BID OF_____

2014

PROPOSAL, CONTRACT, BOND AND SPECIFICATIONS

FOR

LAKEVIEW RESERVOIR REPLACEMENT PROJECT

CONTRACT NO. 7339

IN

MADISON, DANE COUNTY, WISCONSIN

AWARDED BY THE COMMON COUNCIL
MADISON, WISCONSIN ON_____

CITY ENGINEERING DIVISION
1600 EMIL STREET
MADISON, WISCONSIN 53713

https://bidexpress.com/login

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

INDEX

This Proposal, and Agreement have
been prepared by:

MADISON WATER UTILITY
CITY OF MADISON
MADISON, DANE COUNTY, WISCONSIN

Alan L. Larson, P.E., BCEE

SECTION A: ADVERTISEMENT FOR BIDS AND INSTRUCTIONS TO BIDDERS

REQUEST FOR BID FOR PUBLIC WORKS CONSTRUCTION
CITY OF MADISON, WISCONSIN

A BEST VALUE CONTRACTING MUNICIPALITY

PROJECT NAME:	LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO.:	7339
SBE GOAL	5%
BID BOND	5%
PRE BID MEETING (1:00 P.M.)	August 5th, 2014
PREQUALIFICATION APPLICATION DUE (1:00 P.M)	August 15th, 2014
BID SUBMISSION (1:00 P.M.)	August 22nd, 2014
BID OPEN (1:30 P.M.)	August 22nd, 2014
PUBLISHED IN WSJ	7/25/14, 8/1/14, 8/8/14 & 8/15/14

PRE BID MEETING: Representatives of the Affirmative Action Department will be present to discuss the Small Business Enterprise requirements at project site.

PREQUALIFICATION APPLICATION: Forms are available on our website, www.cityofmadison.com/business/pw/forms.cfm. If not currently prequalified in the categories listed in Section A, an amendment to your Prequalification will need to be submitted prior to the same due date. Postmark is not applicable.

BIDS TO BE SUBMITTED by hand to 1600 EMIL ST., MADISON, WI 53713 or online at www.bidexpress.com.

THE BID OPENING is at 1600 EMIL ST., MADISON, WI 53713.

STANDARD SPECIFICATIONS

The City of Madison's Standard Specifications for Public Works Construction - 2014 Edition, as supplemented and amended from time to time, forms a part of these contract documents as if attached hereto.

These standard specifications are available on the City of Madison Public Works website, www.cityofmadison.com/Business/PW/specs.cfm.

The Contractor shall review these Specifications prior to preparation of proposals for the work to be done under this contract, with specific attention to Article 102, "BIDDING REQUIREMENTS AND CONDITIONS" and Article 103, "AWARD AND EXECUTION OF THE CONTRACT." For the convenience of the bidder, below are highlights of three subsections of the specifications.

SECTION 102.1: PRE-QUALIFICATION OF BIDDERS

In accordance with Wisconsin State Statutes 66.0901 (2) and (3), all bidders must submit to the Board of Public Works proof of responsibility on forms furnished by the City. The City requires that all bidders be qualified on a biennial basis.

Bidders must present satisfactory evidence that they have been regularly engaged in the type of work specified herein and they are fully prepared with necessary capital, materials, machinery and supervisory personnel to conduct the work to be contracted for to the satisfaction of the City. All bidders must be pre-

qualified by the Board of Public Works for the type of construction on which they are bidding prior to the opening of the bid.

In accordance with Section 39.02(9)(a)l. of the General Ordinances, all bidders shall submit in writing to the Affirmative Action Division Manager of the City of Madison, a Certificate of Compliance or an Affirmative Action Plan at the same time or prior to the submission of the proof of responsibility forms.

The bidder shall be disqualified if the bidder fails to or refuses to, prior to opening of the bid, submit a Certificate of compliance, Affirmative Action Plan or Affirmative Action Data Update, as applicable, as defined by Section 39.02 of the General Ordinances (entitled Affirmative Action) and as required by Section 102.11 of the Standard Specifications.

SECTION 102.4 PROPOSAL

No bid will be accepted that does not contain an adequate or reasonable price for each and every item named in the Schedule of Unit Prices.

A lump sum bid for the work in accordance with the plans and specifications is required. The lump sum bid must be the same as the total amounts bid for the various items and it shall be inserted in the space provided.

All papers bound with or attached to the proposal form are considered a part thereof and must not be detached or altered when the proposal is submitted. The plans, specifications and other documents designated in the proposal form will be considered a part of the proposal whether attached or not.

A proposal submitted by an individual shall be signed by the bidder or by a duly authorized agent. A proposal submitted by a partnership shall be signed by a member/partner or by a duly authorized agent thereof. A proposal submitted by a corporation shall be signed by an authorized officer or duly authorized registered agent of such corporation, and the proposal shall show the name of the State under the laws of which such corporation was chartered. The required signatures shall in all cases appear in the space provided thereof on the proposal.

Each proposal shall be placed, together with the proposal guaranty, in a sealed envelope, so marked as to indicate name of project, the contract number or option to which it applies, and the name and address of the Contractor or submitted electronically through Bid Express (www.bidexpress.com). Proposals will be accepted at the location, the time and the date designated in the advertisement. Proposals received after the time and date designated will be returned to the bidder unopened.

The Bidder shall execute the Disclosure of Ownership form. REFER TO SECTION F.

SECTION 102.5: BID DEPOSIT (PROPOSAL GUARANTY)

All bids, sealed or electronic, must be accompanied with a Bid Bond equal to at least 5% of the bid or a Certificate of Annual/Biennial Bid Bond or certified check, payable to the City Treasurer. Bid deposit of the successful bidders shall be returned within forty-eight (48) hours following execution of the contract and bond as required.

PREVAILING WAGE RATES

Prevailing Wage Rates may be required and are attached in Section J of the contract. See Special Provisions to determine applicability.

Bidders for this Contract(s) must be Pre-Qualified for at least one of the following type(s) of construction denoted by an ☒

Building Demolition

101 ☐ Asbestos Removal
120 ☐ House Mover
110 ☐ Building Demolition

Street, Utility and Site Construction

201 ☐ Asphalt Paving
205 ☐ Blasting
210 ☐ Boring/Pipe Jacking
215 ☐ Concrete Paving
220 ☐ Con. Sidewalk/Curb & Gutter/Misc. Flat Work
221 ☐ Concrete Bases and Other Concrete Work
222 ☐ Concrete Removal
225 ☐ Dredging
230 ☐ Fencing
235 ☐ Fiber Optic Cable/Conduit Installation
240 ☐ Grading and Earthwork
241 ☐ Horizontal Saw Cutting of Sidewalk
242 ☐ Infrared Seamless Patching
245 ☐ Landscaping, Maintenance
250 ☐ Landscaping, Site and Street
251 ☐ Parking Ramp Maintenance
252 ☐ Pavement Marking
255 ☐ Pavement Sealcoating and Crack Sealing
260 ☐ Petroleum Above/Below Ground Storage Tank Removal/Installation
262 ☐ Playground Installer
265 ☐ Retaining Walls, Precast Modular Units
270 ☐ Retaining Walls, Reinforced Concrete
275 ☐ Sanitary, Storm Sewer and Water Main Construction
276 ☐ Sawcutting
280 ☐ Sewer Lateral Drain Cleaning/Internal TV Insp.
285 ☐ Sewer Lining
290 ☐ Sewer Pipe Bursting
295 ☐ Soil Borings
300 ☐ Soil Nailing
305 ☐ Storm & Sanitary Sewer Laterals & Water Svc.
310 ☐ Street Construction
315 ☐ Street Lighting
318 ☐ Tennis Court Resurfacing
320 ☐ Traffic Signals
325 ☐ Traffic Signing & Marking
332 ☐ Tree pruning/removal
333 ☐ Tree, pesticide treatment of
335 ☐ Trucking
340 ☐ Utility Transmission Lines including Natural Gas, Electrical & Communications
399 ☐ Other_____

Bridge Construction

501 ☐ Bridge Construction and/or Repair

Building Construction

401 ☐ Floor Covering (including carpet, ceramic tile installation, rubber, VCT
402 ☐ Building Automation Systems
403 ☐ Concrete
404 ☐ Doors and Windows
405 ☐ Electrical - Power, Lighting & Communications
410 ☐ Elevator - Lifts
412 ☐ Fire Suppression
413 ☐ Furnishings - Furniture and Window Treatments
415 ☐ General Building Construction, Equal or Less than $250,000
420 ☐ General Building Construction, $250,000 to $1,500,000
425 ☐ General Building Construction, Over $1,500,000
428 ☐ Glass and/or Glazing
429 ☐ Hazardous Material Removal
430 ☐ Heating, Ventilating and Air Conditioning (HVAC)
433 ☐ Insulation - Thermal
435 ☐ Masonry/Tuck pointing
437 ☐ Metals
440 ☐ Painting and Wallcovering
445 ☐ Plumbing
450 ☐ Pump Repair
455 ☐ Pump Systems
460 ☐ Roofing and Moisture Protection
464 ☐ Tower Crane Operator
461 ☐ Solar Photovoltaic/Hot Water Systems
465 ☐ Soil/Groundwater Remediation
466 ☐ Warning Sirens
470 ☒ Water Supply Elevated Tanks
475 ☐ Water Supply Wells
480 ☐ Wood, Plastics & Composites - Structural & Architectural
499 ☐ Other_____

State of Wisconsin Certifications

1 ☐ Class 5 Blaster - Blasting Operations and Activities 2500 feet and closer to inhabited buildings for quarries, open pits and road cuts.
2 ☐ Class 6 Blaster - Blasting Operations and Activities 2500 feet and closer to inhabited buildings for trenches, site excavations, basements, underwater demolition, underground excavations, or structures 15 feet or less in height.
3 ☐ Class 7 Blaster - Blasting Operations and Activities for structures greater than 15 ' in height, bridges, towers, and any of the objects or purposes listed as “Class 5 Blaster or Class 6 Blaster”.
4 ☐ Petroleum Above/Below Ground Storage Tank Removal and Installation (Attach copies of State Certifications.)
5 ☐ Hazardous Material Removal (Contractor to be certified for asbestos and lead abatement per the Wisconsin Department of Health Services, Asbestos and Lead Section (A&LS).) See the following link for application: www.dhs.wisconsin.gov/Asbestos/Cert. State of Wisconsin Performance of Asbestos Abatement Certificate must be attached.
6 ☐ Certification number as a Certified Arborist or Certified Tree Worker as administered by the International Society of Arboriculture
7 ☐ Pesticide application (Certification for Commercial Applicator For Hire with the certification in the category of turf and landscape (3.0) and possess a current license issued by the DATCP)
8 ☐ State of Wisconsin Master Plumbers License.

SECTION B: PROPOSAL

Please refer to the Bid Express Website at https://bidexpress.com look up contract number and go to Section B: Proposal Page

You can access all City of Madison bid solicitations for FREE at www.bidexpress.com

Click on the “Register for Free” button and follow the instructions to register your company and yourself. You will be asked for a payment subscription preference, since you may wish to bid online someday. Simply choose the method to pay on a ‘per bid’ basis. This requires no payment until / unless you actually bid online. You can also choose the monthly subscription plan at this time. You will, however, be asked to provide payment information. Remember, you can change your preference at anytime. You will then be able to complete your free registration and have full access to the site. Your free access does not require completion of the ‘Digital ID’ process, so you will have instant access for viewing and downloading. To be prepared in case you ever do wish to bid online, you may wish to establish your digital ID also, since you cannot bid without a Digital ID.

If you have any problems with the free registration process, you can call the bidexpress help team, toll free at 1-888-352-2439 (option 1, option1).

SECTION C: SMALL BUSINESS ENTERPRISE

Instructions to Bidders
City of Madison
SBE Program Information

2 Small Business Enterprise (SBE) Program Information

2.1 Policy and Goal

The City of Madison reaffirms its policy of nondiscrimination in the conduct of City business by maintaining a procurement process which remains open to all who have the potential and ability to sell goods and services to the City. It is the policy of the City of Madison to allow Small Business Enterprises (SBE) maximum feasible opportunity to participate in City of Madison contracting. The bidder acknowledges that its bid has been submitted in accordance with the SBE program and is for the public's protection and welfare.

Please refer to the "ADVERTISEMENT FOR BIDS" for the goal for the utilization of SBEs on this project. SBEs may participate as subcontractors, vendors and/or suppliers, which provide a commercially useful function. The dollar value for SBE suppliers or 'materials only' vendors shall be discounted to 60% for purposes of meeting SBE goals.

A bidder which achieves or exceeds the SBE goal will be in compliance with the SBE requirements of this project. In the event that the bidder is unable to achieve the SBE goal, the bidder must demonstrate that a good faith effort to do so was made. Failure to either achieve the goal or demonstrate a good faith effort to do so will be grounds for the bidder being deemed a non-responsible contractor ineligible for award of this contract.

A bidder may count towards its attainment of the SBE goal only those expenditures to SBEs that perform a commercially useful function. For purposes of evaluating a bidder's responsiveness to the attainment of the SBE goal, the contract participation by an SBE is based on the percentage of the total base bid proposed by the Contractor. The total base bid price is inclusive of all addenda.

Work performed by an SBE firm in a particular transaction can be counted toward the goal only if it involves a commercially useful function. That is, in light of industry practices and other relevant considerations, does the SBE firm have a necessary and useful role in the transaction, of a kind for which there is a market outside the context of the SBE Program, or is the firm's role a superfluous step added in an attempt to obtain credit towards goals? If, in the judgment of the Affirmative Action Division, the SBE firm will not perform a commercially useful function in the transaction, no credit towards goals will be awarded.

The question of whether a firm is performing a commercially useful function is completely separate from the question of whether the firm is an eligible SBE. A firm is eligible if it meets the definitional criteria and ownership and control requirements, as set forth in the City of Madison's SBE Program.

If the City of Madison determines that the SBE firm is performing a commercially useful function, then the City of Madison must then decide what that function is. If the commercially useful function is that of an SBE vendor / supplier that regularly transacts business with the respective product, then the City of Madison will count 60% of the value of the product supplied toward SBE goals.

To be counted, the SBE vendor / supplier must be engaged in selling the product in question to the public. This is important in distinguishing an SBE vendor / supplier, which has a regular trade with a variety of customers, from a firm which performs supplier-like

functions on an ad hoc basis or for only one or two contractors with whom it has a special relationship.

A supplier of bulk goods may qualify as an eligible SBE vendor / supplier if it either maintains an inventory or owns or operates distribution equipment. With respect to the distribution equipment; e.g., a fleet of trucks, the term "operates" is intended to cover a situation in which the supplier leases the equipment on a regular basis for its entire business. It is not intended to cover a situation in which the firm simply provides drivers for trucks owned or leased by another party; e.g., a prime contractor, or leases such a party's trucks on an ad hoc basis for a specific job.

If the commercially useful function being performed is not that of a qualified SBE vendor / supplier, but rather that of delivery of products, obtaining bonding or insurance, procurement of personnel, acting as a broker or manufacturer's representative in the procurement of supplies, facilities, or materials, etc., only the fees or commissions will apply towards the goal.

For example, a business that simply transfers title of a product from manufacturer to ultimate purchaser; e. g., a sales representative who re-invoices a steel product from the steel company to the Contractor, or a firm that puts a product into a container for delivery would not be considered a qualified SBE vendor / supplier. The Contractor would not receive credit based on a percentage of the cost of the product for working with such firms.

Concerning the use of services that help the Contractor obtain needed supplies, personnel, materials or equipment to perform a contract: only the fee received by the service provider will be counted toward the goal. For example, use of a SBE sales representative or distributor for a steel company, if performing a commercially useful function at all, would entitle the Contractor receiving the steel to count only the fee paid to the representative or distributor toward the goal. This provision would also govern fees for professional and other services obtained expressly and solely to perform work relating to a specific contract.

Concerning transportation or delivery services: if an SBE trucking company picks up a product from a manufacturer or a qualified vendor / supplier and delivers the product to the Contractor, the commercially useful function it is performing is not that of a supplier, but simply that of a transporter of goods. Unless the trucking company is itself the manufacturer or a qualified vendor / supplier in the product, credit cannot be given based on a percentage of the cost of the product. Rather, credit would be allowed for the cost of the transportation service.

The City is aware that the rule's language does not explicitly mention every kind of business that may contribute work on this project. In administering these programs, the City would, on a case-by-case basis, determine the appropriate counting formula to apply in a particular situation.

2.2 Contract Compliance

Questions concerning the SBE Program shall be directed to the Contract Compliance Officer of the City of Madison Department of Civil Rights, Affirmative Action Division, 210 Martin Luther King, Jr. Blvd., Room 523, Madison, WI 53703; telephone (608) 266-4910.

2.3 Certification of SBE by City of Madison

The Affirmative Action Division maintains a directory of SBEs which are currently certified as such by the City of Madison. Contact the Contract Compliance Officer as indicated in Section 2.2 to receive a copy of the SBE Directory or you may access the SBE Directory online at www.cityofmadison.com/dcr/aaTBDir.cfm.

All contractors, subcontractors, vendors and suppliers seeking SBE status must complete and submit the **Targeted Business Certification Application** to the City of Madison Affirmative Action Division by the time and date established for receipt of bids. A copy of the Targeted Business Certification Application is available by contacting the Contract Compliance Officer at the address and telephone indicated in Section 2.2 or you may access the Targeted Business Certification Application online at www.cityofmadison.com/dcr/aaTBDir.cfm. Submittal of the Targeted Business Certification Application by the time specified does not guarantee that the applicant will be certified as a SBE eligible to be utilized towards meeting the SBE goal for this project.

2.4 Small Business Enterprise Compliance Report

2.4.1 Good Faith Efforts

Bidders shall take all necessary affirmative steps to assure that SBEs are utilized when possible and that the established SBE goal for this project is achieved. A contractor who self performs a portion of the work, and is pre-qualified to perform that category of work, may subcontract that portion of the work, but shall not be required to do so. When a bidder is unable to achieve the established SBE goal, the bidder must demonstrate that a good faith effort to do so was made. Such a good faith effort should include the following:

2.4.1.1 Attendance at the pre-bid meeting.
2.4.1.2 Using the City of Madison's directory of certified SBEs to identify SBEs from which to solicit bids.
2.4.1.3 Assuring that SBEs are solicited whenever they are potential sources.
2.4.1.4 Referring prospective SBEs to the City of Madison Affirmative Action Division for certification.
2.4.1.5 Dividing total project requirements into smaller tasks and/or quantities, where economically feasible, to permit maximum feasible SBE participation.
2.4.1.6 Establishing delivery schedules, where requirements permit, which will encourage participation by SBEs.
2.4.1.7 Providing SBEs with specific information regarding the work to be performed.
2.4.1.8 Contacting SBEs in advance of the deadline to allow such businesses sufficient time to prepare a bid.
2.4.1.9 Utilizing the bid of a qualified and competent SBE when the bid of such a business is deemed reasonable (i.e. 5% above the lowest bidder), although not necessarily low.
2.4.1.10 Contacting SBEs which submit a bid, to inquire about the details of the bid and confirm that the scope of the work was interpreted as intended.

2.4.2 Reporting SBE Utilization and Good Faith Efforts

The Small Business Enterprise Compliance Report is to be submitted by the bidder with the bid: This report is due by the specified bid closing time and date. Bids submitted without a completed SBE Compliance Report as outlined below shall be deemed non-responsible and the bidder ineligible for award of this contract.

2.4.2.1 If the Bidder meets or exceeds the goal established for SBE utilization, the Small Business Enterprise Compliance Report shall consist of the following:

2.4.2.1.1 **Cover Page,** Page C-6; and
2.4.2.1.2 **Summary Sheet,** C-7.

2.4.2.2 If the bidder does not meet the goal established for SBE utilization, the Small Business Enterprise Compliance Report shall consist of the following:

2.4.2.2.1 **Cover Page,** Page C-6;
2.4.2.2.2 **Summary Sheet,** C-7; and
2.4.2.2.3 **SBE Contact Report,** C-8 and C-9. (A separate Contact Report must be completed for each applicable SBE which is not utilized.)

2.5 Appeal Procedure

A bidder which does not achieve the established goal and is deemed non-responsible for failure to demonstrate a good faith effort to achieve such goal and subsequently denied eligibility for award of contract may, within 72 hours of receiving such notification, appeal that decision to a special appeals committee composed of three (3) members of the Affirmative Action Commission, three (3) members of the Board of Public Works and a seventh member appointed by the Mayor. All appeals must be made in writing to the City Engineer and received within 72 hours of City of Madison's notice. Postmark not applicable.

2.6 SBE Requirements After Award of the Contract

The successful bidder shall identify SBE subcontractors, suppliers and vendors on the subcontractor list in accordance with the specifications. The Contractor shall submit a detailed explanation of any variances between the listing of SBE subcontractors, vendors and/or suppliers on the subcontractor list and the Contractor's SBE Compliance Report for SBE participation.

No change in SBE subcontractors, vendors and/or suppliers from those SBEs indicated in the SBE Compliance Report will be allowed without prior approval from the Engineer and the Affirmative Action Division. The contractor shall submit in writing to the City of Madison Affirmative Action Division a request to change any SBE citing specific reasons which necessitate such a change. The Affirmative Action Division will use a general test of reasonableness in approving or rejecting the contractor's request for change. If the request is approved, the Contractor will make every effort to utilize another SBE if available.

The City will monitor the project to ensure that the actual percentage commitment to SBE firms is carried out.

2.7 SBE Definition and Eligibility Guidelines

A Small Business Enterprise is a business concern awarded certification by the City of Madison. For the purposes of this program a Small Business Enterprise is defined as:

A. An independent business operated under a single management. The business may not be a subsidiary of any other business and the stock or ownership may not be held by any individual or any business operating in the same or a similar field. In determining whether an entity qualifies as a SBE, the City shall consider all factors relevant to being an independent business including, but not limited to, the date the business was established, adequacy of its resources for the work in which it proposes to involve itself, the degree to which financial, equipment leasing and other relationships exist with other ineligible firms in the same or similar lines of work. SBE owner(s) shall enjoy the customary incidents of ownership and shall share in the risks and profits commensurate with their enjoyment interests, as demonstrated by an examination of the substance rather than form or arrangements that may be reflected in its ownership documents.

B. A business that has averaged no more than $4.0 million in annual gross receipts over the prior three year period and the principal owner(s) do not have a personal net worth in excess of $1.32 million.

Firm and/or individuals that submit fraudulent documents/testimony may be barred from doing business with the City and/or forfeit existing contracts.

SBE certification is valid for one (1) year unless revoked.

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

Small Business Enterprise Compliance Report

This information may be submitted electronically through Bid Express or submitted with bid in sealed envelope.

Cover Sheet

Prime Bidder Information

Company:_____

Address:_____

Telephone Number:_____ Fax Number:_____

Contact Person/Title:_____

Prime Bidder Certification

I, _____, _____ of
Name Title

_____ certify that the information
Company

contained in this SBE Compliance Report is true and correct to the best of my knowledge and belief.

_____ _____
Witness' Signature Bidder's Signature

_____
Date

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

Small Business Enterprise Compliance Report

Summary Sheet

SBE Subcontractors Who Are NOT Suppliers

Name(s) of SBEs Utilized	Type of Work	% of Total Bid Amount
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%

Subtotal SBE who are NOT suppliers: _____ %

SBE Subcontractors Who Are Suppliers

Name(s) of SBEs Utilized	Type of Work	% of Total Bid Amount
		%
		%
		%
		%
		%
		%

Subtotal Contractors who are suppliers: _____ % x 0.6 = _____ % (discounted to 60%)

Total Percentage of SBE Utilization: _____%.

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

Small Business Enterprise Compliance Report

SBE Contact Report

Submit separate copy of this form for each SBE which you are not able to utilize towards meeting the SBE goal for this project. Attach separate sheets if necessary.

SBE Information

Company: _____

Address: _____

Telephone Number: _____

Contact Person/Title: _____

1. Outline below all efforts to solicit a bid from the above SBE. Include date, means of contact, who from your company made this contact and the result.

   _____

   _____

   _____

2. Describe the information provided to the aforementioned SBE regarding the scope of work for which he/she was to provide a bid.

   _____

   _____

   _____

   Is this the same scope of work on which the subcontractor you intend to utilize based his/her bid?

   ☐ Yes ☐ No

3. Did this SBE submit a bid? ☐ Yes ☐ No

4. Is the General Contractor pre-qualified to self-perform this category of work?

   ☐ Yes ☐ No

5. If you responded “Yes” to Question 3, please check the items below which apply and provide the requested detail. If you responded “No” to Question 3, please skip ahead to item 6 below.

☐ The SBE listed above is unavailable for work on this project for the following reasons. Provide specific detail for this conclusion.

_____

_____

☐ The SBE listed above is unqualified for work on this project. Provide specific details for this conclusion.

_____

_____

☐ The SBE listed above provided a price that was unreasonable (i.e. more than 5% above the lowest bidder). Provide specific detail for this conclusion including the SBE’s price and the price of the subcontractor you intend to utilize.

_____

_____

☐ A contract with the SBE listed above may constitute a breach of the bidder’s collective bargaining agreements. Provide specific detail for this conclusion including, but not limited to, correspondence from the SBE indicating it will not sign a project labor agreement and/or correspondence from the applicable trade union indicating a project labor agreement will not be allowed at the time of project bidding.

_____

_____

☐ Other; please specify reason(s) other than listed above which made it impossible for you to utilize this SBE on this project.

_____

_____

6. Describe any other good faith efforts:

_____

_____

SECTION D: SPECIAL PROVISIONS

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

It is the intent of these Special Provisions to set forth the final contractual intent as to the matter involved and shall prevail over the Standard Specifications and plans whenever in conflict therewith. In order that comparisons between the Special Provisions can be readily made, the numbering system for the Special Provisions is equivalent to that of the Specifications.

Whenever in these Specifications the term "Standard Specifications" appears, it shall be taken to refer to the City of Madison Standard Specifications for Public Works Construction and Supplements thereto.

SECTION 102.10: PREVAILING WAGE

For this project, payment of prevailing wages (white sheet) shall be required unless the box indicating prevailing wages are not required is checked below.

☐ Prevailing wages shall not be required when this box is checked.

If prevailing wages (white sheets) are required, the wages and benefits paid on the contract shall not be less than those specified in the Prevailing Wage Determination included with these contract documents for the following types of work:

☒ Building or Heavy Construction
☐ Sewer, Water, or Tunnel Construction
☐ Local Street or Miscellaneous Paving Construction
☐ Residential or Agricultural Construction

When multiple boxes are checked, worker's wages may vary according to the type and area of work performed. It is the responsibility of the Contractor to determine and apply the appropriate wage rate for the specific work assigned.

SECTION 102.12: BEST VALUE CONTRACTING

Add the following paragraph to the end of Section 102.12:

This Contract shall be considered a Best Value Contract if the Contractor's bid is equal to or greater than $54,000 for a single trade contract; or equal to or greater than $264,500 for a multi-trade contract pursuant to MGO 33.07(7).

SECTION 103.2: AWARD OF CONTRACT

Revise Section 103.2 to read:

All bid shall remain open for ninety (90) calendar days after the day of bid opening. Award will be made to the lowest responsible bidder submitting a conforming bid, unless all bids are rejected.

SECTION 103.5:

The Contractor shall file with the City prior to the time of execution of the contract a payment and Performance Bond on the prescribed form in the full amount of the contract price as security for the payment of all persons supplying labor, services, and materials for the execution of the work and the faithful performance of the contract. The bond shall remain in effect for a period of two years after the date of Certificate of Substantial Completion. The surety furnishing this bond shall have a sound financial standing, a record of service satisfactory to the City, and shall be authorized to do business in the State of Wisconsin.

SECTION 104.1: LANDS FOR WORK

Revise Section 105.1 to read:

The City shall provide the easement upon which the work under this contract is to be done.

It is anticipated, but not guaranteed, that the construction easement for this project will be obtained prior to site construction activities. In no case shall the contractor mobilize on site until the easement is obtained. If the easement is delayed, an appropriate change to the schedule will be made.

Contractor shall make arrangements and pay for contractor employee parking off site of the county owned parcels. Contractor shall provide shuttle to bring employees on and off this site.

SECTION 105.1: AUTHORITY OF THE ENGINEER

The Engineer shall resolve all questions which arise as to the quality and acceptability of materials furnished, work performed, manner of performance, rate progress of the work, interpretation of the plans and Specifications, acceptable fulfillment of the contract, compensation, and disputes, and mutual rights between Contractors under the Specifications. The Engineer shall determine the amount and quantity of work performed and materials furnished.

All decisions of the Engineer shall, when so requested, be rendered in writing. They shall be final and conclusive in all matters unless within ten (10) days after such decision the Contractor applies in writing to the Board of Public Works for a review such decision.

Any change proposed by a Contractor in SBE subcontractors, vendors or suppliers from those SBEs indicated on the SBE Compliance Report must be approved by the Engineer and the City's Manager of the Affirmative Action Division (hereafter, AAD). When requested, such decision shall be rendered in writing. Such decisions shall be final and conclusive in all matters unless within ten (10) days after such decision the Contractor or the affected SBE applies in writing to the Board of Public Works for review of such decision.

In the event the Engineer and the AAD disagree over the proper decision to be made regarding an SBE, the Mayor shall appoint a third person to resolve the disagreement, within 30 days of appointment. The decision thus rendered may be reviewed by the Board of Public Works upon request of the Contractor or the affected SBE as set forth in Section 105.1 and 105.2 of the City's standard specifications.

SECTION 105.6: CONTRACTOR'S RESPONSIBILITY FOR WORK

Add the following paragraph to the end of Section 105.6:

CONTRACTOR shall keep at the Site at all times during the progress of the Work a competent person to comply with OSHA trenching and excavation requirements. The competent person shall be one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

CONTRACTOR shall provide a photographic record of construction and construction progress. Provide a minimum of 10 photos per week. All utilities that are buried or hidden within the construction shall be photographed prior to covering. CONTRACTOR shall submit photographs in the format described below with each payment application.

Photographs shall be color digital photographs. Photographs shall be date-stamped. Photographs shall be provided in a digital format only on compact disc media. Photographs shall be submitted in the .jpg format. Alternate formats may be approved by the OWNER. Photos shall be taken with a minimum 5.0 megapixel camera at highest quality resolution.

CONTRACTOR shall provide a photo log in a Word document stored on compact disk. The photo log shall include photo identification, file name, location information, brief description, and date of photo. Photo log shall contain a minimum of ten photographs per week.

CONTRACTOR shall provide and maintain an e-mail address for electronic communication.

SECTION 105.7: CONTRACT DRAWINGS

Add the following paragraph to the end of Section 105.7:

CONTRACTOR shall keep one record copy of all specifications, drawings, addenda, modifications, and shop drawings at the site in good order and shall record on the drawings all changes made during the construction process. CONTRACTOR providing buried or concealed piping, conduit, or similar items shall locate all such items by dimensions and elevations. The daily record of changes shall be the responsibility of CONTRACTOR's field superintendent No arbitrary mark-ups shall be permitted. CONTRACTOR shall submit his marked up record documents to ENGINEER **prior** to final payment. See Section 105.19 Schedule of Values regarding payment for record documents.

SECTION 105.15: SUBSTANTIAL COMPLETION

Add the following to the end of Section 105.15:

The Project shall be substantially complete and ready for final payment no later than November 15, 2015.

SECTION 105.17: PROGRESS SCHEDULE

Section 105.17 is added as follows:

Within 10 days after delivery of the Notice to Proceed, CONTRACTOR shall submit to OWNER, for approval, an estimated progress schedule indicating the starting and completion dates of the various stages of work, and a preliminary schedule of shop drawing submissions.

Progress schedule shall be updated prior to each construction meeting and an updated schedule submitted with each payment application.

SECTION 105.18: PRECONSTRUCTION CONFERENCE

Section 105.18 is added as follows:

Before starting the work at the project sites, a conference will be held to review schedules, to establish procedures for handling shop drawings and other submissions and for processing Applications for Payment, to review list of proposed subcontractors, to establish a working understanding between the parties as to the project, and to discuss project details.

SECTION 105.19: SCHEDULE OF VALUES OF THE WORK

Section 105.19 is added as follows:

At least ten days following the issuance of the Notice to Proceed, CONTRACTOR shall submit to ENGINEER a schedule of values of the work. This schedule shall include quantities and unit prices aggregating the Contract price and shall subdivide the work into component parts according to Specification sections in sufficient detail to serve as the basis for progress payments during construction. This schedule, when approved by ENGINEER, shall be used as a basis for CONTRACTOR's Application for Payment.

Include lump sum items in the following amounts in the Schedule of Values:

1. Training $5,000
2. Operation and Maintenance Manuals $5,000

3. Record Documents $5,000

Payment of these items will only be made upon completion of these items.

SECTION 106.6: SUBSTITUTE MATERIALS OR EQUIPMENT

Section 106.6 is added as follows:

Whenever in any of the Contract Documents an article, material, or equipment is defined by describing a proprietary product, or by using the name of a manufacturer or vendor, the term ‘or equal," if not inserted, shall be implied. The specific article, material, or equipment mentioned shall be understood as indicating the type, function, minimum standard of design, efficiency, and quality desired, and shall not be construed in such a manner as to exclude manufacturer's products of comparable quality, design and efficiency. If CONTRACTOR wishes to furnish or use a proposed substitute, he shall, prior to the preconstruction conference, make written application to the ENGINEER, for approval of such a substitute certifying, in writing, that the proposed substitute will perform adequately the functions called for by the general design, be similar and of equal substance to that specified and be suited to the same use and capable of performing the same function as that specified; stating whether or not its incorporation in or use in connection with the project is subject to the payment of any license fee or royalty; and identifying all variations of the proposed substitute from that specified and indicating available maintenance service. No substitute shall be ordered or installed without the written approval of the ENGINEER, who will be the judge of equality and may require CONTRACTOR to furnish such other data about the proposed substitute as considered pertinent. No substitute shall be ordered or installed without such performance guarantee and bonds as the ENGINEER may require which shall be furnished at CONTRACTOR's expense.

SECTION.107.1: PROTECTION OF PUBLIC AND UTILITY INTERESTS

Section 1 07.1 is amended as follows:

In order to abate objectionable noise to the extent feasible, motorized construction equipment shall not be operated between the hours of 7:00 P.M. and 7:00 A.M. without the prior written approval of ENGINEER.

The contractor shall use Lakeview Avenue for access to the site. The access from Northport Drive shall be restricted from all vehicle use except for semi-trailer deliveries that can only occur with written notice to the county via e-mail a minimum of five (5) business days in advance of each usage and shall limit deliveries to the periods of 5:00 P.M. – 8:00 P.M. Monday thru Friday and 8:00 A.M. – 8:00 P.M. Saturday. No deliveries shall occur on Sundays. Contractor shall comply with the City’s noise ordinance at all times. Any violation of the truck restriction shall result in a payment from contractor to Owner in the amount of $500 for each truck violation.

SECTION 108.2: PERMITS AND LICENSING

Add the following to the end of Section 108.2:

CONTRACTOR shall secure all required building permits.

Madison Water Utility will pay any required building permit fees.

SECTION 109.6: SUSPENSE OF WORK

Add the following to the end of Section 109.6:

The contractor shall meet the following project time line (Time line is not guaranteed by the Owner and can be adjusted to meet City requirements). The following schedule shall serve as written notification to Contractor for suspension of work for specified periods:

Sept 2014	Tree cutting/grubbing by others Monopole/radio building by others Fencing and erosion control by others Crane pad by others Existing tank demolition by others
Oct – Nov 2014	Watermain construction by others
11/15/14 – 1/15/15	Water Tower foundation construction (Contractor may not mobilize on site until 11/15/14)
1/15/15 – 4/1/15	No activity allowed on site, Contractor demobilizes off site
4/1/15 – 7/31/15	Water tower construction
8/1/15 – 9/30/15	Water tower painting
10/1/15 – 11/30/15	Relocation by cell carriers and City radio of their equipment to new water tower, removal of monopole
11/1/15 – 11/15/15	Water tower contractor completes paving after monopole is removed by 11/1/15. If monopole is not removed by 11/1/15, paving will be completed 5/1/16 to 5/15/16
5/15/16 – 7/1/16	Landscaping work completed by others. Temporary erosion control and fencing removed by others.

SECTION 110.2: PARTIAL PAYMENTS

Add the following to the end of Section 110.2:

All stored equipment and materials for which payment is requested shall have two copies of invoices included with the pay request. Equipment shall be identified thoroughly on the invoices, including serial numbers. Payment for the stored equipment and material which are on the site shall not exceed the invoiced amount for each item, less the contract retainage. The overhead and profit for the stored items shall not be invoiced until the item is installed.

Payment for off-site storage is normally reserved for sensitive or very large pieces of equipment that in ENGINEER's opinion would not be practical to have stored on the site. Payment for off-site stored items shall be limited to 75% of the invoiced value of the item, less contract retainage. CONTRACTOR shall reimburse OWNER the cost of inspecting off-site stored items. When off-site storage is approved CONTRACTOR shall provide Insurance Certificates and Document of Ownership to OWNER.

No partial payments shall be permitted for line items for training, operation and maintenance manuals, or record drawing called for under Section 105.19.

DOCUMENT 00 01 05

CERTIFICATION

I hereby certify that this specification was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Wisconsin.

_____

Jon I. Strand, PE

Date: _____ Lic. No. _____

Reviewed By: _____

Date: _____

This Page Left Blank Intentionally

DOCUMENT 00 01 10

TABLE OF CONTENTS

This Page Left Blank Intentionally

DOCUMENT 00 31 32

GEOTECHNICAL DATA

PART 1 GENERAL

1.01 FOUNDATION BORING NOTES

A. Data shown on boring logs is for the Bidders' information. Bidder should be cognizant that materials between borings can vary from that shown on logs. Final and complete identification of all materials between borings can be verified only by Site excavation. Bidder shall assume full responsibility for excavating all materials encountered during construction regardless of density or groundwater condition.

B. The boring logs are an exact copy of the originals made by photo process reproduction. This information was obtained for design purposes and is made available to Bidders so they may have the same information the designers used. This information is not intended as a substitute for Bidder's personal investigations, interpretations, or judgment. Bidder may make his own soils investigation, but he must first obtain Engineer's approval. Failure of Bidder to conduct his own investigation or to analyze available data shall not relieve Bidder of any responsibility in excavating difficult materials.

C. Water levels indicated on the boring logs are subject to seasonal and/or annual variations.

D. The original investigation report is available for Bidder's inspection at Engineer's office.

END OF DOCUMENT

This Page Left Blank Intentionally

CGC, Inc.

Construction • Geotechnical
Consulting Engineering/Testing

May 16, 2014
C14091

Mr. Al Larson, P.E.
Madison Water Utility
119 East Olin Avenue
Madison, WI 53713-1431

Re: Geotechnical Exploration Report
Lakeview Water Tower Replacement
Madison, Wisconsin

Dear Al:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the subsurface exploration program for the new water tower proposed to replace the existing tower at 1202 Northport Drive. The purpose of this program was to evaluate the subsurface conditions within the proposed construction area and to provide geotechnical recommendations regarding subgrade preparation, foundation design/construction and utility installation. We are sending an electronic copy of this report to you and Dennis Cawley, and are also sending a pdf copy to Mr. Jon Strand of SEH, the project engineer.

PROJECT DESCRIPTION

We understand that the existing water tower will be demolished and replaced with a larger, double-tank tower consisting of a cylindrical, 1-million gallon capacity standpipe storage tank at the base with a smaller 300,000 gallon flared tank at the top. The existing four-legged elevated tank will be demolished, and the new tank will be constructed at the same location within the same approximate footprint. Both concrete and steel tanks are being considered, and as a result, details on the foundation configuration, loads and depths have not been established at this point. For purposes of this report, we have assumed that the water tower, whether steel or concrete, will be supported on either a circular mat foundation or ring wall spread footings. Because a competent bedrock layer was found relatively close to the ground surface, we have further assumed the foundation will bear on or within bedrock rather than on the overlying clay/sand strata.

SITE CONDITIONS

The existing tower is located near the top of a large hill behind the Dane County Department of Human Services (DHS) building at 1202 Northport Drive on the north side of Madison. The tower is on City of Madison property but is surrounded by Dane County property which includes the DHS building to the south, parking lots and a wooded county park. A residential neighborhood of single family homes adjoins the park boundary to the east, north and west sides. A number of cell phone and radio transmitters are mounted on the four-legged elevated tower, and several small equipment buildings are located near the base of the tower. Ground surface elevations within the proximity of the proposed tank are typically at EL 1013 to 1015, with site grades falling off to the south by about 10 ft near Boring 5 where the new water main will be installed.

2921 Perry Street, Madison WI 53713
Telephone: 608/288-4100
FAX: 608/288-7887

SUBSURFACE CONDITIONS

Subsurface conditions on site were explored by drilling five Standard Penetration Test (SPT) soil and rock borings to depths of 10 to 100 ft below existing site grades. The number and desired locations of the borings were selected by SEH following industry guidelines for elevated tanks. However, due to numerous site constraints, the actual locations were adjusted by CGC and the driller with the approval of Madison Water Utility and SEH. The site constraints included the security fence, existing electrical/water equipment inside the fenced area, buried utilities and property boundaries. The boring locations are shown in plan on the Soil Boring Location Map attached in Appendix B. The borings were drilled on April 20-25, 2014 by Badger State Drilling (under subcontract to CGC) using an ATV-mounted CME-750 rotary drill rig equipped with hollow-stem augers, an automatic SPT hammer and NX-size rocking coring equipment. Borings 1 through 4 were located near the base of the new/existing tower and were performed as SPT borings to auger refusal on bedrock at depths of 6.5 to 11 ft. The borings were then completed to their planned depths by rock coring. Boring 5 was performed south of the tower base along a proposed utility line and was extended to 10 ft as an SPT boring. Ground surface elevations at the boring locations were interpolated from a topographic map provided to us by SEH.

The subsurface profile at the boring locations is fairly consistent and can generally be described by the following strata (in descending order):

- 4 to 5 in. of ***topsoil***, underlain by
- 3 to 3.7 ft of stiff to very stiff ***lean clay***, followed by
- 2.5 to 7 ft of loose to very dense ***sand strata*** with varying proportions of silt and gravel, underlain by
- Weathered to sound ***dolomite bedrock*** extending to the maximum depth explored in Borings 1 through 4, except for the layer of sandstone bedrock found below 95 ft in Boring 1.

As exceptions to the above profile, the topsoil and clay layers were not present in Boring 1, and the sand strata appears to grade into weathered bedrock near 4 ft. Also, Boring 5 terminated in the sand/weathered bedrock stratum at 10 ft prior to reaching auger refusal.

The depth to the top of the relatively sound dolomite bedrock (where auger refusal occurred and rock coring could begin) ranged from 6.5 to 11 ft, corresponding to EL 1002 to 1007.7 ft, in Borings 1 through 4. Core recoveries were typically 80 to 100%, except for a few very fractured zones or the very erodible sandstone layer that was encountered below 95 ft in Boring 1. Rock Quality Designations (RQD[1]) are included on the boring logs for each core run and are summarized in Table 1. The average RQD in the upper 30 to 35 ft of bedrock in Borings 1 through 4 is about 33%, but RQD improves with depth in Boring 1 to an overall average of 64% for the entire length of rock cored in that boring. Based on their observation of the drilling action, the drillers did not note significant voids or cavities while drilling.

[1] Rock quality designation (RQD) is the sum of the length of core pieces at least 4 in. long divided by the length of the core run, expressed as a percent.

Table 1
Summary of Core Recoveries and Rock Quality Designations
Lakeview Water Tower Replacement

Boring	Run #	Depth, ft	Length of Run, ft	Length Recovered, in.	Recovery, %	Sum of Pieces > 4 in.	RQD[1], %	Upper/ Lower Zone RQD, %	Total RQD, %
1	1	8.5 to 12	3.5	42	100%	18.3	43%	54%	64%
	2	12 to 17	5	50	83%	29.0	48%		
	3	17 to 25	8	96	100%	52.5	55%		
	4	25 to 35	10	120	100%	72.8	61%		
	5	35 to 42	7	81	96%	57.3	68%	68%	
	6	42 to 52	10	120	100%	109.3	91%		
	7	52 to 62	10	115	96%	87.3	73%		
	8	62 to 72	10	116	97%	71.0	59%		
	9	72 to 75	3	34	94%	27.0	75%		
	10	75 to 85	10	110	92%	89.0	74%		
	11	85 to 87	2	11	46%	5.0	21%		
	12	87 to 95.5	8.5	102	100%	87.0	85%		
	13	95.5 to 100	4.5	0	0%	0.0	0%		
2	1	8.5 to 11.5	3	8	22%	0.0	0%	19%	19%
	2	11.5 to 14	2.5	30	100%	12.0	40%		
	3	14 to 22	8	78	81%	24.0	25%		
	4	22 to 30	8	67	70%	14.0	15%		
3	1	11 to 16	5	24	40%	0.0	0%	27%	27%
	2	16 to 19	3	32	89%	7.8	22%		
	3	19 to 22	3	26.5	74%	9.3	26%		
	4	22 to 30	8	96	100%	44.3	46%		
4	1	6.5 to 15.5	9	83	77%	12.8	12%	34%	34%
	2	15.5 to 22	6.5	66.75	86%	38.8	50%		
	3	22 to 27	5	50.5	84%	21.5	36%		
	4	27 to 30	3	34.5	96%	23.0	64%		

1. Rock Quality Designation (RQD) is the sum of the intact core pieces greater than 4 in. in length divided by the total length of the core run, expressed as a percent.

Groundwater was not encountered in the borings during or shortly after drilling, although the use of drilling fluid to core rock obscured the true groundwater level. Groundwater levels are expected to fluctuate with seasonal variations in precipitation, infiltration, evapotranspiration and other factors, but are anticipated to be below the excavation depths required for this project. A more detailed description of the site soil and groundwater conditions is presented on the Soil Boring Logs attached in Appendix B. Photographs of each core box containing up to 10 ft of rock core are included for future reference in Appendix F.

DISCUSSION AND RECOMMENDATIONS

Subject to the limitations discussed below and based on the subsurface exploration, it is our opinion that the site is suitable for the proposed construction and that the tower can be supported by conventional spread footing foundations at a relatively high allowable bearing pressure on the bedrock layer. Our recommendations for subgrade preparation, foundation and utility design/construction are presented in the following subsections. Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix C.

1. Subgrade Preparation

Following demolition of the existing tower, excavation to proposed base grade for the new tower foundation can commence. As noted above, because of the relatively heavy foundation loads anticipated and the proximity to bedrock, we anticipate that the ring wall footings or mat foundation will extend to the layer of dolomite bedrock found about 6 to 11 ft below grade. Depending on the foundation grade selected by the tower designer, we anticipate that one of the following procedures is likely to be followed:

- The foundation grade will be set relatively deep, and bedrock excavation will be required. We anticipate this will require ripping with a rock tooth mounted on a large dozer/excavator or chipping with a hydraulically powered rock hammer. Blasting could also be considered if approved by local authorities and if vibration levels are monitored to check that the procedures are in compliance with state code.

- Foundation grade may be set shallow (say, at 6 to 8 ft), and the sand/clay soil and closely fractured/loose rock overlying sound bedrock will be removed where necessary and replaced with either lean mix concrete (with an unconfined compressive strength ($\mathbf{f'_c}$) of at least 1000 psi at 28 days) or additional footing concrete.

- Foundation grade will be set at an intermediate depth, and a combination of bedrock removal and undercutting/concrete replacement of soil above bedrock will be used.

2. Foundation Design

In our opinion, the proposed structure can be supported on reinforced concrete spread footings or a mat foundation bearing on bedrock (or replacement concrete after removal of overburden soils as described above), and the following parameters should be used for foundation design:

- Maximum allowable bearing pressure:
  - On weathered bedrock: 15,000 psf
  - On sound bedrock: 30,000 psf

- Minimum footing depth for frost protection: 4 ft

As discussed above, undercutting below footing grade will be required where soil exists above bedrock. In view of the relatively high bearing pressure recommended on the bedrock layer, we recommend that footing subgrades be checked by CGC once loose rock has been removed to expose a relatively consistent bedrock layer. CGC should be present while the contractor drills 5-ft deep holes in each quadrant of the tower base using a hand-held rock hammer/drill and a nominal 2-in. diameter, 5-ft long drill bit. If significant voids are encountered during this procedure, we recommend that they be filled with cement grout. More specific recommendations can be provided as necessary. Note that if the higher bearing value of 30 ksf is used, it is likely that rock with 0% RQD (e.g., Run 1 in both Borings 2 and 3) will need to be removed during subgrade preparation. If the lower value of 15 ksf is used, less of the closely fractured rock would need to be removed. Where undercutting of soil or loose rock is required, the base of the undercut excavations should be widened beyond the footing edges at least 0.5 ft in each direction for each foot of undercut depth for stress distribution purposes. Grade can be restored using either lean mix concrete (with f'_c of at least 1000 psi at 28 days) or additional footing concrete. Provided the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements should not exceed 1.0 and 0.5 in., respectively.

We recommend using granular soils as structural backfill against the foundation, as these soils are generally easier to place and compact in most weather conditions. Note that the sand soils encountered below the topsoil and shallow clayey layers are considered adequate for use as structural fill. We do not recommend using clay/silt soils as structural fill because moisture conditioning will likely be required to achieve desired compaction levels, which could delay construction progress. Instead, silt/clay soils can be used as fill in landscaped areas. Backfill should be compacted to at least 92% (ASTM D1557) in accordance with our Recommended Compacted Fill Specifications presented in Appendix D. If the dead weight of backfill above the footing projection beyond the foundation wall is factored into overturning calculations, we recommend that a moist unit weight of 120 lb/cu ft be used for sand backfill compacted as described above.

3. Utility Construction

Based on the available soil and groundwater information, it appears that water main installation to the new tank in the vicinity of Boring 5 can proceed using traditional open cut methods. Dewatering will likely not be required. It is expected that excavation sidewalls will be sloped back for relatively shallow installations (i.e., less than 8 ft in depth) and that a trench shield and/or internal bracing will be used for deeper excavations. The following are our recommendations regarding trench excavation, dewatering, and backfilling:

- Excavation: Open cuts should be sloped and/or braced in accordance with OSHA guidelines. Slopes of 1H:1V or flatter through the on-site soil deposits are generally expected to be at least temporarily stable. Temporary bracing should be designed by a registered professional engineer.

- Rock Removal: Even though Boring 5 could be completed to a depth of 10 ft without encountering auger refusal, the presence of more competent bedrock at relatively shallow depths in the other borings indicates that there is a potential for rock removal being required along the new pipeline. The use of a ripper tooth on a large excavator/backhoe or a backhoe-mounted rock chisel may be required in some locations. Refer to Appendix E for suggested definitions of bedrock for payment purposes.

- Dewatering: Based on observations made during the field exploration, groundwater infiltration into shallow excavations is generally not expected to be a problem.

- Backfilling - Excavation backfilling may proceed using the following guidelines:

  A. Both clayey and sandy excavation spoils may be used to backfill the utility trenches above the pipe and associated granular bedding material in landscaped areas. *However, we recommend that granular soils be used as backfill below paved areas because they are relatively easy to place and compact in most weather conditions.* The clayey soils on site will likely require some moisture conditioning prior to placement and compaction, which could delay construction progress. Granular soils with cobbles and boulders should not be used in direct contact with utility lines.

  B. Backfill material should be placed in accordance with recommendations presented in Appendix D of this report.

  C. Compaction recommendations below pavements:
     - Depths greater than 3 ft below grade: 90% modified Proctor (ASTM D1557)
     - Final 3 ft: 95% modified Proctor

CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties which could be encountered on the site are discussed below:

- Due to the potentially sensitive nature of some of the on-site soils, we recommend that final site grading activities be completed during dry weather, if possible. Construction traffic should be avoided on prepared subgrades to minimize potential disturbance.

- Earthwork construction during the early spring or late fall could be complicated as a result of wet weather and freezing temperatures. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen or on frozen ground.

- Excavations extending greater than 4 ft in depth below the existing ground surface should be sloped or braced in accordance with current OSHA standards.

- Based on observations made during the field exploration, groundwater infiltration into foundation excavations is not expected to be a problem. However, water accumulating at the base of excavations as a result of precipitation or seepage should be controlled and quickly removed using pumps operating from filtered sump pits.

RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceeds in accordance with our recommendations, the following operations should be monitored by CGC:

- Foundation excavation/subgrade preparation;

- Concrete placement; and

- Fill/backfill placement and compaction.

* * * * *

It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

William W. Wuellner, P.E.
Senior Geotechnical Engineer

Michael N. Schultz, P.E.
Principal/Consulting Professional

Encl: Appendix A - Field Exploration
Appendix B - Soil Boring Location Plan
Logs of Test Borings (5)
Log of Test Boring-General Notes
Unified Soil Classification System
Appendix C - Document Qualifications
Appendix D - Recommended Compacted Fill Specifications
Appendix E - Rock Excavation Considerations
Appendix F – Bedrock Core Photographs

cc: Mr. Dennis Cawley, P.E., Madison Water Utility
Mr. Jon Strand, P.E., SEH

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

Subsurface conditions on site were explored by drilling five Standard Penetration Test (SPT) soil and rock borings to depths of 10 to 100 ft below existing site grades. The number and desired locations of the borings were selected by SEH following industry guidelines for elevated tanks. However, due to numerous site constraints, the actual locations were adjusted by CGC and the driller with the approval of Madison Water Utility and SEH. The boring locations are shown in plan on the Soil Boring Location Map attached in Appendix B. The borings were drilled on April 20-25, 2014 by Badger State Drilling (under subcontract to CGC) using an ATV-mounted CME750 rotary drill rig equipped with hollow-stem augers, an automatic SPT hammer and NX-size rocking coring equipment. Borings 1 through 4 were located near the base of the new/existing tower and were performed as SPT borings to auger refusal on bedrock at depths of 6.5 to 11 ft. The borings were then completed to their planned depths by rock coring. Boring 5 was performed south of the tower base along a proposed utility line and was extended to 10 ft as an SPT boring. Ground surface elevations at the boring locations were interpolated from a topographic map provided to us by SEH.

In each boring, soil samples were obtained at 2.5 foot intervals to a depth of 10 ft and at 5 ft intervals thereafter. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

   The boring is extended downward, between samples, by a hollow-stem auger.

2. Standard Penetration Test and Split-Barrel Sampling of Soils
   (ASTM Designation: D 1586)

   This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance.

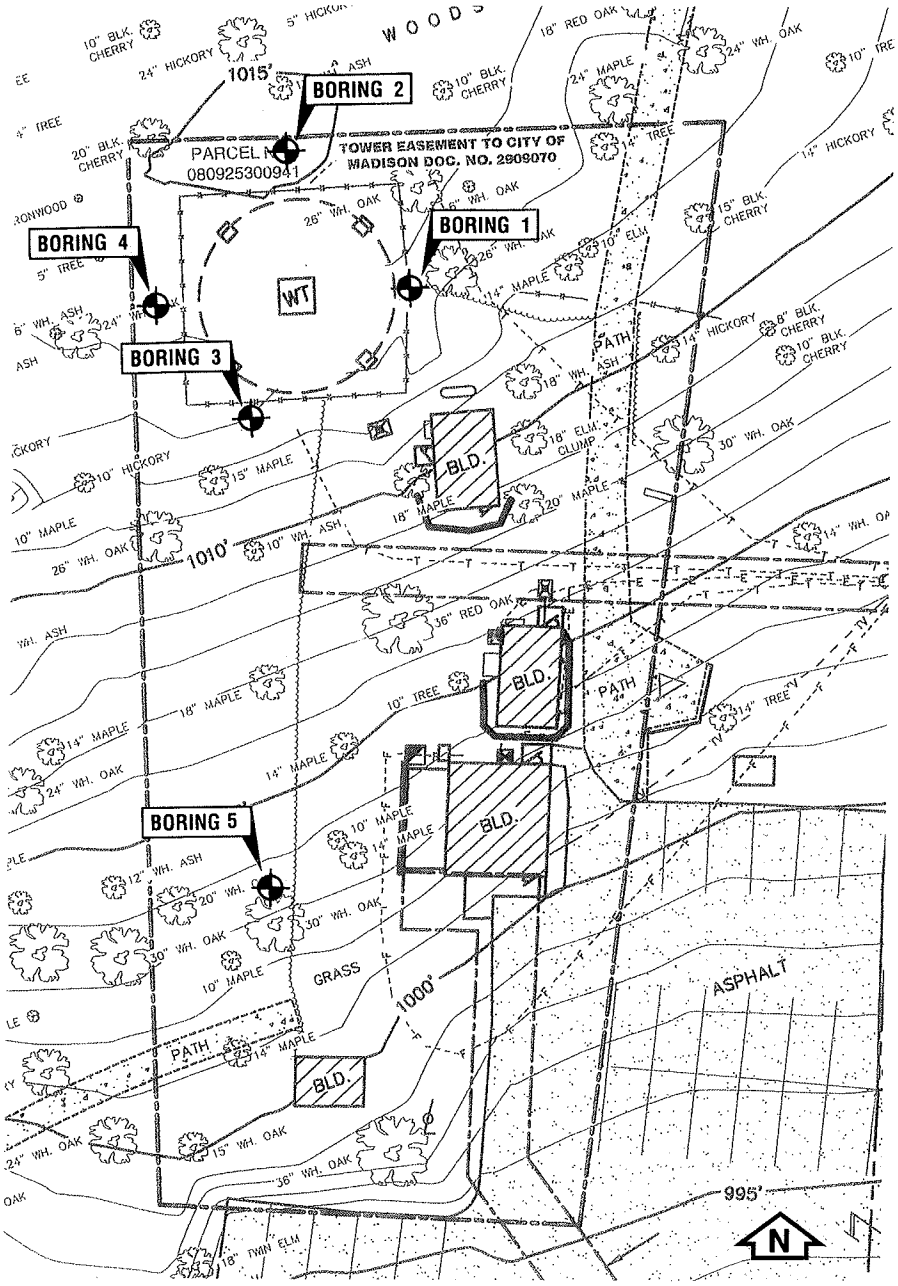
3. Diamond Core Drilling for Site Exploration
   (ASTM Designation: D 2113)

   This method consists of advancing a hole in hard strata by rotating downward a single or double tube core barrel equipped with a cutting bit. Diamond, Tungsten carbide, or other cutting agents may be used for the bit. Wash water is used to remove the cuttings. A 1 ¾-in. O.D. core sample is examined in the field and the laboratory. Cores are stored in partitioned boxed and the length of recovered material is expressed as a percentage of the actual distance penetrated as core recovery. The total length of recovered pieces at least 4 in. long as a percent of the length cored is the Rock Quality Designation (RQD).

