



**SPECIFICATIONS**

**FOR**

**EAGLE CREST SOUTH ADDITION  
PHASE 2**

**BETHANY LUTHERAN HOMES**

**LA CROSSE, WISCONSIN**

**FEBRUARY 2018**

**11067-002.020**

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**BETHANY LUTHERAN HOMES**

**LA CROSSE, WISCONSIN**

**DAVY ENGINEERING CO.  
CONSULTING ENGINEERS  
La Crosse, WI  
Project No. 11067-002.020  
February 2018**

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**BETHANY LUTHERAN HOMES**  
**LA CROSSE, WISCONSIN**

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**ATTACHMENTS**

CPY250 Canopy-Soffit  
OSQ Series Medium  
XSPW Wall Mount  
DNR Construction Site Inspection Report (Form 3400-187)

PLANS (Bound Separately)

**PROJECT TEAM**

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# SECTION II

## GENERAL REQUIREMENTS

**Note: These General Requirements amend or supplement the standard Section I and Section IA General Conditions. All provisions that are not so amended or supplemented remain in full force and effect. This standard specification is supplemented and superseded by the Special Provisions that apply to this project only.**

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# GENERAL REQUIREMENTS

## SECTION 2.1.0 – GENERAL

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### 2.1.1 NOISE CONTROL

Construction vehicle and activity noise shall be limited in residential areas. If noise complaints are received, construction may be limited to daylight hours only. Noise control techniques which may be required are as follows: exhaust mufflers, intake silencers, engine enclosures, use of low noise emission equipment, scheduling operations to keep average noise levels low, setting speed limits and keeping noisy equipment operations as far as possible from site boundaries.

### 2.1.2 DUST CONTROL

When dry conditions create unacceptable amounts of dust, the Contractor shall periodically apply water or other dust control measures to the trench, roadway or other areas effected by the Work.

### 2.1.3 ARCHEOLOGICAL SITES

If an archeological site is discovered during the construction process, construction may be halted to permit expert evaluation. During evaluation, construction shall be shifted to another portion of the project. If work cannot be shifted and the delay exceeds 2 working days, the Contractor shall be compensated as per requirements for extra work for delays over 2 working days.

### 2.1.4 CONTAMINATED SOIL

In the event excavation reveals soils contaminated by petroleum products or organic solvents, work shall be suspended and the Owner and Engineer notified. During evaluation, construction shall be shifted to another portion of the project. If work cannot be shifted and the delay exceeds 2 working days, the Contractor shall be compensated as per requirements for extra work for delays over 2 working days. Under no circumstances shall standard PVC pipe or standard rubber gaskets be used in areas of contamination.

### 2.1.5 ASBESTOS/ASBESTOS-CEMENT PIPE

If the Contractor during the course of work observes the existence of asbestos (other than asbestos-cement pipe) in the work area, Contractor shall promptly notify the Owner and Engineer. Owner shall then consult with Engineer regarding removal or encapsulation of the asbestos material. Contractor shall not perform any work pertinent to the asbestos material prior to receipt of special instructions from the Owner.

Asbestos-cement pipe requires special handling. Asbestos-cement pipe to be removed shall be hauled to an approved landfill by the Contractor.

### 2.1.6 PRIMARY LINE AND GRADE

Primary line and grade will be furnished by the Owner and will be established by the Engineer. All work under this contract shall be built in accordance with the lines and grades shown on the plans and as established by the Engineer.

The Contractor shall provide grade stakes and all other staking materials satisfactory to the Engineer for use on the project. The Contractor shall provide competent assistance as may be required for the setting and preserving line and grade. This generally will require that the Contractor supply one person to assist the Engineer during all project staking. This labor cost is an incidental cost. The Contractor shall accurately preserve all lines and grades of the work so staked until authorized to remove them. Additional staking by the Contractor may be necessary.

Figured dimensions on the plans shall be taken as correct, but shall be checked by the Contractor before starting construction. Any errors, omissions or discrepancies shall be brought to the attention of the Engineer, whose decision thereon shall be final. All notes on the plans shall be followed. The Contractor shall check the accuracy of line and grade stakes by means of visual and taping checks.

The Contractor shall give at least forty-eight (48) hours notice in advance of the need for line and/or grade.

The Contractor shall pay the cost of restaking required due to the Contractor's negligence.

#### **2.1.7 CONSTRUCTION LINE AND GRADE**

The Contractor must bear sole responsibility for the correct transfer of all construction lines and grades from the primary line and grade points, and for the correct alignment and grade of the finished structure, based upon the primary line and grade established by the Engineer.

#### **2.1.8 LOCATION WITH RESPECT TO SEWER OR WATER**

A minimum horizontal distance of ten (10) feet (8 ft. in Wisconsin) and a minimum vertical separation of 18" (6" if above water main in Wisconsin) shall be maintained between sanitary/storm sewer and water main lines and hydrants. The Contractor shall notify the Engineer of any variation before proceeding with construction.

#### **2.1.9 HOUSING FOR ENGINEER**

The Contractor shall provide and maintain throughout the contract the following facilities for the use of the Engineer's representative on all contracts in excess of \$500,000.00.

**A.** A temporary, clean, safely constructed, weather-tight office (which may be a shanty or one end of a shanty blocked off for the exclusive use of the Engineer) with a separate outside entrance. The housing shall have approximately 65 square feet of floor area and headroom of 7.5 feet minimum, suitable windows, a plan table, two chairs or a bench and controlled heating facilities with outside vent. Adequate lights shall be provided. A telephone for local calls shall be provided by the Contractor.

**B.** Such office shall be located at the site of the work and shall be maintained at a mutually agreed upon work location. Upon completion of the work, it shall be removed from the work site.

#### **2.1.10 COMPLIANCE WITH CODES AND PERMITS**

All work shall be installed in accordance with the applicable State and local codes and regulations and the Permits that have been issued for the work.

#### **2.1.11 SALVAGED CULVERTS**

Existing culverts that are deemed salvageable by the Engineer shall be removed and reinstalled by the Contractor using reasonable care. Culverts deemed not salvageable shall be disposed of at the Contractor's expense. The Owner will furnish replacement culverts to be installed by the Contractor where culverts are not salvageable. Removal/Replacement or replacement of culverts within the work zone is an incidental expense.

#### **2.1.12 SURVEY MONUMENTS**

No stone monuments, iron pipe property corners, benchmarks, or other survey marker shall be removed or disturbed unless in the presence of the Engineer and with permission. If monuments are disturbed without permission, the Contractor shall be responsible for retaining a Registered Land Surveyor for replacement.

#### **2.1.13 ELECTRIC POWER**

The Contractor shall arrange and pay for all temporary electric power required for construction purposes, including all necessary wiring, fixtures and utility fees.

If a permanent power supply is required, the Owner will provide power to the site and pay all utility fees to the utility termination point. The Contractor shall furnish and install all service entrance equipment, conduit and wiring as required by the electric utility.

#### **2.1.14 HIGHWAY OR RAILROAD REQUIREMENTS**

The Contractor shall conform to all provisions of any highway or railroad permits issued to the Owner. The cost of conforming to the permits shall be included in the prices bid for other work unless a specific bid item is provided.

### 2.1.15 TRACER WIRE

All non-metallic pipes shall be marked with Tracer Wire. Conductivity shall be tested prior to acceptance.

## SECTION 2.2.0 EXCAVATION

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### 2.2.1 NOTIFY UTILITIES

The Contractor shall provide timely advance notice to all utilities located within the work area.

Iowa	Iowa One Call	(800) 292-8989	<a href="http://www.iowaonecall.com">www.iowaonecall.com</a>
Illinois	Julie	(800) 892-0123	<a href="http://www.illinois1call.com">www.illinois1call.com</a>
Minnesota	Gopher State One Call	(800) 252-1166	<a href="http://www.gopherstateonecall.org">www.gopherstateonecall.org</a>
Michigan	MISS DIG	(800) 482-7171	<a href="http://wwwa.missdig.org/MissDig">wwwa.missdig.org/MissDig</a>
Wisconsin	Diggers Hotline	(800) 242-8511	<a href="http://www.diggershotline.com">www.diggershotline.com</a>

### 2.2.2 LENGTH OF OPEN TRENCH

Not more than 100 feet of trench shall be open at any one time in a developed area and not more than 250 feet of trench shall be open in an undeveloped area. Not more than one street crossing may be obstructed by the same trench at any one time.

### 2.2.3 USE OF DROP WEIGHT

A drop weight or other type of machinery for breaking pavement may be used when such usage does not become a nuisance or a source of damage to underground or adjacent structures. Before employing a drop weight, the Contractor shall make sure that there is no nearby underground structure that would be injured by its use. The Contractor shall be solely responsible for any damage caused thereby.

### 2.2.4 BLASTING

All applicable codes on explosives and all local ordinances regulating blasting shall be adhered to when blasting is to be done. No blasting shall begin until blasting insurance is obtained. The local police department shall be notified of the proposed blasting at least 2 hours in advance. The Contractor will be solely responsible for any damage caused by the blasting operation.

### 2.2.5 SAWING OR CUTTING PAVEMENT

When specified, adjacent bituminous or concrete pavements to remain in place shall be sawcut to a minimum depth of 3" or ½ the depth of the pavement, whichever is greater, before being removed to create a straight, uniform edge for matching the new pavement. If sawcutting is not specified for bituminous pavement, the edge shall be "straight-lined" by other means to avoid a ragged, uneven edge.

### 2.2.6 POTHOLING

Potholing shall be utilized during construction activities to prevent excavation damage to existing underground utilities for all open-cut excavations and trenchless installation methods. Potholing is the practice of digging a test hole to expose underground utilities to determine the horizontal and vertical location of the facility.

The following alternative methods shall be utilized for potholing.

**A. Hand Digging.** Hand digging is the method of excavating a pothole by manual means with hand-held, non-mechanical equipment such as a shovel.

**B. Vacuum Excavation.** Vacuum excavation shall consist of air or water pressure to break up the soil and a vacuum device to collect the spoil. The Contractor shall determine if air or water vacuum excavation shall be used dependent upon specific site and environmental characteristics. Soil types such as heavy clay may require water vacuum excavation. Air vacuum excavators shall be utilized if mud from water vacuum excavators cannot be disposed of properly. Air vacuum excavators shall be used if damage to utilities, such as cutting through cables, will occur with the use of water vacuum excavators.

Air vacuum excavators shall utilize a high velocity air stream to penetrate, expand, and break-up the soil. The loosened particles of soil and rock shall be removed from the excavation through the use of a vacuum.

Water vacuum excavation systems shall excavate the pothole using high-pressure water to reduce and loosen the soil. The wet soil and mud slurry shall be removed to a spoil tank using a vacuum.

Maximum pothole size shall be 12 inches in diameter or 12 inch x 12 inch square.

Construction drawings indicating the proposed construction and existing utilities shall be present and utilized during potholing activities. The construction drawings shall be compared to locate paint marks to determine if all existing utilities shown on the drawings have been identified in the field. If the drawings and locate paint marks do not match, additional potholing shall be completed to determine accurate locations.

If locate paint marks have improperly designated the location of a facility, and the facility is exposed during potholing, the facility owner and the utility marking service shall be notified. The entity that exposed the facility shall document the horizontal and vertical location of the facility and communicate the information to the facility owner. If a utility cannot be located through potholing used in conjunction with construction drawings and locate marks, the facility owner and the utility marking service shall be contacted.

Potholing shall be performed for the following conditions:

**A. Open-Cut Excavations:** Potholing shall be completed to expose existing utilities, including mains and service lines, when open cut excavations are within the tolerance zone of the marked utility. The tolerance zone, also known as the "approximate location", is a strip of land equal to the width of the underground utility plus two feet on each side.

**B. Trenchless Installation Methods:** For trenchless operations with a bore path that parallels a utility (mains and service lines) within 3 feet, potholing shall be completed at the beginning and end of the bore and every 50 feet along the route. For trenchless operations with a bore path that parallels a utility (mains and service lines) within 5 feet, potholing is required at the beginning and end of the bore and every 200 feet along the route. Potholing shall be completed for all utilities (mains and service lines) crossing the path of trenchless operations.

**C. Congested Utilities:** In congested areas having several facilities in close proximity and/or crisscrossing each other, locates have greater potential to be less accurate. Potholing shall be utilized for excavations near congested utility areas.

Facilities exposed during potholing shall be protected throughout the project. Utilities that are rendered unsupported due to potholing shall be temporarily supported by shoring or other means. The utility shall be protected from heavy and sharp items falling into the excavation that could damage or cut the facility.

Potholes shall be restored within 24 hours after the utility has been located or as otherwise directed by the Owner. Backfilling and restoration of the pavement shall be in accordance with these specifications.

Potholing is an incidental cost and shall be included in other bid items.

## 2.2.7 INTERFERENCE OF UNDERGROUND STRUCTURES

When an underground structure interferes with the work to such an extent that an alteration of the plan is required, and the alteration results in a change in the cost to the Contractor, the Engineer will issue a written order for such altered work, specifying the basis of payment or credit for such altered work.

No pipe, conduit or other underground structure shall be allowed to remain in, penetrate, reduce the cross-sectional area or abridge the use of any sewer or appurtenance.

Where an unknown underground structure is encountered in the excavation for the proposed work, and because of interference, part of the structure requires relocation or chipping away, the Contractor shall immediately give notice of such interference to the Engineer and the owner of such underground structures.

Where the line or grade of the proposed work conflicts with an existing water main and alteration is not otherwise specified, the Owner will alter the water main at no cost to the Contractor or negotiate with the Contractor to perform such required alteration as an extra, unless otherwise specified. If unit prices for water main and fittings are included in the

contract, they will be used to determine payment. The Contractor shall in either case excavate the area around the water main to allow sufficient room to alter the main.

No extra compensation will be paid for unavoidable delays caused by the interference of existing underground structures or pipelines.

In the event that relocation is for the convenience of the Contractor rather than actual interference, the Contractor shall first notify the Engineer and the owner of the underground structure and receive permission to temporarily relocate such structure or to discontinue service. Replacement to the original position and condition shall be made at no cost to the Owner. The owner of the structure shall have the right to do all the work in connection with said relocation, discontinuance and replacement, billing the Contractor for all costs of same, or, with the approval of the owner, the relocation, discontinuance or replacement may be made by or arranged for, by Contractor at Contractor's expense.

Where the excavation extends under or approaches an underground structure in a manner to endanger it, the Contractor shall be responsible for the protection of such structure and shall brace, support and otherwise protect it.

## **2.2.8 PROTECTION OF EXISTING STRUCTURES AND UTILITIES**

All surface structures and features, including buildings, pavements, sidewalks, curb and gutter, trees and shrubs, adjacent to the construction easement or right of way, and those within the construction easement, or right of way, which are to be saved shall be properly protected against all damage.

All existing gas pipes, water pipes, steam pipes, electric and telephone conduits, sewers, drains, culverts, buried tanks, hydrants, and other surface or subsurface structures, either of a private or of public ownership, except railway or railroad tracks, shall be carefully supported and protected from injury by the Contractor. In some cases, this protection may require the furnishing and driving of tight sheathing and such other means as may be necessary to properly support and maintain the structure involved. All such work must be done by and at the expense of the Contractor and according to their own plans. The fact that the Owner may be under no legal obligation to provide for doing such work will be no excuse for the Contractor neglecting or refusing to perform the same, such being specifically required. In the event of damage or injury to any of these surface or sub-surface structures, the Contractor will be required to make replacements or repairs to the satisfaction of the Engineer at no additional cost to the Owner.

Support and protection of railroad tracks shall be at the direction of the railroad owner.

## **2.2.9 REMOVAL OF OBSTRUCTIONS**

The Contractor shall remove all obstructions such as mounds of dirt, stone or debris located within the working limits without additional payment. Obstructions such as street signs, culverts and end walls, advertising signs and guard posts located in construction easements or right of ways, may be removed providing they are promptly replaced to their original condition unless otherwise specified.

No trees or shrubs located in private property or easement shall be removed or trimmed without permission of the property owner. In street rights-of-way, the Contractor may remove or trim only those trees or shrubs located within the trench limits. No other trees or shrubs shall be removed, cut down or trimmed unless specifically allowed in the contract documents or by the Owner. The Contractor shall take all precautions necessary to protect such trees from any damage due to the execution of the work or to the movement of equipment. The Contractor shall dispose of brush and wood within 5 days after being removed. Stumps shall be excavated and removed or chipped until removed. Trees to be saved in the construction zone shall be protected by wrapping the trunks or fencing them off. All interfering tree roots or branches one inch (1") or greater in diameter shall be neatly cut perpendicular to the direction of the growth on the tree side of the trench.

## **2.2.10 ROCK EXCAVATION**

Rock excavation shall consist of boulders exceeding one cubic yard (1 cu. yd.) in volume, which are removed from the trench. Rock excavation shall also include solid ledge rock that, in the opinion of the Engineer, requires extraordinary procedures for its removal. No soft shell or disintegrated rock which can be removed with a pick; no loose, shaken or previously blasted rock; no broken stone, and no rock which may fall into the work from outside the limits of excavation will be included. Shales and hardpan shall not be classified as rock. When rock is encountered, the Contractor will be required to use the track mounted backhoe being used for excavation (rated at not less than 170 HP and developing 40,000 lbs. break-out force (SAE J732C)) to remove as much rock as possible before payment for rock excavation is made.



When solid rock is encountered, it shall be stripped of earth and shale and the Engineer notified and given proper time to measure the same before removal. The Contractor will be responsible for having an Engineer's representative present when rock measurements are made. No rock removed that has not been measured by the Engineer will be paid as rock excavation. In lieu of stripping the earth overburden prior to blasting, the Engineer and Contractor may mutually agree on a method to define the vertical limits of the rock. Deleting advance stripping will result in a reduction in the bid unit price for rock removal.

For the purpose of determining payment, the depth of rock excavation shall be measured from the top of the rock to eight inches (8") below the outside wall of the pipe (excluding bells). The width shall be measured as the outside diameter of the pipe plus eighteen inches (18") with a minimum pay width of thirty six inches (36"). For manholes, rock excavation shall be measured from the top of the rock to a point twelve inches (12") below the invert and the nominal diameter of the manhole plus twenty-four inches (24"). Payment for rock excavation shall be the price bid per cubic yard. This payment is in addition to the price per lineal foot of the pipe installed. Bid price for rock removal is to include furnishing foundation and bedding material beneath the pipe/manhole of a type satisfactory to the Engineer. Class I Crushed Rock and Class II Clean Coarse Grained sand are considered suitable. Backfill material to a point twenty-four inches (24") above the crown of pipe shall be Class I or II free of rock larger than one inch (1"). Rock over eight inches (8") diameter shall be hauled at the Contractor's expense to locations designated by Owner and replaced with sand or suitable excess material. Rock under eight inch (8") diameter may be used in the Final Backfill above the pipe but no closer than twenty-four inches (24").

Where unit prices for rock excavation are not provided, the extra cost shall be negotiated prior to the removal of any rock, otherwise no extra payment will be made.

Where hard material is encountered that has physical characteristics lying between solid rock and earth excavation, the Engineer may allow a payment based on a percentage of the bid unit price for rock excavation. Generally, the full rock excavation price will be paid for material removed by blasting. A percentage of the full bid price will be paid for rock removed by use of specialized equipment such as ripping, drilling, impact hammers or rock buckets. No rock payment will be made for material removed with conventional equipment.

In all cases where rock is encountered in the excavation, whether payable as Rock Excavation or not, the foundation and bedding to eight inches (8") below the pipe and twenty-four inches (24") above the pipe shall be Class I or II backfill free of rock greater than one inch (1").

**No additional payment will be made for rock excavation within the limits of lift station, wastewater treatment facility, pump house, water treatment plant or reservoir contracts. All rock excavation on such projects is incidental.**

#### **2.2.11 EXCAVATED MATERIAL**

All street surfacing and base material within the area of the excavation including pavements, paving gravel, crushed rock, breaker rock, sand lift, etc., shall be removed for a suitable distance in advance of the deeper excavation, and kept separate, to be again used in repaving or resurfacing the street, road or ground. This requirement will not apply with streets having less than 3" of combined gravel and asphalt surfacing.

The excavated material to be used for backfilling must be stored so that it will cause a minimum of inconvenience to public travel, adjacent owners or tenants and other contractors or Subcontractors. Stockpiles shall be protected as specified in Section 2.8.4.

No claim for extra payment will be allowed because of the presence of water, quicksand or other materials tending to increase the excavating costs, unless specifically provided for in the contract documents.

#### **2.2.12 UNSTABLE FOUNDATION**

If the bottom of the excavation is of undesirable material, such as rock, Class IV or Class V material, or the presence of ground water causes a condition which cannot adequately support the work, an additional four inches (4") of foundation shall be excavated and backfilled with compacted Class I or II and included as part of the standard sections at no additional payment. In the event that it becomes necessary to extend the foundation to a greater depth, such additional amount of removal and replacement will be paid for as Unsatisfactory Subgrade.

### **2.2.13 UNSATISFACTORY SUBGRADE**

Where in the opinion of the Engineer native material is unsatisfactory for backfill, it shall be removed and replaced with material satisfactory to the Engineer, such as Class I, II or III. No payment for material hauled away will be made, but replacement material will be paid for at the unit price bid. Cubic yards are to be loose box measurement. If a unit price for unsatisfactory subgrade is not provided, the price shall be negotiated before any material is placed. Material will not be considered unsatisfactory solely because it is wet. If the native material would be suitable dry and the wet condition is the result of construction activities, the Contractor shall remove and replace or stabilize at no cost to the Owner. No additional payment shall be made for embedment replacement except as specified. Embedment replacement is included in the pipe installation price.

### **2.2.14 STORAGE OF MATERIALS IN STREETS**

A reasonable amount of structural and other material to be used in constructing the Work may be stored in the streets or highways by or adjacent to the work but only to an extent that is absolutely necessary to avoid delay in construction. Such materials will not be allowed to accumulate but shall be replenished from day to day as they may be required. In any case, materials may be stored only with permission of the street authority and the Owner, which permission shall be revocable at any time. The Contractor, if so ordered, shall immediately remove such materials.

### **2.2.15 SURPLUS EXCAVATED MATERIAL**

The excavated material that is not to be used for backfilling shall be removed immediately from the site of work. The Contractor shall dispose of surplus excavated material at sites designated by the Owner within two miles of the project site or within the corporate limits, whichever is greater. If the Owner does not designate a location, the Contractor shall be allowed to utilize the material and select the disposal site.

The Contractor shall obtain all permits necessary for use of the disposal site(s). If the area involved will be one acre or larger, a Construction Site Erosion Control and Storm Water Discharge Permit shall be obtained in advance. Before delivering material to the disposal location, the Contractor shall erect erosion control devices. The material shall be graded to drain with no side slopes steeper than 2:1. All areas disturbed shall be stabilized with topsoil, seed and mulch or erosion mat, as appropriate. The Contractor shall maintain the site until final cover is established. No material shall be placed in a floodway, waterway or wetland without prior written approval from the DNR. If the disposal site is not under the Owner's control, the Contractor shall obtain written permission from the property owner.

### **2.2.16 DRAINAGE OF EXCAVATION**

The Contractor shall keep all finished excavations free of water or sewage during the preparation of the sub-grade and until completion of the work. Trenches shall be protected to minimize entrance of runoff.

No ground or surface water shall be allowed to drain into any existing sanitary sewer. Water or sewage may be allowed to flow through completed sewers and sewer structures, but only after all mortar and concrete have set up to a degree that will insure them against damage. No units of work shall be constructed under sewage or under water except when done in accordance with accepted construction procedure. The cost of bypassing, bailing or pumping of storm waters, ground water or sewage shall be included in the price bid for other items of work. All water pumped or bailed from the trench shall be conveyed to a suitable point of discharge. Sewage shall be discharged only to a sanitary sewer tributary to a treatment facility except when temporarily stored in a suitable holding tank.

### **2.2.17 DEWATERING SUMPS AND PUMP WELLS**

The cost for making all extra excavations necessary to prevent the water from interfering with the proper construction of the work, and for forming all dams, and furnishing and laying of underdrains, digging of sumps or wells, bailing and pumping, must be borne by the Contractor, and included in the price bid for other items of work. No additional payment will be made for any dewatering unless a specific bid item is provided. The Contractor is solely responsible for investigating the site prior to bidding to determine the need for dewatering. Dewatering sumps and pump wells are to be strongly sheathed and braced while in use and, when abandoned, shall be backfilled in the manner described for wells.

State permits are required for most dewatering wells. Control measures to eliminate siltation of surface waters are required. The Contractor shall apply for, pay permit fees, obtain and comply with all conditions of the permit including proper abandonment.

## **2.2.18 THAWING OF FROZEN GROUND**

The Contractor shall obtain a permit from the proper authority before building a fire to thaw frozen ground, and shall comply with all conditions of said permit. Thawing shall be accomplished by a method that does not emit excessive smoke or flame, or otherwise inconvenience the public. The Owner reserves the right to prohibit burning whenever it is deemed undesirable.

## **SECTION 2.3.0 – SHEATHING AND BRACING**

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### **2.3.1 EXCAVATION TO BE SHEATHED AND BRACED**

Open-cut excavations shall be sheathed and braced as required by the applicable Federal and State code, and as may be necessary to protect life, property or the work. When tight sheathing is used, it shall be driven so as to prevent soil from entering the excavation either below or through such sheathing. The shoring and bracing of tunnel excavation shall conform to the requirements of the applicable Federal and State codes.

Tight sheathing may be set in place rather than be driven, providing that ground conditions are suitable and the excavation is properly spot braced prior to the placing of sheathing. Any voids behind the sheathing shall be immediately filled with gravel backfill.

Where conditions warrant extreme care in supporting the sides of the excavation, the Contractor shall furnish and drive steel sheathing or piling of the interlocking type or other approved material at no additional expense to the Owner. Care shall be taken to prevent voids outside of the sheathing, but if voids are formed, they shall be immediately filled with granular backfill.

### **2.3.2 LOWER LIMITS OF SHEATHING**

Sheathing shall be driven to the full depth of the excavation or to such additional depths as may be required for the protection of the work. Where the soil in the lower limits of excavation has the necessary stability, the Contractor may stop the driving of sheathing at some designated elevation above the excavation bottom.

### **2.3.3 REMOVAL OF SHEATHING AND BRACING**

Sheathing and bracing, including sections which have been ordered left in place, shall be removed to a depth of 3 feet below the established street grade or the existing surface grade, whichever is lower.

Sheathing and bracing shall be removed only when and in such manner as will insure adequate protection of the completed structures and adjacent ground. Trench bracing, except that which must be left in place, may be removed when the backfilling has reached the respective levels of such bracing. Sheathing, except that which must be left in place, shall be removed after the backfilling has been completed or has been brought up to such elevation as to permit its safe removal.

### **2.3.4 COST OF SHEATHING AND BRACING**

The cost of furnishing, placing and removing of sheathing and bracing and the leaving in place of sheathing and bracing indicated in the Contract Documents, shall be included in other unit prices unless a specific bid item is available. Additional sheathing and bracing may be ordered left in place as an extra, by written order of the Engineer.

### **2.3.5 ENGINEER'S FAILURE TO ORDER SHEATHING AND BRACING LEFT IN PLACE**

The right of the Engineer to order sheathing and bracing left in place shall not be construed as creating any obligation to issue such order. The failure to exercise this right shall not relieve the Contractor of any liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place in the trench sufficient sheathing and bracing to prevent the caving or moving of the ground, or disturbance of the completed work or any of the surface or sub-surface structures.



### **2.3.6 PORTABLE TRENCH BOX OR SLIDING TRENCH SHIELD**

Portable trench boxes or sliding trench shields approved by appropriate Federal and State agencies may be used as long as job conditions warrant such use. Use of the shield shall not relieve the Contractor of any liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place in the trench sufficient sheathing and bracing to prevent the caving or moving of the ground, or disturbance of the completed work or any of the surface or subsurface structures.

Care shall be taken when a trench box or shield is moved ahead so as not to pull the already jointed pipe apart or leave voids around the pipe wall.

The Contractor shall provide an acceptable method of rechecking line, grade and horizontal location of the pipe after the shield has been moved ahead. If the pipe has moved, it shall be reset to the proper line and grade.

The width of the trench shield or box shall be such that a minimum of six (6) inch horizontal clearance is maintained between the pipe and shield at all times.

Any voids occurring between the trench box or shield and the undisturbed trench wall within the pipe zone (bottom of trench to top of cover material) shall be filled with crushed rock or granular backfill, immediately after the box or shield is positioned.

## **SECTION 2.4.0 – BACKFILLING**

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### **2.4.1 EXCAVATED MATERIAL USED AS BACKFILL**

Unless otherwise specified, excavated material shall be used for backfill provided that such material consists of clay, sand or other materials that are suitable for backfilling. Unsuitable backfill materials include vegetable or other organic matter, all types of refuse, large pieces or fragments of inorganic material and such other material as, in the judgment of the Engineer, are unsuitable for backfilling. Suitable excavated material shall be used for backfill. Lumps shall be broken up. Stones, lumps or clods greater than 2 inch shall not be placed within 2 feet of the pipeline or structure. Rock larger than 6" shall not be used as backfill. Where backfill material is not suitable, in the opinion of the Engineer, the Engineer may request removal and replacement as Unsatisfactory Subgrade per Section 2.2.13.

Material will not be considered unsatisfactory solely because it is wet. If the native material would be suitable dry and the wet condition is the result of construction activities, the Contractor shall remove and replace or stabilize at no cost to the Owner.

Adjust the soil moisture content as required plus or minus 2% of optimum. Adding water or drying fill material to achieve suitable moisture content is incidental to the Project

Where excavated material is not suitable for backfill or pipe bedding and granular material is used, the trench can become a conduit for water. Clay or bentonite barriers shall be provided at approximately 100 ft. intervals to prevent movement of water.

### **2.4.2 PLACING OF BACKFILL**

All pipe or manholes with a rubber gasket or resilient type joint shall be backfilled within 24 hours after installation. Pipe sewers or manholes with cement mortar joints shall not be backfilled until initial set has occurred. Concrete shall not be backfilled until it has been determined that the concrete has reached a compressive strength of 2,500 psi.

Large stones (6" in longest dimension) or hard or frozen lumps of material will not be allowed in the backfill. Material that has frozen in the stockpile shall be replaced with acceptable backfill at the Contractor's expense.

After the cover material has been placed, the backfill shall be deposited and consolidated in accordance with the requirements of Chapter 2.4.4. The Contractor will be held responsible for any damage to underground structures and any settlement of the trench.

### 2.4.3 UPPER LEVEL OF BACKFILL

In existing pavement and roadways, the trench shall be backfilled to the existing surface, subject to pavement replacements as required in the Contract Documents. In streets under construction, in open areas and in easements, the excavation shall be backfilled to the existing ground surface or as specified.

### 2.4.4 COMPACTION

Backfill shall be compacted to preclude settlement, in accordance with the following:

**A. Special Compaction.** Unless otherwise specified, all backfill in areas to be used for structures or driving surfaces (streets, highway shoulders, parking lots, driveways, etc.) shall receive Special Compaction. This requires mechanical compaction by specialized equipment in lifts not exceeding twelve inches (12"). The equipment and procedures shall be appropriate for the type of material. Mechanical compaction shall not begin until the embedment material has been placed to the specified depth above any pipelines. Compaction procedures shall be performed to provide a minimum 90% Modified Proctor Density from the bottom of the excavation or top of bedding to 6 feet deep and 95% Modified Proctor Density for the top six feet (6'). The Engineer reserves the right to order compaction tests at the Contractor's expense if compaction efforts do not appear to be adequate.

**B. Standard Compaction.** Backfill in open fields shall receive Standard Compaction. Backfill shall be placed in 12" to 18" lifts and tamped or bulldozer compacted to a minimum 90% Modified Proctor Density. Each layer shall be compacted until no further appreciable consolidation takes place.

### 2.4.5 MINIMUM BACKFILL AND/OR COVER FOR PIPELINES

The minimum depth of backfill and/or cover shall be 4 feet above the outside top of sewer pipe and 7 feet for water pipe, unless specifically required by the Engineer or shown on the plans.

### 2.4.6 BACKFILL AT CROSSINGS OF STREETS, ALLEYS, DRIVEWAYS, PARKING AREAS OR TRAVELED ROADWAYS

Where an open-cut trench crosses a street, alley, driveway, parking area or traveled roadway, such crossing shall be compacted to prevent settlement and shall receive Special Compaction to a minimum of 95% Modified Proctor Density for the full depth of the trench. Where excavated material is not suitable as backfill, the Engineer may request removal and replacement as Unsatisfactory Subgrade per 2.2.13.

The top eight (8) inches of backfill shall be compacted crushed rock.

Where an open trench is cut in a traveled roadway or shoulder of a street and pavement replacement is not specified, the trench shall be surfaced with twelve (12) inches compacted depth of crushed rock.

## **SECTION 2.5.0 – SURFACE REPLACEMENT AND SITE RESTORATION**

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### 2.5.1 REPLACEMENT OF PAVEMENTS

All street surfacing and base material within the area of the excavation including pavements, paving gravel, crushed rock, breaker rock, sand lift, etc., shall be removed for a suitable distance in advance of the deeper excavation, and kept separate, to be again used in repaving or resurfacing the street, road or ground. This requirement will not apply with streets having less than 3" of combined gravel and asphalt surfacing.

Unless otherwise specified, all streets are to have a total thickness of compacted base course equal to that originally existing. This depth shall consist of approved salvaged material (see above) or crushed rock furnished and placed by the Contractor. When the Owner requests a greater thickness than existing, the extra crushed rock shall come from the Owner's stockpile.

The surface of the ground in the streets and elsewhere shall in all cases be left in as good of condition as it was prior to the commencement of the work; and when of gravel or crushed rock it shall be bladed and compacted in accordance with standard road construction practices. Filling and resurfacing shall be done in a manner to prevent as far as possible after settlement.

All culverts, sidewalks, curb and gutter sections, driveways, etc., are to be protected and not removed unless specifically directed by the Engineer. Asphaltic or concrete street surfacing material shall not be replaced unless specified.

## 2.5.2 REPLACEMENT PAID BY CONTRACTOR

Wherever any sidewalk, driveway, curb, gutter, culvert or pavement has been damaged or removed by the Contractor, whether deliberately or through failure to carry out the requirements of the appropriate codes, the Contract Documents or the specific direction of the Engineer relative to their protection, or through failure to employ usual or reasonable safeguards, such existing improvements shall be replaced or repaired at the Contractor's expense. The Engineer shall have the option of ordering the Contractor to make the necessary repair or replacement at Contractor's expense or to have such repair or replacement done by the Owner and the cost deducted from the monies due the Contractor.

## 2.5.3 MAINTENANCE OF SURFACE

The Contractor shall be responsible for placing the specified surfacing and for its maintenance and safety to travel for the duration of the contract and for 30 days following final acceptance. The Owner shall maintain the surface after the 30-day period, although the Contractor shall correct deficiencies for the full one-year warrantee period. Temporary surfacing material such as breaker rock or crushed rock necessary to access the work area or maintain traffic shall be furnished and installed at the Contractor's expense.

In the event that it becomes necessary for the Owner to provide emergency maintenance of the Contractor's trenches, the cost of such work shall be deducted from the monies due the Contractor.

The Owner will provide crushed rock to be used for maintenance of streets only where subgrade or pavement replacement by the Contractor is not specified.

## 2.5.4 REPLACEMENT OF LAWNS

Where a project is constructed in an established lawn area the Contractor shall restore the damaged area with Type "C" lawn replacement, unless otherwise specified in the Contract Documents.

The following shall be standard types of lawn replacement:

**TYPE "A" LAWN REPLACEMENT.** Replace lawn with top grade nursery sod laid over three inches (3") of fertilized, screened topsoil spread evenly over the entire area.

**TYPE "B" LAWN REPLACEMENT.** Replace lawn with a good grade of weed-treated field sod laid over the disturbed area.

**TYPE "C" LAWN REPLACEMENT.** Replace lawn by means of placing four inches (4") of fertilized, screened topsoil spread evenly, seeding with an approved grass seed at the recommended rate and mulching.

**TYPE "D" LAWN REPLACEMENT.** Carefully salvage all topsoil in advance of excavation. Scarify the construction area and replace topsoil. Seeding and maintenance will be done by others.

All lawns shall be rolled, fertilized and watered by the Contractor as necessary until sustained growth is assured. If salvaged topsoil is insufficient, the Contractor shall supply suitable material from offsite to meet the minimum thickness specified. In all cases the lawn area shall be landscaped to be suitable for maintenance and mowing by the type of equipment expected to be used for the area. For example, residential lawns shall be smooth enough for mowing by normal home mowing equipment and rural ditches shall be suitable for mowing by normal highway equipment.

The cost of such lawn replacement shall be included in the unit price bid for other items of work, unless a specific bid item is listed. When a Contractor damages an existing lawn area and it is not repaired, the Owner will deduct the cost from the monies due the Contractor. Refer to Chapter 2.8.0 - Erosion and Sedimentation Control for further requirements.

## SECTION 2.6.0 – JACKING, DRILLING OR BORING

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### 2.6.1 GENERAL REQUIREMENTS

When jacking, drilling or boring operations are required or permitted, the Contractor shall submit details giving the limits of the proposed jacking, drilling or boring, the method and equipment to be used, and the location of the shaft, pit or approach tunnel. This shaft, pit or approach tunnel shall be at a location that will not unduly interfere with traffic or with the use of adjacent property.

Upon completion of the operations, all voids around the outside face of the pipe shall be filled.

### 2.6.2 CASING PIPE

A casing pipe is a pipe into which another pipe, the carrier pipe, conveying the flow is inserted. The pipe shall meet the minimum requirements of the applicable highway or railroad permit. The casing pipe shall be the type specified and comply with the following:

#### A. Types

1. *Steel Pipe.* The steel pipe shall be new, welded or seamless pipe, minimum Schedule 30 with minimum yield strength of 35,000 psi and meeting ASTM A139 – Grade B, ASTM A232 – Grade 2 or ASTM A53 – Grade B. The joints of sections of casing pipe to be jacked shall be welded with a continuous circumferential weld. It shall be the Contractor's responsibility to provide stress transfer across the joints that is capable of resisting the jacking forces involved.

2. *Reinforced Concrete Pipe.* When reinforced concrete pipe is used, it shall be Class IV, Wall B, meet the requirements of Section III and have two circular rings of reinforcement extending into both the tongue and groove of the pipe. The use of quadrant reinforcement or elliptical reinforcement, as an alternate to full inner and outer circular cages, will not be permitted in pipe intended for jacking. The barrel and joints of all jacked pipe shall be protected from crushing, or other damage, by placing cushioning material on the outside shoulder of the spigot end of each section of pipe prior to jacking out of the shaft. Jacking pressures used shall be such that crushing or other damage to the barrel or joints of the pipe will not occur. After the pipe is in final position, the joints shall be pointed with a non-shrink cement mortar. This pointing is not required when rubber type gasket joints are used.

#### B. Seal Ends

Geotextile fabric (8-oz/sq. yd. non-woven) shall protect the annular space at the ends of the casing pipe. The fabric shall be attached to the carrier pipe with stainless steel bands and overlapped 18" on the casing pipe before being held in place by the backfill. APS Casing Pipe End Seals or equal are also acceptable.

#### C. Casing Spacers

APS polyethylene casing spacers or equal shall be furnished and installed at 6 ft. intervals. Provide field-adjustable runners for gravity flow carrier pipes.

### 2.6.3 HORIZONTAL DIRECTIONAL DRILLING

#### A. Qualifications

The work shall be completed by an experienced contractor who can demonstrate expertise in trenchless methods and provide a list of five utility references for directional drilling for pipe sizes ranging from 4" to 24" performed in the last two years.

**B. Obstructions**

If an unknown obstruction is encountered, the Contractor shall promptly implement measures to adjust the borehole alignment as necessary to bypass/avoid the obstruction. Adjustments to the borehole alignment to bypass the obstruction shall be gradual and shall not impose abrupt changes in the alignment that will impose additional stresses and deformations on the pipe. The reasonable additional costs for alignment adjustment measures due to unknown obstruction shall be reimbursed only if a price is established in advance of the work.

**C. Instrumentation**

The Contractor shall provide and maintain instrumentation or other controls which will accurately locate the pilot hole, measure drill string axial and tensional loads, and measure drilling fluid discharge rate and pressure. The Engineer shall be allowed to have access to these instruments and their readings at all times.

**D. Record Information**

Following the completion of pilot hole drilling, the Contractor shall provide a tabulation of three dimensional coordinates referenced to the drilled entry point which accurately described the location of the pilot hole at intervals of 25 feet along the length of the pilot hole alignment.

**E. Borehole Abandonment**

Boreholes installed and/or partially installed pipe that fails to meet specifications shall be abandoned and backfilled with grout. Rejection criteria includes failure to drill the boreholes to within the required tolerances, failure to install the pipe properly without damage, collapse or parting the joints. Abandoned boreholes and pipe shall be completely grouted with a sand-cement grout mix as approved by the Engineer.

**F. Ream and Pull Back**

Prereaming operations shall be conducted at the discretion of the Contractor. The Contractor shall insure that a hole sufficient to accommodate the pull section has been produced. Any damage to the pipe resulting from inadequate prereaming shall be the responsibility of the Contractor. All provisions of this Specification relating to simultaneous reaming and pulling back operations shall also pertain to prereaming operations. The pull section shall be installed in the reamed hole in such a manner that external pressures are minimized and an appropriate counterbalancing internal pressure is maintained. Any damage to the pipe resulting from external pressure during installation shall be the responsibility of the Contractor. Buoyancy modification shall be used at the discretion of the Contractor. Any buoyancy modification procedure proposed for use shall be submitted for approval. The Contractor shall be responsible for any damage to the pull section resulting from buoyancy modifications.

