepared for a Type 4 or 5 trench as described in AWWA C150. Foundation preparation and bedding placement shall be conducted as necessary to produce a stable foundation and provide continuous and uniform pipe bearing between bell holes. The initial excavating or backfilling operations shall produce a subgrade level a minimum of four inches (4”) below proposed bottom of pipe grade. Final subgrade preparations shall consist of placement and compaction of bedding material, such as to produce a finished grade at the centerline of the pipe that is within 0.03 foot of a straight line between pipe joints and to provide bell-hole excavation at each joint as will permit proper joining of pipe and fittings.

b. Special / Improved Foundations: In rock foundations and when unsuitable materials such as clay, silt, and organic materials are encountered, the undesirable materials shall be removed and foundation material as defined in WM-2.13 shall be installed one foot around the pipe. The backfill material shall be placed and compacted thoroughly (100% Standard Proctor Density) as will provide uniform pipe support. Placement of the backfill shall be in relatively uniform layers not exceeding 8" in loose thickness or less if required for proper compaction given the method employed. Compaction shall be achieved by means of mechanical compaction equipment as approved by the Engineer.

c. Engineered Foundation: Where the foundation soil is found to consist of materials that the Engineer considers to be so unstable as to preclude removal and replacement to a reasonable depth to achieve solid support, a suitable foundation shall be constructed as the Engineer directs in the absence of special requirement therefore in the Contract. The Contractor may be required to furnish and drive piling and construct concrete or timber bearing supports or other work as may be directed by the Engineer. Any work so directed by the Engineer will be paid for as Extra Work.

Care shall be taken during final subgrade shaping to prevent any over-excavation. Should any low spots develop, they shall only be filled with approved material, compacted to 100% Standard Proctor Density.

The finished subgrade shall be maintained free of water and shall not be disturbed during pipe lowering operations except as necessary to remove pipe slings. The discharge of trench dewatering pumps shall be directed to natural drainage channels or storm drains following current storm water quality standards. Draining trench water into sanitary sewers or combined sewers will not be permitted.

All costs of excavating below grade and placing foundation or bedding aggregate as required shall be included in the bid prices for pipe items to the extent that the need for such work is indicated in the Contract and the Proposal does not provide for payment therefore under separate Contract Items. Any excavation below grade and any foundation or bedding aggregate required to achieve the foundation and isolating conditions as specified above will be considered to be incidental work and no direct compensation will be made therefore.

WM-2.4 INSTALLING MAIN LINE PIPE AND FITTINGS – DUCTILE IRON PIPE

2.4.1. INSPECTION AND HANDLING OF PIPE

Proper and adequate implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution

of the work. All pipe, hydrants, valves, and fittings shall be handled carefully and in such manner as will prevent damage to protective coatings and linings; preclude the entrance of foreign materials into the inner areas of the pipe and fittings; and avoid piece to piece contact of parts that may be damaged by jolting.

Before being lowered into laying position, and while the pipes are suspended, the Contractor shall make a thorough visual inspection of each pipe section and of each hydrant, valve and fitting unit to detect cracking and other damage that may need corrective action or be cause for rejection. In addition, other crack revealing methods of inspection (hammer ringing or kerosene coating) shall be employed as directed by the Engineer to check out possible or suspected defects more definitely. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective action or rejection.

Immediately before placement, the joint surfaces of bell and spigot pipe and fittings shall be inspected for the presence of foreign matter, coating blisters, rough edges and projections, and any imperfections so detected shall be corrected by cleaning, trimming or repair as needed

2.4.2. LOWERING AND SETTING OF PIPE

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. Every precaution shall be taken to prevent foreign materials from entering the pipe while it is being placed and before any length of pipe is lowered into the trench, it should be inspected for damage and the inside of the pipe must be swabbed to remove loose dirt and foreign objects. If mud and trench water have been permitted to stand or flow through the pipe, the inside shall be power washed and scrubbed with a strong chlorine solution. The water main materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.

At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than is adequate. No pipe material shall be laid in water nor when the trench or bedding conditions are otherwise unsuitable or improper.

When placement or handling precautions prove inadequate, in the Engineer's opinion, the Contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before it is lowered into laying position, and they shall remain so covered until removal is necessary for connection of an adjoining unit.

As each length of bell and spigot pipe is placed in position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material, which shall be thoroughly compacted around the pipe with portable mechanical compaction equipment. The joint areas shall remain exposed and precautions shall be taken to prevent the soil from entering the joint space, until the joint seal is effected.

At all times while pipe laying is in progress or during noon hour and overnight periods, all open ends of the pipeline in the trench shall be closed by watertight plugs or other means approved by the Engineer. If water is present in the trench, the seals shall remain in place until the trench is pumped completely dry.

2.4.3. ALIGNING AND FITTING OF PIPE

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe and so as to leave a smooth square-cut end. Cast iron and ductile iron pipe shall be cut with approved mechanical cutters. Flame cutting shall not be used under any conditions. All rough edges shall be removed from the cut ends of the pipe and, where rubber gasket joints are used, the outer edge shall be rounded or beveled by grinding or filing to produce a smooth fit.

Whenever it is necessary to deflect the pipe from a straight line either in the vertical or horizontal plane, to avoid obstructions, or produce a long radius curve when permitted, the amount of deflection allowed at each joint shall not exceed the allowable limits for maintaining satisfactory joint seal as given in AWWA C600 for mechanical joints and push-on joints, or as otherwise established in the Contract or approved by the Engineer in the case of caulked joints.

Connection and assembly of joints shall be accomplished during the setting, aligning, and fitting operations in accordance with the provisions of these Special Provisions, to the extent that the jointing requirements will permit.

2.4.4. BLOCKING AND ANCHORING OF PIPE

All plugs, caps, tees, bends and other thrust points shall be provided with approved joint restraining devices and/or with reaction (thrust) blocks as shown on the plans and detailed in these specifications (in the case of joint restraining devices) or in the City of Minneapolis Standard Detail Plates for Thrust Restraint at Ductile Iron Water Main Fittings (in the case of thrust blocks).

The Contractor shall provide means of thrust restraint at all fittings or changes in direction, regardless of whether or not the means is indicated in the plans. Where the

method of thrust restraint is not shown in the plans, the Contractor may select between the use of thrust blocks or joint restraining devices (EBAA megalug or Engineer-approved equivalent). Installation of either method shall conform to the requirements specified below.

a. Thrust blocks:

i. Sizing: Concrete thrust blocks shall be sized according to the Minneapolis Water Works standard details. Soil type to be used in determining the sizing shall be based upon available soil information, if any, and verified in the field by the Contractor, and shall be subject to review of the Engineer.

ii. Construction: Follow provisions of Section WM-2.11, Concrete Encasement in regard to concrete construction. Concrete thrust blocks shall be poured against firm, undisturbed ground and shall be formed in such a way that the joints can be wrapped with poly so that they will be kept free of concrete and remain accessible for repairs. Wood forms shall be removed prior to backfilling. Metal forms which are to be left in place shall be AMICO Stay-Form or approved equal.

iii. Concrete Mix: The concrete mix used in thrust block construction shall meet the requirements of Mn/DOT Mix Number 3A42 ¾.

iv. Hot or Cold Weather placing: Shall be performed in accordance with ACI Specifications 305 and 306.

b. Joint Restraint Devices

Joint restraint devices shall be as specified in the Section WM-1.1.3, and shall be installed in complete accordance with the manufacturers written instructions. Contractor shall furnish and install joint restraint devices in locations indicated in the plans and / or as directed by the Engineer. Joints shall be restrained for an adequate distance in all directions along from the centerline of the fitting to fully restrain all joints. Contractor shall submit calculations by Licensed Professional Engineer or a qualified representative of the joint restraint manufacturer upon request to support its determination of required restrained length.

WM-2.5 CONNECTION AND ASSEMBLY OF JOINTS – DUCTILE IRON PIPE

Where rubber gasketed joints are specified, care shall be taken during the laying and setting of piping materials to insure that the units being joined have the same nominal dimension of the spigot outside diameter and the socket inside diameter. A special adaptor shall be provided to make the connection when variations in nominal dimension might cause unsatisfactory joint sealing.

Immediately before making the connection, the inside of the bell or socket and the outside surface of the spigot ends shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. During insertion of spigot ends assure proper centering and insertion to full depth. The joint seal and securing requirements shall be as prescribed below for the applicable pipe and joint type.

2.5.1. DUCTILE IRON AND CAST PIPE JOINTS

a. Push-On Joints

The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket. A thin film of approved gasket lubricant shall be applied to either the inside surface of the gasket or the outside surface of the spigot end, or to both. Care shall be taken while inserting the spigot end to prevent introduction of contaminants. The joint shall be completed by forcing the spigot end to the bottom of the socket by the use of suitable pry-bar or jack type equipment.

Spigot ends which do not have depth marks shall be marked before assembly to insure full insertion. Field cut pipe shall be filed or ground at the spigot end to resemble the manufacturer's fabricated detailing.

b. Mechanical Joints

The last 8" of the outside spigot surface and the inside bell surface of each pipe and appurtenance joint shall be painted with a soap solution, after being thoroughly cleaned. The cast iron gland shall then be slipped on the spigot end with the extension toward the socket or bell end. The rubber gasket shall be painted with soap solution and be placed on the spigot end with thick edge toward the gland. An approved lubricant for potable water provided by the pipe manufacturer may be used in lieu of the soap solution.

After the spigot end is inserted into the socket to full depth and centered, the gasket shall be pressed into place within the bell evenly around the entire joint. After the gland is positioned behind the gasket, all bolts shall be installed and nuts tightened alternately to the specified torque, such as to produce equal pressure on all parts of the gland.

Unless otherwise specified, the bolts shall be tightened by means of a suitable torque-limiting wrench to within a foot-pound range of: 40 to 60 for 5/8 inch bolts; 60 to 90 for ¾ inch bolts; 70 to 100 for 1 inch bolts; and 90 to 120 for 1-¼ inch bolts. After tightening, all exposed parts of the bolts and nuts shall be completely coated with a bituminous rust preventive material approved by the

Engineer.

WM-2.6 INSTALLATION OF STEEL PIPE AND FITTINGS

2.6.1. TRANSPORTATION AND DELIVERY

All handling of coated pipe shall be in conformance with AWWA C200, Section 6 and the manufacturer's recommendations.

All pipe shall be trucked to the jobsite, unloaded with wide belt slings and stored on padded bolsters. Placement locations shall be as directed by the Project Engineer.

Effective measures shall be used in loading and attaching pipes on cars or trucks so that during shipment, no injury to the pipe or coating can develop. No welded clips will be permitted on coated sections.

Any section or special section that shows dents, kinks, abrupt changes in curvature other than specified, or injuries at the delivery destination shall be rejected. Any pipe section or special section that has been dropped from a truck or crane prior to completion of delivery will be rejected. Rejected pipe materials shall be replaced by the Contractor with new materials that fully meet all specifications, including testing requirements.

2.6.2. WELDING

a. Applicable Standards

   i. AWWA Standard C206 - Field Welding of Steel Water Pipe
   ii. American Welding Society (AWS) Standards
   iii. State of Minnesota Plumbing Code

b. Qualifications

   All water main construction welders shall possess relevant certification by the State of Minnesota **and** be required to pass a welding test administered by the Minneapolis Water Works and performed on steel water main of the same size that is to be installed.

c. Weld Details

   i. Bell and Spigot Joints

      All outside welded joints shall be full-depth fillet welds which shall be accomplished with a minimum number of passes as specified in the drawings.

The inside of the joints shall be fillet welded with a minimum of one pass, sufficient to provide a seal against water or contaminants from entering the joint from the inside of the pipe. An additional pass may be required by the inspector depending on the gap between the spigot end and the bell. No extra compensation shall be made for the inspector requiring an additional pass. The welds are shown on the City Standard Plates

ii. Butt Strap Joints

All outside welded joints shall be full-depth fillet welds which shall be accomplished with a minimum of passes as specified in the drawings. The insides of the joints shall be fillet welded with a minimum of one pass, sufficient to provide a seal against water or contaminants from entering the joints from the inside of the pipe. An additional pass may be required by the inspector depending on the gap between the spigot end and the bell. The welds are shown on the City Standard Plates.

d. Quality Control / Quality Assurance

The Installing Contractor shall have up to 25 percent of the welds x-rayed by a qualified testing agency at its own expense and submit copies of the test results to the Minneapolis Water Works. Additional tests due to unsatisfactory results on tested joints or due to reasonably suspected defects in previously untested joints shall be made at the Contractor's expense. Additional tests ordered by the Engineer for any other reason shall be performed at its expense. The welds to be X-Rayed shall be as selected by the Engineer. The testing agency shall be approved in advance by the Engineer.

2.6.3. JOINT (EXTERIOR) FIELD WRAPPING

After the outside welded pipe joint has been thoroughly cleaned, it shall be coated per manufacturer's written direction and in accordance with AWWA Standards C209.

2.6.4. JOINT (INTERIOR) LINING

The inside of all field welds shall be cement mortar lined in accordance with AWWA Standard C205. The cement mortar used for joints should consist of not less than one part cement to not more than two parts of silica sand dry mixed and moistened with sufficient water, so that when the mortar is firmly compressed into a ball it will hold it's shape without slump. If regular sand is used it shall be graded within the limits of grading for plaster sand and must meet AWWA standards.

The welded joint on the inside of the water main should be cleaned thoroughly with a wire brush. If grease is present, etch with 10% solution of muriatic acid, rinse with household ammonia and scrub with brush and detergent. Let the surface dry before the field welded joint is cement mortar lined.

The cement mortar mix should be applied as follows:

a. Pack mortar tight in joint with hand or towel
b. Screed off excess mortar, so that patched area is at the same level as the rest of the lining.
c. Using a steel trowel, apply a smooth finish to the patch.
d. A water mixture can be brushed over the grout and re-toweled to make the joint smooth.

Cracks / damage to the joint lining shall be addressed per pipe manufacturer's specifications and AWWA Standard C-205.

2.6.5. ACCEPTANCE OF WORK

The City of Minneapolis shall have a representative inspecting the work during construction. It shall be the responsibility of the Contractor to notify the City one week in advance of its activities with regard to installation of the water main.

In addition, the City will make final inspection of all work included in the Contract or any portion thereof, as soon as practicable after notification by the Contractor that such work is nearing completion. If such work is not acceptable to the Engineer at the time of his inspection he will advise the Contractor in writing as to the particular defects to be remedied before such work can be accepted.

The Engineer at any time prior to the final acceptance of the improvement may order the Contractor to immediately tear out, remove and properly reconstruct any portion of this improvement which the Engineer may decide to be defective and the Contractor will be held wholly responsible for the safety, proper construction and perfection of the entire improvement until the same has been finally accepted.

The Contractor shall furnish to the City of Minneapolis Public Works all samples of material for testing purposes that may be required by the Engineer.

WM-2.7 INSTALLATION OF WATER SERVICE FACILITIES

Water service facilities consisting of tap service lines and branch service line, complete with all required appurtenances, shall be included in accordance with the City of Minneapolis ordinances and permit requirements.

2.7.1. TAP AND BRANCH SERVICE LINES

Branch service piping shall be cast iron or ductile iron water pipe of the size and wall thickness specified. The pipe and appurtenances shall have caulked lead joints or rubber gasketed push-on or mechanical joints. Hydrant service pipe shall be six inches in diameter. All branch service lines smaller than 2" shall be tapped connections.

2.7.2. TAP SERVICE LINES

A Minneapolis licensed plumbing contractor must complete all service line connections, reconnections, and cut-offs. This includes new taps and cut-offs necessitated by the relocation of an existing lead service. The licensed and bonded plumber who will be responsible for all service line-related work will be required to obtain all necessary permits from the City of Minneapolis Utility Connections Inspections office before the service line installation begins.

All costs for permits and inspection fees required for the work shall be included in the Contractor's bid price. It shall be the sole responsibility of the Bidder to obtain all up-to-date information related to these costs for inclusion in the bid. Contact the City of Minneapolis Utility Connections office (contact information below) for current fees and permit application procedures.

All new taps will be installed within the line of the building it services. Each service line will be perpendicular in the street.

The City of Minneapolis Utility Connections Inspections office, as per City of Minneapolis ordinances and requirements, shall inspect all new service line connections and cut-offs.

Taps, 2-inch and larger, will require the water main contractor to install the tee, short length of pipe, gate and pre-cast manhole, as he proceeds with the installation of the main line. The licensed plumber will be responsible for installing the pipe from the gate valve to the required building connection.

The Contractor may obtain a list of Minneapolis Licensed Plumbing Contractors at the Utility Connections office at the Public Service Center at 250 South 4th Street, telephone number (612) 673-2451.

WM-2.8 SETTING VALVES, HYDRANTS, FITTINGS AND SPECIALS

Valves, hydrants, fittings, and specials shall be provided and installed as required by the Plans and these Special Provisions and City Standard Detail Plates for Typical Hydrant Branch or Hydrant Branch with Hydrant and Valve in the Same Manhole. The exact

locations and settings shall be as directed by the Engineer, and with each installation shall be accomplished in accordance with the requirements for installation of mainline pipe to the extent applicable. Support blocking, reaction backing, and anchorage devices shall be provided as previously outlined elsewhere herein.

Hydrants shall be installed plumb, and the length of hydrant shall be as required to provide a minimum cover of 8 feet from the bottom of the base shoe to the ground and a distance of 3 to 5 inches from the break-away flange to the ground. The hydrants shall be connected to the mainline pipe with 6” diameter ductile iron branch pipe, controlled by an independent gate valve housed inside of a 48” precast manhole.

Wherever a hydrant is set, a drainage drip box shall be placed around the top half of the hydrant base as shown on the City Standard Plate. The drainage box shall have a wood top to prevent backfill material from filling the drainage box and plugging the wastewater openings. The drainage box shall be constructed of 2x8 or similar lumber.

Precast manholes shall be located so the offset manhole opening will provide for vertical operation of a valve wrench nut and be in line with steps. The valve shall be centered as closely as possible within the manhole.

An operating hole shall be located on the offset manhole cover and a cone provided for operation of the by-pass valve on 16” and larger valves.

Pitot taps shall be installed on both sides of all line gates.

Drainage branches, blow-offs, air vents, and other special appurtenances shall be provided and installed as required by the Plans and these Special Provisions.

WM-2.9 ELECTRICAL CONDUCTIVITY TEST

The Contractor shall perform a conductivity test within one week after completion of pressure testing of the main on all iron pipe water main to establish that electrical thawing may be carried out in the future.

The system (pipeline, valves, fittings and hydrants) shall be tested for electrical continuity and current capacity. The electrical test shall be made after the hydrostatic pressure test and while the line is at normal operating pressure. Backfilling shall have been completed. The line may be tested in sections of convenient length as approved by the Engineer.

Direct current of 350 amps at 30 volts shall be passed through the line for four minutes. Current flow shall be measured continuously on a suitable ammeter and shall remain steady without interruption or excessive fluctuation throughout the period. At the end of the four-minute period, the current shall be raised to 400 amps for one minute without

fluctuation.

WM-2.10 HYDROSTATIC TESTING OF DUCTILE IRON WATERMAINS

The Contractor shall not conduct any pressure tests or leakage tests against any valve currently installed in the Minneapolis Water system. Installations made where a new section of pipe connects to an existing valve, the Contractor must install a plug with a pitot tap attached, as close to the valve as possible on the new section of pipe, and any pressure or leakage test must be taken against this plug. All temporary plugs, pitot taps and other materials installed or used for hydrostatic testing purposes only, shall be considered an incidental cost for water main work.

After the installation and partial backfill of the water main, leaving the joints exposed for examination, each valve section shall be subjected to the pressure and leakage test prescribed herein. The Contractor shall furnish the pump, pipe connections, gauges, and measuring equipment, and shall perform the testing under the direct supervision of the Minneapolis Water Works Engineer. Where permanent air vents are not provided, the Contractor shall provide and install pitot taps as directed by the Minneapolis Water Works Engineer for release of air as the line is filled with water.

Where concrete reaction blocking is placed, the water main shall not be subjected to hydrostatic pressure until at least 5 days have elapsed after the concrete casting, with the exception that this period may be reduced to two days where high early strength concrete is used.

At the option of the Contractor, the pressure and leakage tests may be conducted simultaneously. Any defective joints, and any defective pipe, fittings, valves or hydrants revealed during the testing or before final acceptance of the work, shall be satisfactorily corrected and the tests shall be repeated until the specific requirements have been met.

2.10.1. PRESSURE TEST

The section being tested shall be slowly filled with water and the specified test pressure shall be applied after all air has been expelled from the pipe. A hydrostatic pressure of not less than 150 pounds per square inch, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner.

The specified pressure shall be held for a minimum duration of two hours, during which time all exposed pipe, fittings, valves, hydrants, and joints shall be carefully examined for visible leaks. Any defects discovered shall be corrected satisfactorily and the tests repeated until there is less than a 5 psi pressure loss for the two-hour duration.

2.10.2. LEAKAGE TEST

After satisfactory completion of the pressure test, a leakage test shall be performed on the new section of water main to determine the quantity of water that must be supplied into the section to maintain a test pressure of 150 pounds per square inch, after the air in the pipeline has been expelled and the pipe has been filled with water.

After filling the pipe with water and expelling all air in the line, the specified pressure shall be applied in the same manner as prescribed for the pressure test, and sufficient water shall be measured and supplied into the pipe section to maintain the pressure for a test duration of two hours.

No pipe installation will be accepted if the amount of makeup water is greater than that determined by the following formula:

In inch-pound units:

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where:

L = Testing allowance (makeup water) in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of pipe, in inches.
P = Average test pressure during the hydrostatic test, in pounds per square inch (gauge).

In metric units:

Where:

Lm = Testing allowance (makeup water) is liters per hour.
S = Length of pipe tested, in meters.
D = Nominal diameter of the pipe, in millimeters.
P = Average test pressure during the hydrostatic test in KPA.

WM-2.11 CONCRETE ENCASEMENT

Reinforced concrete encasements are required and where shown in the Plans, shall be installed in strict accordance to City of Minneapolis Standard Detail Plates for the relevant water main pipe diameter(s).

a. Concrete Mix: Mn/DOT mix No. 3A42¾.

b. Formwork: Forms shall be adequately braced and selected to withstand forces placed upon it by the poured concrete and maintain true dimensions of the encasement. All formwork shall be removed prior to backfilling, unless a leave-in-place type form system, approved by the Engineer, is used.

c. Reinforcing Steel: Reinforcing steel shall be installed in accordance with all ACI standards and tolerances by qualified ironworkers.

d. Placement and finishing: Shall be done by personnel experienced in placing and finishing concrete and shall be done in accordance with ACI standards.

e. Cold Joints: Cold joints in concrete encasements shall be allowed only with pre-approval of the Engineer. Contractor shall submit for approval a written plan and / or sketches showing proposed cold joint construction, to include
   i. Keyed construction at the cold joint(s).
   ii. Properly dimensioned lap splices for rebar at the cold joints.
   iii. Provision of neat cement slurry on cured concrete to act as bonding agent, brush applied just prior to pouring new abutting concrete.
   iv. 3 days time shall elapse between adjacent pours.

f. Cold Weather Placement: Comply with provisions of ACI 306.

   i) Concrete shall not be placed against any frozen substrate, including subgrade soils and surfaces of formwork.
   ii) Concrete shall not be placed around any embedment, including reinforcing steel, that is at a temperature below freezing.
   iii) Concrete shall be delivered at the following temperatures:

Air Temperature	Min. Concrete Temperature
Above 30 Degrees F	60 Degrees F
0 to 30 Degrees F	65 Degrees F
Below 0 Degrees F	70 Degrees F

   iv) Cure the entire surface and edges as soon as surface conditions permit after the finishing operations.
   v) Maintain concrete temperatures between 50 and 70 degrees for minimum of 72 hours. Engineer may require Contractor to provide method of verification of temperature. Provide means of maintaining moist cure conditions during temperature protection.
   vi) Provide method for protection of concrete from exhaust gasses from combustion heaters, if used, for first 24 hours.

vii) Provide gradual removal of heat from concrete at conclusion of heating period.

g. Hot Weather Placement
   i. Comply with ACI 305 when hot weather conditions exist.
   ii. Maintain concrete temperature at time of placement below 90 degrees F.
   iii. Provide required extra measures to protect all surfaces from rapid drying.

WM-2.12 CATHODIC PROTECTION

2.12.1. ANODES

Anodes shall be installed as and where shown on the Plans and/or as directed by the Engineer in the field.

The Contractor shall install the anodes in a vertical position as shown on the Plans. The top of the anodes shall, unless otherwise shown on the Plans, be located flush with the top of the pipe.

Excavate hole to a minimum two inches larger than the packaged anode diameter, to the depth indicated. Anode lead wire shall be installed in a trench. The lead wire shall be installed at a depth of not less than 24 inches. The trench bottom shall be smooth. Excavation and backfilling shall be as specified elsewhere in the Technical Specifications.

The Contractor shall not lift or support the anode by the lead wire. Exercise care to prevent damage to cloth bag or lead wire insulation. Center the packaged anode in the hole and backfill with clean native soil materials in layers not exceeding six inches deep. Carefully tamp each layer to properly compact the backfill. When the backfill is level with the top of the anode, pour not less than five gallons of water into the hole. The backfill material shall be completely saturated. Add additional backfilling material as necessary to compensate for soil shrinkage.

The Contractor shall connect the test station lead wires to the water piping or casing at the top side after the structure has been cleaned to bare metal by scraping, filling, or other approved means. Connection of lead wires shall be made using the thermite weld method applied in strict accordance with the manufacturer's published instructions and recommended procedures, and as shown on the Plans. The connection area shall be primed with Royston No. 747 primer and covered with a Royston "Handy Cap" installed in accordance with the manufacturer's written instructions, and as shown on the Plans. Any damaged coating, shall be repaired.