During the field exploration, the driller visually classified the soil and prepared a field log. *Field screening of the soil samples for possible environmental contaminants was not conducted by the drillers as these services were not part of CGC's work scope.* Water level observations were made in each boring during and after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the borings were backfilled with bentonite (where required) to satisfy WDNR regulations and the soil samples were delivered to our laboratory for visual classification and laboratory testing. The soils were visually classified by a geotechnical engineer using the Unified Soil Classification System. The final logs prepared by the engineer and a description of the Unified Soil Classification System are presented in Appendix B.

APPENDIX B

SOIL BORING LOCATION MAP
LOGS OF TEST BORINGS (5)
LOG OF TEST BORING - GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM



Legend

Denotes Recent Boring Location and Number

Scale: Reduced

Notes

1. Soil borings performed by Badger State Drilling in April, 2014
2. Base map provided by SEH.
3. Boring locations are approximate.

Job No. C14091	CGC, Inc.	**SOIL BORING LOCATION MAP** **Lakeview Water Tower Replacement** **1202 Northport Drive** **Madison, Wisconsin**
Date: 5/15/14		

CGC Inc.

LOG OF TEST BORING

Project: **Lakeview Water Tower Replacement**

Location: **Madison, WI**

Boring No. **1**
Surface Elevation (ft) **1013.5**
Job No. **C14091**
Sheet **1** of **3**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
1		0	M	6		Very Dense, Reddish Brown Fine to Coarse GRAVEL, Some Sand, Little Silt (SP-SM - Probable Weathered Dolomite Bedrock in Lower Zone)					
2		10	M	75	5						
3		0	M	50/2"		Pushed Rock					
Run 1		42	M		10	Gray to Tan DOLOMITE BEDROCK with Vugs Run 1: 8.5 to 12 ft; 100% Recovery; 43% RQD					
Run 2		50	M		15	Run 2: 12 to 17 ft; 83% Recovery; 48% RQD					
Run 3		96	M		20	Highly Weathered/Fractured Near 16.5 ft Run 3: 17 to 25 ft, 100% Recovery; 55% RQD					
Run 4		120	M		25	Highly Weathered/Fractured Near 24 ft Blue to Gray Shale/Clay Seams (<1/4 in.) Near 25 ft Run 4: 25 to 35 ft; 100% Recovery; 61% RQD Becomes Tan in Color Near 28 ft, Less Vuggy					
Run 5		81	M		30 35 40	Run 5: 35 to 42 ft; 96% Recovery; 68% RQD					

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **4/16/14** End **4/16/14**
Driller **BSD** Chief **AP** Rig **CME-750**
Logger **KD** Editor **AJB**
Drill Method **4 1/4" HSA: 0-8';**
Autohammer; RC (NX): 8-100'

CGC Inc.

LOG OF TEST BORING

Project: **Lakeview Water Tower Replacement**

Location: **Madison, WI**

Boring No. **1**
Surface Elevation **1013.5**
Job No. **C14091**
Sheet **2** of **3**

2921 PERRY STREET, MADISON, WIS. 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
Run 6		120	M		45	Run 6: 42 to 52 ft; 100% Recovery; 91% RQD Becomes Gray Near 42 ft					
					50						
Run 7		115	M		55	Run 7: 52 to 62 ft; 96% Recovery; 73% RQD Vuggy (1/8 to 3/4-in.)					
					60						
Run 8		116	M		65	Run 8: 62 t 72 ft; 97% Recovery; 59% RQD Highly Weathered/Fractured Near 64 to 65 ft					
					70	Blue to Gray Shale/Clay Seams (<1/4 in.) Near 71 ft					
Run 9		34	M			Run 9: 72 to 75 ft; 94% Recovery; 75% RQD					
Run 10		110	M		75	Run 10: 75 to 85 ft; 92% Recovery: 74% RQD					
					80	Highly Weathered Near 81 ft Vuggy 81 to 88 ft					
Run 11		11	M		85	Run 11: 85 to 87 ft; 46% Recovery; 21% RQD					
Run 12		102	M			Run 12: 87 to 95.5 ft; 100% Recovery; 85% RQD					

CGC Inc.

LOG OF TEST BORING

Project: **Lakeview Water Tower Replacement**

Location: **Madison, WI**

Boring No. **1**
Surface Elevation **1013.5**
Job No. **C14091**
Sheet **3** of **3**

2921 PERRY STREET, MADISON, WIS. 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
					90	Run 12: 87 to 95.5 ft; 100% Recovery; 85% RQD Grades Sandy Near 91 ft Blue to Gray Clayey Seam (<1/4-in.) Near 92 ft					
					95						
Run 13		0	M			Fine to Medium Grained SANDSTONE Run 13: 95.5 to 100 ft; 0% Recovery; 0% RQD					
					100	End of Core at 100 ft Borehole backfilled with grout and bentonite chips					
					105						
					110						
					115						
					120						
					125						
					130						
					135						

CGC Inc.

LOG OF TEST BORING

Project: **Lakeview Water Tower Replacement**

Location: **Madison, WI**

Boring No. **2**
Surface Elevation (ft) **1015.2**
Job No. **C14091**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						5 in. TOPSOIL					
1		6	M	6		Very Stiff, Brown Lean CLAY, Trace Sand (CL)	(2.75-3.5)				
2		10	M	12	5	Medium Dense, Brown Fine to Medium Sand, Some Silt, Little Gravel (SM)					
3		11	M	11							
Run 1		8	M		10	Gray to Tan DOLOMITE BEDROCK with Vugs (1/8 to 1/4 in.)					
Run 2		30	M			Run 1: 8.5 to 11.5 ft; 22% Recovery; 0% RQD Run 2: 11.5 to 14 ft; 100% Recovery; 40% RQD					
Run 3		78	M		15	Weathered Near 12 ft Run 3: 14 to 22 ft; 81% Recovery; 25% RQD					
					20						
Run 4		67	M			Weathered Near 21 ft					
					25	Becomes Less Vuggy with Depth Run 4: 22 to 30 ft; 70% Recovery; 15% RQD					
					30	End of Core at 30 ft Borehole backfilled with grout and bentonite chips					
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **4/20/14** End **4/20/14**
Driller **BSD** Chief **AP** Rig **CME-750**
Logger **KD** Editor **AJB**
Drill Method **4 1/4" HSA: 0-8.5';**
Autohammer; RC (NX): 8.5-30'

LOG OF TEST BORING

CGC Inc.

Project: **Lakeview Water Tower Replacement**

Location: **Madison, WI**

Boring No. **3**
Surface Elevation (ft) **1013.0**
Job No. **C14091**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						4 in. TOPSOIL					
1		6	M	7		Stiff to Very Stiff, Brown Lean CLAY, Trace to Little Sand (CL)	(1.75-2.5)				
2		8	M	8	5	Loose to Medium Dense, Brown Fine to Medium SAND, Some Silt, Little to Some Gravel (SM)					
3		14	M	16							
4		8	M/W	21	10						
Run 1		24	M			Light Brown to Gray DOLOMITE BEDROCK, Scattered Vugs (<1/8 in.) Run 1: 11 to 16 ft; 40% Recovery; 0% RQD					
Run 2		32	M		15	Run 2: 16 to 19 ft; 89% Recovery; 22% RQD					
Run 3		26	M		20	Run 3: 19 to 22 ft; 74% Recovery; 26% RQD					
Run 4		96	M			Run 4: 22 to 30 ft; 100% Recovery; 46% RQD					
					25	Weathered Near 29 ft					
					30	End of Core at 30 ft Borehole backfilled with grout and bentonite chips					
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling

Time After Drilling

Depth to Water ▼

Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **4/23/14** End **4/23/14**
Driller **BSD** Chief **AP** Rig **CME-750**
Logger **KD** Editor **AJB**
Drill Method **4 1/4" HSA: 0-11';**
Autohammer; RC (NX): 11-30'

CGC Inc.

LOG OF TEST BORING

Project: **Lakeview Water Tower Replacement**

Location: **Madison, WI**

Boring No. **4**
Surface Elevation (ft) **1014.2**
Job No. **C14091**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						4 in. TOPSOIL					
1		6	M	6		Very Stiff, Brown Lean CLAY, Trace Sand (CL)	(2.5)				
2		8	M	17	5	Medium Dense to Very Dense, Brown Fine to Medium Sand, Some Silt, Little Gravel (SM)					
Run 1		83	M		10	Gray to Light Brown DOLOMITE BEDROCK with Vugs (1/8-in.) Run 1: 6.5 to 15.5 ft; 77% Recovery; 12% RQD					
Run 2		67	M		15	Run 2: 15.5 to 22 ft; 86% Recovery; 50% RQD					
Run 3		50	M		20	Run 3: 22 to 27 ft; 84% Recovery; 36% RQD Less Vuggy Below 25 ft					
Run 4		34	M		25	Run 4: 27 to 30 ft; 96% Recovery; 64% RQD					
					30	End of Core at 30 ft Borehole backfilled with grout and bentonite chips					
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling ▽ Upon Completion of Drilling

Time After Drilling

Depth to Water ▼

Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **4/22/14** End **4/22/14**
Driller **BSD** Chief **AP** Rig **CME-750**
Logger **KD** Editor **AJB**
Drill Method **4 1/4" HSA: 0-6.5';**
Autohammer; RC (NX): 6.5-30'

CGC Inc.

LOG OF TEST BORING

Project: **Lakeview Water Tower Replacement**

Location: **Madison, WI**

Boring No. **5**
Surface Elevation (ft) **1003.5**
Job No. **C14091**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						4 in. TOPSOIL					
1		6	M	7		Stiff to Very Stiff, Brown Lean CLAY, Trace Sand and Organics (CL)	(1.75-2.75)				
2		14	M	25	5	Medium Dense, Brown Fine to Coarse Sand, Some Gravel, Trace to Little Silt (SP/SP-SM)					
3		14	M	56		Very Dense, Light Brown to Tan, SAND AND GRAVEL, Little Silt, (SP-SM - Probable Weathered Dolomite Bedrock)					
4		14	M	64	10	End Boring at 10 ft Borehole backfilled with bentonite chips					
					15						
					20						
					25						
					30						
					35						
					40						

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **4/23/14** End **4/23/14**
Driller **BSD** Chief **AP** Rig **CME-750**
Logger **KD** Editor **AJB**
Drill Method **2 1/4" HSA: Autohammer**

CGC, Inc.

LOG OF TEST BORING
General Notes

DESCRIPTIVE SOIL CLASSIFICATION

Grain Size Terminology

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse	¾" to 3"	¾" to 3"
Fine	4.76 mm to ¾"	#4 to ¾"
Sand: Coarse	2.00 mm to 4.76 mm	#10 to #4
Medium	0.42 to mm to 2.00 mm	#40 to #10
Fine	0.074 mm to 0.42 mm	#200 to #40
Silt	0.005 mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

General Terminology

Physical Characteristics
Color, moisture, grain shape, fineness, etc.
Major Constituents
Clay, silt, sand, gravel
Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
Glacial, alluvial, eolian, residual, etc.

Relative Density

Term	"N" Value
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

Relative Proportions Of Cohesionless Soils

Proportional Term	Defining Range by Percentage of Weight
Trace	0% - 5%
Little	5% - 12%
Some	12% - 35%
And	35% - 50%

Consistency

Term	q_u-tons/sq. ft
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

Organic Content by Combustion Method

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt/Clay	4 – 12%
Sedimentary Peat	12% - 50%
Fibrous and Woody Peat	More than 50%

Plasticity

Term	Plastic Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

SYMBOLS

Drilling and Sampling

CS – Continuous Sampling
RC – Rock Coring: Size AW, BW, NW, 2"W
RQD – Rock Quality Designation
RB – Rock Bit/Roller Bit
FT – Fish Tail
DC – Drove Casing
C – Casing: Size 2 ½", NW, 4", HW
CW – Clear Water
DM – Drilling Mud
HSA – Hollow Stem Auger
FA – Flight Auger
HA – Hand Auger
COA – Clean-Out Auger
SS - 2" Dia. Split-Barrel Sample
2ST – 2" Dia. Thin-Walled Tube Sample
3ST – 3" Dia. Thin-Walled Tube Sample
PT – 3" Dia. Piston Tube Sample
AS – Auger Sample
WS – Wash Sample
PTS – Peat Sample
PS – Pitcher Sample
NR – No Recovery
S – Sounding
PMT – Borehole Pressuremeter Test
VS – Vane Shear Test
WPT – Water Pressure Test

Laboratory Tests

q_a – Penetrometer Reading, tons/sq ft
q_a – Unconfined Strength, tons/sq ft
W – Moisture Content, %
LL – Liquid Limit, %
PL – Plastic Limit, %
SL – Shrinkage Limit, %
LI – Loss on Ignition
D – Dry Unit Weight, lbs/cu ft
pH – Measure of Soil Alkalinity or Acidity
FS – Free Swell, %

Water Level Measurement

▽ - Water Level at Time Shown
NW – No Water Encountered
WD – While Drilling
BCR – Before Casing Removal
ACR – After Casing Removal
CW – Cave and Wet
CM – Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

CGC, Inc.

Madison - Milwaukee

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

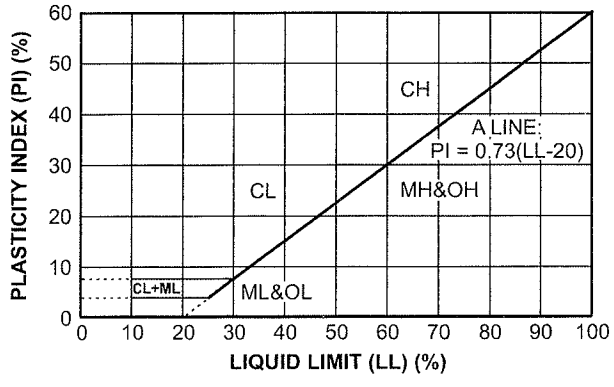
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



APPENDIX C

DOCUMENT QUALIFICATIONS

APPENDIX C
DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, , *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not Informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where surface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgement and opinion, geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's recommendations if we do not perform construction observation.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having CGC participate in prebid and preconstruction conferences, and by providing construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

GEOENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of ASFE, for more information.

Modified and reprinted with permission from:

ASFE/The Best People on Earth
881 Colesville Road, Suite G 106
Silver Spring, MD 20910

APPENDIX D

RECOMMENDED COMPACTED FILL SPECIFICATIONS

APPENDIX D

CGC, INC.

RECOMMENDED COMPACTED FILL SPECIFICATIONS

General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

Table 1
Gradation of Special Fill Materials

Material	WisDOT Section 311	WisDOT Section 312	WisDOT Section 305			WisDOT Section 209		WisDOT Section 210
	Breaker Run	Select Crushed Material	3-in. Dense Graded Base	1 1/4-in. Dense Graded Base	3/4-in. Dense Graded Base	Grade 1 Granular Backfill	Grade 2 Granular Backfill	Structure Backfill
Sieve Size	Percent Passing by Weight							
6 in.	100							
5 in.		90-100						
3 in.			90-100					100
1 1/2 in.		20-50	60-85					
1 1/4 in.				95-100				
1 in.					100			
3/4 in.			40-65	70-93	95-100			
3/8 in.				42-80	50-90			
No. 4			15-40	25-63	35-70	100 (2)	100 (2)	25-100
No. 10		0-10	10-30	16-48	15-55	75 (2)		
No. 40			5-20	8-28	10-35	15 (2)	30 (2)	
No. 200			2-12	2-12	5-15	8 (2)	15 (2)	15 (2)

Notes:

1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction.*
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

Table 2
Compaction Guidelines

Area	Percent Compaction (1)	
	Clay/Silt	Sand/Gravel
Within 10 ft of building lines		
Footing bearing soils	93 - 95	95
Under floors, steps and walks		
- Lightly loaded floor slab	90	90
- Heavily loaded floor slab and thicker fill zones	92	95
Beyond 10 ft of building lines		
Under walks and pavements		
- Less than 3 ft below subgrade	92	95
- Greater than 3 ft below subgrade	90	90
Landscaping	85	90

Notes:

1. Based on Modified Proctor Dry Density (ASTM D 1557)

APPENDIX E

ROCK EXCAVATION CONSIDERATIONS

APPENDIX E

ROCK EXCAVATION CONSIDERATIONS

In order to minimize probable "rock" excavation expenses during construction, we suggest that project specifications incorporate the following:

A. It is assumed that all excavations to levels and dimensions required by the Contract Documents are earth excavation. Earth excavation includes removal and disposal of all materials encountered except rock/sound bedrock which is defined as natural materials which:

1. Cannot be excavated with a minimum 3/4 cubic yard capacity backhoe without drilling and blasting;

2. Cannot be economically removed with a one-tooth ripper on a D8 cat (or equivalent);

3. Requires the use of special equipment such as a pneumatic hammer;

4. Requires the use of explosives (after obtaining written permission of the owner).

B. Examples of material classified as rock are boulders 1/2 cubic yard or more in volume, bedrock, rock in ledges, and rockhard cementitious aggregate deposits.

C. Do not proceed with rock excavation work until architect, engineer and/or testing firm (i.e., CGC) has taken the necessary measures to determine quantity of rock excavation required to complete the work. Measurements will be taken after properly stripped of earth by the contractor. Contractor will be paid the difference between the cost of rock and earth excavation based on an agreed upon unit price established prior to starting rock excavation.

A statement should also be included in the specifications to the effect that: "Stated models of earth excavation equipment are merely for purposes of defining the various excavation categories and are not intended to indicate the brand or type of equipment that is to be used."

APPENDIX F

BEDROCK CORE PHOTOGRAPHS

Boring 1 - core

8.5 to 100 ft


Top
Lakeview Water Tower
Madison, WI C140911 B-1
Top
B.5 - 19.3
4-16-14
Bottom
B.5
10.5
10.5
11.9
13.1
17


Top
Lakeview Water Tower C14091
Madison, WI B-1
19.3 - 29.0 T
B 4-16-14
19.3
21.3


Top
Lake View Water Tower C14091
Madison, WI
29D-38.3 B-1
Top
Bottom
29
31
35
36.3
38.3


Top Lakeview Water Tower 4-16/17-14
Madison, WI
38'-48' B-1
T
B
38.2
42'
44'
46
48


Lake View Water Tower C14091
Madison, WI 4-17-14
48-57.5 B-1
T
B
48
50
52
54
56


TP Lakeview Water Tower C14091
4.17.14
57.5-67.5 B-1
T
B
57.5
59.5
61.5
63.0
164
166


TOP
Lakeview Water Tower C14091
Madison, WI
67.5 - 77.5 B-1
T
B
68
70
72
75'
77'


Lakeview Water Tower
Madison, WI
C14091
77.5 - 89' B-1
T
B
77.5
84.5
91.5
83.5
85'
87'
87'
87'


Top
Lakeview Water Tower C140911
Madison, WI
4-18-14
89-95.5 B-1
T
B
89
91
91
93
93
95
95.5

Boring 2 - core

8 to 30 ft


Lakeview Water Tower
Madison, WI
C14091
8' - 22' B-2
8'
11'
14'
22'


Water Tower
Madison, WI
22-30'
B-2

Boring 3 – core

6.5 to 30 ft

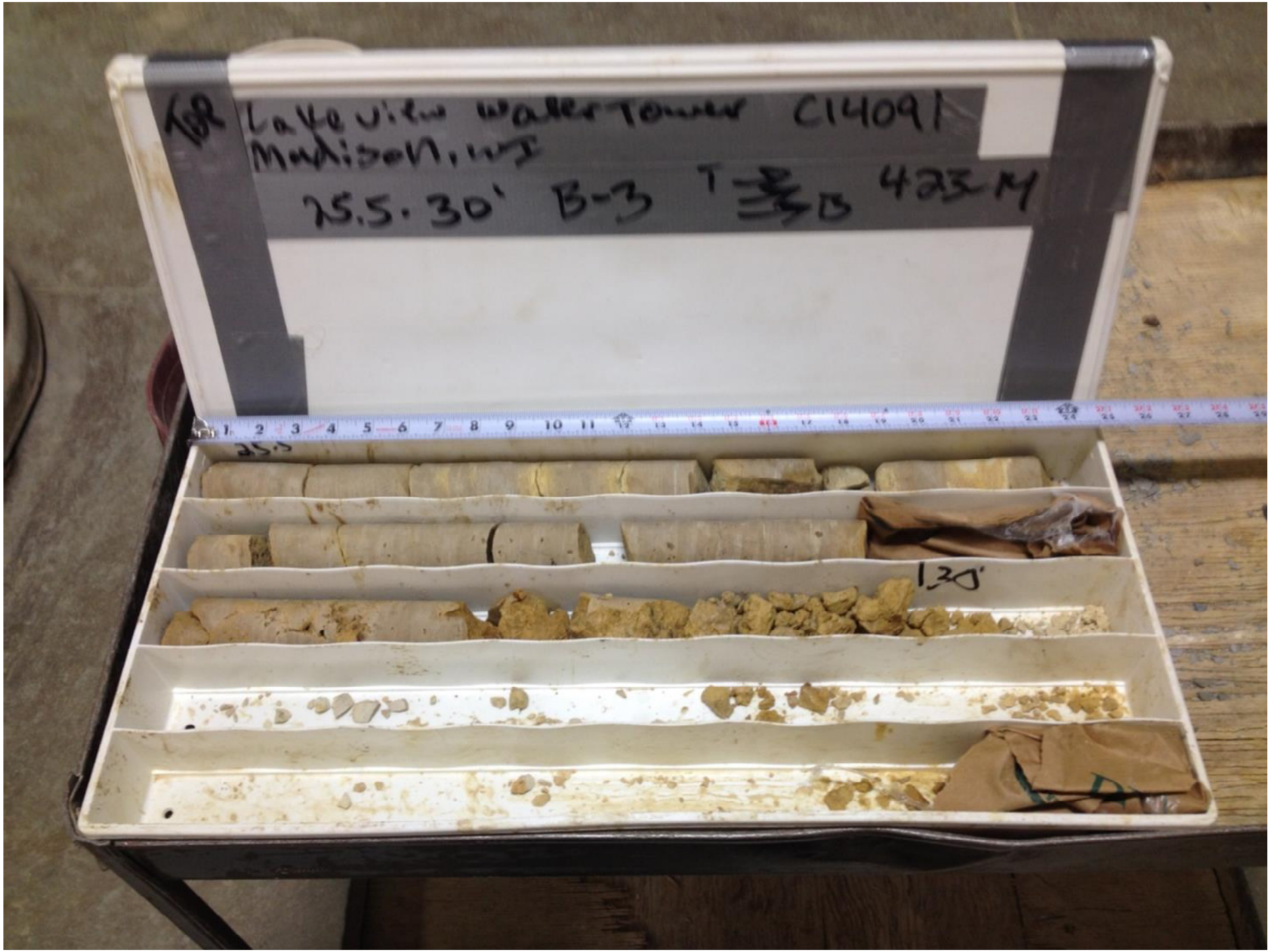

Lakeview Water Tower (14091
Madison, WI
6.5 - 20.5 B-4
T
B
6.5
15.5
20.5


Lake view Water Tower C141091
Madison, WI
20 - 30' B-4
20'
25'
27
30

Boring 4 – core

11.5 to 30 ft


TOP
Lakeview Water Tower
Madison, WI
C14091
4-23-14
11'-25.5
B-3
T
B
11'
16'
19'
22'
25.5'


KBR
Lakeview Water Tower C14091
Madison, WI
25.5-30' B-3 T B 423 M
25.5
30'

This Page Left Blank Intentionally

DOCUMENT 00 73 00.13

SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.1 SUPPLEMENTARY CONDITIONS

A. These Supplementary Conditions modify, change, delete from or add to the "Standard General Conditions of the Construction Contract" EJCDC No. C-700, 2007 edition, herein brought into the contract by reference. The EJCDC documents supplement the City of Madison General Conditions. Where any Article of the General Conditions is modified, or any Paragraph, Subparagraph, or Clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause shall remain in effect.

The General Conditions also may be supplemented elsewhere in the Contract Documents by provisions located in, but not necessarily limited to Division 01 of the Specifications.

1.2 ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

A. SC-1
1. The terms used in these Supplementary Conditions which are defined in the Standard General Conditions of the Construction Contract have the identical meaning assigned to them in said General Conditions.

B. SC-(1.01A.17)
1. The term "Drawings" and the term "Plans" shall be considered synonymous whenever and wherever used in the Contract Documents.

1.3 ARTICLE 2 - PRELIMINARY MATTERS

A. SC-2.07
1. Delete paragraph 2.07 in its entirety and substitute the following:

2.07 Prior to submission of the first Application for Payment, but no later than 30 calendar days after Contract Times commence, Contractor shall submit to Engineer for review and approval:

A. A progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

B. A schedule of Shop Drawings and Sample submittal which will list each required submittal and the times for submitting, reviewing, and processing such submittal;

C. A schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work; and

D. A schedule of progress payments Contractor anticipates will be earned during the course of the Work.

No progress payment shall be made to Contractor until the schedules are submitted to and acceptable to Engineer as provided below. The progress schedule will be acceptable to Engineer as providing an orderly progression of the Work to completion within any specified Milestones and the Contract Times, but such acceptance will neither impose on Engineer responsibility for the sequencing, scheduling or progress of the Work nor interfere with or relieve Contractor from Contractor's full responsibility therefore. Contractor's schedule of Shop Drawing and Sample submissions will be acceptable to Engineer as providing a workable arrangement for reviewing and processing the required submittals. Contractor's schedule of values will be acceptable to Engineer as to form and substance.

1.4 ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

A. SC-4.02.A
1. Under paragraph 4.02.A, change "The Supplementary Conditions" to "Section 00 31 32.11 Subsurface Drilling Information or Section 00 31 32.13 Subsurface Drilling and Sampling Information."

B. SC-4.02.B
1. Under paragraph 4.02.B, delete the second sentence "Such technical data is identified in the Supplementary Conditions".

C. SC-4.05.A
1. Under paragraph 4.05.A., delete first sentence and substitute the following:
A. Owner shall provide land surveys necessary to establish right-of-way, easements and property lines. Engineer will provide base lines, bench marks and reference points which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall provide all stakes, markers, labor and assistance required by Engineer.

2. Under paragraph 4.05.A, last sentence, insert the words "and pay" between the words "responsible" and "for".

1.5 ARTICLE 5 - BONDS AND INSURANCE

A. SC-5.02 through 5.10
1. Delete paragraphs 5.02 through 5.10, inclusive in their entirety and substitute the following:

5.02 Licensed Sureties and Insurers; Insurance Policies:

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Contractor shall be obtained from surety or insurance companies that are fully licensed or authorized in the jurisdiction in which the Project is located.

5.03 Certificates of Insurance and Endorsements to Insurance Policies:

A. In addition to delivering certificates of insurance in accordance with paragraph 2.01.B, Contractor shall also deliver to Owner, with copies to each additional insured, copies of all endorsements to the insurance policies which Contractor is required to purchase and maintain in accordance with paragraphs 5.04 and 5.06, within 90 calendar days after the Effective Date of the Agreement or prior to final payment, whichever comes first. Owner will withhold from the third, and subsequent progress payments due Contractor, pending the receipt of all required insurance policy endorsements, an amount equal to 10 percent of the value of the completed work, in addition to any retainage required by paragraph 14.02.A.3. Certificate of Insurance and endorsements shall be fully completed, signed and delivered in accordance with the requirements of Article 5. Samples of Certificate of Insurance Form, and Additional Insureds endorsements, acceptable to Owner, are included in Sections 00 6216,00 62 16.13, 00 62 16.16 and 00 62 16.19.

5.04 Contractor's Liability Insurance:

5.08 Additional Insureds:
Additional insureds referenced in paragraphs 5.04, 5.06, and 5.07 shall be as follows:

Owner: Madison Water Utility
Address: 119 E. Olin Avenue, Madison, WI53713
Engineer: Short Elliott Hendrickson, Inc.
Address: 6808 Odana Road, Suite 200, Madison, WI 53719

1.6 ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assume all Contractor Responsibilities noted in Article 6. Contractor is solely responsible for the Ways, Means, Methods and Safety procedures in regards to the Project.

B. SC-6.02.B
1. Under paragraph 6.02.B, add: The regular working hours are between 7:00AM and 5:00 PM, Monday through Friday. In the event Contractor works more than eight hours on any weekday, or works anytime on Saturdays, Sundays, or holidays, during which time the Engineer, Resident Project Representative, or assistants are required to be present, Owner shall pay the cost for such overtime engineering services and shall deduct such cost from payments due Contractor.

Overtime engineering services shall be charged at Engineer's standard hourly rates applied on a time and one-half basis for all time over eight hours on any single working day and for all hours on Saturday, and on a double time basis for all Sunday and holiday hours. If the amount due Contractor is not sufficient to cover the cost of overtime engineering services, Contractor shall reimburse Owner in the amount necessary to cover such costs. Legal holidays include:

New Year's Day	Memorial Day
Independence Day	Labor Day
Thanksgiving Day	Christmas Day

If the legal holiday falls on Saturday, all hours worked on the preceding Friday and/or the Saturday will be considered as holiday hours. If the legal holiday falls on Sunday, all hours worked on the following Monday will be considered as holiday hours.

C. SC-6.06.A

1. Under paragraph 6.06.A, add: Any person employed by Contractor or Subcontractors who does not perform his work in a proper and skillful manner, or who is intemperate, disorderly, or otherwise objectionable, shall, at the written request of Owner, be forthwith removed from the project site and shall not be employed again in any portion of the Work without written consent of Owner.

D. SC-6.06.8

1. Under paragraph 6.06.8, add: Contractor shall identify all Subcontractors, major Suppliers and other persons or organizations providing principal items of work, material, and equipment. Contractor shall within ten working days of the date on the Notice of Award identify and submit in writing to the Engineer for Owner acceptance the names, addresses, and telephone numbers of all Subcontractors, Major Suppliers, and other persons or organizations providing principal items of work, material, and equipment.

E. SC-6.20.C

1. Under paragraph 6.20.C, add: Except insofar as indemnification is sought by Engineer or Engineer's Consultants for litigation type expenses including, but not limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs.

1.7 ARTICLE 8 - OWNER'S RESPONSIBILITIES

A. SC-8.06

1. Delete paragraph 8.06 in its entirety.

1.8 ARTICLE 9- ENGINEER'S STATUS DURING CONSTRUCTION

A. SC-9.03

1. Under the paragraph 9.03.A., delete the second sentence.

2. Under paragraph 9.03A add the following:

ENGINEER IS NOT RESPONSIBLE FOR THE CONTRACTORS WAYS, MEANS AND METHODS OR SAFETY ON THE PROJECT. A LISTING OF THE DUTIES, RESPONSIBILITIES AND LIMITATIONS OF AUTHORITY OF THE RESIDENT PROJECT REPRESENTATIVE (RPR).

A. General

RPR is Engineer's agent at the site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's dealings in matters pertaining to the on-site work shall in general be with Engineer and Contractor keeping Owner advised as necessary. RPR's dealings with subcontractors will only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner with the knowledge of and under the direction of Engineer.

B. Duties and Responsibilities of RPR

1. *Schedules:* Review the progress schedule, schedule of the Shop Drawing submittals and schedule of values prepared by Contractor and consult with Engineer concerning acceptability.

2. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences and other project-related meetings, and prepare and circulate copies of minutes thereof.

3. *Liaison:*
   a. Serve as Engineer's liaison with Contractor, working principally through Contractor's superintendent and assist in understanding the intent of the Contract Documents; and assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-site operations.
   b. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

4. *Shop Drawings and Samples:*
   a. Record date of receipt of Shop Drawings and samples.
   b. Receive samples which are furnished at the site by Contractor, and notify Engineer of availability of samples for examination.
   c. Advise Engineer and Contractor of the commencement of any Work requiring a Shop Drawing or sample if the submittal has not been approved by Engineer.

5. *Review of Work, Rejection of Defective Work, Inspections and Tests:*
   a. Conduct on-site observations of the Work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.

b. Report to Engineer whenever RPR believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made: and advise Engineer of Work that RPR believes should be corrected or rejected or uncovered for observation, or requires special testing, inspection and approval.

c. Verify that tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel and that Contractor maintains adequate records thereof; and observe, record and report to Engineer appropriate details relative to the test procedures and startups.

d. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections and report to Engineer.

6. *Interpretation of Contract Documents:* Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

7. *Modifications:* Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report with RPR's recommendations to Engineer. Transmit to Contractor decisions as issued by Engineer.

8. *Records:*

a. Maintain at the job site orderly files for correspondence, reports of job conference, Shop Drawings and samples, reproductions of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the Contract, Engineer's clarifications and interpretations of the Contract Documents, progress reports, and other Project related documents.

b. Complete a Daily Report recording Contractor hours on the job site, weather conditions, data relative to questions or Work Directive Changes, Change Orders or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the *case* of observing test procedures; and send original to Engineer.

c. Record names, address and telephone numbers of all Contractors, subcontractors and major suppliers of materials and equipment.

9. *Reports:*

a. Furnish Engineer periodic reports as required of progress of the Work and the Contractor's compliance with the progress

scheduled and schedule of Shop Drawings and sample submittals.

b. Consult with Engineer in advance of schedule major tests, inspections or start of important phases of the Work.

c. Draft Field Orders, obtain backup material from Contractor and recommend to Engineer Change Orders and Work Directive Changes. Furnish Engineer copies of all Field Orders.

d. Report immediately to Engineer and Owner upon occurrence of any accident.

10. *Payment Requests:* Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the schedule of values. Work completed and materials and equipment delivered at the site but not incorporated in the Work.

11. *Certificates, Operation and MAINTENANCE Manuals:* During the course of the Work, verify that certificates, operation and maintenance manuals and other data required to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to Engineer for review and forwarding to Owner prior to final payment for the Work.

12. *Completion:*

a. Before Engineer issues a Certificate of Substantial Completion, prepare and furnish to the Engineer a list of observed items requiring completion or correction.

b. Conduct final inspection in the company of Engineer, Owner, and Contractor and prepare and furnish to the Engineer a final list of items to be completed or corrected.

c. Observe that all items on final list have been completed or corrected and make recommendations to Engineer concerning acceptance.

C. **Limitations of Authority**

Resident Project Representative:

1. Shall not authorize any deviation from the Contract Documents or substitution of materials or equipment, unless authorized by Engineer.

2. Shall not exceed limitations of Engineer's authority as set forth in the Agreement or the Contract Documents.

3. Shall not undertake any of the responsibilities of Contractor, subcontractors or Contractor's superintendent.

4. Shall not advise on, issue directions relative to or assume control over any aspect of the means, methods, techniques, sequences or procedures or construction unless such advice or directions are specifically required by the Contract Documents.

5. Shall not advise on, issue directions relative or assume control over safety precautions and programs in connection with the Work.

6. Shall not accept Shop Drawing or sample submittals from anyone other than Contractor.

7. Shall not authorize Owner to occupy the Project in whole or in part.

8. Shall not participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by Engineer.

1.9 ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

A. SC-12.04 through 12.06
1. Add the following paragraphs:

12.04 Start and Completion Times
The date of beginning and the time for completion of the Work are essential conditions of the Agreement and the Work required shall be commenced on a date specified in the Notice to Proceed.

12.05 Time for Completion
Contractor shall proceed with the Work at such rate of progress to insure full completion within the Contract Times. It is expressly understood and agreed, by and between the Contractor and the Owner, that the Contract Times for the completion of the Work described herein is a reasonable time, taking into consideration the adverse weather conditions for the season, or seasons, involved and other factors prevailing in the locality of the Work.

1.10 ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

A. SC-13.10
1. Add new paragraph 13.10 as follows:

13.10 Notification and Time Limit for Repairs:

A. Contractor shall be responsible for the proper and safe protection of his work at all times during construction and also during the three-year guarantee period after the acceptance of the completed work by Owner. Contractor shall provide, erect, and maintain barricades, red flags, and

torches and lights at all places where work is in progress, and wherever else required by Owner.

B. Contractor shall maintain an emergency phone number where he/she can be notified at any time, Sundays and holidays included, of an emergency condition due to the work which requires immediate repair or protection. Upon such notification by Owner, Contractor shall be given a two-hour time limit to provide whatever barricades, flags, torches and lights are required to mark and protect the hazard. If Contractor fails to provide this protection within the two-hour period from time of notification, Owner will provide the necessary protection and deduct the sum of $200.00 for each occurrence from the monies due and payable to Contractor for completed work.

C. Also, upon notification by Owner, Contractor shall be given a 24-hour time limit to begin to make any repairs to the Work as deemed necessary by Owner. If Contractor fails to proceed with necessary repairs within the 24-hour notification period, Owner will make the necessary repairs to the Work and deduct the cost of labor and materials, including engineering costs, for each repair incident from the monies due and payable to Contractor for completed work.

1.11 ARTICLE 14- PAYMENTS TO CONTRACTOR AND COMPLETION

A. SC-14.03

1. Under paragraph 14.03.A, add the following:

B. Contractor shall procure from each Subcontractor and Supplier of material or labor a waiver of any claim which they may have under the mechanics lien laws of the state in which the Work is located, to insure Owner immunity from mechanics liens on account of anything which is done by Contractor or his Subcontractors in carrying out the Agreement and any work orders for additions thereto, all as a condition of any payment by Owner. Any payments made by Owner without requiring compliance with this paragraph shall not be construed as a waiver by Owner of the right to require compliance with this paragraph as a condition of later payments. Contractor shall furnish with his final Application for Payment a complete release of all liens arising out of this contract, or receipts in full in lieu thereof and an affidavit that the releases and receipts include all labor and material for which a lien could be filed.

1.12 ARTICLE 19- PREVAILING WAGE RATES

A. SC-19.01 Prevailing Wage Rates

1. Contractor shall comply with the attached prevailing wage rates as determined by the State of Wisconsin Department of Workforce Development (DWD). If DWD finds a contractor violating the prevailing wage law DWD will assess liquidated damages of 100% of the wages owed to employees.

2. Contractor shall comply with all applicable federal, state, and local rules and regulations regarding the posting, certification, and filing of wage rates paid to employees. Contractor shall file certified payroll records with DWD on a monthly basis in a format that meets DWD reporting requirements. Certified payroll reports must be filed with DWD by the end of the first week following the month in which the work was conducted.

3. Upon completion of the Work and prior to final payment, Contractor shall file with Owner, an affidavit of compliance with prevailing wage rate determination.

END OF SUPPLEMENTARY CONDITIONS

SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Work Included in Contract Documents
   2. Contract Information
   3. Work Under Other Contracts
   4. Contractor Use of Premises
   5. Occupancy Requirements
   6. Products Ordered in Advance
   7. Work Restrictions

1.02 WORK INCLUDED IN CONTRACT DOCUMENTS

A. Description of the Project:
   1. Construction of an elevated water storage tank reservoir and associated water main.

1.03 CONTRACT INFORMATION

A. Type of Contract: Owner will award a Single Prime Contract.

B. Scope of Contract:
   1. This Contractor is solely responsible for the Work.
   2. The Contract will include:
      a. Contract Forms:
         1) Agreement
         2) Performance Bond
         3) Payment Bond
         4) Certificates
      b. Conditions of the Contract:
         1) General Conditions
         2) Supplementary Conditions
      c. Specifications:
         1) Division 1 - General Requirements
         2) Applicable Technical Sections
      d. Addenda
      e. Contract Modifications

1.04 WORK UNDER OTHER CONTRACTS

A. Other Work at Site:
   1. Owner reserves the right to let other separate contracts for Work of the Project, or to pursue other Work at the Site with its own personnel.
   2. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.
   3. Coordinate the Work of this Contract with work performed under separate contracts.

B. Work Not Included:
   1. Work not included is either marked “NIC,” or “by others,” on Drawings or is noted in each section of Specifications.
   2. Provide all labor and materials required unless so specifically noted or marked.

3. Install Work indicated to be furnished by others or Owner unless specifically stipulated to be furnished and installed by others or Owner.

C. Preceding Work: will award separate contracts for the following construction operations at Site. Those operations are scheduled to be substantially complete before work under this Contract begins:
   1. Contractor: TBD.
   2. Description of Work: Demo of existing legged tank and water main construction to booster station.

1.05 CONTRACTOR USE OF PREMISES

A. Confine operations at Site to areas permitted under contract or as directed by Owner.

B. Conform to site rules and regulations affecting Work while engaged in Project construction.

C. Existing Structures:
   1. Keep existing driveways, playgrounds, playing fields, and adjacent streets clear and available to public in accordance with Owner's or local authority's requirements.
   2. Repair damages caused to existing public and private property and structures due to operations of Contractor to the satisfaction of, and at no additional cost to Owner.
   3. Take complete field measurements affecting all existing construction, wiring, piping, and equipment in this Contract, and assume responsibility for proper fit between Work and existing structures and other equipment.

D. Construction personnel may park only in areas designated by the Owner.

E. Construction Material Deliveries: Deliveries are restricted to Special Provision 107.1.

F. Damaged Property:
   1. Patch and/or clean existing improvements and restore damage of property on, or adjacent to Site occasioned by this Work, including, but not limited to, lawns, walks, curbs, pavements, roadways, structures, and utilities which are cut or damaged by operations and are not designated for removal, relocation, or replacement in the course of construction.
   2. Public Property or Utilities: Comply with laws, ordinances, rules, regulations, standards, orders of utility owner or any public authority having jurisdiction.
   3. Provide written acceptance of restoration work by authority or Owner.

1.06 OCCUPANCY REQUIREMENTS

A. General Requirements:
   1. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
   2. Schedule the Work to accommodate this requirement.
   3. Coordinate activities which could cause interruption to Owner's activities.
   4. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

B. Owner Occupation During Construction: Owner will occupy Site during the Work.

C. Owner Occupancy of Completed Areas of Construction:
   1. Owner reserves the right to place and install equipment as necessary in completed areas of the facilities and to occupy such completed areas prior to Substantial Completion in accordance with the Supplementary Conditions. Such use shall not constitute acceptance of such portions of the Work or relieve the Contractor of any obligations except for improper use or damage caused by employees or agents of Owner.
   2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
   3. Mechanical and electrical systems shall be fully operational and required tests and inspection successfully completed.

1.07 PRODUCTS ORDERED IN ADVANCE

A. Storage:
   1. Products will be allowed to be stored at the Site 1 week prior to commencement of construction activities.
   2. Contractor shall store such items as directed by Owner.

1.08 WORK RESTRICTIONS

A. On-Site Work Hours:
   1. Normal business working hours of 7:00 a.m. to 5:00 p.m. Monday through Friday.
   2. Weekend Hours: only with prior permission.
   3. Legal Holidays: Defined in General Conditions.
   4. Hours for Utility Shutdowns: 7am to 3pm Monday through Friday.

B. Existing Utility Interruption:
   1. Do not interrupt utilities serving facilities occupied by Owner or others without written permission by Owner.
   2. Notify Owner not less than 3 days in advance of proposed utility interruptions.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This Page Left Blank Intentionally

SECTION 01 21 00

ALLOWANCES

PART 1 GENERAL

1.01 SUMMARY

A. Administrative and procedural requirements governing handling and processing allowances.

B. Types of Allowances:
   1. Lump-sum allowance.

C. Schedule of Allowances.

D. Related Document:
   1. Electrical Sheet E3/E4

1.02 DEFINITIONS

A. A monetary amount or product quantity established by Owner to be included in Bid for an otherwise undefined item.

1.03 SELECTION AND PURCHASE

A. At earliest feasible date after Contract award, advise Engineer of date when final selection and purchase of each product or system described by an allowance must be completed in order to avoid delay in performance of Work.

B. When requested by Engineer, obtain proposals for each allowance for use in making final selections; include recommendations relevant to performance of Work.

C. Purchase products and systems as selected by Engineer from designated supplier.

1.04 SUBMITTALS

A. Proposals for Purchase of Products or Systems: Submit in form specified for Change Orders.

B. Invoices or Delivery Slips: Submit to indicate actual quantities of materials delivered to Site.

1.05 LUMP SUM/UNIT COST ALLOWANCE

A. Costs Included:
   1. Include the following costs; submit invoice from manufacturer to Engineer.
      a. Wholesale cost of material.
      b. Shipping cost.
      c. Tax.

B. Costs Not Included in Allowance (Include in Base Bid):
   1. Contractor/Subcontractor overhead and profit.
   2. Labor for installation.
   3. Accessory materials.
   4. Incidental costs such as equipment rental.

1.06 UNUSED MATERIAL

A. Return unused material to supplier for credit to Owner, after installation has been completed and accepted.

B. When it is not economically practical to return material for credit, prepare unused material for storage by Owner and deliver when directed by Engineer.

C. Disposal of material not wanted by Owner is Contractor's responsibility.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect products covered by allowance promptly upon delivery for damage or defects.

3.02 PREPARATION

A. Coordinate materials, installation for each allowance with related materials and installations, to ensure that each is completely integrated and interfaced with related construction activities.

3.03 SCHEDULE OF ALLOWANCES

A. Lump Sum Allowance. Include allowance of $20,000 to be used for security/card access system as specified on sheet E3/E4, as directed by Engineer.

END OF SECTION

SECTION 01 25 13

PRODUCT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Administrative and procedural requirements for handling requests for substitutions.

B. The following is not included in this Section:
   1. Procedural requirements governing Contractor's selection of product options (Section 01 60 00).

1.02 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment and methods of construction required by Contract Documents proposed by Contractor.

C. The following are not considered substitutions:
   1. Revisions to Contract Documents requested by Owner or Engineer.
   2. Specified options of products and construction methods included in Contract Documents.
   3. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.03 SUBMITTALS

A. Substitution Request Prior to Bid: For a Product Substitution to be considered, the following conditions must be met:
   1. All requests must be submitted in writing no later than 10 calendar days prior to the date for receipt of the bids.
   2. Faxed submittals will <u>not</u> be considered.
   3. Submit each request for substitution (one material or product per form) on the attached "Substitution Request Form" attached at the end of this section (either duplicated from the Project Manual or available from Engineer's office) together with a self-addressed, stamped envelope. Submittals not accompanied by this form properly filled in and endorsed will be discarded without review. NO EXCEPTIONS.
   4. Identify any impact of the substituted product on related items.
   5. Approved items will be listed in addenda. Requests for substitution will be returned in the self-addressed, stamped envelope provided by bidder at Engineer's earliest convenience.

B. All substitutions permitted on addenda must meet or exceed requirements of the specifications including, but not limited to:
   1. Warranty.

C. Substitution Request After Bid: Requests for substitution will be considered if received within 60 days after commencement of the work. Requests received more than 60 days after commencement of the work may be considered or rejected at the discretion of Engineer.
   1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for change order proposals.
   2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related specification section and Drawing numbers.

3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
    a. Product data, including drawings and descriptions of products, fabrication and installation procedures.
    b. Samples, where applicable or requested.
    c. A detailed comparison of significant qualities of the proposed substitution with those of the work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
    d. Coordination information, including a list of changes or modifications needed to other parts of the work and to construction performed by Owner and separate contractors that will become necessary to accommodate the proposed substitution.
    e. A statement indicating the substitution's effect on Contractor's construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall contract time.
    f. Cost information, including a proposal of the net change, if any in the contract sum.
    g. Certification by Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated.
    h. Include Contractor's waiver of rights to additional payment or time, which may subsequently become necessary because of the failure of the substitution to perform adequately.

D. Substitution Conditions:
    1. Contractor's substitution request will be received and considered by Engineer when one or more of the following conditions are satisfied, as determined by Engineer, otherwise requests will be returned without action except to record noncompliance with these requirements:
        a. Extensive revisions to Contract Documents are not required.
        b. Proposed changes are in keeping with the general intent of Contract Documents.
        c. The request is timely, fully documented and properly submitted.
        d. Contractors and suppliers will be expected to provide the specified product unless prior approval is received from Engineer's office in sufficient time so that all bidders can be notified through an addendum.
        e. The specified product or method of construction cannot be provided within the contract time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.
        f. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
        g. A substantial advantage is offered to Owner, in terms of cost, time, energy conservation, or other considerations of merit, after deducting offsetting responsibilities Owner may be required to bear. Additional responsibilities for Owner may include additional compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, or separate contractors, and similar considerations.
        h. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where Contractor certifies that the substitution will overcome the incompatibility.
        i. The specified product or method of construction cannot be coordinated with other materials, and where Contractor certifies that the proposed substitution can be coordinated.
        j. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where Contractor certifies that the proposed substitution provides the required warranty.
        k. Where a proposed substitution involves more than one prime contractor, each contractor shall cooperate with the other contractors involved to coordinate the work, provide uniformity and consistency, and to assure compatibility of products.

E. Limitations: Contractor's submittal and Engineer's acceptance of Shop Drawings, Product Data, or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

F. Substitution Causing Redesign: Engineer time for redesign as a result of substitution, will be charged to Owner, then deducted by Construction Change Directive from Contract Amount.

G. Engineer's Action:
   1. Request Prior to Bid: If approved, substitution will be included in an addendum.
   2. Request After Bid:
      a. If necessary, within one week of receipt of the request for substitution, Engineer will request additional information or documentation necessary for evaluation of the request.
      b. Within two weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, Engineer will notify Contractor of acceptance or rejection of the proposed substitution.
      c. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name.
      d. Acceptance will be in the form of a change order.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SUBSTITUTION REQUEST FORM

TO: Attn: Jon Strand, PE
Short Elliott Hendrickson Inc.
10 North Bridge Street
Chippewa Falls, WI 54729-2550
715.720.6200

PROJECT: Lakeview Reservoir Replacement Project

SECTION NO.	ARTICLE NO.	SPECIFIED PRODUCT	PROPOSED SUBSTITUTION

ok

A. Does the substitution affect dimensions shown on Drawings? Yes ☐ No ☐

B. Does the substitution affect other trades? Yes ☐ No ☐

C. Does the manufacturer's guarantee differ from that specified? Yes ☐ No ☐

D. If you indicated "Yes" to Items A, B, or C above, attach a thorough explanation on your company letterhead.

E. If there are other differences between proposed substitution and specified product, attach a thorough explanation on your company letterhead. If differences are not noted and acknowledged in writing by Engineer, product must comply with specification requirements.

F. The proposed substitution was used within the last 24 months on the following project:

Project Name _____

Location _____

Engineer _____

Telephone No. _____

G. Has the proposed substitution been used on an SEH project within the last 12 months? Yes ☐ No ☐

If yes, which project? _____

All questions must be answered. Incomplete forms will not be reviewed.
Include a self-addressed, stamped envelope for reply.

Submitted By: _____

Signature

Firm

Address

Date

Phone

E-mail

For Use by Design Consultant

☐ Not Accepted, Not Enough Information
☐ Not Accepted, Does Not Appear to be Equal
☐ Accepted ☐ Accepted as Noted
☐ Received Too Late

By _____
Date _____
Remarks _____

SECTION 01 35 60

COORDINATION OF WORK WITH EXISTING ANTENNA SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. There are antenna systems, coaxial and fiber optic transmission lines in service at the completion of this facility. The antenna systems serve a mobile and point-to-point communication networks.

1.02 DEFINITIONS

A. Coaxial: A metal conductor surrounded by a non-conductivity dielectric (insulator) covered by a concentric metal shell and encased in an outer shell of polymeric jacketing.

B. Fiber Optic: A glass fiber cable used for telecommunication purposes.

C. Tenant: Owner of an antenna system.

1.03 TRANSMISSION LINE DESCRIPTIONS

A. A transmission line connects each antenna to radio equipment located on the ground in a sheltered area. All transmission lines vary in diameter. These transmission lines may be damaged if they are sprayed with corrosive chemicals, paint, or if they are sandblasted. Thus, all transmission lines must be protected at all times with coverings that prevent the paint removal chemicals, sandblasting material, or the paint to contact the outer surface of the transmission lines.

B. The transmission lines can also be damaged if they are bent to a radius of less than the minimum recommended by the cable manufacturer. The bending limits for the transmission lines are as follows:

Cable Outer Diameter	Minimum Bending Radius
1/2 inch	5 inch
7/8 inch	10 inch
1 5/8 inch	20 inch
2 1/4 inch	22 inch

C. Transmission lines that are damaged as a result of excessive bending must be replaced in their entirety from the radio equipment to the antenna. They cannot be straightened, patched, or spliced.

1.04 RESPONSIBILITIES

A. Tenant Responsibility:
   1. Each tenant will be notified prior to the beginning of this Project in accordance with their lease agreement with the tank owner. They will be required to provide:
      a. Pre and post testing of equipment as conducted by a qualified third party.
      b. Background information on equipment related to worker Right-to-Know.
   2. Tenant will be required to provide contact information for coordination of:
      a. Equipment protection.
      b. Equipment removal/replacement.
      c. Temporary sector shutdown/ re-activation.
   3. Tenant, in accordance with their lease, will be responsible for any removal (prior to project commencement) and reinstallation of:
      a. Antennas.
      b. Coaxial cables.
      c. Detachable equipment brackets and covers.

4. Tenant is responsible for painting of:
    a. Antenna panels.
    b. Detachable equipment.

B. Contractor Responsibility:
1. Provide personal monitors for identification of non-ionizing radiation exposure to all employees entering identified warning areas, and those working directly in front of in-place antennas.
2. Coordinate scheduling of temporary sector shutdown(s) and re-activation with each tenant.
3. Protect associated tenant ground equipment, as applicable.
    a. The method(s) of protection must be approved and coordinated with each tenant.
    b. Methods may include, but are not limited to the following:
        1) Placement of tarps for ground cover.
        2) Enclosure of equipment cabinets and air conditioning units.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 42 18

REFERENCE STANDARDS FOR INFRASTRUCTURE IMPROVEMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Quality Assurance.

B. List of References.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by Assoc., trade, or federal and state standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents.