## **G. Drilling Fluids**

Drilling fluids shall be non-hazardous materials which comply with, state and federal regulations and permit requirements. The Contractor shall be responsible for obtaining, transporting, and storing any water required for drilling fluids. The recirculation of drilling fluid surface returns shall be maximized. The Contractor shall provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse. Disposal of drilling fluids and drill cutting shall be the responsibility of the Contractor. Excess drilling fluids and drill cuttings shall be disposed of in approved off-site locations in accordance with local, state, federal laws and regulations, right-of-way and workspace agreements, and permit requirements. No additives which would prevent off-site/non-hazardous disposal of drilling mud will be allowed. The Contractor shall employ his best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns or breakouts at locations other than the entry and exit points shall be minimized. In the event that annular circulation is lost, the Contractor shall take steps to restore circulation. If inadvertent surface returns or breakouts of drilling fluids occur, they shall be immediately contained with hand placed barriers (i.e. hay bales, sand bags, silt fences, etc.) and collected using pumps. If the amount of the breakout is not great enough to allow practical collection, the affected area shall be diluted with fresh water and the fluid will be allowed to dry and dissipate naturally. If the amount of the breakout exceeds that which can be contained with hand placed barriers, small collection sumps (less than 5 cubic yards) may be used. If the amount of the breakout exceeds that which can be contained and collected using small sumps, drilling operations shall be suspended until breakout volumes can be brought under control. The Contractor shall take all necessary steps to avoid any drilling fluid-induced blow out or any drilling fluid leak. Any damage resulting from such blow outs and leaks shall be the Contractor's responsibility.

## **H. Pipe Installation**

The entry and exit angles shall be kept to a minimum to reduce the pull back forces required. The maximum entry angle shall be 15° from horizontal and the maximum exit angle shall be 8°. The Contractor shall provide the calculated as-built location coordinates at 30 ft. intervals. Each pipe shall have a firm bearing along its entire length. At all times when pipe installation is not in progress, the open ends of the pipe shall be closed with temporary watertight plugs or by other suitable means. If water accumulates in the entry and exit work shafts during stoppages when work is resumed, the plug shall not be removed until all conditions are suitable to prevent water, earth, slurry, or other material from entering the pipe. At all times, including when pipe installation is not in progress, the drilling slurry for support of the pipe excavation and hole must be maintained in a condition that provides borehole stability. If unstable ground sections or pervious zones are encountered in the ground sections or pervious zones are encountered in the ground, the Contractor shall implement appropriate measures, such as installation of temporary casings, grouting or other adjustments, to avoid borehole collapse.

## **I. Pipe Pulling**

The maximum lengths of pipe assembled above ground and pulled at any one time shall not exceed the length recommended by the pipe manufacturer. The maximum allowable tensile load imposed on the pull section shall be equal to 90% of the product of the specified minimum yield strength of the pipe and the area of the pipe section. IF more than one value is involved for a given pull section, the lesser shall govern. The Contractor shall provide a suitable pulling force measuring device connected to the drilling string or pulling mechanism. A swivel shall be used to connect the pull section to the reaming assembly to minimize torsional stress imposed on the section. The pull section shall be supported as it proceeds during pullback so that it moves freely and the pipe and corrosion coating are not damaged.

## **J. Tracer Wire**

A Tracer Wire shall be installed for all non-metallic pipe. The tracer wire shall be pre-installed in conduits or interduct or as an integral part of the pipe installation.



## **SECTION 2.7.0 – PROTECTION OF THE WORK, PUBLIC AND PRIVATE PROPERTY AND THE PUBLIC**

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### **2.7.1 PROTECTION OF WORK**

During performance and up to the date of final acceptance, the Contractor shall be under an absolute obligation to protect finished and unfinished work against any damage, loss or injury. This includes concrete sidewalk and curb and gutter. In the event of such damage, loss or injury, the Contractor shall promptly replace or repair such work, whichever the Engineer shall determine to be preferable.

The Contractor shall provide guards, if necessary, and take such other precautions as are required both by day and by night to protect life and property.

### **2.7.2 PROTECTING OPENINGS**

Adequate protection shall be provided around all openings wherever required to safeguard the work or the public. All openings and surface obstructions shall be protected with barricades, signs and suitable warning devices.

### **2.7.3 STREET BARRICADES, SIGNS AND WARNING DEVICES**

The Contractor shall be responsible for the erection and maintenance of all barricades, lights and signs necessary for public safety and convenience. In general, all hazards within the limits of the work or on detour around the work must be marked with well-painted, well-maintained barricades, reflectors, electric lights, flashers and warning and directional signs in sufficient quantity and size adequate to protect life and property. These safeguards shall be moved, changed, increased or removed as required during the progress of the work to meet changing conditions.

When a street is closed to through traffic, barricades shall be placed at the adjacent intersections as well as at the location of the obstruction. Detour signs shall be attached to the barricades at the adjacent intersections. Detour signs shall be adequately illuminated and/or reflectorized so as to be clearly visible at all times.

Barrier fence may be required to be installed at locations where street or alleys are closed for the full width of the roadway.

All warning devices shall be kept clean and in good repair so as to be readily discernible at all times. The signing shall be done in accordance with the latest revision of the Manual on Uniform Traffic Control Devices (MUTCD) (<http://mutcd.fhwa.dot.gov/>) unless the Owner approves deviations in writing.

The Owner shall have full authority to suspend or limit the Contractor's operations, without additional compensation, if signing or barricading practices are inadequate. Failure to implement or maintain proper signing practices shall be justification for withholding or reducing payments to the Contractor.

### **2.7.4 FLAGGERS REQUIRED**

Whenever the Contractor's operations obstruct or endanger a used traffic lane, and no marked detour has been provided, flaggers shall be furnished to direct traffic through or around the congested area.

### **2.7.5 REMOVAL OF SNOW**

The Contractor shall be responsible for immediate removal of snow from those sections of streets that are obstructed by construction activities.

### **2.7.6 ACCESS TO PROPERTIES**

The Contractor shall neither shut off nor unnecessarily interfere with either pedestrian or vehicular access to property without the consent of the Engineer or Owner.

### **2.7.7 PROTECTING PRIVATE PROPERTIES**

All private property shall be fully protected by the Contractor. All trees, bushes, shrubs, sod, etc. on private property damaged by the Contractor shall be repaired or replaced by the Contractor at no cost to the Owner, and to the satisfaction of the Engineer.

Prior to commencing an excavation or tunnel in the immediate vicinity of any building or other structure, the safety of which may be endangered thereby; the Contractor shall serve notice upon the Owner of such building or structure, giving the date of beginning of such work. During the course of the work adjacent to such property, the Contractor shall at all times exercise due caution and care and furnish and place such extra timbering, bracing and sheathing as may be necessary to insure against loss of ground adjacent to the excavation or tunnel.

### **2.7.8 DRAINAGE**

Storm water drainage must not be obstructed at any time. When necessary, a continuous pipe, of ample capacity, shall be laid to carry off the storm water. Such pipe or drain shall be kept open and free of obstructions. Proper precautions shall be taken to prevent excessive silt, sand or clay from entering sewers or drainage ways.

### **2.7.9 ACCESS TO WATER HYDRANTS**

The Contractor shall maintain access to hydrants at all times. Before any hydrants are removed from service temporarily, the Contractor shall notify the Fire Department.

### **2.7.10 TRAFFIC**

The Contractor shall maintain vehicular traffic as directed in the Contract Documents or by the local, State or County Highway authority. Generally, one lane traffic shall be maintained unless a detour is provided.

### **2.7.11 WORK IN PRIVATE RIGHT-OF-WAY**

Whenever the work is to be prosecuted through private property for which the Owner has obtained a license or an easement, the Contractor must abide fully with the terms of the license or the easement, a copy of which is on file with the Owner.

### **2.7.12 APPROVAL OF EASEMENT RESTORATION**

Prior to final payment, the Contractor shall send a notice to all easement grantors by certified mail, return receipt requested, a copy of which shall be filed with the Owner, said notice to be similar to the following:

*“The undersigned Contractor has completed the restoration of the construction site on which you have granted an easement for installation of certain utilities and improvements. If the site restoration is not complete to your satisfaction, please contact Davy Engineering Co., 115 S. 6<sup>th</sup> St., La Crosse, WI 54601 in writing and arrangements will be made immediately to view the site and restore the site in conformance with our contract. If Davy Engineering Company does not hear from you in writing within ten days from the above date, site restoration of your property will be deemed complete and approved by you.”*

*(Name of Contractor)  
(Address of Contractor)*

The Owner shall furnish the Contractor with names and addresses of easement grantors.

Upon receipt of a notice of deficiency, the Owner will examine the site, and direct the Contractor to complete all work that may be necessary to satisfy the terms of the Contract. If the Contractor refuses to comply, the Owner reserves the right to have the work done by others and to deduct the cost thereof from the monies due the Contractor. Should conditions exist which preclude the Contractor from completing satisfactory restoration, the Owner may require the Contractor to furnish a bond in a sum sufficient to cover any legal claims for damages.

If the Owner is satisfied that the work has been completed in agreement with the Contract Documents and the terms of the license or easement, the requirement to obtain the statement may be waived.

### **2.7.13 SANITARY PROVISIONS**

The Contractor shall provide and maintain properly sheltered sanitary conveniences for workers, and their use must be strictly enforced.



## 2.7.14 EMERGENCY MAINTENANCE AND PROTECTION

In the event it becomes necessary for the Owner to perform emergency maintenance and protection, which is the responsibility of the Contractor under the Contract Documents, the cost of such work shall be billed to the Contractor and deducted from his final payment if not paid.

## SECTION 2.8.0 – EROSION AND SEDIMENTATION CONTROL

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### 2.8.1 GENERAL

The Contractor shall take positive action to adequately control erosion and sedimentation as a result of construction activities associated with this project. Unless bid items are provided in the proposal form, costs associated with erosion and sedimentation control shall be incidental to the project and included in the total bid price.

Erosion and sediment controls shall be installed, inspected and approved prior to beginning any construction activities. In general, the Contractor shall practice the following control measures.

- Minimize size of disturbed areas.
- Stabilize disturbed areas.
- Keep runoff velocity slow.
- Protect disturbed areas from runoff.
- Retain sediment on site.
- Maintain control measures and conduct frequent follow-up inspections.
- Maintain log of inspections.

As used in this specification, "site" shall mean the entire area on which land disturbing or land development activities associated with this contract occur. Any eroded material leaving the site shall be removed and the effected area fully restored.

Erosion control practices shall comply with all permits issued for the Project.

### 2.8.2 IMPLEMENTATION OF EROSION CONTROL METHODS

#### A. Wisconsin

1. **Technical Standards.** All Contractors shall comply with NR 151.105 and NR 151.11 of the Wisconsin Administrative Code unless an alternate is specifically approved by the Engineer. Technical standards to comply with these requirements can be found at:  
<http://dnr.wi.gov/topic/stormwater/standards/index.html>
2. **Comply with Requirements.** All erosion and sediment control measures shall be constructed and maintained in accordance with the Erosion Control Plan, the plans, the specifications and Stormwater Technical Standards at:  
[http://dnr.wi.gov/topic/stormwater/standards/const\\_standards.html](http://dnr.wi.gov/topic/stormwater/standards/const_standards.html).

#### B. Minnesota

1. **Stormwater Permit for Construction Activity.** If an NPDES Permit is required for Construction, the Contractor shall work with the Owner to coordinate submittal. Information on submittal can be located at:  
<http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/construction-stormwater/index.html>
2. **Stormwater Pollution Prevention Plan.** The Contractor shall work with the site owner to create a stormwater pollution prevention plan (SWPPP) prior to beginning construction on the site.
3. **Construction activity requirements.** Construction activities shall meet Article IV of the General Permit to Discharge Stormwater Associated with Construction Activity, Permit Number: MN R1000001. The stormwater program for construction activity steps for construction are listed at:  
<http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/construction-stormwater/stormwater-steps-to-construction.html>

- C. Maintenance.** Periodic inspection and maintenance of all sediment control structures shall be provided to ensure the intended purpose is accomplished. Sediment control measures shall be in working condition at the end of each working day. After any significant rainfall, sediment control structures shall be inspected for integrity. Any damaged structures shall be corrected. Sediment control measures shall not be removed until the areas served have established vegetative cover.
- D. Waste and Material Disposal.** All waste and unused building materials (including garbage, debris, cleaning wastes, wastewater, toxic materials or hazardous materials) shall be properly disposed and not allowed to be carried by runoff into a receiving channel or storm sewer system.
- E. Tracking.** Each site shall have graveled roads, access drives and parking areas of sufficient width and length to prevent sediment from being tracked onto public or private roadways. Any sediment reaching a public or private road shall be removed by street cleaning (not flushing) before the end of each workday.
- F. Drain Inlet Protection.** All storm drain inlets that can potentially receive water originating from or passing through the site shall be protected with a straw bale, filter fabric or equivalent barrier as specified or approved by the Engineer.
- G. Pipeline Construction.** Sediment control for pipeline construction shall also include the following:
  - 1. Excavated trench material shall be placed on the high side of the trench.
  - 2. Immediately following pipe installation, the trench shall be backfilled, compacted and stabilized at the end of each working day.

### 2.8.3 SITE EROSION CONTROL

The following criteria apply only to land development or land disturbing activities that result in runoff leaving the site:

- A.** Channeled runoff passing through the site from adjacent areas shall be diverted around disturbed areas, if practical. Otherwise, the channel shall be protected as described below. Sheetflow runoff from adjacent areas greater than 10,000 square feet in area shall also be diverted around disturbed areas. Diverted runoff shall be conveyed in a manner that will not erode the conveyance and receiving channels. (Note: Soil Conservation Service guidelines for allowable velocities in different types of channels should be followed.)
- B.** All activities on the site shall be conducted in a logical sequence to minimize the area of bare soil exposed at any one time.
- C.** Runoff from the entire disturbed area on the site shall be controlled by the following:
  - 1. All disturbed ground left inactive for 7 or more days shall be stabilized by seeding or sodding (only available prior to September 15th) or by mulching or covering, or other equivalent control measure as approved by the Engineer.
  - 2. For sites with more than 10 acres disturbed at one time, or if a channel originates in the disturbed area, one or more sedimentation basins shall be constructed. Each sedimentation basin shall have a surface area of at least 1% of the area draining to the basin, be at least 3 feet deep and be constructed in accordance with accepted design specifications. Sediment shall be removed as necessary to maintain basin depth of 3 feet. The basin discharge rate shall also be sufficiently low as to not cause erosion along the discharge channel or the receiving water.
  - 3. For sites with less than 10 acres disturbed at one time, silt fences, straw bales or equivalent control measures shall be placed along all sideslopes and downslope sides of the site. If a channel or area of concentrated runoff passes through the site, silt fences shall be placed along the channel edges to reduce sediment reaching the channel.

#### **2.8.4 PROTECTION FOR STORAGE PILES**

Any soil or dirt storage piles containing more than ten cubic yards of material should not be located with a downslope drainage length of less than 25 feet to a roadway or drainage channel. If remaining for more than 7 days, they shall be stabilized by mulching, vegetative cover, tarps or other means approved by the Engineer. Erosion from piles that will be in existence for less than 7 days shall be controlled by placing straw bales or filter fence barriers around the pile. In-street dirt storage piles located closer than 25 feet of a roadway or drainage channel must be covered with tarps or suitable alternative control, if exposed for more than 7 days. The storm drain inlets as defined above shall be protected with straw bales or other appropriate filtering barriers as approved by the Engineer.

#### **2.8.5 CONTROL BY OWNER**

The Owner shall have full authority to suspend or limit the Contractor's operations, without additional compensation, if erosion control practices are inadequate. Failure to implement or maintain erosion control practices shall be justification for withholding or reducing payments to the Contractor.

### **SECTION 2.9.0 – PAY MEASUREMENT**

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#### **2.9.1 PAY MEASUREMENTS BY CONTRACTOR**

The Contractor shall measure all quantities necessary for unit price payments and provide the quantities and supporting data to the Engineer.

#### **2.9.2 PAY MEASUREMENT FOR NEW SEWERS AND DRAINS**

Sewers shall be paid for at the unit price bid per lineal foot measured horizontally. Pay measurement for sewers eight inches (8") through forty-eight (48") inches in diameter, inclusive, shall extend from centerline of manhole to centerline of manhole, or from centerline of manhole to the end of a portion not starting or terminating in a manhole.

Pay measurements for sewer greater than in diameter shall extend from the inside face of manhole or chamber to inside face of manhole or chamber.

Pay measurements for storm water drains shall extend from centerline of catch basin or storm water inlet to the centerline of manhole or sewer forty-eight (48") inches wide or less, or from centerline of catch basin or storm water inlet to the inside of sewers of structures wider than forty-eight (48") inches.

#### **2.9.3 PAY MEASUREMENT FOR NEW BUILDING SEWERS**

Pay measurements for new building sewers shall extend from the centerline of the main sewer to the end of the pipe laid. New building sewers shall be paid for at the unit price bid per lineal foot measured horizontally, and shall include the cost of all necessary bends and plugs.

#### **2.9.4 PAY MEASUREMENT FOR RELAID BUILDING SEWERS AND DRAINS**

Pay measurement for relaid building sewers and drains shall extend from the centerline of the main sewer to the end of the pipe laid. This measurement shall be made along the centerline of the relaid pipe. Relaid building sewers and drains will be paid for at the unit price bid per lineal foot.

#### **2.9.5 PAY MEASUREMENT FOR WYES**

Payment for wyes shall be made at the unit price bid. This price is to be in addition to the price per lineal foot of sewer and shall include the bend and plug.

#### **2.9.6 PAY MEASUREMENT FOR RISERS**

Pay measurement for risers shall extend from the flow line of the main sewer to the flow line of the connection pipe. Risers will be paid for at the unit price bid per vertical foot unless a lump sum bid is requested in the proposal.

#### **2.9.7 PAY MEASUREMENT FOR MANHOLES**

Manholes shall be paid for at the lump sum bid.

### **2.9.8 PAY MEASUREMENT FOR WATER MAIN AND FORCE MAIN**

Pay measurement for water main and force main shall extend from the centerline of fitting to centerline of fitting. Water main and force main shall be paid for at the unit price bid per lineal foot of pipe installed.

### **2.9.9 PAY MEASUREMENT FOR HYDRANT LEAD**

Pay measurement for hydrant lead shall extend from the centerline of the water main to the centerline of the hydrant. Hydrant lead shall be paid for at the unit price bid per lineal foot of pipe installed.

### **2.9.10 PAY MEASUREMENT FOR HYDRANTS**

Hydrants shall be paid for per unit installed. This shall be a lump sum bid and include the cost of the hydrant, blocking and gravel backfill.

### **2.9.11 PAY MEASUREMENT FOR VALVES**

Valves shall be paid for per unit installed. This shall be a lump sum bid and include the furnishing and setting of the valve box.

### **2.9.12 PAY MEASUREMENT FOR FITTINGS**

Fittings for watermain shall be paid per pound for each fitting installed. The weight shall be based on the tables in ANSI/AWWA C153 *Ductile-Iron Compact Fittings for Water Service*. Joint accessories, including restraints, are incidental. Unless otherwise specified, the cost of fittings for forcemain shall be included in the price bid per foot of pipe.

### **2.9.13 PAY MEASUREMENT FOR CORPORATION STOPS**

Corporation stops shall be paid for per unit installed and shall include the 1/8 bend coupling.

### **2.9.14 PAY MEASUREMENT FOR WATER SERVICES**

Pay measurement for water services shall extend from the centerline of the main to the end of the pipe laid. This measurement shall be made horizontally. Water services shall be paid for at the unit price bid per lineal foot.

### **2.9.15 PAY MEASUREMENT FOR CURB STOPS**

Curb stops shall be paid for per unit installed and shall include the furnishing and installing of the box.

### **2.9.16 PAY MEASUREMENT FOR WATER SERVICE ALTERATIONS**

Water service alterations shall be paid for per unit altered. This shall be a lump sum bid.

### **2.9.17 PAY MEASUREMENT FOR WATER CURB STOP RELOCATIONS**

Water curb stop relocations shall be paid for per unit relocated. This shall be a lump sum bid and include the stop and furnishing and setting the new service box.

### **2.9.18 PAY MEASUREMENT FOR CATCH BASINS AND STORM WATER INLETS**

Catch basins and storm water inlets shall be paid for per unit constructed. This shall be a lump sum bid and include the furnishing and installing of all castings.

# SECTION III MATERIAL SPECIFICATIONS

***Note: This standard specification includes general requirements for materials and is supplemented and superseded by the following sections and the Special Provisions that apply to this project only.***

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## MATERIAL SPECIFICATIONS

### SECTION 3.1.0 - GENERAL

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**3.1.1 SAMPLES.** Samples of the materials proposed or furnished for the work may be taken by the Engineer at any time, at the point of manufacture, point of delivery or site of work. They will be selected, as far as practicable, in accordance with standard methods for sampling materials as specified in the standards of the American Society of Testing and Materials.

**3.1.2 STANDARDS.** The use of an ASTM, ANSI, AASHTO, or AWWA designation in these specifications refers to the latest revision of that particular standard or tentative standard of that organization.

**3.1.3 COST OF TESTS.** The specified tests and samples shall be furnished at no cost to the Owner unless otherwise specified. The manufacturer or seller shall furnish the required samples and the Contractor shall pay for the specified tests.

**3.1.4 DELIVERY OF SAMPLES.** The Contractor or supplier will be responsible for delivery of all test specimens to the laboratory of the designated testing agency without cost to the Owner.

**3.1.5 TESTING LABORATORIES.** Laboratories engaged to conduct the tests shall be approved by the Engineer and must be independent of the supplier or Contractor. The specified tests and samples shall be furnished by the supplier or Contractor at no cost to the Owner. The results shall be certified and submitted to the Engineer within 3 days of completion. The tests conducted by the Engineer and independent laboratories shall be the basis for requiring the replacement of substandard material. All test lab results shall be certified by a Professional Engineer licensed in the state where the project is located.

### SECTION 3.2.0 - GENERAL REQUIREMENTS FOR ALL PIPE

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**3.2.1 INSPECTION.** Each length of pipe shall be subject to inspection at the factory, point of delivery and site of work. Samples of pipe shall be selected at random and shall be delivered to a testing laboratory approved by the Engineer.

**3.2.2 ACCEPTANCE OR REJECTION.** When the specimens tested conform to specifications, then all pipe represented by such specimens shall be considered acceptable. Copies of test reports shall be submitted to the Engineer before the pipe is installed in the project.

In the event that any of the test specimens fail to meet these requirements, all pipe represented by such tests shall be subject to rejection. The Contractor, however, has the right to furnish and test additional specimens from the same shipment or delivery, at no cost to the Owner. The pipe will be considered acceptable if all of these specimens meet the requirements.

**3.2.3 REJECTED PIPE.** Pipe which has been rejected by the Engineer shall be marked and removed from the site of the work by the Contractor and replaced with pipe which meets the requirements without cost to the Owner.

**3.2.4 STRAIGHTNESS.** Pipe shall not deviate from straight.

**3.2.5 MARKING.** Each length of pipe shall bear the name or trademark of the manufacturer, the location of the plant and the date of manufacture. Each length shall likewise be marked to designate the class or strength of the pipe. The markings shall be plainly visible. Pipe with either elliptical or quadrant reinforcing shall have the word Top or Bottom clearly stenciled on the inside of the pipe at the correct place to indicate the proper position when laid.

**3.2.6 FITTINGS.** Fittings such as wyes, tees and bends shall be made in such a manner as will provide strength and water tightness at least equal to the class of the adjacent main line pipe to which they are joined and shall conform to all other requirements specified for pipe of corresponding class and internal diameter.

Fabricated branches for wyes and tees shall be securely attached to the wall of the pipe in a watertight manner and shall be flush with the inside surface of the pipe. Tee branches shall have their axes perpendicular to the longitudinal axis of the pipe. Wye branches shall have their axes approximately 60 degrees from the longitudinal axis of the pipe, measured from the bell end. Pipe reinforcement shall not be interrupted beyond a radial distance of 3 inches outside of the fitting.

**3.2.7 PIPE REJECTION.** Pipe shall be subject to rejection for failure to conform to any requirement of the specifications or for any of the following reasons:

**A. Concrete Pipe Only**

1. Fractures or cracks passing through the pipe wall or socket, except that a single crack not exceeding 2 inches in length at either end of the pipe or a single fracture in the socket not exceeding 3 inches in width nor 2 inches in length shall not be considered cause for rejection unless these defects exist in more than 5% of the entire shipment or delivery.
2. Chips or fractures on the interior of the pipe exceeding 2 inches in length, 1 inch in width and of a depth more than 1/4 the barrel thickness.

**B. All Pipe**

1. Cracks, sufficient to impair the strength, durability, or serviceability of the pipe.
2. Defects that indicate improper proportioning, mixing and molding.
3. Variations of more than 1/8 inch per linear foot in alignment of a pipe intended to be straight.
4. Insecure attachment of spurs.
5. Damaged ends, where such damage would prevent making a satisfactory joint.

**3.2.8 FOUNDATION, BEDDING AND EMBANKMENT.** The requirements for the pipe foundation, bedding and embankment are the same for all pipe materials, classes and sizes. Refer to the Construction Specifications.

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**SECTION 3.3.0 - REINFORCED CONCRETE PIPE (12" OR LARGER)**

**3.3.1 REQUIREMENTS.** Pipe furnished under this classification shall meet the requirements set forth in ASTM C-76, Class III, Wall B and ASTM C-655 for elliptical pipe. The maximum allowable depth of bury shall be 13 feet unless greater depths are approved in writing by the Engineer.

**3.3.2 JOINTS.** Joints shall be rubber gasket Type 1-MS as made by Press-Seal Gasket Corporation, Type CP as made by the Hamilton Kent Manufacturing Company or equal Gaskets shall comply with ASTM C443. All pipe grooves or bells shall have a concrete shoulder to help confine the gaskets. The gaskets shall be stored in as cool, clean and shaded a place as practicable, preferably at 70 degrees F or less.

**3.3.3 HANDLING HOLES.** Pipe lifting holes are permitted only on reinforced concrete storm sewer pipe 24 inches or larger in diameter that is not being installed below expected high water. One preformed handling hole is permitted on straight lengths of pipe, less than 48" in diameter, and two on pipe 48" and larger in diameter. After the pipe has been laid, the handling holes shall be promptly plugged with non-shrink epoxy grout applied to the interior and exterior to provide a water-tight seal. The Owner reserves the right to prohibit handling holes.

**3.3.4 TRACER WIRE.** All non-metallic pipe shall be marked with Tracer Wire.

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**SECTION 3.4.0 - POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS**

**3.4.1 REQUIREMENTS.** Pipe and fittings furnished under this classification shall meet the requirements of ASTM D3034 and F-679 (12454C). Type ASTM D3034 SDR 35 only will be accepted for sewer mains, 8" through 18". Building sewers (laterals) shall be ASTM D3034 SDR 26. Installation is to be in accordance with ASTM D2321. The maximum allowable depth of bury shall be 20 feet unless greater depths are approved in writing by the Engineer.

**3.4.2 DIMENSIONS.** The dimensions of the pipe shall be in accordance with the following table for SDR 35.

The wall thickness shall not be less than 97% of that specified in the following table:

**PVC PIPE DIMENSIONS**

Outside Diameter (inches)

Nominal Size	Average	Tolerance on Average	Minimum Wall Thickness (inches)
8"	8.400	±0.012	0.240
10"	10.500	±0.015	0.300
12"	12.500	±0.018	0.360
15"	15.300	+0.023	0.437
18"	18.701	+0.028	0.536

**3.4.3 MARKING.** Each length of pipe shall be clearly marked as follows in intervals of 10 feet or less and each fitting shall be marked as follows:

1. Manufacturer's name or trademark
2. Nominal pipe size
3. ASTM Designation D3034 or F-679
4. The legend, "Type PSM SDR 35 PVC Sewer Pipe"

**3.4.4 TRACER WIRE.** All non-metallic pipe shall be marked with Tracer Wire.

**3.4.5 FITTINGS.** Fittings such as saddles, elbows, tees, wyes and others shall be of material, construction and joint design corresponding to the adjacent pipe. Approved adapters shall be provided for transitions to other types of pipe.

**3.4.6 JOINTS.** Only State approved rubber gaskets joints complying with ASTM F477 shall be used. Assembled joints shall pass the performance tests specified in ASTM D3212.

**3.4.7 MANHOLE ENTREES.** Flexible, watertight, pipe-to-manhole seals shall be furnished and installed at all manholes. The cost shall be included in the unit price per foot of pipe.

**3.4.8 DEFORMATION REQUIREMENTS.** PVC pipe deforms rather than breaks. The Contractor will be required to pull an approved go-no-go device through the pipe. Testing shall be completed before placing finished surface.

If testing occurs within 30 days of backfill, maximum deflection shall not exceed 5 percent. When testing occurs more than 30 days after backfilling, maximum deflection shall not exceed 7.5 percent. The testing device dimensions shall be as follows:

**TESTING DEVICE DIMENSIONS FOR PVC PIPE**

Nominal Size (Inches)	Minimum Diameter (Inches)		
	Base ID	5% Defl.	7.5% Defl.
8	7.67	7.28	7.09
10	9.56	9.08	8.85
12	11.36	10.79	10.51
15	13.90	13.20	12.85
18	16.98	16.13	15.70



The device must pass through the entire section in one pass when pulled by hand without the use of excessive force. In case of failure to meet the test requirement, the faulty section must be repaired.

**SECTION 3.5.0 – HIGH DENSITY POLYETHYLENE (HDPE) STORM SEWER PIPE AND FITTINGS**

**3.5.1 PIPE REQUIREMENTS:** Pipe shall have smooth interior and annular exterior corrugations. Pipe and fittings shall meet the requirements of AASHTO M-252 (4"-10") and 12- through 60-inch shall meet AASHTO M294, Type S or SP ASTM F2306. Manning's "n" value for use in design shall be 0.012. Pipe shall be ADS N-12 or approved equal as manufactured by Advanced Drainage System, Inc.

**3.5.2 MATERIAL PROPERTIES:** Pipe and fittings shall be made of virgin polyethylene compounds that comply with the cell classification 424420C for 4- through 10-inch diameters, or 435400C for 12- through 60-inch diameters, as defined and described in ASTM D3350, except that carbon black content should not exceed 4%. The 12- through 60-inch virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Section 9.5 and 5.1 of AASHTO M294 and ASTM F2306 respectfully.

**3.5.3 DIMENSIONS.** The dimensions of the pipe shall be in accordance with the following table:

Nominal Diameter, in													
Pipe I.D., in	4	6	8	10	12	15	18	24	30	36	42	48	60
Pipe O.D., in	4.8	6.9	9.1	11.4	14.5	18	21	28	36	42	48	54	67

\*Pipe O.D. values are provided for reference purposes only, values stated for 12- through 60-inch are ± 1 inch

**3.5.4 MARKING.** Each length of pipe and or fitting shall be clearly marked as follows in intervals of 10 feet or less and each fitting shall be marled as follows:

1. Manufacturer's name or trademark
2. Nominal pipe size
3. ASTM Designation AASHTO M 252, AASHTO M 294, or ASTM F2306
4. Plant designation code
5. Date of Manufacture or an appropriate code

**3.5.5 TRACER WIRE.** All non-metallic pipe shall be marked with Tracer Wire.

**3.5.6 FITTINGS.** Fittings shall conform to AASHTO M294 or ASTM F2306. Fabricated fittings shall be welded at all accessible interior and exterior junctions. Fittings such as saddles, elbows, tees, wyes and others shall be of material, construction and joint design corresponding to the adjacent pipe. Approved adapters shall be provided for transitions to other types of pipe.

**3.5.7 JOINTS.** Pipe shall be joined with a watertight joint meeting the requirements of AASHTO M 252, AASHTO M294 or ASTM F2306. The 4- through 60-inch pipe shall be watertight and pass performance tests according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. Only State approved "O-Ring" rubber gaskets joints complying with ASTM F477 shall be used.

**3.5.8 MANHOLE ENTREES.** Flexible, watertight, pipe-to-manhole seals shall be furnished and installed at all manholes. The cost shall be included in the unit price per foot of pipe.

**3.5.9 INSTALLATION:** Installation shall be in accordance with ASTM D2321 and manufacturer's installation guidelines.

## **SECTION 3.6.0 - DUCTILE IRON PIPE**

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**3.6.1 REQUIREMENTS.** All pipe furnished under these specifications shall conform to AWWA C-151 or ANSI A21.51 for ductile iron pipe and be Pressure Class 350 unless otherwise specified. Joints shall meet the requirements of AWWA C-111.

**3.6.2 DESCRIPTION.** Pipe and fittings shall be made with bell and spigot ends adaptable for use of a rubber gasket slip joint. They shall be straight and of true circular section with their inner and outer surface concentric.

**3.6.3 COATING.** The pipe shall have a cement mortar lining per AWWA C104 and internal and external asphaltic coating per AWWA C-151, Section 51.8. The thickness of the standard cement lining shall be 1/16" for sizes 3" to 12" in diameter, inclusive, and 3/32" for sizes 14" through 24".

The asphaltic coating shall be applied over the cement lining on the inside of the pipe and an asphaltic seal coat shall be applied on the exterior of all pipe and fittings. The coating shall be smooth, tough and tenacious, and impervious to water without any tendency to scale off, and shall not be brittle.

**3.6.4 MARKINGS.** Each pipe shall have the weight and class designation or thickness conspicuously painted on it. In addition, the manufacturer's mark and year in which the pipe was cast and the letters "DI" or the word "Ductile" shall be distinctly cast or stamped on the face or interior of the bell.

**3.6.5 PUSH-ON JOINTS.** All rubber gaskets shall be Tyton, Fastite or approved equal and conform to AWWA C-111 or ANSI 21.11 for Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

Gaskets shall be furnished in sufficient number for all joints. Sufficient joint lubricant shall be furnished by the manufacturer with the gaskets. Mechanical joints shall be provided where specified.

### **3.6.6 INSTALLATION PROCEDURES**

#### **A. Rubber Gasket Joints**

1. The main shall be joined by means of a compression type push-on rubber gasket unless otherwise specified.
2. The bell and spigot of each pipe shall be wiped clean and dry. The gasket shall be inserted, large round end first, into the gasket seat inside of the bell.
3. A thin film of non-toxic lubricant shall be applied to the inside surface of that portion of the gasket which comes in contact with the entering pipe and the spigot up to the insertion line. The only type of lubricant to be used shall be that recommended by the pipe manufacturer.
4. Extreme care shall be exercised when lowering the pipe into place to avoid foreign material from adhering to the spigot, bell or gasket. The entering pipe shall be placed in approximate alignment with the receiving bell and inserted until it just makes contact with the gasket. Sufficient pressure shall be applied on the entering pipe until the spigot end sockets in the bell. This can be accomplished by one of the following methods:
  - a. A leverage bar or other approved method shall be used on pipe 12 inches in diameter or smaller.
  - b. A jack and two choker-slings, or other approved method, may be used on pipe larger than 12 inches in diameter.
5. Whenever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, the amount of deflection shall not exceed the following:

**MAXIMUM PERMISSIBLE DEFLECTION IN LAYING PUSH-ON JOINT PIPE**

<u>Size of Pipe Inches</u>	<u>Maximum Permissible Deflection Per Length (Inches)</u>			<u>Approximate Radius of Curve Produced By Succession of Joints (Feet)</u>		
	<u>16-Foot</u>	<u>18-Foot</u>	<u>20-Foot</u>	<u>16-Foot</u>	<u>18-Foot</u>	<u>20-Foot</u>
	<u>LENGTH</u>					
3	17	19	21	185	205	230
4	17	19	21	185	205	230
6	17	19	21	185	205	230
	<u>LENGTH</u>					
<u>Size of Pipe Inches</u>	<u>16-Foot</u>	<u>18-Foot</u>	<u>20-Foot</u>	<u>16-Foot</u>	<u>18-Foot</u>	<u>20-Foot</u>
8	17	19	21	185	205	230
10	17	19	21	185	205	230
12	17	19	21	185	205	230
14	10	11	12	300	340	380
16	10	11	12	300	340	380
18	10	11	12	300	340	380

**B. Mechanical Joints**

- Where specified, the water main shall be jointed by means of a mechanical joint assembly.
- The last 8 inches of the outside of the spigot and inside of the bell shall be thoroughly cleaned of all foreign matter and painted with a soap solution. The ductile iron gland shall then be slipped on the spigot end with the lip extension toward the socket or bell end. The rubber gasket shall be painted with the soap solution and placed on the spigot end with the thick edge toward the gland.
- Nuts and bolts used in the joint assembly shall be made of high-strength, low-alloy, corrosion resistant steel having the characteristics specified in AWWA C-111 Section 11.6.5.
- The entire section of the pipe shall be pushed forward to seat the spigot end in the bell. Care shall be taken to locate the gasket evenly around the entire joint. All nuts may be tightened with a suitable torque-limiting wrench. The torque for various sizes of bolts shall be as follows:

<u>Bolt Size (Inches)</u>	<u>Range of Torque (ft.-lbs)</u>
5/8	45 – 60
3/4	75 – 90
1	100 – 120
1-1/4	120 – 150

Nuts shall be tightened alternately in order to produce an equal pressure on all parts of the gland. After a joint is assembled and securely tightened, the entire joint shall be double wrapped in polyethylene encasement per AWWA C105, loosely held in place with tape.

**3.6.7 CERTIFICATION BY MANUFACTURER.** At the Engineer’s request, the manufacturer shall furnish certification data representing each class of pipe furnished. The certification report shall clearly state that all pipe furnished meets the appropriate AWWA and ANSI specification.

## SECTION 3.7.0 - POLYETHYLENE WRAP

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**3.7.1 REQUIREMENTS.** Unless otherwise specified, all ductile iron pipe shall be enclosed in a polyethylene film. Polyethylene Wrap shall conform to AWWA C-105 or ANSI A21-5. Film shall be Class "C" – Black, with a minimum nominal thickness of 0.008 inches (8 mils). Tape for securing the film shall be a thermoplastic material with a pressure sensitive adhesive face capable of bonding to metal, asphaltic coating, and polyethylene. Tape shall have a minimum thickness of 8 mils and a minimum width of one inch.

**3.7.2 DESCRIPTION.** The polyethylene wrap shall be free as is commercially possible of gels, streaks, pinholes, particles, of foreign matter and undispersed raw materials. There shall be no other visible defect such as holes, tears blisters or thinning out at folds.

**3.7.3 CERTIFICATION BY MANUFACTURER.** When requested, manufacturers shall furnish certification detailing the conformance of the material to the requirements of AWWA C-105/ANSI A21.5.

**3.7.4 INSTALLATION.** The polyethylene wrap shall be cut approximately 2 feet longer than the length of the pipe section. After assembling the pipe joint, the polyethylene shall be overlapped approximately 1 ft. and at all joints sealed with approved adhesive tape. Additional taping shall be used at 3 ft. intervals along the pipe. Any rips, punctures, or other damage to the polyethylene shall be prepared immediately with adhesive tape. All copper service connections shall be wrapped for a distance of 3 feet from the centerline of the main. Before installing the polyethylene wrap the exterior of the pipe shall be free of foreign material.

**3.7.5 WRAPPING OF SPECIAL FITTINGS AND VALVES.** When valves, tees, crosses, etc. cannot be wrapped practically in a tube, a double wrap of flat sheet or split tube shall be used. The wrap shall extend approximately 18 inches beyond all joints. All seams shall be taped securely.

**3.7.6 BACKFILL AROUND POLYETHYLENE WRAPPED PIPES.** The bedding and cover material shall be placed with care so as to prevent damage to the polyethylene wrap. Any rips or punctures in the wrap shall be repaired immediately.

## SECTION 3.8.0 - POLYVINYL CHLORIDE (PVC) PRESSURE MAIN

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**3.8.1 GENERAL.** PVC pressure main shall meet the requirements of AWWA C-900 for 4" through 12" and AWWA C-905 for 14" through 36". Forcemain pipe shall meet the requirements of AWWA C-900 or ASTM D2241. Watermain pipe shall be AWWA C-900 SDR 18.

**3.8.2 PRODUCT.** Pipe shall be suitable for use at hydrostatic working pressures of 150 psi and sustained pressures of 500 psi at 73 degrees F. All pressure pipe must meet requirements as set forth in PS 22-70 and bear the National Sanitation Seal for potable water pipe. Provisions must be made for contraction and expansion at each joint with a rubber ring and integral thickened bell as part of each joint. Pipe and fitting must be assembled with a non-toxic, approved lubricant. No solvent weld joints are permitted. Laying length shall be 20 feet. The outside diameter shall be equal to cast iron pipe.

**3.8.3 MARKINGS.** Markings on the pipe shall include the following: Nominal pipe size, type of plastic pipe material, SDR number, AWWA Designation with which the pipe complies, and the manufacturer's name.

**3.8.4 TRACER WIRE.** All non-metallic pipe shall be marked with Tracer Wire.

**3.8.5 LAYING OF PVC PIPE.** The laying of PVC pipe shall be as specified with the additional following requirements.

**A. Pipe Surfaces.** The inside and outside surface of each length of pipe shall be free from nicks, scratches, and other surface defects and blemishes. The pipe shall be homogeneous throughout and free of any bubbles, voids, or inclusions.

**B. Jointing Areas.** The jointing areas of the barrel of each length of pipe shall be free from dents or gouges.

**C. Gaskets.** The rubber gasket shall be supplied by the manufacturer and conform to the requirements of ASTM F477.

**D. Lubricant.** Sufficient pipe lubricant shall be supplied by the manufacturer for use with each joint. A light film of lubricant shall be applied to each pipe spigot before insertion into bell.