Place a three (3) inch layer of select bedding material all around lead wire in the trench; this select bedding material shall be clean native soil material obtained from the trench excavation in the immediate area only: Carefully center lead wire in

trench. Backfill over the wire, using the select backfill material, shall be placed in layers not exceeding six inches deep and each layer thoroughly compacted. Tree roots, wood scrap, organic matter and refuse shall not be allowed in the backfill. Exercise care to avoid damaging the lead wire or its connections.

2.12.2. REFERENCE ELECTRODE

The permanent references electrode shall be installed horizontally in native soil, flush with top of pipe and one foot from edge of pipe. The reference electrode shall be backfilled with clean native soil material in layers not exceeding six inches deep. Backfill material shall be obtained from the trench excavation in the immediate area only. Carefully tamp each layer to properly compact the backfill. When the backfill is level with the top of the reference electrode, pour not less than five (5) gallons of water into the hole. The backfill material shall be completely saturated. Add additional backfill material as necessary to compensate for soil shrinkage.

2.12.3 ENERGIZING AND TESTING

After installation of the cathodic protection system the entire system shall be tested by the Corrosion Technician in accordance with recommended procedures of the NACE International, to assure its proper operation. Testing shall include a determination of proper operation of the test station, adequacy of cathodic protection, and electrical isolation of pipe from foreign structures. Testing shall also include measurement of galvanic anode current output measurement of pipe-to-soil potentials, and all tests deemed necessary to verify proper operation of the cathodic protection system.

2.12.4 THERMITE BRAZES

Wire to pipe connections shall be made using exothermic brazes, “Cadweld” by Erico Products. Connections shall be made with a mold shaped to fit the pipe. Brazing alloy shall be formulated for use on steel pipe and/or ductile iron pipe. Brazing cartridges shall be of the weight recommended by the manufacturer for the size cable and mold being used. Use “F-33 alloy” for steel pipe and “XF-19 alloy” for ductile iron pipe. The coating shall be carefully removed and the braze made in accordance with the braze manufacturer’s instructions. Pipe and the braze shall be thoroughly cleaned after completion of brazing. Prime and cover with a mastic filled plastic cap as depicted on the drawings.

2.12.5 THERMITE-WELD CAPS

Thermite-weld caps shall be high-density polyethylene plastic, “Handy-Cap” as manufactured by Royston Laboratories, or an approved equal. Design shall

incorporate an elastomeric filled dome and tunnel portions to contain the lead wire from the thermite weld connection and a 4” x 4” elastomeric tape base.

WM-2.13 WATERMAIN BACKFILLING OPERATIONS

2.13.1. GENERAL

All water main excavations shall be backfilled as will restore pre-existing conditions as the minimum requirements, and fulfill all supplementary requirements indicated in the Plans and these Special Provisions. The backfilling operations shall be started as soon as conditions will permit on each section of pipeline, so as to provide continuity and subsequent operations and restore normal public service as soon as practicable on a section–by-section basis. All operations shall be pursued diligently, with proper and adequate equipment, as will assure acceptable results.

Sheathing, shoring, and bracing materials shall be removed only when and in such manner as will assure adequate protection of in place structures and prevent displacement of supported grounds. Sheathing and shoring shall be removed as the backfill reaches the level of respective support.

2.13.2. BACKFILL MATERIAL REQUIREMENTS

a. Granular materials provided for foundation, bedding, cover, and backfill, shall be classified as to use in accordance with the following:

Table 2.13-1: Backfill Zones

MATERIAL DESIGNATIONS	ZONE DESIGNATION
Foundation	Area beneath bottom of pipe – undisturbed soil unless unsuitable material (organics, rock, etc) is encountered.
Bedding	Placed below the pipe midpoint, prior to pipe installation, to provide uniform pipe support.
Cover	Placed from pipe centerline to one foot above top of pipe.
Backfill	Placed above cover aggregate to bottom elevation of base course, if any, as the second stage of backfill, to achieve thorough initial consolidation of foundation for surface

improvements

In each case above, unless otherwise shown in the Plans, the lower limits shall be the top surface of the next lower course as constructed. The upper limits of each course are established to define variable needs for aggregate gradation and compaction or void content, taking into consideration the sequence of construction and other variables. The material and zone designations described above shall only serve to fulfill the objective and shall not be construed to restrict the use of any particular materials in other zones where gradation requirements are met.

b. Granular Material Requirements

Granular materials furnished for foundation, bedding, encasement, backfill, or other purposes as may be specified shall consist of any natural or synthetic mineral aggregate such as sand, gravel, crushed rock, or crushed stone that shall be so graded as to meet the gradation requirements specified herein for each particular use.

	MATERIAL USE DESCRIPTION			
PERCENT PASSING SIEVE SIZE	FOUNDATION Mn/DOT 3149.2J	BEDDING Mn/DOT 3149.2G	COVER Mn/DOT 3149.2G	BACK FILL Mn/DOT 3149.2E
3 inch	-	-	-	-
2 inch	-	-	-	100
1 inch	-	100	100	-
3/4 inch	-	90-100	90-100-	-
3/8 inch	100	50-90	50-90-	-
#4	90-100	35-80	35-80	35-100
#10	45-90	20-65	20-65	20-70
#40	5-35	10-35	10-35	10-35
#200	0-3	3-10	3-10	3-10

Suitable granular materials excavated during the project may be allowed for use in the backfill zone with approval of the Engineer.

Suitable material shall be defined as classified granular fill, free of foreign materials (rubbish, debris, etc.). Frozen clumps, oversize stone, rock, concrete or bituminous chunks, and other unsuitable materials that may in the opinion of the Engineer promote corrosion of pipe, damage the pipe installation, prevent thorough compaction, or increase the risks of settlement unnecessarily shall not be used. Use of on-site excavated materials shall be allowed as appropriate with the intent of

making the best and fullest utilization of available on-site material, while taking into consideration specified requirements for backfill material.

2.13.3. PLACEMENT OF BACKFILL

a. Backfill materials shall be carefully placed in accordance with the applicable requirements of Mn/DOT Standards 2451.

b. Backfill in the bedding and cover zones shall be placed in 6" lifts, unless greater lifts are allowed by the Engineer.

c. Backfill above the cover zone shall be placed in 12" lifts, unless greater lifts are allowed by the Engineer.

d. Placement of frozen backfill shall not be allowed. All loose material, rocks, debris, snow shall, etc. shall be removed from the trench prior to placement of backfill.

2.13.4. COMPACTION

a. Bedding and Cover Zones: Compaction of materials placed within the pipe bedding and cover zones shall be accomplished with portable mechanical compaction equipment, so as to achieve thorough consolidation under and around the pipe and avoid damage to the pipe.

b. Above the Cover Zone: Utilize mechanical means until it meets requirements of Mn/DOT specification 2105.3F1 "Specified Density Method". Density shall be 100% Standard Proctor. The use of heavy roller type compaction equipment shall be limited to the safe pipe loading.

c. Natural Soil at the bottom of excavations shall be compacted with several passes of a vibratory compactor prior to placement of any fill or footings.

2.13.5. RESTORATION / REPAIRS

In the absence of specific Contract Items covering restoration items, all necessary restoration work shall be done at the Contractor's expense, as being part of the work required under the pipeline installation items. Where separate payment is specifically provided, only that work which is necessitated by the Contract will be compensated for. Any improvement removed or damaged unnecessarily shall be replaced or repaired at the Contractor's expense.

WM-2.14 BLOCKING

All blocking used under the mains during construction shall be removed prior to

backfilling.

WM-2.15 PRECAST MANHOLES

All line gates and hydrant branch gates shall be housed inside precast manholes per City of Minneapolis Standard Detail Plate for Typical Water Manholes. The size of the manholes shall be as follows:

6", 8" and 12" Gates	-	48 Inch Precast Manholes
16" Gates	-	60 Inch Precast Manholes
24" Gates and Larger	-	Per Design Drawings

All manholes shall rest on concrete slabs that act as footings to insure against settlement. Slabs shall be per Standard Detail Plates.

Before the manhole top is installed the Contractor shall put granular fill material in the manhole to a point halfway up the water main to support the main and gate. Valves 16" and larger require a saddle to be constructed per detail in the plan set.

Locations requiring special manholes shall be indicated in the plans, and a detail shall be provided in the plan set.

WM-2.16 GATE STEM OPERATING RODS

The Contractor shall install all gate stem operating rods for new or relocated gates. The City of Minneapolis will provide gate stem operating rods. Contractor shall allow one (1) week for fabrication of rods.

WM-2.17 STOP BOX RELOCATIONS

The Contractor is required to get a permit at the Utility Connections Office in Room 224, Public Service Center, 250 South 4th St., prior to relocating any stop boxes. The new stop boxes shall be relocated in the boulevard or sidewalk behind the new curb. (A "stop box adjust" refers to adjustment of the elevation of the stop box to suit the new grade only. If the improvements to the right of way place the stop box outside of the allowable area described above, the stop box must be relocated.)

The Contractor is advised that relocation of stop boxes on service lines which are constructed of lead between the water main and the stop box will require replacement of the tap, the service line between the main and stop box, and the stop box itself, as determined by the City of Minneapolis Utility Connections. In such cases, when bid items exist, the contractor shall be compensated for the new corporation stop (each by size), the linear footage of new type K copper pipe (by size), and curb stop and box (each

by size). No extra compensation shall be made for the discontinuation of the existing tap, unless the new tap must be made in a separate hole. When bid items do not exist, compensation for the work shall be made per provisions in the contract for extra work. Any work on private service lines shall be by permit only as indicated in this specification (see WM 2.7).

WM-2.18 RELOCATED HYDRANTS

The Contractor shall use the new hydrants per these specifications for all hydrant relocations unless the Minneapolis Water Works determines the existing hydrant shall be salvaged and reused. Measurement and Payment for relocated hydrants shall be as outlined in the Method of Measurement and Basis of Payment sections of this specification.

WM-2.19 PITOT TAPS

Pitot Taps shall be installed on both sides of line gates for pressure testing, flushing, chlorination, and for taking bacteriological samples. The taps shall be housed inside of the pre-cast manholes required for all gate valves. Taps shall be made within 9" of the gate valve flange. Pitot tap size to be specified by Minneapolis Water Works.

WM-2.20 DISINFECTION OF WATERMAINS

Any construction work done on existing water mains, which may include cuts, plugs, valves or other fittings, and all newly installed watermain, shall be **disinfected and flushed by Minneapolis Water Works personnel,** and the **water sampled and tested by the Minneapolis Water Works Water Quality Laboratory. The samples shall be confirmed to be free of coliform organisms prior to the watermain being put back in service**. It may be necessary to add Pitot taps to the existing water main to flush and bleed the air from the main. Also, with an existing water main out of service it may be necessary to provide temporary service to the Minneapolis Water Works customers.

WM-2.21 WATER QUALITY SAMPLES

Water quality samples shall be taken by the City of Minneapolis Water Quality Laboratory, as directed by the Engineer, after cutting and plugging an existing main or before putting a new section of water main into service. If any sample turns out positive, the City shall resample or re-chlorinate that section of water main as necessary until the main is free of all coliform bacteria and meets Minneapolis Water Quality Standards. Required re-chlorination, flushing, sampling, etc. needed on mains that the Contractor installed shall be at the Contractors' expense. Required re-chlorination, flushing, sampling, etc. on mains rehabilitated by the City shall be done at its own expense

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SECTION WM-3

METHOD OF MEASUREMENT FOR WATER SERVICE CONSTRUCTION IN MINNEAPOLIS

WM-3.1 METHOD OF MEASUREMENT

All items will be measured separately according to design designation as indicated in the Pay Item name and as may be detailed and defined in the Contract. Pipe will generally be designated by size (inside diameter or span), strength class, kind or type, and laying condition. Items with an "each" or "lump sum" method of measurement as well as items specified as "complete-in-place" shall include all component parts thereof as described or required to complete the unit, but excluding any excess covered by separate Pay Items. Linear measurement of piping will include the running length of any special fittings (tees, wyes, bends, gates, etc.) installed within the line of measurement between specified terminal points.

3.1.1. Water Pipe / Water Main (Excluding Steel Water Main)

Mainline pipe, branch service pipe, and tap service pipe of each kind and size will be measured separately by the overall length along the axis of the pipeline, from beginning to end of each installation and without regard to intervening valves or specials. Terminal points of measurement will be the spigot or cut end, base of hub or bell end, center of valves or hydrants, intersecting centers of tee or wye branch service connections, and center of corporation stop or curb stop couplings.

3.1.2. Valves (Install only)

Valves to be furnished by the City of Minneapolis. Installation of valves shall be measured on an "each" basis.

3.1.3. Curb Stops

Curb stops of each size and type will be measured separately by the number of units installed, including the required curb box.

3.1.4. Hydrants

New Hydrants will be measured by the number of complete units (hydrant, thrust reinforcement, drip box, and backfill) installed per specifications and details.

Salvaged hydrants will be measured by the number of complete units removed and

set aside for collection by the City of Minneapolis.

3.1.5. Rearrangement of Inplace Facilities

Relocating, moving, lowering, adjusting, salvaging, installing or removing of in place facilities such as hydrants, valves, curb stops, pipe, etc., will be measured, as indicated in the Contract, by the number of complete units of each item on a per each or lump sum basis, or by the number of linear feet of each item such as pipe rearranged, as per the pay item description.

No separate measurement will be made of the various hardware, fittings or new materials that may be required to complete work identified as relocate, move, lower, adjust or install. Any hardware or fittings necessary to complete the work shall be incidental to the associated Contract pay items.

Unless otherwise provided, no separate measurement will be made for new 6" D.I.P. pipe necessary to connect relocated hydrants to the mains as required by the Contract.

When so described in the pay item, hydrants and associated valves shall be measured as one complete unit.

Excavation and Backfill shall be included as part of the bid item for which the excavation is being done (gate, valve, branch piping, and hydrant, for example).

3.1.6. Polyethylene Encasement

No separate measurement will be made for the polyethylene encasement of the pipe or other appurtenances. It shall be furnished as specified as an incidental cost to the furnished materials.

3.1.7. Ductile / Cast Iron Watermain Fittings

Water main fittings will be measured by the pound without joint accessories and shall be the standard weight of fittings ("MJ & MJ" or "All MJ") for the specified pressure rating as published in ANSI A21.10 (AWWA C110). When both cast iron and ductile iron weights are listed for the same pressure rating, the weight of the cast iron fitting shall be used. When ductile iron fittings and compact ductile iron fittings are used, either at the Contractor's option or as specified, the standard weight as specified in the preceding sentence shall be the weight used for measurement.

3.1.8. Access Structures

Access structures, such as Valve Boxes, Service Boxes, Manholes and Vaults, will be measured for payment only when and to the extent that the Contract contains specific items therefore. Otherwise, the required structures are included for payment as part of the pipe appurtenance (Gate Valve, Curb Stop, Air Vent, etc.) item which is served. When applicable, measurement will be by the number of individual units installed of each type and design.

3.1.9. Insulation

Insulation will be measured in square yards of the specified thickness of the insulation installed.

3.1.10. Bedding Materials

No direct payment will be made for furnishing and installing granular backfill and bedding materials (except for Rock Bedding, which will only be used when directed to do so by the Engineer). All granular backfill and bedding materials (except for Rock Bedding) shall be furnished and installed as an incidental cost to the water main installation. Rock Bedding will be used only when directed for use by the Engineer. Rock Bedding (CV) will be measured for payment by the cubic yard ,compacted volume (CV), as determined by cross-section method of the material in its placed and compacted position, according to the placement dimensions shown in the Plan or as designated by the Engineer.

3.1.11. Connect & Reconnect Services

Connect Water Service shall be measured per each connection of replacement or new service pipe to the new water main. Reconnect Water Service shall be measured per each connection of unaffected service to the new water main (use Connect Water Service whenever new service pipe replaces or is added on to existing service pipe to make the connection to the main, use Reconnect Water Service whenever the existing service is simply reattached to the new main).

3.1.12. Connect To Existing Water Main

Connect to Existing Water Main shall be measured per each connection of water main pipe to existing water main where shown in the plans. In the case of installation of tees, gates, or other fittings on an existing line, it shall be understood that there will be one “connect to existing water main” pay item. This shall generally be applied to appurtenances that are installed in one isolated excavation of limited size, and shall be at the discretion of the Engineer.

3.1.13. Construct Water Manhole

Construct Water Manhole shall be measured per each complete structure installed as per details in the plans.

3.1.14. Access Holes

Access openings shall be quantified as each, to include:

- Planning and Location, including "One Call" and safety preparations
- Shoring (whether using corrugated metal cans or wood sheeting)
- Excavation
- Backfill

Access holes required for City-Installed gate valves shall be considered the same as for cleaning access holes, and will be measured and paid for as the same.

3.1.15. Cut Off Service

Cut off service (otherwise referred to as “disconnect service”) shall be measured as an “each” quantity on a “per service” basis. All work necessary to accomplish the task shall be considered part of this quantity, including but not limited to:

- Permitting, planning, and locating (one-call)
- Excavation and shoring
- Excavation
- Backfill

Cutting off a service line at the main shall be considered incidental in the case where a new service line for the same property is being installed in the same hole as the cut-off.

3.1.16. Removal of Structures and Appurtanences

Removal of Manholes, hydrants, gate valves, etc. shall be measured and paid for per each.

3.1.17. Concrete Encasement

Concrete encasement shall be measured by linear foot of encasement for each nominal inside diameter water main pipe encased.

WM-3.2 BASIS OF PAYMENT

3.2.1. Water Pipe / Water Main (Excludes Steel Water Main)

Payment for Water main Pipe, Branch Service Pipe, and Tap Service Pipe, of each size, kind, type and class, at the appropriate Contract prices per linear foot, shall be compensation in full for all costs of furnishing and installing the pipe complete in place as specified, with the exception of pipeline appurtenant items, but including all costs of pipe installation and surface restoration as may not be specifically covered under other Contract Items. All costs of pipeline disinfection, leakage testing, pipe jointing materials, dead end plugs and caps, making connections to existing facilities, blocking and restraint materials, and other work necessary for proper installation of pipe as specified shall be included for payment as part of the pipe item, without any additional compensation being made therefore.

3.2.2. Furnish and Installation - Appurtenances

Payment for furnishing and installing valves, corporation stops, curb stops, hydrants, air vents, and other specially identified appurtenant Items, at the appropriate Contract prices per each, shall be compensation in full for all costs of furnishing and installing the specified item complete in place as specified, and detailed in the Contract, including final elevation adjustments as necessary. The Contract unit price shall include all costs of furnishing and installing or constructing the required access structures for valves, vents, and specials, which are not to be paid for separately. Access structures such as valve boxes, service boxes, manholes, and vaults will be paid for as separate items only when and to the extent that the Contract contains separate items therefore. When the Contract does not contain a separate pay item for 6" D.I.P., all such pipe required to connect the new hydrant to the water main shall be furnished and installed as an incidental cost to the hydrant.

3.2.3. Relocate Curb Stop

Payment for relocation or moving in place curb stops, along with all associated access boxes at the appropriate Contract prices per each shall be compensation in full for all costs of performing the relocation as specified and detailed in the Contract, including final elevation adjustments as necessary. The Contract unit price shall include, but not limited to the following:

a. Furnishing and installing new pipe and fittings of the same kind and size as the existing components as necessary when the relocation can not be completed with the existing components.

b. Furnishing and installing new pipe and fittings of the same kind and size as the existing components as necessary to provide continuous piping in any gaps

resulting from the relocation.

c. Furnishing and installing caps and plugs as necessary when items are permanently removed.

3.2.4. Adjustment of Water Structures

Payment for adjusting in place hydrants, valve boxes, and curb stop boxes at the appropriate Contract prices per each shall be compensation in full for all costs of adjusting the specified item to the required elevation, without changing the elevation of the actual valve or associated water supply line. The Contract unit price shall include, but not be limited to, furnishing and installing new materials of the same kind and type as the existing components as necessary when the required adjustments can not be made using the existing materials.

3.2.5. Installation of Salvaged Items

Payment for the installation of salvaged (or otherwise furnished by others as specified) water main piping or other system components as specified at the appropriate Contract prices per defined unit of measure shall be compensation in full for all costs of installing the specified item complete in place as specified and detailed in the Contract, including final elevation adjustments as necessary. The Contract unit price shall include, but not be limited to, furnishing and installing replacement bolts, glands, rods, gaskets, and other miscellaneous hardware as may be required to complete the installation.

3.2.6. Salvaged Items

Payment for removing or salvaging water main piping or other system components as specified shall be in accordance with the provisions of Mn/DOT 2104. The Contract unit price for salvaged items shall include, but not be limited to, furnishing and installing a suitable plug or valve on the end of the existing line remaining so that it can be returned to service when construction activities are performed.

3.2.7. Polyethylene Encasement

No direct payment will be made for furnishing and installing the specified polyethylene encasement materials on the pipe or other appurtenances as required. This work shall be incidental to the appropriate Contract prices of the components encased.

3.2.8. Fittings

Payment for water main fittings of cast or ductile iron at the Contract price per

pound, as specified in WM-3.1.7 hereof, shall be compensation in full for all costs of furnishing and installing the iron water main fittings as required. The Contract price per pound shall include the costs for all necessary glands, gaskets, rods, bolts or other accessories as necessary.

3.2.9. Insulation

Payment for furnishing and installing insulation of the specified thickness at the Contract price per square yard shall be compensation in full for furnishing and installing the insulation as specified and detailed in the Contract and as directed by the Engineer.

3.2.10. Access Structures

Where access structures as defined in section WM - 3.1.8 are indicated separately in the quantities as a pay item, they shall be paid for on an each basis to include furnish and installation.

3.2.11. Insulation

Insulation shall be paid for by the square yard, furnished and installed as shown in the plan set.

3.2.12. Backfill

No direct payment will be made for furnishing and installing granular backfill and bedding materials (except for Rock Bedding, which will only be used when directed to do so by the Engineer). All granular backfill and bedding materials (except for Rock Bedding) shall be furnished and installed as an incidental cost to the water main installation. Payment for Rock Bedding (CV) at the Contract price per cubic yard, compacted volume (CV), shall be compensation in full for furnishing and placing the material as directed by the Engineer.

3.2.13. Connect / Reconnect Water Service

Payment for Connecting Water Service and Reconnecting Water Service at the Contract bid price per each shall be compensation in full for furnishing and installing materials (except the service pipe, which is paid for separately) and all work necessary to connect or reconnect each service to the new main.

3.2.14. Connect to Existing Main

Payment for Connect to Existing Main shall be compensation in full for all costs associated with connecting new water main pipe to existing mains.

3.2.15. Construct Water Manhole

Payment for Construct Water Manhole shall be compensation in full for furnishing and installing the structure and all associated components as shown in the plan details including, but not limited to, the structure and structure base, casting and rings, and excavating, backfilling, and compacting as needed to complete the installation.

3.2.16. Access Holes

Access Holes shall be paid for on a per hole basis. All costs associated with performing the work per Section WM – 3.1.14 shall be included in the Contractor's bid price for the preparation and backfill of access holes. If extra holes are required beyond the number indicated in the Quantities section of the plans, those holes will be paid for as extra work at the Contractors bid price for access holes.

3.2.17. Cut Off Service

Cut off service shall be paid for per each. Payment shall be compensation in full for performing such work per the specifications, including related tasks necessary for accomplishing the tasks.

3.2.18. Concrete Encasement

Concrete encasement shall be paid for by the lineal foot for each size (nominal inside diameter) of pipe encased. Payment shall be compensation in full for furnishing all materials and qualified labor to excavate, form, pour, remove forms, backfill, and all other items necessary to complete the encasement. Extra compensation for encasing pipe sections (proposed or existing) that are described in the plan to contain bends shall not be made.

3.2.19. Steel Water Main (Furnish and install)

Steel water main shall be measured and paid for on a Lump Sum basis, which shall be the bid price for furnishing and installing the steel water main and all connected appurtenances, specials, fittings, and corrosion control measures as shown on the plan, all in accordance with the specifications, contract documents, and referenced standards. Deviations from the plans shall require a change order executed per the provisions of the contract documents at a price negotiated between the Engineer and the Contractor.

3.2.20. Other Miscellaneous

Unless its existence is shown in the Plans, and other provisions provided for payment, the removal of ledge rock or rocks larger than ½ cubic yard in volume from the excavation shall be paid for as Extra Work.

All costs of excavating to foundation grade, preparing the foundation, placing and compacting backfill materials, restoring surface improvements, and other work necessary for prosecution and completion of the work as specified, shall be included for payment as part of the appropriate pipe and pipe appurtenance items without any direct compensation being made therefore.

All costs of disinfecting and performing the required electrical conductivity, pressure and leakage tests on all piping and appurtenances installed in the completion of the work shall be incidental to the Contract water main pay items provided, and no direct payment shall be made therefore.

No payment will be made for the use of steel plates for covering trenches or for providing temporary water service to all users as may be necessary to complete the work.

In the absence of special payment provisions, all costs of repairing, replacing, or otherwise restoring surface improvements as required by the Contract shall be included for payment as part of other Contract items without any direct compensation being made therefore.