C. Obtain copies of standards when required by Contract Documents.

D. Maintain copy at jobsite during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

F. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.03 LIST OF NATIONAL REFERENCES

AABC
Associated Air Balance Council
1518 K Street NW
Washington, DC 20005
202.737.0202 www.aabc.com

AASHTO
Am. Assoc. of State Hwy. & Transportation Officials
444 N. Capital Street NW, Ste. 249
Washington, DC 20001
202.624.5800 www.transportation.org

ABMA
American Bearing Manufacturers Association
2025 M Street, NW, Suite 800
Washington, DC 20036
202.367.1155

ACC
American Chemistry Council
700 Second Street NE
Washington, DC 20002
202.249.7000
www.plastics.americanchemistry.com

ACEC
American Council of Engineering Companies
1015 15th Street, 8th Floor, NW
Washington DC 20005-2605
202.347.7474 www.acec.org

ADA
Americans with Disabilities Act
US Dept. of Justice
950 Pennsylvania Avenue NW
Civil Rights Division/Disability Rights Section - NYA
Washington, DC 20530
800.514.0301 www.ada.gov

AGA
American Gas Assoc.
400 N. Capitol Street NW
Washington, DC 20001
202.824.7000 www.aga.org

AGC
Associated General Contractors of America
2300 Wilson Boulevard., Ste. 400
Arlington, VA 22201
703.548.3118 www.agc.org

AI
Asphalt Institute
2696 Research Park Drive
Lexington, KY 40511-8480
859.288.4960 www.asphaltinstitute.org

AISI
American Iron & Steel Institute
1140 Connecticut Avenue NW, Ste. 705
Washington, DC 20036
202.452.7100 www.steel.org

ANSI	American National Standards Institute 1819 L Street NW, 6th Floor Washington, DC 20036 202.293.8020 www.ansi.org
ARRA	Asphalt Recycling & Reclaiming Assoc. #3 Church Circle – PMB 250 Annapolis, MD 21401 410.267.0023 www.arra.org
ASCE	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191-4400 800.548.2723 www.asce.org
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 610.832.9500 www.astm.org
AWMA	Air & Waste Management Assoc. One Gateway Center, 3rd Floor 420 Fort Duquesne Blvd. Pittsburgh, PA 15222-1435 412.232.3444 www.awma.org
AWWA	American Water Works Assoc. 6666 W. Quincy Avenue Denver, CO 80235 800.926.7337 www.awwa.org
CDA	Copper Development Assoc. 260 Madison Avenue New York, NY 10016 212.251.7200 www.copper.org
CPI	Concrete Paver Institute, a division of NCMA See ICPI
CLFMI	Chain Link Fence Manufacturers Institute 10015 Old Columbia Rd, Ste. B-215 Columbia, MD 21046 410.290.6267 www.chainlinkinfo.org
CMRA	Construction Materials Recycling Assoc. 1001 I Street, PO Box 40125 Sacramento, CA 95812-4025 916.341.4027 www.calrecycle.ca.gov/RCP
CRSI	Concrete Reinforcing Steel Institute 933 North Plum Grove Road Schaumburg, IL 60173-4758 847.517.1200 www.crsi.org
CSI	Construction Specifications Institute 110 South Union Street, Ste. 100 Alexandria VA 22314 800.689.2900 www.csinet.org
DOE	U.S. Department of Energy 1000 Independence Ave. SW Washington DC 20585 202.586.5000 www.energy.gov
DOT	U.S. Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590 202.366.4000 www.dot.gov
EEOC	Equal Employment Opportunity Commission 131 M Street NE Washington, DC 20507 800.669.4000 www.eeoc.gov
EIMA	EIFS Industry Members Assoc. 513 West Broad Street, Ste. 210 Falls Church, VA 22046-3257 800.294.3462 www.eima.com
EJCDC®	Engineers' Joint Contract Documents Committee® See ACEC, AGC, ASCE, and NSPE www.ejcdc.org
EPA	U.S. Environmental Protection Agency Ariel Rios Building 1200 Pennsylvania Ave. NW Washington, DC 20004 202.272.0167 www.epa.gov
FEMA	Federal Emergency Management Assoc. 500 C Street SW Washington, DC 20472 800.621.3362 www.fema.gov
FMG	FM Global (Factory Mutual System) 270 Central Avenue, PO Box 7500 Johnston, RI 02919 401.275.3000 www.fmglobal.com
Green Seal	Green Seal 1001 Connecticut Avenue NW, Ste. 827 Washington, DC 20036-5525 202.872.6400 www.greenseal.org
Green-e	Green-e Program Center for Resource Solutions 1012 Torney Avenue, Second Floor PO Box 29512 San Francisco, CA 94129 415.561.2100 www.green-e.org
Green Guard	Greenguard Environmental Institute 2211 Newmarket Parkway, Ste. 110 Marietta, GA 30067 800.427.9681 www.greenguard.org
GRI	Geosynthetic Research Institute See GSI
GSI	Geosynthetic Institute 475 Kedron Avenue Folsom, PA 19033-1208 610.522.8440 www.geosynthetic-institute.org
ICEA	Insulated Cable Engineers Association, Inc. P.O. Box 1568 Carrollton, GA 30112 www.icea.net
ICPI	Interlocking Concrete Pavement Institute 13921 Park Center Road, Ste. 270 Herndon VA 20171 703.657.6900 www.icpi.org
IMI	International Masonry Institute 42 East Street Annapolis, MD 21401 410.280.1305 www.imiweb.org
IPBA	International Pipe Bursting Assoc. Division of NASSCO 410.486.3500 www.nassco.org/about_nassco/an_div_ipba.html
LEED	Leadership in Energy and Environmental Design See USGBC

MIA	Masonry Institute of America 22815 Frampton Avenue Torrance, CA 90501-5034 800.221.4000 www.masonryinstitute.org
MSS	Manufacturers Standardization Society of the Valve and Fitting Industry 127 Park St NE Vienna, VA 22180-4602 703.281.6613 www.mss-hq.com
MUTCD	Manual on Uniform Traffic Control Devices www.mutcd.fhwa.dot.gov
NACE	National Assoc. of Corrosion Engineers 1440 S. Creek Drive Houston, TX 77084-4906 281.228.6200 www.nace.org
NCMA	National Concrete Masonry Assoc. 13750 Sunrise Valley Drive Herndon, VA 20171-4662 703.713.1900 www.ncma.org
NEC	National Electric Code See NFPA
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877 301.977.3698 www.nebb.org
NEMA	National Electrical Manufacturers Assoc. 1300 N. 17th Street., Ste. 1752 Rosslyn, VA 22209 703.841.3200 www.nema.org
NFPA	National Fire Protection Assoc. 1 Batterymarch Park Quincy, MA 02169-7471 617.770.3000 www.nfpa.org
NIOSH	National Institute for Occupational Safety and Health Centers for Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30333 800.232.4636 www.cdc.gov/niosh
NPCA	National Precast Concrete Assoc. 1320 City Center Drive, Suite 200 Carmel, IN 46032 800.366.7731 www.precast.org
NPDES	National Pollutant Discharge Elimination System www.epa.gov
NSF	NSF International 789 N. Dixboro Road, PO Box 130140 Ann Arbor, MI 48113-0140 800.673.6275 www.nsf.org
NSPE	National Society of Professional Engineers 1420 King Street Alexandria, VA 22314-2794 703.684.2800 www.nspe.org
NSWMA	National Solid Wastes Management Assoc. 4301 Connecticut Avenue NW, Ste. 300 Washington, DC 20008 800.424.2869 www.environmentalistseveryday.org/about-nswma-solid-waste-management
NSSGA	National Stone, Sand & Gravel Assoc. 1605 King Street Alexandria, VA 22314 703.525.8788 www.nssga.org
OSHA	U. S. Occupational Safety and Health Administration 200 Constitution Avenue NW Washington, DC 20210 800.321.6742 www.osha.gov
PCA	Portland Cement Assoc. 5420 Old Orchard Road Skokie, IL 60077 847.966.6200 www.cement.org
PCI	Precast/Prestressed Concrete Institute 200 W. Adams Street, #2100 Chicago, IL 60606 312.786.0300 www.pci.org PCI Midwest 952.806.9997 www.midwestprecast.com
PPI	Plastics Pipe Institute 105 Decker Court, Ste. 825 Irving TX, 75062 469.499.1044 www.plasticpipe.org
SSPC	Society for Protective Coatings 40 24th Street, 6th Floor Pittsburgh, PA 15222-4656 877.281.7772 www.sspc.org
TMS	The Masonry Society 105 South Sunset Street, Ste. Q Longmont, Colorado, 80501-6172 303.939.9700 www.masonrysociety.org
TPI	Turfgrass Producers International 2 East Main Street East Dundee, IL 60118 800.405.8873 www.turfgrasssod.org
UL	Underwriters' Laboratories, Inc. 2600 N.W. Lake Rd. Camas, WA 98607-8542 877.854.3577 www.ul.com
USACE	U.S. Army Corps of Engineers Publication Department 2803 52nd Avenue Hyattesville, MD 20781-1102 301.394.0081 www.usace.army.mil
USGBC	U.S. Green Building Council 2101 L Street, Ste. 500 Washington DC 20037 800.795.1747 www.usgbc.org
WQA	Water Quality Assoc. 4151 Naperville Road Lisle, IL 60532-3696 630.505.0160 www.wqa.org

1.04 LIST OF STATE REFERENCES

WDNR	Wisconsin Department of Natural Resources 101 S. Webster, PO Box 7921 Madison, WI 53707 608.266.2621 www.dnr.wi.gov
WisDOT	Wisconsin Department of Transportation 4802 Sheboygan Avenue, PO Box 7916 Madison, WI 53707 www.dot.state.wi.us
WEDC	Wisconsin Economic Development Corporation PO Box 7962 Madison, WI 53707 www.wedc.org
WMUTCD	WI Manual on Uniform Traffic Control Devices Division of Transportation 4802 Sheboygan Avenue Madison, WI 53707 608.266.0150 www.dot.Wisconsin.gov

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Selection and Payment
   2. Quality Assurance
   3. Contractor Submittals
   4. Laboratory Responsibilities
   5. Laboratory Reports
   6. Limits on Testing Laboratory Authority
   7. Contractor Responsibilities
   8. Retesting

B. Related Sections:
   1. Document 00 31 32 - Geotechnical Data: Information available to Bidders
   2. Document 00 72 00 - General Conditions: Inspections, testing, and approvals required by public authorities
   3. Section 01 21 00 - Allowances: Allowance for payment of testing services
   4. Section 01 33 00 - Submittal Procedures: Manufacturer's certificates
   5. Section 01 75 00 - Starting and Adjusting: Testing, adjusting, and balancing of systems
   6. Section 01 77 00 - Closeout Procedures: Project Record Documents

C. Individual Specification Sections: Inspections and tests required, and standards for testing.

1.02 REFERENCES

A. ANSI/ASTM:
   1. D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
   2. E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction

1.03 SELECTION AND PAYMENT

A. Owner will employ and pay for services of independent testing laboratory CGC, Inc. of Madison to perform geotechnical and material testing.

B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.04 QUALITY ASSURANCE

A. Comply with requirements of ANSI/ASTM D3740 and ANSI/ ASTM E329.

B. Laboratory: Authorized to operate in state in which Project is located.

C. Laboratory Staff: Maintain a full time registered Engineer specialist on staff to review services.

D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards (NBS) Standards or accepted values of natural physical constants.

1.05 CONTRACTOR SUBMITTALS

A. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer specialist and responsible officer.

B. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards (NBS) during most recent tour of inspection, with memorandum of remedies of any deficiencies reported by the inspection.

1.06 LABORATORY RESPONSIBILITIES

A. Test samples of mixes submitted by Contractor.

B. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.

C. Perform specified inspection, sampling, and testing of Products in accordance with specified standards.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or Products.

F. Perform additional inspections and tests required by Engineer.

G. Attend preconstruction conferences and progress meetings.

1.07 LABORATORY REPORTS

A. After each inspection and test, promptly submit two copies of laboratory report to Engineer, and to Contractor.

B. Include:
1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and Specifications Section.
6. Location in the Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

C. When requested by Engineer, provide interpretation of test results.

1.08 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop the Work.

1.09 CONTRACTOR RESPONSIBILITIES

A. Deliver to laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.

B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturer's facilities.

C. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

D. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

E. Employ services of a separate qualified testing laboratory. Arrange with laboratory and pay for additional samples and tests required by Contractor beyond specified requirements.

1.10 RETESTING

A. Where results of quality control services prove unsatisfactory and do not indicate compliance of related work with requirements of the contract documents, retests are responsibility of Contractor, regardless of whether the original test was Contractor's responsibility. Retesting will be at the rate of 2 retests for each failed test. Retest of work revised or replaced by Contractor is Contractor's responsibility. Retesting costs invoiced to the Owner will be deducted from Contract amount by Supplemental Agreement.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This Page Left Blank Intentionally

SECTION 01 51 00

TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Temporary utility services and facilities including, but not limited to:
   1. Construction water.
   2. Electric power service.
   3. Lighting.
   4. Telephone services.
   5. Heat.

B. Related Requirements:
   1. Section 01 57 00 - Temporary Controls
   2. Section 01 52 19 - Temporary Sanitary Facilities

1.02 PRICE AND PAYMENT PROCEDURES

A. Temporary Utilities are incidental to the installation of proposed applicable permanent utility improvements and include:
   1. Devices required by Section 01 57 00.
   2. Costs associated with required tests and inspections.

1.03 REFERENCES

A. ANSI - A10 Series Safety Requirements Standards

B. AWWA - C651 Disinfecting Water Mains

C. FM Global

D. NECA - NJG-6 - Temporary Job Utilities and Services

E. NEMA

F. NFPA:
   1. 70 - National Electrical Code
   2. 241 - Safeguarding Construction, Alteration, and Demolition Operations

G. Underwriter's Laboratory (UL)

1.04 COORDINATION

A. Contractor shall coordinate tests and inspections required by state and local health departments and AWWA C651.

B. Utility interruptions required for tie-ins:
   1. Determine requirements, time constraints, etc. for installing temporary service to the Site, or to make connections to existing service.
      a. Shall be requested by Contractor in writing to Engineer.
      b. Shall not commence until Contractor has received written response from Engineer.
      c. Engineer reserves the right to restrict the time and duration of interruption.

2. Arrange with utility companies for service interruption, where necessary, to make connections for temporary services.

1.05 QUALITY ASSURANCE

A. Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary utilities and related services.

B. Comply with requirements of NECA NJG-6, NFPA 241, ANSI A10, AWWA C651 Series Standards.

C. Comply with applicable NEMA, NECA, and UL standards and governing regulations for materials and layout of temporary electric service.

D. Where local laws and regulations conflict with the requirements of NEMA, NFPA, ANSI, AWWA, or NECA, comply with the most stringent requirements.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Provide all required materials and equipment for temporary utilities, services, and facilities.

B. Used materials and equipment may be used, if acceptable to Engineer.

C. Provide only materials and equipment that are suitable for intended use and comply with appropriate standards.

2.02 UTILITIES

A. Where local utility company provides only a portion of temporary utility, provide remainder with matching, compatible materials and equipment. Comply with utility company's recommendations and requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide each temporary service and facility ready for use at each location when service or facility is first needed.

B. Locate temporary utilities where they will serve Project and result in minimum interference with performance of the Work.

C. Maintain, relocate, modify, and extend utilities as required during course of Work.

D. Use qualified tradepersons for installation of temporary utilities.

3.02 CONSTRUCTION WATER

A. Contractor will pay for water used for construction purposes.

B. Secure water necessary for construction and testing and pay service connection charges.

C. Install water service and distribution piping of sizes and pressures adequate for construction purposes.

D. Where available supply of potable water is inadequate, provide non-potable water for purposes other than drinking and washing.

E. Where non-potable water is used, provide warning signs on the discharge end of each length of hose and at the shut-off nozzles.

F. Where shut-off nozzles are used at water hose discharge, provide heavy-duty abrasion-resistant hoses with a pressure rating greater than the maximum pressure of the water distribution system.

G. Trades needing a larger source of water are responsible for the source and distribution.

H. Exercise control over usage to conserve water.

I. Sterilize temporary water piping for potable water prior to use.

J. Maintain distribution system to avoid damage to existing or new construction.

K. Avoid damage to permanent plumbing at source of temporary water.

3.03 ELECTRIC POWER SERVICE

A. Provide a weatherproof, grounded temporary electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of Work.

B. Contractor shall pay for electricity used for construction purposes.
   1. Electrical service shall be provided and installed by Contractor.
   2. Any Trade requiring power with different characteristics than provided shall arrange and pay for access to such power.

C. When permanent power and lighting systems are in operation, they may be used for construction purposes.

D. Whenever an overhead floor or roof deck has been installed, install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in area of Work.

E. Install service and grounding in compliance with NFPA 70. Include necessary meters, transformers, overload protected disconnect, and main distribution switch gear.

F. Connect temporary service to local electric power company main as directed by electric company officials.

G. Install temporary service with an automatic ground-fault interrupter feature, activated from circuits of the system.

H. Install circuits of adequate size and proper characteristics for each use.
   1. Run wiring overhead and rise vertically where wiring will be least exposed to damage from construction operations.
   2. Install rigid steel conduit or equivalent raceways for wiring that must be exposed on grade, floors, decks, or other areas of possible damage or abuse.

I. Provide identification/warning signs at power outlets that are other than 110 to 120 volt power.

J. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110 to 120 volt plugs into higher voltage outlets.

K. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for plug-in connection of power tools and equipment.

L. Use only grounded extension cords.
   1. Use “hard-service” cords where exposed to abrasion and traffic.
   2. Use single lengths or waterproof connectors to connect separate lengths of electric cords.

3.04 LIGHTING

A. Install local switching of temporary lighting, spaced to allow lighting to be turned off in patterns to conserve energy and retain light suitable for work-in-progress, access traffic, security check, and Project lock-up.

B. Provide not less than one 200-watt incandescent lamp per 1,000 square feet of floor area, uniformly distributed, for general construction lighting, or equivalent illumination of a similar nature.
   1. In corridors and similar traffic areas, provide not less than one 100-watt incandescent lamp every 50 feet.
   2. In stairways and at ladder runs, locate not less than one 100-watt incandescent lamp for illuminating each landing and flight.

C. Install and operate temporary lighting that will fulfill security and protection requirements, without the necessity of operating entire temporary lighting system.

D. Provide general service incandescent lamps of wattage required for adequate illumination.

E. Protect lamps with guard cages or tempered glass enclosures.

F. Provide cut-off blinds and/or other materials or methods on light to prevent light transmission onto neighboring property.

3.05 TELEPHONE SERVICES

A. Contractor shall maintain and pay for telephone (and fax machine) on Site for use of Contractors, Engineers, Architect, and others who have legitimate need for telephone communication in pursuit of Work of this Project.

B. Arrange for local telephone company to install temporary service. Install telephone on a separate line for each temporary office and first aid station.

C. At each telephone location post a list of important telephone numbers, including:
   1. Local police and fire departments.
   2. Doctor.
   3. Ambulance service.
   4. Contractor’s offices.
   5. Engineer’s offices.
   6. Subcontractor’s offices.

D. Long distance calls are to be by credit card.

E. Provide high speed internet access.

3.06 HEAT

A. Provide temporary heat for performance of the Work, curing or drying of recently installed work, or protection of work-in-place from adverse effects of elements.

B. Provide temporary heating units, tested and labeled by UL, FM, or other recognized trade association related to the fuel being consumed.

C. Select units known to be safe and without deleterious effect upon work-in-place or being installed.
   1. Except where conditions make it necessary to use another system, and where use of the permanent heating system is available and authorized by Engineer, provide properly vented self-

contained liquid propane gas or fuel oil heaters with individual space thermostatic controls for temporary heat.

D. Coordinate ventilation requirements to produce indicated ambient condition required, to prevent accumulations of dust, fumes, vapors or gases, and to minimize consumption of fuel or energy.

E. Coordinate use of existing facilities with Owner.

F. Temporary heating and ventilation required by Work under Contract shall be provided and paid by Contractor requiring same.

G. Extend and supplement with temporary units as required to maintain specified conditions for construction operations, and to protect materials and finishes from damage due to temperature or humidity.

3.07 OPERATION, TERMINATION, AND REMOVAL

A. Enforce strict discipline in use of temporary services and facilities at the Site.
   1. Limit availability of temporary services and facilities to essential and intended uses to minimize waste and abuse.
   2. Do not permit temporary installations to be abused or endangered.
   3. Do not allow hazardous, dangerous, or unsanitary conditions to develop or persist on Site.

B. Operate temporary services and facilities in a safe and efficient manner.
   1. Do not overload temporary services or facilities.
   2. Protect from damage by freezing temperatures and similar elements.
   3. Prevent water-filled piping from freezing by use of ground covers, insulation, draining, or by temporary heating.
   4. Maintain distinct markers for underground lines.
   5. Protect from damage during excavation operations.

C. Unless Engineer requests that it be maintained for a longer period of time, remove each temporary service and facility promptly when no longer needed, when it has been replaced by the authorized use of a permanent facility, or no later than Substantial Completion.

D. Complete or restore permanent Work which may have been delayed because of interference with temporary service or facility.

E. Repair damaged Work, clean exposed surfaces, and replace Work which cannot be satisfactorily repaired.

F. Materials and facilities that constitute temporary services and facilities are, and will remain, the property of Contractor.

G. At Substantial Completion, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during construction, including but not limited to:
   1. Replace air filters and clean inside of ductwork and housings.
   2. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
   3. Replace lighting system lamps that are burned out or noticeably dimmed.

END OF SECTION

This Page Left Blank Intentionally

SECTION 01 51 36

TEMPORARY WATER

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Availability of Water for Construction.

B. Related Sections:
   1. Section 01 57 33 - Application of Water

1.02 DESCRIPTION

A. Water is available from the City of Madison.

B. City will establish rates and conditions.

C. Water shall be obtained from approved city hydrant.

D. Piping shall be the responsibility of the Contractor.

E. Keep water use to minimum and consistent with needs.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This Page Left Blank Intentionally

SECTION 01 52 13

FIELD OFFICE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes furnishing and maintaining field office for use by Contractor, subcontractors, and Engineer during construction operations.

B. Related Sections:
1. Section 01 11 00 - Summary of Work
2. Section 01 51 00 - Temporary Utilities
3. Section 01 71 13 - Mobilization

C. Basis of Payment: Incidental to Mobilization.

1.02 DESCRIPTION

A. Basic Requirements:
1. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
2. Minimum 8-foot wide and 7-foot ceiling height.
3. Minimum 120 square feet of usable space.
4. Weatherproof and insulated.
5. Finished interior walls.
6. Heating and air conditioning system: See Section 01 51 00.
7. Telephone service: See Section 01 51 00.
8. Electrical service: See Section 01 51 00.
9. Lighting: 50-foot C at desktop height and exterior lighting at entrance doors.
10. Internet access: See Section 01 51 00.

B. Furnishings:
1. Desk and chair.
2. Flat surface large enough to examine Construction Documents.
3. Drawing rack.
4. Conference table and chairs to seat at least 6 persons.
5. Telephone.
6. Answering machine.
7. Wastebasket.
8. Potable water supply.
9. Fire extinguisher.
10. Six adjustable-band protective helmets for visitors.
11. One 10-inch outdoor weather thermometer.

1.03 LOCATION

A. Locate to provide convenient access to construction Site and as provided on Drawings or determined in field by Engineer.

B. Subject to Owner’s approval.

C. Existing facilities shall not be used for field offices.

1.04 SCHEDULE

A. Provide facility and services upon commencement of construction or within 10 days after date fixed in Notice to Proceed.

B. Remove building, utilities, and foundation upon completion and acceptance of Work. Restore area.

1.05 MAINTENANCE

A. Maintain, clean, and repair field office and services to ensure proper working order throughout the duration of construction operations.

B. Maintain approach walks free of mud, water, and snow.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 52 19

TEMPORARY SANITARY FACILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Provide temporary closet or privy.

B. Maintain throughout Project duration.

C. Type and location subject to Engineer's approval.

D. Remove upon completion of Project.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This Page Left Blank Intentionally

SECTION 01 57 00

TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Drainage control.
   2. Dust control.
   3. Erosion and sediment control.
   4. Noise control.
   5. Pollution control.
   6. Barriers.
   7. Protection:
      a. Shoring and bracing.
      b. Enclosures.
      c. Installed work.
      d. Security.
      e. Fire protection.
   8. Site cleaning.

B. Related Sections:
   1. Section 01 11 00 - Summary of Work
   2. Section 01 52 13 - Field Office
   3. Section 01 57 19 - Air, Land, and Water Pollution
   4. Section 01 58 13 - Project Signs
   5. Section 31 23 10 - Excavation and Embankment
   6. Section 31 25 10 - Temporary Erosion Control

1.02 QUALITY ASSURANCE

A. Regulatory Requirements: As a minimum, comply with local, state, and federal requirements.

1.03 DRAINAGE CONTROL

A. Reference: See 31 23 10.

B. Maintain excavations free of water.
   1. Grade Site to drain.
   2. Provide, operate, and maintain pumping equipment.
   3. Protect Site from puddling or running water.

1.04 DUST CONTROL

A. Reference: See Section 31 25 10.

B. Execute Work by methods to minimize raising dust from construction operations.

C. Provide positive means to prevent airborne dust from dispersing into atmosphere.

1.05 EROSION AND SEDIMENT CONTROL

A. Reference: See Section 31 25 10.

B. Prevent erosion and sedimentation:
   1. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas.
   2. Minimize amount of bare soil exposed at one time.
   3. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   4. Use selective placement at construction fill and waste areas to avoid erosive surface silts or clays.
   5. Periodically inspect earthwork to detect evidence of erosion and sedimentation.
   6. Promptly apply corrective measures.

1.06 NOISE CONTROL

A. Comply with local noise ordinances.

B. Avoid use of tools or equipment that produce harmful noise.

C. Restrict use of noise-making tools and equipment to hours of use that will minimize noise complaints from persons or businesses near Site.

D. Provide noise suppression barriers or equipment used to perform the Work.

1.07 POLLUTION CONTROL

A. Reference: See Section 01 57 19.

B. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.08 BARRIERS

A. Barriers as required to:
   1. Prevent public entry to construction areas.
   2. Protect existing facilities, designated plantings and trees, and adjacent properties from damage from construction activities.

B. Construction:
   1. Type: Commercial grade chain link fence.
   2. Height: 7-foot.
   3. Gates: Equip with vehicular and pedestrian gates with locks.

C. Access: Provide barricades and covered walkways as required for public rights-of-way, for public access to, and emergency egress from existing buildings.

1.09 PROTECTION

A. Shoring and Bracing:
   1. Reference: See Section 31 40 00.
   2. Provide temporary shoring, bracing, and protection as required for installation and protection of Work.
   3. Ensure adequacy of such items.
   4. Repair or replace damaged Work occasioned by inadequate temporary supports.
   5. Leave temporary shoring and bracing in place until permanent construction is complete to point where installed Work is properly supported.

B. Installed Work:
   1. Provide temporary protection for installed products; control traffic in immediate area to minimize damage.

2. Provide protective coverings at walls, projections, jambs sills, and soffits of openings; protect finished floors and stairs from traffic, movement of heavy objects.
3. Prohibit traffic and storage on waterproofed and roofed surfaces or on lawn and landscaped areas.

C. Security:
1. Provide security program and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, and theft.
2. Provide doors in enclosures with self-closing hardware and locks.
3. Provide temporary locks for doors installed in Work.

D. Fire Protection:
1. Fire extinguishers shall be non-freeze type such as A-B-C rated dry chemical of not less than 10-pound capacity.
2. Provide and maintain in working order during entire construction period, a minimum of 1 fire extinguisher in construction area and 1 in field office.
3. Contractors who maintain enclosed sheds on the premises shall provide and maintain, in an accessible location, a minimum of 1 non-freezing type extinguisher in each shed.
4. Each Contractor using open flame (i.e., welding or soldering) shall have a 10-pound minimum extinguisher within closest practical distance.

1.10 SITE CLEANING

A. Keep Site neat, clean, free of debris.

B. Prevent papers, cardboard or other debris from blowing around Site or onto adjacent property.

C. Contractor shall provide and pay for dumpsters for collection of trash.

D. Control accumulation of waste materials and rubbish. Collect and dispose of all trash from the Site at regular intervals.

E. Separate and recycle applicable materials.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This Page Left Blank Intentionally

SECTION 01 57 12

EROSION CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section includes prevention and control of soil erosion and siltation and the resultant turbidity of streams, lakes, and impoundments.

B. Related Sections:
   1. Section 31 22 10 - Site Grading
   2. Section 31 23 10 - Excavation and Embankment
   3. Section 31 23 33 - Trench Excavation and Backfill
   4. Section 31 25 10 - Temporary Erosion Control

C. Basis of Payment:
   1. All expenses shall be borne by the Contractor with no direct compensation.
   2. Failure to comply with established erosion control measures will result in withholding of progress payments by the Owner.

1.02 SUBMITTALS

A. Proposed schedule for accomplishment of Work within, adjacent to, or affecting surface water.

B. Erosion control schedule.

C. Submit within 30 days of Notice of Award and prior to the Preconstruction Conference.

1.03 QUALITY ASSURANCE

A. Obtain all necessary permits from the responsible regulatory agencies for temporary erosion control measures not shown on the Drawings.

B. “Wisconsin Site Best Management Handbook” by the WDNR Bureau of Wastewater Management will be the basis for all erosion control on this Project.

1.04 REFERENCES

A. WisDOT 628 - Erosion Control

1.05 SEQUENCING AND SCHEDULING

A. Construct drainage facilities and turf establishment concurrently with earthwork operation.

B. Complete construction and finishing operation on a drainage area basis to minimize erosion.

C. Incorporate erosion control measures at the earliest practical time during construction.

D. Install erosion control measures as directed prior to the disturbance of inplace ground cover in critical areas that are tributary to public waters.

1.06 MAINTENANCE

A. Maintain all erosion control facilities to provide proper function throughout the Project.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

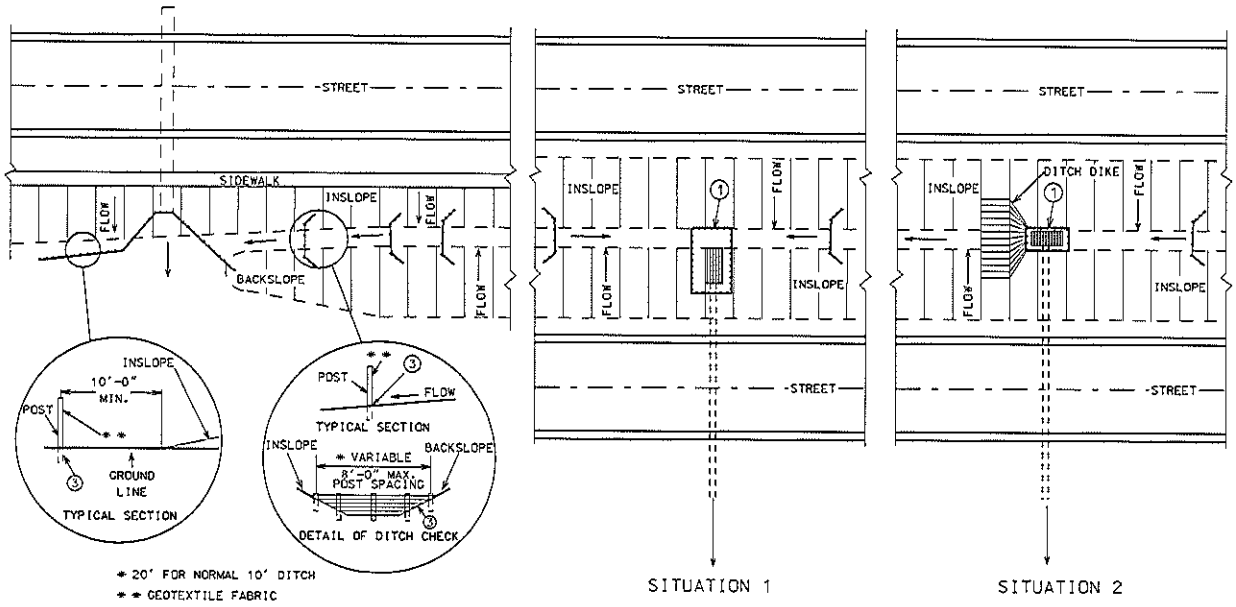
A. Shape exposed soil areas to permit runoff with minimal erosion.

B. Install safeguards to prevent water pollution from haul roads, work platforms or other temporary construction facilities.

C. Restore all plant, equipment or other supplementary operation sites to prevent siltation and erosion.

D. Repair any offsite damage resulting from failure to install or maintain erosion control measures.

END OF SECTION



PLAN VIEW

TYPICAL APPLICATIONS OF SILT FENCE

PLAN VIEW

SILT FENCE AT MEDIAN SURFACE DRAINS

GENERAL NOTES

DETAIL OF CONSTRUCTION NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND APPLICABLE SPECIAL PROVISIONS.

(1A) WHEN POSSIBLE THE SILT FENCE SHOULD BE CONSTRUCTED IN AN ARC OR HORSESHOE SHAPE WITH THE ENDS POINTING UPSLOPE TO MAXIMIZE BOTH STRENGTH AND EFFECTIVENESS.

(1) CROSS BRACE WITH 2" X 4" WOODEN FRAME OR EQUIVALENT AT TOP OF POSTS AS DIRECTED BY THE ENGINEER.

(2) MINIMUM 14 GAGE WIRE REQUIRED. FOLD FABRIC 3" OVER THE WIRE AND STAPLE OR PLACE WIRE RINGS ON 12" C-C.

(3) EXCAVATE A TRENCH A MINIMUM OF 4" WIDE & 6" DEEP TO BURY AND ANCHOR THE GEOTEXTILE FABRIC. FOLD MATERIAL TO FIT TRENCH AND BACKFILL & COMPACT TRENCH WITH EXCAVATED SOIL.

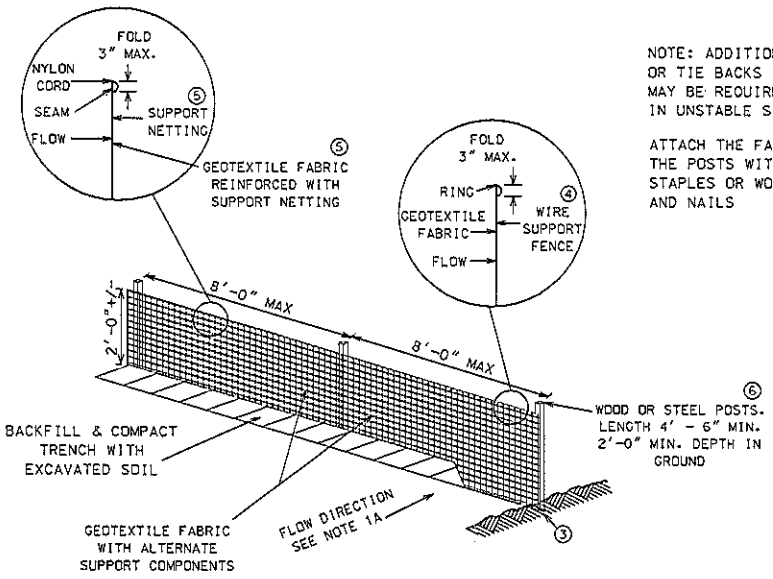
(4) WIRE SUPPORT FENCE SHALL BE 14 GAGE MINIMUM WOVEN WIRE WITH A MAXIMUM MESH SPACING OF 6". SECURE TOP OF GEOTEXTILE FABRIC TO TOP OF FENCE WITH STAPLES OR WIRE RINGS AT 12" C-C.

(5) GEOTEXTILE FABRIC SHALL BE REINFORCED WITH AN INDUSTRIAL POLYPROPYLENE NETTING WITH A MAXIMUM MESH SPACING OF 3/4" OR EQUAL. A HEAVY DUTY NYLON TOP SUPPORT CORD OR EQUIVALENT IS REQUIRED.

(6) STEEL POSTS SHALL BE STUDDED "TEE" OR "U" TYPE WITH A MINIMUM WEIGHT OF 1.28 LBS/LINEAL FOOT (WITHOUT ANCHOR). FIN ANCHORS SUFFICIENT TO RESIST POST MOVEMENT ARE REQUIRED. WOOD POSTS SHALL BE A MINIMUM SIZE OF 4" DIA. OR 1 1/2" X 3 1/8" EXCEPT WOOD POSTS FOR GEOTEXTILE FABRIC REINFORCED WITH NETTING SHALL BE A MINIMUM SIZE OF 1 1/8" X 1 1/8" OAK OR HICKORY.

ALTERNATES A & B ARE EQUAL AND EITHER MAY BE USED.

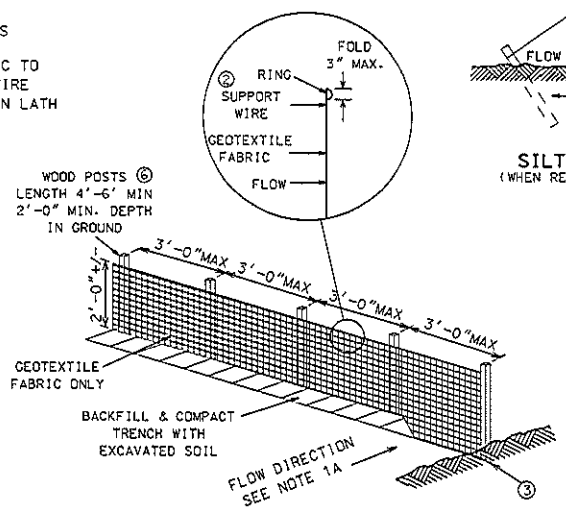
(7) REMOVAL OF ACCUMULATED SILT IS REQUIRED ONCE IT REACHES HALF THE HEIGHT OF THE SILT FENCE.



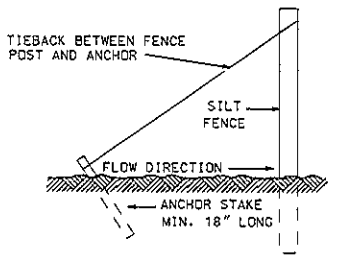
ALTERNATE "A"

NOTE: ADDITIONAL POST DEPTH OR TIE BACKS MAY BE REQUIRED IN UNSTABLE SOILS

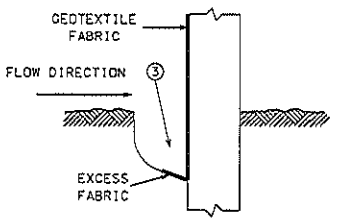
ATTACH THE FABRIC TO THE POSTS WITH WIRE STAPLES OR WOODEN LATH AND NAILS



ALTERNATE "B"



SILT FENCE TIE BACK
(WHEN REQUIRED BY THE ENGINEER)



TRENCH DETAIL

2012

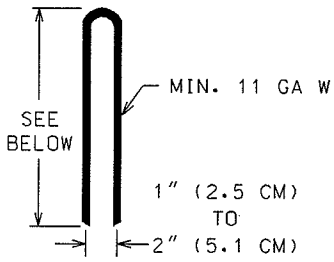
CITY OF MADISON
ENGINEERING DIVISION

SILT FENCE

STANDARD DETAIL DRAWING 1.01

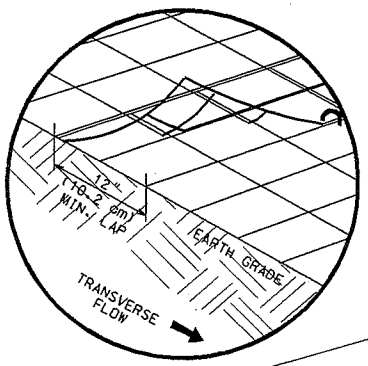
SILT FENCE

1.01

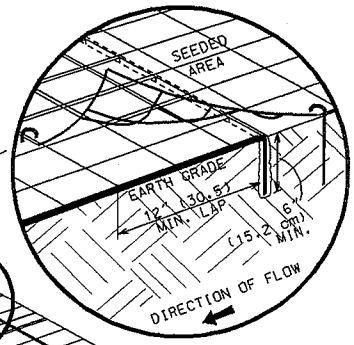


DETAIL OF TYPICAL STAPLE

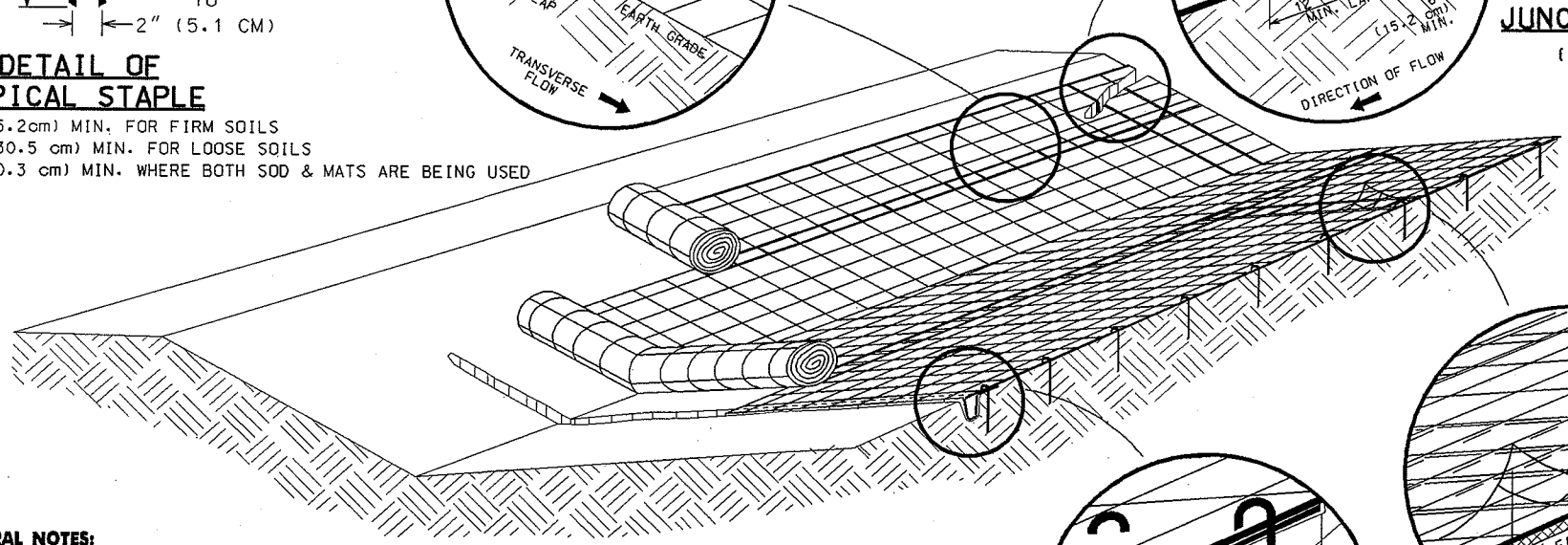
6" (15.2cm) MIN. FOR FIRM SOILS
12" (30.5 cm) MIN. FOR LOOSE SOILS
8" (20.3 cm) MIN. WHERE BOTH SOD & MATS ARE BEING USED

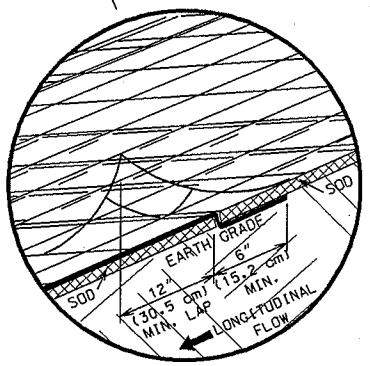


LAP JOINT
(SEED AND SOD)

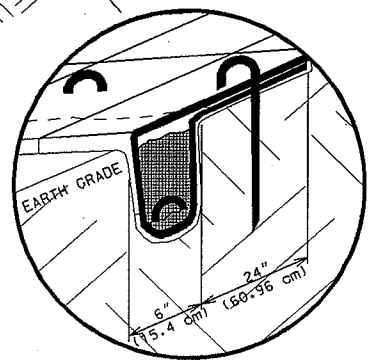


JUNCTION SLOT
(SEED ONLY)





JUNCTION SLOT
(SOD ONLY)



ANCHOR SLOT
AT BEGINNING OF EROSION MAT
EXTRA STAPLE AT END ONLY
(SEED AND SOD)

GENERAL NOTES:

DETAILS OF CONSTRUCTION MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.

VARIATIONS IN THE DIMENSIONS OR MATERIALS SHOWN HEREON SHALL BE PERMITTED IF THEY PROVIDE EQUIVALENT PROTECTION AND MATERIAL STRENGTH AND IF PRIOR APPROVAL OF THE ENGINEER IS OBTAINED.

LAP JOINTS SHALL NOT BE PLACED IN THE BOTTOM OF V-SHAPED DITCHES.

JUNCTION SLOTS ON ADJACENT STRIPS OF MATTING SHALL BE STAGGERED A MINIMUM OF 4 FEET (1.219 m) APART.

EROSION MAT SHALL BE MEASURED AND PAID FOR IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

EROSION MAT OVER SOD:

a. ONLY JUTE FABRIC WILL BE PERMITTED OVER SOD.

b. WOOD STAKES FOR SOD MAY BE OMITTED BY THE ENGINEER IF EXISTING SLOPE AND SOIL CONDITIONS SO WARRANT.

c. THE WIDTH OF EROSION MAT SHALL ALWAYS EXCEED THE SOD WIDTH.

EROSION MAT OVER SEEDING:

JUNCTION OR ANCHOR SLOTS SHALL BE AT MINIMUM INTERVALS OF 100 FEET (30.48 m) ON GRADES UP TO AND INCLUDING 3 PERCENT. AND 50 FEET (15.24 m) ON GRADES EXCEEDING 3 PERCENT.

DRAWING NOT TO SCALE

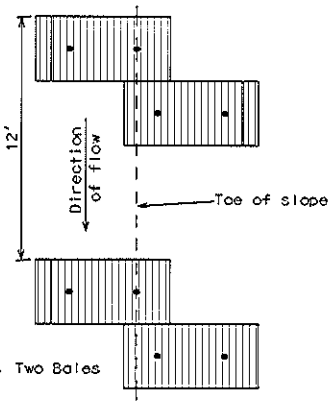
2004

CITY OF MADISON
ENGINEERING DIVISION

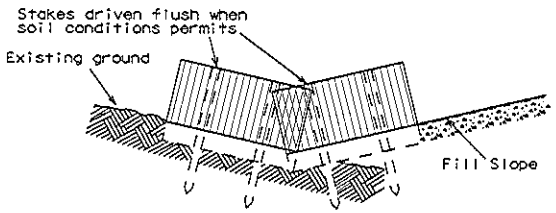
EROSION MAT

STANDARD DETAIL DRAWING 1.02

1.02

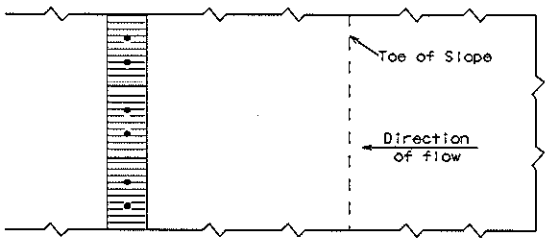


PLAN VIEW

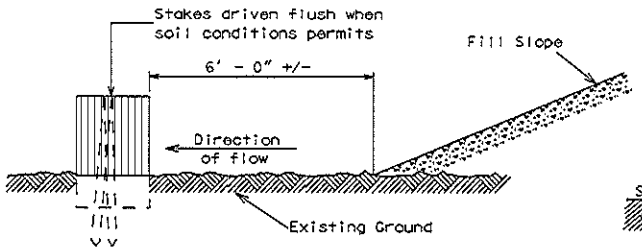


FRONT ELEVATION

EROSION BALES AT TOE OF SLOPE
WHEN EXISTING GROUND SLOPES TOWARD FILL SLOPE

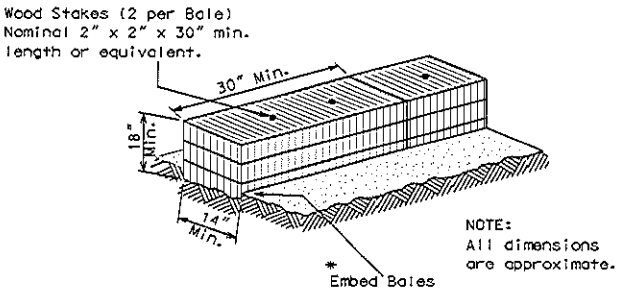


PLAN VIEW

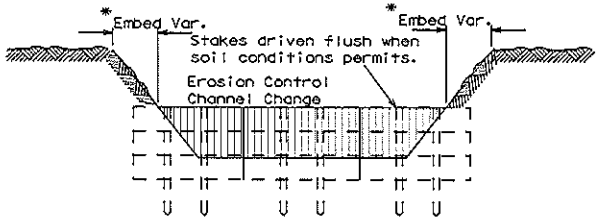


FRONT ELEVATION

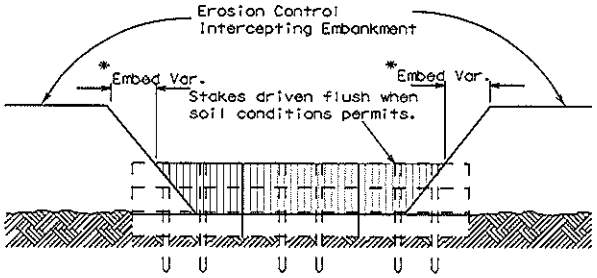
EROSION BALES AT TOE OF SLOPE
WHEN EXISTING GROUND SLOPES AWAY FROM FILL SLOPE



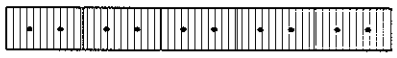
DETAIL OF EROSION BALE INSTALLATION



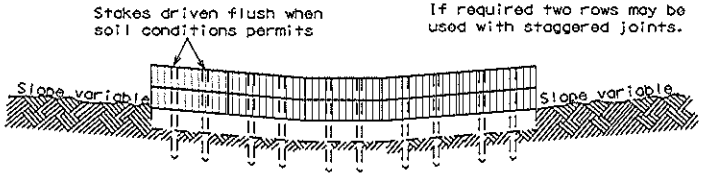
EROSION CONTROL CHANNEL CHANGE



EROSION CONTROL INTERCEPTING EMBANKMENT



PLAN VIEW



FRONT ELEVATION

EROSION BALES ACROSS DITCH BOTTOM

GENERAL NOTES

DETAILS OF CONSTRUCTION, MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.

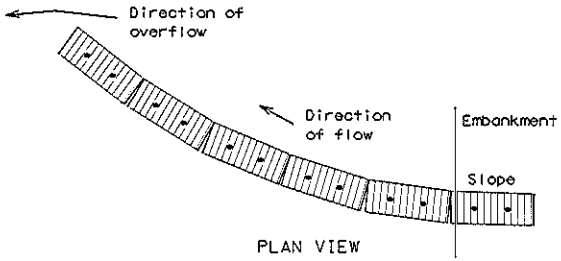
BALES SHALL BE PLACED END TO END OR OVERLAPPING AT RIGHT ANGLES TO THE DIRECTION OF FLOW AND FAR ENOUGH UP THE SIDES OF THE DITCH TO PREVENT ERODING AROUND ENDS.

BALES SHALL BE PLACED WITH TWINE OR TIE WIRES PARALLEL TO THE GROUND.

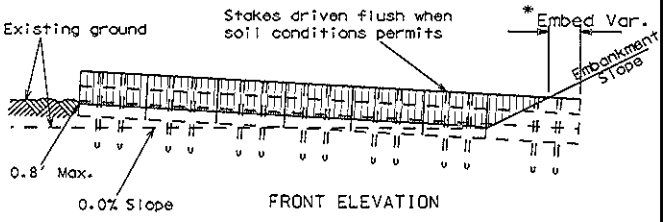
STAKES TO BE BATTERED IN OPPOSITE DIRECTIONS.

ACCUMULATED SEDIMENT REMOVAL SHALL BE COMPLETED ONCE SEDIMENT DEPTH EQUALS TO HALF THE HEIGHT OF THE BALES.

* AS DETERMINED BY THE ENGINEER.



PLAN VIEW



FRONT ELEVATION

EROSION BALES AT TOE OF SLOPE

2012

CITY OF MADISON
ENGINEERING DIVISION

TYPICAL INSTALLATIONS OF EROSION BALES

STANDARD DETAIL DRAWING 1.03

1.03

This Page Left Blank Intentionally

SECTION 01 57 19

AIR, LAND, AND WATER POLLUTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes general requirements for the control of pollution from construction sites and related activities.

B. Related Sections:
   1. Section 01 57 12 - Erosion Control
   2. Section 31 25 10 - Temporary Erosion Control

C. Unit Prices:
   1. All activities required by or relating to this section will be considered incidental.
   2. No direct payment will be made.
   3. No additional compensation or time extension will be granted due to actions brought against the Contractor for failure to comply with pollution control requirements.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Conduct all operations to prevent, control and abate the pollution of air, land and water in accordance with the rules, regulations and standards adopted and established by the following agencies:
      a. Wisconsin Department of Natural Resources
      b. U.S. Army Corps of Engineers

1.03 SCHEDULING

A. Schedule and conduct all operations to minimize soil erosion and prevent siltation and the resultant turbidity of public waters.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Review all local conditions and regulations pertaining to air and land pollution prior to commencing operations.

3.02 PROTECTION OF WATERS

A. Prevent pollution of flowing or impounded waters from particulate or liquid matter that may be harmful to fish and wildlife or detrimental to public use.

B. Remove sediment from aggregate wash operations by filtration or settlement prior to discharge into public waters.

C. Do not discharge wash water or waste from concrete mixing operations into live streams.

3.03 SPECIAL REQUIREMENTS

A. Provide temporary bridging where stream crossings are necessary.

B. Remove temporary bridging as soon as crossings are no longer necessary.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements governing:
      a. Products.
      b. Delivery, storage and handling.
   2. The following is not included in this section: Product Substitution Procedures (Section 01 25 13).

1.02 PRODUCT DEFINITIONS

A. Products:
   1. Unless indicated otherwise, the term “products” represents new material, machinery, components, equipment, fixtures, and systems forming the Work.
   2. Does not include machinery and equipment used for preparation, fabrication, conveying, or erection of the Work.

B. Named Products: Items identified by manufacturer’s product name, including make or model designation, indicated in the manufacturer’s published product literature, that is current as of the date of the Contract Documents.

C. Materials: Products that are substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed as part of the Work.

D. Equipment: A product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.03 PRODUCT QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

B. Limited Quantities:
   1. When specified products are available only from sources that do not or cannot produce a quantity adequate to complete Project requirements in a timely manner, consult with Engineer for a determination of the most important product qualities before proceeding.
   2. Qualities may include attributes relating to:
      a. Visual appearance.
      b. Strength.
      c. Durability.
      d. Compatibility.
   3. When a determination has been made, select products from sources that possess these qualities to the fullest extent possible.

1.04 PRODUCT REQUIREMENTS

A. Minimum Requirements: Comply with specifications and referenced standards.

B. Product Provision: Provide products complete with all accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for the intended use and effect.

C. Components: Items required to be supplied in quantity within a specification section shall be the same and shall be interchangeable.

D. Compatibility of Options: When Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

E. Existing Products: Do not use materials and equipment removed from existing premises, except as specifically required or permitted by Contract Documents.

F. Nameplates:
   1. Except for required labels and operating data, do not attach or imprint manufacturer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
   2. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on an accessible surface that is not conspicuous.
   3. Equipment Nameplates:
      a. Provide permanent nameplate on each item of service-connected or power-operated equipment.
      b. Locate on an easily accessible surface that is inconspicuous in occupied spaces.
      c. Provide the following information and other essential operating data on nameplate:
         1) Name of product and manufacturer.
         2) Model and serial number.
         3) Capacity.
         4) Speed.
         5) Ratings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General Requirements:
   1. Deliver, store and handle products in accordance with the manufacturer's recommendations.
   2. Schedule and coordinate the delivery of materials to ensure personnel and equipment will be available at the Site.
   3. Sequence deliveries to avoid delays but minimize on-site storage.
   4. Prevent damage, deterioration, soiling, and loss, including theft.
   5. Repair or replace damaged materials at no additional cost to Owner.

B. Packing and Shipping: Deliver products to the jobsite in manufacturer's sealed containers bearing the manufacturer's name and brand, and appropriate UL labels for fire hazard and fire resistance classification.

C. Acceptance at Site:
   1. Promptly inspect shipments to ensure that:
      a. Products comply with requirements.
      b. Quantities are correct.
      c. Products are undamaged.
   2. Replace damaged or defective materials.

D. Storage and Protection:
   1. Store with manufacturer's seals and labels intact and legible.
   2. Store sensitive products in weather-tight, climate-controlled enclosures.
   3. Cover products subject to deterioration with impervious sheet covering, providing ventilation to avoid condensation.
   4. For exterior storage of fabricated products, place on sloped supports, above ground.
   5. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
   6. Provide off-site storage and protection when Site does not permit on-site storage or protection.
   7. Protect stored materials from damage by adjacent work, falling debris, or equipment.

8. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under required conditions.

1.06 PRODUCT SELECTION

A. Product selection is governed by the Contract Documents, and governing regulations by previous project experience.

B. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.

C. Semi-Proprietary Specification Requirements:
   1. Where 2 or more products or manufacturers are named, provide 1 of the products indicated. No substitutions will be permitted.
   2. Where products or manufacturers are specified by name, accompanied by the term “or equal,” or “or approved equal”, comply with Section 01 25 13 or other Contract Document provisions concerning “substitutions” to obtain approval for use of an unnamed product.
   3. Contractors and suppliers will be expected to provide the specified product unless prior approval is received from Engineer’s office in sufficient time to notify Bidders through addendum.

D. Descriptive Specification Requirements: Where specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

E. Performance Specification Requirements:
   1. Where specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated.
   2. Manufacturer’s recommendations may be contained in published product literature, or by the manufacturer’s certification of performance.
   3. General overall performance of a product is implied where the product is specified for a specific application.

F. Compliance with Standards, Codes and Regulations: Where the specifications only require compliance with an imposed code, standard or regulation, select a product that complies with applicable standards, codes and regulations.

G. Visual Matching:
   1. Where specifications require matching an established sample, Engineer’s decision will be final on whether a proposed product matches satisfactorily.
   2. Where no product available within the specified category matches satisfactorily but complies with other specified requirements, comply with provisions of the Contract Documents concerning “substitutions” for selection of a matching product, or for noncompliance with specified requirements.

H. Visual Selection: Where specified product requirements include the phrase *“…as selected from manufacturer’s standard colors, patterns, textures…”* or a similar phrase, select a product and manufacturer that comply with other specified requirements. Engineer will select the color, pattern and texture from the product line selected.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CLEANING AND PROTECTION

A. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 01 71 13

MOBILIZATION (WisDOT 619)

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Preparatory work and operations.
   2. Movement of personnel, equipment, supplies and incidentals to the Site.
   3. Establishment of Contractor offices and facilities.

B. Related Sections:
   1. Section 01 52 13 - Field Office
   2. Section 01 52 19 - Temporary Sanitary Facilities

C. Basis of Payment:
   1. If the Lump Sum Bid amount for Mobilization exceeds 5 percent of the total Base Bid amount, the Owner will withhold the amount in excess of 5 percent until Substantial Completion of the Project.