**E. Jointing Pipe.** The bell end of the pipe shall be free of dirt or other foreign matter. The gasket shall be inserted with the painted edge facing toward the end of the bell. After lubricating the spigot end, each length of pipe shall be pushed home individually. The use of the backhoe bucket bearing directly against the pipe to force the spigot is not allowed. The pipe shall be positioned so that the reference mark on the spigot end is in line with the bed end.

**F. Cutting Pipe.** PVC pipe shall be cut at right angles to the centerline of the pipe with an approved saw or mechanical cutter. A coarse hand file or an approved machining tool shall be used for beveling the end similar to the factory beveled edge as supplied by the manufacturer. A reference mark equal to that as shown on the pipe of similar size supplied by the manufacturer shall be made at the proper distance from the cut end.

**G. Deflection.** Maximum deflection shall not exceed that recommended by the manufacturer. Bell design will not allow deflection at the joint.

**H. Storage.** The pipe shall be stored on the job site protected from direct sunlight and excessive heat. Stored pipe shall be covered with tarps.

**3.8.6 USE FOR HYDRANT LEAD.** PVC pipe will not be allowed for hydrant leads. All hydrant leads shall be ductile iron pipe Pressure CI 350.

**3.8.7 CERTIFICATION BY MANUFACTURER.** At the Engineer's request, the manufacturer shall furnish certification data representing each SDR of pipe furnished. The certification report shall clearly state that all pipe furnished meets the appropriate AWWA or ASTM Specification.

### **SECTION 3.9.0 – HIGH DENSITY POLYETHYLENE (HDPE) PRESSURE MAIN**

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**3.9.1 PIPE AND FITTINGS** The pipe supplied under this specification shall be high performance, high molecular weight, high density polyethylene pipe as manufactured by Phillips Driscopipe, Inc. (Driscopipe 1000), Flying "W" Plastics, Inc. or equal and shall conform to the Plastic Pipe Institution Standards, AWWA C906 and ASTM D3350 (cell classification of PE 345434C).

Dimensions and workmanship shall conform to ASTM F714. The fittings supplied under this specification shall be molded from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe or shall be manufactured using a polyethylene compound having a cell classification equal to or exceeding the cell classification of the pipe supplied under this specification. To insure compatibility of polyethylene resins, all fittings supplied under this specification shall be of the same manufacture as the pipe being supplied.

#### **3.9.2 PHYSICAL PROPERTIES OF PIPE COMPOUND**

**A. Density** - The density shall be no less than 0.904 gms/cm<sup>3</sup> as referenced in ASTM D1505.

**B. Melt Flow** - Melt flow shall be no greater than 0.15 gms/10 minutes when tested in accordance with ASTM D1238 - Condition E. (Melt flow shall be no greater than 4.0 gms/10 minutes when tested in accordance with ASTM D1238 - Condition F.)<sup>1</sup>

**C. Flex Modulus** - Flexural Modulus shall be 110,000 to less than 160,000 psi as referenced in ASTM D3350.

**D. Tensile Strength at Yield** - Tensile strength shall be 3,200 to less than 3,500 psi as referenced in ASTM D638.

**E. ESCR** - Environmental Stress Crack Resistance shall be in excess of 1,500 hours (5,000 hours) with zero failures when tested in accordance with ASTM D1693 - Condition C.

**F. Hydrostatic Design Basis** shall be 1,600 psi at 23<sup>o</sup> C when tested in accordance with ASTM D2837.

**3.9.3 CERTIFICATION.** The pipe supplier shall furnish certification stating that the pipe furnished meets the above requirements.

**3.9.4 REJECTION.** Polyethylene pipe and fittings shall be rejected for failure to meet any of the requirements of this specification.

**3.9.5 PIPE DIMENSIONS.** Pipe supplied under this specification shall have a nominal DIPS (ductile iron pipe size) OD unless otherwise specified. **The pipe shall be Dimension Ratio 11 (DR 11)** unless otherwise specified by the Engineer.

### **3.9.6 CONSTRUCTION PRACTICES**

**3.9.6.1 HANDLING OF PIPE.** Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking should be done in accordance with the pipe manufacturer's recommendations. The handling of the pipe should be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment.

**3.9.6.2 REPAIR OF DAMAGED SECTIONS.** Segments of pipe having cuts or gouges in excess of 10% of the wall thickness of the pipe should be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method.

**3.9.6.3 PIPE JOINING.** Sections of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment and fusion pressures.

**3.9.6.4 HANDLING OF FUSED PIPE.** Fused segments of pipe shall be handled so as to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable type chokers should be avoided. Nylon slings are preferred. Spreader bars should be used when lifting long fused sections. Care should be exercised to avoid cutting or gouging the pipe.

## **SECTION 3.10.0 – HDPE WATER SERVICES**

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**3.10.1 REQUIREMENTS.** All High Density Polyethylene (HDPE) pipe furnished under these specifications shall be ¾" through 2" and conform to AWWA C901, ASTM D2737 and NSF 14 & 61. The pipe shall be blue with a clear core, SDR 9, CTS, 200 psi and produced with PE 3408 resin. HDPE water tubing shall only be used in outdoor, buried applications.

**3.10.2 MARKINGS.** The pipe shall be labeled with the ASTM standard, NSF certification logo, SDR and pressure rating.

**3.10.3 STORAGE AND HANDLING.** Pipe shall be stored so as to prevent damage by crushing or piercing and UV exposure. Do not expose pipe to excessive heat. Do not drag across rough ground and avoid hitting or placement on sharp objects when storing or placing in service. Before pipe is installed each length should be inspected for transport damage, cuts, punctures or excessive abrasion. Damage from shipping or handling may have occurred. Flush the pipe before final connections.

**3.10.4 JOINING PIPE.** Join pipe with external compression fittings that seal via internal gaskets and external clamping. Heat fusion is also acceptable for joining HDPE to HDPE. The compression fittings shall be specifically designed for heavy wall HDPE CTS pipe. HDPE pipe is chemically inert and there are no known glues that can be used to create effective joints that will stand up over long periods of time. **DO NOT LUBRICATE THE PIPE.** Lubrication other than water shall not be used. Use of any lubricants, sealing compounds or pipe dope voids all pipe producers' warranties and may cause damage to the pipe.

**3.10.5 TRACER WIRE.** Furnish, install and test tracer wire per 3.11.0. Pipe with an integral tracer wire may be substituted for the external tracer wire.

**3.10.6 COLD WEATHER.** HDPE pipe may develop some ovality from storage and in cold weather it may be necessary to warm the pipe to enable the assembly of a compression fitting. To warm HDPE **DO NOT USE A TORCH TO HEAT THE PIPE** and never heat the plastic above 200 degrees F. The recommended method for warming the pipe is immersion in hot water or warming with a hair dryer. Use care to warm the inside of the pipe as well as the outside and never heat the outside of the pipe only. HDPE does not become brittle when subjected to extremely low temperatures, but does become much stiffer. The workability of HDPE increases with higher temperatures. The heavier the wall thickness of the pipe being used the more stiffness will be encountered in cold weather. It is recommended that the pipe be kept in a warm environment prior to installation in the winter months to keep it as flexible as possible.

### 3.10.7 CONSTRUCTION PRACTICES

**3.10.7.1 TRENCH PREPARATION.** Install per ASTM D2774, F645-95 and ASTM D2321. Pipe shall be surrounded with a bed of sand or other backfill material that is 1/2" or less in diameter and is free from rocks, sharp objects and debris that might puncture the pipe. The base of the trench must be lined first with sand and the pipe uniformly and continuously supported for its entire length. Pipe should be placed with at least 7 foot cover. Trenches may be curved to avoid obstacles with the minimum trench radius being 24 inches. HDPE's natural flexibility allows it to be routed around objects to eliminate fittings.

**3.10.7.2 THERMAL EXPANSION AND CONTRACTION.** HDPE is stable in its cross section dimensions, but can expand and contract longitudinally with changing temperatures. Allowing HDPE pipe to naturally "snake" in a trench will provide adequate slack to compensate for this expansion and contraction. A minimum 12 inches of slack per 100 feet of pipe shall be provided to compensate for thermal changes.

**3.10.7.3 INSTALLATION IN CONTAMINATED SOILS.** Hydrocarbon fuels, certain organic solvents and a few other chemical compounds can have a serious negative effect on HDPE if present in sufficient quantity. Water is vulnerable to contamination by absorption of chemicals through the walls or joints. HDPE pipe shall not be installed in areas when chemical contamination is present or suspected or if chemical spills are likely to occur.

**3.10.7.4 PRESSURE TESTING.** All HDPE water service pipe shall be pressure tested with water before backfilling. All joints and connections shall be inspected for leaks. After backfilling, the water service lines shall be pressure tested with the mains per Section 8.10.0.

**3.10.7.5 DIRECTIONAL DRILLING.** The boring tool should create a hole that is 25% larger than the outside diameter of the pipe to allow the pipe to pass through the soil without being abraded or subjected to excessive tension. All bends and changes in elevation should be within the guidelines established for HDPE pipe and tubing. Pipe installed with directional boring equipment shall not be subjected to tensions greater than the tensile strength of the product being used. Excessive tension can cause damage to polyethylene pipe. The nominal tensile strength of 3/4" pipe is 877 psi and 1" pipe 1,463 psi. In some soils it may be necessary to grout the bore hole to prevent collapse prior to installation of the pipe. Grouting will maintain the hole and reduce friction that could damage the pipe. It is essential to maintain an open hole during pipe installation and avoid sharp rocks or debris that cut or scrape the pipe causing damage that may reduce the wall thickness.

**NOTE:** Pipe laying in sunlight can increase significantly in temperature often to temperatures as high as 140° F. If pipe is bored at elevated temperatures it is possible that the pipe will stretch or elongate. If the pipe stretches greater than 5% the pipe is damaged and is capable of carrying it's rated pressure. Pipe that has been stretched greater than 5% shall be removed and replaced.

### SECTION 3.11.0 – TRACER WIRE

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**3.11.1 GENERAL.** To assist in locating buried pipe, a tracer wire shall be laid for all non-metallic pipe.

**3.11.2 TYPE OF WIRE.**

**3.11.2.1 GENERAL.** Tracer wire shall be #12 AWG, annealed copper-clad high carbon steel. Copper shall conform to ASTM B170, oxygen free electrolytic copper. The HDPE coating shall be solid blue (potable water), purple (non-potable water), green (sanitary sewer) or brown (storm sewer). The wire shall be rated for 30 volts. Wire surface shall be free of any defects. Tracer wire shall be as manufactured by Copperhead Industries, LLC; Pro-line Safety Products; or equal.

**3.11.2.2 OPEN TRENCH.** Tracer wire for open trench shall be high strength tracer wire with a minimum breaking load of 450 pounds, with 30 mil thick HDPE insulation. Copper clad wire shall conform to ASTM B910 / B910M.

**3.11.2.3 HORIZONTAL DIRECTIONAL DRILLING / BORING** Tracer wire for directional drilling / boring shall be extra high strength tracer wire with a minimum breaking load of 1,150 pounds, with 45 mil thick HDPE insulation. Copper clad wire shall conform to ASTM B869.

**3.11.2.4 PIPE BURSTING/SLIP LINING.** Tracer wire shall be 7 x 7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.

**3.11.3 PLACEMENT OF WIRE.** The wire shall be placed along the bottom half of the pipe and attached in 5 foot intervals with at least 3 overlapping wraps of standard PVC electrical tape or plastic ties.

**3.11.4 WIRE TO SURFACE.** Wire shall surface every 400 to 500 feet. Wire shall typically surface at hydrants, services or locator boxes.

**3.11.5 WIRE TERMINATION/ACCESS.** All trace wire termination points must utilize an approved tracer wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose. All grade level/in-ground access boxes shall be appropriately identified with “sewer” or “water” cast into the cap and be color coded. A minimum of 2 feet of excess/slack wire is required in all tracer wire access boxes after meeting final elevation. All tracer wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection. Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

**A. Sewer Service Laterals on Public Property** – Tracer wire must terminate at an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway.

**B. Sewer Service Laterals on Private Property** – Tracer wire must terminate at an approved above-ground tracer wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than 5 vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within 2 linear feet of the building being served by the utility.

**C. Hydrants** – Tracer wire must terminate at an approved above-ground tracer wire access box, properly affixed to the hydrant grade flange with HDPE or stainless steel bracket, (affixing with tape or plastic ties is not acceptable).

**D. Long-runs, in excess of 500 linear feet without service laterals or hydrants** – Tracer wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-a-way, and out of the roadway. The grade level/in-ground tracer wire access box shall be delineated using a minimum 48” polyethylene marker post, color coded per APWA standard for the specific utility being marked.

**3.11.6 CONNECTORS.** Minimize splices. Tracer wire systems shall be installed as a single continuous wire except where using approved connectors. All tracer wire shall be joined using dielectric silicon filled connectors to seal out moisture and corrosion and to prevent any uninsulated tracer wire exposure. Connectors shall be as manufactured by Copperhead Industries, LLC; Pro-line Safety Products; 3M DBR; or equal. All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative. Direct bury wire connectors shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure. Non locking friction fit, twist on or taped connectors are prohibited.

**3.11.7 GROUNDING.** Tracer wire must be properly grounded at all dead ends/stubs. Grounding of tracer wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20 feet of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility. When grounding the tracer wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the tracer wire, at the maximum possible distance. When grounding the tracer wire in areas where the tracer wire is continuous and neither mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the tracer wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to tracer wire with a mainline to lateral lug connector. Where the anode wire will be connected to a tracer wire access box, a minimum of 2 feet of excess/slack wire is required after meeting final elevation.

**3.11.8 TESTING.** All new tracer wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, Engineer and facility Owner as applicable, prior to acceptance. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project. Continuity testing in lieu of actual line tracing is not acceptable.

**3.11.9 PAY ITEMS.** Tracer wire, accessories and grounding anodes shall be included in the price per foot of pipe, hydrant or sewer or water service.



## **SECTION 3.12.0 - FITTINGS FOR PRESSURE PIPE**

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**3.12.1 REQUIREMENTS.** Fittings shall be compact ductile iron fittings and conform to AWWA C-110 or ANSI A-21.20. The entire fitting shall be double wrapped in polyethylene encasement per AWWA C105, loosely held in place with tape.

**3.12.2 DESCRIPTION.** Push-on joints and mechanical joints shall conform to AWWA C-111. Mechanical joint bolts and nuts shall be made of high-strength, low-alloy, corrosion resistant steel having the characteristics specified in Section 11.6.5 of AWWA C-111. Flange joints and bell-and-spigot joints shall conform to AWWA C-110. "Compact" fittings shall be cast from ductile iron grade 70-50-05 in accordance with AWWA/ANSI C-110/A21.10 and AWWA/ANSI C-153/A21.53 with exception of the manufacturer's proprietary design dimensions and weights. The working pressure rating shall be 350 psi.

**3.12.3 COATING.** Interior and exterior coatings shall conform to AWWA C-110. Ductile iron compact fittings which shall be cement lined per AWWA C153 and AWWA C104 or epoxy coated per AWWA C550 and C116.

**3.12.4 MARKINGS.** The manufacturer's mark, nominal diameters of openings and the number of degrees or fraction of the circle on all bends, shall be distinctly cast on the fittings. The pressure rating shall be distinctly marked on the fitting. Ductile iron fittings shall have the letters "DI" or "DUCTILE" cast on them.

**3.12.5 JOINT RESTRAINTS.** Concrete blocking shall be used only where specifically approved by the Engineer in advance. Joint restraints shall be EBBA Iron MegaLug Series 1100 (DI Mech Joint), Series 2000 (PVC Mech Joint), Series 1500 (PVC Slip Joint) or Series 1700 (DI Slip Joint); Uni-Flange Series 1300C (Mech Joint), Uni-Flange Series 1390C (Slip Joint); or equal. Only qualified welders having adequate skill and experience in the practice of manual electric arc welding and cutting ferrous materials shall be allowed to field weld and field cut restrained joints for Ductile Iron pipe. Pipe manufacturers' recommended procedures shall be followed while exercising reasonable care.

**3.12.6 PAY MEASUREMENT FOR SPECIAL FITTINGS.** Fittings for watermain shall be paid per pound for each fitting installed. The weight shall be based on the tables in ANSI/AWWA C153 *Ductile-Iron Compact Fittings for Water Service*. Joint accessories, including restraints, are incidental. Unless otherwise specified, the cost of fittings for forcemain shall be included in the price bid per foot of pipe.

## **SECTION 3.13.0 - COPPER WATER TUBING**

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**3.13.1 REQUIREMENTS.** Tubing furnished shall be Type "K" soft annealed seamless copper tubing and shall conform to the specification of the ASTM Designation B-88. Water services shall be 1" unless otherwise specified.

**3.13.2 MARKINGS.** The name or trademark of the manufacturer, and a mark indicative of the type, shall be permanently and plainly marked on tubing at intervals not greater than 10 feet

**3.13.3 FITTINGS.** Fittings for copper tubing shall be of cast brass having an alloy of 85% copper, 5% tin, 5% zinc, and 5% lead. They shall have uniformity in wall thickness and strength, and shall be free from any defect which may affect their serviceability. Each fitting shall be permanently and plainly marked with the name or trademark of the manufacturer. Fittings shall be of the flared or compression-type only. Unions shall be extra heavy 3-part unions only.

## **SECTION 3.14.0 - SERVICE BOXES AND CURB STOPS**

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**3.14.1 REQUIREMENTS.** Curb boxes shall comply with AWWA C-800 and ASTM B-62 and match the Owner's standard. If the Owner does not have a written standard the service boxes shall be Minneapolis pattern, extension type with 1-1/4" upper section, stationary rods and lid Mueller H-10300, A.Y. McDonald 5614 or equal with telescope movement 6" in excess of trench depth. Curb stops shall be Mueller H-1504-2 (3/4"-1") or H-15209 (1-1/4", 1-1/2", and 2"), A Y. McDonald 6104. The castings shall be free from blowholes, porosity, hard spots, shrinkage defects or cracks, or other injurious defects and shall have a normal smooth casting finish. The Contractor shall note that the stop must be installed in the proper direction. All curb boxes shall be suitable for the specified depth (7 0" minimum cover) without the use of an extension section.

**3.14.2 SHUT-OFF RODS.** Shut-off rods and pentagon keys are to be included at the rate of one each per 100 curb stops installed with a minimum of one each. Upper section is to be 1-1/4" minimum. Bottom section is to be threaded to fit the stop. A stationary rod is to be included with each box.

## **SECTION 3.15.0 - CORPORATION STOPS**

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**3.15.1 REQUIREMENTS.** Corporation stops shall comply with AWWA C-800 and ASTM B-62 and match the Owner's standard. If the Owner does not have a written standard the corporation stops shall be Mueller H-15008 or H-15023, A.Y. McDonald 4701 or equal, complete with necessary couplings. Saddles shall be used for 1-1/4", 1-1/2" and 2" corporation stops and shall be Rockwell 313, Mueller or equal.

## **SECTION 3.16.0 - VALVES AND BOXES**

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**3.16.1 REQUIREMENTS.** Valves shall meet AWWA C-509 and match the Owner's standard. If the Owner does not have a written standard the valves shall be full-opening, iron-body, non-rising stem, open to left, resilient seated wedge-type valves. All internal ferrous metal surfaces shall have an approved 6-mil, non-toxic, epoxy coating. Valves shall be American Flow Control 2500, Mueller #A-2360-20, Clow F-6100 epoxy-lined, or equal. End connections shall be mechanical joints.

All valves shall be of uniform make.

**3.16.2 BOXES.** The adjustable cast iron valve box with removable cover shall be Tyler Pipe 6860 or equal, screw-type, three (3) pieces consisting of a cover, a tube extension section, a bottom section, and a base. The base shall completely overlap the valve box. The length shall be such that when extended to the specified depth of cover (7 ft. minimum), there shall be not less than 6" overlap remaining between the top section and the next section.

**3.16.3 VALVE BOX ADAPTERS.** Each valve box shall be provided with a valve box adapter to help support the box on top of the valve to eliminate shifting and settling. The adapter shall be as manufactured by Adapter, Inc. or equal and include the epoxy coated support and a rubber gasket between the valve body and adapter. The adapter shall fit the valve furnished.

**3.16.4 TYPE.** Detailed information with regard to construction and operation shall be furnished to the Engineer for approval before purchase by the Contractor. If the proposed valves do not meet the Engineer's approval, the Contractor shall provide acceptable valves without additional cost to the Owner.

**3.16.5 JOINTS.** Valves and fittings shall be furnished with mechanical joints consisting of high quality cast iron glands, rubber gaskets, and corten alloy bolts.

**3.16.6 WRENCHES.** The Contractor shall furnish one extension wrench for each 100 valves installed, with a minimum of one. Each wrench shall be 18" longer than the depth of the trench. The wrenches shall fit the valves furnished.

## **SECTION 3.17.0 - FIRE HYDRANTS**

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**3.17.1 REQUIREMENTS.** All hydrants shall comply with AWWA C502 and match the Owner's standard. If the Owner does not have a written standard fire hydrants shall be 5" self-draining, dry-barrel type. Each hydrant shall have one (1) pumper connection to match local standards and two 2-1/2" nozzles with National Standard threads and National Standard operating nut (1" pentagon). Hydrants shall open to the left (counter-clockwise). All hydrants shall be designed for the specified depth of cover (7'0" minimum) and include a 16" traffic section so the pumper connection shall be 24" above grade. Hydrants shall be of uniform make. Hydrants and fittings shall be furnished with mechanical joints, consisting of high quality cast iron glands, rubber gaskets, and corrosion-resistant bolts.

All hydrants shall be painted solid red or match the local standard. Hydrants shall be the local standard, Waterous Pacer or equal.

Hydrants shall be equipped with a 16" traffic flange located approximately 2" above grade to permit a "break away" of the hydrant barrel and stem.

**3.17.2 REPAIR KITS.** On projects with over 25 hydrants, one (1) repair kit shall be furnished. Each repair kit shall contain at least 2 gaskets, 1 break off flange, 1 break off standpipe to match hydrants furnished, 1 sleeve coupling (2 halves), 1 stud coupling and 4 nut couplings.

**3.17.3 CONNECTIONS.** All hydrant connections shall consist of 6" Pressure Class 350 ductile iron pipe connecting the hydrant directly to the main line fitting. Whenever the main is 6" in diameter or over or a valve is provided on the lead, retainer glands or metal strapping shall be provided from the main line tee to the hydrant. Concrete blocking for the hydrant is required.

**3.17.4 TYPE.** The hydrants shall match the local standard and meet these specifications unless approved in writing. Detailed information with regard to construction and operation shall be furnished to the Engineer before purchase by the Contractor. If the hydrants do not meet the Engineer's approval, the Contractor shall provide acceptable hydrants without additional cost to the Owner.

**3.17.5 WRENCHES.** One standard wrench for operating the hydrants shall be furnished for each order of 25 or more hydrants.

## **SECTION 3.18.0 - PRECAST REINFORCED CONCRETE MANHOLES**

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**3.18.1 REQUIREMENTS.** Refer to Section 4.4.0 for additional storm and sanitary manhole requirements. Precast reinforced concrete manhole risers and tops shall meet the minimum requirements of ASTM Designation C-478. Precast manhole tops shall be the eccentric cone type except for water valve manholes where concentric cones shall be used. Flat top slabs may be used only with the permission of the Engineer. The cone section and barrel above a depth of 12'0" shall not be less than 5" thick with not less than 0.098 square inches per lineal foot of reinforcing. For manholes below this depth, barrel sections shall have not less than 0.32 square inches per lineal foot. Concrete strength shall be not less than 4,000 psi. Tongue and groove joint will be required.

All manholes are to be 48" I.D. crowned to a 24" opening as shown on the detailed sketches. The cone is to start 18" below finished grade.

Concrete is to be used for all manhole bases. All sanitary sewer pipe shall be connected to precast manholes by means of a flexible, watertight pipe-to-manhole seal except as provided in Section 4.4.6.

**3.18.2 JOINTS.** Manhole sections shall be jointed with a 1 inch butyl rubber gaskets or butyl rubber rope. A 1/2" rope shall be used between adjusting rings in the chimney. Where manhole sections are known to be below high groundwater, double 1" butyl rubber ropes shall be used. The rubber-type gaskets shall meet the requirements of ASTM C-443. Gasketed, flexible, water-tight connections shall be provided for all inlet and outlet pipes. Refer to Section 4.4.0.

**3.18.3 STEPS.** Manhole steps shall be steel-reinforced plastic installed by the manufacturer and shall be Neenah R1981J, M.A. Industries PS 1 or equal. The steps shall meet the requirements of OSHA 1910.27 and ASTM 478. The spacing of the steps shall be 16" with an allowable tolerance of 1" plus or minus. Minimum embedment shall be 3".

**3.18.4 FRAME/CHIMNEY SEAL.** All new sanitary manholes shall be provided with an external frame/chimney seal, Cretex or equal. The manufacturer shall submit a certification to the Engineer that the frame/chimney seal has a service life of 20 years, will allow repeated vertical movements of 2" and horizontal movements of 1/2". All new storm sewer manholes shall have the frame and chimney area wrapped with geotextile fabric.

**3.18.5 REJECTION.** Precast reinforced concrete manhole risers and tops shall be subject to rejection on account of failure to conform to any of the specification requirements. In addition, individual sections of manhole risers and tops may be rejected because of any of the following reasons:

- A.** Fractures or cracks passing through the shell, except for a single end crack that does not exceed the depth of the joint.
- B.** Defects that indicate imperfect proportioning, mixing, and molding.
- C.** Surface defects indicating honey-combed or open texture.
- D.** Damaged ends, where such damage would prevent making a satisfactory joint.
- E.** Manhole steps out of line, or not properly spaced.
- F.** Infiltration.

- G. The internal diameter of the manhole section shall not vary more than 1% from the nominal diameter.
- H. Any continuous crack having a surface width of 0.01 inch or more and extending 12 inches or more.

**SECTION 3.19.0 - MANHOLE CASTINGS**

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**3.19.1. REQUIREMENTS.** All manhole castings shall conform to the requirements of ASTM A-48, Class 35B (Gray Iron) with tensile strengths of 35,000 psi. Castings shall be of uniform quality and free from blowholes, shrinkage, distortion, cracks or other defects. They shall be smooth and well cleaned by shot blasting.

All manhole castings shall have machined bearing surfaces, concealed pick holes and be self-sealing.

The manhole castings shall be Neenah R1550 Type B, Campbell 1269 Heavy Duty or equal. Where water-tight covers are specified, the castings shall be equal to Neenah R1916-C with anchor bolts and bolt holes, Campbell Type A No. 1502 with gasket or equal.

For any project including 25 or more manhole covers, one (1) "cover lift" to open the cover through the concealed pickhole is to be furnished by the Contractor.

**SECTION 3.20.0 - GRASS SEED**

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**3.20.1 REQUIREMENTS.** Grass seed used shall conform to the following standards by weight and be uniformly distributed at a rate of 7#/1000 square feet.

Kentucky Blue Grass	33.5%	Minimum Germination 78%
Red Creeping Fescue	14.4%	Minimum Germination 90%
Perennial Rye	25.0%	Minimum Germination 90%
Annual Rye	24.6%	Minimum Germination 93%
Inert Material (Maximum)	7.0%	
Weeds (Maximum)	0.5%	
Crop Seeds (Maximum)	4.2%	

**SECTION 3.21.0 - PORTLAND CEMENT**

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**3.21.1 REQUIREMENTS.** All cement shall be delivered to the mixing site in original packages bearing the type and name brand or stamp of the manufacturer. Bulk cement may be used at ready-mixed concrete plants only. Cement containing lumps or crusts shall not be used.

Cement shall conform to the *Standard Specifications for Portland Cement* (ASTM C-150 Type I or IA) or *Standard Specifications for High Early Strength Portland Cement* (ASTM C-150 Type III or IIIA).

**3.21.2 MINIMUM CEMENT IN CONCRETE.** Where using standard separated fine and course aggregates, and regardless of the design strength adopted and compressive strength test results actually obtained, the minimum amount of standard Portland cement per cubic yard of concrete in place shall be not less than 6 bags per cubic yard. This mix is expected to yield 28-day strengths in excess of 4,000 psi. If test results indicate 28-day strengths less than 4,000 psi, but greater than 3,000 psi, the Contractor will be required to verify the design mix. If test results indicate 28-day strengths less than 3,000 psi, the Contractor will be required to remove and replace the substandard concrete. The water/cement ratio shall be based on 6 bags cement per cubic yard and not more than 6.0 gallons water per bag of cement.

**SECTION 3.22.0 - CONCRETE AGGREGATE**

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**3.22.1 FINE AGGREGATE REQUIREMENTS.** Fine aggregate shall conform to ASTM C33 and consist of sand having clean, hard, durable, uncoated grains free from deleterious substances and shall range in size from fine to coarse within the limits indicated below, percentage by weight:

<u>Sieve (Specification E 11)</u>		<u>Percent Passing</u>
3/8 inch	(9.5 mm)	100
No. 4	(4.75 mm)	95 to 100
No. 8	(2.36 mm)	80 to 100
No. 16	(1.18 mm)	50 to 85
No. 30	(600 μm)	25 to 60
No. 50	(300 μm)	5 to 30
No. 100	(150 μm)	0 to 10

Not more than 45% shall pass a standard size sieve and be retained on the next smaller standard sieve.

The fineness modulus shall be between 2.3 and 3.1. Aggregates containing silt and clay particles in excess of 2% by weight shall not be used.

**3.22.2 COARSE AGGREGATE REQUIREMENTS.** Coarse aggregate shall conform to ASTM C33 and consist of gravel, crushed stone, crushed gravel or other approved inert materials with similar characteristics or combination thereof, having clean, hard, durable, uncoated particles free from deleterious matter. Recycled material shall not be used. ***The use of crushed limestone for coarse aggregate will not be permitted unless it meets the following specific conditions:***

<u>TEST</u>	<u>Maximum %</u>
Soundness (Magnesium Sulfate) – Loss at 5-cycles of any fraction of the coarse aggregate (ASTM C33).....	5
Abrasion Loss (LAR), ASTM C131 .....	40
Absorption (ASTM C127).....	2.5
Freezing and Thawing Loss (16 cycles) .....	12
<b>Deleterious Substances</b>	
1. Clay Lumps & Friable Particles (ASTM C142).....	0.3
2. Soft Particles (ASTM C235).....	2.5
3. Total Spall Material .....	1.5
4. Total of 1, 2 & 3 .....	3.0

Coarse aggregate shall range in size from fine to coarse within the following percentages by weight without exceeding the maximum size.

**ASTM C 33, TABLE 2, SIZE 467**  
**FOR GREATER THAN 12" THICK**

<u>Sieve</u>	<u>Percent Passing</u>
2 inch (50 mm)	100
1-1/2 inch (37.5 mm)	95 - 100
3/4 inch (19.0 mm)	35 - 70
3/8 inch (9.5 mm)	10 - 30
No. 4 (4.75 mm)	0 - 5

**ASTM C33, TABLE 2, SIZE 57**  
**FOR 12" THICK OR LESS**

<u>Sieve</u>	<u>Percent Passing</u>
1 1/2 inch (37.5 mm)	100
1 inch (25.0 mm)	95 - 100
1/2 inch (12.5 mm)	25 - 60
No. 4 (4.75 mm)	0 - 10
No. 8 (2.36 mm)	0 - 5

The maximum size of the aggregate shall be adjusted to not larger than one-fifth of the narrowest dimension between sides of the member for which the concrete is to be used nor larger than three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars. For unreinforced slabs, the maximum size or aggregate shall not be larger than one-third the slab thickness.

## **SECTION 3.23.0 - READY-MIXED CONCRETE (Refer to Section V for Detailed Concrete Specifications)**

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**3.23.1 REQUIREMENTS.** Ready-mixed concrete may be used if it complies with these specifications and ASTM C94. The Engineer shall have free access at all times to the batching and mixing plant for sampling of all materials and inspection of work performed for this project. Concrete shall be delivered in water-tight containers which will not permit segregation of the materials. When delivered, the concrete shall be uniform throughout the mass.

**3.23.2 DELIVERY TIME.** When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within 1-1/2 hours, or before the drum has been revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates, unless a longer time is specifically authorized by the Engineer. In hot weather, or under conditions contributing to quick stiffening of the concrete, a time less than 1-1/2 hours may be specified by the Engineer. When a truck mixer is used for the complete mixing of the concrete, the mixing operation shall be within 30 minutes after the cement has been intermingled with the aggregates.

**3.23.3 DELIVERY TICKET.** With each load of concrete delivered to the job, there shall be furnished by the ready-mix plant a duplicate delivery ticket, one copy to be retained by the Contractor and the other given to the Engineer. The ticket shall indicate the mix and the time the mixing water was added to the cement and aggregates and the time the cement was added to the aggregates as outlined in ASTM C94, paragraph 16.

### **3.23.4 CONCRETE REQUIREMENTS AND TESTS.**

**Concrete Cylinders:** During progress of the work for each concrete pour of 15 cubic yards or more, a set of 3 standard 6" concrete cylinders shall be made and one tested at 7 days and one tested at 28 days. Cylinders will also be collected and tested for each change of mix. The remaining cylinders may be tested if necessary to confirm results. These cylinders are to be moist closet cured at the designated laboratory per ASTM C31, Paragraph 9.2. Reports shall be sent to the Engineer.

**Curing:** When the Contractor requests early form stripping or backfilling, additional cylinders shall be field cured and tested at intervals to be determined by the Engineer. These cylinders shall be field cured under conditions equivalent to the concrete in the structure per ASTM C33, Paragraph 9.3. Results will be used to determine when the concrete has attained sufficient strength for form stripping and/or backfilling.

**Required Strength:** Where using standard separated fine and coarse aggregates, and regardless of the design strength adopted and compressive strength test results actually obtained, the minimum amount of standard Portland cement per cubic yard of concrete in place shall not be less than 6 bags per cubic yard. The specified 6 bag mix is expected to yield 28 day strengths in excess of 4,000 psi. If test results indicate 28 day strengths less than 3,000 psi, the Contractor will be required to remove and replace the substandard concrete. The Engineer may allow in-place field tests to measure compressive strength to assist in determining the extent of removal. These tests shall be conducted by an independent laboratory at the Contractor's expense.

**Standard Slump Tests:** A uniform consistency shall be continuously maintained in consecutive batches of concrete. Slump tests per ASTM C143 shall be conducted at the rate of one per 15 cubic yards poured. Slump shall be maintained between 1" and 4" (1/2" tolerance) or the batch shall be rejected. These slump numbers do not apply if an approved high-range water reducer is used.

**Air Content Tests:** Where more than 50 cubic yards of concrete are being used, air content shall be field tested by the air pressure method, ASTM C231. The Contractor shall secure an acceptable air content test apparatus for the use of the Engineer on the job site. Air content shall be  $6.0 \pm 1\%$  by volume unless other content is determined by proportioning tests.

## **SECTION 3.24.0 – CRUSHED ROCK AND BEDDING SAND**

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**3.24.1 GRADED CRUSHED ROCK.** Crushed rock for bedding or unsatisfactory subgrade replacement shall be made from crushing sound limestone, dolomite ledge rock, or other rock materials of regional significance. The material shall be hard, tough, and durable. The crushing process shall produce material of which 85% to 100% of the particle shall have at least one machine fractured face. Crushed pea gravel will be acceptable if it meets these criteria.

**GRADATION REQUIREMENTS FOR  
3/8 INCH CRUSHED ROCK**

<u>Sieve Sizes</u>	<u>Percentage Passing By Weight</u>
1/2 Inch	100%
3/8 Inch	90- 100
No. 8	0- 15
No. 30	0- 3

**GRADATION REQUIREMENTS FOR  
3/4 INCH CRUSHED ROCK  
(ASTM C-33 - Size No. 67)**

<u>Sieve Sizes</u>	<u>Percentage Passing By Weight</u>
1 Inch	100%
3/4 Inch	90- 100
3/8 Inch	20 - 55
No. 4	0- 10
No. 8	0- 5

When larger crushed rock is required to improve soil stability or drainage, it shall meet the following requirements:

**GRADATION REQUIREMENTS OF  
2-1/2 AND 2 INCH CRUSHED ROCK**

<u>Sieve Sizes</u>	<u>Percentage Passing By Weight</u>
<b><u>2 1/2 Inch Size (ASTM C-33 / Size No. 2)</u></b>	
3 Inch	100%
2 1/2 Inch	90 - 100
2 Inch	35 - 70
1 1/2 Inch	0 - 15
3/4 Inch	0 – 5
<b><u>2 Inch Size (ASTM C-33 / Size No. 2)</u></b>	
2 1/2 Inch	100%
2 Inch	90 - 100
1 1/2 Inch	35 - 70
1 Inch	0 - 15
1/2 Inch	0 - 5

**3.24.2 BEDDING SAND.** Bedding sand shall consist of durable particles ranging in size from fine to coarse in a substantially uniform combination. Unwashed bank-run sand, rejected concrete sand, and crushed bank-run gravel will be considered generally acceptable under this specification. The presence of approximately 6% of fine clay or loam particles is desirable, but clay or loam lumps are not permitted. The maximum moisture content shall be 10%.

**GRADATION REQUIREMENTS FOR  
BEDDING SAND**

<u>Sieve Sizes</u>	<u>Percentage Passing By Weight</u>
1 Inch	100%
No. 16	45 - 80
Material Finer than No. 200	2 -10

## **SECTION 3.25.0 - SILT FENCE**

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**3.25.1 REQUIREMENTS.** Filter fabric silt fences shall be 24 inches to 36 inches high supported by 5 foot long, 4 inch diameter posts (or equivalent) and a wire fence 42 inches high. Posts shall be driven at least 6 inches into the ground at a maximum spacing of 10 feet. The wire fence shall be 14 gauge minimum with 6 inch maximum mesh spacing: The filter fabric and wire mesh shall be stapled or wired to the upstream side of the posts. The bottom of the filter fabric shall be anchored by extending 8 inch of fabric into a 4 inch x 4 inch trench on the upstream side and backfilled and compacted. The wire mesh shall extend at least 2 inches into the trench.

**3.25.2 GEOTEXTILE FABRIC.** The geotextile filter fabric shall be woven or non-woven polyester, polypropylene, stabilized nylon, polyethylene or polyvinyl chloride. For non-woven fabric the contractor may use needle punched, heat bonded, resin bonded, or combinations of all 3. Submit a certificate of compliance certifying that the geotextile conforms to the following:

<b><u>Test Requirement</u></b>	<b><u>Method</u></b>	<b><u>VALUE</u></b>
Minimum Grab Tensile Strength	ASTM D 4632	120 lb
Minimum Grab Tensile Strength	ASTM D 4632	100 lb
Maximum Apparent Opening Size	ASTM D 4751	No. 30 Sieve
Minimum Permittivity	ASTM D 4491	0.05 s <sup>-1</sup>
Minimum Ultraviolet Stability (500 Hours)	ASTM D4355	70%

**3.25.3 INSTALLATION, MAINTENANCE AND REMOVAL.** The silt fence shall be erected prior to starting any construction operation which might cause any sedimentation or siltation at the site of the proposed silt fence

The silt fence shall, when possible, be constructed in an arc or horseshoe shape with its ends pointing up slope. Silt fences shall be removed, as determined by the Engineer, after the slopes and ditches have been stabilized and turf developed to the extent that future erosion is unlikely. Materials remaining after removal shall become the property of the Contractor and shall be disposed of off the project site. Removal may require a special trip after the area is fully stabilized.

The Contractor shall inspect all silt fences immediately after each rainfall and at least daily during prolonged rainfall. Any deficiencies shall be immediately corrected by the Contractor. In addition, the Contractor shall make a daily review of the location for silt fences in areas where construction activities changes the earth contour and drainage runoff to ensure that the silt fences are properly located for effectiveness. Where deficiencies exist, additional silt fences shall be installed.

Sediment deposits shall be removed when the deposit reaches approximately one half of the volume capacity of the silt fence and disposed of as directed by the Engineer. Any sediment deposits remaining in place after the silt fence is no longer required shall be dressed to conform to the existing grade and the area topsoiled, fertilized and seeded as required. All sediment deposits shall be removed from wetlands.

## **SECTION 3.26.0 - CRUSHED AGGREGATE BASE COURSE**

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**3.26.1 GENERAL REQUIREMENTS.** No crushed concrete, reclaimed asphaltic material, reprocessed material or blended material shall be used unless approved in writing by the Engineer. Crushed aggregate base coarse shall consist of 85% or greater virgin aggregates meeting the requirements of Wisconsin DOT Section 301. Test results shall be furnished upon request.

**3.26.2 GRADITION REQUIREMENTS.** The crushed rock aggregate shall meet the Wisconsin DOT Section 305 Dense Graded Base requirements as follows:



**PERCENT PASSING BY WEIGHT**

<u>Sieve Size</u>	<u>3-Inch</u>	<u>1 1/4 -Inch</u>	<u>3/4-Inch</u>
3	90-100	-----	-----
1	60-85	-----	-----
1 1/4 inch	-----	95-100	-----
1 inch			100
3/4 inch	40-65	70-93	95-100
3/8 inch		42-80	50-90
No. 4	15/40	25-93	35-70
No. 10	10-30	16-48	15-55
No. 40	5-20	8-28	10-35

Unless the plans or Special Provisions specify otherwise, do the following:

1. Use 1 1/4-inch base in top 4 or more inches of base. Use 3-inch base or 1 1/4-inch base in the lower base layers.
2. Use 3/4-inch base in the top 3 inches of the shoulder.