END OF DIVISION WM - WATERMAIN

APPENDIX A

Sample of Traffic Control Log

TRAFFIC CONTROL DEVICES LOG

S.P. _

		Yes	No	If Yes, Number
1.	A. Any devices missing?	( )	( )	( )
	B. Any devices need repair?	( )	( )	( )
	C. Were they all repaired or replaced?	( )	( )	----------
2.	A. Any lights (flashers, etc.) not working?	( )	( )	( )
	B. Were they all repaired or replaced?	( )	( )	----------
3.	A. Any devices improperly placed?	( )	( )	( )
	B. Were they all corrected?	( )	( )	----------
4.	A. Any devices in need of cleaning?	( )	( )	( )
	B. Were they all cleaned?	( )	( )	----------
5.	A. Any changes to the traffic control layout, to the staging or to temporary lane closures either installed or inplace?	( )	( )	----------
	B. If "yes" to 5A, identify location, date and time. _____			

Action to be taken to correct any deficiencies indicated above:

_____

_____

I HEREBY CERTIFY THAT THE ABOVE CHECK WAS COMPLETED BY ME ON:

_____ at _____
(Date) (Time)

_____ _____
(Signature) (Title)

The Contractor shall inspect, on a daily basis, all the traffic control devices, which the Contractor has furnished and installed, and verify that the devices are placed in accordance with **the Traffic Control Layouts**, these Special Provisions, and/or the MMUTCD. Any discrepancy between the placement and the required placement shall be immediately corrected. The person performing this inspection shall be required to make a daily log. This log shall also include the date and time any changes in the stages, phases or portions thereof go into effect. The log shall identify the location and verify that the devices are placed as directed or corrected in accordance with the Plan. All entries in the log shall include the date and time of the entry and be signed by the person making the inspection. Copies of the "Traffic Control Devices Log" will be provided at the Pre-Construction Conference. The completed log shall be submitted each working day to the Project Engineer or Project Inspector.

APPENDIX B

EROSION AND SEDIMENT CONTROL for projects in the Right-of-Way or on City property, including streets and sidewalks, bridges, trails, buildings (examples are police stations, parking ramps, park buildings), parking lots, open spaces (such as parks, plazas), and utilities (traffic lights, watermains, sanitary sewers, stormwater management facilities. *(Reference: Minneapolis Stormwater Management Program, September 2011, SMP No. 4.2.)*

A. Where land disturbance is <u>one or more acres</u>:

- MPCA NPDES General Construction Permit is required, to implement and maintain practices to prevent sediment from entering curb and gutter systems, storm sewer inlets and ultimately surface waters. Prepare SWPPP and apply for and comply with MPCA NPDES General Construction Permit. Provide copy of application to City of Minneapolis Public Works, Surface Water & Sewers Division, c/o of Lois Eberhart, Water Resources Administrator, 309 S 2nd Avenue, Mpls MN 55401 or lois.eberhart@minneapolismn.gov
- Maintain files containing SWPPP, inspection reports and maintenance reports.
- Promptly remove soil or debris that is tracked or otherwise deposited onto right-of-way and/or into storm drains resulting from the construction activity or during transit to and from the construction site.
- Provide management of erosion and sediment control compliance for the life of the project, including inspection and repair of erosion and sediment control devices, proper disposal of wastes at the construction site (concrete truck washout, sawcutting slurry, discarded materials, construction site chemicals, litter and other), and establishment of vegetative cover.
- If dewatering, and if dewatering discharge is sediment laden, create a temporary or permanent sedimentation basin or other sedimentation control measure, so that receiving waters are not adversely affected. The discharge must not cause erosion and scour.

B. Where land disturbance is <u>less than one acre</u>:

- No permit is required, however City or MPRB point of contact for the project must require that the project implements and maintains practices to prevent sediment from entering curb and gutter systems, storm sewer inlets and ultimately surface waters.
- Maintain files containing inspection reports and maintenance reports.
- Promptly remove soil or debris that is tracked or otherwise deposited onto right-of-way and/or into storm drains resulting from the construction activity or during transit to and from the construction site.
- Provide management of erosion and sediment control compliance for the life of the project, including inspection and repair of erosion and sediment control devices, proper disposal of wastes at the construction site (concrete truck washout, sawcutting slurry, discarded materials, construction site chemicals, litter and other), and establishment of vegetative cover.
- If dewatering, and if dewatering discharge is sediment laden, create a temporary or permanent sedimentation basin or other sedimentation control measure, so that receiving waters are not adversely affected. The discharge must not cause erosion and scour.

Targeted Pollutants and Targeted Activities

<u>Pollutants</u>

- Phosphorus and other nutrients
- Oil and grease
- Sediment and other solids
- Chlorides and cyanide
- Bacteria
- Metals
- Volatile organic compounds

<u>Activities</u>

- Soil erosion
- Concrete truck washout, concrete slurry
- Improper handling and disposal of construction materials and chemicals
- Litter
- Paints and stains
- Sanitary waste

The following MPCA guidance sheets are helpful *whether or not* the project is subject to an NPDES Permit from MPCA.

- Sample Maintenance Records (1 page)
- Vehicle Tracking (3 pages)
- Stormwater Inlet Protection (3 pages)
- Perimeter Control (3 pages)
- Concrete Washout (2 pages)
- Slope and Site Stabilization (5 pages)
- Construction Stormwater Permit Training Requirements (5 pages)
- Emergency Construction Stormwater Application (2 pages)
- Stormwater Pollution Prevention Plan (SWPPP) (2 pages)
- Linear Utility Projects (2 pages)
- Stormwater Compliance Assistance Toolkit for Small Construction Operators (45 pages)

Attachment B: Sample Maintenance Records

Inspector	Type of Inspection		Date of Inspection			Rainfall (record all events > 0.5 in)	Time of Inspection			Areas Inspected							Findings and Corrective Actions
	Routine weekly	24 hrs after rain	Month	Day	Year		Time	AM	PM	Erosion / Sediment Control BMPs	Silt Fences	Sedimentation basins	Drainage ditches and other surface waters	Construction site exits	Infiltration areas	Pollution Prevention Measures	
																	Findings: Corrective Actions:
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Minnesota Pollution Control Agency

Vehicle Tracking

NPDES/SDS Construction Stormwater Permit Requirements

wq-strm2-27 • October 2009

Vehicles leaving construction sites track sediment onto adjoining road ways. This sediment can create serious safety hazards as well as contribute significantly to sediment pollution problems in waterways. Through the use of vehicle tracking pads and street sweeping, the amount of sediment and other pollutants leaving the construction site is limited and the amount of sediment discharged to surface water is decreased.

Vehicle tracking pads remove mud from tires and reduce the amount of sediment leaving a construction site.

What is required by the NPDES/SDS construction stormwater permit?

The NPDES/SDS Construction Stormwater Permit states that the tracking of sediment from a construction site onto roadways must be minimized with appropriate best management practices (BMPs) such as stone pads, concrete or steel wash racks or equivalent systems. If these BMPs are not adequate in preventing sediment tracking, street sweeping is required. The permit states that all external washing of vehicles must be limited to a defined area and runoff must be contained to prevent transport of sediment offsite.

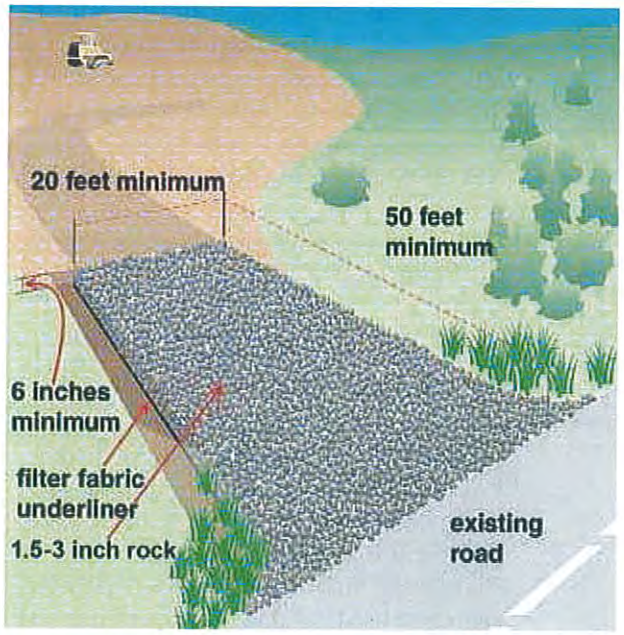
Construction site vehicle exit locations must be inspected for sediment tracked onto paved surfaces. Sediment tracked off-site must be removed within 24 hours of discovery to prevent it from being washed away by stormwater and to avoid a safety hazard. It is important to note that the permit requires street sweeping to remove sediment tracked to the street, but it is NOT an alternative to having a vehicle tracking pad. First work to minimize mud and sediment tracked from the site and follow up with sweeping to collect material that has left the site. For full details of the permit requirements, a copy of the NPDES/SDS construction stormwater permit is available online: www.pca.state.mn.us/water/stormwater/stormwater-c.html.

What is a vehicle tracking pad?

A vehicle tracking pad is typically a stabilized pad of aggregate over a geotextile base installed at every vehicle exit utilized by construction traffic. It is designed in a way that when vehicles drive over the pad, the tires sink into the rock slightly and mud is removed. Generally the aggregate used is 1.5 to 3 inches in size and placed in a layer approximately 6 inches thick. However, the MPCA staff has observed that vehicle tracking pads consisting of coarser aggregate materials (2 to 6 inches) are often more effective in many applications. The vehicle tracking pad should be at least 50 ft long but longer pads may be required to adequately clean tires. The amount of construction traffic and frequency of use should be considered when designing a vehicle tracking pad.

Alternative materials such as wood chip pads or temporary paving can be used as vehicle tracking pads as well. These materials are effective in preventing mud from sticking to tires, but less effective than aggregate at removing mud from tires. In addition commercial products are available for use as vehicle tracking pads. See Resources at the end of this factsheet for a link to the Minnesota Department of Transportation's list of approved products.

In many cases the action of the tires moving over the aggregate pad may not adequately remove sediment from the tires. In these cases the tires may need to be washed before the vehicle leaves the site. A wash rack can be installed on the aggregate pad and generally consists of a prefabricated rack such as a cattle guard. It is important to remember that the type of rack used must support the size of the vehicles crossing it. Wash water should be directed to a suitable settling area to be treated and/or recycled.



A vehicle tracking pad should be at least 50 feet in length but may need to be longer to adequately remove sediment from vehicle tires.

How effective is a vehicle tracking pad?

A vehicle tracking pad can be very effective if it is designed, installed, and maintained properly. In order to effectively prevent sediment from leaving the site on vehicle tires, vehicle tracking pads should be installed prior to any land disturbing activity and all construction traffic should be limited to exiting the site through these designated locations. When planning the most effective vehicle tracking pad, the following should be taken into account

- underlying soils on site
- frequency of use
- length and width of the entrance
- depth of rock
- size and type of vehicles
- frequency of maintenance

It is important to take into consideration the exact situation where the vehicle tracking pad will be used. Simple, sometimes inexpensive changes or additions to the vehicle tracking pad can make it more effective and prevent costly permit violations.

A vehicle wash rack may be needed to remove sediment from tires.

Maintenance considerations

Vehicle tracking pads require constant maintenance especially during and after rain events to effectively prevent tracking of sediment onto paved roads. All vehicle tracking pads should be inspected at a minimum daily and more often when the potential for soil tracking is present. A newly installed pad is the most efficient at removing mud and sediment from vehicles. After extended use and/or heavy rainfall events, the pad can become clogged with mud and no longer work effectively. Rock or wood chips should always be on hand at the construction site for additional top dressing, removal and reinstallation of the pad. If temporary paving is used as the vehicle tracking pad, regular sweeping is needed to clear away sediment. For sites utilizing a wash station, the area established to collect the wash water should be regularly inspected and cleaned out to ensure sediment is contained properly and water is treated or recycled. Street sweeping equipment should be readily available to clean sediment from paved surfaces regularly.

Image Courtesy of Emmons & Olivier Resources, Inc

Street sweeping is required to remove any sediment that is tracked onto the street.

Cold climate considerations

Vehicles leaving a construction site during the winter months can track sediment and sediment-laden snow from the site onto adjacent roadways. It is important to remember that all construction sites must remain in compliance with the NPDES/SDS permit throughout the winter even if no construction is occurring; therefore a well maintained and functioning vehicle tracking pad must be in place. Regular inspection of vehicle tracking pads must continue throughout the winter months and regular maintenance will be needed during the spring thaw. As with the summer months, additional aggregate should be readily available for top dressing and maintenance of the pad throughout winter.

A combination of plowing and street sweeping may be necessary to ensure mud does not remain on the paved streets. Special attention should be paid to promptly remove all sediment and sediment laden snow and ice on the roadways prior to the spring melt.

Image Courtesy of Emmons & Olivier Resources, Inc

Add additional aggregate regularly to maintain a vehicle tracking pad.

Resources

Metropolitan Council Urban Small Sites Best Management Practice Manual – Construction Practices – Vehicle Tracking Pad http://www.metrocouncil.org/environment/Watershed/bmp/CH3_RPPConstVehTrack.pdf

MPCA Protecting Water Quality in Urban Areas – Manual http://www.pca.state.mn.us/water/pubs/sw-bmpmanual.html

MPCA Stormwater Construction Inspection Guide http://www.pca.state.mn.us/publications/wq-strm2-10.pdf

USEPA National Pollutant Discharge Elimination System (NPDES) Menu of BMPs – Construction Site Sediment Control – Vehicle Maintenance and Washing Areas at Construction Sites – Construction Entrances http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=35&minmeasure=4

Minnesota Department of Transportation (Mn/DOT) Approved Products List http://www.mrr.dot.state.mn.us/materials/ApprovedProducts/appchart.asp#ipl

Minnesota Pollution Control Agency

Stormwater Inlet Protection

NPDES/SDS Construction Stormwater Permit Requirements

wq-strm2-28• October 2009

The goal of stormwater inlet protection is to trap sediment from a construction site before it enters a storm sewer. This will keep sediment from being transported to lakes or streams and can also prevent clogging of the storm sewer caused by heavy sediment loads. A stormwater inlet refers to manholes, catch basins, curb inlets and other drop-type structures constructed to direct stormwater into storm sewers or other underground drainage systems. Inlet protection best management practices (BMPs) are fairly inexpensive, easy to construct, and if maintained properly can successfully reduce sediments from entering our waterways.

What is required by the NPDES/SDS construction stormwater permit?

The NPDES/SDS construction stormwater permit requires that sediment control practices be utilized to minimize sediment from entering surface waters, curb and gutter systems and storm sewer inlets. The permit states that all storm drain inlets must be protected by appropriate BMPs throughout construction and until all sources with potential for discharging to the inlet have been stabilized.

The permit also requires that the inlet protection BMPs be inspected at least once every seven days and within 24 hours after a rainfall event greater than 0.5 inches in 24 hours. All nonfunctioning inlet protection BMPs must be replaced or repaired within 24 hours of discovery. For full details of the permit requirements, a copy of the NPDES/SDS construction stormwater permit is available online: www.pca.state.mn.us/water/stormwater/stormwater-c.html.

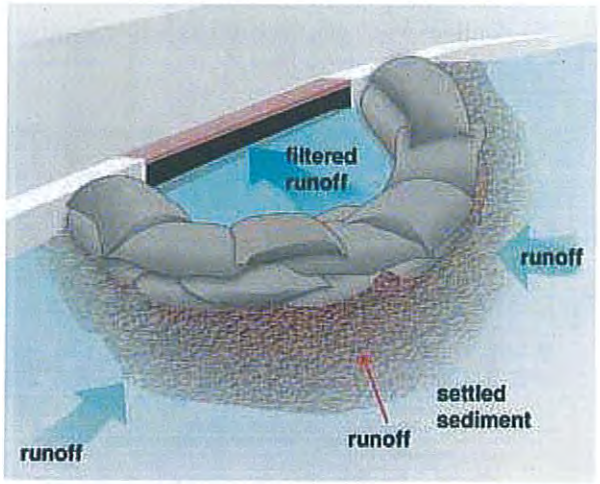
Stormwater inlet protection BMPs can be inserted into a catch basin to trap sediment from a construction site before it enters a storm sewer.

Planning considerations

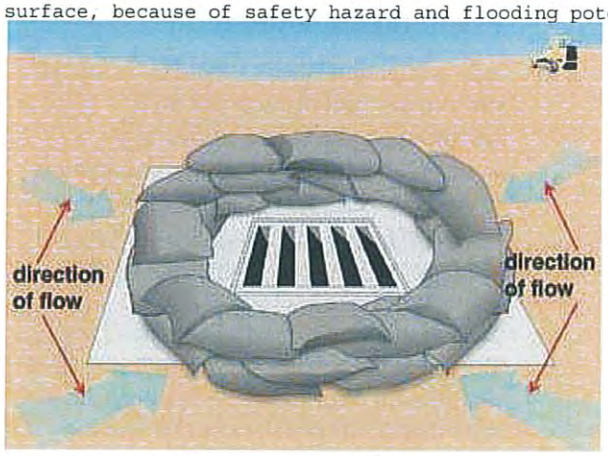
Inlet protection BMPs should be installed prior to any soil disturbance on a construction site where stormsewer systems are in place or BMPs should be installed as stormsewer systems are constructed and inlets begin collecting stormwater. The basic approach to inlet protection BMPs is to install a barrier around the inlet that ponds or filters the flow of stormwater resulting in the settling or filtration of sediment. It is important to note that ponding will occur behind the inlet protection BMPs and that regular maintenance is needed to remove sediment and prevent a safety hazard. Many different types of inlet protection BMPs exist and can be utilized depending on the field conditions and type of inlet.

Commonly used inlet protection BMPs include:

- Rock logs
- Compost logs
- Sediment control inlet hats
- Silt fence rings and rock filter combinations
- Pop-up head risers
- Filter bag inserts
- Sand or gravel bags



Inlet protection BMPs such as sand or gravel bags are used to filter stormwater runoff before entering a catch basin. Commercial products are available that fit in front of or inside the catch basin to filter stormwater. City of MPLS note: In areas open to public traffic, do not use products that stand above the road surface, because of safety hazard and flooding potential.



Inlet protection BMPs such as sand or gravel bags can be used to protect a drop inlet by filtering stormwater runoff and preventing sediment from entering the inlet.

Additional commercial products are available. See Resources at the end of this factsheet for a link to the Minnesota Department of Transportation's list of approved products.

Maintenance considerations

The effectiveness of inlet protection BMPs is greatly diminished if not maintained properly. After each rainfall, inlet protection should be inspected. Sediment collected around the inlet protection BMP should be regularly removed. Care should be taken to dispose of sediment in a location that is not susceptible to additional erosion.

If excess sediment clogs or blocks the inlet protection BMP, flooding may occur and cause a safety hazard or property damage. If significant ponding does occur around the inlet, inspect for any clogging that may be preventing proper drawdown. As soon as the contributing drainage area is stabilized, the inlet protection BMP should be removed.

Cold climate considerations

It is important to consider winter conditions when planning construction and designing inlet protection BMPs. Construction sites must comply with the NPDES/SDS permit throughout winter even if the site is idle and regular inspection of the inlet protection must continue throughout the winter months.

The most common problem with inlet protection BMPs in the winter is clogging due to ice build-up. Snow should be removed around the inlets when possible to prevent the snow from melting and freezing creating ice build-up. If ice build-up does occur, it is necessary to manually break-up the ice for removal or use steam to instigate melting. Under no circumstance should salt be used to remove the ice. Using salt adds unnecessary salt loads to the drainage system.

Image Courtesy of Emmons & Oliver Resources, Inc.

Snow should be removed from around catch basins with installed inlet protection BMPs to prevent ice build-up and clogging.

Drainage system inlet inserts and filters can become a potential source of freeze-up, especially if water does not drain immediately through the BMP. All BMPs used at inlets should have overflow assurance so that flow will by-pass a frozen fabric or natural material filter. Inspection and maintenance will often result in easy ice break-up when problems are quickly discovered.

Prior to the spring, site managers should inspect each of the inlets and undertake actions as necessary to assure unimpeded flow through the inlet protection BMPs.

Image Courtesy of Emmons & Olivier Resources, Inc.

Maintenance should continue through the winter months to ensure that inlet protection BMP is functioning properly.

Resources

Metropolitan Council Urban Small Sites Best Management Practice Manual – Soil Erosion Control – Inlet Protection
http://www.metrocouncil.org/environment/Watershed/bmp/CH3_RPPSedInletProtect.pdf

Minnesota Department of Transportation (Mn/DOT) Approved Products List http://www.mrr.dot.state.mn.us/materials/ApprovedProducts/appchart.asp#ipl

MPCA Protecting Water Quality in Urban Areas – Manual http://www.pca.state.mn.us/water/pubs/sw-bmpmanual.html

MPCA Stormwater Construction Inspection Guide http://www.pca.state.mn.us/publications/wq-strm2-10.pdf

USEPA National Pollutant Discharge Elimination System (NPDES) Menu of BMPs - Construction Site Sediment Control – Storm Drain Inlet Protection
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=60&minmeasure=4

Small Business Environmental Assistance Program Compliance Calendar for Construction Stormwater
http://www.pca.state.mn.us/publications/wq-strm2-08.pdf

Minnesota Pollution Control Agency

Perimeter Control

NPDES/SDS Construction Stormwater Permit Requirements

wq-strm2-26 • October 2009

Perimeter control is a system of sediment control best management practices (BMPs) that acts as a barrier to retain sediment on a construction site. Sediment control BMPs are intended to retard flow, filter runoff, and promote the settling of sediment out of runoff via ponding behind the sediment control BMP.

Types of sediment control

Traditionally sediment control BMPs have been thought of as different types of silt fencing, however, other types of sediment controls exist that can be equally or even more effective depending on the construction circumstances. The following sediment control BMPs are commonly used on construction sites of all sizes.

- Ditch checks
- Rock logs
- Compost berms, logs, and rolls
- Biorolls
- Sand bags
- Perimeter soil berms
- Existing vegetation
- Silt Fence
    - Super duty
    - Heavy duty
    - Preassembled

What is required by the NPDES/SDS Construction Stormwater Permit?

The NPDES/SDS construction stormwater permit requires sediment control BMPs be utilized to minimize sediment from leaving a construction site and entering surface waters. All sediment control BMPs should be identified in the site's Stormwater Pollution Prevention Plan (SWPPP).

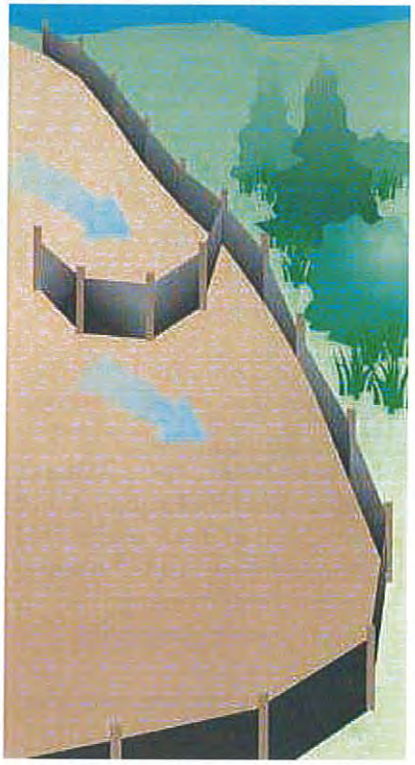
Bioroll used for perimeter control.

Sediment control BMPs must be established on all down gradient perimeters before any up gradient land disturbing activities begin. These BMPs shall remain in place until final stabilization has been established. If down gradient sediment controls are overloaded, additional up gradient controls may be necessary to prevent further overloading.

The timing of the sediment control installation may be adjusted to accommodate short term activities such as clearing and grubbing and passage of vehicles. These short term activities must be completed as quickly as possible and sediment control BMPs must be reinstalled immediately after the activity is finished. All sediment control BMPs, however, must be in place before the next precipitation event, even if the activity is not complete. For full details of the permit requirements, a copy of the NPDES/SDS construction stormwater permit is available online: www.pca.state.mn.us/water/stormwater/stormwater-c.html.

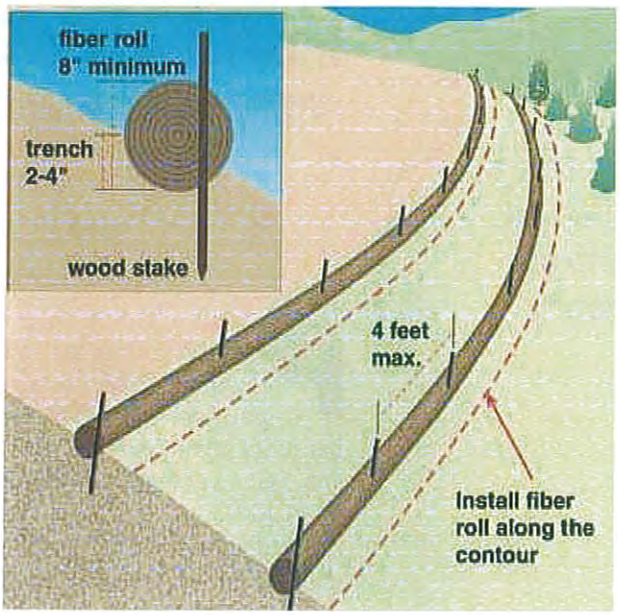
Planning sediment control

Sediment controls should be planned as a system, taking the entire site into consideration, and installed prior to any land disturbing activity. The design of a site's sediment control should anticipate ponding that will occur up gradient of the controls and provide sufficient storage and deposition areas and stabilized outlets to prevent flows from over topping the controls. Flows should be strategically directed to specified deposition areas through appropriate positioning of the sediment controls and site grading.



Curve the ends of silt fence and other sediment controls up slope to form a "J-hook".

Sediment controls serve no function along ridges or drainage divides where there is little movement of water. Sediment controls should be installed on the contour of slopes and the ends of the sediment controls should bend up slope forming a crescent shape or a "J- hook" rather than a straight line. This will prevent runoff from flowing around the ends of the controls.



Install biorolls and other sediment controls along the contour of the slope.

Maintenance considerations

The NPDES/SDS permit requires that sediment controls be inspected once every 7 days or within 24 hours of a rainfall event greater than 0.5 inches in 24 hours. All non-functioning sediment controls must be replaced, repaired or supplemented with functional BMPs within 24 hours of discovery or as soon as field conditions allow access. Generally, sediment controls must be repaired, replaced, or supplemented when they become nonfunctional, or sediment reaches 1/3 the height of the control.

After the contributing drainage area has been stabilized, all sediment controls and the associated sediment build up must be removed and disposed of properly. Care should be taken to dispose of sediment in a location that is not susceptible to additional erosion.