1.02 REFERENCES

A. WisDOT 619 - Mobilization

1.03 PERFORMANCE REQUIREMENTS

A. Submittal of information listed under Article 1.04.

B. Installation of temporary sanitary facilities.

C. Installation of Project signs.

D. Erection of a field office.

E. Commencement of Work.

1.04 SUBMITTALS

A. Approved Project Schedule

B. Shop Drawing Schedule

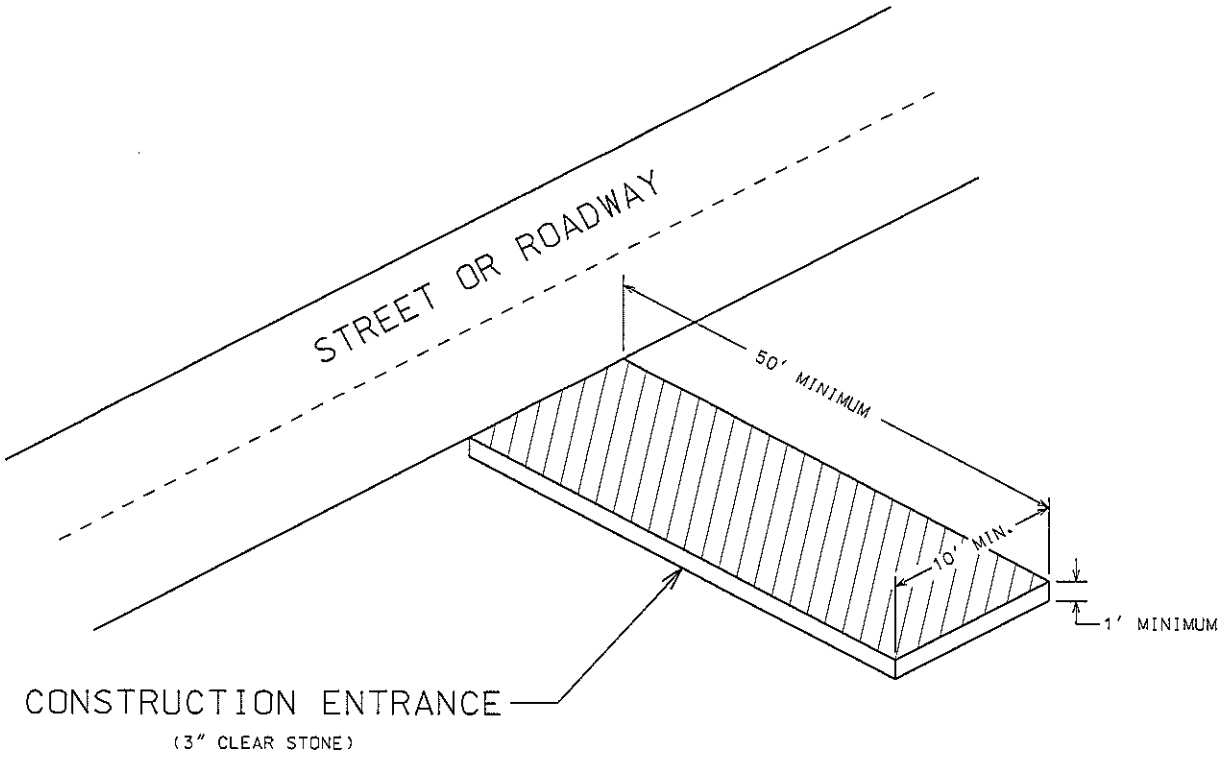
C. List of Proposed Subcontractors

D. List of Proposed Suppliers

E. Material and Procedural Submittals, as required

PART 2 PRODUCTS

Not Used



GENERAL NOTES:

1. CONSTRUCTION ENTRANCE TO BE INSTALLED PRIOR TO ANY TRAFFIC LEAVING THE SITE.
2. THE AGGREATE FOR THE CONSTRUCTION ENTRANCE SHALL BE 3 INCH CLEAR OR WASHED STONE.
3. AGGREGATE SHALL BE PLACED IN A LAYER AT LEAST 12 INCHES THICK.
4. THE CONSTRUCTION ENTRANCE SHALL BE UNDERLAIN WITH A WDOT TYPE HR OR FF GEOTEXTILE FABRIC TO PREVENT MIGRATION OF UNERLYING SOIL INTO THE STONE.
5. SURFACE WATERS MUST BE PREVENTED FROM PASSING THROUGH THE CONSTRUCTION ENTRANCE. FLOWS SHALL BE DIVERTED AWAY FROM THE CONSTRUCTION ENTRANCE OR CONVEYED UNDER AND AROUND THEM BY USE OF A CULVERT, DIVERSION BERM OR OTHER PRACTICES AS APPROVED BY THE CONSTRUCTION ENGINEER.
6. CLEANING BY SCRAPING OR ADDING NEW STONE SHALL BE REQUIRED IF ENTRANCE BECOMES MORE THAN 50% COVERED BY TRACKED MUD.

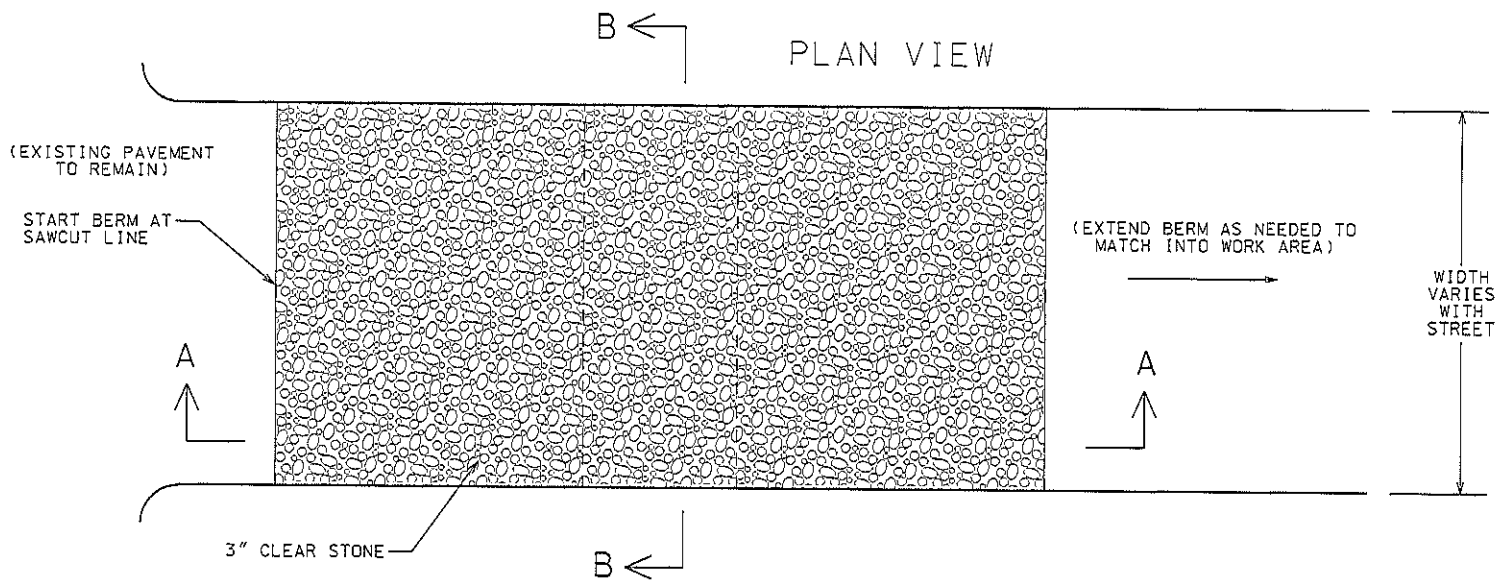
2012

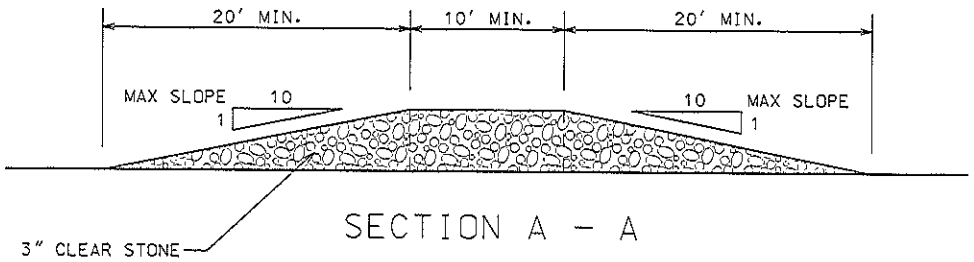
CITY OF MADISON
ENGINEERING DIVISION

CONSTRUCTION ENTRANCE

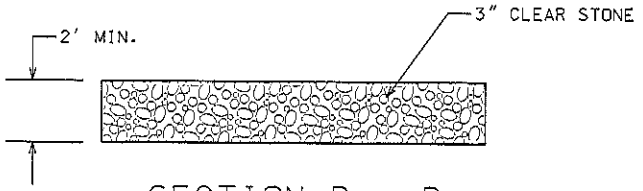
STANDARD DETAIL DRAWING 1.07

1.07





SECTION A - A



SECTION B - B

GENERAL NOTES:

1. THE STREET CONSTRUCTION ENTRANCE BERM IS TO BE INSTALLED PRIOR TO ANY TRAFFIC LEAVING THE SITE.
2. THE AGGREATE FOR THE STREET CONSTRUCTION ENTRANCE BERM SHALL BE 3 INCH CLEAR OR WASHED STONE.
3. MINIMUM OVERALL LENGTH OF THE STREET CONSTRUCTION ENTRANCE BERM SHALL BE 50 FEET. THE BERM SHALL START AT THE SAWCUT LINE AND EXTEND INTO THE WORK AREA UNTIL IT MATCHES INTO THE WORK AREA GRADES.
4. THE MAXIMUM ALLOWABLE SLOPE OF 10:1 SHALL NOT BE EXCEEDED. THIS IS TO ALLOW EMERGENCY VEHICLE ACCESS TO THE CONSTRUCTION AREA WITHOUT NEEDING TO REMOVE THE BERM.
5. THE STREET CONSTRUCTION ENTRANCE BERM SHALL BE UNDERLAIN WITH A WDOT TYPE HR OR FF GEOTEXTILE FABRIC TO PREVENT MIGRATION OF UNERLYING SOIL INTO THE STONE.
6. CLEANING BY SCRAPING OR ADDING NEW STONE SHALL BE REQUIRED IF ENTRANCE BECOMES MORE THAN 50% COVERED BY TRACKED MUD.

2012

CITY OF MADISON
ENGINEERING DIVISION

STREET CONSTRUCTION ENTRANCE BERM

STANDARD DETAIL DRAWING 1.08

1.08

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 75 00

STARTING AND ADJUSTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Starting systems.
   2. Testing, adjusting, and balancing.
   3. Demonstration and instructions.

B. Related Sections:
   1. Section 01 21 00 - Allowances
   2. Section 01 33 00 - Submittal Procedures
   3. Section 01 77 00 - Closeout Procedures
   4. Section 01 78 23 - Operation and Maintenance Data
   5. Individual Technical Sections

1.02 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment systems.

B. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

C. Verify wiring and support components for equipment are complete and tested.

D. When specified in individual specification sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

E. Submit a written report in accordance with Section 01 33 00 that equipment or system has been properly installed and is functioning correctly.

1.03 TESTING, ADJUSTING, AND BALANCING

A. Owner will appoint, employ, and pay for services of an independent firm to perform testing, adjusting and balancing.

B. Reports will be submitted by the independent firm to Engineer indicating:
   1. Observations and results of tests.
   2. Compliance or non-compliance with manufacturer’s requirements and with the requirements of the Contract Documents.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 DEMONSTRATION AND INSTRUCTIONS

A. A manufacturer's representative who is knowledgeable about the project shall meet with Owner's personnel prior to date of final inspection to provide instruction in proper operation and maintenance:
   1. Utilize operation and maintenance manuals as basis for instructions.
   2. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
   3. Include a detailed review of the following items:
      a. Maintenance manuals.
      b. Record documents.
      c. Spare parts and materials.
      d. Tools.
      e. Lubricants.
      f. Fuels.
      g. Identification systems.
      h. Control sequences.
      i. Hazards.
      j. Cleaning.
      k. Warranties.
      l. Maintenance agreements and similar continuing commitments.
   4. Manufacturer's representative shall demonstrate the following procedures to Owner's personnel prior to date of final inspection:
      a. Startup.
      b. Shutdown.
      c. Emergency operations.
      d. Noise and vibration adjustments.
      e. Safety procedures.
      f. Economy and efficiency adjustments.
      g. Effective energy utilization.
      h. Troubleshooting.
      i. Maintenance.

B. Prepare and insert additional data in operations and maintenance manuals if need for additional data becomes apparent during instructions.

C. Provide a digital recording of above procedures.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Administrative and procedural requirements for contract closeout, including:
   1. Submittals.
   2. Inspection procedures.
   3. Warranties.
   4. Record document submittals.
   5. Final cleaning.
   6. Pest control.

B. Related Sections:
   1. Section 01 78 23 - Operation and Maintenance Data
   2. Specific requirements for individual units of work are included in appropriate technical sections

1.02 SUBSTANTIAL COMPLETION

A. Complete the following before requesting Engineer's inspection for certification of Substantial Completion for each phase of work. List items that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Obtain, submit releases enabling Owner unrestricted use of the Work and access to services and utilities.
   3. Regulatory requirements:
      a. Where required, obtain occupancy permits, operating certificates, similar releases.
      b. Obtain elevator inspection from State Inspector.
   4. Bonding and insurance:
      a. Consent of Surety to Reduction In or Partial Release of Retainage.
      b. Advise Owner of pending insurance change-over-requirements.

B. Inspection Procedures:
   1. When prerequisites are complete, submit request in writing to Engineer stating that all requirements are satisfied, and requesting inspection.
   2. Upon receipt of Contractor's request for inspection, Engineer will either proceed with inspection or advise Contractor of unfilled prerequisites.
   3. Following initial inspection, Engineer will either prepare Certificate of Substantial Completion, or advise Contractor of work which must be performed before certificate will be issued. Engineer will repeat inspection when requested and when assured that work has been substantially completed.
   4. Results of completed inspection will form the basis of requirements for Final Acceptance.

1.03 FINAL ACCEPTANCE

A. Before requesting final inspection for determining date of Final Completion, complete the following:
   1. Submittals:
      a. Lien Waivers (from all subcontractors and suppliers).
      b. Certificate of Substantial Completion (AIA G704) - 5 copies.
      c. Contractor's Affidavit of Payment of Debts and Claims (AIA G706).
      d. Contractor's Affidavit of Release of Liens (AIA G706A).
      e. Consent of Surety (if Performance Bond provided).
         1) To Partial Release of Retainage (AIA G707A).
         2) To Final Payment (AIA G707).
      f. Assurance that unsettled claims will be settled.

g. Proof that fees and similar obligations have been paid.
h. Evidence of final, continuing insurance coverage complying with insurance requirements.
i. Certified copy of Engineer's final punch list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by Engineer.

2. Warranties: Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications, and similar documents.
3. Maintenance:
   a. Materials (each type and color):
      1) Paint.
   b. Maintenance manuals: See Section 01 78 23
      1) Organize operating, maintenance data into suitable sets of manageable size.
      2) Bind into individual heavy-duty 2-inch, 3-ring vinyl-covered binders with pocket folders, each set of data, marked with appropriate identification on both front and spine of each binder.
      3) Include:
         a) Emergency instructions.
         b) Spare parts listing.
         c) Copies of warranties.
         d) Wiring diagrams.
         e) Recommended "turnaround" cycles.
         f) Inspection procedures.
         g) Shop Drawings and Product Data.
4. Miscellaneous Record Submittals:
   a. Refer to other sections of specifications for requirements of miscellaneous record keeping and submittals in connection with actual performance of work.
   b. Complete miscellaneous records, place in good order, properly identified and bound or filed, ready for continued use and reference.
5. Records:
   a. Test/adjust/balance records.
   b. Startup performance reports.
   c. Inspection Reports:
      1) Alarm tests.
      2) Meter readings.
      3) Cathodic protection equipment

B. Record Drawings: Submit to Engineer a set of record prints marked to show "as-built" conditions for work of contract.

C. Adjusting:
1. Repair and restore marred exposed finishes.
2. Touch up of painting of marred surfaces.
3. Complete final cleaning requirements.

D. Final Payment Request:
1. Include certificates of insurance for products and completed operations where required.
2. Updated final statement, accounting for final additional changes to Contract Sum.
3. Final liquidated damages settlement statement, acceptable to Owner.

E. Re-inspection Procedure:
1. Engineer will re-inspect work upon receipt of notice that work, including punch list items resulting from earlier inspections, has been completed, except for items whose completion has been delayed because of circumstances that are acceptable to Engineer.
2. Engineer will either prepare a certificate of final acceptance, or will advise Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
3. If necessary, re-inspection procedure will be repeated.

1.04 TRANSFER OF SITE TO OWNER

A. Deliver tools, spare parts, extra materials and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

B. Change door locks to Owner's access. Advise Owner's personnel of changeover in security provisions.

C. Advise Owner of changeover in heat and other utilities.

D. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

1.05 OPERATING AND MAINTENANCE INSTRUCTIONS/DEMONSTRATIONS

A. Arrange for each installer of operating equipment and other work requiring regular or continuing maintenance, to meet at Site with Owner's personnel to provide necessary basic instruction in proper operation and maintenance of entire work. Where installers are not experienced in required procedures, include instruction by manufacturer's representatives.

B. Provide detailed review of following items:
   1. Maintenance manuals.
   2. Record documents.
   3. Spare parts and materials.
   4. Tools.
   5. Lubricants.
   6. Fuels.
   7. Identification systems.
   8. Control sequences.
   9. Hazards.
   10. Cleaning materials and procedures.
   11. Warranties, bonds, maintenance agreements similar continuing commitments.

C. As part of this instruction for operating equipment, demonstrate following procedures:
   1. Start-up.
   2. Shut-down.
   3. Emergency operations.
   4. Noise and vibration adjustments.
   5. Safety procedures.
   6. Economy and efficiency adjustments.
   7. Effective energy utilization.

D. Provide a digital recording of above procedures.

PART 2 PRODUCTS

2.01 CLEANING AGENTS

A. Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned.

B. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 EXECUTION

3.01 FINAL CLEANING

A. Provide final cleaning, following manufacturer's written instructions.

B. Conduct cleaning and waste-removal operations to comply with local laws and ordinances, and federal and local environmental and antipollution regulations.

C. Employ experienced workers or professional cleaners for final cleaning.

D. Comply with safety standards for cleaning.
   1. Do not burn waste materials.
   2. Do not bury debris or excess materials on Owner's property.
   3. Do not discharge volatile, harmful, or dangerous materials into drainage systems.
   4. Remove waste materials from Site and dispose of lawfully.

E. Clean Site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

F. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program.
   1. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   2. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   3. Remove tools, construction equipment, machinery, and surplus material from Site.
   4. Remove snow and ice to provide safe access to building.
   5. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   6. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   7. Sweep concrete floors broom clean in unoccupied spaces.
   8. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
   9. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
   10. Remove labels that are not permanent.
   11. Wipe surfaces of mechanical and electrical equipment**,** elevator equipment**,** and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   12. Replace parts subject to unusual operating conditions.
   13. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   14. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   15. Clean ducts, blowers, and coils if units were operated without filters during construction.
   16. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for operation and maintenance data:
   1. Submittals.

B. Related Sections:
   1. Section 01 33 00 - Submittal Procedures
   2. Section 01 75 00 - Starting and Adjusting
   3. Section 01 77 00 - Closeout Procedures
   4. Individual Technical Sections

1.02 SUBMITTALS

A. Refer to Section 01 33 00.

B. Form and Format:
   1. Organize operation, maintenance data for equipment prepared in the form of an instruction manual of manageable size.
   2. Bind into individual heavy-duty, 2-inch, 3-ring vinyl-covered binders with pocket folders, each set of data, marked with appropriate identification on both front and spine of each binder.
   3. Text shall be manufacturer's printed data or typewritten data on 20-pound paper; page size 8-1/2-inch by 11-inch. Computer generated data shall be by letter quality printers or laser printers.
   4. Clearly mark each sheet of product data to specify products, component parts, and data applicable to installation; delete inapplicable information.
   5. Drawings and photographs shall have reinforced, punched binder tabs. Bind in with text, folding larger drawings to size of text pages.

C. Submittal Schedule:
   1. Submit 2 individually bound copies of preliminary draft of contents no later than 45 calendar days after approval of Shop Drawings.
   2. Submit 6 individually bound copies of completed data in final form not later than 7 calendar days prior to first instruction of Owner personnel.
   3. If instruction of Owner personnel is not required, submit completed data no later than 14 calendar days prior to final inspection.
   4. Submit 6 copies of additional requested data no later than 21 calendar days following instruction of Owner personnel.

1.03 QUALITY ASSURANCE

A. Preparation of Project-specific data shall be by personnel trained and experienced in maintenance and operation of described products, equipment, systems, materials, or finishes.

B. Photocopies: Drawings shall be legible and suitable for photocopying. All materials shall be reproducible. On material that contains data on several types/sizes/models of equipment, the specific type/size/model provided shall be clearly highlighted.

1.04 CONTENTS

A. Table of Contents: Include with each volume, with each product or system description identified.

B. Directory:
   1. List names, addresses and telephone numbers of:
      a. Engineer.
      b. Contractor.
      c. Manufacturers and suppliers, including local source of supplies and replacement parts.

C. Data to be Included:
   1. Assembly, installation, alignment, inspection procedures.
   2. Critical tolerances.
   3. Startup procedures.
   4. Complete parts listing.
   5. Spare parts listing.
   6. Emergency instructions.
   7. Fabrication drawings.
   8. Copies of warranties.
   9. Recommended “turn-around” cycles.
   10. Inspection procedures.
   11. Shop Drawings and Product Data.
   12. Fixture lamping schedule.

D. Data for Equipment and Systems:
   1. Provide manufacturer’s printed operation and maintenance instructions.
   2. Provide sequence of operation and as-installed control diagrams by controls manufacturer.
   3. Provide composite wiring diagrams for supervisory control systems. Include wiring diagrams showing connections between equipment wiring, electrical wiring, and supervisory control system wiring.
   4. For equipment, include description of unit and component parts. Give function, normal operation characteristics and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replacement parts.
   5. For panelboard circuit directories, indicate electrical service characteristics, controls, and communications. Include as-installed color coded wiring diagrams.
   6. Provide manufacturer’s printed operation and maintenance instructions, including start-up, break-in, and normal operation instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operation instructions.
   7. For maintenance and preventative maintenance procedures include routine procedures; guide for “trouble-shooting;” and alignment, adjusting, balancing, and checking instructions.
   8. Provide servicing and lubrication schedule, and list of lubricants required.
   9. Provide manufacturer’s parts list, illustrations, assembly drawings, and diagrams required for maintenance. Include recommended items and quantities to be stocked as spare parts.

E. Data for Materials and Finishes:
   1. For building products, applied materials, and finishes, include manufacturer’s product data with catalog number, size, composition, and color and texture designations.
   2. List instructions for care, maintenance, and preventative maintenance; include manufacturer’s recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
   3. For moisture-protection and weather exposed products, include manufacturer’s product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This Page Left Blank Intentionally

SECTION 01 78 37

PRODUCT WARRANTIES

PART 1 GENERAL

1.01 SUMMARY

A. Requirements include administrative and procedural requirements for:
   1. Warranties
   2. Warranty submittals

B. Related Sections:
   1. Document 00 72 00 - General Conditions
   2. Section 01 33 00 - Submittal Procedures
   3. Section 01 77 00 - Closeout Procedures
   4. Individual Technical Sections

1.02 DEFINITIONS

A. Standard Product Warranties: Preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to Owner.

B. Special Warranties: Written warranties required by, or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for Owner.

1.03 WARRANTY REQUIREMENTS

A. Separate Prime Contracts:
   1. Each prime Contractor is responsible for warranties related to its own contract. Each Contractor shall warrant their work for labor and material for 2-year minimum. This warranty shall include material purchased directly by Owner and installed by Contractor. Warranty requirements noted in individual sections may exceed this 2-year minimum; if it does, the warranty shall apply for the stipulated time for both material and labor. Contractor shall provide a 2-year warranty for the water tank as specified in Section 33 16 20-4.

B. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

E. Disclaimers and Limitations: Manufacturer’s disclaimers and limitations on product warranties do not relieve Contractor of warranty on the Work that incorporates the products.

F. Owner's Recourse: Written warranties made to Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which Owner can enforce such other duties, obligations, rights or remedies.
   1. Rejection of Warranties: Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

G. Right of Refusal: Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.04 SUBMITTALS

A. Warranty Commencement:
   1. Submit duplicate, notarized copies of written warranties to Engineer prior to the date certified for Substantial Completion. Engineer's Certificate of Substantial Completion shall be the commencement date for warranties.
   2. When a designated portion of the Work is completed and occupied or used by Owner, by separate agreement with Contractor during the construction period, submit properly executed warranties to Engineer within 15 days of completion of that designated portion of the Work.
   3. For items of Work delayed beyond the date of Substantial Completion, provide updated submittal within 10 days of acceptance by Owner, listing date of acceptance as start of warranty period.

B. Special Warranty:
   1. When a special warranty is required to be executed by Contractor, or Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to Owner through Engineer for approval prior to final execution.
      a. Execute and assemble documents from subcontractors, suppliers, and manufacturers.
      b. Refer to individual sections of Divisions 2 through 46 for specific content requirements, and particular requirements for submittal of special warranties.

C. Form of Submittal:
   1. At final completion compile 2 copies of each required warranty and bond properly executed by Contractor, subcontractor, supplier, or manufacturer.
   2. Organize the warranty documents into an orderly sequence based on the Table of Contents of the Project Manual.
   3. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-inch by 11-inch paper.
      a. Identify each binder on the front and the spine with the typed or printed title "Warranties and Bonds," the project title or name, and the name of Contractor.
      b. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 03 11 00

CONCRETE FORMING

PART 1 GENERAL

1.01 SUMMARY

A. Design and installation of formwork with shoring, bracing and anchorage for cast-in-place concrete.

1.02 REFERENCES

A. ACI 347 - Recommended Practice for Concrete Formwork

1.03 SUBMITTALS

A. Submit Product Data for form ties.

1.04 QUALITY ASSURANCE

A. The design, engineering, and proper construction of all formwork shall be the responsibility of the Contractor.

B. Design formwork in accordance with ACI 347.

1.05 PRODUCT HANDLING

A. Do not store forms or equipment on finished slabs.

PART 2 PRODUCTS

2.01 FORM MATERIAL

A. Form Facing Material: Smooth faced, undamaged plywood or other panel type material approved by Engineer.

B. The form facing material shall produce a smooth, hard, uniform texture on the concrete.

C. The arrangement of the facing material shall be orderly and symmetrical with the number of seams kept to a minimum.

D. Do not use facing material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface.

E. Fiber Tube Forms: Continuous laminated fiber tube with exterior moisture protection and non-adhering interior surface similar to “A-Coated Sonotube” as manufactured by Sonoco Products, or approved equal.

F. Void Forms:
   1. Corrugated fiberboard forms impregnated with paraffin, as manufactured by firm regularly engaged in production of corrugated fiberboard forms.
   2. Design to safely support dead load of concrete and construction live loads for period of 2 weeks.
   3. Design to prevent leakage of concrete or backfill materials and treat to prevent loss of strength and softening of form material due to moisture absorption.
   4. Size as shown on Drawings.

2.02 FORM TIES

A. Form Ties: Factory fabricated, adjustable length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.

B. The portion of the tie remaining in the concrete after removal of the tie shall be at least 1 inch from the surface of the concrete.

C. Provide waterseals on all wall ties used in water containment structures and exterior walls.

2.03 FORM COATINGS

A. Form Coatings or Release Agents: Commercially formulated chemical release agents containing no lubrication oil, conventional form oil, fuel oil, or kerosene. Containers shall have manufacturer's instructions for use printed thereon.

B. The form coating shall not penetrate, stain, or leave a residual film on the concrete surface and shall not attract dirt or other deleterious material.

2.04 ACCESSORIES

A. Chamfer Strips: 3/4-inch by 3/4-inch wood or plastic strips.

B. Provide all anchorages, braces, and special forms required to construct cast-in-place concrete components shown on the Drawings.

PART 3 EXECUTION

3.01 GENERAL

A. Establish a benchmark in an accessible location and use as a reference point for various construction levels.

B. Verify lines, levels, and centers before proceeding with formwork.

C. Insure that dimensions agree with the Drawings. Report any discrepancies to Engineer before proceeding with Work.

3.02 FORMWORK DESIGN

A. The design and construction of the formwork shall be the responsibility of the Contractor.

B. Design formwork in accordance with ACI 347.

C. Formwork shall be designed, erected, supported, braced, and maintained to safely support all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure.

D. Camber formwork to compensate for anticipated deflections in the formwork prior to hardening of the concrete.

E. Provide positive means of adjustment of shores and struts.
   1. Take up all settlement during concrete placing operations.
   2. Securely brace forms against lateral deflections.

3.03 FORMWORK CONSTRUCTION

A. Provide forms for all concrete work. Do not use earth cuts as forms for vertical surfaces.

B. Construct forms to conform to slopes, lines, and dimensions shown on the Drawings.

C. Forms shall be sufficiently tight to prevent loss of mortar from the concrete.

D. Place chamfer strips at all exposed corners.

E. Install all required openings, frames, pipe sleeves, cavities, slots, and other embedded items.

F. Cut all holes in forms required for installation or embedment of concrete reinforcement bars and ties.

G. Provide sharp clean corners at intersecting planes without visible edges or offsets. Back joints with extra studs or girts to maintain true, square corners.

H. Provide temporary openings at the base of column forms and wall forms to facilitate cleaning and observation immediately before concrete is placed.
   1. Construct closures to ensure a tight fit flush with the adjoining surfaces.

I. Provide runways for moving equipment.
   1. Provide runways with struts or legs and support directly on the formwork.
   2. Runways shall not rest on the reinforcing steel.

J. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris before concrete is placed.

K. Install Void Forms:
   1. Protect from moisture before concrete placement. Store above ground level in dry location.
   2. Do not use forms subjected to water, moist soils, or damp storage unless test loaded.
   3. Install on surface providing uniform support. Conform to recommendations of manufacturer.
   4. Protect from crushing and penetration of form at reinforcing steel supports and at other supports.

3.04 TOLERANCES

A. Construct formwork so that concrete surfaces will conform with the following tolerances:
   1. Variation from Plumb:
      a. In any 10 feet of length: 1/4 inch.
      b. Maximum for entire length: 1/2-inch.
   2. Variation from the Level or Specified Grade:
      a. In any 10 feet of length: 1/4 inch.
      b. Maximum for entire length: 1/2-inch.
   3. Variation of the Linear Building Lines from Established Position in Plan and Related Position of Columns, Walls, Grade Beams and Partitions:
      a. In any 20 feet of length: 1/2-inch.
      b. Maximum for entire length: 1 inch.
   4. Variation in the Sizes and Locations of Sleeves, Floor Openings, and Wall Openings: 1/4-inch plus or minus.
   5. Variation in Cross-sectional Dimensions of Columns and Beams and in the Thickness of Slabs and Walls:
      a. Minus: 1/4-inch.
      b. Plus: 1/2-inch.
   6. Footings (tolerances apply to concrete dimensions only, not to positioning of reinforcing steel):
      a. Variations in dimensions in plan:
         1) Minus: 1/2-inch.
         2) Plus: 1 inch.
      b. Misplacement: 1 inch.
      c. Thickness:
         1) Decrease in thickness: 1/2-inch.
         2) Increase in thickness: No limit

7. Variations in Steps:
    a. In flight of stairs:
        1) Rise: 1/8 inch plus or minus.
        2) Tread: 1/4 inch plus or minus.
    b. In consecutive steps:
        1) Rise: 1/16 inch plus or minus.
        2) Tread: 1/8 inch plus or minus.

3.05 FORM SURFACE PREPARATION

A. Clean surfaces of forms and embedded material of all accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.

B. Before placing the reinforcing steel or the concrete, cover the surfaces of the forms with an acceptable coating material that will effectively prevent absorption of moisture, prevent bond with the concrete, and not stain the concrete surfaces.

C. Do not allow form coating material to stand in puddles in the forms.

D. Form coating material shall not come in contact with hardened concrete against which fresh concrete is to be placed.

E. Spray form coating on all concrete form surfaces, including wood forms for wall openings, keyway strips, and chamfer strips. Apply coatings in accordance with manufacturer's instructions.

3.06 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used.

B. Do not use split, frayed, delaminated, or otherwise damaged form facing material.

3.07 FORM REMOVAL

A. Time specified below in this Article represents cumulative time during which temperature of concrete is maintained above 50 degree F (10 degree C) and for concrete without set-controlling admixtures.
    1. Reduce removal time in half for high-early strength cement concrete.

B. Formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations, but not less than 24 hours after completing concrete placement and finishing.

C. Forms and shoring used to support the weight of concrete in beams, slabs, and other structural members shall not be removed in less than 10 days and not until the concrete has attained 3,500 psi minimum compressive strength. Determine compressive strength by field-cured specimens.

D. Once forms and shoring supporting beams, slabs, and other structural members have been removed, reshore concrete structural members at each level the same day such that all superimposed loads are uniformly distributed and transferred directly to the foundation through temporary supports.
    1. No construction or other live loads shall be permitted on the members, unless sufficient support is in place or concrete has attained full design strength and loads do not exceed the design maximum, as approved by Engineer.

E. Contractor shall be responsible for all damage resulting from removal of forms or premature overloading of structural members.

F. Loosen wood forms for wall openings as soon as possible without damage to the concrete.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish and install concrete reinforcement.

1.02 REFERENCES

A. ACI:
   1. 117 - Standard Specifications for Tolerances for Concrete Construction and Materials
   2. 301 - Specifications for Structural Concrete for Buildings
   3. 315 - Details and Detailing of Concrete Reinforcement

B. CRSI Manual of Standard Practice

1.03 SUBMITTALS

A. Submit complete Shop Drawings and bar lists of all material to be furnished and installed under this Section.
   1. Show bar sizes, spacings, locations, and quantities of reinforcing and bending details.

B. Provide Shop Drawings in accordance with ACI 315 and the CRSI Manual of Standard Practice.
   1. Show in detail the location, size, spacing, bends, and quantities of each and all reinforcing bars to be placed in the structure.
   2. Bars shall have unique identifying labels or marks for each size, length, bend configuration, etc.

C. Submit Product Data on threaded dowel inserts.

D. Submit mill certifications for concrete reinforcement at time of delivery.

E. Submit certification for the epoxy coating at the time of delivery.
   1. Documentation of certification data shall come directly from the manufacturing plant's quality control office.
   2. Certification data shall contain test data and measurements taken at times and locations approved by Engineer.
   3. Monitoring shall be done by personnel not directly involved in production and be sufficient for compliance with approved procedures.

1.04 QUALITY COMPLIANCE

A. Comply with ACI 117, ACI 301, and ACI 315, except as modified in this Section.

1.05 PRODUCT HANDLING

A. Deliver reinforcement to the Site bundled, tagged, and marked.
   1. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement Drawings.

B. Store reinforcement at the Site in a manner to prevent damage from drainage and accumulation of dirt and excessive rust.

C. Do not store reinforcement, supports, or equipment on finished slabs.

D. Store metal bar supports in a weather-proof shelter.

E. Repair coating damage due to shipping, handling, and placing with an epoxy paint or equivalent coating material approved by Engineer.
   1. Damaged areas shall not exceed 2 percent of the surface area per linear foot of each bar.
   2. Coating color fading will not be considered coating damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars: Deformed billet steel bars conforming to ASTM A615, Grade 60.

B. Welded Wire Fabric: Steel wire spot welded at intersections conforming to ASTM A185. Use flat sheets only.

C. Epoxy-Coated Reinforcing Steel: Conform to ASTM A775.

2.02 ACCESSORIES

A. Bar Supports for Elevated Slabs, Walls, Columns, and Beams: All bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place shall be plastic protected, conforming to CRSI Class 1 protection for bar supports.

B. Ground Supported Reinforcing:
   1. All supports for ground supported reinforcement shall conform to CRSI Class 1 protection for bar supports.
   2. All supports shall be supplied with precast concrete blocks with a minimum bearing surface of 100 sq. inches to prevent the support from sinking.

C. Tie Wire for Reinforcing Bars: Black annealed wire, 16 gage or heavier.

D. Tie Wire for Epoxy-Coated Reinforcing Bars: 16 gage or heavier annealed wire epoxy-coated or other polymer approved by Engineer.

E. Threaded Dowel Inserts: Manufactured of minimum Grade 60 steel and shall be capable of achieving 125 percent of specified yield strength of reinforcement steel for the bar size indicated.

F. Mechanical Bar Splices:
   1. Manufactured of minimum Grade 60 steel.
   2. Shall achieve 125 percent of specified yield strength of reinforcement steel for the bar size indicated.

G. Wire Supports for Epoxy-Coated Reinforcement: Supports shall be coated with dielectric material including epoxy or other polymer for a minimum of 2 inches from the point of contact with epoxy-coated reinforcement.

2.03 FABRICATION

A. Shop fabricate reinforcing steel to required shapes and dimensions.

B. Do not rebend or straighten reinforcing steel.

C. Fabricate bars in accordance with the fabricating tolerances given in ACI 315.

2.04 FINISHES

A. Epoxy coating shall be applied in a fusion bonded coating plant that has been granted “Certification” by CRSI (Concrete Reinforcing Steel Institute).

PART 3 EXECUTION

3.01 PLACING

A. Place reinforcing steel in accordance with the Structural Drawings, approved Shop Drawings, and as specified herein.

B. Reinforcing steel shall have the following concrete cover, unless specifically noted differently on the Drawings:
   1. Concrete cast against earth 3 inches.
   2. All other concrete 2 inches.

C. Properly position reinforcing steel and wire it together at intersections and supports to ensure against displacement during concrete placing. Tie all reinforcing steel to wall forms.

D. Support reinforcing steel for slabs on grade by placing the top of precast concrete blocks, flush with grade, at all locations where chairs are to be located. Place chairs or standees over concrete blocks.

E. Wire dowels in place before placing concrete.

F. Place and tie all reinforcing steel before concrete is placed.

G. Do not bend reinforcing steel embedded in hardened or partially hardened concrete after placing.

H. Place wall chairs at the top and bottom of all walls and not greater than 6 feet on center horizontally.

I. All reinforcement at the time concrete is placed shall be free of mud, oil, or other materials that may adversely affect or reduce the bond.

J. Support the reinforcing steel closest to the formed surface with chairs and bolsters. Support beam stirrups and column ties by chairs.

K. After completing welds on epoxy-coated reinforcement, repair damaged coating in accordance with the requirements stated in Part 1 of this Section.

L. Reinforcement used as supports with epoxy-coated reinforcement shall be epoxy coated.

M. After field bending or straightening epoxy-coated reinforcing bars, repair coating damage in accordance with Part 1 of this Section.

N. When epoxy-coated reinforcing bars are cut in the field, coat the ends of the bars with the same material used for repair of coating damage, and repair any coating damage in accordance with Part 1 of this Section.

3.02 SPLICES

A. Provide reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Provide lap splice lengths as shown on the Drawings.

B. Provide splices only as shown on the Drawings or as authorized by Engineer.

C. Provide threaded or other approved mechanical bar splices:
   1. Where shown on the Drawings.
   2. Elsewhere for the convenience of the Contractor at no additional cost to Owner if specifically requested of and approved by Engineer.

3.03 TOLERANCES

A. Place bars to the tolerances specified in ACI 117.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Furnish and install all cast-in-place concrete and accessories.

B. Related Sections:
   1. Section 03 11 00 - Concrete Forming
   2. Section 03 20 00 - Concrete Reinforcing

1.02 REFERENCES

A. ACI:
   1. 301 - Specifications for Structural Concrete for Buildings
   2. 305 - Hot Weather Concreting
   3. 306 - Cold Weather Concreting
   4. 309 - Recommended Practice for Consolidation of Concrete
   5. 350 - Environmental Engineering Concrete Structures

B. ASTM:
   1. A36 - Carbon Structural Steel
   2. A307 - Carbon Steel Bolts and Studs
   3. A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   4. C33 - Standard Specification for Concrete Aggregates
   5. C94 - Standard Specification for Ready-Mixed Concrete
   6. C171 - Standard Specification for Sheet Materials for Curing Concrete
   7. C260 - Standard Specification for Air-Entraining Admixtures for Concrete
   8. C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections
   9. C494 - Standard Specification for Chemical Admixtures for Concrete
   10. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
   11. C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars
   12. C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures

1.03 SUBMITTALS

A. Submit manufacturer’s data for concrete admixtures, liquid curing material, floor joint filler, finishing compounds, bonding agents, and adhesive anchoring material.

B. Submit concrete aggregate test reports and concrete mix designs at least 14 days prior to placement of concrete.

C. Submit results of concrete strength tests.

1.04 QUALITY ASSURANCE

A. Comply with ACI 301, except as modified in this Section.

B. Retain an independent testing laboratory approved by Engineer to perform the work listed below. All costs for this testing shall be paid by Contractor:
   1. Test proposed aggregate.
   2. Design concrete mixes for each type of concrete specified.

3. Cast concrete cylinders for strength tests.
4. Test concrete cylinders.

C. Aggregate Tests: Test aggregates for compliance with ASTM C33.

D. Concrete Mix Design:
1. Prepare mix designs for each type of concrete specified.
2. Design concrete mixes in accordance with ACI 301.

1.05 PRODUCT HANDLING

A. Do not store forms, shores, reinforcing, equipment, or other material on finished slab surfaces.

PART 2 PRODUCTS

2.01 CONCRETE MATERIAL

A. Cement: Conform to ASTM C150, Type I.
1. Alkali content less than or equal to 0.6 percent (expressed as Na2O).
2. Provide cement from one source of supply.

B. Aggregate:
1. Coarse Aggregate: ASTM C33-5S
a. Provide from 1 source of supply.
b. For exterior exposed surfaces.
2. Fine Aggregate: ASTM C33.
a. Provide from 1 source of supply.
b. For exterior exposed surfaces.
3. Do not use fine or coarse aggregates containing spalling-causing deleterious substances.
4. Local aggregates not complying with ASTM C33 but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used when approved by Engineer.
5. Maximum Size:
a. 1/5 the narrowest dimension of concrete member; nor
b. 1/3 the depth of slab; nor
c. 3/4 the clear spacing between reinforcement bars; nor
d. 1-1/2 inches
6. Gradation sizes 467, 57 or 67: ASTM C33, Table 2.

C. Water: Clean potable and free from deleterious amounts of oil, acid, alkali, or other foreign matter.

2.02 ADMIXTURES

A. Air Entraining Admixture: ASTM C260.

B. Water Reducing Admixture: ASTM C494, Type A.

C. High Range Water-Reducing Admixtures (Superplasticizer): ASTM C494, Type F and contain no chlorides.

D. Retarding Admixtures: ASTM C494, Types B and D.

E. Set-Accelerating Admixtures: ASTM C494, Type C. No chloride containing admixtures will be allowed.

F. Viscosity Modifying Admixture: Demonstrate compatibility with other admixtures.

G. Pozzolans:
   1. Fly Ash: ASTM C618, Class C or F. Loss on ignition shall be limited to 3 percent maximum.
   2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
   3. Silica Fume: ASTM C1240, 6 percent maximum.

2.03 MISCELLANEOUS MATERIAL

A. Burlap-Polyethylene Sheet: Burlap weighing not less than 10 ounces per linear yard, 40 inches wide impregnated on 1 side with white opaque polyethylene 0.006 inch thick. Sheeting shall conform to ASTM C171.

B. Liquid Curing Compound: ASTM C309, Type 1-D, Class B clear or translucent with fugitive dye. Do not apply to floor slabs.

C. Expansion Joint Material: Bituminous fiber type conforming to ASTM D1751 with bituminous or paraffin binder.

D. PVC Waterstops:
   1. Serrated type with centerbulb.
   2. Material: Virgin PVC.
   3. Minimum Thickness: 3/16-inch.
   4. Greenstreak Plastic Products Company, specification grade, or approved equal.
   5. Install 4-inch width for construction joints located flush with slab or wall.
      a. Centerbulb diameter: 3/4-inch minimum.
   6. Install 6-inch width for all other construction joints, unless otherwise noted.
      a. Centerbulb diameter: 15/16-inch minimum.
   7. Water Stop Joints: Manufacturer's standard prefabricated joints at intersection points and corners.

E. Hydrophyllic Waterstops:
   1. Rubber Concrete Joint: Volclay Akwastop in accordance with manufacturer's recommendations, or approved equal.
   2. Bentonite RX 101: Colloid Environmental Technologies Company, installed per manufacturer's specification with approved bonding agent.

F. Interior Joint Filler: 1 part, self leveling, polymer reinforced joint filler.
   1. Everjoint manufactured by L&M Construction Chemicals, Inc., or approved equal.

G. Exterior Joint Sealant: 2 parts, self leveling, polyurethane sealant.
   1. Sonolastic SL2 manufactured by Sonneborn, or approved equal.

H. Bonding Agent: Acryl 60 manufactured by Thoro System Products, or approved equal.

I. Adhesive for anchoring steel reinforcement dowels and threaded rods in concrete: 2 component injected epoxy structural adhesive.
   1. Approved Products:
      a. Hilti RE-500 Adhesive by Hilti Fastening Systems
      b. Epoxy-Tie Adhesive by Simpson Strong-Tie
      c. Epogel by Sonneborn

J. Epoxy Injection: Sika 35, Hi-Mod, LV or equal with Sikadur 31 Paste Epoxy or equal to be installed as manufacturer's recommendations.

K. Plastic Coated Manhole Rungs: Copolymer Polypropylene Plastic in accordance with ASTM C478 and ASTM A615 as manufactured by M.A Industries, Inc., or approved equal.

L. Dovetail Anchor Slot: 18 gage stainless steel.

2.04 CONCRETE MIX PROPORTIONS

A. See Table 2.1 at the end of the Section.

PART 3 EXECUTION

3.01 CONCRETE PRODUCTION

A. Ready-mixed concrete: Comply with ASTM C94.
   1. Air Temperature between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C): Reduce mixing and delivery time to 75 minutes.
   2. Air Temperature above 90 degrees F (32 degrees C): Reduce mixing and delivery time to 60 minutes.
   3. Batch Ticket: Provide for each batch discharged and used in work, indicating project identification name and number date, mix type, mix time, quantity and amount of water introduced and available.

B. Mix concrete only in quantities for immediate use. Concrete which has set shall be discarded and shall not be retempered.

C. Do not add water at the Site without the approval of Engineer.

D. Add superplasticizer and mix concrete in accordance with manufacturer's specification.

3.02 PLACING WATERSTOP

A. Place waterstop material at all construction joints, unless shown otherwise and confirmed by Engineer.

B. Center waterstop in the joint and between each layer of reinforcing steel with each half embedded in concrete. Secure waterstop by hog-tying waterstop to protection bar (refer to Drawings) at 12 inches on center prior to placing concrete.

C. Thoroughly and systematically vibrate concrete around the waterstop to ensure positive contact between concrete and waterstop. When concrete is being placed, take care not to deflect waterstop out of proper position.

D. Use prefabricated waterstop fittings or follow proper field splicing procedures for all connections and splices.
   1. Miter all intersecting connections at 45 degrees.
   2. Use a thermostaticlly controlled heating iron to heat both ends of waterstop to be connected, then butt splice pieces to be joined with full contact.

E. Follow manufacturer's recommendations for proper preparation and installation of waterstop material.

3.03 EMBEDDED ITEMS

A. Place all sleeves, inserts, anchors, and embedded items required for adjoining work or for its support prior to placing concrete.

B. Position all embedded items accurately and supported against displacement.

C. Temporarily fill voids in sleeves, inserts, and anchor slots with readily removable material to prevent the entry of concrete into the voids.

3.04 PREPARATION BEFORE PLACING

A. Complete formwork and secure all reinforcement and embedded items in place.

B. Remove all snow, ice, and mud prior to placing concrete.

C. Do not place concrete on frozen ground.

D. Do not place concrete on ground with standing water or when upper 2 inches of ground is saturated.

E. Do not place concrete during rain, sleet, or snow.

3.05 CONCRETE CONVEYING

A. Deliver concrete from the mixer to the place of final deposit as rapidly as practical by methods, which will prevent segregation or loss of ingredients.

3.06 CONCRETE DEPOSITING

A. Deposit concrete continuously or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section.

B. Place concrete at such a rate that the concrete which is being integrated with fresh concrete is still plastic.

C. Do not deposit concrete which has partially hardened or has been contaminated by hardened materials.

D. Remove rejected concrete from the Site.

E. Deposit concrete as nearly as practicable in its final position to avoid segregation due to handling or flowing.

F. Free fall of concrete shall not exceed 4 feet. Use chutes equipped with hopper heads for placing where a drop of more than 4 feet is required.

3.07 PLACING CONCRETE SLABS

A. Deposit and consolidate concrete slabs in a continuous operation.

B. Consolidate concrete placed in slabs by vibrating bridge screeds, roller pipe screeds, or other methods acceptable to Engineer.
   1. Bring slab surfaces to the correct level with a straight edge and then strike off.
   2. Use bullfloats or darbies to smooth the surface, leaving it free from bumps and hollows.

C. Do not leave screed stakes in concrete.

D. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to start of finishing operations.

3.08 COLD WEATHER PLACING

A. Do not place concrete when the air temperature is less than 40 degrees F. without the specific approval of Engineer.

B. Cold Weather Concrete Work: ACI 306.1, except as modified by the requirements of these Contract Documents.

C. Do not place concrete against any frozen substrate, including subgrade soils and surfaces of formwork.

D. Do not place concrete around any embedment, including reinforcing steel that is at a temperature below freezing.

E. The temperature of the concrete delivered at the site shall conform to the following limitations:

	Minimum Concrete Temperature	
Air Temperature	**< 12 Inches Thick**	**12-36 Inches Thick**
Above 30º F	60º F	55º F
0º to 30º F	65º F	60º F
Below 0º F	70º F	65º F

F. If water or aggregate is heated above 100 degrees F., combine water with the aggregate in the mixer before cement is added. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 100 degrees F.

G. When the mean daily temperature is less than 40 degrees F., maintain the temperature of the concrete between 50 and 70 degrees F. for the required curing period.

H. Arrangements for Heating, Covering, Insulation, Or housing the Concrete Work:
1. Made in advance of placement.
2. Adequate to maintain the required temperature without injury due to concentration of cold or heat.
3. Keep protection in place for a minimum of 3 days.

I. Do not use combustion heaters during the first 24 hours, unless precautions are taken to prevent exposure of the concrete to exhaust gases.

J. Once the cold weather concrete protection is removed, continue concrete curing for the remainder of the 10 day curing period.

3.09 HOT WEATHER PLACING

A. Comply with ACI 305 when hot weather conditions exist.

B. Maintain concrete temperature at time of placement below 90 degrees F.

C. When the temperature of the steel is greater than 120 degrees F., spray steel forms and reinforcement with water prior to placing concrete.

D. Keep all surfaces protected from rapid drying. Provide windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering in advance of placement.

3.10 CONSOLIDATION

A. Consolidate all concrete in accordance with provisions of ACI 309.

B. Consolidate each layer of concrete immediately after placing by use of internal concrete vibrators. Maintain a frequency of not less than 8,000 vibrations per minute for each internal vibrator.

C. Provide adequate number of units and power source at all times. Use a minimum of 2 vibrators for all work and maintain spare units to ensure adequacy.

D. Insert the vibrator so as to penetrate the lift immediately below the one being placed. Do not insert the vibrator into lower courses which have begun to set.

E. Limit spacing between insertions of the vibrator to 12-18 inches and do not exceed twice the radius of action as shown in ACI 309 or 18 inches.

F. Do not use vibrators to transport concrete inside the forms.

G. Vibrate concrete to minimize entrapped air and surface voids on formed surfaces.

3.11 CONCRETE SLAB FINISHING

A. Float Finish:
   1. Apply float finish to all slab surfaces.
   2. After placing and screeding concrete slabs, do not work the surface until ready for floating. Begin floating when the surface water has disappeared and when the concrete has stiffened sufficiently to permit operation of a power-driven float.
   3. Consolidate the surface with power-driven float or by handfloating if the area is small or inaccessible to power units.
   4. Check and level the surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10 foot straight-edge placed on the surface at not less than 2 different angles.
   5. Immediately after leveling, refloat the surfaces to a smooth, uniform, granular texture.

B. Trowel Finish:
   1. Apply steel trowel finish to all interior floor slabs, topping, and stair treads and all tank slabs which do not receive a concrete topping.
   2. Apply float finish to slabs as described above in Part 3.11.A.
   3. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
   4. Consolidate the concrete surface by the final hand troweling operation, free from trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8 inch in 10 feet when tested with a 10 foot straight-edge.

C. Broom Finish:
   1. Apply non-slip broom finish to all exterior sidewalks and aprons.
   2. Apply float finish to slabs as described above in Part 3.11.A.
   3. Immediately after floating, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use a fiber-bristle broom.

3.12 FINISHING FORMED SURFACES

A. Provide a smooth formed surface to all formed surfaces not exposed to view, unless otherwise noted in Paragraph B. Smooth formed finish shall consist of the following:
   1. Construct formwork in accordance with Section 03 11 00.
   2. Patch all tie holes and defects larger than 1/8-inch in diameter and/or 1/8-inch deep.
   3. Remove all fins, seams and concrete “buttons” protruding more than 1/16-inch.

B. Provide a special form finish to all formed surfaces exposed to view:
   1. Prepare 3 test samples of various textures for approval by Engineer. Each sample shall be approximately 6 feet by 6 feet in size and located on an unexposed wall surface as directed by Engineer.
   2. Perform all Concrete Crack Repairs in accordance with Article 3.14.B.
   3. Remove all form release agents, curing compounds, hardeners, salts, efflorescence, laitance, loose material, unsound concrete, and other foreign materials by sandblasting, shot blasting, mechanical scarification, or other suitable methods.
   4. Surface Preparation:
      a. Expose, but not undercut or loosen, aggregate.
      b. Expose all bugholes, cracks and subsurface voids.
      c. Provide a clean, sound substrate with sufficient surface profile.
   5. Filling of deep voids, bugholes, etc., exceeding 1/8-inch depth:
      a. Dampen surface with clean water to obtain saturated surface-dry (SSD) with no standing water.
      b. Brush-apply a small quantity of mixed patching material as a scrub coat to prepare substrate. Thoroughly key-in and work material throughout cavity to promote bond.
         1) If scrub coat dries out before wet mortar can be placed, remove scrub coat similar to laitance removal.

c. Place repair mortar onto wet scrub coat using brush with firm trowel pressure.
    1) Completely fill voids.
    2) Key in and compact thoroughly to secure bond.
    3) Apply patching material in lifts of 1/4-inch (8mm) to 2-inches (51mm) and trowel to desired finish promptly after placing material.
d. For successive lifts, thoroughly score each lift and allow reaching initial set before next layer is applied.
e. Perform wet curing of patched areas for the following conditions:
    1) If temperature exceed 85 degrees F (29 degrees C).
    2) If relative humidity is below 30 percent.
    3) If wind speed exceeds 15 mph
    4) If patches are exposed to direct sunlight for 72 hours after placement.
f. Special curing compounds are allowed with approval of Owner and Engineer. Do not use solvent-based curing compound.

6. Dampen surface with clean water just prior to application of finishing compound.
7. Mix 1 part bonding agent to 3 parts clean water for mixing liquid.
8. Mix concrete finishing compound with mixing liquid as specified by the manufacturer.
9. Apply 2 coats using a stiff fiber brush or textured spray equipment. Spray application of the first coat requires back brushing to properly fill voids, bugholes and nonmoving cracks.
    a. First coat: Apply at 2 pounds per sq. yd. and allow to cure a minimum 24 hours.
    b. Second coat: Apply at 2 pounds per sq. yd., allow to set and then float to a uniform finish.
10. Perform damp curing to applied product.

3.13 CURING

A. Immediately after placement, damp cure all concrete for a minimum of 7 days.

B. Cover all slabs and topping with approved burlap-polyethylene film and keep in place throughout the curing period.

C. Cover walls, beams, columns and other formed surfaces with burlap-polyethylene film or spray with an approved curing compound.

D. Anchor all burlap-polyethylene film at the edges to prevent moisture loss.

E. Rewet all slab surfaces at least once a day during the curing period.

3.14 PATCHING

A. Repair honeycomb and other defective areas, fill surface voids, and fill form tie holes and similar defects in accordance with ACI 301.

B. Inject concrete cracks as observed during construction and leak testing operations with epoxy to manufacturer’s recommendations. Confirm procedures with Owner and Engineer prior to installation.

C. Reinforce or replace deficient work as directed by Engineer and at no additional cost to Owner.

3.15 CLEAN UP AND DISPOSAL

A. Upon completion of the walls and prior to any painting, thoroughly clean all exposed or painted concrete surfaces of all concrete spatters, form oil, or other foreign material detrimental to appearance or painting.

B. Remove all excess concrete debris remaining after completion of placement and form removal from the Site and dispose of in a proper and legal manner.