**SECTION 3.27.0 – BREAKER ROCK**

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**3.27.1 GENERAL REQUIREMENTS.** Furnish crushed rock from an approved source substantially free of unconsolidated overburden materials, topsoil, organic materials, and other deleterious materials. An approved source is any source with acceptable DOT test results for wear and soundness on record. The Engineer may also approve other sources as follows:

- A.** Mined or quarried waste rock that, in the engineer's opinion, is hard, durable, and when processed through a primary crusher, will produce a material similar in size and texture to that produced from a quarry face.
- B.** Material from a new or untested quarry or pit that the engineer judges hard, durable, and comparable to that normally used to produce aggregate.
- C.** The engineer may reject material produced from concrete or from non-durable rock such as sandstone, shale, slate, disintegrated granite, or heavily weathered rock of any type.

**3.27.2 GRADATION REQUIREMENTS.** The crushed rock aggregate shall meet the Wisconsin DOT Section 312 Select Crushed Material requirements as follows:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
5"	90-100
1.5"	20-50
No. 10	0-10

Furnish a material that has a minimum of 50 percent, by count, of the number of particles retained on the 1 1/2 inch (37.5 mm) sieve with at least 2 fractured faces. The engineer will assess select crushed material acceptability based primarily on visual inspection.

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# SECTION IV CONSTRUCTION – STORM AND SANITARY SEWERS

*Note: This standard specification includes general requirements for construction of sewers and is supplemented and superseded by the Special Provisions that apply to this project only.*

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# CONSTRUCTION - STORM AND SANITARY SEWERS

## SECTION 4.1.0 - LAYING OF PIPE SEWERS

---

**4.1.1 LINE AND GRADE FOR OPEN-CUT CONSTRUCTION.** The exact grade and line for the pipe will be staked by the Engineer with the assistance of the Contractor, and must be strictly followed.

**A. Laser Beam.** The Contractor may use the laser beam method of maintaining line and grade upon demonstrating to the Engineer that a qualified operator will handle the equipment during the course of the construction.

When "in the pipe" method is used, batter boards will be required to check the installation of the first 100 feet of pipe, and the Contractor shall check the line and grade at any additional points at which offset stakes have been placed or whenever so requested by the Engineer.

If bending of the beam due to air temperature variations becomes apparent with "in the pipe" units, a fan shall be provided to circulate the air. However, air velocity shall not be so excessive as to cause pulsating or vibrating on the beam. If, in the opinion of the Engineer, the beam cannot be accurately controlled, this method of setting line and grade shall be abandoned.

When the above-ground method is used, the setup shall be checked with the three batter boards including one set at the upstream manhole. If the laser has a gradient indicator, two boards may be used to check the setup. The batter board at the upstream manhole shall be retained to check into as pipe laying progresses.

The beam alignment shall be verified at least once during the first half of each day's work shift and at least once more during the second half of each day's work shift. More frequent checks of the beam will be provided when warranted by job conditions.

**B. Grade Boards.** The Contractor shall, at his own expense, furnish and set the line and grade boards. A substantial stake shall be driven on each side of the trench on a line at right angles to each stake of the primary line. A substantial straight and even-edged 2x6 inch board shall be nailed or clamped to the stakes in a level position and at some even foot height above the grade line of the proposed sewer. The centerline of the proposed sewer shall be located by measurement from the primary line stake and marked upon the board. Not less than three (3) such lines and grade boards shall be set and immediately checked visually for errors in line and grade. As each additional board is placed, it shall be checked visually for error in line and grade. At least three (3) boards shall be maintained at all times. During the laying of the pipe, a line shall be fastened to the boards at the center of alignment marks and pulled sufficiently tight to remove any noticeable or measurable sag. The alignment of each pipe shall be obtained by measuring down from the line by means of an approved type of grade pole. Methods other than that described above may be used only if approved by the Engineer.

**4.1.2 POINT OF COMMENCEMENT AND DIRECTION OF LAYING.** The point of commencement for laying of sewer pipe shall be the lowest point in the proposed sewer line. The pipe shall be laid with the bell end of bell and spigot pipe or with the receiving groove end of tongue and groove pipe pointing upgrade. Any other procedure shall be followed only with permission of the Engineer. When a new sewer is to be connected to an existing sewer not terminating in a manhole, the Contractor shall uncover the end of the existing sewer to allow any adjustments in line and grade to be made before any pipe is laid.

**4.1.3 GENERAL REQUIREMENTS FOR LAYING PIPE.** All pipe shall be laid uniformly to line and grade so that the finished sewer will present a uniform bore. Noticeable variations from true alignment and grade will be considered sufficient cause for rejection of the work. All pipe to be laid in open-cut trench shall have 6-inch minimum clearance between the outside face of the pipe-barrel and the face of the trench wall or sheathing.

**4.1.4 JOINING DISSIMILAR MATERIALS.** Maintenance couplings and adapters for sanitary sewer pipe shall be Fernco or equal. Adapters will be permitted for repair or rehabilitation work only.

If adapters are not available for the type or size of pipe involved, the joining method must be approved by the Engineer.

**4.1.5 FITTINGS FOR BUILDING SEWER CONNECTIONS.**

- A.** Fittings for building sanitary sewer connections shall be single branch wyes, unless otherwise specified. The diameter of the smallest branch of the wye shall be either 4” or 6” as determined by the Owner, and the other wye shall be of the diameter of the sewer line in which it is laid. Except where necessary to maintain basement service, the wye branch is to be laid with the branch at an angle of 45 degrees with the horizontal.
- B.** Fittings for reconnections to re-laid sewers shall be as specified.
- C.** All connection fittings not to be extended shall be sealed with a water-tight stopper having the same joint as the spigot ends of pipe on the main sewer.
- D.** Building sewer connections at locations where wyes are not provided shall be made by a saddletee of a type approved by the Engineer. The connection shall be water-tight and not protrude into the sewer.

**4.1.6 PLUGS.** Before extending a sanitary sewer, the Contractor shall provide a plug in the existing sewer immediately downstream of the point of connection. This plug shall be left in place until the new sewer has been cleaned of accumulated water and debris and has been accepted.

All tees, wyes, sockets and bell and spigot pipe sewers 24 inches or smaller in diameter for future sewers shall be plugged with PVC plugs or a watertight stopper having the same joint as the spigot end of the pipe on the main sewer.

**4.1.7 BEDDING CONDITIONS**

The maximum width of trench excavation at the top of the pipe shall be the outside diameter of the pipe plus 24 inches. All pipe, regardless of the material, class, size, or use shall follow the same specifications. Refer to the Standard Details on the plans.

**A. Soil Classifications.** For purposes of pipe installations, the following Soil Classification Chart applies. The Engineer shall make the initial determination of soil classification for the native soils. If the Contractor contests the determination or the material is difficult to classify, the Contractor shall retain an Independent Laboratory to determine classifications. The Soil Classification of the native material is used to guide the pipe installation. In general, coarse grained soils like sands and gravels are suitable for most foundation, bedding, haunching and backfill purposes and fine grained soils like clay may be suitable for foundation and backfill but not for bedding.

<b>Soil Classification Chart</b>			
<b>COARSE-GRAINED SOILS</b>			
<b>Gravels</b>			
GW	Well-graded gravel	More than 50% of coarse fraction retained on #4 sieve	Clean gravels <5% fines
GP	Poorly graded gravel		
GM	Silty gravel		Gravel with fines >12% fines
GC	Clayey gravel		
<b>Sands</b>			
SW	Well-graded sand	50% or more of coarse fraction passes #4 sieve	Clean sands <5% fines
SP	Poorly graded sand		
SM	Silty sand		Sand with fines >12% fines
SC	Clayey sand		

FINE-GRAINED SOILS			
Silts and Clays			
CL	Lean clay	Liquid limit <50	Inorganic
ML	Silt		
OL	Organic clay/silt		Organic
CH	Fat clay	Liquid limit >50	Inorganic
MH	Elastic silt		
OH	Organic clay/silt		Organic
PT	Peat		Organic

**B. Soil Classes** For purposes of pipe installations, the following Soil Classes applies to the backfill material.

Soil Classes			
Crushed rock			Class I
Clean coarse grained	SW, SP, GW, GP	<12% passing #200	Class II
Coarse grained with fines	GM, GC, SM, SC	>12% passing #200	Class III
Silty Clay	CL, ML	>30% retained #200	Class III
Fine grained	CL, ML	<30% retained #200	Class IV
	MH, CH, CL, CH, PT		Class V

**C. Use of Soil Classes for Pipe Foundation, Embedment and Backfill**

Use of Soil Classes for Foundation, Embedment and Backfill	
Foundation	4" minimum in rock excavation
Foundation - no water	Class I, II or III or subcut and use Class I or II
Foundation - with water	Class I or II or subcut and use Class I or II
Bedding	4" minimum Bedding Sand (3.24.2) or 3/8" Crushed Rock (3.24.1)
Embedment - no water	Class I, II or III or replace with Class I, II or III
Embedment - with water	Class I or II or replace with Class I or II
Foundation and embedment	No rock > 1", No Class IV or V
Final Backfill	No rock > 8"
Embedment includes Bedding, Haunching and Initial Backfill	

Compaction for Foundation, Embedment and Backfill	
Foundation	90% Modified Proctor
Bedding	90% Modified Proctor
Haunching	90% Modified Proctor
Initial Backfill	90% Modified Proctor
Final Backfill	90% - 95% Modified Proctor

#### D. Bedding and Backfill Description

**Foundation.** No subcutting is required where a stable foundation of suitable soil exists below the bedding. If the bottom of the excavation is of undesirable material, such as rock, Class IV or Class V material, or the presence of ground water causes a condition which cannot adequately support the work, an additional four inches (4") of foundation shall be excavated and backfilled with compacted Class I or II and included as part of the standard sections at no additional payment. In the event that it becomes necessary to extend the foundation to a greater depth, such additional amount of removal and replacement will be paid for as Unsatisfactory Subgrade.

**Bedding.** Place a minimum of 4" Bedding Sand or 3/8" Crushed rock below the invert of the pipe to provide a firm, stable, uniform bed.

**Haunching.** Work in and tamp the haunching material in the area between the bedding and the underside of the pipe before placing and compacting the rest of the haunching up to the springline. Use Class I, II or III material. If water is present, use Class I or II only.

**Initial Backfill.** Place and compact the initial backfill to 12" above the crown of the pipe. Increase initial backfill to 24" in rock excavation.

**Embedment - Haunching and Initial Backfill.** Use special care near the pipe and only select Class I, II or III material free of debris, frozen material or organic matter. If water is present, use Class I or II only. No rock greater than 1" shall be placed in the embedment. No Class IV or V material shall be placed in the embedment. Compact the embedment to 90% Modified Proctor using vibration or impact for Class I and II and impact for Class III. Use care to avoid damage to the pipe.

**Final Backfill.** Use native material with no rock greater than eight inch (8"). Compact in 12" lifts (Class I and II) or six inch (6") lifts (Class III or IV) to 90% Modified Proctor in open fields and to six feet (6') deep and 95% Modified Proctor from six feet (6') deep to the surface in streets.

The base bid for pipe installation shall include furnishing and installing appropriate material for the first four inches (4") of Foundation and Embankment (Bedding, Haunching and Initial Backfill). Where appropriate, suitable material may be salvaged from within the trench or from other areas of the job.

**Minimum Cover.** The minimum cover for sewer shall be four feet (4') and the minimum cover for water and forcemain shall be seven feet (7'). Provide the minimum unless otherwise indicated on the plans.

**E. Water Checks.** To prevent water from following the granular backfill, provide a clay or bentonite water check at 100 ft. intervals.

**4.1.8 FILL SECTIONS.** Where the sewer is to be laid above the existing ground surface, the topsoil and other organic material to a depth of 12 inches shall be removed from a strip of ground centered on the sewer line and of width equal to twice the amount of height of the sewer flow line above the ground surface. An embankment of approved excavated material shall be constructed to the elevation of the top of the pipe. The material shall be placed in 6-inch layers and compacted by approved mechanical means to 95% Standard Proctor Density. The pipe shall then be laid to line and grade and properly bedded and jointed. Three feet of earth backfill shall be placed over the pipe and embankment. The side slopes of the embankment material and of the earth cover shall be no less than 1.5 horizontal to 1 vertical.

**4.1.9 PROTECTION OF OPEN PIPE.** During all intermissions in construction of the sewer, the open face of the last pipe laid shall be covered or bulkheaded to prevent sand, water, earth or other materials from entering the pipe.

**4.1.10 PROTECTION OF NEW MORTAR JOINT.** Water shall not be allowed to rise in or around, or pass over any mortar joint before it has substantially set. After a joint has been made, no weight shall be placed on the pipe until after the hand backfilling has been completed.

**4.1.11 LAYING OF PIPE IN COLD WEATHER.** Pipe-laying shall be discontinued whenever there is danger of the quality of work being impaired because of cold weather. The Contractor shall be responsible for heating the pipe and jointing materials so as to prevent freezing of joints. No pipe shall be laid on frozen ground.

When pipes are to be laid with rubber gaskets or resilient-type joints in cold weather, the gasket or joint material shall be sufficiently warmed so as to facilitate making a proper joint.

When pipes are to be laid with a solvent cemented joint in cold weather, care shall be taken to insure the removal of all ice and snow from the jointed area prior to the application of the solvent cement. Temperatures shall be above the minimum specified by the manufacturer.

**4.1.12 ABANDONED SEWERS, DRAINS AND SEWER STRUCTURES.** Sanitary and storm sewer mains and structures which are to be abandoned and not removed shall be filled with sand unless otherwise indicated on the plans. Service shall be maintained in such sewers until the Engineer shall order plugs placed. All existing sewers, manholes, catch basins and catch basin leads that are no longer in use shall be plugged with concrete and abandoned. All castings on such abandoned structures are the property of the Owner and shall be salvaged by the Contractor and delivered as directed. All abandoned manholes and catch basins shall be removed to a depth of 3 feet below the proposed or established grade or existing street grade, whichever is lower. The cost of abandonment shall be included in the unit price bid for new sewers.

**4.1.13 CONNECTIONS TO EXISTING MANHOLES OR EXISTING SEWERS.** The Contractor shall cut a new connection into an existing manhole or sewer structure where there is no connection, or where the connection is not to line or grade, or where the connection stub is of a different type of material and/or different joint than on the sewer which is to be extended. When connecting to an existing sewer or manhole connection stub that is of a different type of material and/or has a different type of joint than that of the material and/or joint of the new sewer to be extended, the Contractor shall have the option of using an approved Fernco watertight adapter for the joint.

**4.1.14 BACKFILLING.** Refer to Section 2.4.0 for backfilling and compaction requirements.

**4.1.15 TRACER WIRE.** All pipe shall be marked with Tracer Wire. The Tracer Wire shall be furnished and installed per Section 3.11 and the standard details.

## **SECTION 4.2.0 - BUILDING SANITARY SEWERS**

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**4.2.1 WIDTH OF TRENCH.** The minimum width of trench shall equal the outside diameter of the pipe barrel plus a clear width of 6 inches on each side.

**4.2.2 SIZE.** Standard building sewers are to be not less than 4 inches in diameter. All building sewers shall be laid in standard size unless a larger size is specified or required by State or local codes.

**4.2.3 CONNECTING BUILDING SEWERS.** Standard curve fittings and curve specials shall be used to connect building sewers to the wye of the main sewers. Curves shall be limited to 45, 30 and 22-1/2 degree angles and shall be placed so as to provide a smooth transition from the building sewer to the main sewer in the street. In general, a 30 degree bend will be required.

**4.2.4 ALIGNMENT AND GRADE.** The alignment of a building sewer shall be straight extending from the connection to the main sewer in a direction at right angles to the main sewer or as specified.

The standard grade shall be 1/8" per foot so as to provide maximum fall from the basement to the main sewer. The Contractor shall lay all laterals at this grade unless the property owner desires a shallower lateral. The request must be written, signed by the property owner and approved by the Engineer. The installation must be in accordance with the applicable plumbing code. Between the lot line and the sewer main, or riser pipe there from, the sewer shall be laid at a uniform slope not exceeding 1/2 inch per foot. Between the lot line and the building the slope shall not exceed 1/2 inch per foot, except for a change in elevation, which shall be made by use of 45 degree fittings.

Risers shall be installed when the maximum slope of 1/2 inch per foot would be exceeded between the lot line and the sewer main.

**4.2.5 POINT OF COMMENCEMENT AND DIRECTION OF LAYING.** The point of commencement for laying of building sewer pipe shall be at the connection in the main sewer. Building sewer pipe shall be laid with the bell-end of the pipe pointing upgrade. Any other procedure shall be followed only with the permission of the Engineer.

**4.2.6 CONNECTION OF BUILDING SEWERS TO A MANHOLE.** The building sanitary sewer shall not be connected to a manhole at an elevation of more than 24 inches above the invert of the outgoing sewer.



Where the difference in elevations is greater than 24 inches, the connection shall be made with an outside drop connection.

**4.2.7 GENERAL REQUIREMENTS FOR LAYING PIPE.** All building sewer pipe shall be laid in accordance with Section 4.1.0 with the exception that lasers or line and grade boards do not have to be used except if ordered by the Engineer. If the Engineer so orders the use of lasers or line and grade boards, they shall be furnished and set by the Contractor at no additional cost to the Owner to insure the correct line and grade of the proposed installation. All building sewers shall be installed by open cut unless pavement crossings interfere. Where building sewers are jacked or bored under pavement, the end must be exposed and checked for proper depth.

**4.2.8 PIPE SUPPORT ACROSS TRENCHES.** Where a building sewer crosses an existing trench up to 36" wide, a plank support shall be used, except where use of such planking is deemed unnecessary and waived by the Engineer. A 2" x 12" plank long enough to extend 1-1/2 feet on each side of the trench shall be used. A 4" sand cushion shall be placed between the plank and the pipe. For trench widths over 36", a wall of backfill concrete shall be provided.

**4.2.9 RISERS.** Whenever the excavation exceeds twelve (12) feet or at such points as may be directed by the Engineer, the Contractor shall install CL52 ductile iron risers by one of the following methods:

**A. Straight wall trenches.** A tee shall be inserted in the main at 45 degrees to the horizontal. A 45 degree bend and vertical pipe riser shall be installed to a point 9 feet below the surface and plugged. The tee, bend and riser pipe shall be encased in a minimum 6" envelope of concrete to a point 6" above the top of the main line sewer.

**B. Sloping wall trenches.** A tee shall be inserted in the main line at 45 degrees to horizontal and a pipe installed on a 45 degree angle to a point 9 feet below grade and plugged. The tee and sloping riser shall be encased in a minimum 6" envelope of concrete to a point 6" above the main line sewer.

Refer to the standard sketch for construction details. Riser size shall match lateral size.

If a unit price for risers is not provided, the unit price for wyes plus 50% will be paid for riser tees. Unit price for laterals will be paid for riser installations including elbow. Concrete backings shall be included in other unit prices offered.

**4.2.10 EXTENSIONS, RELOCATIONS, DISCONNECTIONS, AND RECONNECTIONS OF BUILDING SERVICES.** The Contractor will be furnished with available recorded measurements for the location of existing building sewers and water services. Existing service stop boxes, indications of old trenches and any other pertinent evidence also shall be used in their location.

The Contractor shall commence excavation for the location of the existing building sewers and water services at such point as the weight of evidence demands. In case the initial excavation for the location of existing building sewers and water services fails to uncover same, the Contractor, at no cost to the Owner, shall explore a distance of 10 feet in each direction, or a total of 20 feet, immediately in back of and parallel to the curb, or along the main.

In case the existing building sewers or water services cannot be located in these limits, and additional trenching is required, the Contractor shall make application to the Engineer for a written order for extra work, covering such additional exploratory trenching.

**4.2.11 MARKING OF BUILDING SEWER.** Ends of all building sewers are to be checked for proper depth by the Owner's representative before backfilling. The Contractor is to install a 2" x 2" x 5'0" stake directly over the end of each building sewer and drive the stake to 2" above grade.

**4.2.12 RECORDS REQUIRED.** The Contractor shall be responsible for furnishing exact information on wye locations, building sewer locations and building sewer depths at the property line to the Engineer for preparation of final records. Ties shall be provided. These Record Drawings shall be provided before final payment is released.

**4.2.13 TRACER WIRE.** All building sewer shall be marked with Tracer Wire teed off the mainline Tracer Wire. Extend the wire to the locator box and coil 5 feet extra for extension.

**4.2.14 SEPARATION OF WATER SERVICE AND BUILDING SEWERS.** Except as permitted below, the underground water service pipe and building sewer shall not be less than 10 feet apart horizontally and shall be separated by undisturbed or compacted earth. The water service pipe may be placed in the same trench with the building sewer under the following conditions:

- A. The water service is 2" or less and installed concurrently with the building sewer.
- B. The bottom of the water service pipe at all points shall be at least 12 inches above the top of the sewer line.
- C. The water service pipe shall be placed on the solid shelf excavated at one side of the common trench.
- D. The number of joints in the water service pipe shall be kept to a minimum.

#### **SECTION 4.3.0 - RECONNECTING BUILDING SEWERS, STORM WATER DRAINS, AND UTILITY DRAINS**

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**4.3.1 RECONNECTING EXISTING SEWERS, BUILDING SEWERS, AND DRAINS.** Where a main sewer is to be abandoned and replaced, each existing sewer, building sewer, storm water drain, utility or other drain which is connected to the existing main sewer, whether active or apparently inactive, shall be provided with an outlet to the new sewer or appurtenance thereof. Where a building sewer or drain has been identified as abandoned, the Contractor shall omit a new outlet for same.

Existing storm water and utility drains which are to enter new manholes shall be connected by extending them from the last undisturbed intact pipe to the inside face of the manhole using pipe of equal size and type, laid on the same grade as the existing drain. The manhole shall be shaped to conduct sewage from the building sewer to the invert where such drains are to enter the new sewer directly; they shall be connected as set forth for existing building sewer connections to the new sewer. Clear water drains shall not be reconnected to the sanitary sewer without specific authorization.

Existing sanitary building sewers which are to enter new manholes shall be connected as indicated above for storm and utility drains, provided the elevation of the building sewer at the manhole is not more than 24 inches above the invert of the sewer. Where a sanitary building sewer enters the manhole above this elevation, the connection shall be made with an outside ductile iron pipe drop connection.

Where the existing building sewer is to enter the new main sewer approximately at spring line, the connection shall be made by joining the last undisturbed intact pipe of the building sewer to the new sewer with pipe of equal size and type laid at standard grade. As the difference in elevation between the existing building sewer and the new main sewer increases, a 45 degree bend shall be used in making the connection. Where the difference in elevation becomes substantial, the connection shall be made by first joining a straight length of pipe to the new sewer at the middle of the upper quadrant, and extending such pipe upward on an angle of 45 degrees to the approximate elevation of the building sewer. At this elevation, a 45 degree bend shall be inserted and the connection made to the existing building sewer.

All building sewers shall be reconnected to new sewers or manholes and shall be supported by a wall made of concrete, extending from the main sewer to the outside limit of trench. The wyes and all bends used in reconnecting the building sewers shall be encased in concrete.

**4.3.2 BRANCH FITTINGS, PIPE, AND JOINTS.** Branch fittings to be used for reconnecting existing building sewers and drains to the new sewer shall be wye branches placed so that the spur of the branch fittings makes an angle of 45 degrees with the horizontal or a lesser angle when the gradient of the building sewer or drain so requires

**4.3.3 BASIS OF PAYMENT.** When existing building sewers, storm water or other drains are to be connected to the new sewer or to new manholes, payment will be made at the price bid. In the event that there is no bid price for reconnecting building sewer and drains, a change order will be negotiated before the work is done.

#### **SECTION 4.4.0 - MANHOLES**

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**4.4.1 DEFINITION.** Where the term manhole is used in the specification, it shall mean a structure which is placed in the sewer line to permit entry, inspection, cleaning and repairing of the sewer, the entrance to which is enclosed with a manhole frame and cover, as hereinafter specified.

**4.4.2 LOCATION.** Manholes shall be constructed at the locations and grades indicated on the sewer plans or as staked in the field.

**4.4.3 GENERAL REQUIREMENTS.** The following requirements shall apply to all manholes, regardless of size, type, or shape. Refer to Section 3.15.0 for materials specifications.

**A. Manhole Excavation.** The excavation shall be limited to the size required for the manhole to be constructed and shall be sheathed and braced as necessary.

**B. Preparation of Subgrade.** All undesirable material, such as organic soils, which cannot adequately support the manhole shall be removed below the normal manhole bottom and replaced with 3/4" graded crushed rock. The first 6 inches of crushed rock below the normal manhole bottom shall be placed and included in the cost of the manhole. In the event that it becomes necessary to extend the rock fill to a greater depth, such additional amount of rock will be paid for as unsatisfactory subgrade at the bid or negotiated price.

**C. Manhole Inverts.** The invert of the manhole shall be the same diameter as the larger of the adjoining sewers. The pipe or approved lagging shall be laid through the manhole and, if the pipe is left in place, the upper half shall be removed after the manhole is built.

**D. Walls, Corbel, and Chimney.** The precast concrete manhole wall shall be constructed at the specified diameter up to the beginning of the corbel section. From this point the manhole shall be corbelled in at approximately 1/2 inch horizontal to one inch vertical (eccentric) to the diameter of the manhole frame. The face of the manhole in which the steps are installed shall be kept vertical. Flat top slabs may be used only where specified or by permission of the Engineer. The elevation of the manhole frame shall be determined in the field. A chimney having a minimum height of 6 inches and a maximum height of 12 inches (top 2 rings 2") constructed of 2" or 4" precast adjusting rings shall be built on top of the corbel section or flat slab up to the elevation at which the frame is set. The Engineer reserves the right to increase or decrease the height of the chimney as required.

**E. Castings.** Manhole frames and covers shall be furnished and installed by the Contractor. The castings shall conform to the requirements of Section 3.16.0. The manhole frame shall be centered on the chimney and brought to grade. The frame/chimney joint shall be constructed as specified below.

**F. Joints.** Sanitary manholes shall be constructed with a Type I joint. Storm manholes shall be constructed with a Type-II joint.

1. *Type I - Mortar and butyl rubber seal.* A 1-inch butyl rubber rope shall be installed between the manhole frame and the top of the chimney and in all joints in the cone and barrel section. A 1/2 inch butyl rubber rope shall be installed between adjusting rings in the chimney. Where manhole sections are known to be below high groundwater, double 1-inch butyl rubber ropes shall be used in each joint. The surfaces that the butyl rubber rope will adhere to shall be clean and dry before the butyl rubber rope is installed. The butyl rubber rope shall first be installed in the center of the joint and compressed by the weight of the frame or other means. All joints in the chimney and cone shall be pointed up with mortar on the interior and exterior of the manhole as necessary to make a smooth, uniform surface.

2. *Type II - Mortar Joint.* The manhole frame shall be set in a bed of fresh mortar extending the full width of and continuously around the top of the chimney. The inner and outer faces of the mortar joint shall be trowel finished.

**G. Steps.** Manhole steps conforming to the requirements of Section 3.15.3 shall be installed in all manholes in excess of 4 feet deep, and shall be aligned so as to form a continuous ladder with steps equally spaced vertically in the completed manhole at a design distance of 16 inches on center. The steps shall project a minimum clear distance of 4 inches from the wan of the riser or cone section measured from the point of embedment. The steps shall be placed as required with an allowable tolerance of one inch plus or minus.

**H. Chimney Seal.** All new manholes shall be provided with an external chimney seal, Cretex or equal. Internal chimney seals may be used where approved by the Engineer.

**I. Connection for Future Sewers.** Unless waived by the Engineer, where the sewer terminates in a dead-end manhole or where indicated on the sewer plans, manholes shall include connection pipes or bulkheaded openings in the manhole wall for future sewers, building sewers or drains. For sanitary manholes, a cored opening through the manhole wall shall be provided and the opening shall be capped. For storm sewers, the connection pipe shall be of the same type as specified for the sewer through the manhole and shall terminate in a bell, grooved or other type end having the same type of joint as provided on the sewer being constructed. The connection pipe, which shall not extend more than one foot outside the manhole well, shall be carefully set to line and grade and connected to the manhole. If no elevation is shown for the connection pipe, it shall be set at the invert of the outlet sewer and channeled in the direction of the flow. Unused connection pipe shall be plugged.

**4.4.4 MANHOLE BASES.** Concrete manhole bases shall be as follows:

**A. Field Poured Base for Precast Manhole.** The precast manhole bottom barrel section shall be set on concrete brick or solid block so that the bottom of this section is below the spring line of the outlet pipe, set for proper location and plumbed. The manhole base shall then be poured.

**B. Precast Manhole with Integral Base.** The excavation shall be deep enough so that after the bottom manhole barrel section with integral base has been placed thereon, set to grade and plumbed, there remains a 4-inch minimum depth of 3/8" graded crushed rock bedding material below the bottom of the base. The annular space between the manhole excavation and outside wall of the manhole shall be backfilled with 3/8" graded crushed rock bedding material up to the spring line of the incoming pipe. The invert shall not be poured until the manhole is completely built and backfilled. The invert shall be the same diameter as the larger of the adjoining sewers.

**4.4.5 MANHOLE TEES.** Manhole tees shall be made up of Precast Manhole sections and Reinforced Concrete Pipe meeting the requirements of Section III with the same strength as the mainline pipe. Manhole tees may be used only where specified

These manhole tees shall either be poured monolithically or poured separately and joined together such that the completed unit has the same strength as that of the adjoining pipe barrel and the concrete used to complete the section shall not spill or separate. Sufficient additional reinforcement shall be added around the connections during the manufacture and fabrication to prevent shearing or separation after installation.

Manhole tees shall be one of the following types:

**A. Manhole Larger Than Sewer.** Where the diameter of the manhole is greater than the diameter of the outlet sewer which is connected to it, the connecting sewers shall be set in the manhole so there remains a minimum distance of 12 inches between the bottom of the manhole and invert of the outgoing pipe. When the manhole is poured as a single unit, the distance between the bottom of the manhole and the invert of the outgoing pipe may be reduced to a minimum of two times the pipe wall thickness or five inches, whichever is greater.

**B. Manhole Smaller Than Sewer.** Where the diameter of the manhole is equal to or less than the diameter of the outlet sewer to which it is connected, a saddle-type manhole may be used. The face of the manhole riser in which the steps are installed shall be kept even with one side of sewers larger than the manhole. Steps shall be drilled into the wall of the pipe below the spring line. These steps shall be placed on Winch centers with the first or bottom step located 10 to 22 inches above the flow line and the top steps located 8 inches below the top of the manhole tee.

**4.4.6 PIPE TO MANHOLE CONNECTION.** The manhole connection of pipe sewers shall be accomplished by one of the following methods:

**A. Rigid Pipe.** When rigid pipe is connected to either a concrete brick, block, or precast manhole within the manhole base, it shall be supported on brick or solid concrete block. Where the pipe enters the manhole above the manhole base, it shall be supported from the wall of the manhole back to the face of the first pipe joint bell with a wall of backfill concrete, brick, or solid concrete block columns. The connecting pipe shall then be neatly bricked or concreted into the manhole wall. The connection shall be watertight on sanitary manholes.

**B. Plastic Pipe.** All plastic sanitary sewer pipe shall be connected to precast manholes by means of an approved, flexible, and watertight pipe-to-manhole seal. This seal shall meet the physical requirements of ASTM C-443 and the performance requirements of both ASTM C425 and C443. Pipe entering a manhole through this seal shall not be rigidly supported. To maintain the seal flexibility, that portion of the annular space between the pipe and the manhole wall below the spring line of the pipe, shall be plugged with butyl rubber gasket material prior to the placing of concrete in the manhole.

**4.4.7 OUTSIDE DROP MANHOLE.** Where a sanitary sewer or building sewer enters a manhole 24 inches or more above the invert of the outgoing sewer, the incoming sewer shall be connected to the manhole by means of an outside drop connection. Refer to the standard detail

The drop pipe shall be the same diameter as the incoming sewer unless otherwise specified.

For 8" drops, a precast concrete horseshoe is to be utilized. The horseshoe units are to be 6" high with a 4" wall thickness laid up with mortar. The space between the sewer pipe and horseshoe is to be filled with concrete. A fibrous tube form may be used for larger diameter drops.

When an outside drop connection is to be made on an existing manhole, the footing of the drop shall be the same thickness as the manhole base and connected by means of a minimum four, 1/2-inch diameter reinforcing bars drilled into the existing manhole base. An additional four, 1/4-inch diameter reinforcing bars shall be placed as dowels into the new footing and extended into the vertical part of the drop constructed of monolithic concrete. In addition, the drop shall be tied to the existing manhole with 1/2-inch diameter reinforcing bars or steel strapping at a maximum spacing of 2 feet with a minimum of two ties to prevent any separation of the drop from the manhole wall. The entire drop connection shall be encased with a minimum 4-inch thick envelope of concrete.

**4.4.8. LAYING OF BRICK AND CONCRETE BLOCK MANHOLE.** Precast concrete manholes shall be provided unless brick or concrete block is specified. Brick shall be laid flat with the long dimension tangent to the manhole wall except for the fifth course laid as a header or binder course. The depressions in the brick shall be laid upward. Brick shall be laid with full, shoveled joints of standard cement mortar and the inside joints shall be brushed. Vertical joints shall be staggered. The outside face of the manhole shall be back-plastered with a smooth coat of mortar 1/2 inch thick, and covered with a bituminous waterproof coating. The inside face of the brickwork, manhole steps, benches, and the manhole inverts shall be cleaned of mortar. All debris shall be removed from the manhole and all debris, especially cement and mortar bags, shall be removed from the adjacent trench before backfilling.

When solid concrete blocks are substituted for bricks, the above requirements shall apply, except that blocks are laid edgewise, the wall consisting of one or more courses of block and without the header or binder courses. Concrete blocks or bricks shall be clean, dry, and free from frost when they are laid. Any block or brick unfit for use shall be rejecters.

**4.4.9 GRADES FOR SETTING MANHOLE FRAMES.** The manhole frame shall be at the elevation given on the sewer plan, or when no such elevation is given, they shall be set as follows: within a traveled roadway or on the shoulder of a highway, the top of the manhole frame shall be set flush with the existing ground or pavement surface. In other locations, the top of the frame shall be set at the proposed or established street grade, or at the existing surface grade as specified and/or shown on the plans. The frame shall be set upon adjusting rings.

**4.4.10 BUILDING MANHOLES IN FREEZING TEMPERATURES.** When manholes are built in temperatures below 35 degrees Fahrenheit, the ingredients of the mortar at the time of using shall have a temperature not less than 60 degrees and not more than 80 degrees F. The block and brick shall be warmed to the same temperature range. The manholes shall be enclosed and heat furnished inside so as to prevent freezing of the completed work for a minimum of 24 hours. Other precautions may also be necessary.

**4.4.11 CATCH BASINS AND STORM SEWER WATER INLETS.** Catch basins and storm sewer water inlets shall be constructed similar to manholes. Refer to the standard details.

## **SECTION 4.5.0 - TESTING OF SEWERS**

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**4.5.1 GENERAL.** All sewers, except relays with active connected building sewers, shall pass a leakage test before they are accepted by the Owner. The permitted leakage tests are the water infiltration test or the low-pressure air test. The Contractor shall perform either one of these tests unless testing is waived by the Engineer.

The Contractor shall notify the Engineer not less than 48 hours in advance. Water infiltration and low-pressure air tests shall be performed by the Contractor under the observation of the Engineer.

Water infiltration or low-pressure air testing are not required on replacement sanitary sewers (relays) with active connected building sewers. The Engineer may waive testing of storm sewers.

The cost of the equipment, materials, and labor necessary to perform the leakage test shall be included in the prices bid for the sewer. The ends of branches, laterals, tees, wyes, and stubs to be included in the test should be plugged to prevent leakage. When the lateral is connected to a saddle fitting installed on the main line under the same contract, that section of the main sewer shall be included in the lateral test.

The Contractor is required to repair all visible defective joints or leaks in pipes, manholes or catch basins even though leakage test requirements are met.

**4.5.2 WATER INFILTRATION TEST.** The infiltration test shall not be considered a valid leakage test unless the top surface of the groundwater level is at least 2 feet above the pipe during the test measurement. The Contractor may simulate this condition, at no cost to the Owner, by flooding the trenches.

The ground water height above the installed pipe may be determined by attaching a transparent plastic tube to an opening in the manhole and using the plastic tube as a manometer.

The rate of infiltration of water into the sewer project, including appurtenances, shall not exceed 200 gallons per day, per inch diameter, per mile of sewer. The infiltration between any two adjacent manholes shall not be greater than 250% of the allowable infiltration rate.

No infiltration allowance will be allowed for manholes.

This maximum allowable infiltration, expressed in gallons per hour, is shown in the following table for various pipe sizes.

**Allowable Limits of Infiltration  
(Based on 200 gallons/inch diameter/mile)**

Diameter of Sewer, Inches	Infiltration per foot per hour, Gallons	Diameter of Sewer, Inches	Infiltration per foot per hour, Gallons
4"	0.0063	21"	0.0332
6"	0.0095	24"	0.0378
8"	0.0126	27"	0.0426
10"	0.0158	30"	0.0474
12"	0.0190	36"	0.0568
15"	0.0237	42"	0.0663
18"	0.0284	48"	0.0758

**4.5.3 LOW PRESSURE AIR TEST.** The procedure for setting up the apparatus for the low pressure air test shall be approved by the Engineer.

The pipe shall be tested between adjacent manholes. The test time for the air pressure to drop the specified one pound shall be in accordance with the following table. The test time shall be in accordance with the following formula which is based on the maximum air loss of 4.5 cubic feet per minute. In all cases, the length of laterals shall be ignored.

$$T = .00493D^2L$$

Where: T = Test Time, Second<sup>s</sup>  
D = Diameter, Inches  
L = Length of Test Section, Feet

Only after the sanitary sewers, including appurtenances and sanitary laterals have been installed, backfilled and cleaned, shall the Contractor proceed with an air test on the installed facilities.

## **A. Low Pressure Air Test Procedure**

1. The section of sewer line to be tested should be flushed and cleaned prior to conducting the low pressure air test. This serves to clean out any debris, wet the pipe, and produces more consistent results.
2. Isolate the section of the sewer line to be tested by means of inflatable stoppers or other suitable test plugs. One of the plugs should have an inlet tap or other provision for connecting a hose to a portable air control source.
3. If the test section is below the ground water level, determine the height of the groundwater above the spring line of the pipe at each end of the test section and compute the average. For every foot of groundwater above the pipe spring line, increase the gauge test pressures by 0.43 pounds per square inch.
4. Connect the air hose to the inlet tap and a portable air control source. The air equipment should consist of necessary valves and pressure gauges to control the rate at which air flows into the test section and to enable monitoring of the air pressure within the test section. Also, the testing apparatus should be equipped with a pressure relief device to prevent the possibility of loading the test section with the full capacity of the compressor.
5. Add air slowly to the test section until the pressure inside the pipe is raised to 4.0 psi greater than the average back pressure of the groundwater that may be over the pipe. Do not exceed 9 psi.
6. After a pressure of 4.0 psig is obtained, regulate the air supply so that the pressure is maintained between 3.5 and 4.0 psig (above the average ground water back pressure) for a period of two minutes. This allows the air temperature to stabilize in equilibrium with the temperature of the pipe walls. The pressure will normally drop slightly until temperature equilibrium is obtained. During this period, all plugs should be checked with a soap solution to detect any plug leakage.
7. Determine the rate of air loss by the time/pressure drop methods. After the two-minute air stabilization period, the air supply is disconnected and the test pressure allowed to decrease to 3.6 psig. The time required for the test pressure to drop from 3.5 psig to 2.5 psig is determined by means of a stopwatch and this time interval is then compared to the specification time as calculated to determine if the rate of air loss is within the allowable time limit. If the time is equal or greater than the times indicated in the tables, the pipe line shall be deemed acceptable.
8. Upon completion of the test, the bleeder valve is opened and all air is allowed to escape. Plugs should not be removed until all air pressure in the test section has been released. During this time, no one should be allowed in the trench or manhole while the pipe is being decompressed.

### **LOW PRESSURE AIR TEST TIME**

Specification time (Min:Sec) required for loss of air pressure from 3.5 psig to 2.5 psig for size and length of pipe indicated. (Based on 0.003 cfm per sq.ft with a minimum loss of 2.0 cfm and a maximum of 4.5 cfm.)

A	B	C	D	E	F
Pipe Dia. (Inches)	Times Per Foot Up to Length in Column C (Seconds)	Test Length (Feet)	Test Time for Any Length Column C & E (Min: Sec)	Length at Which Time in Column F Applies (Feet)	Time per Foot for Total Length (Seconds)
4	0.18	636	1:54	1432	0.08
6	0.40	424	2:50	955	0.18
8	0.71	318	3:47	716	0.32
10	1.11	255	4:43	573	0.49
12	1.60	212	5:40	477	0.71
15	2.50	170	7:05	382	1.11
18	3.62	141	8:30	318	1.61
21	4.92	121	9:55	273	2.19
24	6.42	106	11:20	239	2.85

EXAMPLE: 15-inch diameter with lengths of 150, 250 and 500 feet.

For 150 feet T = 2.50 Sec (Col B.) x 150 feet = 375 sec = 6: 15

For 250 feet T = 7:05 (Col D)

For 500 feet T = 1.11 sac (Col F) x 500 ft = 555 sec = 9: 15

The Engineer may waive the low pressure air test on any section of sewer based on evaluation of the results of previous tests on the project. When tests are waived, a credit will be negotiated.

**4.5.4 INSPECTION OF COMPLETED SEWER LINE.** Sewer lines will be inspected after backfilling by use of mirrors or flashlights. Any sewer line that does not permit a thorough view of at least half the diameter between manholes shall be re-laid or additional manholes shall be installed by the Contractor without expense to the Owner. The decision as to what corrective measure will be taken shall be determined by the Engineer. The Contractor shall assist the Engineer in checking the sewer.