Cold weather considerations

MCO 52 requires maintenance & installation

It is important to consider winter conditions when planning a sediment control system. All construction sites must remain in compliance with the NPDES/SDS permit throughout the winter even if no construction is occurring. For this reason, regular inspection and maintenance of the sediment controls must continue throughout the winter months. It is also imperative that properly functioning sediment controls are in place during minor thaws throughout the winter and for the large

spring snowmelt to prevent transport of sediment from an exposed construction site.

The best way to ensure proper functioning of sediment controls through out the winter is to have all sediment controls installed prior to the first freeze. Stakes needed for some sediment control BMPs will be difficult, if not impossible to install into frozen ground. The site's SWPPP should clearly outline the strategy to prepare the site for the winter months.

If construction is going to continue during the winter and new areas will be disturbed requiring new sediment controls, materials such as compost berms, logs and rolls, fiber rolls, rock bags and rock filters can be installed over the snow cover. These installations will need extra care and frequent inspection to assure continued effectiveness.

Regular maintenance is needed to ensure that a site's perimeter control is functioning properly.

Resources

Metropolitan Council Urban Small Sites Best Management Practice Manual – Soil Erosion Control – Silt Fences. http://www.metrocouncil.org/environment/Watershed/bmp/CH3_RPPSedSiltFence.pdf

MPCA Protecting Water Quality in Urban Areas – Manual http://www.pca.state.mn.us/water/pubs/sw-bmpmanual.html

MPCA Stormwater Construction Inspection Guide http://www.pca.state.mn.us/publications/wq-strm2-10.pdf

USEPA National Pollutant Discharge Elimination System (NPDES) Menu of BMPs –Construction Site Sediment Control – Silt Fences http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=56&minmeasure=4

Minnesota Pollution Control Agency

Concrete Washout Guidance

NPDES/SDS Construction Stormwater Permit Requirements

wq-strm2-24 • February 2009

Use this guidance for managing concrete washouts on NPDES/SDS construction stormwater permitted sites. To protect water quality, the 2008 NPDES Construction Stormwater Permit requires best management practices (BMPs) for concrete washout onsite.

Background

Concrete washouts are used to contain concrete and liquids when the chutes of concrete mixers and hoppers of concrete pumps are rinsed out after delivery. Washout facilities consolidate solids for easier disposal and prevent runoff of liquids.

Installing concrete washout facilities not only prevents pollution but also is a mater of good housekeeping at a construction site. Wash water is alkaline and contains high levels of chromium, which can leach into the ground and contaminate groundwater. It can also migrate to a storm drain, which can increase the pH of area waters and harm aquatic life. While hardened concrete is relatively benign, liquid concrete waste may carry hydration by-products to receiving waters. Solids that are improperly disposed of can clog storm drain pipes and cause flooding.

MPCA approved the re-issuance of the NPDES/SDS General Stormwater Permit for Construction Activity MN R100001 (Construction Stormwater Permit), which went into effect in Minnesota on August 1, 2008. Owners and operators (Permittees) of a construction activity disturbing one or more acres of land need to obtain an NPDES/SDS Construction Stormwater Permit. If a project obtained Construction Stormwater Permit coverage prior to August 1, 2008 it can continue to follow the requirements of the expired permit until February 1, 2010. If the project is still ongoing at that date, the Stormwater Pollution Prevention Plan (SWPPP) for the project must be amended to meet the requirements of the new permit including the new requirement for concrete washouts on site.

Concrete washout at construction sites

The U.S. Environmental Protection Agency (USEPA) forbids discharging into the nation's waterways untreated wash water used in concrete mixer rinse out operations regardless of the size of project. The 2008 Construction Stormwater Permit reflects the position of the USEPA that all concrete chute rinse water on NPDES/SDS construction stormwater permitted sites must not be discharged onto the ground and should be disposed of in an MPCA-approved manner. A concrete washout sign must be installed at each temporary washout facility to inform the concrete equipment operators to use the designated facilities.

While the Construction Stormwater Permit does not allow concrete-chute rinse water to come into contact with the ground, the permit does allow plastic structural concrete to come into contact with the ground. Excess plastic structural concrete from pumps, forms, and chutes may come into contact with the ground as long as

they are disposed of in accordance with MPCA regulations when in a hardened state.

Best management practices

The MPCA believes that ground water and surface water can be protected from all liquid concrete washout wastes, including washing of concrete tools, by using BMPs for all NPDES/SDS construction stormwater permitted sites.

One BMP option would involve all concrete-chute rinse water being self-contained and returned to an industrial site to be disposed of in an MPCA-approved manner. Another BMP option would involve hiring a service that delivers a prefabricated washout container to collect all concrete chute rinse water generated on site. Some services provide the containers alone without providing maintenance and disposal of materials, while other companies offer complete service that includes delivery of containers and regular pickups of solid and liquid waste materials. A third BMP option would be to self install a washout facility with an impermeable liner. An engineered clay liner is considered impermeable.

Concrete washouts are designed to promote evaporation where feasible. However, if stored liquids have not evaporated and the washout is nearing capacity, vacuum and dispose of them in an approved manner. Check with the local sanitary sewer authority to determine if there are special disposal requirements for concrete wash water. Remove liquids or cover the structures before predicted rainstorms to prevent overflows. Companies that offer prefabricated and watertight washout containers generally offer a vacuum service to remove the liquid material. In case of a spill, immediately contain the spread of the spill, recover spilled materials, clean the area and properly dispose of materials.

Hardened solids can be removed whole or broken up first depending on the type of equipment available on site. In accordance with Minn. R. 7035.2860, subp. 4, item I; the hardened concrete can be used as a substitute for conventional aggregate. If the material is not utilized in accordance with the standing beneficial use determination referenced above, up to 0.5 cubic yards of concrete washout solids may be managed on-site. If concrete washout solids are buried on site, they should be at least two feet below the surface and must not be buried in the groundwater table. Quantities larger than 0.5 cubic yards of concrete washout solids must either be managed with the rest of the sites solid wastes or obtain an approval from the MPCA's solid waste program for other beneficial use options.

Other operations on site such as saw cutting, coring, grinding and grooving or construction of exposed-aggregate concrete surfaces may generate a similar liquid wastewater. Process wastewater generated by these operations cannot be discharged into any of the nation's waterways. The MPCA recommends that liquid and solid wastes generated by these operations be handled in a similar manner as concrete-washout wastes.

Local requirements

In addition to state requirements, please note that there may be city, county or watershed management organization requirements that may be more stringent than those found in the NPDES/SDS Construction Stormwater Permit.

Definitions

Concrete-chute rinse-off water: Liquid wastes generated when a ready mix truck operator washes non-structural concrete materials off the chutes used to deliver concrete to a project.

Concrete equipment and tools rinse-off water: Liquid wastes generated when a concrete contractor or finisher washes non-structural concrete materials off tools or equipment used to place or finish concrete.

Plastic concrete is that freshly mixed structural concrete which is pliable and capable of being molded or shaped like a lump of modeling clay.

Hardened structural concrete is a strong, non-combustible, durable, abrasion-resistant and practically impermeable material.

Additional information

USEPA National Pollutant Discharge Elimination System (NPDES) Menu of BMPs – Construction Site Runoff Control – Concrete Washout.
http://cfpub.epa.gov/npdes/stormwater/menuofbmps

CASQA Concrete Waste Management Fact Sheet in the California BMP Handbook: Construction:
www.cabmphandbooks.com/Construction.asp

More information

For more information, call the MPCA Stormwater Hotline at 651-757-2119 or 800-657-3804.

Minnesota Pollution Control Agency

Slope and Site Stabilization

NPDES/SDS Construction Stormwater Permit Requirements

wq-strm2-25 • October 2009

Improperly treated and untreated runoff from exposed soils of a construction site can cause soil erosion and sedimentation problems resulting in the pollution of lakes, and other water bodies. This factsheet provides guidance on stabilizing a construction site to protect the quality of our water resources.

The Erosion Process

Erosion is the natural process in which soil and rock material is weathered and carried away by wind, water or ice. On a construction site there are factors such as rainfall, climate, location, and soil type that influence erosion and may not be controllable.

Sediment entering a storm sewer inlet as a result of construction related erosion.

Construction activities can increase erosion by removing vegetation, disturbing soil and exposing sediment to the elements. Eroded soil quickly becomes a sedimentation problem when wind and rain carry the soil off the construction site and sediment is deposited in our surface waters. Through proper slope and site stabilization, the use of conservation practices, and temporary and permanent cover, erosion and sedimentation problems can be managed.

What is required by the NPDES/SDS construction stormwater permit?

The NPDES/SDS construction stormwater permit identifies slope and site stabilization requirements that, if followed properly, can control erosion and sediment problems on a construction site.

- Prior to construction, areas not to be disturbed should be clearly flagged, staked or identified with signs and noted on the plan sets.
- All exposed areas must be stabilized no later than 14 days after the construction activity in that area is temporarily or permanently completed.
- The normal wetted perimeter of any temporary or permanent drainage ditch must be stabilized within 200 feet from the property edge.
- Drainage ditches and conveyance systems must be inspected for evidence of erosion and sediment deposition. All deltas and sediment deposited must be removed and the areas must be restablized where sediment removal results in exposed soil.
- In order to maintain sheet flow and minimize rills and gullies, there shall be no unbroken slope lengths of greater than 75 feet for slopes with a grade of 3:1 or steeper.

If the construction site is within **1** mile of a special or impaired water, the following revised and additional requirements are listed in Appendix A of the permit:

- All exposed areas must be stabilized no later than **7** days after the construction activity in that area has temporarily or permanently ceased.
- An undisturbed buffer zone of not less than 100 feet from special waters shall be maintained at all times.

For full details of the permit requirements, a copy of the NPDES/SDS construction stormwater permit is available online: www.pca.state.mn.us/water/stormwater/stormwater-c.html.

What can I do to keep my site stabilized and prevent sediment and erosion problems?

There are several ways to keep a site stabilized and limit and control sediment and erosion:

- Develop and implement a sound stormwater pollution prevention plan (SWPPP) prior to the start of construction.
- Utilize conservation practices.
- Leave as much vegetation on site as possible and reduce the overall disturbed area.
- Prevent runoff from flowing across disturbed areas by diverting the flow to vegetated areas.
- Break up slope lengths and steepness.
- Use sufficient sized temporary basins.
- Protect stock piles.
- Minimize the total area of a site exposed at once.
- Minimize the length of time that soil is exposed.
- Temporarily or permanently stabilize disturbed soils as quickly as possible after construction activity has stopped.

Image Courtesy of Emmons & Oliver Resources, Inc

Leave as much vegetation on a site as possible to reduce the overall disturbed area.

Any and all tools that you plan to implement on the site should be included in the site's SWPPP. When writing the SWPPP, include a description of the practices and integrate them into the time line of all construction activities. In addition, label the locations of the practices on site plans and include detailed specifications for each practice. Including these elements into the SWPPP before construction activity begins will aid in proper planning for the site and ensure that the sediment and erosion control techniques are implemented effectively and efficiently.

What are conservation practices?

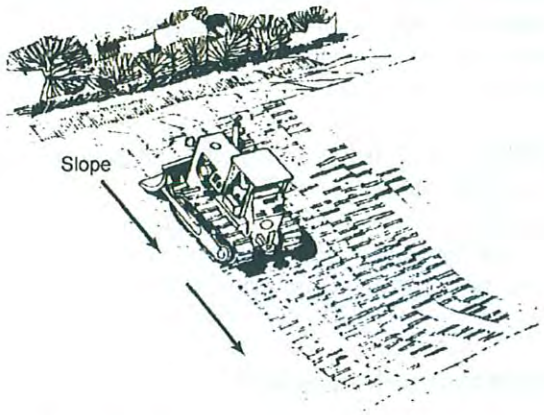
Conservation practices are treatments and management strategies used in construction planning to reduce soil erosion, shelter critical areas, create wildlife habitat, and protect soil and water quality. Successful conservation practices are integrated into the early stages of planning for construction and implemented throughout the life of a project. The following are a few examples of conservation practices that could be utilized to ensure proper site and slope stabilization.

Construction site phasing is the development of a construction work schedule that strategically coordinates the timing of land disturbing activities to minimize soil exposure and plans for the timely installation of all erosion and sediment control practices. The goal of construction site phasing is to disturb a smaller portion of an overall site, substantially finish grading and other construction activities and achieve temporary or permanent stabilization in the area before disturbing the next portion of the overall site. Soil exposure time is decreased, soil and erosion control practices are more manageable, and permit violations can be easily avoided.

Lot benching is often utilized in subdivision developments. Lots are strategically graded to direct the runoff from each lot to a stable outlet rather than to an adjacent lot. Lot benching can result in reduced slope lengths and steepness, decreasing the potential for soil erosion. Lot benching establishes drainage patterns early in the construction process for each lot therefore avoiding potential drainage problems in the future when home construction begins.

Surface roughening involves roughening the surface of the soil on slopes in a horizontally grooved pattern. This is often accomplished by tracking, stair-step grading or ripping and grooving. The roughened surface reduces erosion by decreasing runoff velocity, increasing

infiltration, and aiding in the establishment of temporary or permanent vegetation and cover.



Slope tracking roughens the surface of a slope and decreases the velocity of runoff.

Low impact development (LID) is a stormwater management approach with the goal of keeping stormwater where it falls and reducing or even eliminating stormwater runoff from a site. LID integrates stormwater management practices into the planned or existing infrastructure in a way that mimics the predevelopment hydrology of the site. The techniques provide the filtering of sediment, nutrients, heavy metals and other pollutants from the runoff and result in decreased erosion, increased infiltration, and improved water quality. LID techniques such as protecting natural and existing vegetation, avoiding steep slopes, protecting infiltration areas and minimizing soil compaction can be utilized to prevent unnecessary erosion and sediment pollution problems. For additional information on LID visit: www.pca.state.mn.us/publications/p-gen3-06.pdf.

Using temporary and permanent cover

It is important to utilize stabilization techniques throughout the duration of the project as well as at the end of the project to achieve final stabilization. Temporary covers seek to vegetate or cover bare soil to reduce the potential of soil erosion. Plan to utilize temporary cover on portions of the site that will sit dormant for periods of time whether or not final grading is reached. Permanent cover should be used to accomplish final stabilization at the end of a project or on areas that will sit dormant for an extended period of time. The following are commonly used temporary and permanent cover practices that can be combined and used in conjunction with each other depending on the specifics of a site:

- Seed mixes are available to establish temporary and permanent vegetative cover on exposed soil. The Minnesota Department of Transportation (Mn/DOT) has researched various seed mixes and has identified mixes for specific site characteristics and uses. Reference the MN/DOT Standard Specifications for Construction and the MN/DOT Seeding Manual for specifics on seed mixes for your site. Links to both MN/DOT documents are in Resources at the end of this fact sheet.

- Providing proper nutrients and fertilization are important to establishing permanent vegetation. Fertilization is site specific and should be chosen after a soil test is completed. For more information on soil testing, see the Soil Testing Laboratory at the University of Minnesota at http://soiltest.cfans.umn.edu/.

- Mulch is applied to form a temporary and protective cover on exposed soils. Mulch can help retain moisture in the soil to promote vegetative growth, reduce evaporation, insulate the soil, and reduce erosion. A common mulch material used is straw.

Hydroseeding promotes the rapid growth of vegetation and prevents erosion.

- Hydroseeding is the process by which a seed and mulch mixture or "slurry" is sprayed onto a prepared slope or site. Hydroseeding traps in moisture to promote rapid germination and growth.

- Erosion control blankets and turf reinforcement mats are single or multiple layer sheets made of natural and/or synthetic materials that provide structural stability to bare surfaces and slopes. Blankets and mats are often used in conjunction with seed mixes

to promote vegetation establishment. A wide variety of blankets and mats exist for use under varying circumstances. In addition, compost can be used for erosion control and site stabilization. For more information, see the Minnesota Stormwater Manual at http://www.pca.state.mn.us/publications/wq-strm9-01.pdf.

Erosion control blanket stabilizes pond slopes.

- Sod is commonly used for permanent stabilization and for immediate visual aesthetics on a bare site. Sod can provide immediate stabilization around drop inlets and in swales, ditches, and channels.

What techniques do I choose for my site?

Choosing erosion and sediment control practices, and temporary or permanent cover can be challenging with so many options. Often price is a deciding factor, however the least expensive erosion protection techniques may not be the longest lasting, the most cost effective or the most appropriate for your site. Insufficient protection may leave you with the cost of cleaning up an eroded slope, permit violations, or the task of implementing additional practices over and over again. Carefully consider the specifics of your project including the climate, existing soils, and slope lengths and steepness before choosing a cover or practices. In the long run, choosing the right products and practices for your site will save you time and money.

Cold climate considerations

The best approach to winter months is to plan ahead at the start of a project and develop a sequenced construction schedule to ensure that all exposed areas have cover before the first freeze. Preparation of vegetative cover should begin in the fall. Seeds must be started early enough for them to germinate, establish roots and provide cover before the winter beings. Reference the Mn/DOT Standard Specification for Construction for specifics on the month in which seeding should begin. If construction is continuing through winter and new areas are disturbed, cover material can be applied over a snowpack.

It is important to note that all construction sites must remain in compliance with the NPDES permit MC052 throughout the winter even if no construction is occurring. For this reason, regular inspection and maintenance must continue throughout the winter months.

Maintenance and Inspection

The NPDES permit requires that the entire construction site be inspected once every 7 days or within 24 hours of a rainfall event greater than 0.5 inches in 24 hours. All non-functioning perimeter controls must be replaced, repaired or supplemented with functional practices within 24 hours of discovery or as soon as field conditions allow access. The permittee is responsible for the operation and maintenance of all erosion prevention and sediment control Best Management Practices (BMPs) for the duration of the project. All inspections and maintenance and any changes throughout the construction process should be recorded and kept onsite with the SWPPP.

Image Courtesy of Emmons & Olivier Resources, Inc.

Stabilization BMPs should be inspected and maintained through the winter season.

You can use the Construction Stormwater Compliance Calender for easy recordkeeping. See references.

What is final site stabilization?

As defined in the NPDES/SDS construction stormwater permit, final stabilization is achieved when all soil disturbing activity is completed and the exposed soils have been stabilized with a vegetative cover with a

density of 70% over the entire site. Note that simply seeding and mulching is not considered acceptable cover for final stabilization.
Final stabilization and permit termination can also be achieved if the proposed construction activity on a site is 90% complete and has been complete for 90 days if the site is established with permanent cover.

The permanent stormwater treatment system must be in place and functioning. Drainage ditches and other conveyance systems must have all collected sediment cleaned out and be stabilized with permanent cover. Temporary erosion and sediment control BMPs must be removed.

Final stabilization is achieved when all soil disturbing activity is completed and the exposed soils have been stabilized with a vegetative cover with a density of 70% over the entire site.

For residential construction sites, individual lots are considered to have final stabilization if the structure or building is completed, temporary erosion protection and down gradient perimeter control is in place, and the residential lot has been sold to the homeowner. The permittee is required to give the new homeowner a copy of the MPCA's "Homeowner Fact Sheet." http://www.pca.state.mn.us/publications/wq-strm2-07.pdf.

For construction projects on land used for agricultural purposes such as pipelines across crop land, final stabilization may be accomplished by returning the disturbed land to its preconstruction agricultural use.

Resources

Metropolitan Council Urban Small Sites Best Management Practice Manual http://www.metrocouncil.org/environment/Watershed/bmp/manual.htm

Mn/DOT Approved Products List http://www.mrr.dot.state.mn.us/materials/ApprovedProducts/appchart.asp#ipl

Mn/DOT Seeding Manual http://www.dot.state.mn.us/environment/pdf_files/seedingmanual.pdf

Mn/DOT Standard Specifications for Construction http://www.dot.state.mn.us/pre-letting/spec/index.html

MPCA Protecting Water Quality in Urban Areas – Manual – Chapter 6: Erosion Prevention and Sediment Control http://www.pca.state.mn.us/water/pubs/sw-bmpmanual.html

MPCA Stormwater Construction Inspection Guide http://www.pca.state.mn.us/publications/wq-strm2-10.pdf

Small Business Environmental Assistance Program Compliance Calendar for Construction Stormwater http://www.pca.state.mn.us/publications/wq-strm2-08.pdf

USEPA National Pollutant Discharge Elimination System (NPDES) Menu of BMPs http://cfpub.epa.gov/npdes/stormwater/menuofbmps

Minnesota Pollution Control Agency

Construction Stormwater Permit

Training Requirements

wq-strm2-31 • March 2009

Since March of 2003, the federal Phase II National Pollution Discharge Elimination System (NPDES) stormwater regulations have required all construction projects disturbing one or more acres of land to obtain an NPDES/SDS General Stormwater Permit for Construction Activity (Permit). The Permit has many requirements regarding Best Management Practices (BMPs) for erosion prevention and sediment control in addition to requirements for permanent, post-construction stormwater-treatment systems.

Through construction site inspections the Minnesota Pollution Control Agency (MPCA) has documented that the rate of compliance with the Permit is low. As identified in a report by the Minnesota Stormwater Steering Committee, a prevalent cause of noncompliance with the permit is a lack of education among owners, developers, contractors, inspectors, designers, installers, construction supervisors, and other key construction site personnel. For this reason, the NPDES/SDS Construction Stormwater General Permit issued by the MPCA, in August 1, 2008, contains new training requirements.

Who must be trained

Under the new Permit, permittees have until February 1, 2010, to meet the new training requirements including projects covered under the previous permit. This should give most permittees time to find appropriate training. Projects covered under the previous construction-stormwater general permit are also expected to update their stormwater pollution prevention plans (SWPPP) to comply with the new permit regulations by February 1, 2010.

The owner of the project must ensure that training has been received by individuals who are:

- Preparing the SWPPP (typically the project engineer or consultant)
- Overseeing implementation of, revising, and amending the SWPPP and performing inspections as required in Part IV.E. (this may be the prime contractor, site manager or foreman)
- Performing or supervising the installation, maintenance and repair of erosion and sediment control Best Management Practices (crew supervisor or laborer).

Length of training

There are construction projects, particularly smaller projects, in which some of the permit requirements do no apply. Training for individuals working on these types of projects may not need to be as extensive as others. However, for typical projects the minimum amount of training should be as follows:

Category 1: (SWPPP designer) 12-14 hours

Category 2: (site manager) 12-14 hours

Category 3: (BMP installer) 5-8 hours

Training Content

The content and extent of training must be commensurate with an individual's job responsibilities with regard to activities covered under the permit for the project. For example if an individual's only job is to supervise the installation of silt fence, then the training may be limited to that one particular activity. However, for most individuals identified in the permit the training must be more comprehensive.

A project may have many individuals with varying levels of responsibility; however, most should fit within one of the three groups listed above. If an individual's job responsibility is identified under one of the categories listed below, the training must include information regarding that specific duty. For certain projects, there may be other duties related to stormwater management that are not identified on the listed categories and the training must include those subjects. Note: it is required by the Permit that at least one individual responsible for implementing and revising the SWPPP must be available for an on site inspection within 72 hours.

Because each state issues an NPDES construction stormwater permit, specific requirements may vary, even if all have similar goals regarding proper stormwater management during construction. Training does not need to be specific to the Minnesota permit, however all personnel that are required to have training are expected to know the specific permit requirements for the State of Minnesota. Therefore, it is important to read and understand the permit and related guidance found on the MPCA's Construction Stormwater Web page: www.pca.state.mn.us/water/stormwater/stormwater-c.html

SWPPP designer training requirements

Training content must include the following as it applies to an individual's job duties under the permit. Training for individuals preparing the SWPPP must include the following topics:

- understanding the environmental impacts of construction activity
- general NPDES permit requirements including erosion prevention and sediment control
- dewatering requirements
- understanding that local stormwater requirements may differ from the state requirements
- inspections and maintenance requirements and timeframes
- good housekeeping, how to handle trash, waste, and chemicals
- liability and consequences of enforcement
- use of contracts for delegating SWPPP responsibility
- recordkeeping (inspections, BMP maintenance, SWPPP amendments)
- understanding that in some states the requirements may be different when discharging to certain waters
- SWPPP flexibility and knowing when amendments are required
- SWPPP phasing
- legible plans, better formats, readable by contractors
- specification writing
- narrative writing
- detailed work materials list – estimated preliminary quantities tabulation
- low impact development (LID) innovations and new products
- permanent stormwater management requirements
- TMDL and Special Waters requirements
- concrete washout facilities
- permit application, permit transfers and the notice of termination

The Construction Stormwater General Permit issued in Minnesota has one unique aspect that differs from most other states: Part III.C of the Permit requires post-construction stormwater-management systems to be constructed if the project is creating one or more acres of new impervious surfaces.

Whether the designer chooses to provide a wet sedimentation basin, infiltration basin or trench, rain gardens, filtration system, etc. the permit has very specific design and sizing requirements for each. These systems are usually designed by a licensed Professional Engineer (P.E.) however, this is not required by the permit. In most cases a P.E. certification will still be needed in order to obtain a building permit or to fulfill other local requirements.

A well-designed functional stormwater treatment system contains design elements beyond the permit requirements. For example, for an infiltration basin (or rain garden) the permit specifies sizing requirements and some performance criteria but gives little information on

how that can be accomplished successfully. Soil types must be checked, pre-treatment must be designed properly, construction techniques must be described in detail, and vegetation established at the end of infiltration basin construction. A trained individual must have enough engineering knowledge to understand the specific hydraulic design requirements set forth in the permit in addition to training that covers the additional specifics involved in a good design. Both of these elements are laid out in detail in the Minnesota Stormwater Manual: www.pca.state.mn.us/water/stormwater/stormwater-manual.html

Training must include detailed design examples similar to the examples found in the manual.