3.16 ANCHORING DOWELS

A. Drill hole in concrete to the size and depth recommended by the adhesive supplier and as approved by Engineer.

B. Clean hole with a nylon brush and use compressed air to blow out hole.

C. Fill hole with anchoring adhesive in accordance with manufacturer's recommendations.

3.17 FIELD QUALITY CONTROL

A. Concrete Strength Tests:
   1. Mold and cure 4 specimens from each sample in accordance with ASTM C31. Record any deviations from the requirements of ASTM C31 in the test report.
   2. Test specimens in accordance with ASTM C39. Test 2 specimens at 28 days for acceptance and 1 at 7 days for information. Test 1 specimen at 56 days if desired by Engineer.
   3. Conduct at least 1 strength test for each 100 cu.yds. or fraction thereof for each mixture design placed in any 1 day.
   4. Furnish a copy of the test results to Engineer as soon as available.
   5. Costs of concrete cylinder testing will be paid by Owner.
   6. Mold and field cure specimens as required in ASTM C31.
   7. Acceptance test results shall be the average strengths of the 2 specimens tested at 28 days.
   8. Conduct load test on test cores of concrete that fail to meet the specified strength, in accordance with ASTM C42.
   9. Failure to meet strength requirements of the cores, shall be a cause for rejection by Engineer.
   10. The cost of remedial measures required due to test failures shall be paid for by Contractor.

B. Engineer may request adjustment to concrete mixes when characteristics of materials, job conditions, weather, test results, other circumstances warrant.

C. Concrete Slump Tests:
   1. Owner will determine slump of concrete from each truck in accordance with ASTM C143.
   2. If slump exceeds maximum allowed, remove batch from work and dispose of off-site.
   3. Test slump at end of conveying system.
   4. All costs of slump testing will be paid by Owner.

D. Concrete Air Content Tests:
   1. Owner will determine air content of concrete from each truck in accordance with ASTM C231.
   2. Air content shall be tested at end of conveying system.
   3. All costs of air content testing will be paid by Owner.

E. Concrete Temperature:
   1. Owner will determine temperature of concrete from each truck in accordance with ASTM C31.
   2. Test temperature at end of conveying system.
   3. All costs of temperature testing will be paid by Owner.

F. Leak Testing Watertight Structures:
   1. Structures that shall be constructed watertight include the following:
      a. Intake Splitter Boxes base slab and walls.
      b. Concrete constructed water reservoir tanks.
   2. Water-containing structures shall be accepted as watertight after they have successfully passed the following leakage test:
      a. Fill tank structure and leave standing as directed by Engineer to allow for absorption (up to 2 days).
      b. Fill tank structure and a 55-gallon PVC barrel and leave uncovered to determine evaporation loss.
      c. Monitor both volumes of water for a period of 24 hours after absorption.

d. The leakage test will be considered successful if there is no visible leakage or visible dampness on the outside of the structure or the measured leakage after correcting for evaporation losses is equal to or less than 0.001 times the tank volume.

3. Contractor shall be responsible for the cost of water used in any retests.
4. Structures may not be backfilled until they have passed the leakage test.

Table 2-1

	f'c @ 28 days	Maximum Water/Cement + Pozzolan Ratio	Maximum Pozzolan Content (percent of cement content)[1]	Aggregate	Entrained Air Content (Refer to ACI 350, Moderate Exp.)	Slump (inches) before and after superplasticizer
A. Concrete for walls, grade beams, slabs, beams, columns, base slabs, pads and all other concrete unless noted below.	4,000 psi	0.45	ACI 350 - Table 4.2.3	Section 2.01.B	ACI 350 - Table 4.2.1	2 ± 1 before 6 ± 1 after
D. Grout - For Filling In Bottom Of Tanks	4,000 psi	0.45	ACI 350 - Table 4.2.3	Section 2.01.B	ACI 350 - Table 4.2.1	6 ± 1[3]

END OF SECTION

[1] Or with Engineer's prior approval.

This Page Left Blank Intentionally

SECTION 03 31 20

CONCRETE FOUNDATION FOR STORAGE TANKS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Design.
   2. Formwork.
   3. Reinforcement.
   4. Mixing and placement.

B. Related Sections:
   1. Section 03 31 30 - Concrete Floor Slab on Grade
   2. Section 31 23 16 - Structure Excavations and Backfills
   3. Section 33 16 20 - Welded Steel Water Storage Tanks
   4. Section 33 16 13.16 – Wire or Strand Wound, Prestressed Concrete Tank

1.02 REFERENCES

A. ACI:
   1. 301 - Specifications for Structural Concrete for Buildings
   2. 318 - Building Code Requirements for Reinforced Concrete
   3. 371R - Guide for the Analysis, Design, and Construction of Concrete Pedestal Water Towers

1.03 DESIGN REQUIREMENTS

A. Provide design in accordance with ACI 318 or 371R.
   1. Include an allowance of 40 pounds per square foot on horizontal projection for pressure resulting from snow load.
   2. Include allowances for pressure resulting from a 100-mph wind load on surfaces in accordance with AWWA D100, Section 3.1.4 and AWWA D110.

1.04 SUBMITTALS

A. Submit:
   1. Shop Drawings based on dimensional requirements and elevations shown on Drawings.
   2. Calculations generated in foundation design.
   3. Report of Concrete Mix Designs.
   4. Field testing results.

1.05 SITE CONDITIONS

A. Verification of Subsurface Conditions:
   1. Geotechnical data in Section 00 31 32 is not intended as representation or warranty of accuracy or continuity between soil borings.

B. Design Soil Bearing Pressure: Refer to geotechnical report.

C. Existing Conditions: Drawings to not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Conform to ACI 301.

2.02 REINFORCING STEEL

A. Bars: ASTM A615-60.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, normal - Type 1, Portland, grey color.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

A. Air Entrainment Admixture: ASTM C260.

2.05 CURING MATERIALS

A. Water: Clean and drinkable.

2.06 CONCRETE MIX

A. Mix: ASTM C94.

B. Foundation Concrete:
   1. Compressive Strength (28 days): 4,000 psi.
   2. Slump: 4-inch.

C. Add air entraining agent to mix for concrete exposed to freeze-thaw cycling.

PART 3 EXECUTION

3.01 DESIGN, MIXING, AND PLACING

A. Conform to ACI 318 or 371R.

B. Do not use excavation walls to form vertical surfaces.

C. Provide form on top of sloped surfaces steeper than 2.5:1.

3.02 CONCRETE WORK

A. Conform to ACI 318 or 371R.

B. Finishes:
   1. Formed Surfaces: Form finish.
   2. Unformed Surfaces: Float finish.

3.03 FIELD QUALITY CONTROL

A. Concrete Sampling:
   1. Provide 1 specimen (3 cylinders) for every 75 cubic yards of concrete placed or fraction thereof.
   2. Provide a minimum of 1 specimen per day.

B. Concrete Testing:
   1. Conduct compression testing of cylinders by independent testing laboratory approved by Engineer.
   2. Provide written results of tests to Owner and Engineer.

END OF SECTION

This Page Left Blank Intentionally

SECTION 03 31 30

CONCRETE FLOOR SLAB ON GRADE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Formwork.
   2. Concrete reinforcement and accessories.
   3. Cast-in-place concrete.

1.02 REFERENCES

A. ACI 301 - Specifications for Structural Concrete in Buildings

B. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement

C. ASTM:
   1. C33 - Concrete Aggregates
   2. C94 - Ready- Mixed Concrete
   3. C150 - Portland Cement
   4. C260 - Air Entraining Admixtures for Concrete

1.03 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Maintain copy of ACI 301 on site.

1.04 PROJECT CONDITIONS

A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MATERIALS

A. Forms: Conform to ACI 301.

B. Reinforcing Steel:
   1. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A185; in 6 by 6 - W.1.4 by W.1.4 WWF coiled rolls; uncoated finish.

C. Concrete:
   1. Cement: ASTM C150, normal - Type 1 portland, grey color.
   2. Fine and Coarse Aggregates: ASTM C33.
   3. Water: Clean and not detrimental to concrete.

D. Admixtures:
   1. Air Entrainment Admixture: ASTM C260.

E. Curing Materials:
   1. Water: Clean and drinkable.

2.02 ACCESSORIES

A. Vapor Barrier: ASTM E1745, Class A, minimum 10 mils thick polyethylene film, water vapor transmission of 0.00 or perm level of 0.01.

B. Floor Hardener: Acid-base, liquid.

2.03 CONCRETE MIX

A. Mix concrete in accordance with ASTM C94.

B. Slab On Fill Concrete:
   1. Compressive Strength: (28 days): 4000 psi.
   2. Slump: 4-inch.

C. Add air entraining agent to mix for concrete exposed to freeze-thaw cycling.

PART 3 EXECUTION

3.01 PREPARATION

A. Formwork Erection:
   1. Verify lines, levels, and measurement before proceeding with formwork.
   2. Hand trim sides and bottom of earth forms; remove loose dirt.
   3. Align form joints.
   4. Slope floor at 0.50 percent toward floor drain.

B. Vapor Barrier:
   1. Install per ASTM E1643.
   2. Place membrane over compacted fill prior to placement of base fill; minimum number of joints.
   3. Overlap sheets and seal joints with tape in accordance with manufacturer's recommendations.

C. Reinforcement:
   1. Place, support, and secure reinforcement against displacement.
   2. Do not disturb vapor barrier while placing reinforcement.

3.02 PLACING CONCRETE

A. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.03 FINISH

A. Trowel finish surfaces.

3.04 TOLERANCES

A. Provide Class A tolerance to floor slabs according to ACI 301.

3.05 TREATMENT

A. Apply hardener in accordance with the manufacturer's recommendations to all interior floors.

3.06 FIELD QUALITY CONTROL

A. Concrete Sampling: Provide 1 specimen (3 cylinders) for each day when concrete is poured.

B. Concrete Testing:
   1. Conduct compression testing of cylinders by independent testing laboratory approved by Engineer.
   2. Provide written results of tests to Owner and Engineer.

END OF SECTION

This Page Left Blank Intentionally

SECTION 03 41 00

PLANT-PRECAST STRUCTURAL CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Provide precast reinforced concrete units as follows:
   1. Wall panels.
      a. Insulated
   2. Accessories.
      a. Bearing pads.
      b. Core end plugs.
      c. Clips, hangers.
      d. Joint sealant.
   3. Installation of precast reinforced concrete units.

B. Perform the following:
   1. Provide openings as indicated on Drawings.

C. Related Sections:
   1. Section 03 30 00 - Cast-in-Place Concrete

D. Install the following provided by other sections:
   1. Sleeves and embedded items for plumbing, heating, or electrical distribution.

1.02 REFERENCES

A. ACI:
   1. 301 - Specifications for Structural Concrete for Buildings
   2. 318 - Building Code Requirements for Reinforced Concrete

B. ANSI/AWS:
   1. D1.1 - Structural Welding Code - Steel
   2. D1.4 - Structural Welding Code - Reinforcing Steel

C. ASTM:
   1. A36 - Structural Steel
   2. A82 - Cold Drawn Steel Wire for Concrete Reinforcement
   3. A123 - Hot Dip Galvanized Coatings on Steel Products
   4. A153 - Zinc-Coating Iron and Steel Hardware
   5. A185 - Wire Fabric for Concrete Reinforcement
   6. A276 - Stainless Steel Bars and Shapes
   7. A416 - Undercoat Seven-Wire Stress-Relieved Strand for Prestressed Concrete
   8. A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
   9. A666 - Cold-Worked Austenitic Stainless Steel Sheets, Plates, Strips
   10. C33 - Concrete Aggregates
   11. C144 - Aggregate for Masonry Mortar
   12. C150 - Portland Cement
   13. C260 - Air Entraining Admixtures for Concrete
   14. C1107 - Packaged Dry Nonshrink Hydraulic Cement Grout
   15. F593 - Stainless Steel Bolts, Hex Caps, Screws, Studs

D. CRSI - Manual of Standard Practice

E. PCI:
   1. MNL 116 - Manual for Quality Control for Plants and Production of Precast Concrete Products
   2. MNL 120 - Design Handbook-Precast and Prestressed Concrete
   3. MNL 123 - Manual on Design of Connections for Precast Prestressed Concrete
   4. MNL 124 - PCI Design for Fire Resistance of Precast Prestressed Concrete

1.03 SYSTEM DESCRIPTION

A. Critical Design Requirements for Architectural Precast Wall Panels:
   1. Openings through panels larger than 8 inches must be plant-formed and cast.
   2. Exposed panel faces, returns and edges must receive specified finish.
   3. Controlled surface cracking - for faces and members exposed to weather - shall be limited to 0.007 inch.
   4. Allowable tolerances: Panels must comply with the maximum allowable tolerances listed in the *Guide Specifications* of the Precast/Prestressed Concrete Institute (PCI), latest edition.
   5. Design Deviations:
      a. Permitted only after Engineer's written approval of manufacturer's proposed design supported by complete design calculations and drawings.
      b. Design deviations shall provide an installation equivalent to the basic intent without incurring additional cost to Owner.

B. Performance Requirements:
   1. Size components to withstand design loads in an unrestrained condition according to State Building Code.
   2. Insulation: Total minimum R-Value of 15 in walls.

1.04 SUBMITTALS

A. Reference: Refer to Section 01 33 00.

B. Product Data: Submit manufacturer's current Product Data including specifications, concrete design mix, handling, storage and installation instructions, and maintenance and cleaning recommendations.

C. Shop Drawings: Show complete information for fabrication and installation of precast concrete units, including:
   1. Member dimensions, cross-section, location, size, type of reinforcement, including special reinforcement, and lifting devices necessary for handling and erection.
   2. Layout, dimensions, and identification of each unit corresponding to sequence and procedure of installation.
   3. Welded connections by AWS standard symbols.
   4. Detail inserts, connections, and joints; including accessories and construction at openings in precast units.
   5. Location, details of anchorage devices to be embedded in other construction. Furnish templates if required for accurate placement.
   6. Erection procedure for precast units and sequence of erection.

D. Samples:
   1. Selection Samples: Submit manufacturer's standard color and textures with Product Data and Shop Drawings.
   2. Color Verification: Prior to shipping, submit each type of finish indicated; in sets for each color, texture, and pattern specified, showing a full range of variations expected in these characteristics. Include notification to Engineer if selection is not within quoted price range.
   3. Components: Submit samples of anchors, fasteners, hardware, and other materials and components if requested by Engineer.

E. Quality Assurance/Control Submittals:
   1. Test Reports: Written report of proposed mix for each type of concrete and/or other materials at least 15 days prior to start of precast unit production if requested by Engineer.

2. Certificates:
    a. Certified design calculations: Prepared by structural engineer licensed in state where project is located.
    b. Submit certificates of approval in compliance with Section 01 33 00 and Conform to IBC Chapter 17 - Special Inspections for Prefabricated Construction.
    c. Provide AWS D1.1 certification for welders.
3. Calculated fire-resistance analysis.
4. Material Certificates:
    a. Concrete materials.
    b. Reinforcing materials and prestressing tendons.
    c. Admixtures.
    d. Bearing pads.

F. Maintenance Manual: Provide to Owner, maintenance and warranty data in “Maintenance Manual” compliant with Section 01 78 23.

1.05 QUALITY ASSURANCE

A. Qualifications of Personnel/Firm:
1. Design Calculations: Professional Structural Engineer licensed in the state where project is located.
2. Fabricator: Firm with 5 years successful experience in fabrication of precast concrete units similar to units required for project; with sufficient production capacity to produce required units without delay in work; producer member of PCI or satisfactory participant in its Plant Certification Program or NPCA Plant Certification Program.
3. Fabrication Plant: Plant engaged primarily in manufacturing of similar units.
4. Supervision: 1 person present during execution of work, thoroughly trained with 5 years experience in materials and methods required, to direct fabrication and installation.
5. Welder: Certified by AWS D1.1.

B. Codes and Standards: Comply with referenced standards unless otherwise indicated.

C. Fire-Resistance Rated Precast Units:
1. Comply with IBC code for state in which Project is located.
2. Conform with PCI MNL-124 to achieve required ratings.

D. Testing: Perform following ASTM tests for each 150 cubic yards of concrete placed, minimum of weekly, and provide documentation of compliance:
1. Slump: C143
2. Compressive Strength: C31, C192, C39
3. Air Content: C231 or C173
4. Unit Weight: C138

E. Field Samples: Furnish example of each type of finish to Engineer for review prior to manufacture.

F. Plant Review: If requested by Engineer, review precast products at plant prior to shipment to job site.

G. Preinstallation Meetings: Installer and manufacturer’s technical representative shall meet with Engineer prior to the start of installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protection: Comply with manufacturer’s recommendations for job-site storage and protection.

B. Deliver precast structural concrete units to Site in such quantities and at such times to ensure continuity of installation.

C. Damaged Material: Replace damaged material prior to acceptance at no additional cost to the Owner.

D. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

E. Place stored units so that identification marks are discernible.

F. Separate stacked members by battens across full width of each bearing point.

G. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

H. Protect units from contact with soil or ground.

1.07 PROJECT CONDITIONS

A. Environmental Requirements: Heat surfaces to be grouted to above freezing prior to installation of grout; keep temperature above 40 degrees F for 48 hours after completion of grouting.

B. Existing Conditions: Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.08 SEQUENCING

A. Coordination with Other Trades: Coordinate with installation of other materials and erection of other structural systems, including items to be cast in pre-cast units.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Precast Concrete Units:
   1. Standard of Quality: Design is based on products of Huffcut Concrete, Inc., Chippewa Falls, WI www.huffcutt.com
   2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
      a. Concrete Inc., Grand Forks, ND www.ciprecast.com
      b. County Materials, Eau Claire, WI www.countymaterials.com
      c. Fabcon, Savage, MN www.fabcon-usa.com
      d. Gage Bros. Concrete www.gagebrothers.com
      e. Hanson www.hansonspancretemidwest.com
      f. Molin, Lino Lakes, MN www.molin.com
      g. Wieser Concrete, Maiden Rock, WI www.weiserconcrete.com
      h. Wells Concrete Products Company, Wells, MN www.wellsconcrete.com
      i. Manufacturer of comparable products submitted to and approved by Engineer.

B. Metallic Grout:
   1. Acceptable manufacturers:
      a. Embeco 885, Master Builders, Inc.
      b. Ferrogrout, L & M Construction Chemicals. Inc.
      c. Vibra-Foil, Grace Construction Products
      d. Manufacturer of comparable products submitted to and approved by Engineer.

C. Nonmetallic Grout:
   1. Acceptable manufacturers:
      a. Crystex, L & M Construction Chemicals, Inc.
      b. Masterflow 928, Master Builders, Inc.
      c. Manufacturer of comparable products submitted to and approved by Engineer.

2.02 MATERIALS

A. Formwork:
   1. General Requirements: Provide forms and form facing materials of metal, plastic, wood, other acceptable material, non-reactive with concrete, which produces required finish surfaces.
   2. Construction: Accurate, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations; completed units of shapes, lines, dimensions indicated, within fabrication tolerances specified in PCI MNL 116.
   3. Design: Unless forms for plant manufactured prestressed concrete units are stripped prior to detensioning, design so stresses are not induced in precast units due to deformation of concrete under prestress or to movement during detensioning.

B. Reinforcing Materials:
   1. Reinforcing Bars:
      a. Deformed billet-steel: ASTM A615, Grade 60.
      b. Deformed rail-steel: ASTM A616.
      c. Deformed axle-steel: ASTM A617.
      d. Deformed low-alloy steel: ASTM A706.
   2. Steel Wire: Plain, cold-drawn, ASTM A82.
   3. Wire Fabric:
      a. Welded Steel: ASTM A185.
      b. Welded Deformed Steel: ASTM A497.
   4. Supports for Reinforcement:
      a. Bolsters, chairs, spacers, other devices for spacing, supporting, fastening reinforcing.
      b. Comply with CRSI recommendations.
      c. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, support with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
   5. Dove Tail Slots: 22-gage galvanized steel slots 1-inch-wide by 1-inch-deep with 3/4-inch throat, plastic foam filled.
   6. In areas of high corrosion, water use only stainless steel accessories.

C. Concrete Materials:
   1. Portland Cement: ASTM C150, Type I or Type III; one brand and type throughout unless otherwise acceptable to Engineer.
   2. Aggregates: ASTM C33, and as specified, from single source for exposed concrete.
   3. Lightweight Aggregate: ASTM C330.
   4. Water: Drinkable, free from foreign materials in amounts harmful to concrete and embedded steel.
   5. Admixtures: Certified by manufacturer to be compatible with other required admixtures.
      a. Air-entraining 6 percent, ASTM C260.
      b. Water reducing, accelerating, high range water reducing admixtures: ASTM C494 Type A.
      c. No other admixtures may be used without Engineer's acceptance.
      d. Salts: The use of calcium chloride, chloride ions or other salts is not permitted.

D. Supplementary Cementitious Materials:
   1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
   2. Metakaolin Admixture: ASTM C618, Class N.
   3. Silica Fume Admixture: ASTM C1240, with optional chemical and physical requirement.
   4. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

E. Connection Materials:
   1. Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A283, Grade C.
   2. Wide Flange Shapes: ASTM A992.
   3. Miscellaneous Steel Shapes: ASTM A36.
   4. Carbon-steel Headed Studs: ASTM A108, cold finished.
   5. Stainless Steel: ASTM A240, 302 or 304.
   6. Anchor Bolts: ASTM A307, low-carbon steel regular hexagon nuts, carbon steel washers.

7. High Strength Threaded Fasteners: Heavy hexagon structural bolts, and hardened washers complying with ASTM A325.
8. Finish of Steel Unit: Exposed units galvanized per ASTM A153; others painted with rust-inhibitive primer.

F. Bearing Pads:
1. Elastomeric: Vulcanized, chloroprene elastomeric compound, molded to size or cut from molded sheet, 50 to 70 Shore A durometer.
2. Laminated Fabric-rubber: Preformed, unused synthetic fibers, new, unvulcanized rubber, surface hardness 70 to 80 Shore A durometer.
3. Random-oriented, Fiber-reinforced Elastomeric: Preformed, fibers set in elastomer, 70 to 90 Shore A durometer.
4. Cotton-duck Fabric Reinforced Elastomeric: Preformed, horizontally layered fabric bonded to elastomer, 80 to 100 Shore A durometer.
5. Frictionless: Tetrafluoroethylene (TFE), with glass fiber reinforcing as required for service load bearing stress.
6. Tempered Hardboard: PS 58, smooth both sides.
7. Plastic: Multimonomer plastic strips, non-leaching, no visible overall expansion under construction loads.

G. Grout Materials:
1. Cement Grout: Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C144. Mix 1 part cement to 3 parts sand, by volume, with minimum water required for placement and hydration.
2. Metallic Shrinkage-resistant Grout:
   a. Premixed factory packaged ferrous aggregate grouting compound.
   b. ASTM C1107, Grade B.
3. Nonmetallic Shrinkage-resistant Grout:
   a. Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents.
   b. ASTM C1107, Grade B.

H. Insulation Materials: Thermomass or equal
1. The Thermomass System, as supplied by Thermomass, consisting of both:
   a. Insulation
      1) Extruded Polystyrene Board Insulation: Complying with ASTM C578, Type IV, with regularly spaced holes identifying connector placement locations.
      2) Polyisocyanurate Board Insulation: Complying with ASTM C1289, Type 1; with regularly spaced holes identifying connector placement locations.
   b. Structurally Non-Composite Wythe Connectors:
      1) Non-conductive, non-corrosive, fiber-composite connectors, having a tensile strength of 120,000 psi, minimum flass content of 76 percent by weight, and a coefficient of thermal expansion of 3.8×10^{-6} in/in/ºF, nominal.
      2) ICC-ES Evaluation Service Report based on data submitted in accordance with ICC-ES Acceptance Criteria 320 indicating compliance with the application building code.

2.03 PRECAST CONCRETE UNITS

A. General Requirements:
1. Free of voids or honeycomb, with straight true edges and surfaces.
2. Texture/Color:
   a. Floor members: Broomed or raked top finish for bonding with concrete floor topping.
   b. Roof members: Smooth, float top finish.
   c. C. Wall Panels: Lannon stone finish color individual with lannon stones for natural stone colors (stain) selected by owner.
3. Reinforcement: Adequate to resist transporting and handling stresses.

4. Cast-in Weld Plates: Provide where required for anchorage or lateral bracing to structural steel and adjacent precast members, including cast-in weld plate to provide connection of flanges of adjoining members.
    a. Provide cast-in weld plates with anchors to be installed in foundation wall.

B. Structural Framing Units: Plant precast prestressed concrete units produced under rigid factory-inspected process.
1. Columns.
2. Beams.

C. Double Tees (Long Span Units): Plant precast prestressed concrete units, produced under rigid, factory-inspected process.

D. Hollow Core Plank: Precast prestressed concrete units with open voids running full length of slabs.
1. Provide headers of cast-in-place concrete or structural-steel shapes for openings larger than 1 slab width, according to hollow-core slab unit fabricator's written recommendations.
2. Provide solid, monolithic precast slab units forming an integral part of hollow slab unit system. Design and fabricate to dimensions and details indicated for hollow slab units.

E. Wall Panels:
1. Panel Types: Insulated Flat Wall Panel.
2. Plant fabricated, solid, precast concrete units produced under rigid factory-inspected process.
3. 10 inches thick, full layer of insulation of thickness indicated, 2-inch minimum thickness prestressed face panel with lannon stone finish and colors (stain).
4. Cast-in weld plates: Where required for anchorage or lateral bracing to structural steel and adjacent precast members, including weld plate to connect flanges of adjoining members.

2.04 ACCESSORIES

A. Joint Sealant: As recommended by precast concrete manufacturer for interior and exterior locations, or if no recommendation by manufacture, use multi-component polyurethane sealant, including backing rod.

B. Clips, hangers, other accessories required for installation and for support of subsequent construction or finishes.

C. Other Materials: Materials not specifically described but required for complete, proper installation of structural precast concrete, subject to acceptance of Engineer.

2.05 MIXES

A. General Requirements: Prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option for each type of concrete required.

B. Proportioning: By either laboratory trial batch or field experience methods, using materials to be employed for each type of concrete required. Comply with ACI 318.

C. Compressive Strength: 5,000 psi minimum at 28 days.

D. Release Strength for Prestressed Units: 3,500 psi minimum.

E. Curing Compression Test Cylinders:
1. Use same methods as for precast concrete work.
2. Do not begin concrete production until Engineer reviews mixes and evaluations.

2.06 FABRICATION

A. Comply with manufacturing and testing procedures, quality control recommendations, dimensional tolerances of PCI MNL-116, and as specified for types of units required.

B. Built-in Anchorages:
   1. Accurately position and secure to formwork.
   2. Locate where they do not affect position of main reinforcement or placing of concrete.
   3. Do not relocate bearing plates in units unless acceptable to Engineer.

C. Openings:
   1. Cast-in holes for openings larger than 8-inch diameter or 8-inch square in accordance with final Shop Drawings.
   2. Other smaller holes may be field cut by trades requiring them, as acceptable to Engineer.

D. Form Preparation:
   1. Coat surfaces with bond-breaking compound before reinforcement is placed, with commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion.
   2. Comply with manufacturer's instructions.

E. Installation of Reinforcement:
   1. Preparation: Clean off loose rust and mill scale, earth, other materials which reduce or destroy bond with concrete.
   2. Displacement: Accurately position, support, secure reinforcement against displacement by formwork, construction, or concrete placement operations.
   3. Support: Metal chairs, runners, bolsters, spacers, and hangers, as required.
   4. Place to obtain at least minimum coverages for concrete protection.
   5. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.
   6. Wire Ties: Set so ends are directed into concrete, not toward exposed concrete surfaces.
   7. Cut ends of strands not enclosed or covered flush and cover with high strength mortar, bonded to unit with epoxy resin bonding agent.

F. Concrete Placement:
   1. Continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304.
   2. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.

G. Identification:
   1. Permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final Shop Drawings.
   2. Imprint date of casting on each precast unit on a surface which will not show in finished structure.

H. Curing by Moisture Retention:
   1. Form cure minimum 20 hours by moisture retention (without heat) method or accelerated heat curing with low-pressure live steam or radiant heat and moisture.
   2. Do not subject concrete to steam or hot air until after the concrete has attained its initial set. Take precautions to prevent moisture loss from concrete if using hot air for curing.
   3. Do not allow temperature of concrete to exceed 160 degrees F.
   4. Keep wet continuously for at least 6 days after being removed from the forms.
   5. Following curing period, allow the units to air dry for minimum 4 days before shipping to Site.
   6. Extend curing period if air temperature is below 50 degrees F.

2.07 FINISHES

A. Formed Surfaces: For formed surfaces of precast concrete as indicated for each type of unit, and as follows:
   1. Standard Finish (non-exposed surfaces):
      a. Normal plant run finish produced in forms that impart smooth finish to concrete.

b. Small surface holes caused by air bubbles, normal form joint marks, minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted.

2. Commercial Finish:
   a. Exposed-to-view precast-prestressed elements.
   b. Remove fins, large protrusions and fill large holes.
   c. Rub or grind ragged edges.
   d. Faces to be true, well-defined surfaces.

B. Unformed Surfaces:
   1. Apply trowel finish to unformed surfaces unless otherwise indicated.
   2. Consolidate concrete; bring to proper level with straightedge, float, and trowel to smooth uniform finish.
   3. Surfaces for Toppings: Apply scratch finish to precast units that will receive concrete topping after installation.
   4. Following initial strike off, transversely scarify surface to provide ridges approximately 1/4 inch deep.

C. Exposed Textures: Fabricate precast units and provide exposed surface finishes as follows to match Engineer's control samples:
   1. Light Broom: After troweling, smooth broom lightly with fine broom drawn over surfaces in direction parallel with long dimension (roof area).
   2. Lannon Stone Finish with Honing or Polishing: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
      a. Provide lannon stone finish with realistic pattern approved by city.
      b. Color:
         1) Exterior surface: Four lannon stone pigments as selected by city.
         2) Interior surface: Natural gray.

2.08 SOURCE QUALITY CONTROL

A. Fabrication Tolerances: Conform to referenced standards.

B. Tests, Inspections:
   1. Testing: Unit dimensions smaller or greater than required, and outside specified tolerance limits are subject to additional testing as specified.
   2. Strength of Units: Strength of units will be considered potentially deficient if manufacturing processes fail to comply with any requirements which may affect strength, including following conditions:
      a. Failure to meet compressive strength tests requirements.
      b. Reinforcement, pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.
      c. Failure to cure, protect units against extremes in temperature as specified.
      d. Precast units damaged during handling and erection.
   3. Suspected Non-compliance Testing: When there is evidence that strength of units does not meet specification requirements, the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C42 and as follows:
      a. At least 3 representative cores from units of suspect strength, from locations directed by Engineer.
      b. Test cores in saturated surface dry condition per ACI 318 if concrete will be wet during use of completed structure.
      c. Test cores in air-dry condition per ACI 318 if concrete will be dry during use of completed structure.
      d. Strength of concrete for each series of cores will be considered satisfactory if average compressive strength is at least 85 percent of 28-day design compressive strength.
      e. Test results are to be made in writing on same day tests are made, copies given to Engineer, Contractor, and precast manufacturer. Include project name, number, date, manufacturer's name, concrete testing service name, identification letter, name, type of member or members represented by core tests, design compressive strength compression

breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of bearing.

4. Patching: Where core test results are satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar. Finish to match adjacent concrete surfaces.
5. Defective Work: Replace with units that meet requirements of this section. Make corrections to other work affected by or resulting from corrections to precast concrete work at no cost to Owner.

C. Verification of Performance:
1. Owner may employ separate testing laboratory to evaluate manufacturer's quality control and testing methods.
2. Allow access to materials storage areas, concrete production equipment, concrete placement and curing facilities.
3. Cooperate, provide samples of materials and concrete mixes as requested.

PART 3 EXECUTION

3.01 EXAMINATION

A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.

B. Verification of Conditions: Verify that the structural precast concrete may be installed in accordance with original design, pertinent codes and regulations, and pertinent portions of referenced standards.

C. Discrepancies:
1. Immediately notify Engineer.
2. Do not proceed with installation in areas of discrepancy until fully resolved.
3. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

A. Protection: Protect installed work and materials of other trades.

B. Surface Preparation, Field Welding and Cutting: Protect units from damage, provide non-combustible shield as required.

3.03 ERECTION

A. Compliance: Comply with manufacturer's instructions, including product technical bulletin installation instructions and Shop Drawing details.

B. Bearing Pads:
1. Where indicated, as precast units are being erected.
2. Set on level, uniform bearing surfaces.
3. Maintain in correct position until precast units are placed.

C. Powder-Actuated Fasteners: Do not use for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.

D. Installation Tolerances: Do not exceed following tolerance limits:
1. Variation from plumb: 1/4-inch in 20-foot run or story height, 1/2-inch total in 40-foot or longer run.
2. Variation from level or elevations: 1/4-inch in 20-foot run; 1/2-inch in 40-foot run; total plus/minus 1/2 inch any location.
3. Variation from position in plan: plus/minus 1/2-inch maximum any location.
4. Offset in alignment of adjacent members any joint: 1/16-inch in 10-inch run: 1/4-inch maximum.

E. Grouting Connections and Joints: After precast concrete units placed and secured, grout open spaces at connection and joints.
   1. Retain grout in place until sufficiently hard to support itself.
   2. Pack spaces with stiff grout material; tamp until voids completely filled.
   3. Finish smooth, plumb, level with adjacent concrete surfaces.
   4. Keep grouted joints damp for not less than 24 hours after initial set.
   5. Promptly remove grout material from exposed surfaces before it hardens.

F. Sealing Joints:
   1. Seal exposed and non-exposed, exterior and interior joints. Use primer and backer rod as recommended by sealant manufacturer.
   2. Seal joints between floor and walls join.

3.04 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.

B. Field welds and connections using high-strength bolts will be subject to tests and inspections.

C. Testing agency to report tests results promptly in writing to Contractor and Engineer.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.05 REPAIR/RESTORATION

A. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use materials, procedures recommended or furnished by manufacturer.

B. Damaged Metal Surface: Clean, apply coat of liquid galvanized repair compound to galvanized surfaces, compatible primer to painted surfaces.

C. Units Having Dimensions Smaller or Greater Than Required and Outside Specified Tolerance Limits: If appearance or function of structure is adversely affected, or if larger dimensions interfere with other construction, repair, or remove and replace as required to meet construction conditions.

3.06 ADJACENT PANEL ALIGNMENT

A. Panels not in flush alignment with adjacent wall panels, and beyond allowable tolerance, must be replaced or, if possible, may be mechanically straightened and permanently fastened to remain at this intended alignment.

B. Fastener hardware for such corrections must be concealed and cast into the original panels to allow for such correction. See Drawings.

3.07 CLEANING

A. Site:
   1. Do not allow accumulation of scraps, debris arising from work of this section.
   2. Maintain premises in neat, orderly condition.

B. System:
   1. Remove temporary covering and other provisions made to minimize soiling of other work.
   2. Promptly clean, repair surfaces stained, marred or otherwise damaged during work.
   3. Clean exposed surfaces of structural precast concrete using materials and methods recommended by manufacturer.
   4. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

5. When work is completed, remove unused materials, containers, equipment, and debris.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Provide structural steel:
   1. All structural steel framing items defined as structural steel in AISC “Code of Standard Practice”.
   2. All steel framing items welded to structural steel framing.

1.02 REFERENCES

A. AISC:
   1. Code of Standard Practice for Steel Buildings and Bridges
   2. Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings, including Commentary” and Supplements
   3. Specifications for Structural Joints using ASTM A325 or A490 Bolts, approved by Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation

B. ASTM:
   1. A6 - General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
   2. A36 - Carbon Structural Steel
   3. A53 - Pipe, Steel, Black, Hot Dipped, Zinc Coated, Welded, Seamless
   4. A148 - High Strength Steel Castings, Carbon, Structural
   5. A307 - Carbon Steel Bolts and Studs
   6. A325 - Structural Bolts, Steel, Heat Treated
   7. A490 - Structural Bolts, Alloy Steel, Heat Treated
   8. A500 - Cold-Formed, Welded and Seamless Carbon Steel Structural Tubing
   9. A501 - Hot-Formed, Welded and Seamless Carbon Steel Structural Tubing
   10. A992 - Structural Steel Shapes

C. AWS:
   1. D1.1 - Structural Welding Code
   2. Standard Qualification Procedure

1.03 DEFINITIONS

A. Structural Steel Lintels: Lintels are included with structural steel.

1.04 SUBMITTALS

A. Product Data: Producer’s or manufacturer’s specifications and installation instructions for following products. Include laboratory test reports, other data to show compliance with specifications (including specified standards):
   1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
   2. High-strength bolts (each type), including nuts and washers.
   3. Structural steel primer paint.

B. Shop Drawings:
   1. Prepare under supervision of Professional Engineer, registered in the state in which Project is located.
   2. Include complete details, schedules for fabrication, assembly of structural steel members procedures and diagrams; details of cuts, connections, camber, holes, other data.

3. Indicate welds by standard AWS symbols; show size, length, and type of weld.
4. Provide setting drawings, templates, directions for installation of anchor bolts, other anchorages to be installed by others.

1.05 QUALITY ASSURANCE

A. Codes and Standards:
   1. Comply with referenced standards, except as otherwise indicated.
   2. Delete the following sentence of Paragraph 4.2.1 - Code of Standard Practice for Steel Buildings and Bridges: “This approval constitutes Owner’s acceptance of all responsibility for design adequacy of any connections designed by fabricator as a part of preparation of these Shop Drawings.”

B. Conflicting Requirements: More stringent shall govern.

C. Qualifications for Welding Work:
   1. Qualify welding processes, operators in accordance with AWS “Standard Qualification Procedure”.
   2. Provide certification that welders have satisfactorily passed AWS qualification tests.
   3. If recertification of welders required, retesting will be Contractor’s responsibility.

D. Surveys:
   1. Owner may employ services of registered Professional Engineer or land surveyor to verify tolerance compliance.
   2. If out of compliance, Contractor responsible for payment.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Ensure uninterrupted progress of work.

B. Storage:
   1. Permit easy access for inspection and identification.
   2. Keep steel members off ground, using pallets, platforms, or other supports.

C. Protection:
   1. Protect steel members, packaged materials from erosion and deterioration.
   2. Do not store materials on structure in manner that might cause distortion or damage to members or supporting structures.

D. Damaged Materials or Structures: Repair or replace as directed.

1.07 PROJECT CONDITIONS

A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:
   1. Materials to be smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness.
   2. Remove blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and application of surface finishes.

B. Wide Flange Shapes and Structural Tees cut from: ASTM 992.

C. Steel Pipe: ASTM A53, Grade B.

D. Cold-form Steel Tubing: ASTM A500, Grade B.

E. Hot-formed Steel Tubing: ASTM A501.

F. All Other Structural Steel Shapes, Plates, and Bars: ASTM A36.

G. Anchor Bolts: ASTM A307, non-headed type unless otherwise indicated.

H. Epoxy Adhesive Anchors:
   1. Hilti: HY 150 Injection Adhesive Anchors, Hilti HVA Adhesive Anchor, Hilti HIT 20 Masonry Anchor, or approved equal.
   2. If the embedment length is not shown on the Drawings, provide the embedment length recommended by the manufacturer to develop the full allowance strength of the bolt.

I. Unfinished Threaded Fasteners:
   1. ASTM A307, Grade A.
   2. Regular low-carbon steel bolts and nuts.
   3. Provide hexagonal heads and nuts for all connections.

J. High-strength Threaded Fasteners:
   1. Heavy hexagon structural bolts, heavy hexagon nuts, hardened washers.
   2. Quenched and tempered medium carbon steel bolts, nuts, and washers.
   3. Comply with ASTM A325.
   4. Direct tension indicator washers may be used.

K. Electrodes for Welding: Comply with AWS.

L. Non-shrink Metallic Grout: Premixed, factory-packaged, interior ferrous aggregate grout complying with CE CRD-C 621 only, specifically recommended by manufacturer for heavy duty loading applications of type specified in this section.

M. Non-metallic Shrinkage-resistant Grout:
   1. Pre-mixed, non-metallic, non-corrosive, non-staining.
   2. Containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents.
   3. Comply with CRD-C621.
   4. Subject to compliance with requirements, products may include, but are not limited to:
      a. *Euco N.S.*; Euclid Chemical Co.
      b. *Crystex*; L&M Construction
      c. Chemicals Masterflow 713; Master Builders
      d. *Upcon*; Upco Chemical Division, USM Corporation.

2.02 FABRICATION

A. Shop Fabrication and Assembly:
   1. Fabricate and assemble structural assemblies in shop to greatest extent possible in accordance with AISC Specifications and as indicated on final Shop Drawings.
   2. Provide camber in structural members where indicated.
   3. Where finishing is required, complete assembly, including welding of units, before start of finishing operations.
   4. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. Marking and Delivery:
   1. Mark and match-mark materials for field assembly.
   2. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

C. Connections:
   1. Shop connections: Weld or bolt as indicated.
   2. Field connections: Bolt, except where welded connections or other connections are indicated.
   3. Principal bolted connections: Provide high-strength threaded fasteners except where unfinished bolts are indicated.
   4. Bolted connections of secondary framing members to primary members. Provide unfinished threaded fasteners
   5. Temporary bracing: Provide unfinished threaded fasteners.

D. High-Strength Bolted Construction:
   1. Install in accordance with AISC “Specifications for Structural Joints using ASTM A325 or A490 Bolts.”

E. Welded Construction: Comply with AWS Code for procedures, appearance, quality of welds, and methods used in correcting welding work.

F. Holes for Other Work:
   1. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final Shop Drawings.
   2. Provide threaded nuts welded to framing, other specialty items as indicated to receive other work.
   3. Cut, drill, or punch holes perpendicular to metal surfaces.
   4. Do not flame cut holes or enlarge holes by burning.
   5. Drill holes in bearing plates.

PART 3 EXECUTION

3.01 EXAMINATION

A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.

B. Verification of Conditions: Verify that Structural Steel may be installed in accordance with original design, pertinent codes and regulations, and pertinent portions of referenced standards.

C. Discrepancies: Immediately notify Engineer. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

A. Protection: Protect installed work and materials of other trades.

3.03 ERECTION

A. Surveys:
   1. Employ registered Professional Engineer or land surveyor for accurate erection of structural steel if deemed necessary.
   2. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Engineer.
   3. Do not proceed with erection until corrections have been made, or compensating adjustments to structural steel work have been agreed upon with Engineer.

B. Temporary Shoring and Bracing:
   1. Provide connections of sufficient strength to bear imposed loads. Remove when permanent members are in place and final connections are made.
   2. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Provide temporary planking and working platforms as necessary to effectively complete work.

C. Anchor Bolts:
   1. Anchor bolts and other connectors: As required for securing structural steel to foundations and other in-place work.
   2. Templates and other devices: As necessary for presetting bolts and other anchors to accurate locations.
   3. Refer to Division 3 for anchor bolt installation requirements in concrete, and Division 4 for masonry installation.

D. Setting Bearing Plates:
   1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
   2. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
   3. Tighten anchor bolts after supported members have been positioned and plumbed.
   4. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
   5. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain.
   6. Finish exposed surfaces, protect installed materials, and allow to cure.
   7. Comply with grout manufacturer's instructions.

E. Field Assembly:
   1. General requirements: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevation and alignment.
   2. Level and plumb individual members of structure within specified AISC tolerances.
   3. Establish required leveling and plumbing measurements on mean operating temperature of structure. Allow for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
   4. Splice members only where indicated and accepted on Shop Drawings.

F. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, grind smooth at exposed surfaces.
   1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, removal of paint on surfaces adjacent to field welds.
   2. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

G. Gas Cutting:
   1. Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing.
   2. Cutting permitted only on secondary members that are not under stress, as acceptable to Engineer.
   3. Finish gas-cut sections equal to sheared appearance when permitted.

3.04 REPAIR/RESTORATION

A. Touch-up Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint.
   2. Apply paint to exposed areas using same material as used for shop painting, by brush or spray to provide minimum dry film thickness of 1.5 mils.
   3. Touch up marred finishes.
   4. Verify paint for areas to be fireproofed.

3.05 ADJUSTING

A. Replace damaged materials with new materials complying with specified requirements.

3.06 CLEANING

A. Site: Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.

B. Other Work:
   1. Remove temporary covering and other provisions made to minimize soiling of other work.
   2. Promptly clean surfaces soiled by this section, repair surfaces stained, marred or otherwise damaged during work.

C. Structural Steel:
   1. Clean exposed surfaces of structural steel using materials and methods recommended by manufacturer.
   2. When work is completed, remove unused materials, containers, equipment, and debris.
   3. Collect offcuts and scrap and place in designated areas for recycling.

3.07 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer to ensure work is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Provide:
   1. Ladder/safety cage.
      a. Steel ladders.
   2. Metal bar gratings.
   3. Floor plate.
   4. Steel tube and pipe railings.
   5. Metal fabrication accessories including, but not limited to:
      a. Rough hardware.
      b. Grout and anchoring cement.

B. Furnish the following for other sections to install including, but not limited to:
   1. Pipe bollards.
   2. Metal fabrication accessories including, but not limited to:
      a. Rough hardware.

C. Related Sections:
   1. Section 03 30 00 - Cast-in-Place Concrete
   2. Section 05 12 00 - Structural Steel Framing
   3. Section 09 97 13 - Coating Systems for Water Storage Tanks

1.02 REFERENCES

A. Building Codes:
   1. International Building Code

B. AASHTO H20 - Loading Conditions for Gratings

C. ASTM:
   1. A27 - Steel Carbon Castings, General Applications
   2. A36 - Carbon Structural Steel
   3. A47 - Ferritive Malleable Iron Castings
   4. A48 - Gray Iron Castings
   5. A53 - Pipe, Steel, Black, Hot Dipped, Zinc Coated, Welded, Seamless
   6. A123 - Zinc Coatings on Iron and Steel Products
   7. A153 - Zinc Coatings on Iron and Steel Hardware
   8. A167 - Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strips
   9. A500 - Cold-Formed, Welded and Seamless Carbon Steel Structural Tubing
   10. A501 - Hot-Formed, Welded and Seamless Carbon Steel Structural Tubing
   11. A510 - Wire Rods and Coarse Round Wire, Carbon Steel
   12. A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
   13. A536 - Ductile Iron Castings
   14. A569 - Tables, Mess, Marine, Steel
   15. A653 - Steel Sheet, Galvanized or Galvannealed by Hot Dip Process
   16. A780 - Repair of Damaged Galvanized Coatings
   17. A786 - Hot Rolled Carbon, Low Alloy, High Strength Low Alloy, and Alloy Steel Floor
   18. A992 - Structural Steel Shapes
   19. A1008 - Steel Sheet, Cold Rolled, Carbon, Structural High Strength, Low Alloy
   20. B632 - Aluminum Alloy Rolled Tread Plates
   21. E119 - Test Method for Fire Tests of Building Construction and Methods

22. E894 - Test for Anchorage of Permanent Metal Railing Systems and Rails for Buildings
23. E935 - Performance of Permanent Metal Railing Systems and Rails for Buildings
24. E985 - Permanent Metal Railing Systems and Rails for Buildings
25. E936 - Roof Systems Assemblies Employing Steel Deck, Preformed Insulation, and Bituminous Built-up Roofing
26. G90 - Standard for Performing Outdoor Weathering of Nonmetallic Materials Using Sun

D. AWS:
1. D1.1 - Structural Welding Code - Steel
2. D1.2 - Structural Welding Code - Aluminum
3. D1.3 - Structural Welding Code - Sheet Metal

E. NAAMM:
1. Metal Finishes Manual
2. MBG 532 - Heavy-Duty Metal Bar Grating Manual

F. SSPC:
1. PA1 - Paint Application Specification No. 1
2. SP3 - Power Tool Cleaning
3. SP6 - Commercial Blast Cleaning

1.03 DEFINITIONS

A. Metal Fabrications: Items made from iron and steel shapes, plates, bars, strips, tubes, pipes, castings not part of structural steel or other metal systems specified elsewhere.

1.04 SYSTEM DESCRIPTION

A. Design Requirements:
1. Handrails and Railing Systems: Design, engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E985 for structural performance based on testing performed in accordance with ASTM E894 and E935.
2. Thermal Movement: Allow for thermal movement for exterior assemblies resulting from maximum 150 degree change in ambient temperature in design, fabrication, installation to prevent buckling, opening up of joints, over stressing of welds and fasteners.
3. Base design calculations on actual surface temperatures of metals due to solar heat gain and nighttime sky heat loss.

B. Performance Requirements: Design, engineer, fabricate, and install the following metal fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections.
1. Apply each load to produce the maximum stress in each respective component of each metal fabrication.
2. Top Rail of Guardrail Systems:
    a. Concentrated load of 300 pounds applied at any point non-concurrently, vertically downward, or horizontally.
    b. Uniform load of 100 pounds per linear foot, applied non-concurrently, vertically downward or horizontally.
    c. Concentrated and uniform loads above need not be assumed to act concurrently.
3. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 pounds applied to one square foot at any point in the system including panels, intermediate rails balusters, or other elements composing the infill area.
4. Heavy Duty Metal Bar Gratings:
    a. Floors: Uniform load of 125 lbf/square foot or concentrated load of 3000 lbf.
    b. Limit deflection to 1/4 inch.

1.05 SUBMITTALS

A. Product Data: Data for products used, including paint products and grout.

B. Shop Drawings:
   1. Detail fabrication, erection of each metal fabrication indicated. Include plans, elevations, sections, details of metal fabrications, their connections. Show anchorage and accessory items.
   2. Provide templates for anchors, bolts specified for installation under other sections.

C. Samples:
   1. Two sets, representative of materials, finished products as requested by Engineer.
   2. Ship's Ladders: Submit for approval prior to fabrication showing full dimensions, wall and floor attachments, materials, construction and finish.

D. Calculations:
   1. Where indicated to comply with certain design loadings, include structural computations, material properties, other information needed for structural analysis, signed and sealed by qualified professional engineer, registered in the state where project located, responsible for their preparation.

E. Welder Certificates: Signed by Contractor certifying that welders comply with specified requirements.

F. Qualification Data: For firms and persons specified, to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.06 QUALITY ASSURANCE

A. Qualifications:
   1. Fabricator: Firm experienced in successfully producing metal fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.
   2. Installer: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.
   3. Welding Processes and Welding Operators:
      a. Qualify in accordance with AWS D1.1 "Structural Welding Code - Steel," D1.3 "Structural Welding Code - Sheet Steel," and D1.2 "Structural Welding Code - Aluminum."
      b. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. Regulations:
   1. Gratings:
      a. Meet ADA Section 4.5.4.
      b. Comply with NAAMM MBG 532: "Heavy-Duty Metal Bar Grating Manual."

1.07 SITE CONDITIONS

A. Field Measurements:
   1. Check actual locations of walls, other construction to which metal fabrications must fit, by accurate field measurements before fabrication.
   2. Show recorded measurements on final Shop Drawings.
   3. Coordinate fabrication schedule with construction progress to avoid delay of Work.
   4. Where field measurements cannot be made without delaying Work, guarantee dimensions, proceed with fabrication without field measurements.
   5. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.08 SEQUENCING AND SCHEDULING

A. Handrails:
   1. Mount only on completed walls.
   2. Do not support temporarily by any means not satisfying structural performance requirements.
   3. Mount only on gypsum board assemblies reinforced to receive anchors, where location of concealed anchor plates clearly marked.

B. Metal Bar Gratings:
   1. Coordinate installation of anchorages for gratings, grating frames, and supports.
   2. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

PART 2 PRODUCTS

2.01 FERROUS METALS

A. Metal Fabrications Exposed to View:
   1. Provide materials selected for surface flatness, smoothness, and freedom from surface blemishes.
   2. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. Wide flange shapes and structural tees cut from: ASTM A992.

C. Steel Shapes, Plates, and Bars: ASTM A36.

D. Rolled Steel Floor Plates: ASTM A786.

E. Wire Rod for Grating Cross Bars: ASTM A510.

F. Gray Iron Castings: ASTM A48, Class 30.

G. Malleable Iron Castings: ASTM A47, grade as recommended by fabricator for type of use indicated.

H. Ductile Cast Iron Castings: ASTM A536, grade 65-45-12.

I. Steel Tubing: Cold-formed, ASTM A500; or hot-rolled, ASTM A501. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A53.

J. Steel Bar Grating: ASTM A569 or ASTM A36 of size, design required for span indicated on Drawings.
   1. Bar Stock: ASTM A276, Type 302 or 304.
   2. Plate: ASTM A167, Type 302 or 304.

K. Structural Steel Sheet: Hot-rolled, ASTM E936; or cold-rolled ASTM 1008, Class 1; grade required for design loading.

L. Galvanized Structural Steel Sheet: ASTM A653, grade required for design loading. Coating designation indicated; if not indicated, G90.

M. Steel Pipe:
   1. ASTM A53; Type, Grade B, as required for design loading.
   2. Black finish unless galvanizing is indicated.
   3. Galvanized finish for exterior installations and where indicated.
   4. Standard weight (Schedule 40) unless otherwise indicated.

N. All other steel shapes, plates and bars: ASTM A36.

O. Brackets, Flanges, and Anchors: Cast or formed metal of same type material, finish as supported rails, unless otherwise indicated.

P. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM 153.

Q. Stainless Steel: ASTM A167 W/No. 2B Mill Finish.

2.02 FINISHES

A. Preparation for Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated.

2.03 FABRICATION, GENERAL

A. Forming:
1. Form from materials of size, thickness, shapes indicated, complying with performance requirements indicated.
2. Work to dimensions indicated or noted on Shop Drawings.
3. Form exposed work true to line, level, with accurate angles and surfaces and straight sharp edges.

B. Cutting and Shaping:
1. Shear, punch metals cleanly, accurately. Remove burrs.
2. Ease exposed edges to radius of approximately 1/32 inch unless otherwise indicated.
3. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
4. Remove sharp or rough areas on exposed traffic surfaces.

C. Welding:
1. Comply with AWS recommendations.
2. Use materials, methods to minimize distortion, develop strength and corrosion resistance of base metals.
3. Fuse without undercut or overlap.
4. Remove welding flux immediately.
5. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Joints:
1. Form exposed connections with hairline joints flush, smooth, using concealed fasteners wherever possible.
2. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts.
3. Locate joints where least conspicuous.

E. Anchorage:
1. Provide for type indicated; coordinate with supporting structure.
2. Fabricate, space anchoring devices to provide adequate support for intended use.

F. Joints: Fabricate joints exposed to weather in manner to exclude water, or provide weep holes where water may accumulate.

G. Shop Assembly:
1. Preassemble in shop to greatest extent possible.
2. Disassemble only as necessary for shipping, handling limitations.
3. Use connections that maintain structural value of joined pieces.

4. Clearly mark for reassembly and coordinated installation.
5. Cut, reinforce, drill, tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

H. Finishes:
1. Comply with referenced NAAMM manual.
2. Finish metal fabrications after assembly.

2.04 STEEL LADDERS

A. Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as indicated. Comply with requirements of ANSI A14.3.

B. Siderails: Continuous steel flat bars, 1/2 inch by 2-1/2 inches, with eased edges, spaced 18 inches apart.

C. Bar Rungs:
1. Round steel bars, 3/4-inch diameter.
2. Space as shown on Drawings, or if not shown, evenly spaced (12 inches on center maximum).
3. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
4. Provide non-slip surface on top of each rung, either by coating the rung with aluminum oxide granules set in epoxy resin adhesive, or by using a type of manufactured rung that is filled with aluminum oxide grout.

D. Support:
1. Support each ladder at top and bottom and at intermediate points spaced not more than 5 feet on center by means of welded or bolted steel brackets.
2. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches.
3. Extend side rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided.
4. If the adjacent structure does not extend above the top rung, gooseneck the extended rails back to the structure to provide secure ladder access.

E. Ladder Safety Cages:
1. Provide SAF-T-CLIMB fall prevention system as specified in 33-16-20 and 33-16-21.

2.05 METAL BAR GRATINGS

A. Produce metal bar gratings of description indicated per NAAMM marking system that comply with the following:
1. Heavy Duty Metal Bar Grating Standard: “Guide Specifications for Heavy Duty Metal Bar Grating” published in NAAMM “Heavy Duty Metal Bar Grating Manual.”

B. Finish:
1. Steel:
a. Shop prime paint applied in accordance with manufacturer’s standard practice.
2. Aluminum: Mill finish.

C. Fabrication:
1. Fabricate removable grating sections with banding bars attached by welding to entire perimeter of each section.
2. Include anchors and fasteners of type indicated, or if not indicated, as recommended by manufacturer, for attachment to supports.

D. Fasteners: Provide not less than 4 anchor blocks for each section of heavy duty grating composed of bearing bars over 3/16 inch in thickness, with each block shop-welded to 2 bearing bars.

E. Provide not less than 4 flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars. Furnish threaded bolts with nuts and washers for each clip required.

F. Toe Plates: Attach 4-inch high toe plates to grating by welding, unless otherwise indicated.

G. Cut Outs:
   1. Fabricate cutouts in grating sections for penetrations indicated.
   2. Arrange layout of cutouts to permit grating removal without disturbing items penetrating gratings.

2.06 PIPE BOLLARDS

A. Fabricate pipe bollards from:
   1. Schedule 80 steel pipe.
   2. Cap bollards with 1/4-inch minimum thickness steel base plate.
   3. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch thick steel plate welded to bottom of sleeve.

2.07 FINISHES

A. Comply with NAAMM “Metal Finishes Manual” for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

C. Steel and Iron Finishes:
   1. Primer Application:
      a. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated.
      b. Comply with requirements of SSPC-PA1 “Paint Application Specification No. 1” for shop painting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.

B. Verification of Conditions: Verify that Metal Fabrications may be installed in accordance with original design, pertinent codes and regulations, and pertinent portions of referenced standards.

C. Discrepancies: Immediately notify Engineer. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

A. Coordination:
   1. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction.
   2. Coordinate delivery of such items to Site.