**4.5.5 DEFLECTION TESTING.** Deflection testing is required for some types of pipe. Refer to Section III.

**4.5.6 TRACER WIRE TESTING.** Test for locatable signal on all Tracer Wire per Section 3.11.

#### **SECTION 4.6.0 - FORCEMAIN**

**4.6.1 GENERAL.** Where forcemain is indicated on the plans, the Contractor shall furnish and install the specified pipe at the locations shown. Forcemain may be laid in the same trench with sanitary sewer where indicated on the plans. A minimum separation of 18" between the walls of the pipe shall be maintained. The forcemain shall be shelved to maintain a minimum of 12" between the bottom of the forcemain and the top of the sewer unless the minimum cover of 7'0" over the forcemain cannot be maintained. The top of the forcemain shall be a minimum of 12" below the bottom of the sewer, if necessary, to maintain the depth of cover.

**4.6.2 LENGTH AND DEPTH OF TRENCH.** No more than 450 feet of trench shall be open at any one time, except with special permission of the Engineer. In no case shall such excavation extend at the same time across any two parallel streets which intersect the street in which the work is being done. The depth of the trench is to be such that the top of the pipe is at least seven (7) feet below the surface of the existing or proposed ground, unless specified elsewhere. The width of the trench shall be adequate to insure good workmanship and proper inspection of joints.

**4.6.3 WIDTH OF TRENCH FOR FORCEMAIN.** The maximum width of the trench excavation at the top of the pipe shall be the outside diameter of the pipe used plus twenty-four (24) inches, except where sheathing or trench boxes are required

All pipe to be laid in open-cut trench shall have 6 inch minimum clearance between the outside face of the pipe barrel and the face of the sheathing.



**4.6.4 LINE AND GRADE FOR OPEN-CUT CONSTRUCTION.** If the Contractor is not able to maintain the depth of cover or grade by other means, the Engineer may require the use of line and grade boards. A substantial stake shall be driven on each side of the trench on a line at right angles to each stake of the primary line. A substantially straight 2 x 6 inch board shall be nailed or clamped to the stakes in a level position and at some even foot height above the grade line of the proposed water main. The elevation of each pipe shall be obtained by sighting across at least three batter boards to a mark on an approved type of grade pole. If, in the opinion of the Engineer, the accurate elevation of the pipe cannot be determined by sighting over the grade boards, the Contractor may be ordered to fasten a line to the boards at the center alignment marks and obtain the elevation by measuring down from the line by means of an approved type grade pole. The alignment of each pipe shall be obtained by plumbing down from the center marks or line, by means of a plumb bob. Methods other than described above may be used only if approved by the Engineer.

**4.6.5 PREPARATION.** The bottom of the trench will be excavated to the exact form and size of the lower portion of the pipe with additional excavation at the joints so that bearing will be continuous and the pressure equally distributed.

**4.6.6 UNSTABLE FOUNDATION.** If the bottom of the trench is of undesirable material, such as organic soil, or the presence of ground water causes a condition which cannot adequately support the main, an additional 3 inches shall be excavated and filled with 3/8" graded crushed stone and included as part of the standard sections at no additional payment. In the event that it becomes necessary to extend the rock fill to a greater depth, such additional amount of rock will be paid for as unsatisfactory subgrade.

**4.6.7 SUBGRADE REPLACEMENT.** Where in the opinion of the Engineer more than 3" of subgrade beneath main is unsatisfactory, it shall be removed and replaced with material satisfactory to the Engineer, such as 3/8", 2" or 2 1/2" graded crushed rock. No payment for material hauled away will be made, but replacement material will be paid for at the unit price bid. Cubic yards are to be loose box measurement. If a unit price for subgrade replacement is not provided, the price shall be negotiated before any material is placed.

**4.6.8 WOOD BLOCKING PROHIBITED.** Force mains shall be installed without the use of wood blocking. Special fittings shall be supported on solid concrete block and blocked with retainer gland type thrust restraint.

**4.6.9 HANDLING OF PIPE, FITTINGS, ETC.** The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench. Extreme care shall be exercised by the Contractor in handling all pipe, fittings and special castings so as to prevent breakage and coating damage. Any damage to coating shall be repaired before installation. Under no circumstances shall pipe or fittings be dropped or so handled as to receive hard blows or jolts when being moved. All mud or dirt shall be removed prior to installation.

**4.6.10 FIELD INSPECTION OF MATERIALS.** All pipe or fittings shall be inspected for defects. All materials used in the work must pass field inspection.

**4.6.11 DIRECTION OF LAYING.** Unless otherwise ordered, pipe shall be laid with the bell ends facing the direction of laying. When the grade exceeds 10 feet of rise per 100 feet of trench, the bells shall face upgrade.

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

**4.6.13 OBSTRUCTIONS IN LINE OR GRADE.** Whenever it becomes necessary to lay a main over, under or around a known obstruction, the Contractor will furnish and install the required fittings. Such fittings shall be included in the unit price bid. No additional compensation will be paid to the Contractor for any expenses incurred because of such obstruction. When an unknown underground structure interferes with the work to such an extent that an alteration of the plan is required, which alteration results in a change in the cost to the Contractor, the Engineer will issue a written change order, acceptable to the Owner, specifying the basis of payment or credit for such altered work.

**4.6.14 PIPE INSTALLATION.** Requirements for pipe installation are included in Section III under the type of material.

**4.6.15 JOINT RESTRAINT.** At all bends, elbows, tees, dead ends, valves and hydrants, installed approved joint restraints per Section 3.9.0. Joint restraints are also required on all joints within the "L", "Lr", or "b" dimensions from a fitting or deadend as shown on the standard details.

**4.6.16 TESTS REQUIRED.** All new mains shall be tested by the Contractor and shall successfully pass the pressure, and leakage tests described in the following sections. The Contractor shall notify the Engineer at least 48 hours before performing the tests. The tests must be witnessed by a representative of the Owner. Where a new main will be connected to an existing main, it may be necessary for the Contractor to install a temporary plug in the new main for testing purposes. After the specified pressure and leakage tests have been completed on the new main, actual connection to the existing main shall be made. The section of new connecting main between the removed test plug and the existing main shall be subject to line pressure prior to backfilling. Any visible defects observed in the connecting main shall immediately be repaired at the Contractor's expense, prior to backfilling.

In lieu of separate leakage and pressure tests, a combination leak/pressure test may be run at a pressure of 150 psi for a duration of two hours with the approval of the Engineer.

**4.6.17 PRESSURE TEST.** After the test connections are made and the main filled with water, the test section shall be subjected to 60 psi water pressure. After examination of exposed parts of the system, the test pressure will be increased to 150 pounds per square inch on the main at the lowest elevation. The main shall be examined and if any defects are found, the Contractor shall immediately make the necessary repairs at his own expense. The pressure test shall be repeated until no defects can be found. The duration of the final pressure test shall be one hour. The pressure shall be kept within 5 psi of the specified level.

**4.6.18 LEAKAGE TEST.** The leakage test shall be conducted after satisfactory completion of the pressure test. The test section shall be subjected to a minimum 100 pounds per square inch gauge pressure at the point of highest elevation of the main under test. The test pressure shall be 50 psi above normal operating pressure.

Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section of it, necessary to maintain the specified leakage test pressure after the main has been filled with water and the air expelled.

**ALLOWABLE LIMITS OF LEAKAGE**  
Gallons/Hour/1000 Feet

Nominal Pipe Diameter - in.

		4	6	8	10	12	14
	225	0.45	0.68	0.90	1.13	1.35	1.58
Avg. Test	200	0.43	0.64	0.85	1.06	1.28	1.48
Pressure	175	0.40	0.59	0.80	0.99	1.19	1.39
p.s.i.	150	0.37	0.55	0.74	0.92	1.10	1.29
	125	0.34	0.50	0.67	0.84	1.01	1.18
	100	0.30	0.45	0.60	0.75	0.90	1.05

**4.6.19 TEST LENGTH.** Pipe lines shall be tested in lengths of not more than 800 feet unless approved by the Engineer.

**4.6.20 REPAIRS AND RETESTING.** All visible leaks at exposed joints, and all leaks evident on the surface where joints are covered shall be repaired and leakage minimized, regardless of the total leakage as shown by test.

All pipe, fittings, blocking and other materials found to be defective shall be removed and replaced at the Contractor's expense.

Lines which fail to meet the tests shall be repaired and retested as necessary, all at the Contractor's expense, until test requirements are complied with.

**4.6.21 ELECTRICAL CONTINUITY.** All metal pipe shall be tested for electrical continuity. Lead tipped gaskets will not be permitted. Copper jumpers or cable bond are to be utilized to secure electrical continuity on metallic pipe. Contractor is to check the line for electrical continuity or tracking signal after backfilling is completed. Sections shall be tested in lengths of 1,000 feet or less. Where continuity or signal is not obtained, it must be established at the Contractor's expense. The Engineer or Owner shall witness each test.

# SECTION VI – EQUIPMENT SPECIFICATIONS

## STORM WATER PUMP LA CROSSE, WISCONSIN

- 6.1 INSTRUCTIONS TO SUPPLIERS OF EQUIPMENT
- 6.2 STORM WATER PUMP

PRELIMINARY FOR REVIEW  
NOT FOR CONSTRUCTION

# SECTION VI – EQUIPMENT SPECIFICATIONS

## SECTION 6.1 - INSTRUCTIONS TO SUPPLIERS OF EQUIPMENT

### 6.1.1 INSTRUCTIONS TO SUPPLIERS OF EQUIPMENT

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Equipment suppliers shall refer to Section 00 **7200** - General Conditions of the specifications. In addition to general requirements, refer to Patent Fees and Royalties (3.17), Shop Drawings and Samples (3.11, 3.12), Supervision of Erection (3.12.10) and Operation and Maintenance Manuals to be furnished and similar items are detailed.

#### **SGC6.22** OPERATION AND MAINTENANCE MANUALS

**A.** The manufacturer shall prepare and supply Operation and Maintenance Manuals for each item of equipment. The manuals shall be customized for the specific size and type of equipment being furnished. The cost of the manuals shall be included in the base price quoted to the Contractor. Furnish three (3) hard copies and one (1) electronic (Portable Document Format (.pdf)) of each manual. The manuals shall be delivered to the Engineer before the Work is 75% complete. Failure to deliver the manuals on time shall be cause for withholding payment from the Contractor.

Reference to a brand name and model for a particular item of equipment does not waive the requirement to comply with these specifications. All equipment, including pre-approved suppliers, shall fully meet specified requirements. Only deviations specifically approved by addenda prior to bidding will be permitted. **READ THE SPECIFICATIONS - DO NOT ASSUME THIS IS A STANDARD EQUIPMENT ITEM.**

## SECTION 6.2 – STORM WATER SUMP PUMP

### 6.2.1 GENERAL

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The Contractor shall furnish and install a simplex, submersible pump, lift station system. The system shall be designed to permit pump removal from the ground surface for inspection or service without dewatering the wet well or interrupting operation of the other pump in the system. The pump shall automatically connect to the discharge-piping flange with a positive action when lowered into place. The system shall include a non-clog, submersible sewage pump, water level control system, discharge piping with metal-to-metal non-sparking discharge flange, pump guide rail system to facilitate pump removal, stainless steel lifting cable or chain, shall utilize a precast concrete wet well, and electrical power and control panel.

Storm water sump pump shall be provided with a new precast concrete wet well as shown on the plans. The Contractor shall be responsible for insuring compatibility of pump, piping, structure, and all components of this station, and so demonstrate by approval drawings submitted to the Engineer prior to fabrication and shipment.

All bolts, washers, nuts, fasteners, cables, brackets, shackles, hooks, guide rails, and other accessories shall be stainless steel, unless otherwise specified.

#### 6.2.1.1 QUALITY ASSURANCE

Supplier shall provide the services of a factory-trained representative to check installation and to start-up the pump. Factory representative shall have complete knowledge of proper installation, operation, and maintenance of equipment supplied. Representative shall inspect the final installation and supervise a start-up test of the equipment.

The pump and control panel shall be factory tested to ensure satisfactory operation.

The pump shall be provided with a corrosion resistant nameplate affixed to the unit. Nameplate information shall include manufacturer's name and address, equipment name and model number, and serial number.

### 6.2.2 WET WELL

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#### 6.2.2.1 WET WELL

Storm water pump shall be provided with a new precast concrete wet well. The wet well shall be constructed of 48-inch diameter precast concrete sections and integral floor. Precast concrete pipe shall meet requirements of ASTM C-76, AASHTO M-170, and ASTM C-443.

A pipe gasket seal, Press Seal Gasket Corporation PSX or equal, shall be installed in the wet well wall to provide a watertight joint for the influent pipe. The influent pipe shall conform to the exact alignment, grade, and elevation as shown on the plans. The wet well barrel section joints shall be sealed with a double Kent seal gasket system, or equal. All voids in the joints and lift holes shall be sealed with a non-shrink grout.

The wet well cover shall be a common base of reinforced concrete. The reinforced concrete shall conform to the pertinent requirements of AASHTO Specification Designation, M-199-07, similar to ASTM Specification Designation, C-478-066. All piping and electric conduit penetrations passing from the wet well shall be sealed per NEC Code.

#### 6.2.2.2 ACCESS HATCH

The precast base shall be equipped with aluminum access hatch to allow for installation and removal of the pump. Aluminum access hatch shall be provided for access to the wet well. The access hatch shall be suitably sized for installation and removal of the pump with a minimum size of 30 inches by 30 inches. Steel hatches or access doors are not acceptable. The 3-inch by 3-inch aluminum frame shall be ¼-inch thick extruded aluminum having a continuous concrete anchor. The access hatch cover shall be of minimum ¼" aluminum diamond plate, reinforced with stiffener bars as required. The cover shall be able

to withstand a live load of 300 lbs. per square foot. The cover will have stainless steel hinges and be equipped with a lifting handle and a padlock locking post. A padlock shall be provided and shall be keyed to match the other lock systems. The cover shall open to 90 degrees and lock automatically in that position by a stainless steel positive locking arm. The hatch shall be equipped with a snap-lock and removable handle, and a recessed locking hasp covered by a hinged lid flush with the surface. Hatch shall be installed such that the complete assembly is set flush with the floor. The hatches shall be provided with Type 316 stainless steel compression springs enclosed in telescoping tubes to counter balance the door and to require no more than 30 pounds of opening force. The access hatch shall be as manufactured by the Bilco Company, Nystrom, Halliday Products, or equal. All padlocks for access hatch, control panel, and disconnect switch shall be keyed alike, all-weather type by Master Lock.

The access hatch frame and hatch area shall be equipped with a hook to the pump lifting chain to when they are not in use. Lifting chain shall be as recommended by the manufacturer.

### **6.2.2.3 CAUTION SIGN**

The storm water pump access hatch shall be provided with caution sign. Caution sign shall be provided at the top entrance to the wet well. The caution sign shall be of premium fiberglass, similar to Brady catalog # 70248 B-120. The sign shall read as follows:

CAUTION: DANGEROUS / HAZARDOUS GASES  
LEVEL 2 CONFINED SPACE  
DO NOT ENTER WITHOUT PROPER EQUIPMENT OR  
SUPERVISION

## **6.2.3 PUMP CONSTRUCTION**

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Major pump components shall be of gray cast iron, ASTM A-48, Class 30, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with storm water, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Buna N rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Bearings shall have a minimum B-10 life of 50,000 hours at the design point.

The pump shall have two mechanical seals, mounted in tandem with an oil chamber between the seals. Rotating seal faces shall be carbon and the stationary seal faces shall be ceramic. The lower seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminants out of the seal area. A seal failure sensor shall be installed in the seal chamber between the two tandem mechanical seals.

Pump and motor shall be the same unit. The pump shaft is an extension of the motor shaft. The shaft shall be stainless steel and machined from a solid 400 series stainless steel forge. The use of stainless steel sleeves will not be considered equal to stainless steel shafts.

The impeller(s) shall be of gray cast iron, Class 30, dynamically balanced, two vane, enclosed, non-clogging design having pump-out vanes on the backside of the impeller to prevent grit and other material from collecting in the seal area. The impeller shall be capable of handling solids, fibrous materials, heavy sediment, and other matter found in storm water. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. The impeller shall have a stainless steel wear ring. The Impeller(s) shall be keyed to the shaft, retained with a 300 series stainless steel bolt. The impeller shall be capable of passing a minimum 3 inch diameter solid.

If a wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet.

Pump volute(s) shall be single-piece gray cast iron, Class 30, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

Motors shall be sufficiently cooled by the surrounding environment or pumped media.

#### **6.2.4 MOTOR**

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The pump motor shall be a maximum rpm as indicated in section 6.2.7 herein. The motors shall be rated to operate on 480, 3 phase as indicated, 60 hertz power. The stator windings and stator leads shall be insulated with moisture resistant Class F or H insulation rated for 155°C (311°F) or better, NEMA B design. The motor shall be oil filled. The stator, rotor, and bearings shall be mounted in a sealed submersible type housing. The stator shall be securely held in place with a removable end ring and threaded fasteners. The pump motor shall bear the UL label, all drain holes shall be provided with breather/drain devices approved for hazardous locations. UL approved devices shall be provided to detect and automatically deenergize the motor if there is any increase in temperature beyond 180°C (356°F). Auxiliary equipment shall be of the type approved for installation in Class I, Division I, Group D hazardous locations. The motor and pump shall be designed and assembled by the same manufacturer.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.2. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

Each pump shall be provided with submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA. Electrical power cord shall be STW-A, water resistant, 600V rated. The power cable shall be of sufficient length to reach the junction box without the need of any splices. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. The pump shall be triple protected with a compression fitting and two epoxy potted areas at the power cord entry to the pump. Power cord leads shall be connected to the motor leads with extra heavy connectors.

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

All motors are subject to megger testing at any time after delivery to the job site or during the warranty period. Any defective motor or one whose insulation resistance is less than 10 megohms will be rejected, and shall be replaced at no cost to the Owner. Each polyphase motor shall have its insulation resistance to ground measured with 1,000V "Megger" by the Contractor. Values of resistance of less than ten megohms shall be cause for equipment rejection.

#### **6.2.5 SEAL FAILURE AND MOTOR THERMAL SENSOR**

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All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125°C (260°F) the thermal switches shall open, stop the motor and activate an alarm.

A leakage sensor shall be provided to detect water in the stator chamber. The switch shall be used to detect the presence of water in the stator chamber and indicate a seal failure by contact closure for remote alarm and/or indicator light.

#### **6.2.6 GUIDE RAIL SYSTEM**

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The pump manufacturer shall provide a 90 degree flanged base elbow designed to automatically connect the pump discharge as the pump is lowered on the guide rails. The pump discharge elbow shall be a quick-disconnect non-sparking type. The discharge pipe shall attach directly to the base elbow without the need for any fasteners or gaskets. The guide rails shall be schedule 40, AISI Type 304 stainless steel and of adequate length to extend from the lower guide holders on the base elbow to the upper guide rail mounting bracket mounted on the access frame. Each pump shall be furnished with a AISI Type 304 stainless steel chain or stainless steel lifting cable of sufficient length and strength to raise and lower the pump. The lifting chain shall be attached to the pump so as to provide a direct pull over the pump. Intermediate stainless steel supports shall be provided. Stainless steel shall not be painted.

## 6.2.7 DESIGN CONDITIONS

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The pump shall be 4-inch model S4N as manufactured by Hydromatic. The pump supplier shall furnish pumping unit designed to meet the following conditions:

### Lift Station

250 GPM

80 LF of 4-inch diameter Forcemain (C=140)

Discharge Elevation	651.8 ft
Pump Off Elevation	638.0 ft
Static Head	20.0 ft

### Friction Loss (C=140)

Station Piping & Misc.	1.86ft
Forcemain	2.68 ft
Safety Factor	0.46 ft
TDH =	23.00 ft

**Design 250 GPM @ 23.0 ft. TDH**

Motor shall be rated for 3 Hp minimum, non-overloading over the entire performance curve. 480V, 3 phase, 60 Hz, 1800 nominal rpm.

## 6.2.8 PIPING AND VALVES

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The station sewage piping shall be class 53 ductile iron pipe that will extend down through the common base plate terminating in plain ends exterior to the pump chamber. The force main discharge elbow located in the wetwell shall be a flanged fitting as shown on the drawings. The pipes shall be sealed where they protrude through the basin wall with link seal to form a gas tight seal. The discharge line shall be fitted with a ball type check valve as specified herein and sized as shown on the plans. All mill scale, rust, weld flux and other foreign matter shall be removed from all steel surfaces by abrasive blast cleaning to SSPC SP-10 specification for near-white blast cleaning. Surface irregularities shall be removed by grinding. The piping surfaces shall receive a minimum of two coats of self-priming, hi-build epoxy coating. These surfaces shall receive two coats at a minimum of 3 mils per coat to a total minimum dry film thickness of 6 mils. A paint touch-up kit shall be provided with the station for coating damaged areas. Piping exposed in the wet well shall receive two coats of Tnemec 46H-413 coal tar epoxy 12.0-15.0 mils DFT each, total 24.0-30.0 mils DFT total, Carboline Bitumastic 300-M, Porter Intertuf 708HS, or equal.

### 6.2.8.1 CHECK VALVES

Ball type check valves shall be 4 inch and shall be shown on the shop drawing submittal and shall be installed in the discharge piping. The valve shall permit flow in one direction only and close tightly without slamming when the discharge pressure exceeds the inlet pressure. The valve body shall be epoxy coated ASTM 48 cast iron construction with a gasketed flanged cover for access to the ball. The ball shall be a Buna-N covered metal ball. Ball check valves shall be Flomatic Type 408 or equal.

## 6.2.9 FLOAT SWITCHES

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Lift Station shall each be provided with four (4) heavy duty float switches for control and alarm. The float switches shall be enclosed in a Teflon coated spherical AISI Type 316 stainless steel covered float. The float switches shall contain an SPST magnetic reed switch rated for not less than 100 VA at up to 250VAC. Switch cable shall be 2 conductor plus ground, 16 gauge, CPE jacketed cable in lengths as required to run unspliced to the control panel. A flexible neoprene sleeve shall be provided for the cable to relieve stress. Float switches shall be provided complete with mounting brackets and counter weights. Float switches shall be suitable for suspended or pinned end mounting. Float switches shall be NO or NC as required. Float switches shall be Siemens Model 9G-EF or equal.

The Contractor shall provide the float switches. The float switches shall be individually suspended in the wet well and provided with anchor type kit. Clamp tube, bracket, and clamping hardware shall be AISI Type 316 stainless steel. The Contractor shall provide the anchor.



The pump level controller shall connect to the float switches through an intrinsically safe module. The module shall provide an intrinsically safe interface for the sensors located in an area rated Class I, Division 1, Group D, hazardous area. The intrinsic safety barrier shall be UL listed.

## **6.2.10 PUMP CONTROL SYSTEM**

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### **6.2.10.1 GENERAL**

The Contractor shall provide an underground power service from the building to the lift station. The pump control panel shall be located inside the basement, with a NEMA 3R service disconnect and control station adjacent to and in view of the lift station.

All wiring shall be minimum 600-volt (UL) type MTW and have a current carrying capacity of not less than 125% of the full load current. The conductors shall be in complete conformity with the National Electric Code, state, local and NEMA electrical standards.

To ensure the safety of all personnel working with this equipment, as well as providing a simple means of tracing wires when troubleshooting, all wiring shall be color-coded in strict accordance with the wiring diagrams furnished by the equipment supplier.

The instrumentation systems erector shall provide all components and shall be responsible for the satisfactory operation of the entire system. The complete instrumentation system shall be provided by a single erector regularly engaged in the design and erection of process and pump instrumentation systems.

### **6.2.10.2 CONTROL PANELS**

The control panel shall be constructed in compliance with Underwriter's Laboratories Industrial Control Panels listing and follow-up service; utilizing UL listed recognized components where applicable. The control panel shall bear a UL 508-14 serialized label and will be service entrance rated.

The described equipment shall be housed in a NEMA 12 enclosure. The enclosure shall be constructed of not less than 14-gauge steel. This enclosure shall be designed specifically for mounting in an unprotected indoor location. It will have a hinged front door with 3 point latching mechanism and locking capability. It will also have an internally mounted hinged dead front panel so that all the components normally actuated by operating personnel are accessible without opening the dead front and yet are not exposed to the elements or to unauthorized personnel.

All major components and sub-assemblies shall be identified as to function with laminated, engraved Bakelite nameplates or similar approved means. The following described equipment shall be furnished and matched to the specific pumping station equipment:

- A. A lightning arrestor shall be supplied in the control and connected to each line of the incoming side of the power input terminals. The arrestor shall protect the control against damage due to lightning strikes on the incoming power line.
- B. A solid state, phase sequence/failure and under voltage release relay shall be provided to ensure additional running protection for the pump motors. The relay shall be complete with an LED to indicate proper phase sequence, all phases in operation and voltage within limits. The relay shall also include an adjustable voltage monitor, be UL and CSA certified and be complete with automatic reset feature.
- C. A thermal magnetic circuit breaker shall be supplied as branch circuit protection for the pump motor. The circuit breaker must have a minimum ampere interrupting capacity of 10,000-240 volt symmetrical RMS amps. The circuit breakers shall be operable through the operator's door of the enclosure. The circuit breaker shall be properly sized to protect the control circuit conductors, motor starter and the motor against overcurrent due to short circuit or grounds.
- D. A NEMA rated full voltage non-reversing motor starter with manual reset, ambient compensated, 3 phase thermal overload relay shall be provided for each of the pumps.

- E. An inner door mounted ground fault interrupter (GFI) type convenience receptacle rated at 15 amperes shall be supplied for the operating of trouble lights, drill, etc. It shall be protected by a separate 15 ampere trip rated circuit breaker.
- F. Provide a 3 KVA step-down transformer and distribution with a single phase lighting and power panel board. Provide a 480V, 3 phase to 120/240V single phase step-down transformer and power distribution to provide single phase power to the control panel for the GFI outlet and motor controls.
- G. Intrinsically safe relays shall be listed as an intrinsically safe, switch-controlled connection to non-voltage producing switches in Class I, Division I, Group D areas. Units shall be completely encapsulated. Units shall consist of a transformer, load contacts, and an amplifier section. Load contacts shall be rated for not less than 5 amps at 120V AC. Switch current shall not exceed 0.10 mA DC.

## 6.2.11 FUNCTIONAL DESCRIPTION AND CONTROL SETTINGS

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Control settings are provided for the initial start-up of the pump control system. The settings are preliminary and final adjustments will be required based upon actual operating conditions during start-up. Control setting adjustments shall be made as required for acceptable operation of the system at no additional cost to the Owner.

The control system shall automatically start and stop the pump in response to changing water level in the wet well. The wet well level shall be sensed by float switches to stop and start the pump. The wet well level is sensed by four (4) float switches used for high and low alarms, pump on, and pump off.

The following are initial settings for the controls:

<u>Control Action</u>	<u>Elevation</u>
High Level Alarm	643.00
Pump Start	632.00
Pump Stop	641.00
Low Level Alarm	631.50

A seal failure relay specifically designed to interface with a contact closure from each of the specified pumps shall be included. A Seal Fail alarm shall be displayed on the controller.

Over temperature protection relays shall be provided in the control panel to operate in conjunction with the over temperature switch in pump motor. The controller shall provide an Overtemp Fail alarm and pump lockout of operation upon occurrence of high temperature. The circuitry shall also include a reset push button on the controller for manual reset capability.

A heavy-duty, oil tight type, three-position, hand-off-automatic selector switch shall be flush-mounted on the inner door of the control center for the operation of the pump. In addition, an inner door heavy-duty, oil tight, green pilot light operated from a respective starter auxiliary contact shall be provided to indicate a "pump running" condition; a red pilot light shall indicate high alarm; a red pilot light shall indicate low alarm; and yellow pilot light shall indicate pump seal failure. The pilot lights shall be wired for the push-to-test function shall have a replaceable bulb or LED lamp. A light and a horn shall be provided for indicating alarms. A weather proof, alarm light assembly including a high impact resistant Lexan red lens shall be included. The alarm light shall be mounted on the station control panel enclosure so that it is visible from the exterior of the panel. The alarm shall have a reset button. The alarm light bulb shall be replaceable from inside the control panel without having to remove the weatherproof red lens from the panel. A solid state flasher shall be included to strobe the alarm light for any of the specified alarm conditions.

# SECTION VIII

## CONSTRUCTION – WATER SYSTEMS

*Note: This standard specification includes general requirements for water system projects and is supplemented and superseded by the Special Provisions that apply to this project only.*

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# CONSTRUCTION - WATER SYSTEM

## SECTION 8.1.0 - GENERAL

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**8.1.1 SCOPE.** The work to be done under this contract shall consist of the complete construction of a water distribution system or extension ready for immediate and continuous use including the furnishing of all the required pipe, fittings, hydrants, valves and accessories, as well as the necessary materials, equipment and labor, all as shown on the accompanying plans, described in these specifications and/or listed in the proposal.

**8.1.2 MATERIAL FURNISHED.** The Contractor shall furnish all materials unless specifically noted on the plans or Contract Documents. All materials furnished by the Contractor shall be new and conform to the requirements of the Material Specifications (Section III). The types of materials are specified on the plans, in the Proposal and/or in the Special Provisions.

**8.1.3 LOCATION.** Water mains shall be placed approximately fifteen (15) feet from the centerline of the street on the side of the street indicated on the plans, or as staked by the Engineer.

Fire hydrants shall be placed a minimum of twelve (12) inches clear from the present or future curb at the location on the plans. Curb stops and curb valves are to be located seven (7) feet from the property line. The Contractor shall continue the service piping to the property line.

The Engineer may revise the location of pipes, hydrants, valves or services before work on their installation is started, and the Contractor shall install them in the revised locations at the unit prices stated in the proposal.

**8.1.4 RECORD DRAWINGS.** The Contractor shall be responsible for furnishing exact information on the location of fittings, valves, corporation stops, curb boxes and the deadend location of all mains and services. Ties shall be provided. These Record Drawings shall be provided before final payment is released.

## SECTION 8.2.0 - EXCAVATION

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**8.2.1 LENGTH AND DEPTH OF TRENCH.** No more than 450 feet of trench shall be open at any one time, except with special permission of the Engineer. In no case shall such excavation extend at the same time across any two parallel streets which intersect the street in which the work is being done. The depth of the trench is to be such that the top of the pipe is at least seven (7) feet below the surface of the existing or proposed ground, whichever is deeper, unless specified elsewhere. The width of the trench shall be adequate to insure good workmanship and proper inspection of joints.

**8.2.2 WIDTH OF TRENCH FOR WATER MAIN.** The maximum width of the trench excavation at the top of the pipe shall be the outside diameter of the pipe used plus twenty-four (24) inches, except where sheathing or trench boxes are required

All pipe to be laid in open-cut trench shall have 6 inch minimum clearance between the outside face of the pipe barrel and the face of the sheathing.

## SECTION 8.3.0 - LAYING OF WATER MAIN

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**8.3.1 LINE AND GRADE FOR OPEN-CUT CONSTRUCTION.** If the Contractor is not able to maintain the depth of cover and grade by other means, the Engineer may require the use of line and grade boards. A substantial stake shall be driven on the side of the trench on a line at right angles to each stake of the primary line. A substantially straight 2" x 6" inch board shall be nailed or clamped to the stakes in a level position and at some even foot height above the grade line of the proposed water main. The elevation of each pipe shall be obtained by sighting across at least three batter boards to a mark on an approved type of grade pole. If, in the opinion of the Engineer, the accurate elevation of the pipe cannot be determined by sighting over the grade boards, the Contractor may be ordered to fasten a line to the boards at the center alignment marks and obtain the elevation by measuring down from the line by means of an approved type grade pole. The alignment of each pipe shall be obtained by plumbing down from the center marks or line, by means of a plumb bob. Methods other than described above may be used only if approved by the Engineer.

**8.3.2 PREPARATION.** The bottom of the trench will be excavated to the exact form and size of the lower portion of the pipe with additional excavation at the joints so that bearing will be continuous and the load equally distributed.

**8.3.3 BEDDING CONDITIONS.**

The maximum width of trench excavation at the top of the pipe shall be the outside diameter of the pipe plus 24 inches. All pipe, regardless of the material, class, size, or use shall follow the same specifications. Refer to the Standard Details on the plans.

**A. Soil Classifications.** For purposes of pipe installations, the following Soil Classification Chart applies. The Engineer shall make the initial determination of soil classification for the native soils. If the Contractor contests the determination or the material is difficult to classify, the Contractor shall retain an Independent Laboratory to determine classifications. The Soil Classification of the native material is used to guide the pipe installation. In general, coarse grained soils like sands and gravels are suitable for most foundation, bedding, haunching and backfill purposes and fine grained soils like clay may be suitable for foundation and backfill but not for bedding.

<b>Soil Classification Chart</b>			
<b>COARSE-GRAINED SOILS</b>			
<b>Gravels</b>			
GW	Well-graded gravel	More than 50% of coarse fraction retained on #4 sieve	Clean gravels <5% fines
GP	Poorly graded gravel		
GM	Silty gravel		Gravel with fines >12% fines
GC	Clayey gravel		
<b>Sands</b>			
SW	Well-graded sand	50% or more of coarse fraction passes #4 sieve	Clean sands <5% fines
SP	Poorly graded sand		
SM	Silty sand		Sand with fines >12% fines
SC	Clayey sand		
<b>FINE-GRAINED SOILS</b>			
<b>Silts and Clays</b>			
CL	Lean clay	Liquid limit <50	Inorganic
ML	Silt		
OL	Organic clay/silt		Liquid limit >50
CH	Fat clay	Inorganic	
MH	Elastic silt		
OH	Organic clay/silt	Organic	
PT	Peat		Organic

- B. Soil Classes** For purposes of pipe installations, the following Soil Classes applies to the backfill material.

Soil Classes			
Crushed rock			Class I
Clean coarse grained	SW, SP, GW, GP	<12% passing #200	Class II
Coarse grained with fines	GM, GC, SM, SC	>12% passing #200	Class III
Silty Clay	CL, ML	>30% retained #200	Class III
Fine grained	CL, ML	<30% retained #200	Class IV
	MH, CH, CL, CH, PT		Class V

- C. Use of Soil Classes for Pipe Foundation, Embedment and Backfill**

Use of Soil Classes for Foundation, Embedment and Backfill	
Foundation	4" minimum in rock excavation
Foundation - no water	Class I, II or III or subcut and use Class I or II
Foundation - with water	Class I or II or subcut and use Class I or II
Bedding	4" minimum Bedding Sand (3.24.2) or 3/8" Crushed Rock (3.24.1)
Embedment - no water	Class I, II or III or replace with Class I, II or III
Embedment - with water	Class I or II or replace with Class I or II
Foundation and embedment	No rock > 1", No Class IV or V
Final Backfill	No rock > 8"
Embedment includes Bedding, Haunching and Initial Backfill	

Compaction for Foundation, Embedment and Backfill	
Foundation	90% Modified Proctor
Bedding	90% Modified Proctor
Haunching	90% Modified Proctor
Initial Backfill	90% Modified Proctor
Final Backfill	90% - 95% Modified Proctor

- D. Bedding and Backfill Description**

**Foundation.** No subcutting is required where a stable foundation of suitable soil exists below the bedding. If the bottom of the excavation is of undesirable material, such as rock, Class IV or Class V material, or the presence of ground water causes a condition which cannot adequately support the work, an additional four inches (4") of foundation shall be excavated and backfilled with compacted Class I or II and included as part of the standard sections at no additional payment. In the event that it becomes necessary to extend the foundation to a greater depth, such additional amount of removal and replacement will be paid for as Unsatisfactory Subgrade.

**Bedding.** Place a minimum of 4" Bedding Sand or 3/8" Crushed rock below the invert of the pipe to provide a firm, stable, uniform bed.

**Haunching.** Work in and tamp the haunching material in the area between the bedding and the underside of the pipe before placing and compacting the rest of the haunching up to the springline. Use Class I, II or III material. If water is present, use Class I or II only.

**Initial Backfill.** Place and compact the initial backfill to 12" above the crown of the pipe. Increase initial backfill to 24" in rock excavation.

**Embedment - Haunching and Initial Backfill.** Use special care near the pipe and only select Class I, II or III material free of debris, frozen material or organic matter. If water is present, use Class I or II only. No rock greater than 1" shall be placed in the embedment. No Class IV or V material shall be placed in the embedment. Compact the embedment to 90% Modified Proctor using vibration or impact for Class I and II and impact for Class III. Use care to avoid damage to the pipe.

**Final Backfill.** Use native material with no rock greater than eight inch (8"). Compact in 12" lifts (Class I and II) or six inch (6") lifts (Class III or IV) to 90% Modified Proctor in open fields and to six feet (6') deep and 95% Modified Proctor from six feet (6') deep to the surface in streets.

The base bid for pipe installation shall include furnishing and installing appropriate material for the first four inches (4") of Foundation and Embankment (Bedding, Haunching and Initial Backfill). Where appropriate, suitable material may be salvaged from within the trench or from other areas of the job.

**Minimum Cover.** The minimum cover for sewer shall be four feet (4') and the minimum cover for water and forcemain shall be seven feet (7'). Provide the minimum unless otherwise indicated on the plans.

**E. Water Checks.** To prevent water from following the granular backfill, provide a clay or bentonite water check at 100 ft. intervals.

**8.3.4 WOOD BLOCKING PROHIBITED.** Water mains shall be installed without the use of wood blocking. Valves, hydrants and special fittings shall be supported on solid concrete block.

**8.3.5 HANDLING OF PIPE, FITTINGS, ETC.** The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench. Extreme care shall be exercised by the Contractor in handling all pipe, fittings and special castings so as to prevent breakage and coating damage. Any damage to coating shall be repaired before installation. Under no circumstances shall pipe or fittings be dropped or so handled as to receive hard blows or jolts when being moved. All mud or dirt shall be removed prior to installation.

**8.3.6 FIELD INSPECTION OF MATERIALS.** All pipe or fittings shall be inspected for defects. All materials used in the work must pass field inspection.

**8.3.7 DIRECTION OF LAYING.** Unless otherwise ordered, pipe shall be laid with the bell ends facing the direction of laying. When the grade exceeds 10 feet of rise per 100 feet of trench, the bells shall face upgrade.

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

After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The open ends of the pipe shall be closed by a watertight plug at all times pipe laying is not in progress.

The pipe shall be secured in place with bedding material, placed by hand or equally careful means, keeping the bell end open. Existing pipe fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipe and fittings or proper dimensions to insure such uniform space. Precautions shall be taken to prevent foreign materials from entering the joint space.

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

**8.3.10 OBSTRUCTIONS IN LINE OR GRADE.** Whenever it becomes necessary to lay a main over, under or around a known obstruction, the Contractor will furnish and install the required fittings. Such fittings will be paid for at the unit price bid. No additional compensation will be paid to the Contractor for any expenses incurred because of such obstruction. When an unknown underground structure interferes with the work to such an extent that an alteration of the plan is required, which alteration results in a change in the cost to the Contractor, the Engineer will issue a written change order, acceptable to the Owner, specifying the basis of payment or credit for such altered work.

**8.3.11 CONFLICT WITH STORM AND SANITARY SEWER.** A minimum horizontal distance of 10 ft. (8 ft. in Wisconsin) shall be maintained between storm or sanitary sewer and watermains. A vertical separation of at least 18" (6" in Wisconsin) shall be maintained whenever a water main passes over a sewer. If the specified depth of cover over the water main cannot be maintained at this separation, the water main shall pass under the sewer. A vertical separation of at least 18 inches between the top of the water main and bottom of the sewer shall be maintained. The water main shall be centered at the point of crossing so that the nearest joints will be equidistant and as far as possible from the sewer. Extra fittings and pipe required will be paid for at the unit prices bid. No other payment shall be made.

**8.3.12 JOINT RESTRAINT.** At all bends, elbows, tees, dead ends, valves and hydrants, installed approved joint restraints per Section 3.9.0. Joint restraints are also required on all joints within the "L", "Lr", or "b" dimensions from a fitting or deadend as shown on the standard details.

**8.3.13 PIPE INSTALLATION AND BACKFILLING.** Requirements for pipe installation are included in Section III under the type of material. Refer to Section 2.4.0 for backfilling and compaction requirements.

**8.3.14 TRACER WIRE.** All non-metallc pipe shall be marked with Tracer Wire.

## **SECTION 8.4.0 - WATER SERVICES**

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**8.4.1 WATER SERVICE PIPING.** Water service piping is the section of pipe from the main to the customer. Water service piping is designated as either tap service piping or branch service piping depending on size and arrangement

**A. Tap Service Piping.** All water service piping two inches in diameter or smaller is designated "Tap Service Piping". The component parts of a tap service are the corporation stop, copper piping and the curb stop with a service box.

The standard water service shall have a minimum internal diameter of 1" with the curb stop located as specified by the Engineer. This size of tap service shall be installed unless otherwise specified. The copper piping shall be extended to the lot line.

**B. Branch Service Piping.** All water service piping 3 inches in diameter or larger is designated "Branch Service Piping". The component parts of a branch service are a tapping sleeve and valve or a branch 3-way and valve, a valve box, and ductile iron piping extending to the lot line at which point the end shall terminate with a plug or cap.

**8.4.2 TYPE OF PIPE.**

**A. Tap Water Services.** For water services up to and including 2 inches in diameter, copper pipe conforming to the requirements of Section III shall be used, unless otherwise specified in the Contract Documents.

**B. Branch Water Services.** Branch service pipe shall be Class 350 ductile iron pipe, conforming to the requirements of Section III, unless otherwise specified in the Contract Documents.

**8.4.3 TYPE OF JOINT.** Copper pipe shall have flared or rubber gasket compression type joints. When copper tubing is used to extend existing water service piping, the connection of the copper tubing to the existing pipe shall be made with an approved mechanical joint.