Site manager training requirements

Training for contractors overseeing implementation of, revising, and amending the SWPPP and performing inspections must include the following topics:

- understanding the environmental impacts of construction activity
- general NPDES permit requirements including erosion prevention and sediment control
- dewatering requirements
- inspections and maintenance requirements and timeframes
- good housekeeping, how to handle trash, waste, and chemicals
- liability and consequences of enforcement
- contracts
- recordkeeping (inspections, BMP maintenance, SWPPP amendments)
- understanding that there is more than one solution to a problem, promote innovation
- reading plans and specifications
- risk management - taking initiative before bad things happen
- communication between site staff and subcontractors, dissemination of knowledge
- emergency response – weekends, storms, freezes, notification, reclamation of sediment plumes
- requirements regarding concrete washout facilities
- permit application process, permit transfers and the notice of termination
- local availability of specific erosion and sediment control BMPs
- BMPs
  - ☐ installation
  - ☐ maintenance (to repair, replace or if necessary upgrade to better BMP)
  - ☐ are they installed in correct location
  - ☐ parking/access

Training should include many examples, group participation and discussions. Field demonstrations may also be appropriate. Individuals who are considered trained must also be knowledgeable about requirements specific to the State of Minnesota.

Training for individuals performing or supervising the installation, maintenance and repair of BMPs must include the following topics.

BMP installer training requirements

The third category of individuals who are required to be trained are those who are physically installing the BMPs or supervising that activity. The type of training for this group may be highly specialized for a particular task or more encompassing for an individual who operates a full service erosion and control business. Some of the typical BMPs that require installation by a trained individual include:

- silt fence
- dewatering
- mulch
- erosion control blankets
- ditch checks
- compost logs
- inlet protection
- hydro seeding or liquid soil stabilizers
- flocculants

The list of BMPs being used today for erosion-prevention and sediment control is extensive and growing. Construction site owners must ensure that individuals installing BMPs (to fulfill a requirement within the permit) be properly trained or supervised by a properly trained individual.

Recommended training for construction-site owners and others

Training is also recommended for owners of construction projects and for sub-contractors that have the potential to inadvertently cause or contribute to violation of the permit. This training is not required by the permit; it can, however, can be extremely beneficial to site owners.

A site owner should be aware of the basic requirements within the permit and understand that enforcement actions can result if a site is found out of compliance. Owners should understand the potential for environmental harm that exists during a typical construction project. Other topics owners should be aware of include:

- application procedure
- how to transfer a Permit if a portion of a project is sold
- liability and consequences of enforcement
- notice of Permit termination requirements
- SWPPP basics
- erosion prevention and sediment control basics
- dewatering requirements
- good housekeeping, how to properly handle trash, waste and chemicals
- local requirements
- role of post-construction stormwater treatment systems and potential value of LID or conservation design methods
- costs and bidding concepts
- contracts
- inspection and maintenance requirements

There are also subcontractors that should be aware of certain Permit requirements. Owners are advised to inform anyone on site about the presence of erosion and sediment control BMP's. For example, an operator delivering building supplies should know what a silt fence is and understand that it is a Permit violation to damage the fence and not repair or replace it. Another example: owners are required to provide a leak proof system to be used for concrete washout and concrete truck operators should understand that a site has such a facility and concrete washout activities can only occur using the washout system.

Where training is available

The MPCA has partnered with the University of Minnesota for the past five years to provide various certification courses for individuals working within the stormwater program. These certification courses are also sponsored by the Minnesota Department of Transportation (MnDOT) and are required for those individuals working on MnDOT projects.

There are currently three different classes targeted at the three different categories of individuals required to obtain the training outlined in the permit. When selecting a class be sure to select the class that best fits your role. For example SWPPP designers should enroll in the SWPPP design course while a site foreman in charge of the day-to-day activities in the field should take the site-management course. In order to remain certified for work on MnDOT projects, the course must be repeated every three years.

There is, however, no expiration period associated with the training requirements in the permit. It is highly recommended that ongoing education is repeated at least once every three years as the stormwater management industry is rapidly changing. The classes generally run in the fall and winter. More information and a class schedule can be found at: www.erosion.umn.edu

Other training opportunities exist and there are qualified individuals offering training. If you have received training in another state, it may satisfy the training requirements if the course curriculum was adequate and the individual has familiarized themselves with the specific requirements in the permit.

When selecting training courses or reviewing your past training, be sure to review the course content and verify that it meets all of your SWPPP-related duties.

Training should be provided by instructors with some background in education methods. Individuals that are widely accepted as experts in erosion control or SWPPP design, and who have provided training in the past, are considered trained for the purposes of this construction permit. These individuals usually have ten or more years of experience in the field.

Other entities that may offer training opportunities include:

- University of Minnesota
- Minnesota Erosion Control Association
- Private industries

- Other local, state, federal agencies, professional organizations, or other entities with expertise in erosion prevention, sediment control or permanent stormwater management.

Nationally recognized certifications

There are other nationally recognized certification programs regarding construction stormwater. These certifications include Certified Professional in Erosion Sediment Control (CPESC), Certified Professional in Storm Water Quality (CPSWQ) and Certified Erosion Sediment and Storm Water Inspector (CESSWI).

These certifications may fulfill the training requirements if the individual is knowledgeable about the stormwater requirements that are specific to the State of Minnesota and the content of the certification covers all of the individual's responsibilities regarding the permit. For example, an individual that holds a CPESC certification may be considered trained as a site manager but would not be considered a trained SWPPP designer if the SWPPP was required to have stormwater treatment systems constructed such as rain gardens or detention basins as the CPESC course does not cover those topics.

Likewise, a professional engineer is not considered trained to design an entire SWPPP as the typical engineering curriculum does not cover any erosion prevention or sediment control techniques. However a professional engineer would be considered trained to design the permanent stormwater treatment system as the sizing and hydrology principals are a part of the engineering curriculum if the individual is knowledgeable about the stormwater requirements that are specific to the State of Minnesota.

Documentation of training

The permit requires that documentation of the individuals working on a project be documented in the SWPPP or made available with 72 hours upon request by the MPCA. Documentation must include:

- names of the personnel associated with this project that are required to be trained
- dates of training and names of instructor(s) and entity that provided training

content of training course or workshop (including the number of hours of training)

More information

If you have questions, call the MPCA Stormwater Hotline at 651-757-2119 or 800-657-3804.

Minnesota Pollution Control Agency

Emergency Construction Stormwater Application

Overview

wq-strm2-32 • February 26, 2009

Emergency construction that is required to minimize the impacts of an emergency situation, in certain cases, does not require an application to be submitted to the Minnesota Pollution Control Agency (MPCA) in order to receive Construction Stormwater Permit coverage.

Notification

In emergency situations, small construction activities that disturb one to less than five acres may begin immediately after the MPCA is notified with basic site information including:

- Contact name/owner's name
- Name/address of the construction company
- Location/address of the construction activity
- List of the cities, counties, and townships where the construction activity is occurring
- The approximate acres to be disturbed by the construction activity
- A brief description of the emergency situation

How to contact MPCA

Emergency construction notification to the MPCA must be done through letter, telephone, or by facsimile.

Mailing address

Construction Stormwater Program
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155

Stormwater Program phone

651-757-2119 or toll-free at 800-657-3804 (leave message after hours)

Stormwater Program fax

651/297-8683

Requirements

Under the federal rule, National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit coverage for stormwater discharges associated with construction activity is required before the start of construction.

However, emergency situations often arise where immediate action is required to restore utility related services such as gas, or electricity or other essential public services including public transportation systems such as airports and roadways. These emergency situations may be the result of natural disasters or failures of systems unrelated to the utility operation and, therefore, may require immediate construction of emergency access, diversionary or replacement structures, or other types of activities

The MPCA has developed some flexibility in meeting the Construction Stormwater Permit application requirements when construction activities must begin

immediately to minimize the impacts of an emergency situation.

Minn. R. 7090.2020, subparts 1 and 2 - *Scope and Emergency* construction allow emergency construction resulting from natural disasters such as floods, tornados, and severe storms that present an imminent threat to public health and safety, public drinking water or the environment to begin without permit application, if the following specific requirements are met:

- The owner must notify the MPCA that emergency construction activities will begin. This is required so that the MPCA will know that purpose of the construction activity is for an emergency situation.
- The owner and the operator of the emergency construction activity must comply with the requirements of the Construction Stormwater Permit that apply to specific stormwater management practices, and Best Management Practices (BMPs) used to prevent or mitigate polluted stormwater runoff from leaving the construction site.

For emergency construction that will disturb equal to or greater than five acres, the owner must immediately contact the Construction Stormwater Hotline at 651-757-2119 or 800-657-3804

Notification

The MPCA will notify owners and operators of construction activities that disturb one to less than five acres of soil and meet the requirements stated above that they are covered under the Construction Stormwater Permit, even if the owner or operator has not submitted a permit application.

The construction activity must incorporate the erosion and sediment control requirements contained in the Construction Stormwater Permit even though a formal stormwater pollution prevention plan (SWPPP) has not been written. Though all requirements of the permit should be complied with, BMPs conducted on the site should at a minimum include these five steps to help you get your job done without damaging the environment:

1. Stabilize slopes

Without vegetation, whole hillsides are quickly washed away in a downpour. Cover your slopes with mats or mulch that will get plants growing right away.

2. Control your perimeter

Watch the flow of water on and off your site. Silt fences and other barriers make sure dirt doesn't escape. Embankments may keep extra water from entering your site.

3. Maintain silt fences

Silt fences only work so long, so replace them if they're torn or beat down. They'll also need to be replaced if silt has reached one-third the height of the fence.

4. Stop vehicle tracking

Install a section of course gravel at the exit to your site to keep mud off roads and residential streets.

5. Protect inlets

Prevent your stormwater ponds from filling with silt when you install storm-sewer inlet protection.

Measuring area

The area of disturbance measured to determine if the project disturbance is one to less than five acres should include all areas to be graded or otherwise within what might be considered the construction limits including construction of access roads and staging areas. Even if your emergency repair project is less than an acre in size and therefore does not require Construction Stormwater Permit coverage, the Construction Stormwater Program always recommends you incorporate appropriate BMPs to minimize the impact of runoff from the construction site to the lakes, streams or wetlands down slope of the project.

Submitting an application

A written project specific SWPPP must be developed and permit application submitted when the emergency effort becomes stabilized or for any follow-up project(s).

More information

For more information contact the Construction Stormwater Hotline at 651-757-2119 or 800-657-3804.

Visit Minnesota Pollution Control Agency Stormwater Web site: www.pca.state.mn.us/stormwater

Minnesota Pollution Control Agency

Stormwater Pollution Prevention Plan (SWPPP)

NPDES/SDS Construction Stormwater Permit Requirements

wq-strm2-29• March 2009

This factsheet provides guidance on writing an adequate stormwater pollution prevention plan (SWPPP) that will assist in keeping a construction site in compliance with the NPDES/SDS construction stormwater permit. The development of a proper SWPPP is a requirement of the permit and the responsibility of the owner.

What is a SWPPP?

A SWPPP is a plan that describes the strategies and steps that will be taken to prevent nonpoint source pollution discharging from a construction site. The SWPPP is a valuable tool and will become the backbone of the entire construction process related to erosion and sediment control and stormwater management, both during construction and post construction. The SWPPP includes a description of all construction activity, temporary and permanent erosion and sediment control BMPs, permanent stormwater management, and other pollution prevention techniques to be implemented throughout the life of the construction project. The SWPPP includes a combination of narrative plans and standard detail sheets.

Why do I need a SWPPP?

All construction projects disturbing one acre or more or that are part of a larger common plan of development that ultimately disturbs one acre or more are required to apply for an NPDES/SDS construction stormwater permit through the MPCA. The permit states that prior to submitting a permit application, the owner must develop a SWPPP for the construction site. The SWPPP is to be kept at the site for the duration of the project and retained in files for three years after the project is completed. If the construction project disturbs 50 acres or more and discharges to a special or impaired water, the SWPPP must be submitted along with the permit application to the MPCA 30 days prior to the start of any construction activity.

Planning ahead is the most effective way to minimize erosion and sedimentation during construction and reduce project costs.

How is a SWPPP helpful to me?

A successful SWPPP identifies the issues of concern before construction begins and is also adaptable for the many unexpected changes that come about with every construction project. Planning ahead is the most effective way to minimize erosion and sedimentation during construction and reduce project costs. A well organized and planned out SWPPP will assist in the prevention of unnecessary permit violations and save the owner and contractor time,

money, and effort over the course of the project.

What are the necessary components of a SWPPP?

The NPDES/SDS construction stormwater permit outlines specific requirements of a SWPPP. In order to develop a truly effective and useful SWPPP however, it is important to carefully think about each of these requirements and to clearly document a plan for the construction project.

- Identify all receiving surface waters; note any receiving impaired or special waters and the additional permit requirements for these waters.
- Identify the person to oversee BMP implementation and maintenance and define a chain of responsibility.
- Include a detailed description and timeline of all construction activities including the implementation of sediment and erosion control BMPs, as they are planned for at the start of the project.
- Strategically plan construction activities to limit the time in which soils are exposed; develop phases of the project so that some areas can be stabilized while others are exposed.
- Identify areas on site that can be left as undisturbed for the duration of the project or for a portion of the project.
- Clearly explain and include standard plates and specifications for all temporary erosion and sediment control BMPs.
- Estimate the quantities of temporary and permanent erosion and sediment control BMPs that will be needed for the duration of the project.
- Calculate the totals of pre-impervious and post-impervious surface acres. (*Minimization of impervious surfaces is encouraged.)*
- Plan out the permanent stormwater management provisions for sites resulting in more than 1 acre of impervious surfaces.
- Plan areas and develop specifications for all temporary and final stabilization.
- Identify all other pollutant sources on site and pollution prevention measures to be taken.
- Prepare inspection and maintenance documents for easy use throughout the project and identify a location where they will be kept onsite.

Note: additional information is required to be included in the SWPPP per the NPDES/SDS construction stormwater permit. See resources below for a copy of the permit and other guidance materials.

Changes and revisions to the SWPPP

The NPDES/SDS construction stormwater permit requires that the SWPPP be developed prior to the start of a construction project. It is often difficult to fully plan ahead and more often than not, unexpected changes arise throughout the duration of the project. For this reason, the SWPPP is a flexible and amendable document. It is a living document that should be revised as the project changes and should be used to document all project modifications. All changes to the project site must still fall under the requirements of the NPDES/SDS permit, but it is understood that the SWPPP will change as the construction project changes.

In the case of a change in property ownership, any new owner is required to have an up to date and complete SWPPP. The new owner can modify the original SWPPP or develop a new SWPPP that covers all information required by the permit.

Image courtesy of Emmons & Olivier Resources, Inc.

The NPDES permit requires that all erosion and sediment BMPS be clearly outlined in a site's SWPPP. Changes made throughout construction should be documented in the SWPPP.

Resources

Stormwater Compliance Assistance Tool Kit for Small Construction Operators. MPCA.
www.pca.state.mn.us/publications/wq-strm2-09.pdf

General Stormwater Permit for Construction Activity. MPCA.
http://www.pca.state.mn.us/water/stormwater/stormwater-c.html

Construction SWPPP Template. MPCA
www.pca.state.mn.us/publications/wq-strm2-12.pdf

Minnesota Pollution Control Agency

Linear Utility Projects

Guidance Regarding NPDES/SDS Construction Stormwater Permit Requirements

Water Quality/Stormwater #2.46 • February 2010

Use this guidance to determine whether a National Pollutant Discharge Elimination System/ State Disposal System (NPDES/SDS) construction stormwater permit is needed for your linear underground/ overhead project. Linear facilities include conduits, substructures, pipelines, towers, poles cables, wires, connectors, switching, regulating and transforming equipment, and associated ancillary facilities.

Background

Construction activities including clearing, grading, and excavating that will disturb one or more acres of land, or that are part of a larger common plan of development or sale that will disturb one or more acres of land, requires coverage under a NPDES/SDS construction stormwater permit.

How do I determine land disturbance area for my linear project?

Depending on the project type, to determine if the land area to be disturbed will be one acre or more, include the following areas in calculating the disturbed area:

- Surface areas of trenches and associated laterals. Backhoe or trencher work, including excavation width and stockpile area, and vehicle width if soil will be exposed during operation. The area of trenching impact should be determined by the width of trench, side casted material pile, and depending on level of disturbance, the width of the installation equipment. Trench spoils on a paved surface that are either returned to the trench or excavation or hauled away from the project daily for disposal or reuse are not included in the disturbed area calculation.
- Soil areas outside the surface area of trenches, laterals, and ancillary facilities that will be graded or disturbed by the use of construction equipment, vehicles, and machinery during construction activities. This includes tracked vehicles that cause rutting that disturbs the vegetative cover exposing soil the length of a vehicle traverse. (In general, work with tracked vehicles can result in minimal soil disturbance, as long as slope, soils, and weather are favorable.)
- Surface area of soil stockpiles located onsite or immediately adjacent to the project if the stockpile is not on a paved surface.
- Surface area of borrow areas located onsite or immediately adjacent to the project.
- Surface area of structure installation and other ancillary facilities (e.g. poles, pull boxes, fuse boxes, splice boxes, pads, etc.).
- Paved surface areas constructed for the purpose of the project.

Minnesota Pollution Control Agency • 520 Lafayette Rd. N., St. Paul, MN 55155-4194 • www.pca.state.mn.us
651-296-6300 • 800-657-3864 • TTY 651-282-5332 or 800-657-3864 • Available in alternative formats

- New roads constructed or major reconstruction to existing roads (e.g. improvements to two-track surfaces or road widening) for the purpose of accessing construction activities or as part of the final project.
- Staging, preparation, equipment and material storage areas not on paved surfaces.

How do I determine if my linear project is part of a common plan?

A common plan of development or sale means a contiguous area where multiple separate and distinct land disturbing activities may be taking place at different times, on different schedules, under one proposed plan. A "common plan" may consist of non-contiguous separate projects. In this case, for discrete construction projects that are located within a larger common plan that are at least 1/4 mile apart, each project (e.g. individual structure) can be treated as a separate plan of development or sale provided no land disturbing activity is proposed between the projects.

Example: Two oil and gas well pads separated by 1/2 mile could be treated as separate development plans if no land disturbing activity is proposed between the pads. However, if the same two well pads are connected by an access road or other land disturbing activity, all three areas would be considered part of a "common plan" for permitting purposes even if the construction activity is occurring at separate times.

Example: If a utility company were constructing new trunk lines off an existing transmission line to serve separate residential subdivisions located more than 1/4 mile apart, the two trunk line projects could be considered to be separate projects

What if conditions change during construction and the disturbed area is greater than originally estimated?

If you originally determined that NPDES/SDS construction stormwater permit coverage was not required for your project, appropriate best management practices (BMPs) should be used for erosion prevention and sediment control to avoid transport of sediment and associated contaminants that would violate water quality standards downstream from the project area during project construction.

During dry or frozen ground conditions with snow cover, soil disturbance from installation of linear facilities is generally expected to be minimal. Under these conditions, the need for BMPs is dependent on the proximity of the project to waters of the state, the amount of soil disturbance, and the potential to violate state water quality standards during construction.

However, if unexpected rainfall or wet soil conditions occur that will result in larger exposure of soil, one acre or more, or your area of disturbance is greater than you originally calculated, you will need to meet the requirements for permit application and obtain NPDES/SDS construction stormwater permit coverage.

What is required for linear projects and wetlands?

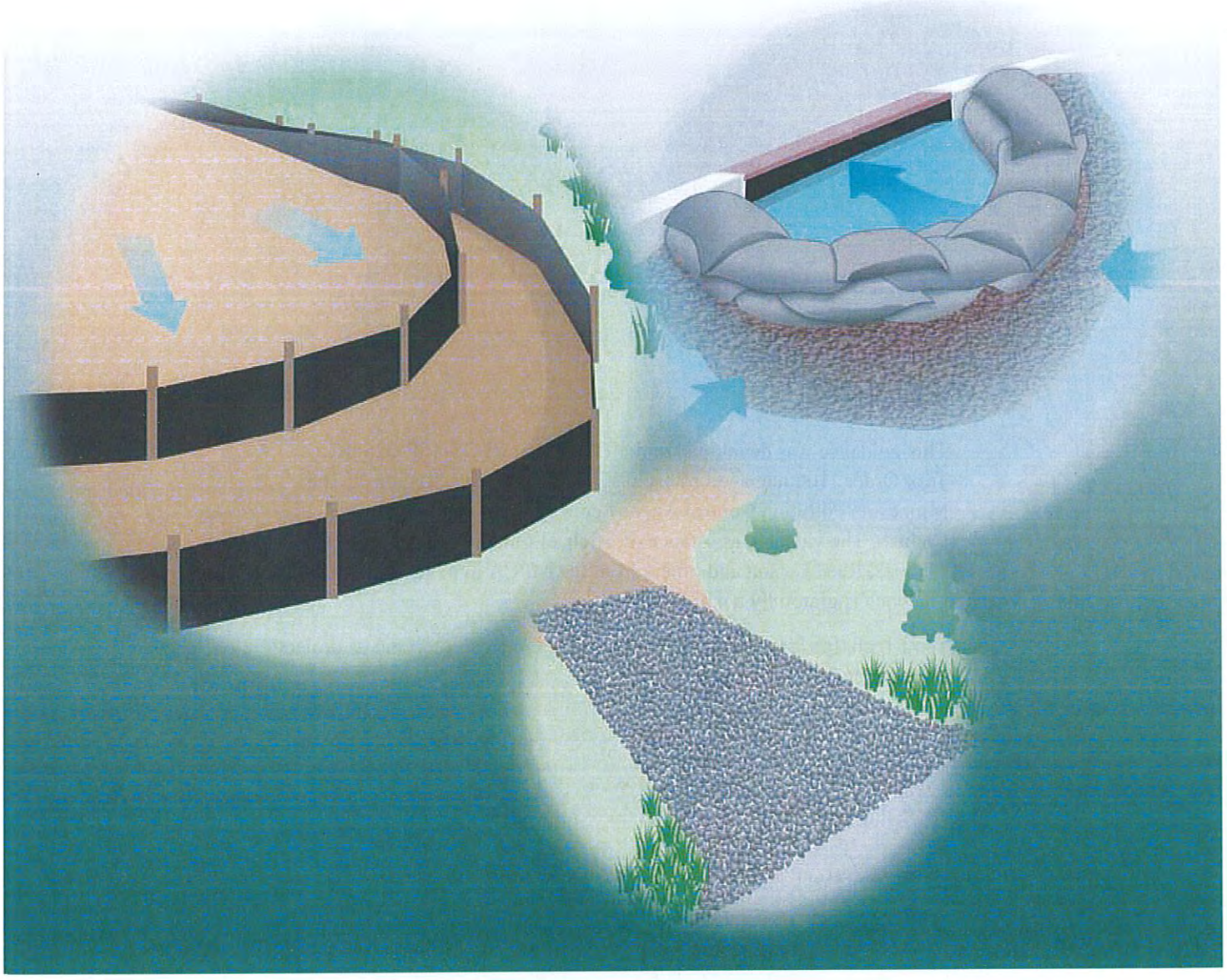
The project should be in compliance with state and federal wetland regulations, including the Minnesota Wetland Conservation Act, and Section 404 of the Clean Water Act, as applicable.

Application materials

To get an application form and find more information about applying for permit coverage, visit the MPCA construction stormwater Web site at: www.pca.state.mn.us/water/stormwater/stormwater-c.html

More information

MPCA Stormwater Hotline
651-757-2119
800-657-3804 (toll free)



Stormwater Compliance Assistance Toolkit for Small Construction Operators

Minnesota Pollution Control Agency

August 2008

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Introduction

This guidance is intended as a resource to help small construction operators comply with the Minnesota Pollution Control Agency's (MPCA) Construction Stormwater General Permit. The permit requires the development and implementation of a stormwater pollution prevention plan (SWPPP), which is your plan to decrease soil erosion and water pollution during construction. Small construction operators manage construction projects on sites less than 5 acres; however, large construction operators may also benefit from the information in this guidance.

This guidance explains who needs to apply for the permit, how to develop a stormwater pollution prevention plan (SWPPP), typical best management practices (BMPs) you may use during construction, and what you need to do during and after construction. In addition, a SWPPP template is included in Attachment A to help small construction operators develop a SWPPP that meets permit requirements.

This guidance does not replace the construction stormwater permit. All construction operators are strongly encouraged to read and understand the requirements described in the actual permit before applying for the permit and commencing construction.

It's important to note that the BMPs described in this guide need to be executed in the proper manner or the expected benefits will not be realized and the site may be deemed in violation.

Comments welcome

This is the second edition of the *Compliance Assistance Toolkit*. We welcome comments and suggestions on how it might be changed in future editions to better assist developers and construction firms in reducing stormwater runoff, both during construction and longterm. Send comments to:
Joyce Cieluch, MPCA Stormwater Compliance
714 Lake Avenue, Suite 220, Detroit Lakes, MN 56501
joyce.cieluch@pca.state.mn.us

Chapter 1

MPCA's Construction Stormwater Permit

The MPCA issued the National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) General Stormwater Permit for Construction Activity in August 2008. Owners and operators of construction activity disturbing **one acre or more** of land need to obtain the construction stormwater permit. Sites disturbing less than one acre within a larger common plan of development or sale that is more than one acre also need permit coverage.

Who is required to obtain the MPCA construction stormwater permit?

The ***owner*** who signs the application is a permittee and is responsible for compliance with all terms and conditions of this permit. The ***operator*** (usually the general contractor) who signs the application is a permittee for Parts II.B., Part II.C. and Part IV. of the permit and is jointly responsible with the owner for compliance with those portions of the permit.

The owner can also be a lease, easement, or mineral rights license holder if the construction activity is for the leaseholder, or the owner can be the contracting government agency responsible for the construction activity. The owner and operator can be one and the same and must sign both sections in the application. However, if you are required to have permit coverage on a site that already has a NPDES permit, you may transfer the coverage to your name by using the Notice of Termination/Permit Modification form.

The operator is the person designated by the owner who has day-to-day operational control and/or the ability to modify project plans and specifications related to the stormwater pollution prevention plan (SWPPP). This person must be knowledgeable in those areas of the permit for which he is responsible (Part II.B and Part IV).