B. Utilize templates and other systems required to ensure accurate placement of items that will be embedded in concrete and masonry.

3.03 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Temporary Bracing: Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.04 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. Anchor supports securely to, and rigidly brace from, overhead building structure.

3.05 INSTALLATION OF METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of NAAMM grating standard referenced under Part 2 that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Removable Units: Secure removable units to supporting members with type and size of clips and fasteners indicated, or if not indicated as recommended by grating manufacturer for type of installation conditions shown.

C. Non-removable Units: Secure non-removable units to supporting members by welding where both materials are the same; otherwise, fasten by bolting as indicated above.

D. Toe Plates: Attach toe plates to gratings by welding, at locations indicated.

3.06 INSTALLATION OF BOLLARDS

A. Anchor bollards in concrete by means of pipe sleeves preset and anchored into concrete.
   1. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solid with non-shrink, nonmetallic grout, mixed and placed to comply with grout manufacturer’s directions.
   2. Wrap bollard with bond breaker prior to installation of paving or slabs.

3.07 INSTALLATION OF FLOOR POTS

A. Cast into slab in accordance with manufacturer’s instructions.

3.08 INSTALLATION OF PREFABRICATED BUILDING COLUMNS

A. Install prefabricated building columns to comply with AISC “Code of Standard Practice for Steel Building Construction,” AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings,” and requirements of the testing and inspecting agency that apply to the fire resistance rating indicated.

3.09 TOLERANCES

A. Install in required position and within following tolerances:
   1. Maximum variation from plumb: 1/4-inch.
   2. Maximum offset from true alignment: 1/4-inch.

3.10 ADJUSTING AND CLEANING

A. Touch-Up Painting: Cleaning touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal.

B. Galvanizing: For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

C. Collect offcuts and scrap and place in designated areas for recycling.

END OF SECTION

This Page Left Blank Intentionally

SECTION 09 97 13

COATING SYSTEMS FOR WATER STORAGE TANKS

PART 1 GENERAL

1.01 SUMMARY

A. Tank Description:
   1. Tank is described in Section 33 16 20.

B. Scope of Work:
   1. Surface preparation.
   2. Application of coating systems to the following surfaces:
      a. Interior wet:
         1) All surfaces.
         2) Refer to drawings for locations of 3 exterior colors.
      b. Interior dry:
         1) All steel surfaces
      c. Exterior:
         1) All surfaces.
   3. Erection if required of a containment system:
      a. Including Bonnet.
   4. Control of interior tank environment.

C. Related Sections:
   1. Section 33 16 20 - Welded Steel Water Storage Tanks
   2. Section 33 16 30- Disinfection of Water Storage Facilities

1.02 REFERENCES

A. ASTM: American Society of Testing Materials

B. AWWA: American Water Works Association
   1. D102-Coating Steel Water Storage Tanks

C. NACE: International Association of Corrosion Engineers
   1. RPO 188 - Discontinuity (Holiday) Testing of Protective Coatings

D. NSF: National Sanitation Foundation
   1. ANSI/NSF Standard 61

E. SSPC: Society of Protective Coatings
   1. Volume 1 - Good Painting Practice
   2. Volume 2 - Systems and Specifications.
   3. Lead Paint Removal Guidelines - Supplement to Volume 2, Guide 6I (CON) and Guide 7I (DIS)

1.03 DEFINITIONS

A. Regional: The state in which the Project is located and surrounding states.

B. LEL: Lower explosion limit.

C. PEL: Permissible exposure limit.

D. DFT: Dry Film Thickness (Mils).

E. SFPG: Square Feet Per Gallon

F. Containment: Equipment (if required), supports, screens, tarps, or shrouds that prevent airborne debris generated during surface preparation and coating application from entering the environment, and also facilitates controlled collection of debris for disposal.

1.04 SUBMITTALS

A. Product Data:
   1. Provide current data sheets for:
      a. Coatings
      b. Abrasives
      c. Proposed additives

B. Procedures: Written plan for the containment of fugitive airborne particles compliant with current state and/or federal regulations.

C. Equipment: Provide list of equipment to be used including rigging.
   1. Provide documentation, from a certified inspection firm, attesting to the annual conditions and operational safety of the rigging equipment.

D. Records: Daily onsite operations:
   1. Provide on forms provided by Engineer or Contractor's pre-approved form.
   2. Contents should be inclusive of all daily records.
   3. Should include daily quantities if applicable.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Provide written statement from coating manufacturer's authorized representative attesting that Applicator has been instructed on proper preparation, mixing, and application procedures for coatings specified.
   2. Supervisor will be responsible for onsite training related to proper surface preparation, mixing, and application of the coating system.
      a. Contractor shall provide the Engineer with a copy of field training sign-in (and dated), as applicable to each operation.
      b. Only employees listed on sign-in sheet shall be authorized to complete the above listed operation.
   3. Applicator shall have minimum of 5 years application experience on water storage tank projects of similar size, style and scope.
   4. Provide regional references illustrating management competency for a minimum of 3 different projects of similar size, style and scope completed in the last 5 years, including:
      a. Contact person.
      b. Project location.
      c. Size and style of tank.
      d. Cost of coating work.
      e. Start/finish dates.

B. No more than 50 percent of the value of the Bid may be performed by subcontract.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Deliver all materials in original, factory-sealed containers bearing manufacturer's intact and legible label with the following information:
      a. Material identification by name or number.
      b. Manufacturer's stock number, batch number, and date of manufacture.
      c. Color name and number.

B. Storage:
   1. Store materials in an environmentally controlled location as recommended by paint manufacturer's product information guidelines.
   2. Store materials not in actual use in tightly covered containers.
   3. Comply with health and fire regulations of governing authorities having jurisdiction.

C. Handling:
   1. Handle materials in a manner that precludes the possibility of contamination or incorrect product catalyzation.
   2. Do not open containers or mix components until surface preparation has been completed and approved by the Engineer.
   3. Maintain containers used for storage, mixing, and application in a clean condition, free of foreign materials and residue.

1.07 PROJECT CONDITIONS

A. Environmental Requirements for Tank Interior:
   1. As necessary to maintain required ambient conditions and contract scheduling, the contractor shall provide all required equipment for supplemental heating, dehumidification, and power.
   2. Vent exhaust from combustion-type heat sources to prevent contact with interior surfaces.
   3. Provide continuous forced air ventilation by mechanical means during blasting, blowdown, and coating operations.
      a. Not to exceed 10 percent of LEL.
      b. Exhaust air from the lowest portions of the tank with the top opening kept open and clear.
      c. Vent exhaust of spent abrasives downward during blast and blowdown operations.
      d. Maintain exhaust in compliance with state standards.
   4. Provide continuous forced ventilation in accordance with the manufacturer's recommendation.
      a. Minimum rate: 3 air changes per hour.
         1) For 12 hours following each prime coat application.
         2) For the initial 24 hours following finish coat application.
   5. Provide the following through the use of dehumidification equipment:
      a. Dew point of the ambient air at a minimum 15 degrees below the surface and air temperature.
      b. Dehumidification shall be maintained at all times during surface preparation, coating application, and cure.

B. Containment:
   1. Provide containment during abrasive blasting and coating application to prevent emission of abrasives, existing coatings, and contaminants onto adjacent property, streets or structures.
   2. Containment (including ground cover) shall comply with state requirements for preventing emission of fugitive dust.
   3. Containment: The components of the containment structure shall be in accordance with SSPC Guide 6.
      a. Class 1A including specific components, A2, C2, E1, G2, H2.
      b. Include the installation of a properly sized and fitted bonnet.
      c. Employ a properly sized dust collection system.
   4. Assessment of visible emissions:
      a. SSPC-Guide G6 5.5.1 Method A, Level 2 emissions.

C. Weather Conditions:
   1. Do not apply coatings in rain, snow, fog, or mist.
   2. Conduct surface preparation and coating operations only when the following conditions are met.
      a. Air, surface temperature and humidity are within limits recommended by coating manufacturer.
      b. Air and surface temperature is more than 5 degrees above the dew point of the ambient air.
      c. Surfaces to be painted are clean and completely dry.

1.08 SEQUENCING AND SCHEDULING

A. Sequence blasting operations to prevent the contact of blasted materials with freshly painted surfaces.

B. Sequence interior blasting and painting operations per each vessel as follows:
   1. Complete surface preparation on steel tank lower level.
   2. Complete surface preparation on the remainder of the interior surfaces.
   3. Clean roof plates, structural roof support system, and shell plates to first section removing most spent abrasive, dust and any other surface contaminants.
   4. Apply prime-coat followed by finish-coat.
   5. Remove remaining spent abrasive, dust and other surface contaminants.
   6. Apply prime-coat followed by finish-coat to the floor and bottom steel shell plate section.

C. Do not apply coatings until surface preparation has been approved by the Engineer.

D. Do not apply finish coat until:
   1. All prime coat application is completed.
   2. All surfaces have been cleaned.
   3. All surfaces have been approved for coating by the Engineer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Coatings:
   1. Sherwin Williams Company, Cleveland, OH
   2. Tnemec Company, Inc., Kansas City, MO
   3. Or Prequalified equal by the Engineer and Owner

B. Dehumidification Equipment:
   1. Polygon Moisture Control www.polygongroup.com.
      a. Minimum CFM: as to be determine by Polygon or approved equal.
      b. Exactaire Monitoring System may also be used for environmental reporting.

C. Substitution of fast-cure products or acceleration additives must receive prior approval by the Engineer.
   1. Approval will be based on anticipated ambient conditions per the submitted schedule and manufacturer's recommendations.

D. Furnish all coating products from a single manufacturer.

2.02 MATERIALS

A. Regulatory Requirements:
   1. Products shall comply with current state VOC requirements.
   2. Products shall comply with state environmental and health standards.

B. Thinners: Use thinners approved by coating manufacturer and within their recommended limits.

C. Abrasive:
   1. Abrasive materials must be in compliance with state environmental and health standards.
   2. Exterior use of silica sand is prohibited.
   3. Properly size abrasives to provide the required surface profile.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that all surfaces are sound, and ready for surface preparation and coating application.

B. Notify the Engineer in writing of any conditions that may be detrimental to Work.

C. Do not proceed with Work until detrimental conditions have been corrected.

3.02 PREPARATION

A. Protection: Protect or remove all appurtenances that are not to be coated.

B. Shop prime all new steel and components.
   1. Surface preparation: SSPC-SP10.
   2. Primer: See Coating Schedule.
   3. Mask-off 4-inch strip from edge of plate to provide for field welding.

C. Clean and remove all rust, slag, weld splatter, weld scabs, mill scale, loose paint, and surface contaminants.

D. Grind welds and other sharp projects smooth.

E. Allow new concrete to cure a minimum 28 days.
   1. Verify dryness by testing in accordance with ASTM D4263.

F. Fill cracks and voids according to coating manufacturer's recommendations.

G. Surface profile shall be in accordance with the manufacturer's product recommendation.

H. Re-blast all Surfaces:
   1. Where rusting has recurred.
   2. That do not meet the requirements of this Section.

I. On the interior wet, scarify by blasting with a fine abrasive all shop-primed surfaces before topcoating.

J. Feather edges of existing coating to form a smooth transition prior to spot priming.

K. Mix corrosion inhibitor and apply in accordance with manufacturer's recommendations.

L. Interior Wet Surfaces: SSPC SP 7 Brush Off Blast Cleaning
   1. All shop paint surfaces to remove dirt and or other contaminants
   2. SSPC-SP10 Near White Blast Cleaning.
      a. All Steel Surfaces shall be cleaned of all contaminants.
      b. All weld seams shall be re-blasted to SSPC-SP10 and the edges feathered smooth.
   3. SSPC-SP13 - Surface Preparation of Concrete.
      a. All surfaces.
         1) 4.3.1. Abrasive Blast.

M. Interior Dry Surfaces:
   1. SSPC-SP6 Commercial Blast Cleaning.
      a. All Steel Surfaces shall be cleaned of surface contaminants.
         All weld seams shall be re-blasted to SSPC-SP6 and the edges feathered smooth.

N. Exterior Surfaces:
   1. SSPC-SP6 Commercial Blast Cleaning.
      a. All Steel Surfaces shall be cleaned of surface contaminants.

b. All weld seams shall be re-blasted to SSPC-SP6 and the edges feathered smooth.
   1) SSPC-SP13 - Surface Preparation of Concrete Surfaces
c. All Concrete Surfaces
   1) 4.3.1. Abrasive Blast.
   2) 4.3.2. High Pressure Water Cleaning.

3.03 MATERIALS PREPARATION

A. Materials shall be mixed, thinned, and applied according to the manufacturer's written instructions and in accordance with this Section.

B. Maintain containers used in mixing and application in a clean condition, free of foreign materials and residue.

C. Mixing of partial containers and field tinting will not be allowed.

3.04 APPLICATION

A. Apply in accordance with manufacturer's directions.
   1. Do not apply in snow, rain, fog, mist, or on damp surfaces.
   2. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the painting operation.
   3. Work may continue during inclement weather only if areas and surfaces are enclosed and temperatures within the area can be maintained within limits specified during application and drying periods.

B. Use equipment and techniques best suited for substrate and type of material being applied.
   1. Brush-apply stripe coat primer or intermediate on all welds and edges prior to general application of finish coat.
   2. Spray-apply all complete coats on interior wet portion of the tank.

C. Apply each coat at the rate specified. If material is thinned or film thickness cannot be achieved due to application equipment, temperatures, etc., apply additional coats to obtain the specified film thickness.

D. Avoid degradation and contamination of blasted surfaces and avoid intercoat contamination.
   1. Surfaces shall be free from grease, oil, abrasives, and other contaminants that may have an adverse effect on coating application, bonding, curing, or performance.
   2. Clean contaminated surfaces before applying next coat.

E. Provide application thickness to specified mil requirements.

F. Allow preceding coats to dry before recoating.
   1. Recoat within time limits specified by the coating manufacturer.

G. Prime Coat:
   1. Verify that field-applied coatings are compatible with shop-applied system.
   2. Apply prime coat immediately after surface preparation and prior to surface rusting or dust accumulation.

H. Where voids are present exposing the substrate or undercoats, apply additional coat(s) until a uniform color and finish is obtained.

I. Finish coats shall be uniform in color and sheen without streaks, laps, runs, or missed areas.

J. Apply caulking along all intermittent welds and lap plate seams above the high water line.

K. Within the confines of the handrail on top of the tank, apply a non-skid walkway surface.
   1. This surface is to consist of an additional application of intermediate coatings at 4 to 6 mils wet.
   2. While second coat is still wet, broadcast clean 40-mesh silica sand to saturation.

3. When the surface has dried sufficiently, remove excess sand and apply finish coat as specified.

3.05 FIELD QUALITY CONTROL

A. Contractor shall provide all necessary equipment to monitor and record the information required on the Daily Application Record.
   1. Equipment shall be in good condition.
   2. Operational within its design range.
   3. Calibrated as required by the specified standard for use of each device.

B. Maintain a copy of the following information at the site:
   1. Product Data Sheets.
   2. Material Safety Data Sheets (MSDS).
   3. Contract Document and submittals.
   4. Daily Application Record.
      a. Record information (in English) on form located at the end of this Section.

C. Owner's representative may be on site to observe the application of each coating, and the preparation of each substrate.

D. Provide safe and complete access to all surfaces for observation by Owner and/or Engineer.

E. Prepare rigging so that all surfaces are within arm's reach of observer.

F. Contractor shall measure and document wet paint with wet film thickness gages.

G. Provide DFT measurements for all coatings in accordance with SSPC-PA2.

H. Perform Holiday testing on interior wet immersion steel surfaces in accordance with NACE RPO 188 as directed by Engineer.

I. Correct any deficiencies observed or detected by field testing as directed by Engineer.

3.06 CLEANING

A. Remove all discarded paint materials, rubbish, cans, rags, and other debris from the Site in accordance with current state and federal regulatory requirements.

B. Upon completion of Work, clean all spattered surfaces.
   1. Remove spattered materials by proper methods of washing and scraping.
   2. Use care to not scratch or damage finished surfaces.

3.07 WARRANTY INSPECTION

A. At the Owner's option, an inspection of the coating system may be held within 24 months of the date of Substantial Completion.

B. Owner's Responsibilities:
   1. Establish date and time for inspection.
   2. Provide minimum 14 days notice to Contractor.
   3. Determine inspection method.
   4. Provide suitable access.
   5. Advise Contractor of any coating failures, and the required corrective measures.
      a. Coating failures shall be interpreted to include:
         1) Peeling.
         2) Blistering or bubbling.
         3) Cracking.
         4) Rusting or rust staining.

C. Contractor's Responsibilities:
1. Repair all coating failures as follows:
a. Coordinate Work schedule with Owner.
b. Perform corrective measures in accordance with this Section.
c. Complete Work within 30 days of receipt of Owner's notice.
d. Complete Work at no cost to Owner.
2. Disinfect tank in accordance with Section 33 16 30.

3.08 COATING SYSTEM SCHEDULE

A. SHERWIN WILLIAMS COMPANY
1. SHOP PAINTING (if applicable)

PRIMER- Zinc	Corothane I Galvapac	Gray	2.0 - 3.0	2.0 - 3.0

2. FIELD PAINTING-Steel

INTERIOR Dry – (incl. Valve Vault) Epoxy	PRODUCT	COLOR	DFT	TOTAL DFT
Primer(Bare Metal)	Macropoxy 646 PW	Lt. Blue	4.0 - 6.0	8.0 - 12.0
Intermediate				
Finish	Macropoxy 646 PW	White	4.0 - 6.0	

INTERIOR WET Zinc/Epoxy	PRODUCT	COLOR	DFT	TOTAL DFT
Primer(Bare Metal)	Corothane I Galvapac	Gray	2.0 - 3.0	10.0 - 15.0
Intermediate	Macropoxy 646 PW	Lt. Blue	4.0 - 6.0	
Finish	Macropoxy 646 PW	White	4.0 - 6.0	

EXTERIOR Zinc/Epoxy/Polyurethane	PRODUCT	COLOR	DFT	TOTAL DFT (Excluding Logo)
Primer(Bare Metal)	Corothane I Galvapac	Gray	2.0 - 3.0	6.0 - 9.0
Intermediate	Macropoxy 646	To Be Selected by Owner	2.0 - 3.0	
Finish Semi Gloss	Acrolon 218 HS	To Be Selected by Owner	2.0 - 3.0	

3. Alternate Exterior Systems

EXTERIOR Zinc/Fluoropolymer	PRODUCT	COLOR	DFT	TOTAL DFT (Excluding Logo)
Primer(Bare Metal)	Corothane I Galvapac	Gray	2.0 - 3.0	6.0 - 9.0
Intermediate	Acrolon 218	3 Colors To Be Selected by Owner	2.0 - 3.0	
Finish Semi Gloss	FluoroKem	3 Colors To Be Selected by Owner	2.0 - 3.0	

4. FIELD PAINTING – Concrete

INTERIOR WET Epoxy	PRODUCT	COLOR	DFT	TOTAL DFT
First Coat	Macropoxy 646 PW	Lt. Blue	6.0 - 8.0	12.0 - 16.0
Finish Coat	Macropoxy 646 PW	White	6.0 - 8.0	

EXTERIOR Acrylic	PRODUCT	COLOR	DFT	TOTAL DFT
First Coat (Fine,)	WB Ultra-Crete	3 Colors To Be Selected by Owner	6.0 - 8.0	12.0 - 16.0
Finish Coat (Fine)	WB Ultra-Crete	3 Colors To Be Selected by Owner	6.0 - 8.0	

B. TNEMEC COMPANY

1. SHOP PAINTING

PRIMER- Zinc	91H20 Hydro Zinc	Greenish Gray	2.5 - 3.5	2.5 - 3.5

2. FIELD PAINTING – Steel

INTERIOR DRY Epoxy	PRODUCT	COLOR	DFT	TOTAL DFT
Primer(Bare metal)	N140 Pota-Pox	1255 Beige	4.0 - 6.0	7.0 - 11.0
Intermediate				
Finish	N140 Pota-Pox	15BL Tank White	3.0 - 5.0	

INTERIOR WET Zinc/Epoxy	PRODUCT	COLOR	DFT	TOTAL DFT
Primer(Bare Metal)	91H20 Hydro Zinc	Greenish Gray	2.5 - 3.5	10.5 - 15.5
Intermediate	N140 Pota-Pox	1255 Beige	4.0 - 6.0	
Finish	N140 Pota-Pox	15BL Tank White	4.0 - 6.0	

EXTERIOR Zinc/Epoxy/Polyurethane	PRODUCT	COLOR	DFT	TOTAL DFT (Excluding Logo)
Primer(Bare Metal)	91H20 Hydro Zinc	Greenish Gray	2.5 - 3.5	6.5 - 9.5
Intermediate	N69 Epoxoline	3 Colors To Be Selected by Owner	2.0 - 3.0	
Finish Semi Gloss	1075U / 1074U Endurashield	3 Colors To Be Selected by Owner	2.0 - 3.0	

3. Alternate Exterior System

EXTERIOR Zinc/Fluoropolymer	PRODUCT	COLOR	DFT	TOTAL DFT (Excluding Logo)
Primer(Bare Metal)	91H20 Hydro Zinc	Greenish Gray	2.5 - 3.5	6.5 - 9.5
Intermediate	1075 Endurashield	3 Colors To Be Selected by Owner	2.0 - 3.0	
Finish Semi Gloss	701 / 700 Hydroflon	3 Colors To Be Selected by Owner	2.0 - 3.0	

4. FIELD PAINTING – Concrete

INTERIOR WET Epoxy	PRODUCT	COLOR	DFT	TOTAL DFT
First Coat	N140 Pota-Pox	1255 Beige	6.0 - 8.0	12.0 - 16.0
Finish Coat	N140 Pota-Pox	15BL Tank White	6.0 - 8.0	

EXTERIOR Acrylic	PRODUCT	COLOR	DFT	TOTAL DFT
First Coat Smooth	180 / 181 Tneme-Crete	3 Colors To Be Selected by Owner	6.0 - 8.0	12.0 - 16.0
Finish Coat Smooth	180 / 181 Tneme-Crete	3 Colors To Be Selected by Owner	6.0 - 8.0	

END OF SECTION

DAILY APPLICATION RECORD

DATE				----------*RECORD EVERY 3 HOURS*----------					
				Surface Temperature (Deg. F.)	Air Temperature (Deg. F.)	Material Temperature (Deg. F.)	Relative Humidity (%)	Dew Point (Deg. F.)	Weather Conditions
TIME START		AM	PM						
		AM	PM						
		AM	PM						
		AM	PM						
		AM	PM						
TIME STOP		AM	PM						

Area Prepared

Area Coated

Type of Material & Quantity Applied:

SIGNED

PROJECT NAME:	**SEH FILE #:**
OWNER:	**CONTRACTOR:**

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General Scope of Electrical Work –Madison, WI– Lakeview Reservoir Replacement Project's electrical installation:

1. This project includes the Owner's selection between concrete types or a steel type reservoir as noted on the plans.
2. The Electrical installation consists of, but not limited to:
   a. Furnishing and installing:
      1) Proposed utility transformer secondary conduits.
      2) Metering Equipment.
      3) Proposed grounding.
      4) Conduit Systems.
      5) Control Conductors.
      6) Motor Controls.
      7) Circuit Breakers.
      8) Panel Boards.
      9) Disconnect Switches.
      10) Surge Suppression Systems.
      11) Motor Starters.
      12) Power Wiring.
      13) Receptacles.
      14) Light Switches.
      15) Motion Detectors.
      16) Pressure Transducers.
      17) Intrusion Switches.
      18) Electric Heater and Exhaust Fan with Motorized Dampers
      19) Interior and Exterior Building Lighting fixtures.
      20) 600 volt Conductors.
      21) Instrumentation & Control Panels and wiring.
      22) Underground Wiring.
      23) Instrumentation Wiring.

B. Basic Electrical Requirements specifically applicable to Division 1.

The Electrical Contractor is responsible for, but not limited to; metering equipment and electrical installations and installing and wiring of the equipment supplied by the Owner's System Integrator. The Owner's System Integrator is:

L.W. Allen
4633 Tompkins Drive
Madison, WI 53716
Contact: Mr. Mark Kane
(608) 222-8622
No Approved Equal.

If there are any conflicts or misunderstanding, the Electrical Contractor shall immediately bring it to the attention of the Engineer before beginning any such work. In addition, it is the Electrical Contractors responsibility to coordinate with the Owner's System Integrator for the installation and wiring of all components and equipment required for the project and start-up, testing and placing all systems into full operation.

The Electrical Contractor shall inspect and determine if any of the equipment furnished by the Owner's System Integrator is damaged before installation. If any equipment furnished by the System Integrator is damaged, it is the Electrical Contractor's responsibility to notify the Engineer immediately before the installation. If the Electrical Contractor damages any equipment, it is his/her responsibility to repair or replace at the Engineer's discretion at no additional cost to the Contract.

1.02 CONDUIT LAYOUT

A. Install all conduits under floor slabs and surface mount on the interior walls where practicable and where specified on the plans. Coordinate all conduit penetrations with the Engineer before proceeding with work.

B. Some of the general routing of conduit is shown on the plans. The Electrical Contractor is responsible for locating and installing all conduit. Field verify that all equipment safeties, emergency stop switches and equipment interlocks are properly working. In addition, in some cases it is the Electrical Contractor's responsibility to determine exact conductor or cable count and conduit sizes, if not noted on the plans.

C. Before cutting or removing the finish such as welding on the tank, consult the manufacturer and Engineer prior to doing so.

1.03 REFERENCE

A. ANSI/NFPA 70 - National Electrical Code.

B. State of Wisconsin Electrical Code.

1.04 EQUIPMENT ADJUSTMENTS

A. Submit under provisions of Division 1.

B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in single submittals.

C. Mark dimensions and values in units to match those specified.

D. Where specific catalog or model numbers of equipment and lighting are shown on the plans or specified within, it is the Electrical Contractor's and the Owner's System Integrator responsibility to correct and supply any equipment with the newest and most current numbers that match the specified equipment at no additional cost to the project.

1.05 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Install Work in locations shown on Drawings, unless prevented by Project conditions.

C. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding. Install Work in locations shown on Drawings, unless prevented by Project conditions.

D. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner or Engineer before proceeding.

E. Where spare conductors are shown in each conduit, they shall be terminated at both ends on spare terminal blocks. They shall be identified as spare conductors unless otherwise required. If shop drawings require additional control conductors installed in the raceways, they shall be furnished and installed at no additional cost to the contract.

F. During shop drawing review it is determined that equipment relocation or change in equipment is required, the disconnect switches, junction boxes, other electrical enclosures and conduit and wiring shall be relocated up to 30 feet from their original location whether closer or farther distance from the intended location shown on the plans at no additional cost to the contract. This shall consider voltage drop and if the conductors are required to increase in size, this shall also occur at no additional cost to the contract.

G. If additional junction boxes, pull boxes, hand holes, or conduit fittings are required to complete the installation, whether to meet NEC requirements or due to project conditions, these shall be furnished and installed at no additional cost to the contract.

H. The general conduit routing of some conduits are shown on the plans, if conduit require requires a different routing this shall occur at no additional cost to the contract. Where conduits become longer the conductors shall be upsized to accommodate the minimum voltage drop as directed by the Engineer at no additional cost to the contract.

I. If conduits entering the building require a different routing other then shown on the plans they shall enter the building to meet project conditions and these changes shall occur at no additional cost to the contract.

J. As noted on the plans, the Electrical Contractor shall verify the location of all equipment before installing conduit, lighting, enclosures and other devices and materials with the other trades so there are no conflicts. Failure to do so will require the Electrical Contractor to relocate any equipment that is in conflict at no additional cost to the contract whether it is caused by him/her or the other trades. Where caused by the other trades immediately notify the Engineer to resolve these issues before proceeding with the installation.

K. Where there is a conflict on the drawings indicating different conduit or conductor sizes, use the larger conduit and conductors or verify with the Engineer. This requirement shall be at no additional cost to the contract.

L. Where light fixtures may conflict with ductwork or other items, relocate the light fixture(s) and include all necessary additional support hardware, conduit and wiring and other materials to meet project expectations. Coordinate these relocations with the Engineer at no additional cost to the contract.

M. The Electrical Contractor shall review these requirements set forth in these specifications and understand there impact on the project.

N. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

O. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

1.06 SEQUENCING AND SCHEDULING

A. Construction Work in sequence under provisions of Division 1.

1.07 TEMPERATURE CONTROL EQUIPMENT AND WIRING

A. The Electrical Contractor is responsible for furnishing and installing the heater, exhaust fan and motorized dampers and associated power to the heating and ventilation equipment shown on the plans.

1.08 CONDUIT ROUTING

A. The Electrical Contractor shall submit conduit routing plans before installation. This information shall be supplied with the shop drawings.

B. If the Electrical Contractor's routing does not meet the Engineers expectations, the Electrical Contractor shall relocate the conduits at no additional cost to the contract as directed by the Engineer.

1.09 TELEPHONE SERIVCE

A. Not Required.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.

3.02 ELECTRICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate electrical systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
   7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
   9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
   10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
   11. Install access panel or doors where units are concealed behind finished surfaces.
   12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

13. After installation, verify that all motors are “phased” for proper rotation.
14. Coordinate electrical service work and required equipment with local electrical utility company.

3.03 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section. In addition to the requirements specified in Division 1, the following requirements apply:
   1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
      a. Uncover Work to provide for installation of ill-timed Work.
      b. Remove and replace defective Work.
      c. Remove and replace Work not conforming to requirements of the Contract Documents.
      d. Remove samples of installed Work as specified for testing.
      e. Install equipment and materials in existing structures.
      f. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer observation of concealed Work.
   2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
   3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
   4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
   5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
   6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers’ qualifications refer to the materials and methods required for the surface and building components being patched.
   7. See the plans or other specification divisions for construction phasing.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 05 01

SUBMITTAL REVIEW

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop drawing review and O&M Manual review based on the Contract Documents:

B. The list created below may not include all equipment due to Electrical Contractor substitutions when acceptable by the Engineer. With this occurrence, the Electrical Contractor shall submit additional information as directed by the Engineer at no additional cost to the contract.

C. The SCADA Panel is shown on the plans, but is limited to Owner's System Integrator's requirements.

D. Project References
Madison, WI – Reservoir Project Specifications.
1. Section 01 33 00.
2. Section 01 78 23.

E. The Electrical Contractor shall submit shop drawings on the following Electrical Equipment:
1. 600 Volt Conductors.
2. Control Cables or Conductors.
3. Grounding Conductors and clamps.
4. Ground Rods or Ground Plates. (See Plans)
5. Schedule 80 PVC Conduit.
6. Counterpoise and Down Conductors.
7. Conduit Elbows.
8. Rigid Steel Conduit.
9. Conduit Supports and Hangers.
10. Interior Junction and Pull Boxes.
11. Exterior Junction and Pull Boxes.
12. Electrical Cabinets and Terminal Blocks.
13. Unistrut Channel.
14. Meter Socket.
15. Conduit Fittings and Conduit Bodies.
16. Conduit Supports.
17. Interior Lighting Fixtures as Listed on the Plans.
18. Exterior Lighting Fixtures as Listed on the Plans.
19. Emergency Lighting Fixtures as Listed on the Plans.
20. Lamps, as Listed on the Plans.
21. Exterior Photo-cell and Obstruction Lights.
22. Receptacles including corrosion-resistant Type and GFCI types.
23. Interior and Exterior Back Boxes.
24. Light Switches.
25. Cover Plates and In-Use Covers.
26. Panelboards.
27. Circuit Breakers.
28. Fuses.
29. Disconnect Switches.
30. Manual Starters.
31. Control Transformers.
32. Magnetic Contactors and Starters.
33. Relays and Contactors.
34. Instruments.
35. SCADA Control Panel.

36. Individual Combination Motor Starters and Enclosures.
37. Electrical and Instrumentation Devices.
38. Fault Current and Circuit Breaker/Fuse Coordination Data and Information. (Separate specifications not provided.)
39. Motor Controls and diagrams for UL Listed equipment to be furnished by the Owner's System Integrator.

All electrical equipment shall include the listing of the available fault current and circuit breaker/fuse coordination for each MCC, panelboard, and control panels required under this contract.

1.02 SHOP DRAWING SUBMITTALS

A. Submit shop drawings in accordance with procedures of Section 01 33 00. Before any components are fabricated and/or integrated into assemblies, or shipped to the site, the Electrical Contractor and Owner's System Integrator shall furnish to the Engineer and receive his review of shop drawings with all details, catalog cuts, inter-connecting wiring diagrams, and such other descriptive matter and documentation as described herein to fully describe the equipment and to demonstrate its conformity to these Specifications.

B. The shop drawings for all Electrical Equipment shall be submitted to the Engineer under single cover. The shop drawings for the Instrumentation & Controls submittal may be under a separate cover.

C. The Electrical Contractor shall each provide six (6) sets of shop drawings in 3 ring binders (hard copy only, emailed versions are not acceptable).

D. The Electrical equipment shop drawing submittal and Instrumentation & Controls shop drawings shall follow the specified format listed in C below. Incomplete submittals or submittals not as described in the specifications shall be returned "NOT REVIEW-RESUBMIT".

Shop Drawing Submittal for Electrical Equipment:

Each submittal shall be indexed to organize the required Electrical Equipment submittal information. The shop drawings shall include written description of operation (if required), equipment lists, equipment cut sheets with identification of each item submitted.

All electrical equipment documentation shall be typed and the drawings shall be produced in AutoCAD format for all control drawings and all equipment, conduit layouts and piping layouts.

Each group of equipment shall be placed in each individual section and all equipment submitted shall be clearly identified. The Electrical Contractor shall follow the general format outlined in the Instrument & Control submittal requirements.

The shop drawing submittal shall be all inclusive for all Electrical Equipment furnished for the project and shall contain all details, cut sheets, equipment layouts where required and the equipment shall be clearly identified for its intended purpose. The shop drawing submittal shall indicate the complete component listing with product literature including manufacturer's model or catalog numbers. The Electrical Contractor shall tag or otherwise identify exactly the model or catalog number of the part being furnished and where the part is to be installed in the system or building. If this information is not provided the shop drawings will be returned to the Electrical Contractor **"NOT REVIEWED-RESUBMIT".**

The maximum number of shop drawing or O&M Manual reviews by the Engineer for each submittal group (Electrical equipment and Instrumentation and Control" shall be two (2). If more than two (2) reviews are required due to incomplete or inaccurate shop drawing or O&M Manual submittals, the Electrical Contractor shall pay the Engineer $500.00 per each additional review of each submittal. The payment shall be made to the Engineer when each submittal is submitted. The shop drawings or O&M Manuals will not be reviewed and will be returned to the Electrical Contractor or the Booster Skid manufacturer. The third and subsequent shop drawings or O&M Manual submittals will not be further reviewed without first receiving payment in advance.

1.03 OPERATION AND MAINTENANCE (O&M)MANUALS

A. Submit operation and maintenance manuals under provisions of Section 01 78 23.

B. The O&M manuals shall be furnished at least 15 calendar days before the scheduled delivery of equipment. The manuals shall include a table of contents.

C. The O&M manuals shall exactly follow the format of the submittal manual and include the shop drawings and other documentation as specified.

D. The O&M manuals shall in addition contain an indexed section to house the calibration and loop testing documentation that shall be provided for the project.

E. The Electrical Contractor shall provide six (6) sets of "record" O&M manuals to the Engineer after the installation. The Engineer shall provide those O&M manuals to the Owner after Engineer review. If the O&M manuals are in-complete the Engineer will return the O&M Manuals to the Electrical Contractor for re-submittal. If this process requires more than two submittals, then the Electrical Contractor shall provide the same review fees as required for the shop drawing review(s).

F. The factory testing results shall become part of the O & M manuals. The tests shall include the following information:
   1. Field Operational Acceptance Tests: These tests are to demonstrate that the system of Process Instrumentation and Control is ready for final operation. The I&C System shall be checked for proper installation, adjusted, and calibrated on a loop-by-loop basis to verify that it is ready to function as specified. All system elements shall be checked to verify that they have been installed properly and that all terminations have been made correctly. All discrete elements and systems shall have their set points adjusted and shall be checked for proper operation (e.g., interlock functions, contact closure on rising/ falling P.V., etc.). All continuous elements and systems shall have three-point calibrations performed. All controller tuning constants shall be adjusted to preliminary settings. The operational acceptance tests shall be completed before starting the functional acceptance tests. The actual testing program shall be conducted in accordance with prior approved procedures and shall be documented as required hereinafter.
   2. Functional Acceptance Tests: These tests are to demonstrate that the system of Instrumentation and Controls is operating and complying with the specified performance requirements. A witnessed, functional acceptance test shall be performed on the complete system of Instrumentation and Controls. Each function shall be demonstrated to the satisfaction of the Engineer on a paragraph by paragraph and loop by loop basis. Each test shall be witnessed and signed off by the Electrical Contractor upon satisfactory completion. The actual testing program shall be conducted in accordance with prior approved procedures and shall be documented as required hereinafter.
   3. The Electrical Contractor shall notify the Engineer at least 2 weeks prior to the date of the functional acceptance test.

G. Test Procedure Development and Test Documentation: The Electrical Contractor shall perform testing procedures as approved by the Engineer. The Electrical Contractor shall include in the submittal, the test procedures proposed.

H. The Engineer may participate in many of the tests. The Engineer reserves the right to test or retest any and all specified functions whether or not explicitly stated in the prior-approved Test Procedures.

I. The Engineer's decisions shall be final regarding the acceptability and completeness of all testing.

J. A List of recommended spare parts shall be included in the O & M Manual.

PART 2 EXECUTION

2.01 ELECTRICAL CONTRACTOR & SYSTEM INTEGRATOR RESPONSIBILITIES

A. Where the Electrical Contractor's equipment interfaces with other equipment furnished by other Contractor's, it is the Electrical Contractor's responsibility to verify that all the submitted equipment is compatible.

B. The Electrical Contractor shall read and understand the information contained in this specification section. Any misunderstanding by the Electrical Contractor is not acceptable as these requirements are bound within the Project Contract Documents.

C. The Electrical Contractor shall provide the specified information that is required by these Electrical Specifications and shall submit this information to the Engineer by mail in a timely manner.

END OF SECTION

SECTION 26 05 04

CLEANING, INSPECTION AND TESTING ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Work:
   1. Prior to energizing new equipment, perform inspections and tests as herein specified and follow the Owner's System Integrators directions.
   2. Ensure electrical equipment supplied by other Contractors is operational, within industry and manufacturer's tolerances and installed in accordance with Specifications.
   3. The Electrical Contractor shall megger (test) each individual branch, feeder and motor circuit installed under this contract to verify the insulation values are within specifications and that grounding continuity exists from the origin of the circuit to the load. See the INSULATION AND EQUIPMENT SCHEDULE 1A at the back of this specification section. After each circuit is tested the Electrical Contractor shall fill in the required data into the table. The Electrical Contractor shall make as many copies of the table as needed to complete the testing. The Electrical Contractor shall designate which site has been tested on the schedule. This information shall be turned over to the Engineer. If the tests do not meet the minimum values that are shown in the INSULATION RESISTANCE TESTS FOR ELECTRICAL EQUIPMENT & SYSTEMS chart, replace circuit conductors and repair or replace motors, receptacles or other devices.

1.02 QUALITY ASSURANCE

A. Recommendations for acceptance or rejection shall be given upon consultation of Engineer.

B. Inspections and tests shall utilize the following:
   1. Project specifications.
   2. Project drawings.
   3. Manufacturer's instruction manuals applicable to each particular apparatus.

C. Requirements of Regulatory Agencies:
   1. National Fire Protection Associates (NFPA):
      a. National Electrical Code (NEC) (NFPA No. 70) and State of Wisconsin amendments thereto Water tower, currently under construction.
   2. Underwriters Laboratories, Inc. (UL).
   3. Local Codes.

D. National Fire Protection Associates (NFPA):
   1. National Electrical Code (NEC), (NFPA No. 70E) The Electrical Contractor shall provide the required protective clothing and other protection required if working on live equipment.
   2. The Electrical Contractor shall calculate the fault current at the panelboard and provide the following Arc Flash labels per NEC 110-16 and ANSI Z535.4-1998 on the electrical equipment with the shop drawings including the calculations:
      a. Label No.1: WARNING on first line. "Arc Flash and Shock Hazards" on second line. "Appropriate PPE Required" on third line. "Failure to Comply Can Result in Death or Injury" on forth line and "Refer to NFPA 70E" on fifth line.
      b. Label No.2: WARNING on first line. "Arc Flash and Shock Hazards" on second line. "Appropriate PPE Required" on third line. "Failure to Comply Can Result in Death or Injury" on forth line "Available Three Phase bolted Fault Current" on fifth line with the appropriate fault current for the project site. The "Flash Hazard Boundary" on the sixth line, "Cal/CM 2 Flash Hazard at 18 Inches", "Hazard Risk Category" on the seventh line, Voltage "Shock Hazard" on the eighth line, "Limited Approach" on the ninth line, "Restricted Approach" on the tenth line and "Prohibited Approach" on the eleventh line.

E. Reference Standards:
   1. Institute of Electrical and Electronic Engineers (IEEE):
      a. IEEE Standard No. 81-83 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
      b. IEEE Standard No. 400.

F. The Electrical Contractor shall review the contract drawings and other specification sections and provide additional spare equipment as noted. In the case of duplication of spare equipment, the Electrical Contractor shall provide the spare in accordance with the specification that requires the greater number.

1.03 SUBMITTALS

A. Test Reports and Demonstration Log:
   1. Permanently record checks and tests and demonstrations.
   2. Submit copy of complete testing or demonstration report no later than 30 days after testing or demonstration is complete.

B. Submit copy to Engineer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 DEMONSTRATIONS

A. Demonstrate the proper operation of all electrical systems and equipment in the presence of the owner and/or owners designated representatives. The demonstrations shall include, but not be limited to, the following equipment and systems:
   1. Circuit breakers.
   2. Disconnect switches.
   3. Ground fault receptacles.
   4. Motor starters and contactors.
   5. Motor Controls
   6. SCADA controls.
   7. Panel Boards.
   8. Conduit Systems.
   9. Lighting Systems.
   10. Motors.
   11. Heating and Ventilation equipment.
   12. Surge Arrestor systems.
   13. Metering equipment.
   14. Instrumentation and Control Panels.

B. Demonstration Log:
   1. Keep log of individual demonstrations.
   2. Data:
      a. Date and time of demonstration.
      b. Owner’s representative.
      c. Equipment or system demonstrated.
      d. Result of demonstration.
         1) Success of fail.
         2) If failure, description of failure.
         3) Corrective action.
         4) Re-demonstration result.

3.02 TESTS

A. Test work and equipment installed to ensure proper and safe operation in accordance with intent of drawings and specifications.
   1. Check interlocking and automatic control sequences and test operation of safety and protective devices.
   2. Correct defects.
   3. Cooperate with supplier's and manufacturer's representatives in order

B. Test, adjust, and record operating voltages at each system level before energizing services, feeders or branch circuits. Re-adjust after energizing as necessary.
   1. Transformer taps must be adjusted to obtain as near as possible nominal system voltage. Prior to energization of transformers, check phase-to-phase and phase-to-ground insulation resistance levels. Check transformers for continuity of circuits and short circuits.
   2. Where transformer is under utility jurisdiction, obtain services of utility to correct voltage.
   3. Replace devices and equipment damaged due to failure to comply with this requirement.
   4. Motors:
      a. Complete nameplate data.
      b. Overload relay element.
      c. Voltage and current phase readings.
      d. Direction of rotation.
      e. Circuit breaker/MCP instantaneous trip settings.
   5. Ampere readings on any cable operating in parallel to insure an even division of current.

C. Balance load among feeder conductors at each panelboard, switchboard or substation and reconnect loads as may be necessary to obtain reasonable load balance on each phase. Electrical load unbalance shall not exceed 7-1/2%.

D. Control Circuits, Branch Circuits, Feeders, Motor Circuits, and Transformers:
   1. Megger check of phase-to-phase and phase-to-ground insulation levels for all feeders. Do not megger on Hipot Test solid state equipment.
   2. Continuity.
   3. Short circuit.
   4. Operational check.

E. Wiring Devices:
   1. Test all new receptacles with Hubbell 5200, Woodhead 1750 or equal tester for current polarity, proper ground connection, and wiring faults.

3.03 ADJUSTMENT AND CLEANING

A. Disconnects and Motor Starters:
   1. Adjust covers and operating mechanisms for free mechanical movement.
   2. Tighten wire and cable connections to proper torque.
   3. Verify overcurrent protection thermal unit size with motor nameplate to provide proper operation and compliance with NEC.
   4. Clean interior of enclosures.
   5. Touch up scratched or marred surfaces to match original finish.
   6. Protect all electrical/electronic equipment from dust and debris. Make sure all equipment is wrapped in plastic and protected during construction.

B. Circuit Breakers:
   1. Adjustable settings shall be set to provide selective coordination, proper operation, ground fault and compliance with NEC.
   2. Provide record of all circuit breaker information and settings including circuit breaker instruction manuals and time-current characteristic curves.

3.04 GROUNDING SYSTEMS

A. Visual and Mechanical Inspection:
   1. Inspect ground system for compliance with drawings and specifications.

B. Electrical Tests:
   1. Fall of potential test per IEEE No. 81, Section 9.04 on main grounding electrode or system.
   2. Two-point method test per IEEE No. 81, Section 9.03, to determine ground resistance between main grounding system and major electrical equipment frame, system neutral, and derived neutral points.
   3. Alternate to two-point method.
      a. Ground continuity test between main ground system and equipment frame, system neutral, and/or derived neutral point.
      b. Test shall be made by passing minimum of 10 amp dc current between ground reference system and ground point to be tested.
      c. Voltage drop shall be measured and resistance calculated by voltage drop method.
   4. Electrical grounding test shall be performed by an independent testing firm approved by the Owner and Engineer and paid for by the Electrical Contractor. Copies of test reports shall be submitted to the Engineer and Owner.
   5. Test Values.
      a. Main ground electrode system resistance to ground shall be no greater than 5 ohms for commercial or industrial systems and 1 ohm or less for generating or transmission station grounds, unless otherwise specified by ENGINEER.

3.05 GROUND FAULT SYSTEMS

A. Electrical Tests:
   1. Measure system neutral insulation resistance to ensure no shunt ground paths exist, neutral-ground disconnect link removed, neutral insulation resistance measured, and link replaced.
   2. Determine relay pickup current by primary injection at sensor and circuit interrupting device operated.
   3. Test relay timing by injecting 150% and 300% of pickup current into sensor. Electrically monitor total trip time.
   4. Test system operations at 55% rated voltage.
   5. Test primary service cable per IEEE 400.

INSULATION RESISTANCE TESTS FOR NEW ELECTRICAL EQUIPMENT & SYSTEMS ONLY

MAXIMUM RATING OF EQUIPMENT IN VOLTS	MINIMUM TEST VOLTAGE, DC IN VOLTS	RECOMMENDED MINIMUM INSULATION RESISTANCE*
250	500	Infinity
600	1,000	Infinity
5,000	2,500	Infinity
8,000	2,500	Infinity
15,000	2,500	Infinity
25,000	5,000	Infinity
35,000	15,000	Infinity
46,000	15,000	Infinity
69,000	15,000	infinity

Note 1: The minimum resistance level shall be 500 meg-ohms for existing motors. If resistance is less than specified, remove motor and repair or replace. If the meg-ohm readings are less than specified remove conductors and replace with new conductors as required by Specification Section 26 05 19.

END OF SECTION

INSULATION AND EQUIPMENT TEST SCHEDULE 1A: MADISON, WI – RESERVOIR REPLACEMENT PROJECT

EQUIPMENT OR CIRCUIT NAME:	TEST BY:	TEST RESULT: PASS OR FAIL	DATE TESTED:	OWNER OR ENGINEER PRESENT:	COMMENTS:

THE ABOVE INFORMATION SHALL BE TURNED OVER TO THE OWNER OR ENGINEER AFTER CONSTRUCTION IS COMPLETED.

SECTION 26 05 05

ELECTRICAL EQUIPMENT STARTUP

PART 1 GENERAL

1.01 ELECTRICAL EQUIPMENT STARTUP

A. The Electrical Contractor shall test (MEGGER) each feeder, branch circuit, motor circuit and associated equipment per Specification Section 26 05 04 “CLEANING, INSPECTION AND TESTING ELECTRICAL EQUIPMENT” before beginning system(s) startup.

B. Each motor shall be rotated by hand before energizing any existing equipment. Provide all system check-outs as required in Specification Division 1 and Division 22 and 23. Coordinate pump/motor startup testing with Mechanical Contractor present. Do not run pump/motor(s) dry unless otherwise directed by the Engineer.

C. Visually inspect each motor, motor starter, control transformer, indicating lights, switches and auxiliary control equipment for damage, broken or missing parts. Field verify that each motor is protected with proper size overload and replace same if required. Where indicating lights are defective, replace same.

1.02 MEETINGS

A. Conduct a planning meeting two weeks prior to equipment startup. Coordinate all meetings with Engineer.

1.03 PRESTARTUP CHECKOUT

A. Field verify that all equipment safeties, emergency stop switches and equipment interlocks are properly working.

B. Check for proper motor rotation and correct if required.

1.04 CLEANING

A. Clean any debris that is inside each motor starter bucket, panelboard, switchboard, automatic transfer switch, generator, disconnect switch and other electrical enclosures.

1.05 EQUIPMENT ADJUSTMENTS

A. Check floats, control panels, limit switches, valve position switches and solenoid for proper operation. Make all necessary adjustments as required for proper operation or as recommended by the manufacturer.

B. Test and calibrate all control circuits, both analog and digital types.

C. Check and calibrate all flow meters, level transducers and transmitters and similar analog and pulse devices.

D. Verify that all new equipment is compatible. Notify the Engineer immediately if the new equipment is not compatible with equipment provided by the other trades.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 26 05 06

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements specified in Section 26 05 00 apply to this Section.

1.02 SUMMARY

A. This Section includes limited scope general construction materials and methods for application with electrical installations as follows:
   1. Excavation for underground utilities and services, including underground raceways and equipment.
   2. Miscellaneous metals for support of electrical materials and equipment.
   3. Wood Framing including nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment.
   4. Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for electrical materials and equipment.

C. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under Division 1.

D. Schedules indicating proposed methods and sequence of operations for installation prior to commencement of Work. Include coordination for connection of electrical service.
   1. Coordinate sequencing with construction phasing and Owner occupancy specified in Division 1.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer for the installation and application joint sealers, access panels, and doors.

B. Qualify welding processes and welding operators in accordance with AWS D1.1 “Structural Welding Code - Steel.”
   1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.
   2. Verify with tank manufacturer and Engineer prior to any welding on or in the reservoir. Coordinate the installation of all brackets and other equipment that requires welding or otherwise anchored to the reservoir, if the installation is not in a timely fashion and is after the tank has been coated, the Electrical Contractor is responsible for recoating areas where the finish requires repair due to improper installation requiring rework, not installed at all or not installed in a timely fashion at his cost as directed by the manufacturer and tank installer.

C. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL “Building Materials Directory” for rating shown.
   1. Provide UL Label on each fire-rated access door.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle joint sealer materials in compliance with the manufacturers’ recommendations to prevent their deterioration and damage.

1.06 PROJECT CONDITIONS

A. Conditions Affecting Excavations: The following project conditions apply:
   1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
   2. Use of explosives is not permitted.

B. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 PRODUCTS

2.01 MISCELLANEOUS METALS

A. Steel plates, shapes, bars, and bar grating: ASTM A 36.

B. Cold-Formed Steel Tubing: ASTM A 500.

C. Hot-Rolled Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Schedule 40, welded.

E. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout, recommended for interior and exterior applications.

F. Fasteners: Zinc-coated, type, grade, and class as required.

2.02 MISCELLANEOUS LUMBER

A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.

B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches.

2.03 JOINT SEALERS

A. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire- rated walls and floors. Sealants and accessories shall have fire- resistance ratings indicated, as

established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. "Dow Corning Fire Stop Foam," Dow Corning Corp.
   b. "Pensil 851," General Electric Co.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation of access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 EXCAVATION

A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
   1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.

C. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
   1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
   2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

D. Trenching: Excavate trenches for electrical installations as follows:
   1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 3 to 6 inches clearance on both sides of raceways and equipment.
   2. Excavate trenches to depth indicated or required.
   3. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
   4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.

E. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F. (2 deg C).

F. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
   1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
   2. Under building slabs, use drainage fill materials.
   3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
   4. All underground conduits shall be installed 30 inches below finished grade, unless otherwise noted on the plans, and shall be routed adjacent other underground piping or as directed by the Engineer. The conduits shall be installed in trench per the details shown on the plans.
   5. Other areas, use excavated or borrowed materials.

G. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Inspection, testing, approval, and locations of underground utilities have been recorded.
   2. Removal of concrete form work.
   3. Removal of shoring and bracing, and backfilling of voids.
   4. Removal of trash and debris.

H. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

I. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

J. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.

K. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification.

3.03 CUTTING AND PATCHING

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS “Structural Welding Code.”

3.04 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood framing, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building wire and cable.

1.02 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code.

1.03 SUBMITTALS

A. Submit under provisions of Division 1.
   1. Submit six copies of shop drawings and samples of the following:
      a. Wire connectors, of each type for both underground and above ground installations.
      b. Wire identification markers or tags. See Specification section 26 05 53 for additional information on required products.
      c. Insulation tape as specified within. Samples only need to be six inch cut-offs.
      d. All samples will be retained by the Engineer.

B. Test Reports: Indicate procedures and values obtained.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.05 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper. Use 75^{o}C ratings for all conductors. All conductors for power and lighting circuits shall be sized as shown on the plans or as required by the actual load to be served, whichever is larger. Article 310 of the NEC shall be the guide in determining conductor sizes. Long circuits shall be sized to prevent voltage drops in excess of 2 percent.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions. Include wire and cable lengths within 10 feet of length shown.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.06 COORDINATION

A. Coordinate Work under provisions of Division 1.

B. Determine required separation between cable and other work.

C. Determine cable routing to avoid interference with other work.

PART 2 PRODUCTS

2.01 BUILDING WIRE AND CABLE

A. Description:
   1. Type; XLP insulated wire.
   2. Type; Thermo-plastic insulation, nylon jacket

B. Conductor: Stranded Copper only.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: ANSI/NFPA 70; Type XHHW insulation for feeders and branch circuits #8 AWG and larger. Type XHHW or THWN insulation for feeders and branch circuits #10 AWG and smaller. Where wiring is routed underground or wet and damp locations or classified locations (Class 1, Division 1 or Class 1, Division 2) provide XHHW only.

E. Where conductors are shown to be installed into polyethylene duct, the insulation shall be type USE for direct burial applications.

2.02 WIRING CONNECTORS

A. Split Bolt Connectors for #8 and larger wire and all motor connections. Use Vulcowrap insulating tape only as manufactured by TPC Wire and Cable Company and 3M Scotch 33 Tape as manufactured by 3M Company.

B. Spring Wire Connectors for branch circuit #14, #12, and #10 wire. Use Ideal Twister DB silicon filled safety connectors below finished grade or in wet and damp location areas.

C. Compression Connectors required on all control wire and cable terminations. Control and metering wire terminations shall be completed using vinyl insulated, crimp terminals or terminal blocks designed for direct wire termination. Crimp type terminals shall not be installed on solid wires.

D. All primary and/or secondary power cable conductor terminations for copper conductors No. 4/0 AWG size or larger shall be completed using cast bronze, two-bolt minimum, pressure type conductor terminals.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire has been completed.

3.02 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.03 COMBINING OF CONDUCTORS IN RACEWAYS

A. The following rules shall apply:
   1. Motor power conductors may be run together for two motors which are three horse power and less provided motors are deemed non-critical; or they may be critical but not back-ups of each other. Thus motors connected to pumps of a common type may not be run together.
   2. Power conductor for motors over three horse power and for critical loads without back-up should be run in separate individual conduits unless otherwise specified or approved.
   3. Conduit fill for power to motors shall meet the requirements of the National Electric Code.
   4. No more than SIX (6) current carrying conductors (including the neutral conductor) may be installed in a single conduit.

3.04 SPECIAL WIRING – SEE SPECIFICATION SECTION 26 05 23.01

3.05 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Use stranded conductor for feeders and branch circuits 10 AWG and larger.

C. Use stranded conductors for control circuits.

D. Use conductor not smaller than 12 AWG for power and lighting circuits.

E. Use conductor not smaller than 14 AWG for control circuits.

F. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet, whether shown on the plans or not.

G. Pull all conductors into raceway at same time.

H. Use suitable wire pulling lubricant for building wire 8 AWG and larger.

I. Protect exposed cable from damage.

J. Support cables above accessible ceiling, using cable tray. Do not rest cable on ceiling panels.

K. Use suitable cable fittings and connectors.

L. Neatly train and lace wiring inside boxes, equipment, and panelboards.

M. Clean conductor surfaces before installing lugs and connectors.

N. Make splices, taps, and terminations to carry full capacity of conductors with no perceptible temperature rise.

O. Use split bolt connectors for copper conductor splices and taps, 8 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

P. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

Q. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller. All wet location areas shall include the use of ideal twister DB wire connecting approved equal.

R. Tag all wires at each end and at junction boxes. Do not change wire color at splices.

3.06 CORROSION RESISTANT AREAS

A. All connections and wiring shall be installed to eliminate or minimize corrosion of conductors and terminations installed in these areas.