Ductile iron pipe shall have approved gasket joints.



**A. Flared Joint.** The joint shall be the standard flared or rubber gasket compression-type of joint for copper tube using only extra-heavy three-part unions. The ends of the copper tubing shall be accurately sized and rounded with copper tubing sizing tools to remove any imperfections in the tubing due to coiling or handling. All ends shall be cut squarely and rough edges or burrs removed. The flared or flange-end of the copper tube which is to be joined shall only be formed with the proper size and type of Range tool designed for that purpose. The flared end shall be fitted against the bevel of the fitting and secured against leakage by tightly screwing and fitting into the sleeve nut. The use of any jointing compound with copper tube flared fittings is prohibited.

**B. Gasket Joints.** Gasket joints shall be as specified in Section III.

**8.4.4 TYPE OF TRENCH SECTION.** The placing of the water service pipe on a shelf dug out of the sidewall of the building sanitary sewer trench is permitted when spot sheathing is used and the ground is sufficiently stable to maintain such a section. When the ground is not sufficiently stable to maintain a shelf, two-inch by six inch planks shall be used.

Where the water service pipe only is to be installed, it shall be laid in a separate trench of the necessary depth and approximately 2 feet in width.

**8.4.5 WATER SERVICE BEDDING.** Water service piping shall be laid with a minimum of 4 inches of bedding material below the pipe. If the trench has an unstable foundation, the trench bottom shall be treated in accordance with Section 8.3.3. Bedding may be placed by machine up to the bottom of the pipe. From the bottom of the pipe, bedding material shall be placed by hand or equally careful means to a depth of 6 inches over the top of the pipe. The bedding shall be such that uniform bearing is provided at every point along the length of the pipe. If installed in a separate trench, a minimum 10 foot horizontal separation must be maintained between the water service and the building sewer.

**A. Tap Service Bedding.** Where ground conditions permit, Tap Service piping shall be placed on a shelf in the side wall of the building sanitary sewer trench. It shall be laid on solid ground, free from stones or hard lumps, or otherwise satisfactorily supported. The minimum width of this shelf shall be 6 inches plus the outside diameter of the water service pipe.

**B. Branch Service Bedding.** The excavation for Branch Service piping 3 inches or larger in diameter shall be made in such a manner that the pipe can be laid at least 2 feet clear of the building sanitary sewer. This may be done by increasing the width of the building sanitary sewer trench, by a wide shelf in the trench wall, or by the use of a separate trench for the branch pipe.

**8.4.6 CONNECTION TO WATER MAIN.** The connection to the water main shall be made with an approved corporation stop or, if specified, tapping sleeve and valve.

<u>Size of Service</u>	<u>Size of Main</u>	<u>Type of Connection</u>
Any Size	3" or smaller	Approved tees or service clamps
3/4"	4" or larger	3/4" corporation stop
1" or 1-1/4"	4"	2-3/4" stops with 2 branch connection
1"	6" or larger	1" corporation stop
1-1/4"	6" or larger	1-1/4" corporation stops with saddle
1-1/2"	4"	3-3/4" corporation stops with 3 branch connection
1-1/2"	6" or larger	1-1/2" corporation stop with saddle
2" or larger	Any size	Approved fitting or tapping tee

The minimum distance from the bell end of a water pipe or fitting, or from another tap on either side of the watermain, to a corporation stop or tapping valve shall be:

Corporation Stop = One Foot  
Tapping Valve = Four Feet

When two insertions are made, one on each side of the main, they shall be separated by at least 1 foot (measured along the pipe length). Multiple insertions made on the same side of the main shall be staggered and separated by at least one foot.

Service connections to PVC water main with 6 inches or greater nominal size may be direct tapped wet or dry for insertion of corporation stops. The largest size corporation stop which may be tapped directly into the pipe is one inch. Service clamps or bossed sleeve must be used for larger outlet sizes. Use only shell type cutter with multiple cutting teeth.

Teflon tape shall be placed on the corporation stop threads prior to installation. Corporation stops shall not be torqued to more than 35 ft-lb. Manufacturer's recommendations more stringent than the above shall be adhered to.

**8.4.7 TRACER WIRE.** Tracer wire systems shall be provided on all watermain and services. See Section 3.11.0

**8.4.8 SEPARATION OF WATER SERVICE AND BUILDING SEWERS.** Except as permitted below, the underground water service pipe and building sewer shall not be less than 10 feet apart horizontally and shall be separated by undisturbed or compacted earth. The water service pipe may be placed in the same trench with the building sewer under the following conditions:

- A.** The water service and the building sewer are installed concurrently.
- B.** The bottom of the water service pipe at all points shall be at least 12 inches above the top of the sewer line.
- C.** The water service pipe shall be placed on the solid shelf excavated at one side of the common trench.
- D.** The number of joints in the water service pipe shall be kept to a minimum. For tap services, the service pipe shall be laid on a straight line at right angles to the water main or parallel to the building sewer. The center line of the pipe shall be offset approximately 6 inches from the wall of the building sanitary sewer trench and approximately 18 inches from the center line of the building sanitary sewer. For branch services, the pipe (3 inches and larger in diameter) shall be laid with a clear horizontal space of not less than 2 feet between the sanitary building sewer and the branch service.

**8.4.9 GRADE.** The water service piping shall be laid with a minimum 7 feet cover from the established or proposed street grade.

The curb stop of the tap water service or the gate valve of the branch service shall be placed not less than 7 feet and not more than 7-1/2 feet below the established or proposed street grade. The unit price shall include the necessary fill or excavation for a 10 foot radius to fit the surrounding terrain.

**8.4.10 LAYING WATER SERVICES.** Water service piping which crosses either above or below a pipe conduit or other underground structure shall have at least 3 inches clearance provided at the crossing point and such clear space is to be filled with sand.

Copper water service piping 1-1/4 inches in diameter and smaller shall be installed without any coupling or joint from the corporation stop at the water main to the curb stop, except with permission of the Engineer.

Copper water service piping 1-1/2 inches in diameter and larger shall be laid in lengths of 20 feet or more between the corporation stop and the curb stop except for one shorter length permitted for closure.

**8.4.11 CLOSING END OF SERVICE PIPE.** The open end of copper water services shall be closed by peening the end.

The open end of branch service pipe shall be closed by a cast iron plug with an approved gasket joint. The end shall be securely blocked.

**8.4.12 SETTING WATER SERVICE BOX.** The water service box shall be centered over the curb stop and shall be brought to proper grade. The legs of the service box shall rest firmly upon a 2-inch by 6-inch by 8-inch solid concrete block. Clearance shall be provided so that the service box does not rest upon the water service pipe. Where the bench does not afford a firm support for the service box blocking, such support shall be furnished by the use of a 2-inch by 6-inch hardwood plank placed across the building sanitary sewer trench and firmly supported in each bank.

The service box shall be plumbed and braced so it will remain vertical throughout the backfilling. Sufficient excavation shall be made for the service box installation to insure proper setting and backfilling around the service box. Before placing backfill around the water service box, the Contractor shall wrap 8 mil polyethylene around the base and bedding material shall be tamped in place from a point above the pipe to a point 6 inches above the blocking to prevent entrance of backfill materials into the openings at the base. A copper disc shall be inserted in the curb stop coupling on the building side.

**8.4.13 TESTING.** The water service installation shall be tested for leaks prior to the placement of the hand backfill, and before the service box is installed, before the disc is inserted and before the end is peened. The corporation stop at the water main shall be turned on and the curb stop opened until a full flow of water is obtained. The curb stop shall then be turned off and all joints and couplings checked for leaks. Upon acceptance of the service piping, the remainder of the installation work shall be completed. The corporation stop shall be left open.

At the completion of the project, the Contractor shall, in the presence of the Engineer, open and close each curb stop to check for proper operation. In case of difficulty in operation, the Contractor shall make the necessary repairs at no cost to the Owner.

**8.4.14 LOCATION OF EXISTING BUILDING SEWERS AND SERVICES.** The Contractor will be furnished with available recorded measurements for the location of existing building sewers and water services. Existing service stop boxes, evidence of existing trenches and any other pertinent evidence also shall be used in their location.

When necessary to locate existing services, the Contractor shall commence excavation for the location of the existing building sewers and water services at such point as the weight of evidence demands. In case the initial excavation for the location of existing building sewers and water services fails to uncover same, the Contractor shall explore a distance of 10 feet in each direction, or a total of 20 feet, immediately in back of and parallel to the curb, or along the water main, at no additional cost.

In case the existing building sewers or water services cannot be located in these limits, and additional trenching is required, the Contractor shall make application to the Engineer for a written order for extra work, covering such additional exploratory trench. The price shall be established before the extra excavation begins.

**8.4.15 WATER SERVICE EXTENSION, RELOCATION, DISCONNECTION AND RECONNECTION.**

**A. Water Service Curb Extension.** To extend tap service piping, a length of copper piping and a new curb stop shall be jointed to the end of the existing service. The new curb stop shall be located as specified by the Engineer. The copper tubing shall be extended to the lot line and the end closed.

To extend branch service piping, a length of pipe equal in size to the existing branch service piping shall be jointed to the existing branch service piping. This pipe shall be laid to the property line and the end plugged.

**B. Relocation of Curb Stops and Service Boxes.** To relocate curb stops and service boxes the existing curb stop shall be closed. The existing tap service piping shall be severed at the point specified by the Engineer. A new curb stop of the same size as the existing water service piping shall be installed and opened. The old curb stop shall then be opened and the new service box installed in its proper position over the new curb stop. The Contractor shall freeze the existing water service piping between the main and the existing curb stop. The existing curb stop shall be removed and replaced with piping of the same size as the existing water service piping.

**C. Disconnection of Water Service.** To disconnect tap service piping at the main, the corporation stop shall be closed and the service pipe severed from the tail piece of the corporation stop. The union shall be uncoupled and the tail piece shall be closed by peening the end. A solid disc shall be inserted into the union and the union again coupled securely to the corporation stop. The curb stop and box shall be salvaged and delivered to the Owner's stockpile.

## **SECTION 8.5.0 - CONNECTION, REMOVAL AND ABANDONMENT**

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**8.5.1 CONNECTION TO EXISTING WATER MAIN.** Before excavation of trenches is begun, the Contractor shall uncover the existing water main to which the new main is to be connected. This will permit adjustments in line and grade to avoid the use of extra fittings. The exposed section of an existing main must be protected and blocked by the Contractor to prevent the blowing out of the plug or cap at the end of the main.

**8.5.2 CUTTING OF EXISTING MAINS.** The Owner will assist the Contractor in locating distribution system valves. The Contractor shall cut the water main, remove any plugs or caps, and pump the water out of the trench caused by cutting of the main or removal of the plugs or caps. All excavations required shall be made by the Contractor. The Contractor shall have all the necessary fittings at the site and shall expose the pipe before requesting that valves be closed.

**8.5.3 NOTICE TO WATER UTILITY.** The Contractor shall give a minimum of 48 hours written notice to the Water Utility when requesting a water shut-off. The Water Utility shall determine the time and duration of the shut-off. The Contractor shall continue the work to completion and restore service to the interrupted main. No claim for extra compensation will be considered for overtime due to the hours of shut-off.

**8.5.4 REMOVAL OF WATER MAIN MATERIALS.** The Contractor shall remove all abandoned gate valves, tapping valves, valve boxes and all other water main material indicated on the plans or as the Engineer determines. The cutting of pipe and burning and chipping out of joints shall be started only after permission is given by the Engineer.

All water main material removed by the Contractor shall be carefully handled. Any water main material broken by carelessness of the Contractor in removing will be replaced. If the material is to be re-used by the Contractor, it shall be cleaned thoroughly inside and outside. If any water main materials are not to be re-used, they shall be piled neatly on a site designated by the Owner. Lead removed shall become the property of the Contractor. Asbestos cement pipe requires special handling and shall be disposed of at an approved landfill at the Contractor's expense. All other material shall remain the property of the Owner.

**8.5.5 ABANDONMENT.** The open ends of all water mains, large services and branches that are abandoned in place shall be filled with a heavy masonry plug. The minimum thickness of plugs shall be 8 inches for mains up to and including 16 inches in diameter and 12 inches for mains over 16 inches in diameter.

Valves on the section of main to be abandoned shall also be abandoned if the special provisions or plans do not require their removal.

When valves or curb stops are to be abandoned, the Contractor shall close the valve or curb stop and remove only the top section of the valve or stop box and backfill the remaining hole with the required backfill material.

When a hydrant is to be removed and its branch is to be abandoned and it is connected to an abandoned or to be abandoned water main, the Contractor shall remove the entire hydrant and bulkhead the open end of the remaining hydrant branch and drain, if any.

When a hydrant is to be removed and its branch is to be abandoned and it is connected to a water main that will remain in service, the Contractor shall excavate and plug the hydrant tee or cross.

## **SECTION 8.6.0 - GATE VALVES AND HYDRANTS**

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**8.6.1 GATE VALVES.** The Contractor shall install valves where indicated on plans. Valves shall be set on a solid concrete block (2"x 6"x18") and leveled.

**8.6.2 VALVE BOXES.** Valve boxes shall be set over all valves unless valve manholes are specified.

**8.6.3 SHIFTED VALVE BOXES.** Valve boxes and covers shall be centered over the valve operating nut and the entire box assembly secured in place before backfilling operations. Valve boxes that become shifted or filled during backfilling shall be entirely uncovered and reset.

**8.6.4 INSTALLATION OF VALVES AND BOXES.** The valves and boxes shall be installed in a vertical position as far as feasible. The box shall be suitably braced to prevent displacement during the backfilling. The top of the box shall be level with the finished grade of the street unless otherwise directed by the Engineer. A sheet of 8 mil polyethylene shall be used to prevent bedding material from entering around the operating nut. Where gravel pavement or no pavement occurs at the location of the valves, the Contractor shall provide the pavement described below, extending a minimum of two (2) feet in each direction from the valve box after the backfill material has thoroughly settled.

The pavement shall be a minimum of 8" thick and shall consist of thoroughly tamped gravel with all voids filled with a substantial bituminous binding material placed in layers in a maximum of four (4) inches thick, the top finished with the same binding material. At least one-half (1/2) of the gravel shall be one-half (1/2) inch to one and one-quarter (1-1/4) inch in size and the balance shall be smaller. These paving materials and all workmanship shall conform to the standard specifications of the Wisconsin Department of Transportation for asphalt aggregate pavements.

**8.6.5 INSTALLING HYDRANTS.** Hydrant units shall be installed or relocated by the Contractor where indicated on the plans, unless otherwise directed by the Engineer. The hydrant shall be installed in accordance with the Standard Detail. Hydrants shall be set on solid concrete blocking and solidly blocked against the trench wall. The centerline of hydrants, when set, shall be vertical and the pumper nozzle shall face the curb. A minimum of 6 cubic feet of approved gravel shall be supplied for the hydrant drain. Whenever the main is over 6" in diameter or a valve is provided on the lead, metal strapping or retainer glands shall be provided from the main line tee to the hydrant. If hydrants are located in an area with known high groundwater, the drain ports shall be plugged and the barrel pumped dry. The Engineer shall be notified prior to plugging drain ports.

**8.6.6 TESTING HYDRANTS AND VALVES.** At the completion of the project, the Contractor shall, in the presence of the Engineer, open and close each valve and hydrant to check for proper operation. In case of difficulty in operation, the Contractor shall make the necessary repairs.

**8.6.7 DEPTH.** Valves and hydrants shall be suitable for seven (7) feet depth of cover. The hydrant unit price shall include the additional excavation or fill necessary for a 10 foot radius around the hydrant to fit the surrounding terrain. Where grading is not feasible, the Engineer may allow hydrant extensions by Change Order.

## **SECTION 8.7.0 - MANHOLES**

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**8.7.1 CONSTRUCTION.** Manholes shall be built where shown on the plans, and shall be constructed according to the requirements of Section III and as follows:

**A. Valve Manhole.** All valves to be installed in manholes shall be installed in the Standard Valve Manhole, as shown on the Standard Detail.

**B. Air-Release Manhole.** When an air-release manhole is required on the plans, it shall be as shown on the Standard Detail, and shall include the cost of furnishing and installing the air-release assembly.

## **SECTION 8.8.0 - INSULATION**

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**8.8.1 GENERAL.** Water mains and services shall be insulated where noted on the plans and wherever the depth of cover is less than 4-1/2 feet

**8.8.2 TYPE OF INSULATION.** The insulation shall be either polystyrene boards or insulating concrete.

**A. Polystyrene Boards.** Polystyrene boards shall be closed-cell extruded polystyrene (blueboard) (2" thick) and shall be installed as follows:

1. Prior to placement of the polystyrene boards, bedding material shall be placed to a height of 6 inches over the top of the pipe, leveled and compacted.

2. The insulating boards shall be placed on the cover material with the long side parallel to the centerline of the water main for a minimum width of O.D. + 24". The boards shall be placed in a staggered arrangement so as to eliminate continuous transverse joints. If two or more layers of insulation board are used, each layer should be placed so as to cover the joints of the layer immediately below.

3. The first lift of backfill material shall consist of 6 inches of bedding material which shall be end or side dumped onto the insulation board and spread in such a manner that construction equipment does not operate directly on the insulation. This layer shall be compacted with equipment that exerts a contact stress of 70 to 80 psi. Once this layer has been compacted to the specified density, the remaining layers of backfill may be constructed utilizing conventional procedures.

**B. Insulating Concrete.** Insulating concrete shall consist of 1 part Portland cement and 8 parts perlite or vermiculite aggregate by volume. Clean water shall be added and mixed until mass is workable and homogeneous. The insulating concrete shall be placed around the entire main above the bedding material to a minimum thickness of 6 inches.

## **SECTION 8.9.0 - DISINFECTION OF WATERMAINS**

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**8.9.1 GENERAL.** Disinfection shall be in accordance with AWWA C651 except where altered by the following. In general, disinfection includes the following steps: (1) Keeping pipe clean, (2) Chlorination and (3) Flushing.

**8.9.2 PIPE KEPT CLEAN.** The interior of all pipe, fittings and other accessories shall be kept as free as possible from dirt and foreign matter at all times.

Every precaution shall be used to protect the pipe against the entrance of foreign material before the pipe is placed in the new line. At the close of the day's work, or whenever the workers are absent from the job, the end of the last laid section of pipe shall be plugged, capped or otherwise tightly closed to prevent the entry of foreign material of any nature.

If the pipe-laying crew cannot put the pipe into the trench, and in place, without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe.

Unless extreme care and thorough inspection is practiced during the laying of water mains, small stones, pieces of concrete, particles of metal or other foreign material may gain access to mains newly laid or repaired. All hydrants on the lines shall be thoroughly flushed and carefully inspected after flushing to see that the entire valve operating mechanism of each hydrant is in good condition.

**8.9.3 METHOD OF CHLORINATION.** During construction, 5-g calcium hypochlorite tablets shall be placed in each section of pipe and also one such tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. The following table shows the number of tablets required for commonly used sizes of pipe. They shall be attached by an adhesive such as Permatex No. 1, Oatey 30236 or equal. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the surface of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

## NUMBER OF 5-G HYPOCHLORITE TABLETS REQUIRED FOR DOSES OF 25 mg/L\*

Pipe Diameter (Inches)	Length of Pipe Section (Feet)		
	13 or less	18	20
4	1	1	1
6	1	1	1
8	1	2	2
10	2	3	3
12	3	4	4
16	4	6	7

\*Based on 3.25 g available chlorine per tablet, any portion of tablet rounded to next higher number.

When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 fps. Precautions shall be taken to assure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 5 degrees C (41 degrees F), the water shall remain in the pipe for at least 48 hours. Valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service.

**8.9.4 CHLORINATING VALVES AND HYDRANTS.** In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent.

**8.9.5 FINAL FLUSHING AND TEST.** Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipeline at its extremities until the replacement water throughout its length shall, upon test, be proved comparable to the quality of water served the public from the existing water supply system and approved by the public health authority having jurisdiction. The Contractor shall collect samples at various locations for bacteriological analysis. A tap located and installed in such a way as to prevent outside contamination shall be used to collect samples. Samples should never be taken from an unsterilized hose or from a fire hydrant because such samples seldom meet bacteriological standards. All flushing and testing shall be done at the Contractor's expense. If necessary to protect the receiving stream, dechlorination shall be provided.

**8.9.6 REPETITION OF PROCEDURE.** Two bacteriologically safe samples must be obtained for each 1,000 lineal feet of pipeline installed. The tests shall be collected 24 hours apart. Should the initial treatment fail to result in safe samples, chlorination shall be repeated until safe results are obtained.

**8.9.7 REPAIR AND EXTENSIONS TO EXISTING MAINS.** Disinfection procedures for cutting into or repairing existing mains shall be in accordance with the applicable procedures of A.W.W.A. C651-86, Section 9.

**8.9.8 STERILIZATION OF RESERVOIRS.** The completed water reservoir is to be sterilized and thoroughly cleaned by the Reservoir Contractor on completion of the work. The interior is to be swept clean and the entire interior is to be sprayed with a 50 p.p.m. concentration of chlorine including floor, walls, ceiling, manholes and piping. On completion, HTH or Perchloron is to be mixed with water in an amount sufficient to insure 50 p.p.m. of available chlorine in the reservoir when full of water. Clear solution is to be decanted into reservoir (balance is to be disposed of) and the reservoir filled with water to the overflow and left to stand for 24 hours. Reservoir is to be drained and refilled with clean water. If a safe sample is not obtained from the system, the procedure is to be repeated. Water will be furnished from the municipal supply without charge for up to two (2) tests. Water will be billed at cost for additional tests. If necessary to protect the receiving stream, dechlorination shall be provided.

### SECTION 8.10.0 - WATERMAIN TESTS

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**8.10.1 TESTS REQUIRED.** All new mains shall be tested by the Contractor and shall successfully pass the pressure, and leakage described in the following sections. These tests are in addition to the bacteriological tests specified in the previous section. The Contractor shall notify the Engineer at least 48 hours before performing the tests. The tests must be witnessed by a representative of the Owner.

The Contractor shall furnish the gauges and measuring device for the leakage and pressure tests, including the pump, pipe, connections and all other necessary apparatus and shall furnish the necessary assistance to conduct the test. Where a new main will be connected to an existing main, it may be necessary for the Contractor to install a temporary plug in the new main for testing purposes. After the specified pressure and leakage tests have been completed on the new main, actual connection to the existing main shall be made. The section of new connecting main between the removed test plug and the existing main shall be subject to line pressure prior to backfilling. Any visible defects observed in the connecting main shall immediately be repaired at the Contractor's expense, prior to backfilling.

When existing water mains are used to supply test water, they shall be protected from backflow contamination by temporarily installing a double check-valve assembly between the test and supply main. Prior to pressure and leakage testing, the temporary backflow protection should be removed and the main under test isolated from the supply main.

**8.10.2 PRESSURE TEST.** After the test connections are made and the main filled with water, the test section shall be subjected to water pressure normal to the area. After examination of exposed parts of the system, the test pressure shall be increased to 150 pounds per square inch on the main at the lowest elevation. The main shall be examined and if any defects are found, the Contractor shall immediately make the necessary repairs at his own expense. The pressure test shall be repeated until no defects can be found. The duration of the final pressure test shall be one hour. The pressure shall be kept within 5 psi of the specified level.

**8.10.3 LEAKAGE TEST.** The leakage test shall be conducted after satisfactory completion of the pressure test. The test section shall be subjected to a pressure of 50 psi above normal operating pressure at the point of highest elevation of the main under test. The minimum test pressure shall be 100 psi gauge pressure.

The leakage test shall be conducted for not less than two (2) hours. The test pressure shall be kept within 5 psi of the specified level.

Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section of it, necessary to maintain a pressure within 5 psi of the specified leakage test pressure after the main has been filled with water and the air expelled.

**ALLOWABLE LIMITS OF LEAKAGE**

Gallons / Hour/ 1000 Feet

		<u>Nominal Pipe Diameter - inches</u>					
		<u>4</u>	<u>6</u>	<u>8</u>	<u>10</u>	<u>12</u>	<u>14</u>
	225	0.41	0.61	0.81	1.01	1.22	1.42
Avg. Test	200	0.38	0.57	0.76	0.96	1.15	1.34
Pressure,	175	0.36	0.54	0.72	0.89	1.07	1.25
p.s.i.	150	0.33	0.50	0.66	0.83	0.99	1.16
	125	0.30	0.45	0.60	0.76	0.91	1.06
	100	0.27	0.41	0.54	0.68	0.81	0.96

**8.10.4 COMBINATION PRESSURE/LEAKAGE TEST.** In lieu of separate leakage and pressure tests, a combination leak/pressure test can be run at a pressure of 150 psi for a duration of two hours with the approval of the Engineer.

**8.10.5 TEST LENGTH.** Pipe lines shall be tested between valves in lengths of not more than 800 feet unless approved by the Engineer.

**8.10.6 REPAIRS AND RETESTING.** All visible leaks at exposed joints, and all leaks evident on the surface where joints are covered shall be repaired and leakage minimized, regardless of the total leakage as shown by test.

All pipe, fittings, blocking and other materials found to be defective shall be removed and replaced at the Contractor's expense.

Lines which fail to meet the tests shall be repaired and retested as necessary, all at the Contractor's expense, until test requirements are complied with.



**8.10.7 ELECTRICAL CONTINUITY.** All metal pipe shall be tested for electrical continuity or trace wire signal. Lead tipped gaskets will not be permitted. Copper jumpers or cable bond are to be utilized to secure electrical continuity on metallic pipe. Contractor is to check the line for electrical continuity or signal after backfilling is completed. Sections shall be tested in lengths of 1,000 feet or less. Where continuity signal is not obtained, it must be established at the Contractor's expense. The Engineer or Owner shall witness each test.

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**SECTION X – SPECIAL PROVISIONS  
EAGLE CREST SOUTH ADDITION PHASE 2  
BETHANY LUTHERAN HOMES  
LA CROSSE, WISCONSIN**

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**SECTION X – SPECIAL PROVISIONS  
EAGLE CREST SOUTH ADDITION PHASE 2  
BETHANY LUTHERAN HOMES  
LA CROSSE, WISCONSIN**

**10.1 PROJECT SUMMARY**

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**10.1.1 GENERAL**

Preceding sections include general specifications for this Project. References in this Section supersede references in general sections.

The Civil portion of this Project includes the following items of work: All erosion control, clearing and grubbing, excavation, grading; construction of all storm sewer, sanitary sewer service, water service, parking lot, restoration work, and associated work with the "Eagle Crest South Addition Phase 2 Bethany Lutheran Homes" Project.

The Contractor shall provide all staking necessary for construction.

Obtain City of La Crosse grading permit and comply with DNR Construction Site Erosion Control requirements.

All costs for site work covered by these specifications shall be included in the Lump Sum Bid for the total project, including the building construction (covered in architectural plans and specifications). Unit prices shall be provided for additional work as directed by Weiser Brothers.

Contractor shall be familiar with the Geotechnical Evaluation Report Rev.1, January 29, 2018 prepared by Braun Intertec. This report is **Section 01 79 01 Geotechnical Explorations Report**.

**10.1.2 COMPLETION SCHEDULE**

Substantial Completion – Site Work:	March 20, 2018
Final Completion – Site Work	July 28, 2019

**10.1.3 PERMITS**

Weiser Brothers shall apply and obtain a Building Permit.

A Storm Water Construction Site Permit Notice of Intent which includes a Water Resources Application for Project Permits (WRAPP) has been issued by DNR. The DNR permit must be posted in a prominent visible location at the project site. Todd Wilson, Bethany Lutheran Homes, will have the original DNR Construction Storm Water General Permit. Davy Engineer and Weiser Brothers have filled a Storm Water Permit and Land Disturbance Permit Application from the City.

Wieser Brothers shall prepare and submit the Driveway and Sidewalk Construction application and all conditions are part of these specifications.

The review of the exterior water, sanitary, and storm sewer is scheduled for review with the Department of Safety and Profession Services (DSPS) for April 2018.

## 10.2 EROSION CONTROL AND TRAFFIC CONTROL

### 10.2.1 EROSION CONTROL

#### 10.2.1.1 General

An Erosion Control Plan is included within the plan set. Erosion Control is solely the responsibility of the Contractor. Comply with the erosion control plan, plan details, and City Code Chapter 105 and Wisconsin Administrative Code NR 216. The Chapter 105 is attached after this Section 10 and the Land Disturbance Permit Application has been submitted by Wieser Brothers.

All erosion control measures shall be in place before the start of land disturbing activities and shall be maintained throughout the construction period. The Contractor is responsible for the installation, maintenance, and removal of all erosion control measures.

Erosion control includes controlling fugitive dust caused by construction traffic and wind erosion. Necessary watering shall be included in the bid item for Erosion Control. Streets outside of the construction areas shall be kept clean.

Materials and products shall comply with the current Wisconsin DOT Erosion Control Product Acceptability Lists (PAL) at:

<http://wisconsin.dot.gov/Pages/doing-business/eng-consultants/cnslt-rsrcs/tools/pal/default.aspx>.

All Contractors shall comply with NR151 Wisconsin Administration Code unless an alternate is specifically approved by the Engineer. Technical standards to comply with these requirements can be found at [http://dnr.wi.gov/topic/stormwater/construction/erosion\\_control.html](http://dnr.wi.gov/topic/stormwater/construction/erosion_control.html).

Comply With Requirements. All erosion and sediment control measures shall be constructed and maintained in accordance with the Erosion Control Plan, the plans, the specifications, and Storm Water Technical Standards at [http://dnr.wi.gov/topic/stormwater/standards/const\\_standards.html](http://dnr.wi.gov/topic/stormwater/standards/const_standards.html).

When the site is finally stabilized, as determined by the Engineer, remove all temporary erosion control devices including those installed by others. Final stabilization is considered 70% vegetation coverage on all disturbed areas. Upon final stabilization, submit the Erosion Control Permit Notice of Termination and daily logs to the Engineer.

#### 10.2.1.2 Erosion Control Notes

Copies of the WDNR Technical Standards are available for \$35.00. A copy shall be kept on site.

1. Keep a copy of the current erosion control plan onsite throughout the duration of the project.
2. Submit plan revisions or amendments to the Engineer for review and then to the City and DNR at least 5 days prior to field implementation.
3. The contractor is responsible for routine site inspections at least once every 7 days and within 24 hours after a rainfall event of 0.5 inches or greater. Prior to impending rain, inspect all erosion control BMPs (best management practices) and make corrections/additions as necessary to protect work and minimize erosion and sedimentation. Keep inspection reports onsite and make them available upon request. Any facility in disrepair or at 30% capacity shall be cleaned and repaired within 24-hours of the inspection.
4. Inspect and maintain all installed erosion control practices until the contributing drainage area has been stabilized.
5. When possible preserve existing vegetation, minimize land-disturbing construction activity on slopes of 20% or more, minimize soil compaction and preserve topsoil. Disturb only those areas immediately needed for construction.
6. Refer to WDNR Technical Standards for storm water construction at [http://dnr.wi.gov/topic/stormwater/standards/const\\_standards.html](http://dnr.wi.gov/topic/stormwater/standards/const_standards.html)
7. Stage construction grading activities to minimize the cumulative exposed area. Conduct temporary grading for erosion control per **WDNR TECHNICAL STANDARD TEMPORARY GRADING PRACTICES FOR EROSION CONTROL #1067**

8. Install inlet protection prior to land disturbing activities. Use **WDNR TECHNICAL STANDARD STORM DRAIN INLET PROTECTION FOR CONSTRUCTION SITES 1060**.
9. Install perimeter controls and tracking pads at entrances prior to any land disturbing activities. Use **WDNR TECHNICAL STANDARD STONE TRACKING PAD AND TIRE WASHING 1057** for tracking pads. Proprietary tracking pads, such as Mud Mats, are acceptable with the approval of the Engineer, but they have a history of not working as well as a well-maintained rock pad. The day of and the day following rain usually requires the tracking pad to be cleaned and repaired several times per day. Install and maintain a tracking pad at the site entrance per plan details. Adjust the location of the tracking pad as necessary for project phases. The Contractor shall add/replace rock as necessary to insure proper performance. If tracking occurs on the pavement, then the rock at the tracking pad needs to be replaced more frequently. Clean up tracking onto paved roads at the end of each work day with a sweeper vacuum machine.
10. Provide anti-scour protection and maintain non-erosive flow during dewatering. Limit pumping rates to either (A) the sediment basin/trap design discharge rate, or (B) the basin design release rate with the correctly fitted hose and geotextile filter bag. Perform dewatering of accumulated surface runoff in accordance with **WDNR TECHNICAL STANDARD DE-WATERING #1061**.
11. Install and maintain silt fencing, which is also perimeter control, per **WDNR TECHNICAL STANDARD SILT FENCE 1056** except where more restrictive herein.
12. Remove sediment from behind sediment barriers like silt fence, ditch checks, and filter socks, before sediment reaches a depth that is equal to 30% of the barrier height.
13. Immediately stabilize stockpiles and surround stockpiles with silt fence or other perimeter control if stockpiles will remain inactive for 7 days or longer. Immediately stabilize all disturbed areas that will remain inactive for 14 days or longer or within 21 days of initial disturbance. Between September 15 and October 15: stabilize with mulch, tackifier, and perennial seed mixed with winter wheat, annual oats, or annual rye, as appropriate for region and soil type. October 15 through cold weather stabilize with a polymer and dormant seed mix, as appropriate for region and soil type. See note 17. Stabilization is installation of compact base course on driving surfaces and seed and mulch proposed vegetated areas. Erosion can be reduced 98% by protecting soil from raindrop impact.
14. Sweep/clean up all sediment that moves offsite due to construction activity for storm events before the end of the same workday or as directed by the Engineer. Separate swept materials (soils and trash) and dispose of appropriately.
15. The Contractor is responsible for controlling dust per **WDNR TECHNICAL STANDARD DUST CONTROL ON CONSTRUCTION SITES 1068**. Erosion control includes controlling fugitive dust caused by wind erosion. Necessary watering shall be included in the bid item for Erosion Control. Streets and roads outside of the construction areas shall be kept clean. Best Management Practices include watering, mulching, and using silt fence or straw bales as "snow" fence.
16. Coordinate with the Engineer to update the land disturbance permit to indicate the anticipated or likely disposal locations for excavated soils or construction debris that will leave the site. The deposited or stockpiled material need to include perimeter sediment control measures such as silt fence, hay bales, filter socks or compacted earthen berms.
17. Make provisions for watering during the first 8 weeks following sod installation whenever more than 7 consecutive days of dry weather (less than 0.1" of rainfall) occur.
18. Install additional erosion and sediment control measures as needed (such as temporary sediment basins, ditch checks, erosion control matting, silt fence, filter socks, swales, etc) or as directed by the Engineer.
19. Land application of products containing water soluble anionic polyacrylamide (PAM) as temporary soil binding agents shall be installed and maintained per **WDNR TECHNICAL STANDARD LAND APPLICATION OF ANIONIC POLYACRYLAMIDE 1050**. This standard is needed for disturbed area that cannot be vegetated before October 15<sup>th</sup>.
20. Limit external washing of trucks and other construction equipment to a defined area of the site. Contain runoff and properly dispose of waste. No engine degreasing is allowed on site.
21. Prior to weekend shut down or impending rain, inspect all erosion control Best Management Practices (BMPs) and make corrections/additions as necessary to protect work and minimize erosion and sedimentation.

22. In November, the builder shall meet with the Engineer to arrive at a winter erosion control plan.
23. The Contractor shall provide a spill prevention and mitigation plan at the Preconstruction Conference. Refer to this spill plan if there is a discharge of sediment and/or other contaminants.

#### **10.2.1.3 Erosion Sequence**

1. Install inlet protection at grated storm structures and perimeter barrier (silt fence or one foot deep trench) along sidewalk. Install temporary access entrance and tire wash.
2. Salvage aggregate base course and stockpile. Clear and grub. Strip topsoil and stockpile.
3. Excavate and install foundation, conduits for electric, data, fire alarm, fiber optic, and telephone, storm sewer, sanitary sewer service, and water service. Continue construction of building. Install Type A Inlet Protection around new inlets and manholes with grates.
4. Grade site to subgrade and install aggregate base
5. Install sidewalk and curb and gutter.
6. Pave parking lot.

#### **10.2.2 ACCESS AND TRAFFIC CONTROL**

Access and Traffic Control includes temporary traffic control and management of construction materials at the site and maintaining traffic flow along the adjacent street. The Contractor shall execute necessary maintenance before leaving the job site each work day. Weiser Brothers may apply for a partial street closure with the City of La Crosse. Barricades will be necessary in 3<sup>rd</sup> and 4<sup>th</sup> Street. Weiser Brother will be responsible for providing barricades and traffic control devices, but the contractor working in the street shall provide flagmen.

Access to the north parking lot shall be provided at all times for their customers. There shall be access to 50 parking spaces during the weekend and holidays but during the work week ten of these spaces may be used for construction. There shall always be 4 disabled parking spaces available.

### **10.3 EXCAVATION AND GRADING**

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#### **10.3.1 CLEARING AND GRUBBING AND TEST PITS**

The landscaped areas within demolition limits shall be cleared of trees and brush vegetation according to WisDOT Standards Section 201. The Engineer shall establish clearing limits. Do not remove trees unless marked for removal. Trees, stumps, and brush removed shall be disposed offsite. Payment will be made under the square yard bid item Clear and Grub. The landscaped islands are the locations to be cleared and grubbed.

#### **10.3.2 STRIP AND STOCKPILE TOPSOIL**

All black dirt and topsoil shall be stripped from all areas to be cut or filled and shall be stockpiled away from storm water inlets. Remove litter such as brush, rock, and other materials that will interfere with subsequent vegetation establishment. Strip off the humus-bearing soil. Take care to minimize removing the underlying sterile soil. Then stockpile the topsoil and place it directly on the designated areas. Under the Strip and Stockpile Topsoil bid item, remove topsoil from excavation areas or excavation subgrade up to the quantity necessary to cover the slopes for the bid items of Place Salvaged Topsoil.

There is little topsoil at the project site.

Within 7 days of completing topsoil stockpiling, the Contractor shall stabilize the stockpiles with temporary seeding and placing silt fence around the piles to minimize sedimentation.

#### **10.3.3 EXCAVATION AND COMPACTION**

Excavation included all demolition, cut, embankment, compaction, and grading work for the parking lot, sidewalks, pedestrian path, landscaping, driveways, and etcetera. Soils unsuitable for structural embankment may be encountered. These soils shall be removed from the site at a location reported to the Engineer. Some excavation may need to be stockpiled and placed in the final location later.

Contractor shall strip any existing pavement materials from below the paved areas. This material may be used as subgrade after being pulverized. It may also be used as Dense Aggregate Base after the pulverized material is tested to meet WisDOT specifications. The top of any existing soils that may be present within 2 feet of the surface should be scarified and compacted to encourage uniformity. Debris during this process shall be removed. This should be reviewed during grading by Engineer.

Clean sands or gravels shall be used for any needed fill below the pavements. Onsite clean sands from excavations would likely qualify, but should be evaluated by qualified personnel prior to placement.

The site is estimated to have excess excavation that must be removed from the site.

The payment for Excavation is a lump sum and no adjustments will be made unless grades are changed in the field and the Contractor coordinates the quantity measurements and calculations with the Engineer so that the Engineer can recommend payment.

#### **10.3.4 UNSATISFACTORY SUBGRADE**

Most of the excavation at the site is unsatisfactory and shall be removed in accordance with Section 2.2.13. Unsatisfactory subgrade at the pavement areas shall be replaced with Class III material.

In utility trenches where unsatisfactory material is excavated, backfill with 3/8 inch crushed rock as specified in Section 3.21.0. Unsatisfactory subgrade for the pavement and sidewalk shall be replaced with Class III material.

Granular material that is wet is not considered unsatisfactory.

#### **10.3.5 EMBANKMENT AND COMPACTION**

The suitable excavated soils shall be used as embankment so the maximum compacted thickness of any one layer is no more than 12 inches. Embankments shall be compacted in lifts according to Section 207 of the WisDOT Standards. Compaction for sands should take place at moisture levels +/-2% of optimum and at or above optimum for any clays and silts. Compaction shall be tested by two methods, Density Tests and Proof Rolls.

Proof rolls shall be done for every 2 feet of embankment with one pass across every 60 feet wide pavement. A proof roll shall consist of a tri-axle dump truck with a gross weight of 50,000 pounds. Ruts exceeding 1 inch depth are considered failure. Proof rolls are incidental to the excavation pay items.

All embankments and subgrade shall have Density Tests conducted by an Independent Lab at the rate of 1 test per 100 lineal foot per 2 feet of embankment for embankment. Density Tests conducted by an Independent Lab to estimate the number of passes by a compaction machine to meet minimum densities. This is approximately 15 tests. Passing tests will be as part of pavement unit price bid. No payment will be made for failed tests. Test results shall be provided to the Engineer.

The minimum densities shall be as follows:

Subgrade 3 feet below pavement surface – 95% of its maximum Standard Proctor density (ASTM D 698)  
Subgrade within 3 feet of the finished pavement surface – 98% Standard Proctor  
Dense Graded Base Course – 98% Standard Proctor  
General Embankment and mulched subgrade – 90% Standard Proctor

No general embankment is anticipated.

#### **10.3.6 DISPOSAL OF EXCAVATED MATERIALS AND REMOVAL ITEMS**

Existing concrete curb & gutter, driveway, sidewalks, rubble from retaining wall and foundation, asphalt pavement, fence, and other items designated shall be removed from within the project boundaries. Properly dispose of all excavated and removed items offsite. Weiser Brothers will coordinate all materials that are to be salvaged.

Contractor shall salvage suitable granular material from the removal and excavation process for use as embankment on site. The aggregate base may be salvaged and reused. Pavement removal is incidental to the Dense Aggregate Base Course pay item.