What is a "larger common plan of development or sale?"

A common plan of development or sale means a contiguous area where multiple separate and distinct construction activities are occurring under one overall plan (e.g., the operator is building on three half-acre lots in a 6-acre development). The "plan" in a common plan of development or sale is broadly defined as any announcement or documentation or physical demarcation indicating that construction activities may occur on a specific plot.

What type of projects do not require this construction stormwater permit?

Agricultural land disturbing activity – if one or more acres of land will be disturbed for conversion of previously non-agricultural (crop) land to agricultural (crop) land, that activity is not required to have permit coverage.

Silvicultural activity – logging activity that is not associated with a construction project (not performed in order to clear land for anticipated construction activity) is not required to have permit coverage. However, roads that are constructed for logging purposes that disturb one or more acres are required to have permit coverage.

What are some of the main permit requirements?

Permittees are required to develop a SWPPP and submit an application and $400 application fee. Applications and other forms are available by calling the MPCA front desk at 800-657-3864 or 651-296-6300 and asking for Construction Stormwater Support Staff or visiting www.pca.state.mn.us/water/stormwater/index.html.

In addition to developing the SWPPP, permittees must implement the SWPPP, conduct regular inspections, and maintain BMPs. Inspections are required once every seven days during active construction and within 24 hours after a rainfall event greater than 0.5 inches in 24 hours. The next inspection must be conducted within seven days after that. At the end of the project, after all disturbed surfaces are stabilized, the permittee must submit a notice of termination (NOT) to let MPCA know that the construction activity is complete.

For most sites, construction may begin seven days after the application is postmarked. For sites that are more than 50 acres and that discharge to outstanding natural resource value waters (special waters) or impaired waters, the SWPPP and application materials must be submitted to the MPCA at least 30 days prior to commencing construction.

What are "special waters?"

Additional requirements apply to construction sites that discharge within one mile of a special water. These waters can include:

- Wilderness areas (such as the Boundary Waters Canoe Area Wilderness, Voyageurs National Park, and parts of Kettle River and Rum River)
- Mississippi River (portions of)
- Scenic or recreational river segments (such as the Saint Croix River and Cannon River)
- Lake Superior
- Lake trout lakes
- Trout lakes
- Scientific and natural areas
- Trout streams

(See Appendix A, Part B of the construction stormwater permit for more information or use the Special Waters Search tool on the MPCA construction stormwater Web page.)

How do I apply for the construction stormwater permit?

To help you comply with the requirements in the construction stormwater permit, the MPCA has developed the following "Steps to construction" to assist with the permit requirements. These steps are also available on the MPCA's stormwater Web site. Remember that completing the application is one of the last things you do. Follow the steps below:

Step 1. Identify the construction site boundaries, the latitude and longitude for the site, and the major phases of the project.

The first thing you will need to do is identify the boundaries of your construction site. Identifying these construction site boundaries is important for determining which environmental resources may be at risk of being impacted by the project. This will also help you fill out the application, which requires you to fill out the total number of acres to be disturbed, the latitude and longitude of the center of the site, surface waters within one mile of the project that will receive stormwater from the site, and a copy of a USGS 7.5-minute quad or equivalent map with the site boundaries indicated. The latitude and longitude should correspond to a point "on site" which is closest to the approximate center of the construction site.

Identifying the major phases of a project will help you develop a plan to eliminate or minimize the potential environmental impacts.

Step 2. Determine if additional permits are needed.

It is your responsibility to contact other state and federal agencies and local governments to determine if additional permits are required in addition to the NPDES/SDS permit issued by MPCA. An example of an additional permit that could be required is a Section 404 permit from the Army Corps of Engineers if work will occur in a waterway or wetland. Local zoning offices are good places to check for required permits.

Step 3. Determine if Environmental Review is needed.

Contact the Minnesota Environmental Quality Board, the appropriate state agency, or local government agency to determine if your proposed project meets or exceeds the thresholds outlined in the state environmental review rules. For more information, see the two Web links below:

Minnesota Environmental Quality Board: Environmental Review
www.eqb.state.mn.us/program.html?Id=18107

MPCA: Environmental Review
www.pca.state.mn.us/programs/envr_p.html

Step 4. Understand the requirements of the NPDES/SDS Construction Stormwater General Permit.

Read and understand the requirements in the NPDES/SDS Construction Stormwater Permit itself. MPCA has developed this guidance document and a summary of the permit *(Overview of Minnesota's NPDES/SDS Construction Stormwater Permit, August 2008)* to help you understand the requirements. Copies of the permit and this summary are available at www.pca.state.mn.us/water/stormwater/stormwater-c.html or call the MPCA front desk at 651-296-6300 or 800-657-3864 and ask for Construction Stormwater Support Staff.

By signing and submitting the application described below, you are legally committing to follow the permit requirements. Make sure you know what these requirements are!

Step 5. Identify waters that have the potential to receive a discharge of stormwater runoff from the project or discharge from a permanent stormwater management system.

Page 2 generally describes "Special Waters." Impaired waters are those identified by the State and EPA as waters not meeting their designated uses for specific pollutants. You will need to identify all waters, including special waters or impaired waters, that are within a mile of a discharge point from your project.

Special Waters. MPCA has developed an electronic map tool called Special Waters Search to help you identify these waters (www.pca.state.mn.us/water/stormwater/stormwater-c.html). You can also download the *Special Waters Document* from the MPCA's stormwater Web site and use a quad map to identify your construction site and any special waters located within a mile of your site boundary.

Impaired Waters. Use the Special Waters Search or the *most recent TMDL List of Impaired Waters* (www.pca.state.mn.us/water/tmdl/tmdl-303dlist.html) and a quad map to identify impaired waters within a mile of your site boundary. If you discharge to an impaired water, go to MPCA's TMDL Web site to determine if that water has a TMDL that includes construction stormwater requirements.

Use a USGS 7.5-minute quad map to identify all waters (other than those identified above) that are within a mile of your construction site and have the potential of receiving a discharge from the site.

Step 6. Determine if discharges from the construction site will impact endangered or threatened species, historic places, or calcareous fens.

It is your responsibility to check if discharges from your site will impact endangered or threatened species, historic places, or calcareous fens. Information on calcareous fens is available using the *Special Waters Search* tool. Projects that discharge to a calcareous fen must get a letter of approval from the Minnesota Department of Natural Resources.

Information on endangered or threatened species and historic places is available from the contacts below:

Minnesota Department of Natural Resources – Natural Heritage Program
www.dnr.state.mn.us/eco/nhnrp/nhis.html

Minnesota Historical Society – National Register Properties
http://nrhp.mnhs.org

Step 7. Prepare a stormwater pollution prevention plan (SWPPP).

See Chapter 2 for more information on developing a SWPPP. You must have this SWPPP developed before you submit your application (step 10).

Step 8. Re-check the receiving waters that the project discharges to.

After developing your SWPPP, you may find that your project boundaries have moved or your discharge locations have changed. Double check the information you obtained in steps 5 and 6 to make sure it is still accurate. You will need to list the waters that receive a discharge from your construction site on the permit application form.

Step 9. Complete the application form for an MPCA NPDES/SDS stormwater permit for construction activities.

The application form includes permit application prerequisite questions, information about the construction activity, and information including signatures of the responsible parties (both the construction site owner and operator). A copy of the application form can be viewed and/or downloaded at www.pca.state.mn.us/water/stormwater/stormwater-c.html or by calling the MPCA front desk at 651-296-6300 or 800-657-3864 and asking for the Construction Stormwater Support Staff. The online file includes the application form/instructions and the entire permit.

Step 10. Submit the application form and fee to the MPCA.

Submit the signed application form, site map, and $400 permit fee (do not include your SWPPP with the application but keep it on site) to the MPCA at:

MPCA
Construction Stormwater Permit Program
520 Lafayette Road North
St. Paul, MN 55155-4194

You must submit the application at least 7 days before your construction start date, except for the following situations or alternatively you may submit your application on-line at least 48 hours before construction activity starts.

- Projects requiring an Individual Permit must submit applications at least 180 days before the construction start date.
- For projects with an alternative treatment technology (see Part III.C.5 of the permit), your application must be postmarked at least 90 days before the construction start date (include a copy of your SWPPP and alternative treatment method documentation with your application).
- For projects disturbing 50 acres or more and discharging within a mile of a special water or impaired water, you must submit (mail) the application fee and SWPPP for MPCA review at least 30 days before the construction start date.

Keep a copy of your completed application form.

Step 11. Implement the SWPPP and begin construction.

Unless notified to the contrary, you can begin construction after completing your SWPPP and after permit coverage is granted, which is 7, 30 or 90 days (depending on the applicable review period) after the postmark date of the completed application form, except for the following situations:

- For Individual NPDES/SDS Construction Stormwater Permit projects, permit coverage starts only after permit development, public input, and permit issuance.
- For projects with alternative technology, permit coverage starts after receiving an alternative treatment approval letter from the MPCA.
- For projects disturbing 50 acres or more and discharging within a mile of a special water or impaired water, permit coverage starts 30 days after the postmarked date of the completed application unless notified in writing that the SWPPP does not meet the general permit requirements.

If the application was submitted on-line, unless notified to the contrary, you can begin construction after completing your SWPPP and 48 hours after submitting your on-line application.

Why get a permit? Addressing the problem of runoff

Construction activity can impact our water resources in two main ways: through water **quality** impacts from excessive erosion and discharge of other pollutants and through water **quantity** impacts caused by increases in impervious surfaces.

During a short period of time, construction activity can contribute more sediment to streams than would be deposited naturally over several decades, causing physical and biological harm to our waters. Uncontrolled construction site runoff can reduce clarity and lower dissolved oxygen in waterbodies; deposit excess sediments in waterways; and smother aquatic habitat including spawning sites. Runoff can also transport other pollutants attached to sediment particles such as pesticides and chemicals.

The addition of impervious surfaces increases the temperature, velocity and volume of discharges into wetlands, ponds and rivers. These factors reduce vegetative filtering and infiltration (less water soaks into the ground for recharge of the aquifer and base flow for streams). Impervious surfaces also increase flooding, which threatens human life and property, causes stream bank erosion, and damage to aquatic habitat and water quality.

There is a suite of enforcement options available to local government or state agencies to help achieve permit compliance, ranging from field requests and formal notices to local citations, administrative penalty orders, stipulation agreements, stop-work orders and permit revocations. Local governments may require developers to acquire a performance bond. State law provides for civil and criminal penalties for permit and water quality law violations of up to $10,000 per violation per day.

An important element when assessing stormwater program violations is whether or not a permit has been applied for. The application process requires a site-specific Stormwater Pollution Prevention Plan (SWPPP), because experience has shown regulated parties are less likely to analyze site conditions relative to erosion and loss of sediment when a SWPPP is not developed. Lack of analysis becomes a key component of environmental harm considerations in the enforcement process.

While enforcement options are available, assisting contractors in achieving permit compliance and resource protection is our main focus and the goal of this publication.

Chapter 2

How Do I Develop a Stormwater Pollution Prevention Plan (SWPPP)?

Steps to developing an effective SWPPP

The following steps will help you develop and implement an effective SWPPP:

Step 1. Evaluate the site

Step 2. Identify goals and objectives

Step 3. Describe roles, the site and construction activity

Step 4. Develop BMPs for construction activity

Step 5. Develop BMPs for permanent stormwater management

Step 6. Implement the SWPPP

Step 7. Inspect, maintain and evaluate BMPs

Step 8. Update the SWPPP

The person preparing the SWPPP must have received appropriate training. (Part III.A.2.)

Step 1: Evaluate the site

Begin by evaluating the site to determine the critical issues that will need to be addressed in the SWPPP. Determine how stormwater will drain from the site, including the number and location of discharge points. Identify any surface waters within a mile that will receive runoff from your site. Note whether any are special or impaired waters. Identify any storm drain inlets that may receive a discharge from your project.

Identify potential sources of pollution that may reasonably be expected to affect the quality of stormwater discharges from your construction site. These could be fueling areas, concrete washouts, material storage areas, trash containers, and other materials that can be mobilized by stormwater runoff. You must also identify potential construction exits from the site, and determine if there are steep slopes on the project that will require extra protection.

Step 2: Identify project goals and objectives

Your overall goals during construction are to prevent erosion and minimize any sediment transport from your site. Post-construction goals are to reduce or minimize the impact on receiving waters from stormwater discharges from the site. You will do this primarily through developing and implementing your SWPPP.

Every project must also try to meet the following objectives:

- *Minimize disturbed areas and protect vegetation.* If practical for your site, consider phasing construction activities so that you only clear the portion of the site that you will be working on in the near future. Identify areas of vegetation, trees, and sensitive areas that must be protected by placing a physical barrier around these areas.
- *Protect slopes and channels.* Convey stormwater runoff around the top of slopes and stabilize slopes as soon as possible. Where a large amount of runoff must flow over a disturbed slope, use a slope drain to convey the water to the bottom of the slope for minimum erosion. Avoid disturbing natural channels.
- *Reduce impervious surfaces and promote infiltration.* Reducing impervious surfaces will ultimately reduce the amount of runoff leaving your site. Also, divert rooftops and other impervious surfaces to grassy areas when possible to promote infiltration.
- *Control the perimeter of your site.* Divert runoff coming on to your site. Install BMPs such as silt fences to capture sediment before it leaves your site.
- *Follow pollution prevention measures.* Provide proper containers for waste and garbage from your site. Store hazardous materials and chemicals so that they are not exposed to stormwater runoff. Define and place signs for concrete washout. Do not degrease machinery on-site.

Step 3: Describe roles, the site and construction activity

The construction *owner* is the person possessing the title of the land on which the construction activities will occur. The construction *operator* has operational control over construction plans and specifications and can commit resources to implementing the BMPs described in the SWPPP. However, stormwater pollution control is typically not the job of a single person; therefore, you must describe in the SWPPP the roles and responsibilities of everyone involved in implementing the SWPPP.

The owner is responsible for identifying a person (or job title such as foreman) who is knowledgeable, experienced and trained in the application of erosion and sediment control BMPs before and during construction. The owner must also identify the person (or entity) who will have the responsibility for long-term operation and maintenance of the permanent stormwater management system. The owner must also develop a chain of responsibility with all operators on the site to ensure that the SWPPP will be implemented and stay in effect until the construction project is complete; the entire site has undergone final stabilization; and a Notice of Termination (NOT) has been submitted to the MPCA.

Provide a brief description of the nature of the construction activity. This must include:

- The function of the project (e.g., low density residential, shopping mall, highway, etc.);
- The intended sequence and timing of activities that disturb soils at the site; and
- Estimates of the total area expected to be disturbed by excavation, grading, or other construction activities, including dedicated off-site borrow and fill areas.

Site Map

Include in your SWPPP a legible site map, showing the entire site, and identifying:

1. Existing and final grades, including dividing lines and direction of flow for all pre and post-construction stormwater runoff drainage areas located within the project limits;
2. Impervious surfaces and soil types;
3. Locations of areas that will not be disturbed;
4. Location of areas where construction will be phased in to minimize duration of exposed soil areas;
5. All surface waters and existing wetlands, which can be identified on maps such as USGS 7.5-minute quad maps within one mile from the project boundaries, which will receive stormwater runoff from the construction site, during or after construction. If these waters do not fit onto the site map, identify them with an arrow indicating the direction and distance to the surface water; and
6. Methods to be used for final stabilization of all exposed soil areas.

Your site plan is a dynamic document. As conditions change at the construction site, such as the locations of BMPs, you must update your site plan to reflect those changes. The person overseeing the implementation of the SWPPP has to have the appropriate training (Part III A.2.).

Step 4: Develop BMPs for construction activity

Select appropriate BMPs to control stormwater runoff during construction. The following BMPs are commonly used on small sites disturbing less than five acres:

- *Protect storm drain inlets.* All inlets receiving stormwater from the project must be protected until all disturbed areas with a potential for discharging to the inlet have been stabilized. Inlet protection may be removed for a particular inlet if a specific safety concern has been identified and you have received written correspondence from the jurisdictional authority.
- *Establish stabilized construction exits.* Use stone pads, concrete or steel wash racks, or equivalent practices to contain vehicle tracking of sediment. Sweep the street if necessary.

- *Protect slopes.* Slopes longer than 75 feet on a 3:1 grade must be broken up using sediment control practices (e.g., sediment barrier). All exposed soil areas must be stabilized as soon as possible to limit soil erosion, but in no case later than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. If you are within one mile of impaired or special waters, all exposed soil must be stabilized as soon as possible but in no case later than seven days after the construction activity in that portion of the site has temporarily or permanently ceased.
- *Protect ditch bottoms (normal wetted perimeter).* Any temporary or permanent ditch that drains water from a construction site or diverts water around a site, must be stabilized within 200 lineal feet from the property line **or** from the point of discharge to any surface water. Stabilization must take place within 24 hours of connecting to a surface water.
- *Install silt fence (or equivalent sediment control) along the down slope perimeter.* Use practices such as silt fence, sediment traps, or other practices to capture runoff leaving the site.
- *Control any dewatering practices.* Discharge dewatering or basin draining water to a temporary or permanent sedimentation basin on the project.
- *Control the location of and runoff from temporary stockpiles.* Place temporary stockpiles away from surface waters including stormwater conveyances such as curb and gutter systems, or conduits and ditches. Control runoff from stockpiles by tarping, using silt fences or other effective sediment controls.
- *Implement pollution prevention measures.* Control solid waste using proper trash management practices. Properly store oil, gasoline, paint and other hazardous substances. External washing of vehicles must be limited to a defined area on the site. No engine degreasing allowed on site. Runoff must be contained. Concrete washout must be limited to defined sites. These sites have to have a sign. Be aware that if your site has a point that is within one mile and discharges to speical waters or impaired waters (impaired because of phosphorous, turbidity dissolved oxygen, or biotic impairement) additional BMPs are needed. These additional BMPs can be found in Appendix A of the permit. (Part I.A.7, Part III.A.9, Appendix A .B.9)

Step 5: Develop BMPs for permanent stormwater management

If your project replaces vegetation and/or other pervious surfaces with one or more acres of cumulative impervious surface, then you will need to design practices to treat the runoff from these impervious surfaces. At least ½ inch of runoff (called the water quality volume or live storage) from the new impervious surfaces must be treated.

Calculations for determining the size of your stormwater management system should be kept with the SWPPP.

The methods available for treating the water quality volume include (see the permit for all of the design requirements):

- *Wet sedimentation basins.* A permanent storage volume (dead storage) of 1800 cubic feet/acre that drains to the basin must be provided. The water quality volume (live storage) must be discharged at no more than 5.66 cubic feet per second (cfs) per acre of surface area of the pond.
- *Infiltration/filtration.* Options include infiltration basins, infiltration trenches, rainwater gardens, sand filters, organic filters, bioretention areas, enhanced swales, dry storage ponds with underdrain discharge, off-line retention areas, and natural depressions.
- *Regional ponds.* You must obtain written authorization from the pond owner before discharging to a regional pond and the pond must meet the permit's design requirements.
- *Combination of practices.* You can use a combination of the above practices.
- *Alternative method.* You can propose an alternative method, but it must achieve 80% removal of total suspended solids on an annual average basis and MPCA must approve your plan before construction.

For those areas of your project where there is no feasible way to meet the requirements for the water quality volume, you may use other treatment such as grassed swales, smaller ponds, or grit chambers prior to discharging to surface waters. You can treat a cumulative maximum of three acres or 1% of project size (whichever is larger) in this manner.

See part III.C of the general permit for more information and minimum design requirements of the permanent stormwater management system. Additional information on permanent stormwater management practices is available in MPCA's guidance document called *Protecting Water Quality in Urban Areas*. This document is available for ordering or downloading on the MPCA's Web site: www.pca.state.mn.us/water/pubs/sw-bmpmanual.html.

Step 6: Implement the SWPPP

You must implement your SWPPP *before* construction activity begins. This typically means installing storm drain inlet protection, stabilizing construction exits, and installing perimeter sediment controls before clearing and grading activities begin. The person who implements the SWPPP has to have appropriate training. (Part III.A.2)

Additional BMPs must be installed as soon as possible during construction.

Step 7: Inspect, maintain and evaluate BMPs

Your responsibility doesn't stop after your BMPs are implemented. You are required to periodically inspect and maintain the BMPs on your site and you need to have received

the appropriate training (Part III A.2). See Chapter 4 for more information on the inspection and maintenance requirements.

You must also evaluate whether the BMPs you have selected are working. If they are not, modify your practices. For example, if your perimeter silt fence is frequently failing, you may need additional erosion controls upslope of the silt fence. You must continuously evaluate the practices you've implemented to determine if something better would work.

Records

You must keep the SWPPP, all changes to it, and inspection and maintenance records at the construction site. The SWPPP can be kept in either the field office or in an on-site vehicle. After the construction project is complete, keep the SWPP on file for at least three years after submittal of your NOT.

Step 8: Update the SWPPP

Finally, update your on-site SWPPP as necessary during construction to reflect any changes made. The MPCA requires you to update your SWPPP whenever:

- There is a change in design, construction, operation, maintenance, weather or seasonal conditions that has significant effect on the discharge of stormwater from your site;
- Inspections indicate the SWPPP is not effective in minimizing the discharge of pollutants to surface waters;
- The SWPPP is not consistent with the requirements in the permit; or
- The MPCA notifies you in writing that changes are needed.

Updates to your SWPPP must also include updates to your site plan as necessary to reflect changes in where BMPs are being implemented on-site.

Construction SWPPP Template

To help you develop a construction SWPPP, the MPCA has developed a template which is provided as Attachment A in this guide. This template is also available as a Microsoft Word document on the MPCA stormwater construction Web site.

The Word document allows you to "fill in the blanks" when developing your SWPPP. This is only a template, you may need to include additional information based on the conditions at your site, or based on requirements from local agencies.

Chapter 3

What kind of BMPs can I use in my SWPPP?

Erosion Prevention and Sediment Control BMPs

You can avoid many problems at your construction site by following the advice "divert the clean water, trap the dirty water." Limit the amount of ground you disturb and re-vegetate as soon as possible to prevent runoff from getting dirty in the first place. Divert clean water coming on to your site so you don't have to spend extra money treating it. Finally, for the areas of the construction site you do have to disturb, design practices to minimize erosion and then select practices to control sediment once erosion occurs. Note that you must include in the SWPPP the estimated preliminary quantities anticipated at the start of the project for the site of the project for all erosion prevention and sediment control BMPs (Part III A.4.b). Below are some common BMPs to help you achieve these goals. Note that it is important to construct BMPs properly in order to achieve the desired benefits.

The BMPs below are intended to provide information on selecting appropriate BMPs for your SWPPP. For detailed design guidance, refer to one of the guidance documents below or contact a stormwater design engineer.

- MPCA's *Protecting Water Quality in Urban Areas: Best Management Practices for Dealing with Stormwater Runoff from Urban, Suburban and Developing Areas of Minnesota* (2000).
  www.pca.state.mn.us/water/pubs/sw-bmpmanual.html
- Metropolitan Council's *Minnesota Urban Small Sites BMP Manual: Stormwater Best Management Practices for Cold Climates* (2001).
  www.metrocouncil.org/environment/Watershed/bmp/manual.htm

You should know that if you are going to prepare the SWPPP, you should have received appropriate training (Part III.A.2.).

Minimize disturbance

You must plan for and implement appropriate construction phasing to minimize exposed soil at any one time. Schedule clearing, grading, excavating and other land disturbing activities only when you will be actively working on that portion of the project.

Preserve existing vegetation at the site where possible. This includes areas next to streambanks, steep slopes, floodplains, and other sensitive areas. The location of areas not to be disturbed must be delineated (e.g., with flags, stakes, signs, silt fence, etc.) on the development site before work begins.

Permit requirement (Part IV.B.1):

- The Permittee must plan for and implement appropriate construction phasing, vegetative buffer strips, horizontal slope grading, and other construction practices that minimize erosion...

Protect slopes and ditch bottoms (normal wetted perimeters)

Use terracing or soil roughening practices to decrease runoff velocities, trap sediment, and increase infiltration on slopes. Tracking with machinery up and down (perpendicular to the slope) will provide grooves that catch seed and rainfall, reducing runoff and making it more difficult for rills and gullies to form on the slope.

For steep slopes, consider blankets, seeding or hydromulch to stabilize the slope.

Slopes with a grade of 3:1 or more must not have an unbroken slope length greater than 75 feet. Consider benching, staked fiber rolls, or other practices to break up the slope.

Permit requirement (Part IV.B.2-3):

- All exposed areas must have temporary erosion protection or permanent cover for the exposed soil areas as soon as possible but in not case later than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.
- Any temporary or permanent ditch that drains water from a construction site or diverts water around a site, must be stabilized within 200 lineal feet from the property line **or** from the point of discharge to any surface water. Stabilization must take place within 24 hours of connecting to a surface water.

Storm drain inlet protection

Storm drain inlet protection prevents sediment from entering a storm drain by surrounding or covering the inlet with a filtering material. This allows sediment-laden runoff to pond and settle before entering the storm drain.

Several types of filters are commonly used for inlet protection: silt fence, sand bags or block and gravel. The type of filter will depend on inlet type (curb inlet, drop inlet), slope, and amount of flow. Many commercial inlet filters are also available. Some commercial inlet filters are placed in front or on top of an inlet, others are placed inside the inlet and under the grate.