3.07 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 26 05 53.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.08 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Division 1.

B. Inspect wire and cable for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

END OF SECTION

SECTION 26 05 23.01

SPECIAL SYSTEMS CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Analog instrument cable.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

A. Submit under provisions of Division 1.

B. Test Reports: Indicate procedures and values obtained.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.05 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet the Project Conditions. Include wire and cable lengths within 10 feet of length shown.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.06 COORDINATION

A. Coordinate Work under provisions of Division 1.

B. Determine required separation between cable and other work.

C. Determine cable routing to avoid interference with other work.

PART 2 PRODUCTS

2.01 ANALOG INSTRUMENT CABLE; VFD'S AND TRANSMITTERS INCLUDING CHEMICAL PUMPS, SCALES, PROPELLER METERS, MAGMETERS AND SIMILAR EQUIPMENT

A. Polyethylene insulated, tinned copper (19 by 27) stranding, No. 16 AWG, 2 conductors or 18 AWG, 2 pair as shown on the plans, cable with aluminum-polyester electrostatic shielding, stranded, tinned, copper drain wire, and chrome vinyl outer jacket. Provide shielding grounding at one end only.

B. Where cables are supplied specifically for or by a manufacturer, provide the recommended cable for the project base on site conditions including length, location and temperature.

C. Cables specified by Instrumentation Manufacturer's for equipment such as those required between flow meters, pressure transducers or other and flow elements shall be provided by the Electrical Contractor whether specified or not.

2.02 FIBER OPTIC CABLE

Not Used.

2.03 ETHERNET CABLE (IF SHOWN ON THE PLANS)

A. A four pair #23 AWG bonded pair cable shall be furnished and installed if required.

B. The Cable shall be jacketed with a PVC .035" inner jacket and polyolefin insulation over the conductor. The cable shall be ANIXTER part # 11872A or approved equal.

2.04 WIRING CONNECTORS

A. Crimp-on type fork connectors shall be used on all control wires and cables. Install connectors at all origination and termination points and in each termination/pull box (TPB) or PLC panel that cable is routed through, unless specifically stated otherwise on the floor plans.

PART 3 EXECUTION

3.01 INSTRUMENTATION OF CONDUCTORS IN RACEWAYS

A. Separate conduit systems shall be as follows:
   1. Analog instrumentation.
   2. Digital input instrumentation (low voltage digital signals).
   3. Digital output instrumentation (120 volt digital cables).

B. Conduit Locations: As shown on plans.

C. A #14 AWG monofilament plastic pullwire shall be installed in all instrumentation conduits installed as a part of this project. This wire shall include be put into all empty and filled conduits. Pull wires shall be accurately marked at each end with a laminated tag indicating that it is a pullwire.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Analog instrumentation cable shall only be grounded at the control panel end.

C. Pull all conductors into raceway at same time.

D. Protect exposed cable from damage.

E. Support cables above accessible ceiling, using cable tray. Do not rest cable on ceiling panels.

F. Use suitable cable fittings and connectors.

G. Neatly train and lace wiring inside boxes, equipment, and panelboards.

H. Clean conductor surfaces before installing lugs and connectors.

I. Maximum conduit fill shall be 25%.

3.03 IDENTIFICATION

A. Identify wire and cable under provisions of Section 26 05 53.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.04 TESTING COPPER & FIBER OPTIC CABLES

Not Used.

3.05 INTERFACE WITH ENGINEER

A. Prior to installing any instrumentation cable, the Contractor shall verify routing and termination type with the Engineer. The Contractor shall assume that all terminations onto terminal blocks or outlets are to be done by the Contractor unless specifically delineated otherwise on the drawings or in the specifications.

3.06 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Division 1.

B. Inspect wire and cable for physical damage and proper connection.

C. Verify continuity of each cable conductor. Provide written report to the Engineer that each cable has been verified.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTETMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. Testing Specifications sections.

1.03 GROUNDING ELECTRODE SYSTEM

A. Rod electrode.

1.04 PERFORMANCE REQUIREMENTS

A. Maximum Grounding System Resistance: 5 ohms.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Accurately record actual locations of grounding electrodes.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

C. UL Standard: UL standard 467 “Grounding and Bonding Equipment.”

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by the following:
   1. Anixter Bros. Inc.
   2. A.B. Chance Co.
   3. Erico Products, Inc.
   4. O-Z/Gedney Co.
   5. Raco, Inc.
   6. Thomas & Betts Corp.

2.02 MATERIALS

A. Grounding and Bonding Products: Types as indicated. Where types, sizes, ratings, and quantities indicated differ from NEC requirements, the more stringent requirements and the greater size, ratings, and quantities indicated differ from NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

B. Conductor Materials: Copper.

C. Wire and Cable Conductors: Comply with Section 26 05 19. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

D. Equipment Grounding Conductor: Green insulated.

E. Grounding Electrode Conductor: Bare stranded copper conductor.

F. Bare Copper Conductors: Conform to the following:
   1. Solid Conductors: ASTM B-3.
   2. Assembly of Stranded Conductors: ASTM B-8.
   3. Tinned Conductors: ASTM B-33.

G. Ground Bus: Bare annealed copper bars of rectangular cross-section.

H. Braided Bonding Jumpers: Copper tape, braided from No. 30-gage bare copper wire and terminated with copper ferrules.

I. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

J. Connector Products: Listed and labeled as grounding connectors for the materials with which used.

K. Pressure Connectors: High-conductivity plated units.

L. Bolted Clamps: Heavy-duty units listed for the application.

M. Exothermic Welded Connections: Provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.

N. Ground Rods: Copper-clad steel, 3/4 inch by 10 feet, minimum.

O. Ground Plates if shown on the plans. The plates shall be 1/8 inch thick tinned copper with pigtails exothermically welded to the plate before the tinning occurs. The plates shall be 36 inches square.

P. Provide lightning down conductors, static dissipaters and lightning arrestors if shown on the plans.

Q. Provide counterpoise system if shown on the plans. All welds shall be exothermically welded types.

PART 3 INSTALLATION

3.01 EQUIPMENT GROUNDING CONDUCTOR APPLICATION

A. Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated. Apply equipment ground conductors in accordance with the following:
   1. Install in separate insulated equipment grounding conductors with all circuit conductors.

2. Nonmetallic Raceways: Install an insulated equipment grounding conductor in nonmetallic raceways except as otherwise indicated or unless they are designated for telephone or data cables.
3. Metal Piping Equipment Circuits: Install a separate insulated equipment grounding conductor to electrical devices connected to metallic piping systems and operating at 120 V and above, including pumps, heaters, heat tracing, and surface anti-frost heating cable. Bond the conductor to each such unit and to the piping.

B. Underground Conductors: Bare, tinned, stranded copper except as otherwise indicated.

C. Signal and communications: For telephone, alarm, and communication systems, provide a #4 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet or central equipment location.

D. Separately derived systems required by NEC to be grounded shall be grounded as approved by the authority having jurisdiction.

E. Installation, General: Ground electrical systems and equipment in accordance with NEC except where grounding in excess of NEC requirements is indicated.

F. Ground Rods: Locate a minimum of one-rod length from each other and at least the same distance from any other grounding electrode. Interconnect ground rods with bare conductors buried at least 24 inches below grade. Connect bare-cable ground conductors to ground rods by means of exothermic welds except as otherwise indicated. Make these connections without damaging the copper coating or exposing the steel. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated.

G. Grounding Electrode Conductor: Provide insulated copper conductor, sized as indicated, in conduit. Bond the ground conductor conduit to the conductor, sized as indicated, in conduit. Bond the ground conductor conduit to the conductor at each end. Where a dielectric fitting is installed in the main metallic water service pipe, connect the ground conductor to the street side of the fitting. Do not install a grounding jumper around dielectric fittings. Bond the ground conductor conduit to the conductor at each end.

H. Braided-Type Bonding Jumps: Install to connect ground clamps on water meter piping to electrically bypass water meters. Use elsewhere for flexible bonding and grounding connections.

I. Route grounding and bonding conductors using the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

J. Connections: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
1. Use electroplated or hot-tin-coated materials to assure high conductivity and make points of contact closer in order of galvanic series.
2. Make connections with clean bare metal at points of contact.
3. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent penetration of moisture to contact surfaces.

K. Exothermic Welded Connections: Use for connections to structural steel and for underground connections. Install at connections to ground rods. Comply with manufacturer’s written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable. Bolted ground connectors shall not be used underground or in concrete encased areas unless specified.

Where bonding to water towers, coordinate locations of bonding conductors with the tank manufacturer before installing.

L. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A and UL 486B.

M. Compression-Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the conductor.

N. Moisture Protection: Where insulated conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

O. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground resistance level is specified, at service disconnect enclosure ground terminal, and at ground test wells. Measure ground resistance without the soil being moistened by any means other than natural precipitation or natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method in accordance with Section 9.03 of IEEE 81, "Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System."
   1. Ground/resistance maximum values shall be as follows:
      a. Equipment rated 500 kVA and less: 10 ohms.
      b. Equipment rated 400 kVA to 1000 kVA: 5 ohms.
   2. Deficiencies: Where ground resistance exceeds specified values, and if directed, modify the grounding system to reduce resistance values. Where measures are directed that exceed those indicated the provisions of the Contract, covering changes will apply.
   3. Report: Prepare test reports, certified by the testing organization, of the ground resistance of each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Conduit and equipment supports.

B. Anchors and fasteners.

C. Comply with NFP 70 “National Electrical Code.”

D. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Materials and Finishes: As a minimum, all conduit straps and hangers shall be hot dipped galvanized. All exterior mounted unistrut, and any other “wet” location, “corrosive” locations shall be stainless steel. Where shown on the drawings, provide stainless steel, or PVC coated supports and hardware.

B. Provide materials, sizes and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit and conduit fittings when selecting products. Use only stainless steel hardware on exterior installations.

C. Anchors and Fasteners:
   1. Concrete and Structural Elements: Use expansion anchors and preset insert channels.
   2. Steel Structural Elements: Use beam clamps.
   3. Concrete Surfaces: Use expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
   5. Solid Masonry Walls: Use expansion anchors.
   6. Sheet Metal: Use stainless steel sheet metal screws.
   7. Wood Elements: Use stainless steel wood screws.
   8. All anchors and fasteners located on the exterior of buildings, Chlorine room, Caustic room, Fluoride rooms shall be stainless steel.

2.02 SUPPORT CHANNEL

A. Manufacturer:
   1. B-Line.
   2. Unistrut.
   3. Approved Equal.

B. Special Requirements.
   1. See drawings for special requirements.

C. Description: Galvanized steel shall be used in building interiors, except below grade applications and chemical rooms, where stainless steel shall be used as specified above. Stainless steel shall be provided, as specified in Specification Section 26 05 33.01 for all exterior mounting locations. Where Stainless Steel channel is used, conduit support clamps and fasteners shall be stainless steel or PVC coated.

2.03 SUPPORT RODS

A. Manufacturer:
   1. B-Line.
   2. Unistrut.
   3. Engineer Approved equal.

B. Description:
   1. Stainless steel with all stainless steel hardware.
   2. U-Channel Systems: 12-gage stainless steel channels and galvanized steel shall be 1 5/8 inches high by 1 5/8 inches wide, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

C. Coordinate with the building structural system and with other electrical installation.

D. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

E. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

F. Raceway Supports: Comply with the NEC and the following requirements:
   1. Conform to manufacturer's recommendations for selection and installation of supports.
   2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.

G. Do not use powder-actuated anchors.

H. Do not drill or cut structural members.

I. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

J. All conduits supports shall be hot dipped galvanized or stainless steel where otherwise noted. All hardware, including threaded rods, washers, bolts, and nuts shall be stainless steel.

K. Support parallel runs of horizontal raceways together on trapeze-type hangers.

L. Support individual horizontal raceways serving by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

M. Space supports for raceways in accordance with Table I of this section. Space supports for raceway types not covered by the above in accordance with NEC.

N. Support exposed and concealed raceway within of an unsupported box and access fittings. In horizontal rungs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

O. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

P. Vertical Conductor Supports: Install simultaneously with installation of conductors.

Q. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

R. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

S. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with “Fire Resistant Joint Sealers” requirement of Section 26 05 06. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

T. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:
   1. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

U. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

TABLE 1: SPACING FOR RACEWAY SUPPORTS

Raceway Size (Inches)	No. of Conductors in Run	Location	Maximum Spacing of Supports (Feet)		
			RMC & IMC	EMT & ALU	RNC
HORIZONTAL RUNS					
1/2,3/4	1 or 2	Flat ceiling or wall	5	5	3
1/2,3/4	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	7	7	...
1/2,3/4	3 or more	Any location.	7	7	...
1/2-1	3 or more	Any location.	6	6	...
1 & larger	1 or 2	Flat ceiling or wall.	6	6	...
1 & larger	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	10	10	...
Any	...	Exposed.	7	7	...
VERTICAL RUNS					
1/2,3/4	...	Exposed.	7	7	...
1,1-1/4	...	Exposed.	8	8	...
1-1/2 and larger	...	Exposed.	10	10	...
Up to 2	...	Shaftway.	14	10	...
2-1/2	...	Shaftway.	16	10	...
3 & larger	...	Shaftway.	20	10	...
Any	...	Concealed.	10	10	...

NOTES:

(1) Maximum spacing of supports (feet).
(2) Maximum spacings for IMC above apply above apply to straight runs only. Otherwise the maximum for EMT apply.

Abbreviations:

EMT Electrical metallic tubing.
IMC Intermediate metallic conduit.
RMC Rigid metallic conduit.
RNC Rigid nonmetallic conduit.

END OF SECTION

SECTION 26 05 33.01

CONDUIT AND RACEWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applicable provisions of Division 1 shall govern work of this section.

B. Rigid steel galvanized conduit.

C. Rigid galvanized steel conduit, PVC coated.

D. Non-Metallic, schedule 80 PVC.

E. Liquid tight flexible metal conduit.

F. Flexible metal conduit.

G. Fittings and conduit bodies.

H. Rigid aluminum conduit.

I. Electrical Metallic Conduit (EMT).

J. Wireways.

K. Polyethylene Duct, Type TC-7.

1.02 REFERENCE

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

D. ANSI/NFPA 70 - National Electrical Code.

E. NECA “Standard of Installation.”

F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

G. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

I. ANSI TC3 - Rigid Aluminum Conduit.

1.03 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70.

1.04 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Accurately record actual routing of conduits larger than 2 inches.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of Division 1.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.07 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS-GENERAL

A. Minimum Size: Interior mounted raceways; 3/4 inch unless otherwise specified. Exterior mounted raceways; 1 inch unless otherwise specified.

B. Underground Installations:
   1. Use Schedule 80 PVC rigid conduit and fittings.
   2. Conduits penetrating the floors and above shall be galvanized rigid steel conduit and fittings including the 90 degree elbows.
   3. Underground conduits routed for electrical utility conductors shall be Schedule 80 PVC. Where penetrating above grade, they shall be galvanized rigid steel unless otherwise noted on the plans.

C. Outdoor Locations, Above Grade: Use Galvanized Rigid Steel.

D. The conduit in the reservoir and valve vault shall be galvanized rigid steel.

E. Liquid-Tight Flexible Conduit:
   1. Use liquid-tight flexible conduit for all motors, control valves, solenoids and transformer connections or where flexibility is required for other equipment per the manufacturers requirements.
   2. Use in all areas for flexible connection except where flexible conduit is allowed as stated above.
   3. Maximum length shall be 3 feet.

F. Each conduit shall have internal grounding conductor installed.

2.02 CONDUIT REQUIREMENTS – FIBER OPTIC CABLES

Not Used.

2.03 PVC COATED METAL CONDUIT

A. Manufacturers:
   1. OCAL-Blue.
   2. Permacote.
   3. NO SUBSTITUTES.

B. Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick. Conduit shall be provided with an internal epoxy coating.

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.04 FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction.

B. Fittings: ANSI/NEMA FB 1.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction with PVC jacket.

B. Fittings: ANSI/NEMA FB 1.

2.06 NONMETALLIC CONDUIT

A. Description: NEMA TC 2; Schedule 80 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.07 POLYETHYLENE DUCT. (WHEN SPECIFIED ON THE PLANS)

A. Description: NEMA TC-7, Schedule 40 Duct, with either trench or plow installation. The duct shall be 2 inch diameter, black in color and shall be installed at the depths shown on the plans.

2.08 WIREWAYS

A. Electrical wire way shall be of types, sizes, and number of channels as indicated. Fittings and accessories including but not limited to couplings, accessories including but not limited to couplings, offsets, elbows, expansion joints, adapters, hold-down straps, and end caps shall match and mate with wireway as required for complete system. Where features are not indicated, select to fulfill wiring requirements and comply with applicable provisions of NEC.

B. Wireway covers shall be hinged type.

2.09 LINKSEALS

A. Where conduit is installed through an existing wall, floor or where water-proofing is required or where temperature extremes or corrosive conditions exist, furnish and install linkseals.

B. Where concrete block is encountered use thermo-plastic sleeves and non-shrink grout with linkseals.

C. All threaded hardware shall be stainless steel.

D. Provide Thunderline linkseals or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install electrical raceways in accordance with manufacturer's written installation instructions, applicable requirements of NEC, and as follows:

B. Do not conceal Conduit, unless indicated otherwise. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install raceways level and square and at proper elevations.

C. Elevation of Raceway: Where possible, install horizontal raceway runs above water and steam piping.

D. Complete installation of electrical raceways before starting installation of conductors within raceways.

E. Provide supports for raceways as specified elsewhere in Division 26.

F. Prevent foreign matter from entering raceways by using temporary closure protection.

G. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

H. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

I. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location.

J. Run concealed raceways where otherwise noted with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated.

K. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical. Where conduits are routed underground, slope all conduits to provide proper drainage.

L. Run exposed, parallel, or banked raceways together. Make bends in parallel or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run such as from wall to ceiling and that the raceways shall be of the same size. In other cases provide field bends for parallel raceways.

M. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.

N. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts; one inside and one outside the box.

O. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

P. Install pull wires in empty raceways. Use no. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

Q. Telephone and Signal System Raceways, if specified, use 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways 2-inch and smaller trade size in maximum lengths of 150 feet and with a maximum of two, 90-deg bonds or equivalent. Install pull or junction boxes where necessary to comply with these requirements.

R. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and as indicated on plans, and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
   1. Where conduits enter or leave hazardous locations.
   2. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
   3. Where required by the NEC.

S. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver-operated threaded flush plugs flush with floor.

T. Flexible Connections: Use short length (maximum of 6 ft.) of flexible conduit for recessed and semi-recessed lighting fixtures, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid tight flexible conduit in wet locations. Install separate ground conductor across flexible connections.

U. Provide equipment grounding conductors in all raceways. Conduit shall not be the sole grounding method.

V. Conduit expansion fittings shall be installed in all conduit runs which cross a structural expansion joint or are in excess of 100 feet without a 90 degree bend or where conduits are stubbed up on exterior applications. The expansion fittings shall match the conduit type used and shall be installed within 12 inches of finished grade or concrete slabs. Polyethylene duct does not require expansion fittings.

W. The Engineer/Owner reserves the right to make reasonable changes in the location of outlets, apparatus, or other equipment up to the time of rough-in. Such changes, as directed by the Engineer, shall be made by the Contractor without additional compensation.

X. Provide dux-seal in all conduits that are routed through exterior walls, underground conduits or conduits routed through areas that are air conditioned or corrosive. Where conduits are installed in explosion-proof areas provide seal-offs for each conduit. Install dux-seal in both ends of conduit where used.

Y. Use long sweep 90 degree elbows for all fiber optic cables and service entrance conduits as shown on the plans.

3.02 SUPPORTING DEVICES

A. Supporting devices shall be as specified in Section 26 05 29.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 05 33.02

BOXES & HAND HOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling outlet boxes.

B. Floor boxes.

C. Pull and junction boxes.

1.02 REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. ANSI/NFPA 70 - National Electrical Code.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.03 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Accurately record actual locations and mounting heights of outlet, pull and junction boxes.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.05 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. The contractor shall include in his bid the cost to allow the Owner/Engineer to move the outlet up to 10’ from the location shown on the floor plans. See plans for installation of flush or surface mounting.

PART 2 PRODUCTS

2.01 OUTLET BOXES

A. All electrical boxes and fittings where used with galvanized rigid steel shall be cast aluminum with cast aluminum cover plates.

B. Where PVC conduit is specified, provide NEMA 4X PVC junction boxes, pull boxes, receptacle boxes, covers and conduit fittings unless specified differently on the drawings.

2.02 PULL, JUNCTION BOXES AND SEALING FITTINGS

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel allowed only in generator room.

B. The drawings have details indicating the type of pullboxes required where conduits enter the building. If the box type is not shown, he shall provide boxes as specified in 2.2 C.

C. Surface-Mounted Cast Iron Boxes: NEMA 250, Type 4X and 7; flat-flanged, surface-mounted junction boxes shall be *Feraloy* iron type manufactured by Crouse Hinds Company.
   1. Material: Feraloy cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. All contractor fabricated pull and junction boxes shall be stainless steel.

E. All sealing fittings if shown on the plans shall be made from *Feraloy* iron as manufactured by Crouse Hinds Company.

2.03 HAND HOLES, COMPOSITE TYPE, IF SHOWN ON THE PLANS

A. Each hand hole shall be the size specified within and as shown on the plans. The hand holes shall be a single unit measuring 24 inches wide, 36 inches long and shall have a nominal depth of 30". The hand holes shall be installed onto a 4 inch thick concrete base with 6” X 6” square galvanized metal mesh of the size shown on the plans. Two 1-inch drain holes shall be installed into the concrete base to permit proper drainage. The holes shall be provided by using 1 inch diameter PVC conduit as a sleeve. <u>The bottom shall be open and shall be caulked completely around both the interior and exterior bottom.</u>

B. Construction. Enclosures shall be made of "composolite" type material as manufactured by Quazite Corporation or approved equal. The box shall catalog number PG2436BA30 with PG2436HH17 one piece cover.
   1. Enclosure with cover shall be concrete gray color and rated for 37,500 pound design load over a space 10" x 10" area and design and tested to temperatures of -50F. Material compressive strength shall not be less than 11,000 psi.
   2. Box shall include factory installed divider located at the center of the long sides shown on the plans.
   3. The cover shall contain the logo "Electric."
   4. All hardware shall be stainless steel including inserts and bolts.
   5. The hand hole shall be UL Listed.
   6. The hand hole shall include internal factory installed divider as shown on the plans.
   7. The openings in the hand holes for the conduits shall be made using a holesaw or knock-out punch per the manufacturer’s recommendations. The opening shall not be larger than the 1/8 inch greater than the outer diameter of the conduit. The area between the conduit and the sidewall opening shall be caulked with a silicon 30 year warranty caulk. Any other openings made by other means. If holes are cut by the use of a circular saw or similar type saw, the hand hole will be replaced with a new hand hole as directed by the Engineer at no additional cost to the contract.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

E. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of NFPA-7.

F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

G. Use flush mounting outlet boxes in finished areas.

H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches separation in acoustic rated walls.

I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

J. Use stamped steel bridges to fasten flush mounting outlet box between studs.

K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

L. Use adjustable steel channel fasteners for hung ceiling outlet box.

M. Do not fasten boxes to ceiling support wires.

N. Support boxes independently of conduit.

O. Use gang box where more than one device is mounted together. Do not use sectional box.

P. Use gang box with plaster ring for single device outlets.

Q. Use cast outlet box in exterior locations exposed to the weather and wet locations.

R. Large Pull Boxes: Boxes larger than 100 cubic inches, in volume or 12 inches in any dimension.
   1. Interior Dry Locations: Use hinged enclosures, NEMA 12 rated.
   2. Outdoor Locations: Use surface-mounted NEMA 4X stainless steel, type 316, with hinged covers. Mount using stainless steel hardware only.

3.02 INSTALLATION

A. The contractor is responsible for providing the proper mounting surface for all equipment. It shall be assumed that boxes shall attach directly to the walls unless otherwise noted. For outside walls, provide minimum 3/8 spacers. For interior walls and where allowed by the Owner and Engineer, the Contractor may use plywood backer boards. All plywood backer boards shall be painted on all sides and ends with a minimum of 2 coats of grey enamel paint unless otherwise noted on the plans.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

B. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.04 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closure in unused box opening.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

1.02 REFERENCES

A. Comply with NFPA 70- National Electric Code.

B. Comply with ANSI Standard A13.1, “Scheme for the Identification of Piping Systems,” with regard to type and size of lettering for raceway and cable labels.

PART 2 PRODUCTS

2.01 NAMEPLATES AND LABELS

A. Nameplates and Labels: Engraved three-layer laminated plastic, black letters on white background. Supply for all equipment furnished for the project by any of the Contractors or the System Integrator.

B. Locations: Install equipment/system circuit/device identification as follows:
1. Apply equipment identification labels made of engraved plastic-laminate on each major unit of electrical equipment in building. This includes communication/signal/alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/2-inch-high lettering on 1-1/2-inch high label (2-inch-high lettering on 1-1/2-inch-high where two lines are required), white lettering in black field. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment.
2. Each electrical distribution and control equipment enclosures.
3. Communication cabinets and PLC Control panels.
4. Each disconnect switch.
5. Each motor combination starter/ disconnect switches.
6. Each separately mounted motor starters.
7. Each separately mounted motor control station, such as PB and LO.
8. Panel boards.
9. Transformers.
10. Contactors.
11. SCADA Control Panel.
12. All Instruments.

C. Cable labels shall be engraved, laminated plastic plates suitable for use from -40 deg. F. to 150 deg. F., and shall be self -extinguishing, resistant to oil, water and solvents. Nameplate shall be minimum size 1-1/2” X 4”. Face shall be white and the letters shall be black. Fasten label to cable with nylon tie-wraps.

Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50 deg F to 350 deg F. Provide ties in specified colors when used for color coding.

D. Letter Size:
   1. Use 1/8 inch letters for identifying individual equipment and loads.
   2. Use 1/4 inch letters for identifying grouped equipment and loads.

2.02 WIRE AND CABLE MARKERS

A. Manufacturer: Computerized Brady tags. Use Brady marker XC plus printer or equal with self-laminating vinyl tags.

B. Description: All wire and cable numbers shall match shop drawings that have been provided with the equipment and have been provided as part of the electrical contractor's cable and wire layout submittal.

C. Locations: Each conductor at panelboard gutters, terminal junction boxes, motor control center, local control panels (LCP), remote hand switch and controls, and at each control and instrumentation device.

D. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on the layout drawings provided to the owner by the contractor.
   2. Control Circuits: Control wire number and "To" and "From" indicated on schematic and interconnection diagrams on shop and approval drawings.

2.03 CONDUIT MARKERS

A. Description: Hand written in non-erasable marker, put on conduit. Put on each duct bank and feeder conduit, at both ends write conduit number on duct bank wall where conduit enters. Put conduit numbers on all communication control and instrumentation conduits in all areas to be visible where normally viewed from.

B. Location: Furnish markers for each conduit at each termination.

C. All conduit markers shall match the conduit schedule that is provided to the owner by the contractor.

2.04 EQUIPMENT LOCATIONS

A. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letters on black face and punched for mechanical fasteners.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.

C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
   1. The following areas shall be identified:
      a. On entire floor area directly above conduits running beneath and within 12 inches of a ground floor that is in contact with earth or is framed above un-excavated space.

b. On wall surfaces directly external to conduits run concealed within wall.
c. On all accessible surfaces of concrete envelope around conduits in vertical shafts, exposed at ceilings or concealed above suspended ceilings.
d. On entire surface of exposed conduits.

2. Apply identification to areas as follows:
   a. Clean surface of dust, loose material, and oily films before painting.
   b. Prime surfaces: For galvanized metal, use single-component acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy-duty acrylic resin block filler. For concrete surfaces, use clear alkali- resistant alkyd binder-type sealer.
   c. Apply one intermediate and one finish coat of orange silicone alkyd enamel.
   d. Apply primer and finish materials in accordance with manufacturer's instructions.

D. Band exposed or accessible raceways of the following systems for identification. Bands shall be pre-tensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Install bands at changes in direction, at penetrations of walls and floors, and at 40-foot maximum intervals in straight runs. Apply the following colors:
1. Mechanical and Electrical Supervisory System: Green and Blue.
2. Telephone System: Green and Yellow.

E. Identify Junction, Pull, and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuits. Use pressure- sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.

F. Underground Electrical Line Identification: During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

G. Install line marker tape for underground conduit and wiring, (both direct-buried and in raceway).

H. Conductor Color Coding: Provide color coding for primary service, feeder, and branch circuit conductors throughout the project. Primary and secondary electrical system shall be designated as follows:

Wire Colors:

System Voltage:	208/120	4160	480/277
Phase A	Black	Brown	Black
Phase B	Red	Orange	Red
Phase C	Blue	Yellow	Blue
Neutral	Grey	White	
Ground	Blue	Green	Green

Control Wiring:

24 Volt AC and DC: Blue
120 Volt AC: Red

All intrinsically safe wiring shall be identified with the label "INTRINSIC SAFETY WIRING" and by using light blue wire color.

I. Use conductors with color factory-applied the entire length of the conductors except as follows:
1. The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
   a. Apply colored, pressure-sensitive plastic tape in half- lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as

specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.

b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

J. Power Circuit Identification: Securely fasten plastic labels to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms. Legends to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-lb test monofilament line or one-piece self-locking nylon cable ties.

K. Tag or label conductors as follows:
1. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.
2. Multiple Circuits: Where multiple branch circuits or control wiring or communications/signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by mean of coded color of conductor insulation. For control and communications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.
3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

L. Apply warning, caution, and instruction signs and stencils as follows:
1. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic- laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

M. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker. All wiring shall match full description of device or load. For example: M-1B-1for MCC1B; all field wiring and terminations shall be configured to M-2-1-1for MCC2, etc. Wiring in MCC's and other related equipment shall be identified as shown above. Color coding shall be as listed in this Specification Section. <u>All labeling shall be identified on the shop drawings. Coordinate all identification requirements with Owner/ Engineer.</u>

N. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

END OF SECTION

SECTION 26 09 24

MOTOR AND LIGHTING CONTROLLERS

PART 1 GENERAL

1.01 GENERAL

A. This specification section covers individual motor starters and lighting contactors only. See control drawings and details on the plans for additional information.

B. Submit product data for products specified in this Section. Include dimensions, ratings, and data on features and components. Include standard wiring diagrams.

C. Submit certified reports of field tests and observations.

D. Submit maintenance data for products for inclusion in Operating and Maintenance Manual specified in Division 1 and in Division 26 Section “Basic Electrical Requirements.”

E. Components and Installation: NFPA 70 “National Electrical Code.”

F. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
   1. The terms “listed” and “labeled” shall be defined as they are in the National Electrical Code, Article 100.

G. NEMA Compliance: NEMA ICS 2, “Industrial Control Devices, Controllers, and Assemblies.” IEC style is not permitted and shall meet a minimum of 10 KAIC ratings.

H. UL Compliance: UL 508, “Electric Industrial Control Equipment.”

I. Single-Source Responsibility: Obtain similar motor-control devices from a single manufacturer.

J. Coordinate features of controllers and control devices with pilot devices and control circuits provided under Division 15 Sections covering control systems.

1.02 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Cutler Hammer.
   2. Allen Bradley
   3. No approved equals

B. Motor Controller and Lighting Contactors with the following features: Provide controllers and contactors consistent with the ratings and characteristics of the supply circuit, the motor, the required control sequence, the duty cycle of the motor, drive, and load, and the pilot device, and control circuit affecting controller functions. Controllers shall be horsepower rated to suit the motor controlled.
   1. Contacts shall open each ungrounded connection to the motor.
   2. Overload Relays: Electronic type with inverse time-current characteristic, with heaters or sensors in each phase matched to nameplate full-load current of the specific motor to which connected, with appropriate adjustment for duty cycle.
   3. Enclosures for Individually Mounted Motor Controllers and Control Devices: Suitable for the environmental conditions at the controller location. Provide NEMA Type 4X enclosures except as otherwise indicated.
   4. Where installed into a MCC section, also see Specification section 26 24 19.

5. Where lighting contactors are specified, provide units that are tungsten rated for amperage specified on the plans. Where photocells and timers are shown on the plans, provide the model or types specified.

C. Manual Motor Controllers: Quick-make, quick-break toggle action.

D. Magnetic Motor Controllers: Provide full-voltage, non-reversing, across-the-line, magnetic controller, except where another type is indicated.
   1. Control Circuit: 120 V. Provide control power transformer integral with controller where no other supply of 120 V control power to controller is indicated. Provide control power transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
   2. Combination Starter/Disconnects: Motor circuit protector; molded-case circuit-breaker type with magnetic-only trip element calibrated to coordinate with the actual locked-rotor current of the connected motor and the controller overload relays. Provide breakers that are factory assembled with the controller, interlocked with unit cover or door, and arranged to disconnect the controller. Provide motor-circuit protectors with field-adjustable trip elements as specified in Division 26 Section “Enclosed Circuit Breakers.”

E. Multi-speed Motor Controllers: Match to motor type, application, and number of speeds required. Conform to Article “Magnetic Motor Controllers” above. Provide auxiliary devices as indicated. Relays shall be factory installed in controller enclosure.

F. Auxiliary Control Devices: Factory installed in controller enclosure, except as otherwise indicated. Where separately mounted, provide NEMA 1 enclosure except as otherwise indicated.
   1. Pushbutton Stations, Pilot Lights, and Selector Switches: Heavy-duty type, 30.5 mm type, NEMA 13 rated. All pilot lights shall be transformer type LED. See other specification sections for additional requirements.
   2. Stop and Lockout Pushbutton Station: Momentary-break pushbutton station with a factory-applied hasp arranged so a padlock can be used to lock the pushbutton in the depressed position with the control circuit open.
   3. Control Relays: Auxiliary and adjustable-time-delay relays.

1.03 EXECUTION

A. Install independently mounted motor control devices in accordance with manufacturer’s written instructions.

B. Location: Locate controllers as indicated and within sight of motors controlled.

C. Mounting: For control equipment at walls, bolt units to wall or mount on light-weight structural steel channels bolted to the wall. For controllers not at walls, provide freestanding racks fabricated of structural steel members and light-weight slotted structural steel channels.

D. Identify motor control components and control wiring in accordance with Division 26 Section “Identification for Electrical Systems.”

E. Install control wiring between motor control devices and control/indicating devices as specified in Division 26 Section “Low-Voltage Electrical Power Conductors and Cables” for hard-wired connections. Wiring in enclosures shall be neatly bundled, trained, and supported.

F. Joints and Connections: Check bus joints and mountings for tightness. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer’s published torque tightening values. Where manufacturer’s torquing requirements are not indicated, tighten connectors and terminals to comply with values tightening torques specified in UL 486A, and UL 486B.

G. Testing and Field Quality Control: Conform to the following:
   1. Labeling: On satisfactory completion of tests and related effort, apply a label to each tested component indicating test results, date, and responsible organization and person.
   2. Schedule visual and mechanical inspections and electrical tests with at least one week's advance notification.
   3. Make continuity tests of circuits.
   4. Motor-Control Device Ratings and Settings: Verify that ratings and settings as installed are appropriate for final loads and final system arrangement and parameters. Recommend final protective device ratings and settings where discrepancies are found. Use accepted revised ratings or settings to make the final system adjustments. Prepare and submit the load current and overload relay heater list.
   5. Inspect for defects and physical damage, and nameplate compliance with current project drawings.
   6. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's instructions.
   7. Verify proper fuse types and ratings in fusible devices.
   8. Perform insulation resistance test of motor control devices conducting parts to the extent permitted by the manufacturer's instructions. Insulation resistance less than meg-ohm requirements listed in Specification section 26 05 04 is not acceptable.
   9. Use primary current injection to check performance characteristics of motor-circuit protectors and for overload relays of controllers for motors 15 horsepower and larger. Trip characteristics not within manufacturer's published time-current tolerances are not acceptable.
   10. Make adjustments for final settings of adjustable-trip devices.
   11. Test auxiliary protective features such as loss of phase, phase unbalance and under-voltage to verify operation.
   12. Check for improper voltages at terminals in controllers that have external control wiring when controller disconnect is opened. Any voltage over 30 V is unacceptable.

H. Correct deficiencies and retest motor control devices. Verify by the system tests that specified requirements are met.

I. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally using methods and materials as recommended by manufacturer.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Distribution panelboards.

B. Branch circuit panelboards.

1.02 REFERENCES

A. NECA (National Electrical Contractors Association) “Standard of Installation.”

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

D. NEMA KS 1 - Enclosed Switches.

E. NEMA PB 1 - Panelboards.

F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

G. NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

A. Submit under provisions of Division 1.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.04 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Record actual locations of Products; indicate actual branch circuit arrangement.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

B. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.06 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.07 MAINTENANCE MATERIALS

A. Provide four (4) panelboard keys for each of the panelboards. All panelboards shall be keyed alike.

1.08 EXTRA MATERIALS

A. Furnish as shown on drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cutler Hammer PLR1a 100 amp, 120/240, 1 phase.

B. General Electric.

C. Engineer Approved Equal.

2.02 DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1; circuit breaker type.

B. Panelboard Bus: Tin plated copper, ratings as indicated. Provide tin plated copper ground bus in each panelboard.

C. Minimum Integrated Short Circuit Rating: See drawings.

D. Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits. Provide HID rated circuit breakers for High discharge lighting systems. Where SWD circuit breakers are required furnish same.

E. Enclosure: NEMA PB 1; Type 1 in interior locations and MCC locations or NEMA 4X stainless steel in exterior locations.

F. Cabinet Front: Surface type, fastened with concealed trim clamps, hinged and latch. Provide hinged door with flush lock. Finish in manufacturer's standard gray enamel. Contractor shall notice special requirements for double or triple fronts for panelboards. The contractor may furnish these panelboard fronts as separate components, however they must fit together so that they can be properly aligned to provide a neat and level appearance on the walls.

2.03 BRANCH CIRCUIT PANELBOARDS

A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1, circuit breaker type.

B. Panelboard Bus: Tin Plated Copper, ratings as indicated. Provide tin plated copper ground bus in each panelboards.

C. Minimum Integrated Short Circuit Rating: Unless otherwise indicated on plans provide 10,000 amperes rms symmetrical for 240 volt panelboards; 65,000 amperes rms symmetrical for 480 volt panelboards.

D. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

E. Where heat trace systems are shown on the plans provide 30ma ground fault circuit breakers.

F. Where ground fault circuit interrupter circuit breakers are required on the plans they shall have maximum ground fault detection of 4-6ma.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes where shown on drawings. Provide supports in accordance with Section 26 05 29.

C. Where panelboards are installed into a MCC section, also see Section 26 24 19.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.

3.02 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 27 01

SERVICE ENTRANCE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.02 SUMMARY

A. Extent of service-entrance work is indicated by drawings and schedules.

B. Types of service-entrance equipment in this section include the following:
   1. Meter socket (Furnished and installed by the Electrical Contractor).
   2. The utility meter will be furnished and installed by the Utility Company.

C. Wires/cables, raceways, and electrical boxes and fittings are specified in Division-26 Basic Electrical Materials and Methods sections, “Low-Voltage Electrical Power Conductors and Cables”, “Conduit and Raceways”, and “Boxes and hand holes.”

D. Refer to other Division-26 sections for wires/cables, raceways, and electrical boxes and fittings work required in connection with service-entrance equipment.

E. The electrical service installation shall meet the Madison Utility requirements. Coordinate any and grounding requirements necessary for proper installation with the Electrical Utility Company.

1.03 SUBMITTALS

A. Not Required.

1.04 QUALITY ASSURANCE

A. Not Required.

1.05 DELIVERY, STORAGE AND HANDLING

A. Not Required.

1.06 SEQUENCING AND SCHEDULING

A. Not Required.

PART 2 PRODUCTS

2.01 SERVICE-ENTRANCE EQUIPMENT

A. Cables/Wires:
   1. General: Provide cables/wires complying with Division-26 Basic Electrical Materials and Methods section “Wires and Cables”, in accordance with the following listing:
      a. Type XHHW copper conductors for underground installation.
      b. Type XHHW for above ground installations.

B. Raceways:
   1. General: Provide raceways complying with Division-26 Basic Electrical Materials and Methods section “Conduit and Raceways”, in accordance with the following listing:
      a. PVC conduit and fittings.
      b. Rigid steel galvanized conduit.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which service-entrance equipment and components are to be installed. Coordinate the electrical services work with Wisconsin Public Service Corporation.

3.02 INSTALLATION OF SERVICE- ENTRANCE EQUIPMENT

A. Install service-entrance equipment as indicated, in accordance with equipment manufacturer’s written instructions, and with recognized industry practices, to ensure that service-entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA standards and each of the utility company(s) requirements.

B. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer’s published torque tightening values for equipment connectors. Where manufacturer’s torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.

3.03 FIELD QUALITY CONTROL

A. Prior to energization of service-entrance equipment, check accessible connections for compliance to manufacturer’s torque tightening specifications.

B. Prior to energization of service-entrance equipment, check with ground resistance tester, phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

C. Prior to energization, test circuitry for electrical continuity, free of shorts.

3.04 GROUNDING

A. Provide equipment grounding connections for service-entrance equipment as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.

3.05 ADJUSTING AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred enclosure surfaces to match original finishes.

3.06 DEMONSTRATION

A. Upon completion of installation of service-entrance equipment and electrical circuitry, energized circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

END OF SECTION

SECTION 26 27 16

ELECTRICAL CABINETS AND ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hinged cover enclosures, where shown on plans.

B. Cabinets.

C. Accessories.

1.02 REFERENCES

A. UL 508.

B. JIC Standard EGP-1-1967.

C. ANSI/NFPA 70 - National Electrical Code.

PART 2 PRODUCTS

2.01 HINGED COVER ENCLOSURES (INTERIOR NON-CORROSIVE INSTALLATIONS ONLY)

A. Construction: NEMA, Type 12, painted steel enclosures or as shown in the plans.

B. Covers: Continuous hinge, held closed by hasp and staple for padlock.

C. Provide interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.

2.02 HINGED COVER ENCLOSURES (EXTERIOR AND CORROSIVE INSTALLATIONS)

A. Construction: NEMA, Type 4X, 316 Stainless steel enclosures as shown in the plans.

B. Covers: Continuous hinge, held closed by hasp and staple for padlock.

C. Provide interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.

2.03 TERMINAL AND POWER BLOCKS

A. Manufacturers:
1. Allen Bradley.
2. Phoenix Contact.
3. All terminal and power blocks shall be finger safe types.

B. Provide ground bus terminal block, with each connector bonded to enclosure.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify conditions.

B. Verify that surfaces are ready to receive work.

3.02 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner.

C. Install cabinet fronts plumb.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Telephone outlets.

D. Device plates and decorative box covers.

1.02 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.

B. NEMA WD 6 - Wiring Device Configurations.

1.03 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Provide manufacturer's catalog information showing dimmers, colors, and configuration.

C. Submit one sample of each type of device that will be provided for the project except for explosion proof area devices. Each sample will be retained by the Engineer.

D. Some equipment may be called out on the plans, if so provide that catalog number or most current catalog number. See latest Hubbell part or catalog numbers and submit latest catalog numbers at no additional cost to the project.

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years of experience.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 WALL SWITCHES

A. Single Pole Switch:
   1. Hubbell Model HBL1221. (Brown)
   2. Hubbell Model HBL1221I. (Ivory)
   3. Or Engineer approved equal.

B. Double Pole Switch:
   1. Hubbell Model HBL1222. (Brown)
   2. Hubbell Model HBL1222I. (Ivory)
   3. Or Engineer approved equal.

C. Three-way Switch:
   1. Hubbell Model HBL1223. (Brown)
   2. Hubbell Model HBL1223I. (Ivory)
   3. Or Engineer approved equal.

D. Four-way Switch:
   1. Hubbell Model 1224. (Brown)
   2. Hubbell Model HBL1224-I (Ivory)
   3. Or Engineer approved equal.

E. Indicator Switch:
   1. Hubbell Model HBL1221-IL. (Ivory)
   2. Or Engineer approved equal.

F. Locator Switch:
   1. Hubbell Model HBL18221CN. (Brown)
   2. Hubbell Model HBL18221ICN. (Ivory)
   3. Or Engineer approved equal.

G. Weather Proof Switch:
   1. Hubbell Model HBL1221/HBL1795 Cover.
   2. Or Engineer approved equal.

H. Explosion Proof Switches:
   1. Appleton. Model EFS Series.
   2. Crouse-Hinds. Model EDS Series.

2.02 RECEPTACLES

A. Duplex Convenience Receptacle:
   1. Hubbell. Model HBL5362. (Brown)
   2. Hubbell Model HBL5362I. (Ivory)
   3. Or Engineer approved equal.

B. GFCI Weather & Tamper Resistant Receptacle:
   1. Hubbell. Model GFTR20. (Brown)
   2. Hubbell Model GFTR20I. (Ivory)
   3. Or Engineer approved equal.

C. Corrosion Resistant Receptacle: (Where Specified).
   1. Hubbell. Model HBL52CM62I. (Ivory)
   2. No Substitutes.

D. Explosion Proof Receptacle:
   1. Crouse-Hinds. Model ENR 21201.
   2. Or Engineer approved equal.

E. Single Receptacle:
   1. Hubbell. Model HBL5251. (Brown)
   2. Hubbell Model HBL5251I. (Ivory)
   3. Or Engineer approved equal.

2.03 WALL PLATES

A. Weatherproof Cover Plate: In-use Gasketed cast metal with hinged gasketed device cover. Required on building exterior.
   1. Hubbell WP8MH for receptacle.
   2. Hubbell WP26MH for GFI receptacle.
   3. Engineer Approved equal.

2.04 TELEPHONE SYSTEM SERVICE

NOT REQUIRED.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and will be completely covered by wall plates.

D. Verify floor boxes are adjusted properly.

E. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices. GFCI's shall be wired as feed-thru devices.

F. Verify openings in access floor are in proper locations.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install receptacles with grounding pole on top.

E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

F. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

G. Connect wiring devices by wrapping conductor around screw terminal.

H. Use jumbo size plates for outlets installed in masonry walls.

I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33.02 to obtain mounting heights specified and indicated on Drawings.

B. Install wall switches 48 inches above finished floor, measured from top of box to finished floor.

C. Install convenience receptacles 36 inches, measured from top of box to finished floor, unless otherwise noted on the plans.

D. Install convenience receptacle 6 inches above counters and in laboratories backsplash if shown on plans.

3.05 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. Verify that each telephone jack is properly connected and circuit is operational.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Specification Section 26 28 15.01 - Enclosed Switches.

C. Specification Section 26 09 24 - Motor and Lighting Controllers.

D. Specification Section 26 24 19 - Motor Control Centers.

1.02 SUMMARY

A. This Section includes the following:
   1. Fuses.
      a. Power
      b. Control

1.03 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each fuse type. Include the following:
   1. Descriptive data and time-current curves.
   2. Fuse size for elevator feeder and disconnect applications.

C. Field test reports indicating and interpreting test results.

D. Maintenance data for tripping devices to include in the “Operating and Maintenance Manual” specified in Division 1.

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70 “National Electrical Code” for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
   1. The Terms “Listed” and “Labeled”: As defined in the “National Electrical Code,” Article 100.

C. Single-Source Responsibility: all fuses shall be the product of a single manufacturer.

1.05 EXTRA MATERIALS

A. Furnish the following extra materials that match products installed, packaged with protective covering for storage, and with identification labels clearly describing contents.

B. Spare Fuses: Furnish quantity equal to 20 percent of each fuse type and size installed, but not less than 1 set of 3 of each type and size.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide fuses by one of the following:
   1. Buss Fuses, Inc.
   2. Bussmann Div., Cooper Industries, Inc.
   3. Circuit Protection Div.; Gould, Inc.
   4. Littelfuse, Inc.

2.02 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1 nonrenewable cartridge fuse, class as specified or indicated, current rating as indicated, voltage rating consistent with circuit voltage.

B. Motor Branch Circuits: Class RK1 time delay.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so that fuse ratings are readable without removing fuse.

3.02 IDENTIFICATION

A. Install typewritten labels on the inside on the inside door of each fused switch to indicate fuse replacement information.

END OF SECTION

SECTION 26 28 16.01

ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed, heavy duty fusible switches.

B. Enclosed, heavy duty non-fusible switches.

C. Manual bypass switches, if shown on plans.

D. See Specification Section 26 28 13 for “FUSES”.

1.02 REGULATORY REQUIREMENTS

A. National Electrical Manufacturers Association (NEMA): Provide switches conforming to NEMA KS 1, “Enclosed Switches.”

B. NEMA: Construct enclosures conforming to NEMA 250, “Enclosures for Electrical Equipment (1000 Volts Maximum).”

C. National Fire Protection Association (NFPA): Conform to NFPA 70, “National Electrical Code,” for installation and minimum fusing requirements.

D. Underwriters Laboratories, Inc. (UL): Manufacture switches conforming to the requirements of UL 98, “Enclosed and Dead-Front Switches.”
   1. Provide switches listed and labeled by UL.
   2. Provide fuse holders conforming to UL 512, “Fuseholders.”
   3. Provide cabinets conforming to UL 50, “Cabinets and Boxes.”

1.03 EXTRA MATERIALS

A. Furnish under provisions of Division 1.

B. Provide three of each size and type fuse installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cutler Hammer, (250 volt and 600 volt).

B. General Electric.

C. No Approved Equal.

2.02 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses.

B. General: Provide individually enclosed air-break switches as indicated on the drawings, with all current-carrying parts enclosed and manually operable by means of external handles. Switches shall be heavy duty (HD) type, ampere and horsepower rated.
   1. Provide cartridge enclosed fuses and rejection fuse holders when fuse switches are indicated.
   2. Provide electrically tripped switches where indicated.
   3. Provide NEMA 1 enclosures for indoors in non-corrosive areas and NEMA 4X stainless steel enclosures for outdoors and corrosive areas, or as indicated on the drawings.
   4. Provide auxiliary break before break contacts where specified on the plans.

C. Switching Action: Provide quick-make, quick-break type switch action.

D. Construction: All current carrying parts shall be high conductivity copper, with heating ratings conforming to UL 98.
   1. Provide silver tungsten or silver-plated copper contacts.
   2. Provide fuse holders of the rejection type, sized for fuses scheduled.
   3. Provide interrupting ratings minimum 10 times locked rotor current of NEMA maximum motor horsepower rating.
   4. Arrange for padlocking with two locks in both “off” and “on” positions.

E. Fuses: Provide fuses of class, type and rating indicated on the drawings and schedules.

F. Enclosures: NEMA KS 1.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 4X.
   3. Class I Division I and II Locations: Type UL listed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install disconnect switches where indicated.

B. Install fuses in fusible disconnect switches.

C. Provide engraved nameplate on outside door of each switch indicating UL fuse class and size for replacement.

END OF SECTION

SECTION 26 28 16.02

ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed main service entrance rated circuit breakers.

1.02 RELATED WORK

A. Section 26 – Transient Voltage Suppression For Low-Voltage Electrical Power Circuits

B. Section 26 29 16 - Panelboards

C. Section 26 09 24 - Motor and Lighting Controllers

D. Section 26 24 19 – Motor Control Centers

E. Section 26 29 24 – Variable Frequency Drives

1.03 SUBMITTALS

A. Submit product data under provisions of Division 1.

B. Product Data: Provide catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation and starting of Product.

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years of experience.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cutler Hammer type HFD thermal magnetic for 10-225 amp frame circuit breakers at 120/240, 240/480 and 277/480 Volt loads where shown on the plans.

B. Cutler Hammer type HMCP magnetic only for 100 amp frame circuit breakers for motor loads where shown on the plans.

C. Cutler Hammer type CHLD thermal magnetic from 400 amp to 600 amp frame circuit breakers at 120/240, 240/480 and 277/480 Volt loads including service entrance where shown on the plans.

D. Cutler Hammer: G frame circuit breaker at 277/480 Volt and BAB type for 120/208 & 120/240 volt circuits located in Panelboards.

E. Engineer approved equal.

2.02 MOLDED CASE CIRCUIT BREAKER

A. Circuit Breaker: NEMA AB 1.

2.03 ENCLOSURE

A. Enclosure: NEMA AB 1; 12.

B. Fabricate enclosure from steel.

C. Finish using manufacturer's standard enamel finish.

D. See One-Line Diagram for additional information.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.

B. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 26 05 29.

C. Height: 5 ft. (1.6 M) to operating handle.

D. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

3.02 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 1.

B. Inspect and test each circuit breaker to NEMA AB 1.

C. Inspect each circuit breaker visually.

D. Perform several mechanical ON-OFF operations on each circuit breaker.

E. Verify circuit continuity on each pole in closed position.

F. Determine that circuit breaker will trip on over-current condition, with tripping time to NEMA AB 1 requirements.

G. Include description of testing and results in test report.

3.03 ADJUSTING

A. Adjust work under provisions of Division 1.

END OF SECTION

SECTION 26 43 13

SURGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER AND CONTROL CIRCUITS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this and the other sections of Division 26.

B. Furnish and install surge protection devices (formally known as transient voltage surge suppressors) as shown on the Drawings and herein specified.

C. Related Sections: The following Sections contain requirements that relate to this section:
   1. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables.
   2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   3. Section 26 28 16.01 - Enclosed Switches.
   4. Section 26 09 01 – Process Instrumentation and Control.

1.02 STANDARDS

A. Underwriters Laboratories - UL 1449 3rd Edition, current Standard for Safety for Surge Protective Devices).

B. Underwriters Laboratories - UL 1283 listed as an electromagnetic interference filter that provides noise attenuation.

C. Underwriters Laboratories – UL 96A 12th Edition, Standard for Installation Requirements for Lightning Protection Systems.

D. Canadian Standards Association – CAN/CSA-C22 No. 8; cUL 1449 Ed.3.

E. National Electrical Code – NEC 2008 Article 285 TVSS Installation Practice; NEC 2008 Article 250.56 Grounding.

F. NFPA-78 and CSA - (National Fire Protection Association and Canadian Standards Associations).

G. ISO 9001:2000 - Quality standard / Military Standards (MIL-STD 220A).

H. American National Standards Institute and Institute of Electrical and Electronic Engineering – ANSI/IEEE – C62.41 and C62.45.

I. The fusing elements must be capable of allowing the suppressor's maximum rated single impulse current to pass through the suppressor at least one time without failure.

J. CBEMA (ITIC) and IEC - (Computer Business Equipment Manufacturers Association or Information Technology Industry Council and International Electrotechnical Commission define clamping voltage tolerance guidelines for sensitive equipment).

K. All manufacturers must comply with above listed standards and any additions current revisions of industry standards. All products that do not comply with current industry standards will not be accepted. Canadian Standards Association (CSA).

L. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, C62.45).

M. National Electrical Manufacturer Association (NEMA LS-1 1992).

N. National Electric Code (NEC).

O. National Fire Protection Association (NFPA 20, 70, 75 and 780).

P. Underwriters Laboratories (UL 1449 Second Edition and UL 1283.)

Q. International Electro-technical Commission (IEC 1000).

R. International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service.

1.03 SUBMITTALS

A. Drawings: Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection notes, wire size and wiring diagram.

B. Equipment Manual: The manufacturer shall furnish an installation manual with installation notes, start-up and operating instructions for the specified system. Installation instructions shall clearly state whether the system requires an external over current device to maintain the system's UL 1449 listing.

C. Submit UL 1449 3rd Edition Listing/Classification page listing the Voltage Protection Ratings with corresponding model numbers.

D. Independent Testing:
   1. High exposure with the 10 x 1,000us tests per IEEE C62.41.2 Section 7.2.
   2. Life Cycle/Repetitive Testing per C62.45-2002 section B.38 minimum of 1,000 to 2,000 times

E. National Electrical Code (NEC) 285 - Installation requirements for SPD's Surge Protection Devices that utilize fuses must have repetitive surge capability that can survive its surge rating and meet UL 1449.

F. Section 285.6, TVSS shall be marked with a short circuit current rating and shall not be installed at a point on the system (ex. service, distribution or branch panels) where the available fault current (AIC rating) is in excess of that rating.

G. UL 1449 stipulation for SPD Type 2 product that requires over-current protection devices; the manufacturer's authorized representative is required to submit the following:
   1. Certify that the SPD system is UL 1449 listed (VZCA file documentation)
   2. Indicate the type of external over-current protection that shall be incorporated
   3. With the SPD system; and, what impact the fusing has on the performance of the device with respect to surge capacity and clamping levels.

H. Maintenance Data: Include maintenance instructions for cleaning methods; cleaning materials recommended; component replacement, testing and adjustment.

I. Any deviation from the specification, modification of products, models, or alternative units must be submitted to the engineer as a letter signed by the owner reflecting the requested changes. The letter should in detail outline the changes and requested product details.

J. Operation and maintenance data for materials specified in this section to include in the "Operating and Maintenance Manual" specified in Division 1.

1.04 SYSTEM DESCRIPTION

A. Environmental Requirements:
   1. Storage Temperature: Storage temperature range shall be -40 to +80°C.
   2. Operating Temperature: Operating temperature range shall be -40 to +80°C.

3. Relative Humidity: Operation shall be reliable in an environment with 0% to 90% non-condensing relative humidity.
4. Operating Altitude: The system shall be capable of operating up to an altitude of 12,000 feet above sea level.