Coordinate with utility companies as necessary.

### **10.3.7 TOPSOIL**

Preparation, processing and placing topsoil shall conform to Section 625 WisDOT Standard Specification. Topsoil borrow shall meet the standards of Section 625 of the Wisconsin DOT Standard Specifications for Highway and Structure Construction.

The Contractor shall strip all topsoil from proposed cut or fill areas and shall stockpile the topsoil for reuse. Stripping shall extend two feet beyond the proposed fill limits. After stripping the topsoil and vegetation, scarify the exposed soils two feet deep before placing embankment or aggregate base course. The existing site has little topsoil to strip.

Protect stockpiles as required by the Erosion Control Plan and these specifications.

After establishing final grade and obtaining the Engineer's approval, the Contractor shall place three to four inches of topsoil over disturbed areas within 1 foot of a proposed plant not covered with pavement, sidewalk, curb, and gutter. Care shall be taken so that the topsoil has less than 25% clay to promote infiltration and at least 3% organic matter. Mulched areas do not need to be cover with topsoil, but topsoil or compost must be mixed in the top foot of soil that is landscape. Use all of the stockpiled topsoil first. Borrow topsoil shall be paid per cubic yard, loose truck volume measure with load tickets.

The cost of stripping and stockpiling onsite topsoil shall be included in the bid item, Strip and Stockpile Topsoil, sq. yds. Payment for placing topsoil from the stockpiles will be made under the bid item, Place Salvaged Topsoil, sq. yds. The Borrow Topsoil bid price shall include furnishing and pricing.

## **10.4 STORM SEWER IMPROVEMENTS**

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### **10.4.1 SCOPE**

This work includes connection to existing storm sewer structures, construction of storm sewer mains, perforated pipe, and structures. Maintain access for vehicles and pedestrians to the extent practical. This shall include placing and maintaining temporary surfacing.

There are two alternatives for detention. The base bid is CMP and the alternate is ADS Stormwater Chambers. The CMP alternative was analyzed and detailed by Davy Engineering, but the ADS was not review. Shop drawings need to be provide for the alternative selected by the Owner to complement the proposed design.

The ADS Stormwater Chamber need to complement the current design will two separate chambers. One on the east and one on the west of MH 21.

### **10.4.2 MATERIALS**

The following materials clarify the material specified in Section II. Shop drawings and material cut sheets shall be provided to the Engineer for review prior to ordering material.

**Manholes:** Section 3.17.0, Precast Concrete Manholes

**Storm sewer pipe:** HDPE Storm Sewer or PVC SDR 26 Storm Sewer

**Storm sewer inlet grates**      – Round: R-2050-C  
   – Rectangular: See detail sheet.

### **10.4.3 STORM SEWER PIPE CONNECTIONS WITH STRUCTURES**

To prevent migration of backfill material, the joints around all pipes entering and leaving storm sewer structures (for example manholes and inlets) shall be wrapped with geotextile Fabric, Type DF, Schedule B or C, meeting Section 645.2.4 of the WisDOT Standard Specification. That is 6 oz./square yard or heavier, non-woven polypropylene geotextile fabric.

All manhole and inlet joints and adjusting rings shall be wrapped with 12 inch "Butyl-Lok Wrap" or equal.

The CMP shall have 1 foot welded connections of CMP with the next larger diameter than the inlet storm sewer pipe and 1 foot of welded connections downstream of the same diameter at the storm sewer. The connections shall be wrapped with geotextile Fabric, Type DF, Schedule B or C, meeting Section 645.2.4 of the WisDOT Standard Specification. The geotextile Fabric, Type DF, Schedule B or C shall be connected to both pipes with a stainless-steel band and then grouted encased with 6 or more inches of concrete in all directions.

#### **10.4.4 TRENCH COMPACTION AND TESTING**

Compact all trenches and fill areas in accordance with Section 2.4.4.A Special Compaction, and Section 2.4.6. With the exception of any backfill placed within three (3) feet of the finished road surface, all lifts shall be compacted to 95% of Standard Proctor density. All backfill placed with three (3) feet of the finished road surface shall be compacted to 98% of Standard Proctor Density.

Wieser Brothers shall retain an independent laboratory to conduct density tests. Notify the Engineer prior to backfilling so density tests can be conducted according to the following schedule:

Trenches – One density test for every 200 lineal feet of trench per two-foot depth of fill.

The Engineer will determine locations and depths for the tests. Excavate and backfill the holes at no additional cost to the Owner. The Contractor shall pay for all tests that fail.

### **10.5 SANITARY SEWER IMPROVEMENTS**

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#### **10.5.1 SCOPE**

The existing 6" sanitary sewer service is proposed to the south of the building. The City requires the contractor to televise the existing service prior to construction. The Contractor shall provide the Wieser Brothers with a lump sum unit price to televise the service line.

#### **10.5.2 MATERIALS**

Materials shall be according to Section 3.3  
Sanitary Sewer Services – SDR 26 PVC Pipe  
Sanitary Sewer Mains – SDR 35 PVC

#### **10.5.3 TRENCH COMPACTION AND TESTING**

See Section 10.4.4.

#### **10.5.4 SANITARY SEWER TESTING**

Per Section 4.5.0, all new sanitary sewer shall be air tested up to the point where it is connected to existing main.

### **10.6 WATER IMPROVEMENTS**

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#### **10.6.1 SCOPE**

A 6 inch water service is proposed on the east side of the building. The Contractor shall provide traffic control and maintenance of traffic flow for the crossing of 4<sup>th</sup> Street.

#### **10.6.2 MATERIALS**

**Water Services Lines:** Water main per section 3.8.

**Water main Wet Tap:** - approved by the Engineer.

**Fire Hydrants:** Hydrants shall be Waterous Pacer Breakaway Model WB-67-250 with a 22-inch top extension and with weathershield and 6" mechanical joint connections per City of La Crosse

Standard Specifications for Water Main Construction. It shall be painted to match the City of La Crosse color code system. Contact the City Utility Department at (608) 789-7536 to request color designations for the hydrants and inspections.

**Gate Valves:** American Flow Control 2500, Mueller A-2360-20, Clow F-6100 epoxy-lined, or equal

### **10.6.3 TRENCH COMPACTION AND TESTING**

See Section 10.4.4.

## **10.7 STREET PATCHING AND PARKING LOT IMPROVEMENTS**

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### **10.7.1 SCOPE**

Work includes, but is not limited to, excavation, grading, subbase, subgrade correction if necessary, curb and gutter, combined curb and sidewalk, base course, concrete pavement, sidewalk, driveway aprons, and restoration work at the site.

### **10.7.2 SPECIFICATION REFERENCES**

The Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction, 2016 Edition, and applicable supplements shall apply except where modified by these specifications. The Contractor shall keep a copy of these WisDOT specifications onsite during construction. The City specification for Sidewalk and Streets is Chapter 40 and is attached hereto.

Sidewalk: 40-3(b)

Driveways: 40-4(b)

Street patches shall be concrete with 24 inch dowels every two feet along the saw cut to connect to existing.

### **10.7.3 MATERIALS**

**Dense Graded Base Course:** Section 3.22.2

**Hot Mix Asphalt (HMA):** WisDOT Section 460, Type E-3, type PG 64-28 binder 12.5 mm gradation for the base course and 9.5 mm gradation nominal aggregate for the surface course.

**Curb & Gutter:** WisDOT Section 601, 30 inch, Type L

**Concrete:** Sections 3.21.0, 3.22.0, and 3.23.0. The concrete mix design shall be based on a 6 bag mix with no fly ash.

**Sidewalk:** WisDOT Section 602 in other locations.

**Tack Coat:** WISDOT, Section 455.

**Pavement Marking Paint:** Pittsburgh Traffic Marking Paint (11-4) or approved equal.

### **10.7.4 PARKING AND PAVEMENT EXCAVATION**

The Contractor shall determine the quantities of cut and fill based on the existing and proposed surfaces and the planned pavement/curb & gutter sections according to Section 10.3.

The parking lot shall be excavated to the subgrade elevations indicated on the grading plan, along with removal of organic material in fill areas. Unsatisfactory excess excavated material shall be loaded, hauled, and properly disposed of offsite.

Suitable granular material shall be salvaged for embankment areas beneath the parking lot areas. Other approved re-useable material shall be salvaged and used for backfill behind curbs, and for embankment outside of parking lot limits. Work shall be in accordance with WisDOT, Section 207, Embankment.

### **10.7.5 EXCAVATION, FILL, AND COMPACTION**

**A. Excavation and Compaction.** See Section 10.3. After excavating to subgrade, proof roll and sub-cut to correct soft areas per section 10.3.5.

**B. Dense Graded Base Course.** Base course material shall be placed so that the maximum compacted thickness of any one layer does not exceed six inches. The total compacted thickness

shall match the depth shown on the project plans. Water the base course as necessary to control dust until surfaces.

The final grading shall be completed by the paving contractor's own grading and shaping crew.

- C. **Compaction.** According to 10.3.5 herein.
- D. **Curb and Gutter Backfill.** The Contractor shall backfill the area between the curb with suitable material (granular) to a plane four inches below finish grade.
- E. **Sidewalk and Driveway Aprons.** Provide four inches of dense aggregate base course under sidewalks and driveway aprons and compact according to Section 10.5.3 herein.

#### **10.7.6 CONCRETE**

The concrete curb and gutter shall be placed with a curb and gutter machine. In small areas where the machine is not capable of providing an acceptable product, such as at corner radii and around inlets, hand formed curb and gutter will be an acceptable alternative. Work shall conform to WisDOT Section 601. Curb and gutter shall be WisDOT Type L.

The bid price for Handicap Ramps shall include furnishing and placing the detectable warning fields and shaping the ramp. The concrete used in the ramp shall be paid at the unit price per square foot for sidewalk construction.

Concrete sidewalk and driveways shall be constructed per WisDOT Section 602.

**The Contractor shall be solely responsible for protecting all new concrete from damage, including but not limited to vandalism, settling, deicers, and cracking. All damaged sections identified within 12 months of Substantial Completion shall be removed and replaced at the Contractor's expense.**

#### **10.7.7 PAVEMENT MARKINGS**

Do not apply pavement-marking paint until layout, colors, and placement have been verified with A/E. The direction arrows shown on the site plan are not pavement markings but requested by the City Engineer for the Driveway permit. Do not paint the traffic flow directions.

Allow paving to age for 30 days before starting pavement marking.

Paint for parking lot stripes shall be white marking paint manufactured especially for this purpose. The paint shall be delivered to the site in sealed containers, which shall be labeled to show the color, designated name, manufacturer's name, date of manufacture, and directions for use, all of which shall be plainly legible at the time of use. The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics. Paint used for the work shall be Pittsburgh Traffic Marking Paint (11-4) or approved equal.

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces are acceptable. The applicator machine shall be equipped with the necessary paint tanks and spraying nozzles and shall be capable of applying paint uniformly at coverage specified.

Thoroughly clean all surfaces to be marked before application of the paint. Remove dust, dirt and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as necessary to provide a clean, dry surface.

Furnish and install two coats of paint. Apply paint to clean, dry surfaces and, unless otherwise approved, only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Maintain paint temperature within these same limits. Provide guidelines and templates as necessary to control paint application. Take special precautions in marking numbers, letters and symbols. All edges of markings shall be sharply outlined. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of asphalt and pickup, displacement or discoloration by tires of traffic. If there is a deficiency in drying of the markings, discontinue painting operations until cause of the slow drying is determined and corrected.

### **10.7.8 TRAFFIC SIGNS**

Traffic signs shall be furnished & installed at the locations shown on the plans in accordance with current Manual of Uniform Traffic Control Devices (MUTCD), Federal Highway Administration. The contract includes furnishing and installing pedestrian crossings signs at each marked crosswalk. The Disability parking sign location is not shown on the plans but must be installed.

## **10.8 RESTORATION**

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Saw cut all pavement surfaces at project limits. Restoration of areas disturbed beyond the construction limits will be at the Contractor's expense. Landscaping is separate work.

### **10.8.1 SEED, FERTILIZE, AND MULCH**

Turf Restoration. Shape the subbase to grade minus three to four inches. Furnish and install Type A Lawn Replacement (2.5.4). The Contractor shall maintain the lawn areas (water, mow, reseed) until a sustained catch of grass is achieved.

### **10.8.2 DECORATIVE MULCH AND LANDSCAPING ROCK**

Decorative Mulch shall consist of wood chips. Material mulch shall be uniform in size, color, quality and overall appearance. Mulch shall be free of material injurious to plant growth. Sources of mulch should be free of weeds and invasive plant parts or seeds. Sawdust, dirt, garbage, or other debris mixed in the mulch is not acceptable. Contractor shall submit two pounds of proposed mulch for inspection by Engineer. Wood chips shall consist of wood products having a size of two and one-half inch (2-1/2") minus with a thickness not greater than three-eighths inch (3/8"). The color shall be gold. Wood chips shall be uniform in overall appearance, color, quality, and size and are subject to approval by the Engineer. Wood chips are to be free of sawdust, dirt, twigs, excessive bark, or any other debris.

Landscaping rock shall be Blue Northern Gabion or Granite 4 to 10 inches.

### **10.8.3 IRRIGATION**

Irrigation shall be drip with at least four zones. Plans of distribution system and materials shall be provided to Engineer for review before ordering materials. Polyethylene pipe shall be used. The number of emitters will vary by the plant. 1 gallon per hour emitter shall be spaced at 4 per yard. The emitter shall extend to the drip zone anticipated in 10 years. At least one emitters per plant along the exterior parking.

## **10.9 TRAFFIC CONTROL AND CONSTRUCTION ZONE SIGNING**

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Notify the City and adjoining property owners 48 hours in advance of any temporary street or drive closures.

All traffic control devices shall conform to the Manual on Uniform Traffic Control Devices. Maintain each traffic control device to assure that legibility is retained, that the device is visible and that it is removed if no longer needed. In addition to physical maintenance, functional maintenance is required to adjust needed traffic control devices to current conditions and to remove unnecessary traffic control devices. Provide temporary signing to guide customers on impacted businesses.

A lump sum bid item has been provided for all costs associated with Traffic Control.

## **10.10 EXTERIOR LIGHTS**

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**Wall Mount:** XPSW™ LED Wall Mount Luminaire **black** shall be used. Specification sheet is attached.

- Slim, low profile design
- Luminaire housing specifically designed for LED applications with advanced LED thermal management and driver
- Luminaire mounting box designed for installation over standard single gang J-Boxes and mud ring single gang J-Boxes
- Luminaire can also be direct mounted to a wall and surface wired

- Secures to wall with four 3/16" (5mm) screws (by others)
- Conduit entry from top, bottom, sides, and rear
- Designed and UL approved for easy through-wiring
- Designed for downlight applications only
- Exclusive Colorfast DeltaGuard® finish features an E-coat epoxy primer with an ultra-durable powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Silver, black, white and bronze are available

**Canopy-Soffit Version B:** CPY250® LED Canopy/Soffit Luminaire shall be used. Specification sheet is attached.

- Easy mounting and servicing from below the deck
- Luminaire housing is constructed of rugged cast aluminum with integral heat sink specifically designed for LED
- Flat lens is 0.125" tempered Solite® glass
- Drop lens is 0.157" molded borosilicate glass
- Direct mount is suitable for use in single or double skin canopies with a minimum 4.0" (102mm) wide panels and a minimum 22-gauge, 0.030" (0.7mm) canopy thickness
- Direct mount luminaire mounts directly to the canopy deck with the drilling of a single 2" to 4" (51mm to 102mm) round hole, is secured in place with self-sealing screws that provide a weathertight seal and includes 3/4" (19mm) conduit entry for direct wire feed
- Hook and cord mount includes a 3' (0.91m) cord out of the luminaire and is intended to hang from the single hook
- Standard pendant mount includes a mounting bracket and a J-Box for customer wiring and is intended to be mounted by 3/4 IP pendant (by others)
- Hazardous location pendant mount has a threaded hub which accepts 3/4" NPT conduit (by others) and secures with a 1/4"-20 set screw
- Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultra-durable powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Black, bronze, silver and white are available

**Parking Lot Poles:** OSQ™ LED Area/Flood Luminaire – Medium

- Slim, low profile design minimizes wind load requirements
- Luminaire housing is rugged die cast aluminum with an integral, weathertight LED driver compartment and high performance heat sink
- Convenient interlocking mounting method on direct arm mount. Mounting adaptor is rugged die cast aluminum and mounts to 3-6" (76-152mm) square or round pole, secured by two 5/16-18 UNC bolts spaced on 2" (51mm) centers
- Mounting for the adjustable arm mount adaptor is rugged die cast aluminum and mounts to 2" (51mm) IP, 2.375" (60mm) O.D. tenon
- Adjustable arm mount can be adjusted 180° in 2.5° increments
- Designed for uplight and downlight applications
- Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultra-durable powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Silver, bronze, black, and white are available

# CPY Series - Version B

CPY250® LED Canopy/Soffit Luminaire

## Product Description

The CPY250® LED Canopy/Soffit Luminaire has an extremely thin profile constructed of rugged cast aluminum. It can be surface mounted easily from below the canopy deck and can be pendant mounted. Direct imaging of the LEDs is eliminated with a highly efficient patterned flat or 0.91" (23mm) drop glass lens.

**Applications:** Petroleum canopies, CNG fueling stations, soffits

## Performance Summary

Assembled in the U.S.A. of U.S. and imported parts

**Initial Delivered Lumens:** Up to 20,080

**Efficacy:** Up to 151 LPW

**CRI:** Minimum 70 CRI

**CCT:** 3000K (+/- 300K), 4000K (+/- 300K), 5700K (+/- 500K)

**Limited Warranty†:** 10 years on luminaire/10 years on Colorfast DeltaGuard® finish

IP66 Rated (Direct Mount only)

Class I, Division 2 Hazardous Location for select models

† See <http://lighting.cree.com/warranty> for warranty terms

## Accessories

Field-Installed	
<b>Direct Mount Luminaires</b>	<b>Pendant Mount Luminaires</b>
<b>Canopy Upgrade Kits (18 ga. steel)</b>	<b>Pendant Mount Kits</b>
XA-BXCCMW – for use with Jet-Philips, 21.60" (549mm) square	XA-PS12KIT* – 5" (127mm) pendant
XA-BXCCNW – for use with ElSCO Franciscan, 22.06" (560mm) square	XA-PS18KIT* – 11" (279mm) pendant
XA-BXCCPW – for use with LSI Dakota or Masters, 22.50" (572mm) square	XA-PS22KIT* – 15" (381mm) pendant
XA-BXCCQW – for use with Whiteway Riviera or Rig-A-Lite, 20.60" (523mm) square	- Includes two conduit fittings and 3/4"-14 NPT pipe threaded on two ends
XA-BXCCRW – for use with ElSCO Merrit, 18.06" (459mm) square	<b>Hand-Held Remote</b>
XA-BXCCSW – for use with LSI Richmond or Whiteway Civic, 23.00" (584mm) L x 13.00" (330mm) W	XA-SENSREM
<b>Direct Mount Junction Box/Stem Kit</b>	- For successful implementation of the programmable multi-level option, a minimum of one hand-held remote is required
XA-BXCCJBOX – 6.0" (152mm) H x 3/4" (19mm) NPT Stem	
- Watertight	
- Rated for feed through 8 (4 in, 4 out) #12 AWC conductors	
<b>Direct Mount Beauty Plates</b>	
XA-BXCCBPW – 26.17" (665mm) Beauty Plate Only (18 ga. steel)	
XA-BXCCBPB12W – 26.17" (665mm) Beauty Plate (18 ga. steel) w/12" (305mm) Backer Plate (16 ga. steel)	
- For use in canopies where deck opening is larger than what is required for mounting the CPY250 luminaire. Maximum deck opening 10.75" x 15" (183mm x 375mm)	
XA-BXCCBPB16W – 26.17" (665mm) Beauty Plate (18 ga. steel) w/16" (406mm) Backer Plate (16 ga. steel)	
- For use in canopies where deck opening is larger than what is required for mounting the CPY250 luminaire. Maximum deck opening 12" x 15" (305mm x 375mm)	

\* Must specify color

## Ordering Information

Example: CPY250-B-DM-D-A-UL-SV

Product	Version	Mounting	Optic	Input Power Designator	Voltage	Color Options	CCT	Options
CPY250	B	DM Direct HC Hook & Cord PD Pendant	D 0.91" (23mm) Drop Lens F Flat Lens	A 60W B 96W C 31W E 145W F 85W	UL Universal 120-277V UH Universal 347-480V - Available with B, E & F input power designators only 34* 347V - A & C input power designators only 48* 480V - A & C input power designators only	BK Black BZ Bronze SV Silver WH White	30K 3000K 40K 4000K 57K 5700K	<b>DIM 0-10V Dimming</b> - Control by others - Refer to Dimming spec sheet for details - Can't exceed wattage of specified Input Power Designator <b>HZ Class I, Div. 2 Hazardous Location Certification</b> - Available with DM and PD mounts only - Not available with DIM, K, or PML options - A & C input power designators available in UL voltage only <b>K NSF 2 Certification</b> - Luminaires include NSF certification mark - Available with the DM mount only - Not available with the HZ or PML options <b>PML Programmable Multi-Level</b> - Available with UL voltage only - Refer to PML spec sheet for details

\* 347 and 480V with A & C input power designators utilize a magnetic step-down transformer. For input power for 347 and 480V, refer to the Electrical Data table

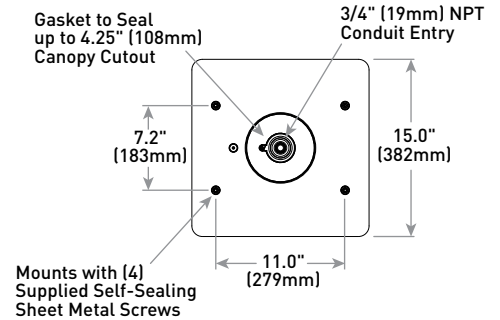
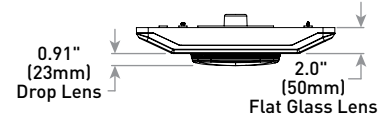
## DM Mount



Flat Lens



Drop Lens



## Weight

12.5 lbs. (5.7kg)



Rev. Date: V11 12/22/2017



US: [lighting.cree.com](http://lighting.cree.com)

T (800) 236-6800 F (262) 504-5415

Canada: [www.cree.com/canada](http://www.cree.com/canada)

T (800) 473-1234 F (800) 890-7507

**Product Specifications**

**CONSTRUCTION & MATERIALS**

- Slim, low profile design
- Easy mounting and servicing from below the deck
- Luminaire housing is constructed of rugged cast aluminum with integral heat sink specifically designed for LED
- Flat lens is 0.125" tempered Solite® glass
- Drop lens is 0.157" molded borosilicate glass
- Direct mount is suitable for use in single or double skin canopies with a minimum 4.0" (102mm) wide panels and a minimum 22 gauge, 0.030" (0.7mm) canopy thickness
- Direct mount luminaire mounts directly to the canopy deck with the drilling of a single 2" to 4" (51mm to 102mm) round hole, is secured in place with self-sealing screws that provide a weathertight seal and includes 3/4" (19mm) conduit entry for direct wire feed
- Hook and cord mount includes a 3' (0.91m) cord out of the luminaire and is intended to hang from the single hook
- Standard pendant mount includes a mounting bracket and a J-Box for customer wiring and is intended to be mounted by 3/4 IP pendant (by others)
- Hazardous location pendant mount has a threaded hub which accepts 3/4" NPT conduit (by others) and secures with a 1/4"-20 set screw
- Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultra-durable powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Black, bronze, silver and white are available
- **Weight:** 12.5 lbs. (5.7kg)

**ELECTRICAL SYSTEM**

- **Input Voltage:** 120-277V or 347-480V, 50/60Hz, Class 1 drivers
- **Power Factor:** > 0.9 at full load
- **Total Harmonic Distortion:** < 20% at full load
- Integral 6kV surge suppression protection standard
- When code dictates fusing, a slow blow fuse or type C/D breaker should be used to address inrush current
- **Operating Temperature Range:** Applications Requiring Class I, Division 2 Hazardous Location Ratings: -40°C to +25°C; A Input Power Designator: -40°C to +40°C (direct mount to plywood), -40°C to +45°C (direct mount to sheet metal/suspended); B & E Input Power Designators: -40°C to +35°C (plywood), -40°C to +40°C (sheet metal/suspended); C Input Power Designator: -40°C to +45°C (plywood), -40°C to +50°C (sheet metal/suspended); F Input Power Designator: -40°C to +40°C (plywood), -40°C to +45°C (sheet metal/suspended)
- **WARNING:** Exceeding maximum operating temperature may result in thermal foldback

**CONTROLS**

- Continuous dimming to 10% with 0-10V DC control protocol
- **10V Source Current:** 0.15mA
- Use only lighting controls with neutral connection or controls intended for use with LED fixtures
- Reference LED Dimming spec sheet for additional dimming information

**REGULATORY & VOLUNTARY QUALIFICATIONS**

- cULus Listed
- Suitable for wet locations when ordered with DM mount
- Suitable for damp locations when ordered with HC and PD mounts
- Suitable for wet locations when ordered with PD mount and HZ option
- Enclosure rated IP66 per IEC 60529 when ordered with DM mount
- Consult factory for CE Certified products
- 6kV surge suppression protection tested in accordance with IEEE/ANSI C62.41.2
- Meets FCC Part 15, Subpart B, Class A standards for conducted and radiated emissions
- Luminaire and finish endurance tested to withstand 5,000 hours of elevated ambient salt fog conditions as defined in ASTM Standard B 117
- Meets Buy American requirements within ARRA
- RoHS compliant. Consult factory for additional details
- Class I, Division 2 Hazardous Location rated when ordered with the DM or PD mount and the HZ option. A & C input power designators are available in UL voltage only. Not available with DIM, NSF or PML options. Rated for Groups A, B, C & D. Bears a T3C (160°C) temperature classification within a 25°C ambient
- NSF Certified when ordered with DM mount. Not available with HZ or PML options. Refer to <http://info.nsf.org/Certified/Food/> for additional details
- DLC and DLC Premium qualified versions available. Please refer to <https://www.designlights.org/search/> for most current information

Electrical Data*								
Input Power Designator	System Watts 120-277V	System Watts 347-480V; 347/480V	Total Current (A)					
			120V	208V	240V	277V	347V	480V
A	60	68	0.51	0.29	0.25	0.22	0.20	0.14
B	96	96	0.82	0.47	0.40	0.35	0.28	0.20
C	31	33	0.26	0.15	0.13	0.11	0.10	0.07
E	145	145	1.22	0.70	0.61	0.53	0.42	0.30
F	85	85	0.72	0.41	0.36	0.31	0.24	0.18

\* Electrical data at 25°C (77°F). Actual wattage may differ by +/- 10% when operating between 120-480V +/- 10%

Recommended CPY Series - Version B Lumen Maintenance Factors (LMF) <sup>1</sup>					
Ambient	Initial LMF	25K hr Projected <sup>2</sup> LMF	50K hr Projected <sup>2</sup> LMF	75K hr Calculated <sup>3</sup> LMF	100K hr Calculated <sup>3</sup> LMF
5°C (41°F)	1.04	1.02	1.00	0.98	0.96
10°C (50°F)	1.03	1.01	0.99	0.97	0.95
15°C (59°F)	1.02	0.99	0.98	0.96	0.94
20°C (68°F)	1.01	0.98	0.96	0.95	0.93
25°C (77°F)	1.00	0.97	0.95	0.94	0.92
30°C (86°F)	0.99	0.96	0.94	0.93	0.91

<sup>1</sup> Lumen maintenance values at 25°C (77°F) are calculated per TM-21 based on LM-80 data and in-situ luminaire testing on sheet metal

<sup>2</sup> In accordance with IESNA TM-21-11, Projected Values represent interpolated value based on time durations that are within six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing ([DUT] i.e. the packaged LED chip)

<sup>3</sup> In accordance with IESNA TM-21-11, Calculated Values represent time durations that exceed six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing ([DUT] i.e. the packaged LED chip)

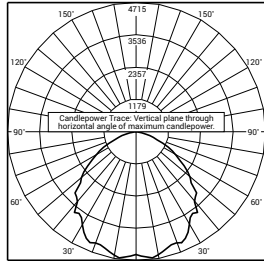




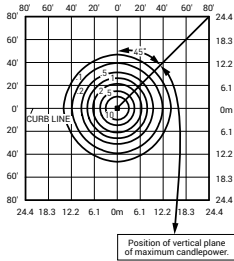
**Photometry**

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: <http://lighting.cree.com/products/outdoor/canopy-and-soffit/cpy-series>

**DROP LENS**



CESTL Test Report #: PL08412-001A  
 CPY250-B-\*\*-D-B-UL-\*\*-57K  
 Initial Delivered Lumens: 12,403



CPY250-B-\*\*-D-B-UL-\*\*-57K  
 Mounting Height: 15' (4.6m) A.F.G.  
 Initial Delivered Lumens: 12,860  
 Initial FC at grade

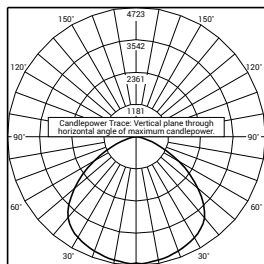
**Drop Lens Distribution**

Input Power Designator	3000K		4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
A	7,250	B3 U2 G1	7,600	B3 U2 G1	7,720	B3 U2 G1
B	11,850	B3 U2 G1	12,380	B3 U2 G1	12,860	B3 U2 G1
C	4,210	B2 U2 G1	4,420	B2 U2 G1	4,520	B2 U2 G1
E	19,100	B4 U3 G2	19,600	B4 U3 G2	20,080	B4 U3 G2
F	11,850	B3 U2 G1	12,380	B3 U2 G1	12,860	B3 U2 G1

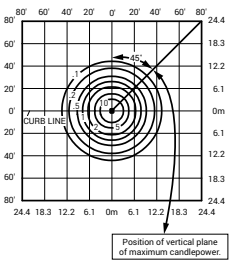
\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens

\*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>

**FLAT LENS**



CESTL Test Report #: PL08165-001C  
 CPY250-B-\*\*-F-B-UL-\*\*-57K  
 Initial Delivered Lumens: 13,040



CPY250-B-\*\*-F-B-UL-\*\*-57K  
 Mounting Height: 15' (4.6m) A.F.G.  
 Initial Delivered Lumens: 12,860  
 Initial FC at grade

**Flat Lens Distribution**

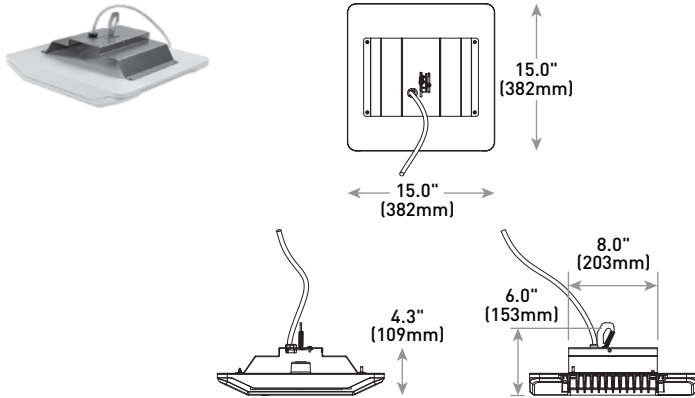
Input Power Designator	3000K		4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
A	7,250	B3 U0 G1	7,600	B3 U0 G1	7,720	B3 U0 G1
B	11,850	B3 U0 G1	12,380	B3 U0 G1	12,860	B3 U0 G1
C	4,210	B2 U0 G1	4,420	B2 U0 G1	4,520	B2 U0 G1
E	19,100	B4 U0 G1	19,600	B4 U0 G1	20,080	B4 U0 G1
F	11,850	B3 U0 G1	12,380	B3 U0 G1	12,860	B3 U0 G1

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens

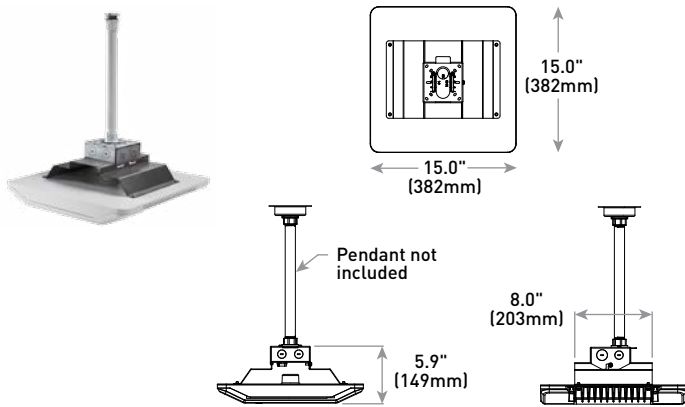
\*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>



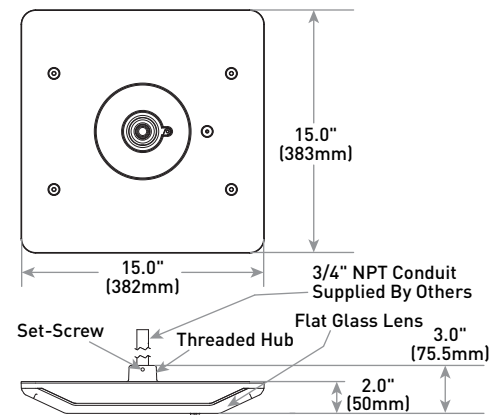
**HC Mount**



**PD Mount**



**PD Mount w/HZ Option**



# OSQ Series

OSQ™ LED Area/Flood Luminaire – Medium

## Product Description

The OSQ™ Area/Flood luminaire blends extreme optical control, advanced thermal management and modern, clean aesthetics. Built to last, the housing is rugged cast aluminum with an integral, weathertight LED driver compartment. Versatile mounting configurations offer simple installation. Its slim, low-profile design minimizes wind load requirements and blends seamlessly into the site providing even, quality illumination. The 'B' Input power designator is a suitable upgrade for HID applications up to 250 Watt, and the 'K' Input power designator is a suitable upgrade for HID applications up to 400 Watt.

**Applications:** Parking lots, walkways, campuses, car dealerships, office complexes, and internal roadways

## Performance Summary

NanoOptic® Precision Delivery Grid™ optic

Assembled in the U.S.A. of U.S. and imported parts

**Initial Delivered Lumens:** Up to 17,291

**Efficacy:** Up to 136 LPW

**CRI:** Minimum 70 CRI

**CCT:** 3000K (+/- 300K), 4000K (+/- 300K), 5700K (+/- 500K)

**Limited Warranty\*:** 10 years on luminaire/10 years on Colorfast DeltaGuard® finish

\* See <http://lighting.cree.com/warranty> for warranty terms

## Accessories

Field-Installed	
<b>Backlight Shield</b> OSQ-BLSMF – Front facing optics OSQ-BLSMR – Rotated optics	<b>Hand-Held Remote</b> XA-SENSREM - For successful implementation of the programmable multi-level option, a minimum of one hand-held remote is required

## Ordering Information

Fully assembled luminaire is composed of two components that must be ordered separately:

Example: **Mount:** OSQ-AASV + **Luminaire:** OSQ-A-NM-2ME-B-40K-UL-SV

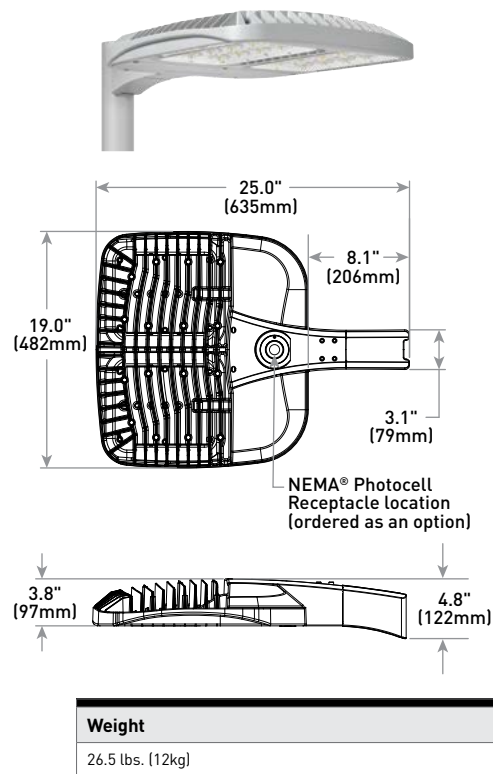
Mount (Luminaire must be ordered separately)*			
OSQ-			
OSQ-AA Adjustable Arm	Color Options:	SV Silver	BZ Bronze
OSQ-DA Direct Arm		BK Black	WH White

\* Reference EPA and pole configuration suitability data beginning on page 7

Luminaire (Mount must be ordered separately)									
OSQ	A	NM							
Product	Version	Mounting	Optic	Input Power Designator	CCT	Voltage	Color Options	Options	
OSQ	A	NM No Mount	<b>Asymmetric</b> 2ME* 4ME* Type II Type IV Medium Medium 130W 3ME* Type III Medium  <b>Symmetric</b> 5ME 25D Type V 25° Medium Flood 55H 40D Type V 40° Short Flood WSN 60D Wide 60° Sign Flood 15D 15° Flood	B 86W K 130W	30K 3000K 40K 4000K 57K 5700K	UL Universal 120-277V UH Universal 347-480V	BK Black BZ Bronze SV Silver WH White	<b>DIM 0-10V Dimming</b> - Control by others - Refer to <a href="#">Dimming spec sheet</a> for details - Can't exceed wattage of specified input power designator  <b>F Fuse</b> - When code dictates fusing, use time delay fuse - Available for U.S. applications only  <b>ML Multi-Level</b> - Refer to <a href="#">ML spec sheet</a> for details - Available with UL voltage only - Intended for downlight applications at 0° tilt  <b>PML Programmable Multi-Level, up to 40' Mounting Height</b> - Refer to <a href="#">PML spec sheet</a> for details - Intended for downlight applications at 0° tilt	<b>PML2 Programmable Multi-Level, 10-30' Mounting Height</b> - Refer to <a href="#">PML spec sheet</a> for details - Intended for downlight applications at 0° tilt  <b>Q9/Q6/Q5/Q4/Q3/Q2/Q1 Field Adjustable Output</b> - Must select Q9, Q6, Q5, Q4, Q3, Q2, or Q1 - Offers full range adjustability - Refer to pages 9-10 for power and lumen values  <b>R NEMA® Photocell Receptacle</b> - Intended for downlight applications with maximum 45° tilt - 3-pin receptacle per ANSI C136.10 - Photocell and shorting cap by others  <b>RL Rotate Left</b> - LED and optic are rotated to the left  <b>RR Rotate Right</b> - LED and optic are rotated to the right

\* Available with Backlight Shield when ordered with field-installed accessory (see table above)

## DA Mount



Rev. Date: V14 01/29/2018



US: [lighting.cree.com](http://lighting.cree.com)

T (800) 236-6800 F (262) 504-5415

Canada: [www.cree.com/canada](http://www.cree.com/canada)

T (800) 473-1234 F (800) 890-7507

**Product Specifications**

**CONSTRUCTION & MATERIALS**

- Slim, low profile design minimizes wind load requirements
- Luminaire housing is rugged die cast aluminum with an integral, weathertight LED driver compartment and high performance heat sink
- Convenient interlocking mounting method on direct arm mount. Mounting adaptor is rugged die cast aluminum and mounts to 3-6" (76-152mm) square or round pole, secured by two 5/16-18 UNC bolts spaced on 2" (51mm) centers
- Mounting for the adjustable arm mount adaptor is rugged die cast aluminum and mounts to 2" (51mm) IP, 2.375" (60mm) O.D. tenon
- Adjustable arm mount can be adjusted 180° in 2.5° increments
- Designed for uplight and downlight applications
- Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultra-durable powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Silver, bronze, black, and white are available
- **Weight:** 26.5 lbs. (12kg)

**ELECTRICAL SYSTEM**

- **Input Voltage:** 120-277V or 347-480V, 50/60Hz, Class 1 drivers
- **Power Factor:** > 0.9 at full load
- **Total Harmonic Distortion:** < 20% at full load
- Integral 10kV surge suppression protection standard
- When code dictates fusing, a slow blow fuse or type C/D breaker should be used to address inrush current
- **10V Source Current:** 0.15mA

**REGULATORY & VOLUNTARY QUALIFICATIONS**

- cULus Listed
- Suitable for wet locations
- Enclosure rated IP66 per IEC 60529 when ordered without R option
- Consult factory for CE Certified products
- Certified to ANSI C136.31-2001, 3G bridge and overpass vibration standards
- 10kV surge suppression protection tested in accordance with IEEE/ANSI C62.41.2
- Meets FCC Part 15 , Subpart B, Class A standards for conducted and radiated emissions
- Luminaire and finish endurance tested to withstand 5,000 hours of elevated ambient salt fog conditions as defined in ASTM Standard B 117
- Meets Buy American requirements within ARRA
- DLC and DLC Premium qualified versions available. Some exceptions apply. Please refer to <https://www.designlights.org/search/> for most current information
- RoHS compliant. Consult factory for additional details
- Dark Sky Friendly, IDA Approved when ordered with 30K CCT. Please refer to <http://darksky.org/fsa/fsa-products/> for most current information

Electrical Data*							
Input Power Designator	System Watts 120-480V	Total Current (A)					
		120V	208V	240V	277V	347V	480V
B	86	0.73	0.43	0.37	0.32	0.25	0.19
K	130	1.09	0.65	0.56	0.49	0.38	0.28

\* Electrical data at 25°C (77°F). Actual wattage may differ by +/- 10% when operating between 120-480V +/-10%