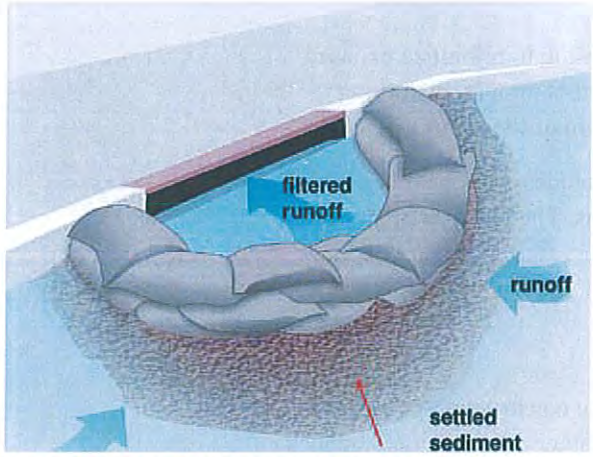

Figure 1. *Sand or gravel bags can be used to filter stormwater runoff before entering a catch basin. Commercial products are also available that fit in front of or inside the catch basin.*

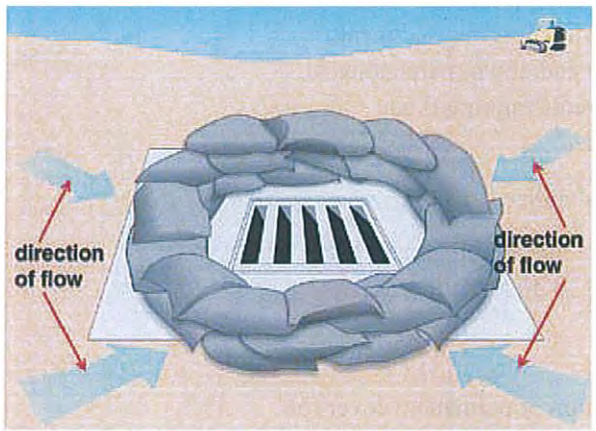

Figure 2. *Sand or gravel bags used to protect a drop inlet.*

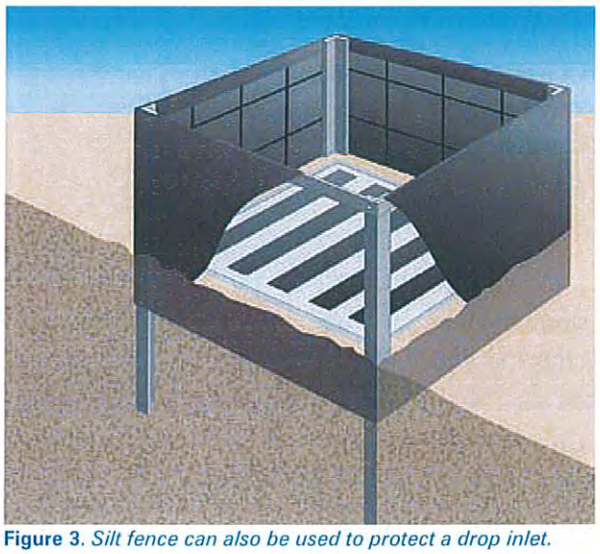

Figure 3. *Silt fence can also be used to protect a drop inlet.*

Permit requirements:

- All storm drain inlets must be protected by appropriate BMPs during construction until all sources with potential for discharging to the inlet have been stabilized. Inlet protection may be removed for a particular inlet if a specific safety concern has been identified and you have received written correspondence from the jurisdictional authority. (Part IV.C.4)
- All sediment control BMPs must be inspected to ensure integrity and effectiveness. All nonfunctional BMPs must be repaired, replaced, or supplemented with functional BMPs (Part IV.E.4)

Installation tips:

- Install inlet protection as soon as storm drain inlets are installed (or before land disturbance activities begin in areas with existing storm drain systems)
- Protect all inlets that will receive stormwater from your construction project.
- Inlet protection is a secondary BMP. Make sure you have other erosion prevention and sediment control BMPs in place.
- Safety is a consideration when determining the best method to protect an inlet. For example, if two feet of ponded water around an inlet will cause flooding of a nearby roadway, have an overflow at one foot of depth and additional controls at the outlet.

Maintenance:

- Inspect inlets at least weekly and within 24 hours after each rain event of at least .5 inches within a 24-hour period. The next inspection must be conducted within seven days after that.
- Remove accumulated sediment behind the inlet protection and any sediment that enters a storm drain.
- Replace the inlet protection when it becomes damaged.

City of MPLS note: In areas open to public traffic, do not use products that stand above the road surface, because of safety hazard and flooding potential.

Stabilized Construction Exit

A rock construction exit can reduce the amount of mud transported onto paved roads by vehicles. The construction exit does this by removing mud from the vehicle tires before the vehicle enters a public road.

In some cases, a wash rack may be used to wash tires and keep driving surfaces mud-free. Wash water must be directed to a suitable settling area and must not be discharged to a stream or storm drain.

Permit requirements:

- Vehicle tracking of sediment from the construction site must be minimized by BMPs such as stone pads, concrete or steel wash racks, or equivalent systems. Street sweeping must be used if such BMPs are not adequate to prevent sediment from being tracked onto the street. (Part IV.C.6)
- Construction site vehicle exit locations must be inspected for evidence of off-site sediment tracking onto paved surfaces. Tracked sediment must be removed from all off-site paved surfaces within 24 hours of discovery, or if applicable, within a shorter time. (Part IV.E.4.d)

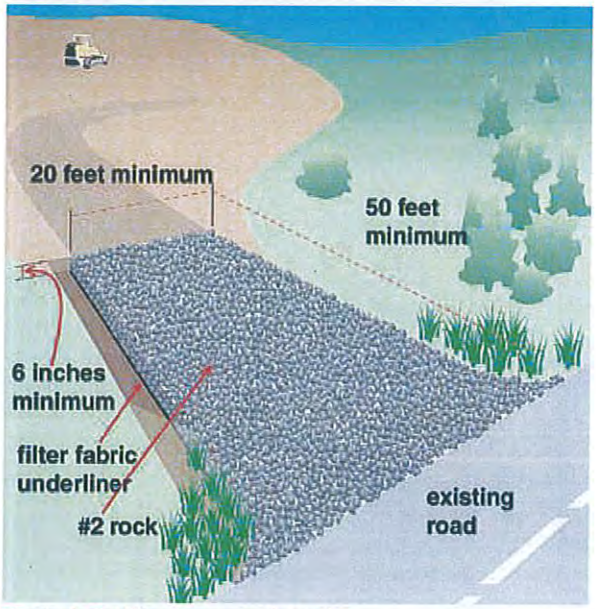

Figure 4. Stabilized construction exit.

Installation tips:

- The exit must be at least 50 feet long (generally the length of two dump trucks), and the exit must be graded so runoff does not enter the adjacent street.
- Place a geotextile fabric under a layer of aggregate at least 6 inches thick. The aggregate must be a minimum of 1 to 3 inches (larger aggregate is better).
- Direct employees to use the designated construction exits.

Maintenance:

- Replenish or replace aggregate if it becomes clogged with sediment.
- Sweep the street regularly.

Silt fence and sediment barriers

Silt fence is a temporary sediment barrier consisting of a geotextile, which is attached to supporting posts trenched into the ground. The purpose of a silt fence is to filter out sediment-laden runoff as it ponds on the uphill side. However, a silt fence is only designed for runoff from small areas, and is not intended to handle flows from large slopes or in areas of concentrated flow.

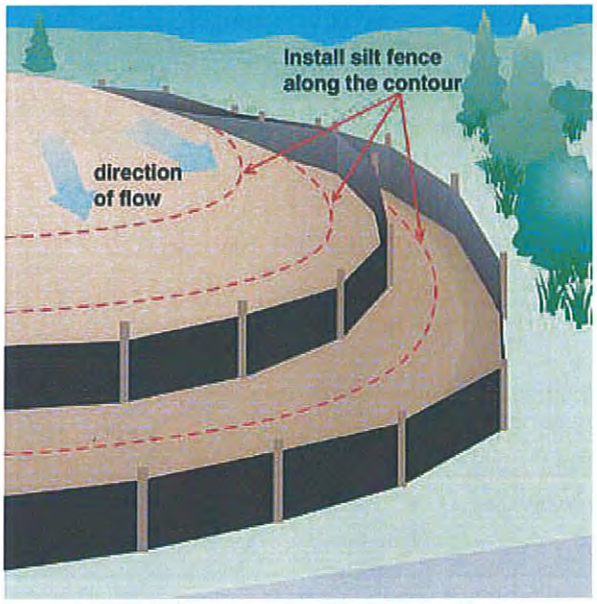

Figure 5. *Illustration of silt fences installed along the contour.*

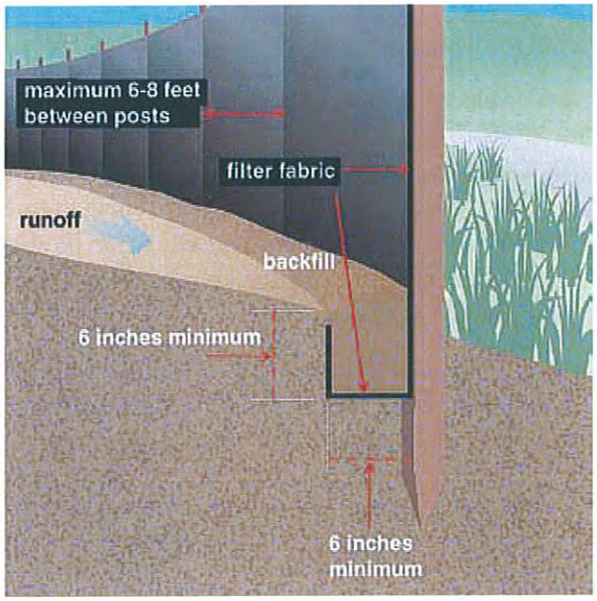

Figure 6. *Detail of silt fence installation.*

Figure 7. *Illustration of "J-hooks" used during silt fence installation.*

Permit requirements:

- Sediment control practices must be established on all down-gradient perimeters before any up-gradient land disturbing activities begin. These practices must remain in place until final stabilization has been established (Part IV.C.2).
- All silt fences must be repaired, replaced, or supplemented when they become nonfunctional or the sediment reaches 1/3 of the height of the fence. These repairs must be made within 24 hours of discovery, or as soon as field conditions allow access (Part IV.E.4.a).

Installation tips

DO:

- Install silt fence along the contour of a slope
- Trench in the silt fence on the uphill side (trench should be 6 inches deep by 6 inches wide)
- Install stakes on the downhill side of the fence
- Curve the end of silt fences up-gradient so that it contains the muddy runoff

DON'T:

- Install silt fence at the top of hills, or up and down hills
- Install silt fence in ditches, channels or areas of concentrated flow
- Use silt fence for areas that drain more than ¼ acre per 100 ft. of fence.
- Rely on silt fence as your only BMP; use it in combination with other practices.

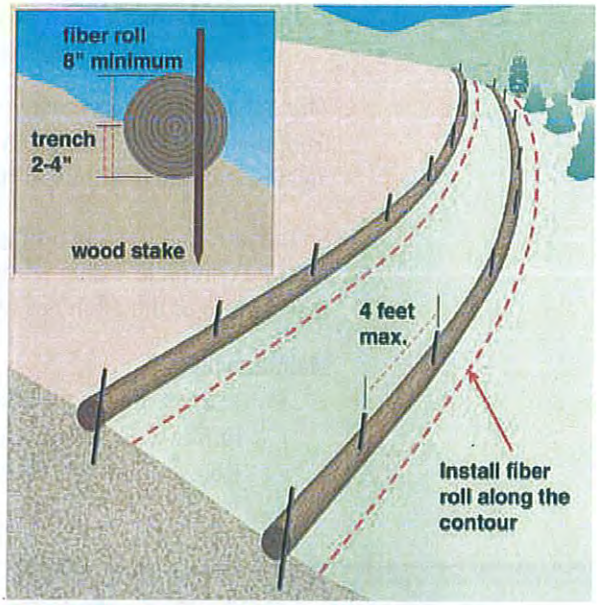

Figure 8. *Fiber roll installation and detail.*

Sediment barriers such as fiber rolls or wattles function similar to silt fence, and many of the same installation tips apply.

Maintenance:

- Remove sediment when it reaches 1/3 of the height of the fence
- Replace the silt fence where it is worn, torn, or otherwise damaged.

Diversion ditches/berms

Diversion ditches or berms direct off-site runoff away from unprotected slopes or direct sediment-laden runoff to a sediment trapping structure. A diversion ditch can be located at the upslope side of a construction site to prevent surface runoff from entering the disturbed area. Ditches or berms on steeper slopes may need to consider erosive velocities. Also, ensure diverted water is released through a stable outlet and does not cause downstream flooding.

Installation tips:

- Divert runoff coming on to your construction site (generally used to protect areas of five acres or less).

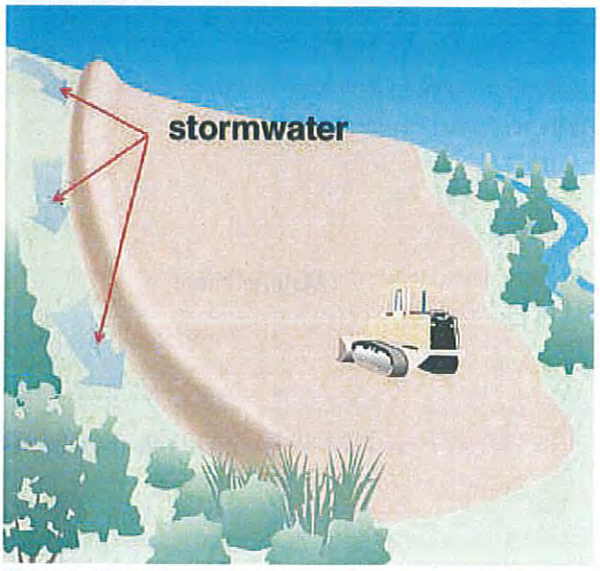

Figure 9. *Diversions must be used to divert stormwater away from disturbed areas.*

- Clean runoff must be discharged to a stable outlet or channel, sediment-laden water must be diverted to a sediment-trapping structure.

The ditches or swales must be stabilized within 200 lineal feet from the property edge, or from the point of discharge into any surface water. Stabilization of the last 200 lineal feet must be complted within 24 hours after connecting to a surface water.

Stabilization of the remaining portions of any temporary or permanent ditches or swales must be complete within 14 days after connecting to a surface water and construction in that portion of the ditch has temporarily or permanently ceased.

Maintenance:

- Inspect diversions and berms after each rain event (within 24 hours of a .5 inch rain in a 24-hour period), including outlets.
- Remove any accumulated sediment.

Mats, mulches, and blankets

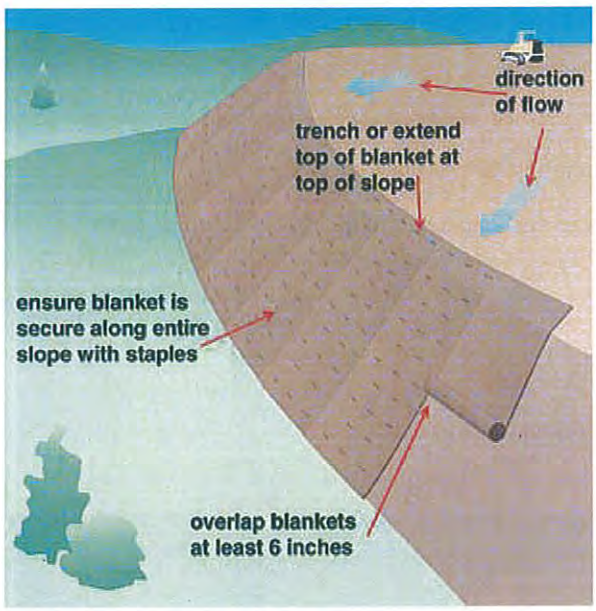

Figure 10. *Erosion control blanket.*

Mats, mulches, and blankets are used for temporary stabilization and establishing vegetation of disturbed soils. Mats and blankets are typically used on slopes or channels while mulches are effective in helping to protect the soil surface and foster vegetation.

Installation tips:

- Mats and blankets must be used on slopes steeper than 3:1 and in swales or long channels (mulches are generally not recommended on slopes greater than 3:1).
- Trench the top of the blanket in to prevent runoff from flowing under the blanket.
- Overlap the end of each blanket and mat.
- Staple blankets and mats according to specifications.
- Do not place mulch in areas of concentrated flow.

Maintenance:

- Periodically check for signs of erosion or failure.
- Apply additional mulch or repair blanket/mat if necessary.
- Continue inspections until vegetation is established.

Temporary sediment trap or pond

A temporary sediment trap, pond or basin is a temporary ponding area formed by constructing an earthen embankment with an outlet across a swale. Temporary sediment traps are intended to detain sediment-laden runoff from small, disturbed areas long enough to allow the majority (at least 75%) of the sediment to settle out.

Sediment traps are designed for small areas. The volume of the trap must be at least 1,800 cubic feet per acre of contributing drainage.

Permit requirements:

- See Part III.B of the permit for temporary sediment basin design details.

Installation tips:

- Install the basin in the low point of your construction site.
- Install the basin before land disturbing activities begin.
- Install a gravel outlet following BMP design
- The basin must not be installed in a main stream.

Maintenance:

- Remove the sediment in the basin when it reaches about 1/2 the design volume.
- Check the outlet for needed maintenance.

Permanent Stormwater System BMPs

Permanent stormwater management BMPs are required when a project will replace vegetation and/or other pervious surfaces with one or more acres of cumulative impervious surface. A water quality volume of ½ inch of runoff from the new impervious surface (1 inch when discharging to special or impaired waters) must be treated by one of the methods below.

If you are creating one acre or more of new imperious surface, then your SWPPP must describe how you will treat the water quality volume from this area, including design calculations. See Part III.C of the permit for all design requirements.

Wet Sedimentation Basin

A wet sedimentation basin is a controlled stormwater release structure that is designed to provide settling time for sediment and other particulates before runoff is discharged. A permanent volume of 1800 cubic feet of storage below the outlet pipe for each acre that drains to the basin is required. The depth of the permanent volume must be at least 3 feet but less than 10 feet.

The basin outlet must be designed so that the water quality volume is discharged at no more than 5.66 cubic feet per second per acre of surface area of the pond, and a stabilized emergency overflow must be designed.

Adequate maintenance access must also be provided to the pond.

Infiltration/Filtration

Infiltration/Filtration options include but are not limited to: infiltration basins, infiltration trenches, rainwater gardens, sand filters, organic filters, bioretention areas, enhanced swales, dry storage ponds with underdrain discharge, off-line retention areas and natural depressions.

Vehicles must be kept away from all infiltration areas to avoid compacting the soil.

Infiltration must be used only as appropriate to the site and land uses. Settleable solids, floating materials, oils and grease must be removed from the runoff to the maximum extent practicable before runoff enters the infiltration/filtration system. Filtration systems must have a reasonable chance of achieving approximately 80% removal of total suspended solids. Use a pretreatment system such as a vegetated filter strip, small sedimentation basin, or water quality inlet before the stormwater discharges to the infiltration or filtration system. Design systems to treat a water quality volume of ½ inch, and discharge through the soil or filter media in 48 hours or less.

You must evaluate the impact of constructing an infiltration practice on existing hydrologic features (e.g., existing wetlands) and try to maintain pre-existing conditions (e.g., do not breach a perched water table which is supporting a wetland). You must provide a way to visually verify that the system is operating as designed.

Do not use infiltration systems when receiving runoff from industrial areas with exposed significant materials or from vehicle fueling and maintenance areas. Refer to the Minnesota Stormwater Manual for discussions on infiltration (www.pca.state.mn.us/water/stormwater/stormwater-manual.html)

Installation tips:

- Do not install infiltration systems until the contributing drainage area has been fully stabilized.
- Keep sediment and runoff away from the infiltration system during construction by using diversion berms.
- Provide maintenance access along with a maintenance plan.
- Must have 3 feet of separation from the seasonally saturated soils (or from bedrock) and the bottom of the proposed infiltration system.
- Keep vehicles away from all infiltration areas to avoid compacting the soil.

Regional Ponds

You may discharge to a regional pond under the following circumstances:

- Discharge is to a constructed pond, and not a natural wetland or waterbody,
- The pond is designed in accordance with the general permit's design requirements for a wet sedimentation basin,

- You must obtain written authorization from the applicable local governmental unit or private entity that owns and maintains the regional pond before applying for the permit (include this in your SWPPP), and
- The written authorization must show that the regional pond will discharge the water quality volume at no more than 5.66 cfs per acre of pond surface area.

Combination of Practices

A combination of the above practices may be used to meet the water quality volume treatment requirement. For example, ¼ inch may be infiltrated and ¼ inch may be treated through a wet sedimentation basin. The SWPPP must contain documentation (infiltration computer model results or calculations, etc.) identifying the volume that each practice addresses.

Alternative Method

An alternative, innovative treatment system may be proposed to achieve 80% removal of total suspended solids on an annual average basis. If you choose this method, you must submit all calculations, drainage areas, plans and specifications to the MPCA at least 90 days prior to the scheduled start of your construction activity for review. You cannot start construction until you have received an approval letter from the MPCA.

You must also develop a 2-year monitoring plan to sample runoff from the proposed alternative treatment method. The plan must include a discussion of the methods that will be used to collect samples, location where samples will be taken (upstream and downstream of the proposed method), frequency of samples (minimum of six events sampled), the lab that will be used to analyze the samples, and quality assurance and quality control methods to be used. The plan must also include a schedule for submitting the monitoring data annually.

Pollution Prevention BMPs

Solid Waste

Provide appropriate containers for solid waste and empty them frequently. If necessary, containers must be covered to prevent wind from blowing the waste around the construction site. Solid waste includes collected sediment, asphalt and concrete millings, floating debris, paper, plastic, fabric, construction and demolition debris and other wastes.

Follow MPCA disposal requirements for all solid waste.

Permit requirement:

- *Solid Waste:* Collected sediment, asphalt and concrete millings, floating debris, paper, plastic, fabric, construction and demolition debris and other wastes must be disposed of properly and must comply with the MPCA disposal requirements (Part IV.F.1).

Hazardous Materials

Hazardous materials must be properly stored, and must have secondary containment to prevent spills, leaks or other discharges. These materials must be stored in a shed or building that can be locked to prevent vandalism or unauthorized access. Hazardous materials include oil, gasoline and paint, so ensure that these materials are also properly stored.

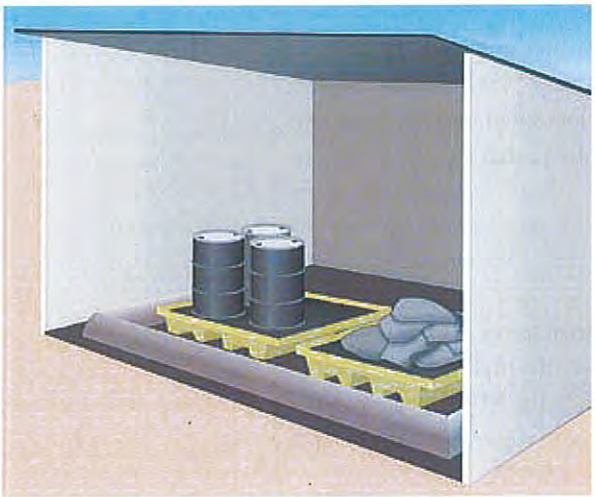

Figure 11. *Example of hazardous materials storage (doors removed for illustrative purposes only). Access to hazardous materials must be restricted.*

Follow MPCA regulations when storing and disposing of hazardous waste. This must include proper labeling of hazardous wastes. Additional information can be found at www.pca.state.mn.us/waste/index.html

Permit requirement:

- *Hazardous Materials:* Oil, gasoline, paint and any hazardous substances must be properly stored, including secondary containment, to prevent spills, leaks or other discharge. Restrict access to storage areas to prevent vandalism. Storage and disposal of hazardous waste must comply with MPCA regulations. (Part IV.F.2)

Vehicle washing

Avoid washing vehicles on the construction site. If washing is necessary, designate a site where the runoff can be contained and properly disposed of, such as an adequately sized sedimentation basin.

Engine degreasing is not permitted on the construction site. Maintenance of vehicles must occur in a properly equipped shop, and not on the construction site.

Permit requirement:

- External washing of trucks and other construction vehicles must be limited to a defined area of the site. Runoff must be contained and waste properly disposed of. No engine degreasing is allowed on site. (Part IV.F.3)

Concrete Washout

The liquid and solid wastes generated by concrete washout operations have to be deposited in leak-proof containers and afterwards, the wastes must be disposed of properly and in compliance with MPCA regulations. The concrete washout needs to be dewatered and then it can be ground and recycled or taken to a demolition landfill. Signs need to be posted of the site(s) where concrete washout operations take place.
For additional information, please check the construction stormwater concrete washout fact sheet at www.pca.state.mn.us/water/stormwater/stormwater-c.html.

Permit requirement:

- *Concrete washout onsite:* All liquid and solid wastes generated by concrete washout operations must be contained in a leak-proof containment facility or impermeable liner. A compacted clay liner that does not allow washout liquids to enter ground water is considered an impermeable liner. The liquid and solid wastes must not contact the ground, and therefore must not be runoff from the concrete washout operations or areas. Liquid and solid wastes must be disposed of properly and in compliance with MPCA regulations. A sign must be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities. (Part IV.F.4)

Chapter 4

Selected Required Activities During Construction

Inspections and Maintenance

Remember that is you are going to be in charge of inspecting and maintaining the BMPs, you need to have received appropriate training (Part III.A.Z.). Conduct routine inspections of the construction site and keep records of these inspections and maintenance performed (Part IV.E). Your SWPPP must identify who is responsible for conducting the inspections. You are required to inspect the construction site:

- Once every 7 days during active construction, AND
- Within 24 hours after a rainfall event greater than 0.5 inches in 24 hours. The next inspection must be conducted within 7 days after this.

In order to conduct inspections after a 0.5-inch rainfall event, you'll need to know how much rain falls on your site. The easiest way to do this is to install a rain gage at or near your construction site. Make sure nothing interferes with rainfall entering the rain gage (like a tree or building). Place the rain gage at the top of a stake or pole, and empty it after each rain event. Keep records of rainfall totals in your SWPPP.

You need to keep records of your inspections with your SWPPP, and your records must include a minimum set of information. The following information is required to be kept in your records:

- Date and time of inspections;
- Name of person conducting inspections;
- Finding of inspections, including corrective actions;
- Corrective actions taken (including dates, times, and party completing maintenance activities);
- Date and amount of all rainfall events greater than 0.5 inches in 24 hours; and
- Documentation of changes made to the SWPPP.

Use a camera during your inspections to document activities and any problems observed. Digital cameras can be especially convenient for this purpose.

An example *Maintenance Record* is provided as Attachment B. The MPCA has also developed an inspection log/calendar to assist in recording inspections. The inspection log/calendar can be found on the MPCA's construction stormwater Web page: www.pca.state.mn.us/water/pubs/sw-insplog.pdf

Parts of the construction site that have undergone final stabilization may be inspected once per month. If work has been suspended due to frozen ground conditions, then required inspections must take place as soon as runoff occurs at the site or prior to resuming construction, whichever comes first.

Records

The permit requires the owner to keep the SWPPP, all changes to it, and inspection and maintenance records at the construction site (Part III.D). You can keep the SWPPP in either a field office, or if a field office is not available, then in an on-site vehicle. An inspector will ask for your SWPPP, so make sure you keep it onsite at all times!

You must also keep the SWPPP and other records on file for three years after submittal of the NOT described in Chapter 5. In addition to the SWPPP, keep copies of any other permits required for the project, records of inspection and maintenance conducted, permanent operation and maintenance agreements that have been implemented, and required calculations for design of the temporary and permanent stormwater management systems.

As part of the SWPPP or with the SWPPP, you should keep training documentation that states the names of the people in charge of developing, implementing, overseeing, revising, and amending the SWPPP and the dates of training, name of instructors and the entity providing training and the content of training courses or workshops.

Chapter 5

What Do I Have to Do When the Construction Project is Finishing?

Final Stabilization

The permit requires final stabilization of the construction site (Part IV.G). Final stabilization entails sections 1 through 5 or section 6:

1. Final Stabilization requires that all soil disturbing actities at the site have been completed and all soils are stabilized by any means necessary to prevent soil failure under erosive conditions or by a uniform perennial vegetative cover with a density of 70 percent over the entire pervious surface area. The density is based on canopy cover at 6" height. This inlcudes sod that is firmly rooted to the underlying soil or direct-seeded herbaceous species that have grown to at least six inches in height. It does not include annual cover crop species such as oats and winter wheat. If soils are too porr to support 70 percent vegetative cover, the percent cover must be 70 percent of the native background vegetative cover, or other equivalent means necessary to prevent soil failure under erosive conditions.

2. You must ensure that the permanent stormwater treatment system meets all requirements in Part III, C. This includes but is not limited to, a final clean out of temporary or permanent sedimentation basins that are to be used as permanent water quality management basins and final construction or maintenance of infiltration basins. All sediment must be removed from conveyance systems and ditches must be stabilized with permanent cover.

3. A notice of termination (NOT) needs to be submitted to terminate the permit, but before that, all temporary synthetic and structural erosion prevention and sediment control BMPs (such as silt fence) must be removed on the portions of the site for which you are responsible. BMPs designed to decompose on site (such as some compost logs) may be left in place.

4. For residential construction only, individual lots are considered finally stabilized if the structure(s) are finished and temporary erosion protection and downgradient perimeter control has been completed and the residence has been sold to the homeowner. Additionally, you must distribute the MPCA's "Homeowner Fact

Sheet" to the homeowner to inform the homeowner of the need for, and benefits of, permanent cover (www.pca.state.mn.us/publications/wq-strm2-07.pdf).

5. If your construction project was on land used for agricultural purposes, final stabilization may be accomplished by returning the disturbed land to its preconstruction agriculutural use.

6. You may terminate permit coverage prior to completion of all construction activity if all of the following are met in addition to sections 2 and 3, and where applicable, section 4 or section 5.

   - construction activity has ceased for at least 90 days
   - at least 90 percent (by area) of all originally proposed construction activity has been completed and permanent cover has been established on those areas
   - on areas where construction activity is not complete, permanent cover has been established

Notice of Termination

You must submit a notice of termination (NOT) by using the notice of termination/permit modification form to the MPCA to terminate coverage under this permit. The coverage terminates at midnight on the postmark date of on the date an on-line notice of termination/permit modification form is submitted to the MPCA.

A copy of the notice of termination/permit modification form is available from the MPCA Web site: www.pca.state.mn.us/water/stormwater/stormwater-c.html.

There are three possible situations where coverage can be terminated.

The first situation arises when you want to terminate the coverage for the entire project, because, either Final Stabilization (page 28) has been achieved in all portions of the site or because the entire site has been sold; including roads and stormwater infrastructure and coverage has been transferred to another owner (Part II.B.5). In both cases a notice of termination/permit modification form must be submitted within 30 days of either the Final Stabilization or the sale of the site.

The second situation arises when you want to terminate coverage for a portion of the entire project that you have either sold or have legally transferred to another party and of which you are no longer the owner or operator. In this case, if construction activity is going to continue, you must submit a notice of termination/permit modification form within seven (7) days after the sale or legal transfer of the property. You must sign the notice of termination/permit modification form where appropriate and so does the new owner, who also needs to state contact information. Instructions on filling this form are available from the MPCA Web site:

www.pca.state.mn.us/water/stormwater/stormwater-c.html.

The third situation arises when permit coverage was obtained using the subdivision registration process, in which case you are required to submit a permit termination/modification withint 30 days after achieving final Stabilization (page 28).

If you use an alternative method for permanent stormwater management (described on page 21), then you cannot terminate the permit until final stabilization has been achieved on the site and you either have two years of monitoring data submitted to the MPCA showing that the required treatment has been achieved, or the MPCA determines that the alternative method is achieving the required treatment.

Finally, as a reminder, you must keep the SWPPP, inspection and maintenance records, permanent operation and maintenance agreements, and design calculations for at least three years after submitting the NOT/Permit Modification form.

Chapter 6

Resource Listing

The following are selected resources to help you develop and implement an effective SWPPP:

MPCA Stormwater Program
www.pca.state.mn.us/water/stormwater/index.html
Click on the construction stormwater program to get copies of the construction permit, application, and information on special waters, fact sheets, and staff contacts.

MPCA Minnesota Stormwater Manual
www.pca.state.mn.us/water/stormwater/stormwater-manual.html
An electronic copy of the MPCA's *Minnesota Stormwater Manual* v.2. (2008). The first part of the manual is dedicated to the management of stormwater in the context of Minnesota. The second part contains diagrams and formulae, helpful for professionals.

MPCA Stormwater BMP Manual
www.pca.state.mn.us/water/pubs/sw-bmpmanual.html
An electronic copy of MPCA's *Protecting Water Quality in Urban Areas: Best Management Practices for Dealing with Stormwater Runoff from Urban, Suburban and Developing Areas of Minnesota* (2000). Includes information on all types of stormwater control practices.

Metropolitan Council's Urban Small Sites BMP Manual
www.metrocouncil.org/environment/Watershed/bmp/manual.htm
An electronic copy of the *Minnesota Urban Small Sites BMP Manual: Stormwater Best Management Practices for Cold Climates* (2001). This BMP manual provides information on construction and permanent stormwater BMPs.

Minnesota Erosion Control Association
www.mnerosion.org - An organization advancing effective stormwater management and erosion and sediment control techniques and practices.

International Erosion Control Association
www.ieca.org - An association for erosion and sediment control professionals

Chapter 7

Definitions

The following selected definitions are reprinted from MPCA's construction permit. For additional definitions, refer to the permit.

"Best Management Practices (BMPs)"
Erosion prevention and sediment control and water quality management practices that are the most effective and practicable means of controlling, preventing, and minimizing degradation of surface water, including avoidance of impacts, construction-phasing, minimizing the length of time soil areas are exposed, prohibitions, and other management practices published by state or designated area-wide planning agencies. Individual BMPs found in the construction permit are described in the current version of *Protecting Water Quality in Urban Areas*, Minnesota Pollution Control Agency 2000. BMPs must be adapted to the site and can be adopted from other sources. However, they must be similar in purpose and at least as effective and stringent as MPCA's BMPs. (Other sources include manufacturers specifications, *Stormwater Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices*, U.S. Environmental Protection Agency 1992, and *Erosion Control Design Manual*, Minnesota Department of Transportation, et al, 1993).

"Common Plan of Development or Sale"
A contiguous area where multiple separate and distinct land disturbing activities may be taking place at different times, on different schedules, but under one proposed plan. One plan is broadly defined to include design, permit application, advertisement or physical demarcation indicating that land-disturbing activities may occur.

"Construction Activity"
Construction activity as defined in 40 C.F.R. part 122.26(b)(14)(x) and small construction activity as defined in 40 C.F.R. part 122.26(b)(15). This includes a disturbance to the land that results in a change in the topography, existing soil cover (both vegetative and non-vegetative), or the existing soil topography that may result in accelerated stormwater runoff, leading to soil erosion and movement of sediment into surface waters or drainage systems. Examples of construction activity may include clearing, grading, filling and excavating. Construction activity includes the disturbance of less than one acre of total

land area that is a part of a larger common plan of development or sale if the larger common plan will ultimately disturb one acre or more.

"Erosion Prevention"
Measures employed to prevent erosion including but not limited to: soil stabilization practices, limited grading, mulch, temporary erosion protection or permanent cover, and construction phasing.

"Final Stabilization" means that either:

a. All soil disturbing activities at the site have been completed and a uniform (evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed;

b. For individual lots in residential construction by either: (a) The homebuilder completing final stabilization as specified above, or (b) the homebuilder establishing temporary stabilization including perimeter controls for an individual lot prior to occupation of the home by the homeowner and informing the homeowner of the need for, and benefits of, final stabilization. (Homeowners typically have an incentive to put in the landscaping functionally equivalent to final stabilization as quick as possible to keep mud out of their homes and off sidewalks and driveways.); or

c. For construction projects on land used for agricultural purposes (e.g., pipelines across crop or range land) final stabilization may be accomplished by returning the disturbed land to its preconstruction agricultural use. Areas disturbed that were not previously used for agricultural activities, such as buffer strips immediately adjacent to surface waters and drainage systems, and areas which are not being returned to their preconstruction agricultural use must meet the final stabilization criteria in (a) or (b) above.

"National Pollutant Discharge Elimination System (NPDES)"
The program for issuing, modifying, revoking, reissuing, terminating, monitoring, and enforcing permits under the Clean Water Act (Sections 301, 318, 402, and 405) and United States Code of Federal Regulations Title 33, Sections 1317, 1328, 1342, adn 1345.

"Operator"
The person (usually the general contractor), designated by the owner, who has day-to-day operational control and/or the ability to modify project plans and specifications related to the SWPPP. The person must be knowledgeable in those areas of the permit for which the operator is responsible (Part II.B. and Part IV.) and must perform those reponsibilities in a workmanlike manner.

"Owner"
The person or party possessing the title of the land on which the construction activities will occur; or if the construction activity is for a lease, easement or mineral rights license

holder, the party or individual identified as the lease, easement or mineral rights license holder; or the contracting government agency responsible for the construction activity.

"Permittee"
A person(or persons), firm, or governmental agency or other institution that signs the application submitted to the MPCA and is responsible for compliance with the terms and conditions of the permit.

"Sediment Control"
Methods employed to prevent sediment from leaving the site. Sediment control practices include silt fences, sediment traps, earth dikes, drainage swales, check dams, subsurface drains, pipe slope drains, storm drain inlet protection, and temporary or permanent sedimentation basins.

"Stormwater"
Defined under Minn. R. 7077.0105, subp. 41(b), and includes precipitation runoff, stormwater runoff, snow melt runoff, and any other surface runoff and drainage.

"Stormwater Pollution Prevention Plan" (SWPPP)
A plan for stormwater discharge that includes erosion prevention measures, sediment controls and permanent stormwater management systems that, when implemented, will decrease soil erosion on a parcel of land and decrease off-site nonpoint pollution.

"Surface Water or Waters"
All streams, lakes, ponds, marshes, wetlands, reservoirs, springs, rivers, drainage systems, waterways, watercourses, and irrigation systems whether natural or artificial, public or private.

"Temporary Erosion Protection"
Methods employed to prevent erosion. Examples of temporary erosion protection include: straw, wood fiber blanket, wood chips, and erosion netting.

"TMDL"
The federal Clean Water Act requires states to adopt water quality standards to protect the nation's waters. These standards define how much of a pollutant (Total Maximum Daily Load) can be in a surface and/or ground water while still allowing it to meet its designated uses, such as for drinking water, fishing, swimming, irrigation or industrial purposes. Many of Minnesota's water resources cannot currently meet their designated uses because of pollution problems from a combination of point and nonpoint sources. TMDL projects are being implemented to address these impaired waters. The list of impaired waters is available at the MPCA Web site:
www.pca.state.mn.us/water/tmdl/index.html

"Waters of the State"
Defined in Minn. Stat. § 115.01, subd. 22 as all streams, lakes, ponds, marshes, watercourses, waterways, wells, springs, reservoirs, aquifers, irrigation systems, drainage systems and all other bodies or accumulations of water, surface or underground, natural or artificial, public or private, which are contained within, flow through, or border upon the state or any portion thereof.

Attachment A: Construction SWPPP Template

Stormwater Pollution Prevention Plan (SWPPP) Template To comply with the General Stormwater Permit for Construction Activity (MN R100001)

IMPORTANT: Before completing this SWPPP, you must read and understand the requirements in the General Stormwater Permit for Construction Activity (MN R100001) available from MPCA at www.pca.state.mn.us/water/stormwater/index.html. An overview of the permit is available from MPCA at www.pca.state.mn.us/publications/wq-strm2-05.pdf. This SWPPP Template will help you complete information required in Parts III and IV of the permit.

Construction Activity Information	
Project Name	
Project Location	
Briefly describe where construction activity occurs. Include address if available	
City or Township	State, Zip Code MN
Latitude and longitude of approximate centroid of project	
Method of collection of latitude/longitude: GPS Online tool USGS Topographic map Scale used (refer to topographic map)	
All cities where construction will occur	
All counties where construction will occur	All townships where construction will occur

Project Size (number of acres to be disturbed)		
Project Type		
▯ Residential	▯ Commercial/Industrial	▯ Road Construction
▯ Residential and Road Construction	▯ Other (describe)	
Cumulative Impervious Surface		
Existing area of impervious surface _____ (to the nearest quarter acre)		
Post construction area of impervious surface _____ (to the nearest quarter acre)		

Receiving Waters			
Name of Water Body	**Type** (ditch, pond, wetland, lake, stream, river)	Special Water? (See Stormwater Permit Appendix A)	**Impaired Water?**** (See Stormwater Permit Appendix A)
		▯ Yes ▯ No	▯ Yes ▯ No
		▯ Yes ▯ No	▯ Yes ▯ No
		▯ Yes ▯ No	▯ Yes ▯ No
		▯ Yes ▯ No	▯ Yes ▯ No
* Impaired water for the following pollutant(s) or stressor(s): phosphorus, turbidity, dissolved oxygen, or biotic impairment			

Dates of Construction	
Construction Start Date	Estimated Completion Date

Contact Information			
Owner of the Site			
Business of Firm Name			
Last Name First Name Title	E-mail	Telephone *(include area code)*	
Mailing Address	City	State Zip Code	
Alternate Contact Last Name First Name	E-mail	Telephone *(include area code)*	
Contractor (Person who will oversee implementation of the SWPPP)			
Business of Firm Name			
Last Name First Name Title	E-mail	Telephone *(include area code)*	
Mailing Address	City	State Zip Code	
Alternate Contact Last Name First Name	E-mail	Telephone (include area code)	
Party Responsible for Long Term Operation and Maintenance of the Permanent Stormwater Management System			
Business of Firm Name			
Last Name First Name Title	E-mail	Telephone (*include area code*)	
Mailing Address	City	State Zip Code	
Alternate Contact Last Name First Name	E-mail	Telephone (*include area code*)	

General Construction Project Information
Describe the construction activity (what will be built, general timeline, etc.)
Describe soil types found at the project.

General site information (III.A)
Describe the location and type of all temporary and permanent erosion prevention and sediment control BMPs. Include the timing for installation and procedures used to establish additional temporary BMPs as necessary. (III.A.4.a)
Attach to this SWPPP a table with the anticipated quantities for the life of the project for all erosion prevention and sediment control BMPs (III. A. 4.b)
Attach to this SWPPP a site map that includes the following features (III.A.3.b – f): • Existing and final grades, including dividing lines and direction of flow for all pre and post-construction stormwater runoff drainage areas located within the project limits. • Locations of impervious surfaces and soil types. • Locations of areas not to be disturbed. • Location of areas of phased construction • All surface waters and existing wetlands within 1mile from the project boundaries that will receive stormwater runoff from the site (identifiable on maps such as USGS 7.5 minute quadrangle maps or equivalent). Where surface waters receiving runoff associated with construction activity will not fit on the plan sheet, they must be identified with an arrow, indicating both direction and distance to the surface water. • Methods to be used for final stabilization of all exposed soil areas.
Were stormwater mitigation measures required as the result of an environmental, archaeological, or other required local, state, or federal review of the project? If yes, describe how these measures were addressed in the SWPPP. (III.A.6.)

Is the project located in a karst area such that additional measures would be necessary to protect drinking water supply management areas as described in Minn. R. chapters 7050 and 7060? If yes, describe the additional measures to be used. (III.A.7.)

Does the site discharge to a calcareous fen listed in Minn. R. 7050.0180, subp. 6.b.? If yes, a letter of approval from the Minnesota Department of Natural Resources must be obtained prior to application for this permit. (Part I B.6 and Part III.A.8)

Does the site discharge to a water that is listed as impaired for the following pollutant(s) or stressor(s): phosphorus, turbidity, dissolved oxygen or biotic impairment? Use the Special and Impaired Waters Search Tool at: www.pca.state.mn.us/water/stormwater/stormwater-c.html. If no, skip to next box.

Does the Impaired water have an approved TMDL with an Approved Waste Load Allocation for construction activity? If yes:

- List the receiving water, the areas of the site discharging to it, and the pollutant(s) identified in the TMDL.
- List the BMPs and any other specific construction stormwater related implementation activities identified in the TMDL.

If the site has a discharge point within one mile of the impaired water and the water flows to the impaired water but no specific BMPs for construction are identified in the TMDL, the additional BMPs in Appendix A (C.1 and C.2) must be added to the SWPPP and implemented. (III.A.7). The additional BMPs only apply to those portions of the project that drain to one of the identified discharge points.

Training (III.A)

Training is required for all permitted projects after February 1, 2010. It must be provided by entities with expertise in erosion prevention, sediment control or permanent stormwater management. Training must be focused on the individual's job duties as they relate to the permit requirements (Part III.A.2). Who must be trained?

- ✓ Individual(s) preparing the SWPPP for the project
- ✓ Individual(s) overseeing the implementation of, revising and amending the SWPPP and individuals performing inspections required by the permit
- ✓ Individuals performing or supervising the installation, maintenance or repair of BMPs

Attach to this SWPPP:

Names of the personnel trained; dates of training; name of instructor(s) and entity providing training; content of training course or workshop (including number of hours of training).

Selection of a Permanent Stormwater Management System (III.C)

Will the project create a new cumulative impervious surface greater than or equal to one acre?

☐ Yes ☐ No

If yes, a water quality volume of ½ inch of runoff from this area must be treated before leaving the site or entering surface waters (1 inch if discharging to special waters).

Describe which method will be used to treat runoff from the new impervious surfaces created by the project (III.C):

- Wet sedimentation basin
- Infiltration/Filtration
- Regional ponds
- Combination of practices

Include all calculations and design information for the method selected. See Part III.C of the permit for specific requirements associated with each method.

If it is not feasible to meet the treatment requirement for the water quality volume, describe why. This can include proximity to bedrock or road projects where the lack of right of way precludes the installation of any permanent stormwater management practices. Describe what other treatment, such as grasses swales, smaller ponds, or grit chambers, will be implemented to treat runoff prior to discharge to surface waters. (III.C)

If proposing an alternative method to treat runoff from the new impervious surfaces, describe how this alternative will achieve approximately 80% removal of total suspended solids on an annual average basis (III.C.5). NOTE: If proposing an alternative method, you must submit your SWPPP to MPCA at least 90 days prior to the starting date of the construction activity.

Erosion Prevention Practices (IV.B)

Describe construction phasing, vegetative buffer strips, horizontal slope grading, and other construction practices to minimize erosion. Delineate areas not to be disturbed (e.g., with flags, stakes, signs, silt fence, etc.) before work begins.

Describe temporary erosion protection or permanent cover used for exposed soil. All exposed soil areas must be stabilized as soon as possible but in no case later than 14 days after the construction activity in that portion of the site has temporarily or permanently (part IV.B.2)

For drainage or diversion ditches, describe practices to stabilize the normal wetted perimeter within 200 lineal feet of the property edge or point of discharge to surface water. The remaining portions of the temporary or permanent ditch or swale must be stabilized within 14 days after connecting to surface waters and construction in that portion of the ditch has temporarily or permanently ceased.

Describe other erosion prevention practices (list and describe).

Sediment Control Practices (IV.C)

Describe sediment control practices used to minimize sediments from entering surface waters, including curb and gutter systems and storm drain inlets. At a minimum, these sediment control practices must include:

- Sediment controls for temporary or permanent drainage ditches and sediment basins that are designed as part of a treatment system
- Installation of check dams or other grade control practice to ensure sheet flow and prevent rills (for slope lengths greater than 75 feet with a grade of 3:1 or steeper).
- Sediment control practices on all down gradient perimeters prior to land disturbing activities.
- Storm drain inlet protection for all inlets.
- Silt fencing or other sediment control surrounding temporary soil stockpiles.
- Minimize vehicle tracking of sediments (e.g., stone pads, concrete or steel wash racks, or equivalent systems).
- Street sweeping of tracked sediment.
- Temporary sedimentation basins (see Part III.B).

Dewatering and Basin Draining (IV.D)

Will the project include dewatering or basin draining? ☐ Yes ☐ No

If yes, describe BMPs used so the discharge does not adversely affect the receiving water or downstream landowners.

Additional BMPs for Special Waters and Discharges to Wetlands (Appendix A, Parts C and D)
Special Waters. Does your project discharge to special waters? ☐ Yes ☐ No If no, skip to Wetlands section below.
If proximity to bedrock or road projects where the lack of right of way precludes the installation of any of the permanent stormwater management practices, then other treatment such as grassed swales, smaller ponds, or grit chambers is required prior to discharge to surface waters. Describe what other treatment will be provided.
Describe erosion and sediment controls for exposed soil areas with a continuous positive slope to a special waters, and temporary sediment basins for areas that drain 5 or more acres disturbed at one time.
Describe the undisturbed buffer zone to be used (not less than 100 linear feet from the special water).
Describe how the permanent stormwater management system will ensure that the pre and post project runoff rate and volume from the 1, and 2-year 24-hour precipitation events remains the same.
Describe how the permanent stormwater management system will minimize any increase in the temperature of trout stream receiving waters resulting in the 1, and 2-year 24-hour precipitation events.
Wetlands. Does your project discharge stormwater with the potential for significant adverse impacts to a wetland (e.g., conversion of a natural wetland to a stormwater pond)? ☐ Yes ☐ No
If Yes, describe the wetland mitigation sequence that will be followed in accordance with Part D of Appendix A.

Inspections and Maintenance (IV.E)
Describe procedures to routinely inspect the construction site: • Once every seven (7) days during active construction and, • Within 24 hours after a rainfall event greater than 0.5 inches in 24 hours, and within seven (7) days after that. Inspections must include stabilized areas, erosion prevention and sediment control BMPs, and infiltration areas.

Pollution Prevention Management Measures (IV.F)
Describe practices to properly manage and dispose of solid waste, including trash (IV.F.1)
Described practices to properly manage hazardous materials (IV.F.2).
Describe practices for external washing of trucks and other construction vehicles (IV.F.3)
Describe how are you going to provide a safe, lake proof, concrete washout on site (IV.F.4):
Describe your spill prevention plan.

Describe measures to address sanitary and septic waste.

Final Stabilization (IV.G)

Describe how you will achieve final stabilization of the site (IV.G).

Records Retention (III.D)

Describe your record retention procedures (must be kept at the site) (III.D). Records must include:

- Copy of SWPPP and any changes
- Training documentation (III.A.2.)
- Inspection and maintenance records
- Permanent operation and maintenance agreements
- Calculations for the design of temporary and permanent stormwater management systems.

Attachment B: Sample Maintenance Records

Inspector	Type of Inspection		Date of Inspection			Rainfall (record all events > 0.5 in)	Time of Inspection			Areas Inspected							Findings and Corrective Actions
	Routine weekly	24 hrs after rain	Month	Day	Year		Time	AM	PM	Erosion / Sediment Control BMPs	Silt Fences	Sedimentation basins	Drainage ditches and other surface waters	Construction site exits	Infiltration areas	Pollution Prevention Measures	
																	Findings: Corrective Actions:
																	Findings: Corrective Actions:
																	Findings: Corrective Actions:
																	Findings: Corrective Actions:
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																	Findings: Corrective Actions:
																	Findings: Corrective Actions:

APPENDIX C

--- S A M P L E ---

LOOP DETECTOR TEST REPORT

STATE PROJECT NO._____

INTERSECTION _____

LOCATION I.D. _____

No.	Loop Detector Number	Dimensions (in feet)		Number of Turns	Continuity (in Ohms)		Inductance (microhenries)	Insulation Resistance (megohms)	Resonant Frequency (Hertz)
		Length	Width		Loop	Cabinet			

--- E. T. C. ---

NOTES: 1. No. 3, 4, 5, and 6 in the above sample report, are an example of a single loop detector and lead-in cable system.

2. Nos. 1 and 2, in the above sample report, are an example of a multiple loop detector and lead-in cable system.

The Project Engineer shall distribute the three (3) final loop detector test reports as follows:

(01) Original report to the official project file
(02) Copy to the traffic signal cabinet
(03) Copy to the City of Minneapolis