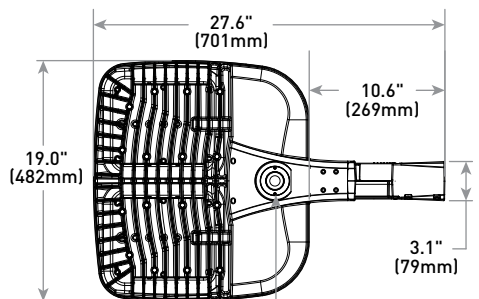
OSQ Series Ambient Adjusted Lumen Maintenance <sup>1</sup>						
Ambient	Optic	Initial LMF	25K hr Projected <sup>2</sup> LMF	50K hr Projected <sup>2</sup> LMF	75K hr Projected <sup>2</sup> / Calculated <sup>3</sup> LMF	100K hr Projected <sup>2</sup> / Calculated <sup>3</sup> LMF
5°C (41°F)	Asymmetric	1.04	1.00	0.95	0.91 <sup>3</sup>	0.87 <sup>3</sup>
	Symmetric	1.05	1.04	1.03	1.03 <sup>2</sup>	1.02 <sup>2</sup>
10°C (50°F)	Asymmetric	1.03	0.99	0.94	0.90 <sup>3</sup>	0.86 <sup>3</sup>
	Symmetric	1.04	1.03	1.02	1.01 <sup>2</sup>	1.00 <sup>2</sup>
15°C (59°F)	Asymmetric	1.02	0.98	0.93	0.89 <sup>3</sup>	0.86 <sup>3</sup>
	Symmetric	1.02	1.02	1.01	1.00 <sup>2</sup>	0.99 <sup>2</sup>
20°C (68°F)	Asymmetric	1.01	0.97	0.93	0.89 <sup>3</sup>	0.85 <sup>3</sup>
	Symmetric	1.01	1.01	1.00	0.99 <sup>2</sup>	0.98 <sup>2</sup>
25°C (77°F)	Asymmetric	1.00	0.96	0.92	0.88 <sup>3</sup>	0.84 <sup>3</sup>
	Symmetric	1.00	0.99	0.98	0.98 <sup>2</sup>	0.97 <sup>2</sup>

<sup>1</sup> Lumen maintenance values at 25°C (77°F) are calculated per TM-21 based on LM-80 data and in-situ luminaire testing. Luminaire ambient temperature factors (LATF) have been applied to all lumen maintenance factors

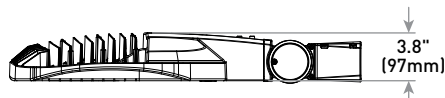
<sup>2</sup> In accordance with IESNA TM-21-11, Projected Values represent interpolated value based on time durations that are within six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing ([DUT] i.e. the packaged LED chip)

<sup>3</sup> In accordance with IESNA TM-21-11, Calculated Values represent time durations that exceed six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing ([DUT] i.e. the packaged LED chip)

**AA Mount**



NEMA® Photocell Receptacle location (ordered as an option)



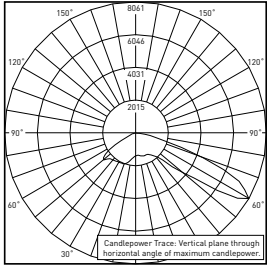
**Weight**

26.5 lbs. (12kg)

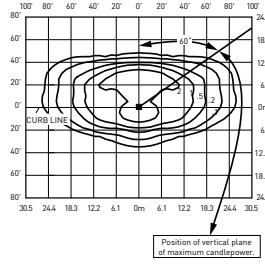
**Photometry**

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: <http://lighting.cree.com/products/outdoor/area/osq-series>

**2ME**



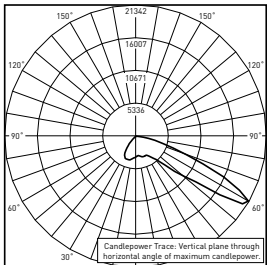
**RESTL Test Report #:** PL08877-001  
**OSQ-A\*\*-2ME-B-30K-UL**  
**Initial Delivered Lumens:** 10,381



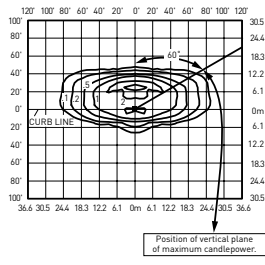
**OSQ-A\*\*-2ME-B-40K-UL**  
**Mounting Height:** 25' (7.6m) A.F.G.  
**Initial Delivered Lumens:** 11,424  
**Initial FC at grade**

Type II Medium Distribution						
Input Power Designator	3000K		4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
B	10,738	B2 U0 G2	11,424	B2 U0 G2	11,648	B2 U0 G2
K	16,022	B3 U0 G3	16,959	B3 U0 G3	17,291	B3 U0 G3

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens  
 \*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>. Valid with no tilt



**CESTL Test Report #:** PL07700-001A  
**OSQ-A\*\*-2ME-U-57K-UL w/OSQ-BLSLF**  
**Initial Delivered Lumens:** 22,822

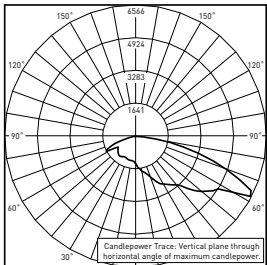


**OSQ-A\*\*-2ME-U-57K-UL w/OSQ-BLSMF**  
**Mounting Height:** 25' (7.6m) A.F.G.  
**Initial Delivered Lumens:** 8,779  
**Initial FC at grade**

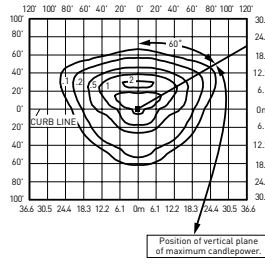
Type II Medium w/BLS Distribution						
Input Power Designator	3000K		4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11
B	8,251	B2 U0 G2	8,779	B2 U0 G2	8,950	B2 U0 G2
K	12,312	B2 U0 G2	13,032	B2 U0 G2	13,286	B2 U0 G2

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens  
 \*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>. Valid with no tilt

**3ME**



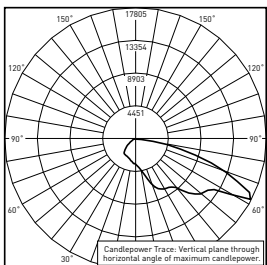
**RESTL Test Report #:** PL08876-001A  
**OSQ-A\*\*-3ME-B-30K-UL**  
**Initial Delivered Lumens:** 10,421



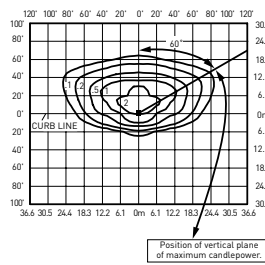
**OSQ-A\*\*-3ME-B-40K-UL**  
**Mounting Height:** 25' (7.6m) A.F.G.  
**Initial Delivered Lumens:** 11,424  
**Initial FC at grade**

Type III Medium Distribution						
Input Power Designator	3000K		4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11
B	10,738	B3 U0 G3	11,424	B3 U0 G3	11,648	B3 U0 G3
K	16,022	B3 U0 G3	16,959	B3 U0 G3	17,291	B3 U0 G3

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens  
 \*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>. Valid with no tilt



**CESTL Test Report #:** PL07699-001A  
**OSQ-A\*\*-3ME-U-57K-UL w/OSQ-BLSLF**  
**Initial Delivered Lumens:** 23,601



**OSQ-A\*\*-3ME-U-57K-UL w/OSQ-BLSMF**  
**Mounting Height:** 25' (7.6m) A.F.G.  
**Initial Delivered Lumens:** 9,019  
**Initial FC at grade**

Type III Medium w/BLS Distribution						
Input Power Designator	3000K		4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
B	8,477	B1 U0 G2	9,019	B1 U0 G2	9,196	B1 U0 G2
K	12,649	B2 U0 G2	13,389	B2 U0 G2	13,650	B2 U0 G2

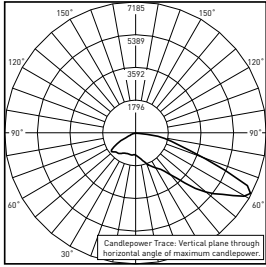
\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens  
 \*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>. Valid with no tilt



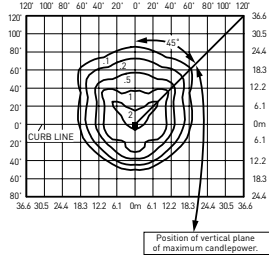
**Photometry**

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: <http://lighting.cree.com/products/outdoor/area/osq-series>

**4ME**



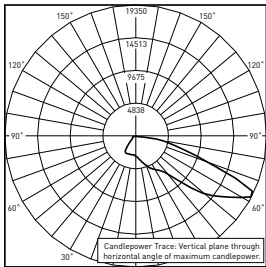
RESTL Test Report #: PL08878-001A  
OSQ-A-\*\*-4ME-B-30K-UL  
Initial Delivered Lumens: 10,230



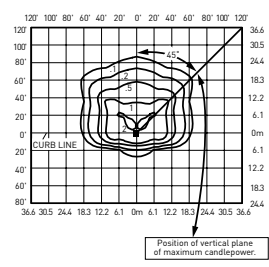
OSQ-A-\*\*-4ME-B-40K-UL  
Mounting Height: 25' (7.6m) A.F.G.  
Initial Delivered Lumens: 11,424  
Initial FC at grade

Type IV Medium Distribution						
Input Power Designator	3000K		4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
B	10,738	B2 U0 G2	11,424	B2 U0 G2	11,648	B2 U0 G2
K	16,022	B3 U0 G3	16,959	B3 U0 G3	17,291	B3 U0 G3

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens  
\*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>. Valid with no tilt



CESTL Test Report #: PL07692-001A  
OSQ-A-\*\*-4ME-U-57K-UL w/OSQ-BLSLF  
Initial Delivered Lumens: 22,793

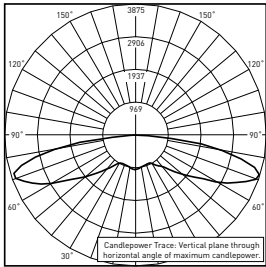


OSQ-A-\*\*-4ME-B-40K-UL w/OSQ-BLSMF  
Mounting Height: 25' (7.6m) A.F.G.  
Initial Delivered Lumens: 8,779  
Initial FC at grade

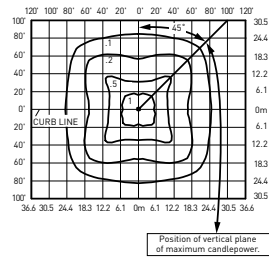
Type IV Medium w/BLS Distribution						
Input Power Designator	3000K		4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11
B	8,251	B1 U0 G2	8,779	B1 U0 G2	8,950	B1 U0 G2
K	12,312	B2 U0 G2	13,032	B2 U0 G2	13,286	B2 U0 G2

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens  
\*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>. Valid with no tilt

**5ME**



CESTL Test Report #: PL08101-001C  
OSQ-A-\*\*-5ME-B-30K-UL  
Initial Delivered Lumens: 9,304

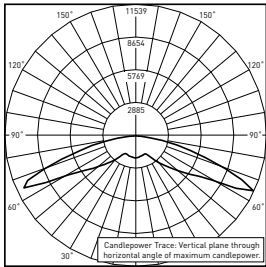


OSQ-A-\*\*-5ME-B-40K-UL  
Mounting Height: 25' (7.6m) A.F.G.  
Initial Delivered Lumens: 10,867  
Initial FC at grade

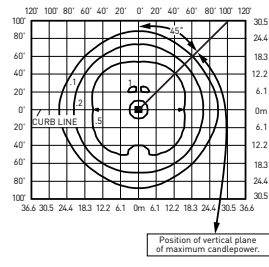
Type V Medium Distribution						
Input Power Designator	3000K		4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
B	10,232	B4 U0 G4	10,867	B4 U0 G4	11,056	B4 U0 G4
K	15,063	B4 U0 G5	15,999	B4 U0 G5	16,277	B4 U0 G5

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens  
\*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>. Valid with no tilt

**5SH**



CESTL Test Report #: PL10754-001A  
OSQ-A-\*\*-5SH-U-40K-UL  
Initial Delivered Lumens: 25,679



OSQ-A-\*\*-5SH-B-40K-UL  
Mounting Height: 25' (7.6m) A.F.G.  
Initial Delivered Lumens: 11,478  
Initial FC at grade

Type V Short Distribution						
Input Power Designator	3000K		4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11	Initial Delivered Lumens*	BUG Ratings** Per TM 15 11
B	10,806	B4 U0 G2	11,478	B4 U0 G2	11,678	B4 U0 G2
K	15,909	B4 U0 G3	16,897	B4 U0 G3	17,191	B4 U0 G3

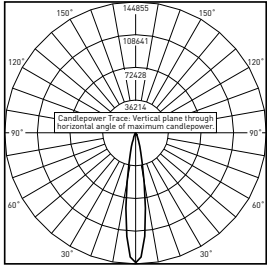
\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens  
\*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>. Valid with no tilt



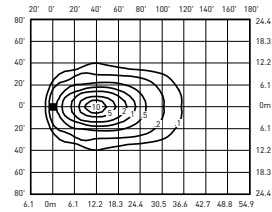
**Photometry**

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: <http://lighting.cree.com/products/outdoor/area/osq-series>

**15D**



CESTL Test Report #: PL07689-001A  
OSQ-A\*\*-15D-U-30K-UL  
Initial Delivered Lumens: 23,254



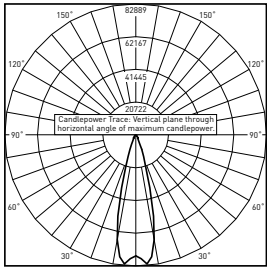
OSQ-A\*\*-15D-B-40K-UL  
Mounting Height: 25' (7.6m) A.F.G., 60° Tilt  
Initial Delivered Lumens: 11,478  
Initial FC at grade

**15° Flood Distribution**

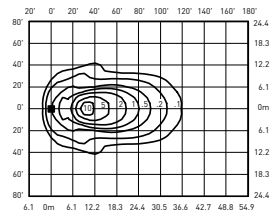
Input Power Designator	3000K	4000K	5700K
	Initial Delivered Lumens*	Initial Delivered Lumens*	Initial Delivered Lumens*
B	10,806	11,478	11,678
K	15,909	16,897	17,191

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens

**25D**



CESTL Test Report #: PL07687-001A  
OSQ-A\*\*-25D-U-30K-UL  
Initial Delivered Lumens: 23,265



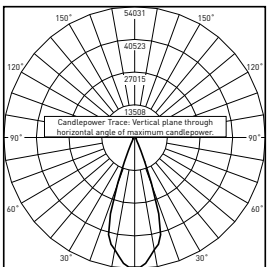
OSQ-A\*\*-25D-B-40K-UL  
Mounting Height: 25' (7.6m) A.F.G., 60° Tilt  
Initial Delivered Lumens: 11,478  
Initial FC at grade

**25° Flood Distribution**

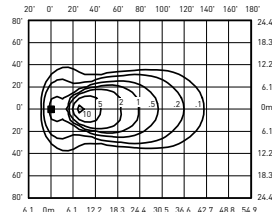
Input Power Designator	3000K	4000K	5700K
	Initial Delivered Lumens*	Initial Delivered Lumens*	Initial Delivered Lumens*
B	10,806	11,478	11,678
K	15,909	16,897	17,191

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens

**40D**



CESTL Test Report #: PL07697-001A  
OSQ-A\*\*-40D-U-30K-UL  
Initial Delivered Lumens: 22,943



OSQ-A\*\*-40D-B-40K-UL  
Mounting Height: 25' (7.6m) A.F.G., 60° Tilt  
Initial Delivered Lumens: 11,478  
Initial FC at grade

**40° Flood Distribution**

Input Power Designator	3000K	4000K	5700K
	Initial Delivered Lumens*	Initial Delivered Lumens*	Initial Delivered Lumens*
B	10,806	11,478	11,678
K	15,909	16,897	17,191

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens

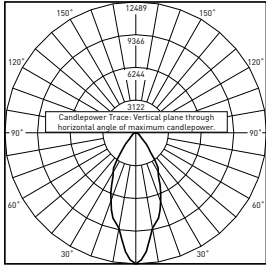


OSQ™ LED Area/Flood Luminaire – Medium

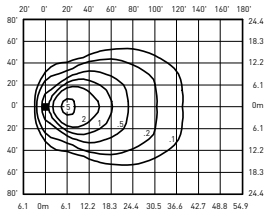
**Photometry**

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: <http://lighting.cree.com/products/outdoor/area/osq-series>

**60D**



CESTL Test Report #: PL08100-001B  
OSQ-A-\*\*-60D-B-30K-UL  
Initial Delivered Lumens: 10,079

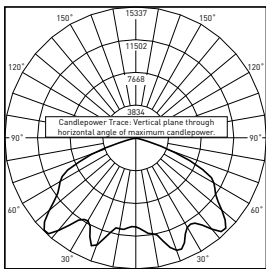


OSQ-A-\*\*-60D-B-40K-UL  
Mounting Height: 25' (7.6m) A.F.G., 60° Tilt  
Initial Delivered Lumens: 11,478  
Initial FC at grade

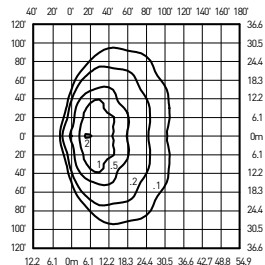
60° Flood Distribution			
Input Power Designator	3000K	4000K	5700K
		Initial Delivered Lumens*	Initial Delivered Lumens*
B	10,806	11,478	11,678
K	15,909	16,897	17,191

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens

**WSN**



CESTL Test Report #: PL07695-001A  
OSQ-A-\*\*-WSN-U-30K-UL  
Initial Delivered Lumens: 23,116









OSQ-A-\*\*-WSN-B-40K-UL  
Mounting Height: 25' (7.6m) A.F.G., 60° Tilt  
Initial Delivered Lumens: 11,478  
Initial FC at grade









Wide Sign Distribution			
Input Power Designator	3000K	4000K	5700K
		Initial Delivered Lumens*	Initial Delivered Lumens*
B	10,806	11,478	11,678
K	15,909	16,897	17,191

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens



**Luminaire EPA**

<b>Fixed Arm Mount – OSQ-DA</b> Weight: 26.5 lbs. (12kg)					
Single	2 @ 180°	2 @ 90°	3 @ 90°	3 @ 120°	4 @ 90°
					
0.74	1.48	1.19	1.93	1.63	2.38

<b>Adjustable Arm Mount – OSQ-AA</b> Weight: 26.5 lbs. (12kg)							
Single	2 @ 180°	2 @ 90°	3 @ 90°	3 @ 120°	3 @ 180°	4 @ 180°	4 @ 90°
<b>Tenon Configuration</b> [0° -80° Tilt]; If used with Cree tenons, please add tenon EPA with Luminaire EPA							
							
PB-1A*; PT-1; PW-1A3**	PB-2A*; PB-2R2.375; PD-2A4(180); PT-2(180); PW-2A3**	PB-2A*; PD-2A4(90); PT-2(90)	PB-3A*; PD-3A4(90); PT-3(90)	PB-3A*; PT-3(120)	PB-3A*; PB-3R2.375	PB-4A*(180)	PB-4A*(90); PB-4R2.375; PD-4A4(90); PT-4(90)
<b>0° Tilt</b>							
0.74	1.48	1.19	1.93	1.63	3.33	4.66	2.38
<b>10° Tilt</b>							
0.75	1.48	1.49	2.23	2.15	4.22	5.84	2.98
<b>20° Tilt</b>							
1.12	1.48	1.86	2.60	2.85	5.31	7.32	3.72
<b>30° Tilt</b>							
1.46	1.48	2.20	2.94	3.56	6.34	8.68	4.40
<b>45° Tilt</b>							
1.96	1.96	2.69	3.43	4.54	7.83	10.68	5.38
<b>60° Tilt</b>							
2.33	2.33	3.07	3.81	5.11	8.94	12.16	6.14
<b>70° Tilt</b>							
2.49	2.49	3.23	3.97	5.11	9.43	12.80	6.46
<b>80° Tilt</b>							
2.58	2.58	3.32	4.06	5.11	9.71	13.16	6.64
<b>Tenon Configuration</b> [90° Tilt]; If used with Cree tenons, please add tenon EPA with Luminaire EPA							
PB-1A*; PT-1; PW-1A3**	PB-2A*; PB-2R2.375; PD-2A4(180); PT-2(180); PW-2A3**	PB-2A*	PB-3A*	PB-3A*; PT-3(120)	PB-3A*; PB-3R2.375	PB-4A*(180)	PB-4A*(90); PB-4R2.375
<b>90° Tilt</b>							
2.61	2.61	4.44	6.05	5.11	9.79	13.28	10.39

\* Specify pole size: 3 [3"], 4 [4"], 5 [5"], or 6 [6"] for single, double or triple luminaire orientation or 4 [4"], 5 [5"], or 6 [6"] for quad luminaire orientation  
 \*\* These EPA values must be multiplied by the following ratio: Fixture Mounting Height/Total Pole Height. Specify pole size: 3 [3"], 4 [4"], 5 [5"], or 6 [6"]



**Tenon EPA**

Part Number	EPA
PB-1A*	None
PB-2A*	0.82
PB-3A*	1.52
PB-4A*(180)	2.22
PB-4A*(90)	1.11
PB-2R2.375	0.92
PB-3R2.375	1.62
PB-4R2.375	2.32
PD Series Tenons	0.09
PT Series Tenons	0.10
PW-1A3**	0.47
PW-2A3**	0.94
WM-2	0.08
WM-4	0.25
WM-DM	None

\* Specify pole size: 3 [3"], 4 [4"], 5 [5"], or 6 [6"] for single, double or triple luminaire orientation or 4 [4"], 5 [5"], or 6 [6"] for quad luminaire orientation  
 \*\* These EPA values must be multiplied by the following ratio: Fixture Mounting Height/Total Pole Height. Specify pole size: 3 [3"], 4 [4"], 5 [5"], or 6 [6"]

Tenons and Brackets* (must specify color)	
<b>Square Internal Mount Vertical Tenons (Steel)</b> - Mounts to 3-6" (76-152mm) square aluminum or steel poles PB-1A* – Single                      PB-4A*(90) – 90° Quad PB-2A* – 180° Twin                PB-4A*(180) – 180° Quad PB-3A* – 180° Triple	<b>Round External Mount Vertical Tenons (Steel)</b> - Mounts to 2.375" (60mm) O.D. round aluminum or steel poles or tenons PB-2R2.375 – Twin                      PB-4R2.375 – Quad PB-3R2.375 – Triple
<b>Square Internal Mount Horizontal Tenons (Aluminum)</b> - Mounts to 4" (102mm) square aluminum or steel poles PD-2A4(90) – 90° Twin                PD-3A4(90) – 90° Triple PD-2A4(180) – 180° Twin            PD-4A4(90) – 90° Quad	<b>Round External Mount Horizontal Tenons (Aluminum)</b> - Mounts to 2.375" (60mm) O.D. round aluminum or steel poles or tenons - Mounts to square pole with PB-1A* tenon PT-1 – Single (Vertical)                PT-3(90) – 90° Triple PT-2(90) – 90° Twin                    PT-4(90) – 90° Quad PT-2(180) – 180° Twin
<b>Wall Mount Brackets</b> - Mounts to wall or roof WM-2 – Horizontal for OSQ-AA mount WM-4 – L-Shape for OSQ-AA mount WM-DM – Plate for OSQ-DA mount	<b>Mid-Pole Bracket</b> - Mounts to square pole PW-1A3** – Single                      PW-2A3** – Double
	<b>Ground Mount Post</b> - For ground mounted flood luminaires PGM-1 - for OSQ-AA mount

\* Refer to the [Bracket and Tenons spec sheet](#) for more details

**Direct Mount Configurations**

Compatibility with OSQ-DA Direct Mount Bracket					
Input Power Designator	2 @ 90°	2 @ 180°	3 @ 90°	3 @ 120°	4 @ 90°
<b>3" Square</b>					
B & K	N/A	✓	N/A	N/A	N/A
<b>3" Round</b>					
B & K	N/A	✓	N/A	N/A	N/A
<b>4" Square</b>					
B & K	✓	✓	✓	N/A	✓
<b>4" Round</b>					
B & K	✓	✓	✓	✓	✓
<b>5" Square</b>					
B & K	✓	✓	✓	N/A	✓
<b>5" Round</b>					
B & K	✓	✓	✓	✓	✓
<b>6" Square</b>					
B & K	✓	✓	✓	N/A	✓
<b>6" Round</b>					
B & K	✓	✓	✓	✓	✓

**Field Adjustable Output (Q9/Q6/Q5/Q4/Q3/Q2/Q1) Option Description:**

The Field Adjustable Output option enables the OSQ area luminaires to be tuned to the exact needs of a particular application through multiple levels of adjustment. When ordered with the Q option, the luminaire will be shipped from the factory at the selected Q setting and will be fully adjustable between the nine settings.

**Q Option Power & Lumen Data – Designator B**

Q Option Setting	CCT	System Watts	Lumen Values						Optics Qualified on DLC QPL	
			120-480V	Asymmetric	5ME	5SH & Floods	2ME w/ BLS	3ME w/ BLS	4ME w/BLS	Standard
Q9 (Full Power)	30K	86	10,738	10,232	10,806	8,251	8,477	8,251	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		11,424	10,867	11,478	8,779	9,019	8,779	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		11,648	11,056	11,678	8,950	9,196	8,950		
Q6	30K	77	9,449	9,004	9,509	7,261	7,460	7,261	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		10,053	9,563	10,101	7,726	7,937	7,726	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		10,250	9,729	10,277	7,876	8,092	7,876		
Q5	30K	72	8,913	8,492	8,969	6,848	7,036	6,848	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		9,482	9,020	9,527	7,287	7,486	7,287	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		9,668	9,176	9,693	7,429	7,633	7,429		
Q4	30K	62	7,731	7,367	7,780	5,941	6,103	5,941	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		8,225	7,824	8,264	6,321	6,494	6,321	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		8,387	7,960	8,408	6,444	6,621	6,444		
Q3	30K	53	6,550	6,241	6,592	5,033	5,171	5,033	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		6,969	6,629	7,002	5,355	5,502	5,355	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		7,105	6,744	7,124	5,460	5,610	5,460		
Q2	30K	45	5,476	5,218	5,511	4,208	4,323	4,208	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		5,826	5,542	5,854	4,477	4,600	4,477	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		5,940	5,639	5,956	4,565	4,690	4,565		
Q1	30K	34	4,188	3,990	4,214	3,218	3,306	3,218	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		4,455	4,238	4,476	3,424	3,517	3,424	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		4,543	4,312	4,554	3,491	3,586	3,491		



**Field Adjustable Output (Q9/Q6/Q5/Q4/Q3/Q2/Q1) Option Description:**

The Field Adjustable Output option enables the OSQ area luminaires to be tuned to the exact needs of a particular application through multiple levels of adjustment. When ordered with the Q option, the luminaire will be shipped from the factory at the selected Q setting and will be fully adjustable between the nine settings.

**Q Option Power & Lumen Data–Designator K**

Q Option Setting	CCT	System Watts	Lumen Values						Optics Qualified on DLC QPL	
			120-480V	Asymmetric	5ME	5SH & Floods	2ME w/BLS	3ME w/BLS	4ME w/BLS	Standard
Q9 (FullPower)	30K	130	16,022	15,063	15,909	12,312	12,649	12,312	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		16,959	15,999	16,897	13,032	13,389	13,032	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		17,291	16,277	17,191	13,286	13,650	13,286		
Q6	30K	117	14,099	13,255	14,000	10,835	11,131	10,835	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		14,924	14,079	14,869	11,468	11,782	11,468	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		15,216	14,324	15,128	11,692	12,012	11,692		
Q5	30K	110	13,298	12,502	13,204	10,219	10,499	10,219	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		14,076	13,279	14,025	10,817	11,113	10,817	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		14,352	13,510	14,269	11,027	11,330	11,027		
Q4	30K	93	11,536	10,845	11,454	8,865	9,107	8,865	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		12,210	11,519	12,166	9,383	9,640	9,383	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		12,450	11,719	12,378	9,566	9,828	9,566		
Q3	30K	80	9,773	9,188	9,704	7,510	7,716	7,510	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		10,345	9,759	10,307	7,950	8,167	7,950	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		10,548	9,929	10,487	8,104	8,327	8,104		
Q2	30K	67	8,171	7,682	8,114	6,279	6,451	6,279	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		8,649	8,159	8,617	6,646	6,828	6,646	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		8,818	8,301	8,767	6,776	6,962	6,776		
Q1	30K	51	6,249	5,875	6,205	4,802	4,933	4,802	5ME	2ME, 3ME, 4ME, 5SH, 15D, 25D, 40D, 60D, WSN
	40K		6,614	6,240	6,590	5,082	5,222	5,082	N/A	2ME, 3ME, 4ME, 5ME, 5SH, 15D, 25D, 40D, 60D, WSN
	57K		6,743	6,348	6,704	5,182	5,324	5,182		

# XSP Series

XSPW™ LED Wall Mount Luminaire

## Product Description

The XSPW™ LED wall mount luminaire has a slim, low profile design intended for outdoor wall mounted applications. The rugged lightweight aluminum housing and mounting box are designed for installation over standard single gang J-Boxes and mud ring single gang J-Boxes. The luminaire allows for through-wired or conduit entry from the top, bottom, sides and rear. The housing design is intended specifically for LED technology including a weathertight LED driver compartment and thermal management. Optic design features industry-leading NanoOptic® Precision Delivery Grid™ system in multiple distributions.

**Applications:** General area and security lighting

## Performance Summary

NanoOptic® Precision Delivery Grid™ optic

Assembled in the U.S.A. of U.S. and imported parts

**CRI:** Minimum 70 CRI

**CCT:** 3000K (+/- 300K); 4000K (+/- 300K); 5700K (+/- 500K)

**Limited Warranty†:** 10 years on luminaire/10 years on Colorfast DeltaGuard® finish

† See <http://lighting.cree.com/warranty> for warranty terms

## Accessories

### Field-Installed

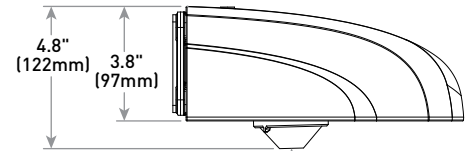
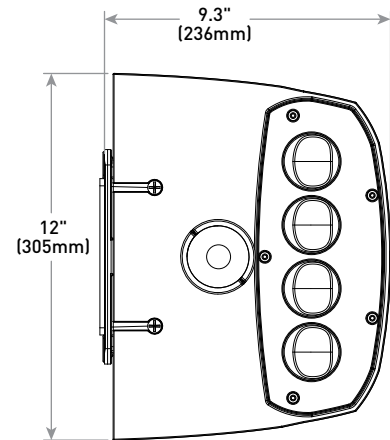
#### Beauty Plate

WM-PLT12\*\* - 12" (305mm) Square

WM-PLT14\*\* - 14" (356mm) Square

- Covers holes left by incumbent wall packs

\*\* Must specify color



Multi-Level Sensor location  
(ordered as an option)

### Weight

9.5 lbs. (4.3kg)

## Ordering Information

Example: XSPW-A-0-2-F-C-U-Z

Product	Version	Mounting	Optic	Modules	Input Power Designator	Voltage	Color Options	Options
XSPW	A	0 Wall	2 Type II Medium 3 Type III Medium	30K 3000K F 4000K M 5700K	C 42W G 25W	U Universal 120-277V 1 120V 2 208-277V 6* 347V	S Silver T Black W White Z Bronze	K <b>Multi-Level</b> - Refer to ML spec sheet for details - Available with Input Power Designator C only - Available with U and 6 voltages only P <b>Photocell</b> - Not available with K option - Available with 1 or 2 voltages only

\* Available in Canada only. 347V utilizes magnetic step-down transformer. For input power for 347V, refer to the Electrical Data table



Rev. Date: VersionA V9 10/05/2017



US: [lighting.cree.com](http://lighting.cree.com)

T (800) 236-6800 F (262) 504-5415

Canada: [www.cree.com/canada](http://www.cree.com/canada)

T (800) 473-1234 F (800) 890-7507

## Product Specifications

### CONSTRUCTION & MATERIALS

- Slim, low profile design
- Luminaire housing specifically designed for LED applications with advanced LED thermal management and driver
- Luminaire mounting box designed for installation over standard single gang J-Boxes and mud ring single gang J-Boxes
- Luminaire can also be direct mounted to a wall and surface wired
- Secures to wall with four 3/16" (5mm) screws (by others)
- Conduit entry from top, bottom, sides, and rear
- Designed and UL approved for easy through-wiring
- Designed for downlight applications only
- Exclusive Colorfast DeltaGuard® finish features an E-coat epoxy primer with an ultra-durable powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Silver, black, white and bronze are available
- **Weight:** 9.5lbs. (4.3kg)

### ELECTRICAL SYSTEM

- **Input Voltage:** 120-277V or 347V, 50/60Hz
- **Power Factor:** > 0.9 at full load
- **Total Harmonic Distortion:** < 20% at full load
- Class 2 driver
- Integral 10kV surge suppression protection standard
- When code dictates fusing, a slow blow fuse or type C/D breaker should be used to address inrush current
- C Input Power Designator is designed with 0-10V dimming capabilities standard. Controls by others
- **10V Source Current:** 0.15 mA

### REGULATORY & VOLUNTARY QUALIFICATIONS

- cULus Listed
- Suitable for wet locations
- Enclosure rated IP66 per IEC 60529
- DLC qualified when ordered with 40K or 57K. Please refer to <https://www.designlights.org/search/> for most current information
- 10kV surge suppression protection tested in accordance with IEEE/ANSI C62.41.2
- Meets FCC Part 15, Subpart B, Class A standards for conducted and radiated emissions
- Luminaire and finish endurance tested to withstand 5,000 hours of elevated ambient salt fog conditions as defined in ASTM Standard B 117
- Meets Buy American requirements within ARRA
- RoHS compliant. Consult factory for additional details

Electrical Data*							
Input Power Designator	System Watts 120-277V	System Watts 347V	Total Current (A)				
			120V	208V	240V	277V	347V
C	42	46	0.36	0.21	0.19	0.16	0.14
G	25	27	0.22	0.13	0.11	0.10	0.08

\* Electrical data at 25°C (77°F). Actual wattage may differ by +/- 10% when operating between 120-347V +/- 10%

XSPW Series Ambient Adjusted Lumen Maintenance <sup>1</sup>						
Ambient	Input Power Designator	Initial LMF	25K hr Projected <sup>2</sup> LMF	50K hr Projected <sup>2</sup> LMF	75K hr Projected <sup>2</sup> LMF	100K hr Calculated <sup>3</sup> LMF
5°C (41°F)	C	1.04	1.02	1.01	1.01	1.00
	G					
10°C (50°F)	C	1.03	1.01	1.00	1.00	0.99
	G					
15°C (59°F)	C	1.02	1.00	0.99	0.98	0.98
	G					
20°C (68°F)	C	1.01	0.99	0.98	0.97	0.97
	G					
25°C (77°F)	C	1.00	0.98	0.97	0.96	0.96
	G					

<sup>1</sup> Lumen maintenance values at 25°C (77°F) are calculated per TM-21 based on LM-80 data and in-situ luminaire testing. Luminaire ambient temperature factors (LATF) have been applied to all lumen maintenance factors

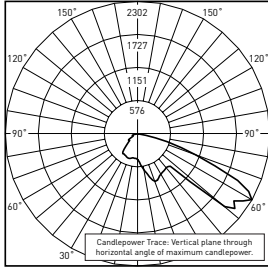
<sup>2</sup> In accordance with IESNA TM-21-11, Projected Values represent interpolated value based on time durations that are within six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing (DUT) i.e. the packaged LED chip

<sup>3</sup> In accordance with IESNA TM-21-11, Calculated Values represent time durations that exceed six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing (DUT) i.e. the packaged LED chip

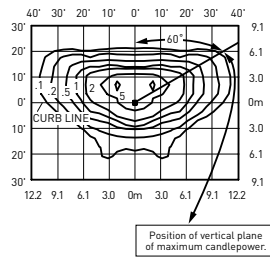
**Photometry**

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: <http://lighting.cree.com/products/outdoor/wall-mount/xsp-series-wall>

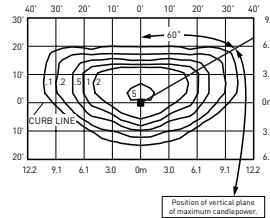
2



**CESTL Test Report #: 2014-0017**  
**XSPW-A\*-2-F-G-U-S**  
**Initial Delivered Lumens: 2,739**



**XSPW-A\*-2-F-C-U-S**  
**Mounting Height: 10' (3.0m) A.F.G.**  
**Initial Delivered Lumens: 3,819**  
**Initial FC at grade**

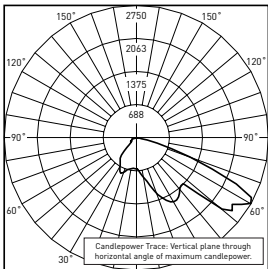


**XSPW-A\*-2-F-G-U-S**  
**Mounting Height: 10' (3.0m) A.F.G.**  
**Initial Delivered Lumens: 2,529**  
**Initial FC at grade**

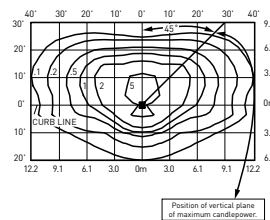
Type II Medium Distribution				
Input Power Designator	3000K/4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
C	3,819	B1 U0 G1	4,109	B1 U0 G1
G	2,529	B1 U0 G1	2,722	B1 U0 G1

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens  
 \*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>

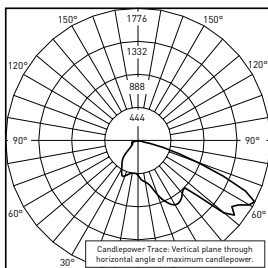
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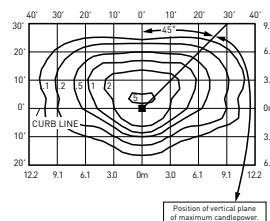
**CESTL Test Report #: 2014-0018**  
**XSPW-A\*-3-F-C-U-S**  
**Initial Delivered Lumens: 4,187**



**XSPW-A\*-3-F-C-U-S**  
**Mounting Height: 10' (3.0m) A.F.G.**  
**Initial Delivered Lumens: 3,819**  
**Initial FC at grade**



**CESTL Test Report #: 2014-0019**  
**XSPW-A\*-3-F-G-U-S**  
**Initial Delivered Lumens: 2,692**



**XSPW-A\*-3-F-G-U-S**  
**Mounting Height: 10' (3.0m) A.F.G.**  
**Initial Delivered Lumens: 2,529**  
**Initial FC at grade**

Type III Medium Distribution				
Input Power Designator	3000K/4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
C	3,819	B1 U0 G1	4,109	B1 U0 G1
G	2,529	B1 U0 G1	2,722	B1 U0 G1

\* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens  
 \*\* For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: <https://www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf>



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**Notice:** Use of this specific form is voluntary, but the information contained on this form must be collected and kept by the permittee under s. NR 216.48(4), Wis. Adm. Code, for a construction site covered under the General WPDES Construction Site Storm Water Discharge Permit, Permit No. WI-0067831-2. This form is provided for the convenience of the permittee to meet the requirements of s. NR 216.48(4), Wis. Adm. Code. Multiple copies of this form may be made to compile the inspection report.

Inspections of implemented erosion and sediment control best management practices must be performed weekly and within 24 hours after a precipitation event 0.5 inches or greater which results in runoff.

Weekly written reports of all inspections conducted by or for the permittee must be maintained throughout the period of general permit coverage.

The information maintained in accordance with s. NR 216.48 (4) must be submitted to the Department upon request.

<b>Name of Permittee:</b>	
<b>Construction Site Name (Project):</b>	<b>Construction Site ID No.:</b>
<b>Location:</b>	<b>County:</b>
<b>Contractor:</b>	<b>Field Office Phone:</b>

**Note: Weekly inspection reports, along with erosion control and stormwater management plans, are required to be maintained on site and made available upon request.**

<b>Date of inspection (mm/dd/yy):</b> _____  <b>Time of inspection: Start:</b> _____ a.m./p.m. <b>End:</b> _____ a.m./p.m.	<b>Type of inspection:</b> <input type="checkbox"/> Weekly <input type="checkbox"/> Precipitation Event <input type="checkbox"/> Other (specify) _____  <b>Name(s) of individual(s) performing inspection:</b>
--	---

**Weather:**

**Description of present phase of construction:**

Modifications Required	Yes	No	Not Applicable	Comments/Recommendations about the overall effectiveness of the erosion and sediment control measures. <b>Note:</b> For each item checked "Yes", complete the follow-up information on page 2.
Ditch Checks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Erosion Control Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Erosion Mat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Grading Practices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Inlet Protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Mulch	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Offsite Sediment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Permanent Seeding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Schedule / Phasing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Silt Fence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Silt Screen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sod	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Stabilized Outlet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Temp. Diversion Channel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Temp. Settling Basin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Temporary Seeding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Tracking Pads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidity Barrier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Other (specify) _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

# CONSTRUCTION SITE INSPECTION REPORT

Form 3400-187 (rev. 9/04)

Page 2 of 2

Name of Permittee:

Construction Site Name (Project):

Construction Site ID No.:

*Use the space below for detailed follow-up action items.*

Exact place of erosion/sediment control inspected	Type of erosion/sediment control and its observed condition	Description of any necessary maintenance or repair to erosion/sediment control, including anticipated date of completion