B. Electrical Installations:
1. Water Tower Operating Voltage: The nominal system operating voltage shall be 120/ 240 single phase, 3 wire plus ground as shown on the plans at the service entrance.
2. Control Panels with operating voltages of 120 VAC.
3. Control cabling including Ethernet Copper at each panel. Please note that this equipment is not shown or listed in the plans, but is required per these specifications.

C. The equipment's minimum surge current capacity shall be 200 kA per phase (L-N plus L-G) and 100 kA per mode (L-N, L-G, L-L and N-G)

D. The UL 1449 Edition 3 Nominal Discharge Current Rating shall be no less than 20 kA.

E. The system protection modules shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449.

F. All primary transient paths shall utilize copper wire, aluminum bus bar and lugs of equivalent capacity to provide equal impedance interconnection between phases. No plug- in module or components shall be used in surge carrying paths.

G. Each protection module shall have a visual indicator that signifies that the protection circuitry is on line. The unit shall not be taken off line to verify integrity system. Redundant status indicators shall be mounted on the front of the door that monitors the system protection circuitry.

H. The system shall be modular with field replaceable modules. Modular units shall contain a minimum of one module per phase.

I. Filter Attenuation shall be equal to, or greater than -40 dB at 100 kHz.

J. Protection modes: The SPD shall provide protection for all modes, L-G, L-N, N-G, L-L for WYE, L-L and L-G for Delta configurations.

K. Service Conditions: ALL SPD shall operate under the following conditions, unless otherwise indicated:
1. MCOV: Maximum Continuous Operating Voltage of 125% or greater.
2. Operating Temperature: 30 to 120 degrees F.
3. Humidity: 0 to 85 percent, non-condensing.
4. Altitude: Less than 20,000 feet above sea level.

L. Equipment shall provide the following monitoring features: N.O./N.C. Relay.

M. Contacts: Digital Surge Counter; Audible Alarm; LED Indication for each Phase.

N. The SPD shall be rated for NEMA 4; or NEMA 4X in corrosive environments.

O. The UL 1449 Ed. 3 Voltage Protection Ratings (VPR) shall be equal to or less then the following voltage configurations:

Voltage:	Mode:	UL 1449 Ed 3 VPR:
120/240	L-G, N-G	700V
(1 Phase)	L-N	1,200V
120/208	L-G, N-G, L-N	700V
(3-Phase WYE)	L-L	1,200V
277/480	L-G, N-G, L-N	1,200V
(3-Phase WYE)	L-L	2,000V
240 (Delta)	L-L, L-G	1,200V
480 (Delta)	L-L, L-G	2,000V

P. Provide an enclosure as follows:
   1. Fabrication shall be made with a heavy duty NEMA 4 enclosures or better for the installation. All monitor indicators shall be displayed without opening doors.
   2. The back panel shall be molded from a thermoplastic or metal.

1.05 WARRANTY

A. The manufacturer shall provide not less than a full five year component warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL listing requirements, and any applicable national or local electrical codes. Manufacturer shall make available (local, national) field engineering service support. Where direct factory employed service engineers are not locally available, travel time from the factory or nearest dispatch center shall be stated.

1.06 QUALITY ASSURANCE

A. The specified systems shall be thoroughly factory tested before shipment. Testing of each system shall include but shall not be limited to quality control checks, dielectric voltage withstand tests at twice rated voltage plus 1000 volts per UL requirements, IEEE C62.41 Category B surge tests, UL ground leakage test, and operational and calibration tests.

PART 2 PRODUCT

2.01 PRODUCT

A. Manufacturers: Subject to compliance with plan requirements, provide products for the service entrance and control panels where required:
   1. Reservoir, Main service panelboard: Critec model number TDX100M, 120/240 volt.
   2. Control Panels: Critec model number DSF6A150V for 120 volt operation.
   3. Control Panels: Critec model number DSF6A30V for 24 volt operation.
   4. Control Panels: Critec model number DSF6A275V for 240 volt operation.
   5. Telephone Line protection: Critec model number SLP1 RJ11.
   6. Remote 4-20ma signals: Critec model number RTP 30 34.
   7. Ethernet Copper: Critec model number LAN RJ45 Series.
   8. No Engineer Approved equals.

B. Accessories
   1. Unit Status Indicators: Solid state indicators with printed labels shall be provided on the front each TVSS enclosure to repeatedly indicate unit module status.
   2. Provide electrically isolated Form C (one N.O. and one N.C.) summary alarm contact rated or at least 120 VAC and 1 ampere shall be provided for remote annunciation of unit status. The summary alarm contact shall change state if any one or more of the surge current modules has failed.

PART 3 INSTALLATION

3.01 INSTALLATION

A. The Electrical Contractor shall install the parallel surge arrestor with short and straight conductors as practically as possible.

B. The surge arrestor units shall be installed as shown on the plans.

C. The Electrical Contractor shall follow the arrestor manufacturer's recommended installation practices and requirements.

D. The Electrical Contractor shall provide Operation & Maintenance Manuals for the equipment.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 51 13

INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior lighting.

1.02 RELATED **WORK**

A. Section 26 56 00 - Exterior lighting.

1.03 SUBMITTALS

A. Submit under provisions of Division 1.

B. Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under "Regulatory Requirements".

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. LED fixtures where specified shall include a life of 25,000 hours or more for A19 type screw in LED lamps and 100,000 hours for fixtures with integral LED lamps.

1.04 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Accurately record actual locations of each luminaire on as-built drawings.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

B. Maintenance Data: Include instructions for maintaining luminaires.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Division 1.

B. Accept products on site. Inspect for damage.

1.08 COORDINATION

A. Coordinate junction box, fixture supports and brackets with other trades.

1.09 EXTRA MATERIALS

A. Furnish under provisions of Division 1.

B. Provide two of each lamp type and wattage installed with exception of LED types.

1.10 MATERIALS SPECIFICATION

A. This Section includes interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

1.11 DEFINITIONS

A. Luminaire: Fixture.

B. Average Life: The time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

1.12 QUALITY ASSURANCE

A. Comply with NFPA 70 “National Electrical Code” for components and installation.

B. Listing and Labeling: Provide fixtures and emergency lighting units that are listed and labeled for their indicated use on the Project.
   1. Special Listing and Labeling: Provide fixtures for use in damp or wet locations, underwater, and recessed in combustible construction specifically listed and labeled for such use. Provide fixtures for use in hazardous (classified) locations that are listed and labeled for the specific hazard.
   2. The terms “Listed” and “Labeled”: As defined in the National Electrical Code, Article 100.

C. Coordination of Fixtures With Ceiling: Coordinate fixtures mounting hardware and trim with the ceiling system.

PART 2 PRODUCTS

2.01 FIXTURES, GENERAL

A. Comply with the requirements specified in the Articles below, and lighting fixture schedule.

2.02 FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs and sharp corners and edges.

B. Sheet Metal Components: Steel, except as indicated. Components are formed and supported to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position.

D. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass except as indicated.
1. Plastic: Highly resistance to yellowing and other changes due to aging, exposure to heat and UV radiation.
2. Lens Thickness: 0.125 inches, minimum.

2.03 FLUORESCENT FIXTURES

A. Fixtures: Conform to UL 1570, “Fluorescent Lighting Fixtures.”

B. Ballasts: Conform to UL 935, “Fluorescent-Lamp Ballasts.”
1. Certification: By Electrical Testing Laboratory (ETL).
2. Labeling: By Certified Ballast Manufacturers Association (CBM).
3. Type: Class P, high-power-factory type except as indicated otherwise.
4. Sound Rating: A rating, except as indicated otherwise.
5. Voltage: Match connected circuits.

C. Low Temperature Ballast Minimum Starting Temperature: Minus 20 deg C.

D. Electronic Ballasts: Solid-state, full-light-output, energy-saving type compatible with energy-saving lamps. Conform to FCC Regulations Part 18 for electromagnetic interference. Conform to IEEE C62.41, “Guide for Surge Voltages in Low-Voltage AC Power Circuits,” Category A, for resistance to voltage surges for normal and common modes.
1. Minimum Power Factor: 90 percent.
2. Minimum Operating Frequency: 20,000 Hz.
3. Maximum Total Harmonic Distortion (THD): 15 percent at 277V.
4. Average Input: The following is the average required wattage when tested according to ANSI C82.2, “Fluorescent Lamp Ballasts, Methods of Measurement.”
   a. 62 or less watts when operating two F32T8 lamps.
   b. 31 or less watts when operating one F32T8 lamp.

E. Electromagnetic Interference Filters: Integral to the fixture assembly. Provide one filter for each ballast. Suppress electromagnetic interference as required by MIL-STD-461, “Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference.”

2.04 HIGH INTENSITY DISCHARGE (HID) FIXTURES

A. Fixtures: Conform to UL 1572, “High-Intensity Discharge Lighting Fixtures.”

B. Ballasts: Conform to UL 1029, “High-Intensity-Discharge Lamp Ballasts” and ANSI C82.4, “Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).” Provide ballasts with the following features, except as otherwise indicated.
1. Constant wattage auto transformer (CWA) or regulator, high-power-factor type.
2. Voltage rating matches system voltage.
3. Single-Lamp Ballasts: Minimum starting temperature of minus 30 deg C.
4. Normal ambient operating temperature is 40 deg C.
5. Open circuit operation will not reduce the average life.
6. High pressure sodium (HPS) ballasts incorporate a solid-state igniter/starter with an average life in the pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.
7. Noise Suppression: Manufacturer’s standard epoxy encapsulated model designed to minimize audible fixture noise.

2.05 INCANDESCENT FIXTURES

A. Conform to UL 1571, “Incandescent Lighting Fixtures.”

2.06 FIXTURES FOR HAZARDOUS LOCATIONS

A. Conform to UL 844, “Electric Lighting Fixtures for Use in Hazardous (classified) Locations,” or provide units that have Factory Mutual Engineering and Research Corporation (FM) certification for the indicated class and division of hazard.

2.07 EXIT SIGNS

A. Conform to UL 924, “Emergency Lighting and Power Equipment,” and the following:
   1. Sign Colors: Conform to local code.
   2. Minimum Height of Letters: Conform to local code.
   3. Arrows: Include as indicated.

2.08 LAMPS

A. Conform to light fixture schedule applicable to each type of lamp.

2.09 FINISH

A. Steel Parts: Manufacturer’s standard finish applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and defects. Remove fixtures showing evidence of corrosion during project warranty period and replace with new fixtures.

B. Other Parts: Manufacturer’s standard finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Setting and Securing: Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer’s printed instructions and approved shop drawings.

B. Support For Recessed type Fixtures: Install units may be supported from suspended ceiling support system. Install ceiling system support rods or wires at a minimum of four rods or wires per fixture located not more than 6 inches from fixture corners.
   1. Fixtures Smaller Than Ceiling Grid: Install a minimum of four rods or wires for each fixture and locate at corner of the ceiling grid where the fixture is located. Do not support fixtures by ceiling acoustical panels.
   2. Fixtures of Sizes Less Than Ceiling Grid: Center in the acoustical panel. Support fixtures independently with at least two 3/4-inch metal channels spanning and secured to the ceiling tees.
   3. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corners.

C. Support for Suspended Fixtures: Brace pendants and rods that are 4-feet long or longer to limit swinging. Support stem mounted single-unit suspended fluorescent fixtures with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.

D. Lamping: Lamp units according to manufacturer’s instructions.

3.02 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

3.03 ADJUSTING AND CLEANING

A. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 56 00

EXTERIOR LIGHTING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior lighting.

1.02 RELATED WORK

A. Section 26 51 13 - Interior lighting Fixtures Lamps, and Ballasts.

1.03 SUBMITTALS

A. Submit under provisions of Division 1.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.04 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Accurately record actual locations of each luminaire on record drawings.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

B. Maintenance Data: Include replacement part list.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1.

B. Accept products on site. Inspect for damage.

1.08 COORDINATION

A. Coordinate junction box, fixture supports and brackets with other trades.

1.09 EXTRA MATERIALS

A. Furnish under provisions of Division 1.

B. Provide two of each lamp type and wattage installed.

1.10 SUMMARY

A. This Section includes exterior lighting fixtures, lamps, ballasts, and accessories.

1.11 DEFINITIONS

A. Fixture: A complete lighting unit. Fixtures include a lamp or lamps and parts required to distribute the light, position and protect lamps, and connect lamps to the power supply.

B. Lighting Unit: A fixture, or an assembly of fixtures with a common support, including a pole or bracket plus mounting and support accessories.

C. Luminaire: A fixture.

D. Protect certification signed by manufacturers of lighting units certifying that their products comply with specified requirements.

E. Maintenance data for products for inclusion in Operating and Maintenance Manual specified in Division 1.

1.12 QUALITY ASSURANCE

A. Comply with NFPA 70 “National Electrical Code” for components and installation.

B. Comply with ANSI C2, “National Electrical Safety Code.”

C. Listing and Labeling: Provide fixtures and accessories that are listed and labeled for their indicated use and location on the Project.

1.13 WARRANTY

A. Special Project Warranty: Submit a warranty, mutually executed by manufacturer and the Installer, agreeing to replace external parts of lighting fixtures exhibiting a failure of finish as specified below. This warranty is in addition to, and not a limitation of, other rights and remedies the Owner may have under the Contract Documents.
   1. Protection of Metal from Corrosion: Warranty against perforation or erosion of the finish due to weathering.
   2. Color Retention: Warranty against fading, staining, and chalking due to the effects of weather and solar radiation.
   3. Special Project Warranty Period: 2 years, beginning on the date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs and sharp edges and corners.

B. Sheet Metal Components: Corrosion-resistant aluminum, except as indicated. Form and support to prevent warping and sagging.

C. Housings: Rigidly formed, weather-tight and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed fixtures.

D. Doors, Frames, and Other Internal Access Provisions: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position. Provide for door removal for cleaning or replacing lens. Arrange for door opening to disconnect ballast.

E. Exposed Hardware Material: Stainless steel.

F. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

G. Plastic Parts: Resistant to yellowing and other changes due to aging and exposure to heat and UV radiation.

H. Lenses and Refractors: Materials as indicated. Use heat-resistant and aging-resistant, resilient gaskets to seal and cushion lens and refractor mounting in fixture doors.

I. Photoelectric Relay: UL 773, Plug-in, Locking Type Photocontrols for Use With Area Lighting, if shown on plans.
   1. Contact Relays: Single-throw, arranged to fail in the “on” position and factory set to turn light unit on at 1.5 to 3 footcandles and off at 4.5 to 10 footcandles with 15 seconds’ minimum time delay.
   2. Relay Mounting: In fixture housing.

2.02 HIGH-INTENSITY-DISCHARGE (HID) FIXTURES

A. Fixtures: Conform to UL 1572, “High-Intensity-Discharge Lighting Fixtures.”

B. Ballasts: Conform to UL 1029, “High-Intensity-Discharge Lamp Ballasts and ANSI C82.4, “Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type). “ Provide constant wattage autotransformer (CWA) or regulating high-power-factor type, unless otherwise indicated.
   1. Operating voltage matches system voltage.
   2. Single-Lamp Ballasts: Minimum starting temperature of minus 30 deg. C.
   3. Construct ballasts so open circuit operation will not reduce the average life.
   4. High-Pressure Sodium (HPS) Ballasts: Equipped with a solid-state igniter/starter having an average life in the pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg. C.
   5. Noise: Uniformly quiet operation, with a noise rating of B or better.

2.03 FIXTURE SUPPORT COMPONENTS

A. Arm, Bracket and Tenon Mount Materials: Match the fixtures.

B. Mountings, Fastenings, and Appurtenances: Corrosion-resistant components compatible with the fixtures that will not cause galvanic action at contact points. Provide mountings that will correctly position the luminaire to provide the indicated light distribution.

2.04 LAMPS

A. Conform to ANSI Standards, C78 series, applicable to each type of lamp. Provide fixtures with indicated lamps. Where lamps are not indicated, provide lamps recommended by manufacturer.

2.05 FINISH

A. Metal Parts: Manufacturer's standard finish except as otherwise indicated. Color of exterior fixtures shall match Architect's samples. Exterior fixtures shall be provided in 3 colors. Finish applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and similar defects. Remove poles, fixtures, and accessories showing evidence of corrosion or finish failure during Project warranty period and replace with new items.

B. Other Parts: Manufacturer's standard finish except as otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Set units plumb, square, level, and secure according to manufacturer's written instructions and shop drawings.

3.02 FIELD QUALITY CONTROL

A. Inspect installed units for damage.

B. Tests: Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source. Include the following:
   1. Check for excessive noisy ballasts.
   2. Check for uniformity of illuminations.

C. Replace or repair damaged and malfunctioning units and retest.

3.03 ADJUSTING AND CLEANING

A. Clean components on completion of installation. Use methods and materials recommended by manufacturer.

END OF SECTION

SECTION 31 13 15

SITE PREPARATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Protection of improvements, plants, and utilities.
   2. Removal and replacement of improvements.
   3. Location of utilities and coordination with utility companies.
   4. Temporary erosion control.
   5. Topsoil salvage.
   6. Miscellaneous demolition.

B. Related Sections:
   1. Section 31 25 10 - Temporary Erosion Control

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that existing plant life and features designated to remain are tagged or identified.

3.02 PROTECTION

A. Protect improvements on site and on adjoining properties. Provide barricades, coverings or other types of protection as necessary to prevent damage and to safeguard against injury. Restore to original condition improvements damaged by the work or improvements that required temporary removal during construction.

B. Protect existing vegetation indicated to remain against unnecessary cutting, breaking, bruising, or smothering by stockpiling excavated materials or parking of vehicles within drip line. Provide temporary fences, tree wells, barricades or guards; repair or replace trees and vegetation damaged by construction operations.

C. Protect survey monuments, reference points, and bench marks from movement. Should removal be necessary, notify Engineer who will set reference stakes and give notice that monument may be removed. Owner will reset monument after construction at no cost to Contractor. Contractor shall pay cost for reestablishing monuments lost due to his negligence or failure to notify Engineer.

D. No extra payment or time will be allowed for protection work that could have been suspected or anticipated by site inspection and interpretation of bidding documents prior to execution of contract.

3.03 UTILITIES

A. Notify all affected utility companies of construction operations at least 3 working days before beginning work near their facilities. Locate existing utilities; provide adequate protection and support during construction operations. If uncharted or incorrectly charted piping or other utilities are encountered during earthwork, consult Engineer immediately for directions as to procedure. Cooperate with Owner,

and public and private utility companies to keep their services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

3.04 TEMPORARY EROSION CONTROL

A. Erosion control will be furnished and maintained by others.

B. Coordinate erosion control measures with earthwork and turf establishment operations. Complete work on a drainage area basis to prevent excessive soil erosion.

C. Construct items in conformance with typical sections and elevation controls as shown on plans.

D. Remove all items upon completion of contract work. Spread and shape accumulated sediment to permit natural drainage and provide for turf establishment.

3.05 TOPSOIL

A. Topsoil shall include all friable, fertile, organic clay loam soil suitable for grass and plants, found at surface to a depth of approximately 6 to 12 inches, reasonably free of subsoil, clay lumps, stones, objects over 2 inches diameter, weeds, large roots, root clusters, and other objectionable material.

B. Strip topsoil from project area to whatever depths encountered; prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping topsoil.

C. Where trees are indicated to remain, terminate stripping a sufficient distance from such trees to prevent damage to root system.

D. Stockpile topsoil in storage piles in areas where designated. Construct storage piles to freely drain surface water. Cover or sprinkle water on storage piles to prevent windblown dust.

3.06 DEMOLITION

A. Remove, pavements and improvements within construction limits as shown and as required for construction. Saw cut bituminous and concrete pavement to provide a smooth straight joint. Remove below-grade items encountered, such as slabs and foundations that interfere with construction.

3.07 DEBRIS DISPOSAL

A. Remove debris and excess materials from site and legally dispose of it; do not burn debris or wood unless properly permitted.

END OF SECTION

SECTION 31 22 10

SITE GRADING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes regrading of a site to accommodate the construction of a water tower.

B. The Work includes the following:
   1. Topsoil removal.
   2. Excavation.
   3. Embankment.
   4. Compaction.
   5. Fine grading.

C. Related Sections:
   1. Section 31 25 10 - Temporary Erosion Control

1.02 DESCRIPTION

A. Grade Site as shown on Drawings.

B. Contours and spot elevations indicate finished surface grades.

C. Construct uniform slopes between contours and spot elevations.

D. Set Site control and grade stakes as required to ensure conformance with Drawings.

1.03 SEQUENCING AND SCHEDULING

A. Complete topsoil removal and general grading prior to structure erection.

B. Perform fine grading and topsoil placement after structure erection.

PART 2 PRODUCTS

2.01 MATERIALS

A. Granular Borrow Material: WisDOT Granular Borrow

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that native materials are suitable for reuse on Site.

B. Notify Engineer of any materials that do not appear suitable for reuse.

3.02 PROTECTION

A. Conduct all operations within designated grading limits.

B. Protect all existing structures, plantings, turf, and other facilities or natural features which are not scheduled for removal.

3.03 CONSTRUCTION OPERATIONS

A. Topsoil Removal:
   1. Excavate all topsoil, root, and organic material within designated grading area and stockpile separately.
   2. Separate all debris, large roots, and rocks greater than 1 inch from the topsoil and remove from Site.

B. Excavation:
   1. Excavate designated areas to proposed subgrade elevations indicated on Drawings.
   2. Perform additional excavation as required to provide for foundation construction of proposed structure.
   3. Advise Engineer immediately if any unsuitable soils, wet conditions or previously undisclosed conditions are unearthed.
   4. Locate and protect inplace utilities within or adjacent to excavation area.

C. Embankment:
   1. Place embankment material in designated areas to proposed subgrade elevations indicated on Drawings.
   2. Place granular borrow material in locations and at dimensions shown on Drawings.
   3. Use suitable excavated material from Site prior to import of common borrow material.
   4. Scarify existing subgrade areas prior to placement of embankments thereon.
   5. Place embankment materials in maximum 12-inch layers and compact each layer.
   6. Maintain proper moisture content during placement and compaction of embankment materials.
   7. Remove excess materials not required for embankment from Site.
   8. Place excess materials in accordance with these requirements in locations on Site as directed by Engineer.

D. Compaction:
   1. Compact granular borrow placed in structure excavation to 98 percent of standard Proctor density.
   2. Compact remaining areas with approved compaction equipment until there is no further evidence of consolidation.

E. Fine Grading: Finish grade all earthwork areas to within 1/10 foot of proposed subgrade elevations.

F. Topsoil Placement:
   1. Top soil placement will be by others.

END OF SECTION

SECTION 31 23 10

EXCAVATION AND EMBANKMENT (WisDOT 205 AND 207)

PART 1 GENERAL

1.01 SUMMARY

A. Section includes construction of excavations and embankments within the designated construction limits.

1.02 REFERENCES

A. WisDOT:
   1. 205 - Roadway and Drainage Excavation
   2. 207 - Embankment

PART 2 PRODUCTS

2.01 MATERIALS

A. Granular Borrow: WisDOT 209, Grade 2, except that all material must pass the 1-inch sieve.

B. Random fill includes all soils except those classified in ASTM D2487 as Pt, OH, OL, MH or CH. Free from ice, snow, frozen earth, trash, debris, organic material, stones larger than 3 inches in any dimension

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. If present, remove ice and snow prior to grading operations.

B. All grading shall conform to the planned grades, cross-sections and stakes.

C. Confine operations to established limits.

D. Maintain Site in a well-drained condition at all times.
   1. Install planned drainage facilities concurrent with embankment operations.
   2. Provide temporary drainage facilities to maintain existing drainage courses until permanent facilities are operative.

3.02 PREPARATION OF EMBANKMENT FOUNDATION

A. Remove topsoil, organic and unstable material from the roadbed prior to placing embankment.

3.03 EXCAVATING OPERATIONS

A. Conform to lines, grades and slopes staked by Engineer.

B. Provide seepage trenches for granular backfill replacement of unstable areas.

3.04 DISPOSAL OF EXCAVATED MATERIAL

A. Use suitable excavated materials for embankment construction.

B. Construct embankment layers from uniform materials.

C. Place granular materials in upper most portion of the embankment.

D. Mechanically mix non-uniform soils to produce uniform moisture content and density.

E. Excavate all suitable topsoil material separately and stockpile.

F. Do not place snow, ice, or frozen lumps in the roadbed embankment.

G. Do not place stone, concrete or bituminous fragments exceeding 3 inches in any dimension roadbed embankment.

H. Do not place stone, concrete, or bituminous fragments exceeding 3 inches in the upper 6 inches of roadbed embankment or within 18 inches of the structure.

I. All surplus excavated materials shall become the property of the Contractor for disposal.

3.05 PLACING EMBANKMENTS

A. Do not place material on soil which is frozen.

B. Backfill excavations below subgrade and seepage trenches in accordance with this Section.

C. Deposit and spread material in uniform layers parallel to the profile grade extending over the full width of the embankment.

D. Place upper 3 feet of roadbed in maximum 8-inch layers.

E. Place remainder of roadbed in maximum 12-inch layers.

3.06 COMPACTING EMBANKMENTS

A. Compact upper 3 feet of embankment to not less than 100 percent of Standard Proctor Density.

B. Compact remainder of embankment to not less than 95 percent of Standard Proctor Density.

C. Maintain proper moisture content during placement and compaction.

3.07 FINISHING OPERATIONS

A. Finish all earthwork to within 0.1 foot of the staked grade.

B. Conduct finishing and topsoiling concurrent with the grading operations to provide for erosion control.

END OF SECTION

SECTION 31 23 16

STRUCTURE EXCAVATIONS AND BACKFILLS (WisDOT 206)

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Structure excavation.
   2. Foundation preparation.
   3. Backfill placement.
   4. Surplus excavated material disposal.

B. Related Sections:
   1. Section 31 11 00 - Clearing and Grubbing
   2. Section 31 23 10 - Excavation and Embankment
   3. Section 31 25 10 - Temporary Erosion Control

1.02 REFERENCES

A. WisDOT:
   1. 205 - Roadway and Drainage Excavation
   2. 206 - Excavation for Structures
   3. 209 - Granular Backfill

1.03 SEQUENCING AND SCHEDULING

A. Do not commence construction of the structure foundation until soil test results are confirmed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Granular Backfill: WisDOT 209.

B. Aggregate Backfill: WisDOT 209.

C. Granular Bedding: WisDOT 209.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that foundation soils are in suitable condition to begin construction.

B. Advise Engineer of any soil types or conditions that are not in accordance with the soil borings.

C. Follow recommendations in geotechnical report with on-site verification by geotechnical firm.

3.02 PREPARATION

A. Temporary Construction:
   1. Provide sheeting, shoring, or other temporary facilities as required to prosecute the work.

2. Provide warning signs, fencing or other temporary facilities as required to prevent unnecessary hazards to the public.
3. Provide pumping or other temporary means as required to establish and maintain dry conditions in the excavation.

3.03 CONSTRUCTION REQUIREMENTS

A. Excavation:
1. Excavate, shape, and prepare all foundation soils to the elevations and dimensions designated on the Drawings.
2. Perform additional excavation as required to permit erection of forms and other temporary construction and to provide for proper compaction of backfill materials.

B. Foundation Preparation:
1. Compact foundation soils as necessary to achieve required stability.
2. Replace unsuitable foundation soils within acceptable materials.
3. Place and compact replacement materials in minimum 6-inch layers.
4. Rock Foundations:
   a. Remove all loose or disintegrated rock material from the excavation.
   b. Clean out all rock seams and fill with concrete.
5. Refer to Water Tower Foundation Analysis and Excavations and Site Drainage sections of the geotechnical report.

C. Backfilling:
1. Uniformly distribute backfill materials in maximum 8-inch layers and compact to 100 percent of Standard Proctor Density prior to placement of successive layers.
2. Do not place backfill material on frozen foundations.
3. Do not place material that will freeze during backfill or compaction.
4. Dispose of suitable surplus materials as embankment for the site grading.
5. Refer to Water Tower Foundation Analysis and Excavations and Site Drainage sections of the geotechnical report.

3.04 FIELD QUALITY CONTROL

A. Soil Tests:
1. Soil bearing test on the foundation soils will be taken at the Owner’s discretion.
2. Soil density tests on the backfill material will be taken at the Owner’s discretion.

3.05 PROTECTION

A. Protect prepared foundation soils from freezing.

B. Protect and maintain prepared foundation soils during dewatering operations.

END OF SECTION

SECTION 31 23 33

TRENCH EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Trench excavation.
   2. Special pipe foundation.
   3. Trench backfill.
   4. Compaction.
   5. Pipe grade and alignment conflicts.

B. Related Sections:
   1. Section 33 11 00 - Water Distribution Systems

1.02 SUBMITTALS

A. Provide for each granular material:
   1. Name and location of source.
   2. Sample gradation.

1.03 SITE CONDITIONS

A. Groundwater: Provide trench dewatering if groundwater surface is above or within 3 feet of pipe zone.

1.04 WARRANTY

A. Repair all trench settlements and resulting damage or displacement of surface facilities that occur within the Contract correction period.

PART 2 PRODUCTS

2.01 MATERIALS

A. Crushed Rock Pipe Foundation: WisDOT 209.

B. Granular Pipe Foundation: WisDOT 209.

C. Aggregate Pipe Foundation: WisDOT 209.

D. Replacement Backfill: WisDOT 209.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Trench Excavation:
   1. Alignment and Grade:
      a. Excavate trench to alignment and grade as staked.
      b. Excavate no more than 100 feet in advance of pipe laying operation.
   2. Trench Width at Pipe Zone:
      a. Center trench on pipe alignment.

b. Minimum width: Pipe outside dimension plus 12 inches.
c. Maximum width: Pipe outside dimension plus 24 inches (except rock excavation).

3. Excavated Materials:
   a. Use stable material for backfill.
   b. Waste unstable material as directed.
   c. Do not place materials on sidewalk, driveways, or drainageways.
4. Drainage:
   a. Provide dewatering trenches when required.
   b. Drain trench water into natural channels or storm sewer.
   c. Do not drain trench water into sanitary sewer.
5. Rock Excavation:
   a. Blasting shall conform to all local and state ordinances.
   b. Submit blasting schedule for approval.
   c. Minimum trench width: 36-inch.
   d. Provide minimum 6-inch vertical clearance between pipe and rock trench bottom.
   e. Provide minimum 12-inch horizontal clearance between pipe and rock trench walls.
   f. Provide pipe foundation material for pipe in rock trenches.

B. Pipe Foundations:
1. Engineer to determine condition of trench bottom.
2. Stable Trench Bottom Condition:
   a. Shape trench bottom to conform to bottom half of pipe.
   b. Excavate bell holes to permit proper jointing.
3. Unstable Trench Bottom Condition:
   a. Excavate below pipe grade to specified depth.
   b. Refill with specified foundation material in accordance with Drawings details and compact.

C. Trench Backfill:
1. Pipe Zone:
   a. Use specified foundation material free of rocks and other unsuitable debris.
   b. Deposit material uniformly on both sides of pipe throughout entire trench width.
   c. Place material in 6-inch lifts and mechanically compact.
2. Above Pipe Zone:
   a. Use native materials free of debris and rock, concrete or clay lumps with a volume greater than 1/3 cubic foot.
   b. Place in uniform lifts no more than 1 foot thick.
   c. Mechanically compact each lift of the upper 3 feet of trench to a standard Proctor density of 100 percent.
   d. Mechanically compact each lift under the upper 3 feet of trench to a standard Proctor density of 95 percent.
   e. Do not backfill unless approved compaction equipment is operating.
   f. Fine grade street subgrade to staked elevation and cross section.
3. Replacement Backfill:
   a. Engineer to determine suitability of native material for backfill.
   b. Use replacement backfill in lieu of native materials as directed.
4. Excess or Deficiency of Backfill Material:
   a. Dispose of excess backfill material as directed after all trenches are backfilled.
   b. Provide replacement backfill as required to establish required surface elevation.

3.02 FIELD QUALITY CONTROL

A. Density tests on backfill materials will be as directed by Engineer.

B. Recompact all areas represented by failed density tests.

3.03 PIPE CLEARANCES AND CONFLICTS

A. Provide clearance between sewers and water main as follows:
1. Maintain 10-foot horizontal between pipes.

2. Maintain 18-inch vertical separation between pipes.

B. When 18-inch vertical separation between sewer and water main cannot be maintained, provide special pipe crossing as follows:
   1. Advise Engineer of pipe conflict.
   2. Lower water main in accordance with Drawing or as directed.
   3. Provide 18-inch vertical separation between pipes.
   4. Construct sewer using pipe material and joints equal to water main at crossing point.
   5. Center pipe lengths at crossing point.
   6. Provide special foundation material for both pipes.
   7. Place insulation as directed.

END OF SECTION

This Page Left Blank Intentionally

SECTION 31 23 50

PREPARING THE FOUNDATION (WisDOT 211)

PART 1 GENERAL

1.01 SUMMARY

A. Section includes shaping and compacting of subgrade prior to placement of base course.

B. Related Sections:
   1. Section 31 23 10 - Excavation and Embankment
   2. Section 31 23 33 - Trench Excavation and Backfill

C. Method of Measurement:
   1. Measurement shall be on a lump sum basis.

D. Basis of Payment:
   1. Payment for subgrade preparation shall be at the contract unit price as listed on the Bid Form. All associated work items shall be considered incidental.

1.02 REFERENCES

A. WisDOT 211 - Preparing the Foundation

1.03 SEQUENCING AND SCHEDULING

A. Prepare subgrade after unstable areas have been repaired and in-place surface courses have been removed.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Re-excavate, compact and shape the top 6 inches of subgrade area to provide smooth, stable surface for the placement of base course thereon.

B. Compact subgrade material to 100 percent of Standard Proctor Density.

C. Produce and maintain the necessary moisture content in the subgrade material by scarification or application of water.

D. Continue operations until no rutting or displacement occurs under construction traffic.

E. Provide a finished surface within 0.05 foot of the prescribed elevation at all locations.

END OF SECTION

This Page Left Blank Intentionally

SECTION 31 25 10

TEMPORARY EROSION CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Temporary measures to control soil erosion and sedimentation.
   2. Erosion control devices will be installed and maintained by others.

1.02 REFERENCES

A. Wisconsin Department of Transportation
   1. 628 - Erosion Control

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials: WisDOT 628.2.

PART 3 EXECUTION

3.01 GENERAL

A. Coordinate erosion control measures with earthwork and turf establishment operations.

B. Complete grading, finishing, and stockpiling.

3.02 PLACING EARTHWORK

A. Construct rough grading in conformance with elevation controls shown on the Drawings.

B. Spread and shape earthwork to permit natural drainage and provide for turf establishment.

END OF SECTION

This Page Left Blank Intentionally

SECTION 31 37 00

RIPRAP (WisDOT 606)

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Stone riprap.
   2. Fabric.

B. Basis of Payment:
   1. Bid Price Includes:
      a. Excavation.
      b. Foundation preparation.
      c. Geotextile filter:
         1) Type R.
         2) Type HR.
   2. Payment for riprap shall be at the contract unit price as listed on the Bid Form. All associated work items shall be considered incidental.

1.02 REFERENCES

A. WisDOT:
   1. 606 - Riprap
   2. 645 - Geotextile Fabrics

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials shall be in accordance with the respective WisDOT Specifications as follows:
   1. Riprap Materials: WisDOT 606, Except waste concrete shall not be acceptable.
   2. Fabric: WisDOT 645.

2.02 ACCESSORIES

A. All accessories shall be in accordance with the respective WisDOT Specifications.

PART 3 EXECUTION

3.01 FOUNDATION PREPARATION

A. Excavate and shape foundation areas to the location and cross section staked by Engineer.

B. Compact all loose foundation material prior to filter material placement.

C. Provide smooth surface, free of stones, sticks, and other debris.

3.02 FILTER MATERIAL

A. Geotextile Filter:
   1. Place multiple fabric widths with the longest dimension parallel to the direction of water flow.

2. Splice multiple fabric widths by mechanical seaming or minimum 24-inch overlap (36 inches under water).
3. Overlap joints in shingle arrangement.
4. Bury upgrade edges of fabric to a minimum depth of 8 inches to prevent undermining.
5. Anchor fabric to prevent movement during riprap placement.
6. Do not operate equipment on fabric.

3.03 RIPRAP STONE

A. Placement:
1. Begin placement at the lowest elevation and work upgrade.
2. Do not drop stones from greater than 1-foot height.
3. Position stones to provide uniform size distribution and minimize void space.
4. Level surface to provide uniform thickness and appearance.
5. Seat smaller stones between the larger stones to produce a uniform surface.
6. Suitable material obtained from on-site rock excavation may be used as chinking.

3.04 THICKNESS REQUIREMENTS

A. All Areas: Minimum 85 percent of specified thickness.

B. Average: Minimum 95 percent of specified thickness.

END OF SECTION

SECTION 32 11 26

CRUSHED AGGREGATE BASE COURSE (WisDOT 305)

PART 1 GENERAL

1.01 SUMMARY

A. Section includes construction of crushed aggregate base course on a prepared subgrade.

B. Related Sections:
   1. Section 31 23 50 - Preparing the Foundation

1.02 REFERENCES

A. WisDOT - Standard Specifications for Highway and Structure Construction:
   1. 305 - Dense Graded Base

1.03 SUBMITTALS

A. Provide for each aggregate material:
   1. Name and location of source.
   2. Two sample gradations taken within the past 30 days from each potential source, delivered to Engineer at least 10 days prior to placement on the project.

1.04 HANDLING AND DELIVERY

A. Stockpile and drain aggregate removed from below water for a minimum 24 hours prior to delivery.

1.05 SITE CONDITIONS

A. Deposit aggregate only on dry, compact subgrade so that no rutting or displacement will occur under construction traffic.

PART 2 PRODUCTS

2.01 MATERIALS

A. Crushed Aggregate Base Course Materials: WisDOT 305.

B. Aggregate Gradation: 1-1/4-inches.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Placing and Mixing:
   1. Place aggregate in layers to produce a maximum 3 inches of compacted thickness.
   2. With vibratory compaction, place to produce maximum 6 inches of compacted thickness.
   3. Deposit only the amount of aggregate that is intended to be spread and compacted during the same day.
   4. Add water as may be required during mixing to produce proper compaction.

B. Spreading and Compacting:
   1. Mix aggregate uniformly to maintain proper gradation.

2. Spread and compact each layer to the required cross section and density prior to placing a succeeding layer.
3. Compact each layer to 100 percent of Standard Proctor Density.

C. Tolerances: Construct each course to within 0.05 foot of the planned grades and staked elevations at all locations.

3.02 PROTECTION

A. Place initial surface course or otherwise protect the in-place aggregate base within 72 hours after placement.

B. Remove and replace any portion of the material that becomes contaminated after placement.

END OF SECTION

SECTION 32 12 18

HOT MIX ASPHALT PAVEMENT (WisDOT 460)

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Hot mix asphaltic pavement.

1.02 REFERENCES

A. WisDOT - Standard Specifications for Highway and Structure Construction:
   1. 211 - Preparing the Foundation
   2. 305 - Dense Graded Base
   3. 350 - Subbase
   4. 450 - General Requirements for Asphaltic Pavements
   5. 455 - Asphaltic Materials
   6. 460 - Hot Mix Asphalt Pavement

1.03 SUBMITTALS

A. Submittals in accordance with Section 01 33 00 - including:
   1. Asphalt mix design in accordance with WisDOT Section 460.2.7.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphaltic surface: Type E-1 per WisDOT 460.2.

B. Asphaltic material: PG 58-28.

PART 3 EXECUTION

3.01 APPLICATION

A. Construct pavement conforming to the general provisions of WisDOT 450.3.

B. Compaction of the pavement shall be in accordance with the HMA Pavement Density Maximum Density Method of WisDOT 460.3.3.

3.02 ADJUSTING

A. Adjust valve boxes, manholes, cleanouts or other appurtenances to new surface elevation. Engineer shall approve method of adjustment.

END OF SECTION

This Page Left Blank Intentionally

SECTION 32 12 50

SAW CUTTING PAVEMENT (WisDOT 690)

PART 1 GENERAL

1.01 SUMMARY

A. Section includes partial-depth or full-depth sawing of old, existing concrete or asphaltic pavements, curb and gutter, driveways, sidewalks and similar work as shown on the Drawings or as directed by Engineer.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Use diamond blades for full depth saw cuts of concrete pavement.

PART 3 EXECUTION

3.01 INSTALLATION

A. Sawing Existing Pavement:
   1. Saw cut to be straight.
   2. Minimum depth is 2 inches.
   3. Remaining surface to be generally vertical for full depth.

B. Sawing Concrete Pavement - Full Depth:
   1. Remove saw cutting sludge after each cut.
   2. Minimize sludge flow onto adjacent pavement.
   3. Clean traffic control devices of sludge daily.
   4. Dispose of sludge where approved by Engineer.
   5. Maximum cut into existing pavement is 12 inches.

END OF SECTION

This Page Left Blank Intentionally

SECTION 32 13 43

POROUS CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SUMMARY

A. Provide pervious exterior cement concrete pavement and accessories including:
   1. Fibrous reinforcing.
   2. Geotextile fabric.
   3. Joint strips.
   4. Pavement marking paint.

B. Related Sections:
   1. Section 31 25 10 - Temporary Erosion Control
   2. Section 32 16 30 - Concrete Curb and Gutter

1.02 REFERENCES

A. AASHTO:
   1. T180 - Moisture-Density Relations of Soils

B. ACI:
   1. 301 - Specification for Structural Concrete

C. ASTM:
   1. C29 - Test for Unit Weight and Voids
   2. C31 - Curing Concrete in Field
   3. C33 - Concrete Aggregates
   4. C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
   5. C94 - Ready Mixed Concrete
   6. C117 - Test for Material Finer Than No. 200 Sieve
   7. C136 - Sieve Analysis for Fine and Course Aggregate
   8. C138 - Test for Unit Weight, Yield, and Air Content of Concrete
   9. C150 - Portland Cement, Types I and II
   10. C171 - Sheet Materials for Curing Concrete
   11. C172 - Sampling Fresh Concrete
   12. C260 - Air-Entraining Admixtures for Concrete
   13. C494 - Chemical Admixtures for Concrete
   14. C595 - Blended Hydraulic Cements, Types IP and IS
   15. C618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan in Portland Cement Concrete
   16. C642 - Absorption, Density, and Voids in Hardened Concrete
   17. C1157 - Moisture Density Relations of Soil and Soil Aggregate Moistures
   18. D1751 - Preformed Expansion Joint Filled for Concrete
   19. D2321 - Underground Installation of Thermoplastic Pipe for Gravity Flow Applications
   20. F758 - Smooth-Wall PVC Underdrain Systems

1.03 DESIGN REQUIREMENTS

A. Design Requirements:
   1. Ensure water flow around Site is adequately diverted to preclude and minimize clogging of pervious concrete layer.
   2. Void Structure: 15-21 percent. No fines (sand).
   3. Design stone reservoir to drain completely within 72 hours. With marginal soils for infiltration, design reservoir to drain within 48 hours.

B. Performance Requirements: 3-8 gallons of water per minute to pass thru each square foot.

1.04 SUBMITTALS

A. Product Data for all components.

B. Shop Drawings.

C. Samples:
1. Color.
2. Exposed edge restraint.
3. Core samples.

D. Concrete Mix Submittals:
1. Include name and address of transit-mix concrete supplier.
2. Catalog information on admixtures or agents to be included in mix.
3. List of concrete mix designs at least 15 days prior to start of Work. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test or other circumstances warrant adjustments.
4. Before submitting, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices.

E. Quality Assurance/Control Submittals:
1. Test Reports: Report test results to Engineer.
2. Material Certificates: Signed by manufacturers certifying materials comply with requirements of Construction Documents.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer: Manufacturer of ready-mixed concrete products who complies with ASTM C94 requirements for production facilities and equipment.
2. Installer: PCI Systems Certified Pervious Concrete Specialist, experienced in installation of pervious concrete.

B. Regulatory Requirements:
1. Comply with ACI 301.

C. Sampling and Testing: Provide services of independent testing laboratory to determine:
1. Permeability.
2. Load bearing capacity.
3. Resistance to frost heave.
4. Swell and shrink.
5. The amount of water that may enter the porous pavement.
6. How fast the water will percolate through the soil.

D. Preinstallation Meeting: Conduct conference at Site, requiring representatives of each entity directly concerned with concrete pavement to attend.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:
1. Do not install during heavy rain or snowfall.
2. Do not use frozen materials or materials mixed or coated with ice or frost.
3. Do not build on wet or frozen subgrade or setting beds.

B. Existing Conditions:
1. Drawings do not purport to show actual dimensions, but are intended only to establish location and scope of Work.

2. Field-verify dimensions and assume full responsibility for their accuracy.

C. Access: Maintain access for vehicular and pedestrian traffic.

D. Freeze-Thaw Climates:
   1. Cement paste to be air-entrained.
   2. Place pervious concrete on 6-12 inches of drainable aggregate base of 3/4 inch or larger clean gravel.
   3. See www.concreteparking.org for more information on freeze-thaw applications.

E. Do not store heavy equipment on the area in which porous asphalt pavement will be laid as it will compact soils and reduce the soil's infiltration. Use construction barriers around site to prevent compaction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Geotextile Fabric:
   1. Standard of Quality: Design is based on products of Mirafi, Norcross, GA www.tcmirafi.com
   2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
      a. Akzo Nobel Geosynthetics, Enka, NC www.akzonobel.com
      b. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

B. Fibrous Reinforcing:
   1. Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
      a. Forta Corporation *Forta Super-net or Forta Ferro* www.fortacorp.com
      b. Fibermesh, Inc. *Fibermesh Fibers* www.fibermesh.com
      c. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

2.02 FORMS

A. Form Materials:
   1. Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
   2. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.03 COURSE DESCRIPTION

A. Concrete Course:
   1. Thickness: See Drawings.
   2. 15-20 percent pore space.

B. Filter Course:
   1. 2-inch layer of 0.5-inch stone aggregate or limestone meeting AASHTO 57 or passing sieve as follows:
      a. 1/2 inch: 85-100.
      b. 3/4 inch: 100.
      c. 3/8 inch: 55-75.
      d. No. 4: 10-35.
      e. No. 8: 5-10.
      f. No. 200: 2-4.
   2. Open graded, screened, clean-washed, pit run gravel.

3. Maximum wash loss of 1.5 percent.

C. Reservoir Course:
   1. Base of 8-inch clean-washed, uniformly graded, stone meeting AASHTO M43-2, size 2.
   2. Maximum wash loss of 1.5 percent.
   3. 40 percent voids per AASHTO T19.
   4. Material: Granite, limestone, dolostone, or traprock.
   5. Shale will not be allowed.
   6. Depth: See Drawings.

D. Additional Filter Course: Provide another 2-inch filter course beneath the reservoir course to allow additional infiltration.

E. Geotextile Filter:
   1. Non-woven filter fabric.
   2. Water Flow Rate: 140 gallons per minute per square foot.

F. Uncompacted, undisturbed, level soil bed with positive overflow catch basin.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
   1. Portland Cement: ASTM C150, Type I or II, gray.
   2. Blended Hydraulic Cement: ASTM C595, Type IS, portland blast-furnace slag or Type IP, portland-pozzolan cement.
   3. Fly Ash: ASTM C618, not to exceed 20 percent of total cementitious material.
   4. Containing no sand or dust.

B. Aggregates: ASTM C33, Class 4S coarse aggregate, uniformly graded. Provide one of the following aggregates from a single source:
   1. Number 8 coarse aggregate (3/8 to 16).
   2. Number 89 coarse aggregate (3/8 to 50).

C. Water: ASTM C94.

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   1. Water Reducing Admixture: ASTM C494, Type A.
   2. Retarding Admixture: ASTM C494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
   4. Air Entraining Agents:
      a. ASTM C260.
      b. 4 to 8 percent.
      c. Air bubble spacing factor of less than 0.01 inch.

E. Fibrous Reinforcing:
   1. Virgin fibrillated polypropylene reinforcing fibers, designed and manufactured specifically for use in concrete.
   2. Furnish fibers in 1-1/2 inch lengths.

2.05 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
   1. Compressive Strength, 28 Days: 2500 psi.
   2. Water-Cementitious Materials Ratio at Point of Placement: Not less than 0.27 nor more than 0.30.

3. Mix Proportion:
    a. Aggregate, cement, water, and admixture per cubic yard equal to 27 cubic feet when calculated as a function of the unit weight determined in accordance with ASTM C29 jigging procedure.
    b. Fine aggregate, if used, shall not exceed 3 cubic feet and shall be included in the total aggregate volume.

B. Ready-Mixed Concrete:
1. Measure, batch, and mix concrete materials and concrete according to ASTM C94.
2. Furnish batch certificates for each batch discharged and used in Work.

C. Fibrous Reinforcing:
1. Add fibers at the rate recommended by the manufacturer for the application indicated, but not less than 1.5 pounds per cubic yard of concrete.
2. Mix in accordance with manufacturer's instructions.

2.06 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

B. Water: Potable.

2.07 MISCELLANEOUS MATERIALS

A. Expansion and Isolation Joint Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Pavement-Marking Paint:
1. Latex, waterborne emulsion, lead and chromate free, ready mixed.
2. Complying with FS TT-P-1952.
3. Drying time of less than 45 minutes.
4. Color: As selected by Engineer from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Work of Other Trades: Prior to commencing Work, with Installer present, carefully inspect and verify that Work is complete to point where this installation may properly commence.

B. Verification of Conditions: Verify that concrete may be installed in accordance with original design, pertinent codes, and regulations.

C. Discrepancies: Immediately notify Engineer. Do not proceed with installation in areas of discrepancy until fully resolved.

3.02 PREPARATION

A. Construct storm water diversions around area where porous pavement is to be constructed.
1. Perform prior to excavating for the reservoir course.
2. Divert all storm water around the porous pavement areas until pavement construction is complete and vegetation is established.

B. Perform excavations for the reservoir course without allowing construction equipment at the bottom of the excavation. Do not compact the soil at the bottom of the excavation.

C. If erosion causes accumulation of fine materials in any areas of the reservoir course excavation, these fine materials shall be removed prior to placement of geotextile.

D. Any areas damaged by erosion, ponding, or traffic compaction shall be reworked before stone placement.

E. Bring subgrade to the line, grade, and elevations indicated; establish and maintain. Notify Engineer for review and approval of final stake lines before construction Work is to begin.

F. Post signs to prevent vehicles from entering the area with muddy tires. If muddy vehicle access cannot be prevented, install a temporary access road.

G. Maintain erosion and sediment control measures until site is stabilized.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations.

B. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

C. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 GRAVEL BED BASE

A. Subgrade:
   1. Top 6 inches of granular or gravelly soil that is predominantly sandy with no more than a moderate amount of silt or clay, with reasonable level of permeability.
   2. Total Base Thickness: 12 inches.
   3. Bottom of bed must be level.

B. Geotextile Fabric:
   1. Install flush over non-compacted subgrade with 16-inch overlapping seams.
   2. Anchor fabric a minimum of 2 feet beyond the recharge bed boundaries and extend up sides of stone reservoir to the top of reservoir.

C. Install 2-inch choker course of 0.5-inch aggregate or limestone evenly over surface of stone bed, sufficient to allow placement of pavement. Notify Engineer for approval.

3.05 JOINTS

A. Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Where no joints are indicated, install at 15-foot intervals. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness.

3.06 CONCRETE PLACEMENT

A. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete and the following:
   1. Mix Time: Truck mixers shall be operated at the speed designated as mixing speed by the manufacturer for 75 to 100 revolutions of the drum.
   2. Transportation: The portland cement aggregate mixture may be transported or mixed on site and shall be used within 1 hour of the introduction of mix water, unless otherwise approved in writing.
      a. The 1 hour requirement can be increased to 90 minutes when utilizing an approved hydration stabilizer, as long as the temperature of the concrete does not exceed 90 degrees F.
      b. Under no circumstance will retempering of concrete be allowed after any water adjustments have been made to concrete delivered to the jobsite.
      c. Trucks used to transport the porous concrete shall have no more than 3 consecutive loads of material without hauling conventional concrete or rinsing.
   3. Water: Water may be added to obtain the required mix consistency in accordance with ACI 301.
   4. Cement paste to display a wet metallic sheen without causing the paste to flow from the aggregate.
      a. Water adjustments made at the Site must be approved by an authorized representative of the concrete supplier.
      b. A minimum of 20 revolutions at the manufacturer's designated mixing speed shall be required following any addition of water to the mix.

B. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

C. Deposit and spread concrete in a continuous operation between transverse joints.
   1. Do not push or drag concrete into place or use vibrators to move concrete into place.
   2. Pavement placement widths restricted to a maximum of 15 feet.

D. Immediately screed pavement surfaces with a straightedge and strike off.

E. Remove the top 1/2 inch from edge forms, lightly mist concrete paving surface, and cover concrete with moisture retaining cover.

F. Compact with mechanical equipment of either slipform or form riding with a following compactive unit that will provide a minimum of 10 psi vertical force.

G. Tolerances: 3/8-inch in 10 feet from profile grade.

H. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.07 CONCRETE PROTECTION AND CURING

A. Curing Method: Moisture-retaining cover curing.

B. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

C. Comply with ACI 306.1 for cold-weather protection.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Cure Times:
   1. Portland Cement Type I, II, or IS: 7 days minimum.
   2. Portland Cement Type I or II with Flyash or Type IP: 10 days minimum.

3.08 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
   1. Elevation: 1/4 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4 inch.
   4. Contraction Joint Depth: Plus 1/4 inch, no minus.
   5. Joint Width: Plus 1/8 inch, no minus.

3.09 PAVEMENT MARKING

A. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.

B. Sweep and clean surface to eliminate loose material and dust.

C. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges.

D. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

E. Provide handicap parking space marking – size as required for city ordinance. Provide handicap parking sign.

3.10 FIELD QUALITY CONTROL

A. Testing and Analysis of Concrete: See Section 01 45 00.
B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
   1. Testing Frequency: Obtain at least 3 core samples and an additional 3 core samples for each 1,000 square feet or fraction thereof of each concrete mix placed each day.
   2. Thickness: ASTM C42; Average of all production cores shall not be less than the specified thickness with no individual core being more than 1/4 inch less than the specified thickness.
   3. Void Structure: ASTM C138; 15 percent minimum; 21 percent maximum.
   4. Unit Weight: ASTM C642; plus or minus 5 pcf of the design unit weight.
   5. Compression Test Specimens: ASTM C31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C39; test 1 specimen at 7 days and 2 specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that requirements have not been met.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for minimum 14 days after placement.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material.

E. Clogging: Vegetative matter can collect on the surface of pervious concrete. Routine sweeping or vacuuming will restore porosity. Pressure washing will restore pervious concrete to nearly new condition. Provide necessary sweeping or washing within 2 days of Substantial Completion.

3.12 MAINTENANCE INSTRUCTIONS

A. Manufacturer's representative to schedule and attend meeting with Owner's representatives to explain:
   1. Maintenance and Care Instructions.
   2. Recommended Maintenance Program.
   3. Warranty Requirements.

END OF SECTION

This Page Left Blank Intentionally

SECTION 32 16 30

CONCRETE CURB AND GUTTER (WisDOT 601)

PART 1 GENERAL

1.01 SUMMARY

A. Section includes construction of cast-in-place concrete facilities as follows:
   1. Curb and gutter.
   2. Curb.

B. Related Sections:
   1. Section 32 13 43 Porous Concrete Pavement.

1.02 REFERENCES

A. WisDOT - Standard Specifications for Highway and Structure Construction:
   1. 601 - Concrete Curb and Gutter

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials shall be in accordance with the respective WisDOT Specifications as follows:
   1. Granular Materials: WisDOT 209.
   2. Joint Filler: WisDOT 415.2.3.
   3. Concrete: WisDOT 501.
   4. Steel Reinforcement: WisDOT 505.

2.02 ACCESSORIES

A. All materials shall be in accordance with the respective WisDOT Specification as follows:
   1. Curing Materials:
      a. Plastic sheeting: WisDOT 415.2.4.
      b. Membrane curing compound: WisDOT 415.2.4.
      c. Wet fabric method: WisDOT 415.3.12.4.

2.03 CONCRETE MIX DESIGNATION

A. Concrete shall be Grade A, A-WR, A-FA or A-18.

B. All concrete shall be air entrained.

PART 3 EXECUTION

3.01 FOUNDATION PREPARATION

A. Excavate shape and compact foundation to the planned section and grade.

B. Remove unsuitable subgrade soil as directed.

C. Provide and compact granular material to the required depth as indicated on the Drawings.

3.02 INSTALLATION

A. Forms: Provide forms that are capable of sustaining the concrete in the proper line, grade, and cross section until set.

B. Joint Construction:
   1. Construct joints perpendicular to the subgrade.
   2. Align with similar joints in adjacent work.
   3. Place transverse joints at right angles to the alignment.
   4. Transverse Expansion Joints:
      a. Fill with 1/2-inch preformed joint filler material.
      b. Place as follows:
         1) At 300-foot intervals on all tangent sections.
         2) Three feet on each side of all catch basins.
         3) At the end of all curved sections.
         4) At the ends of curved portions of entrance and street returns.
         5) Where new construction surrounds or adjoins any existing fixed object.
         6) To match the locations of expansion joints in adjacent concrete pavements.
   5. Contraction Joints:
      a. Provide at 10-foot intervals in curb or curb and gutter constructions.
      b. Form or saw to a minimum 2-inch depth from all exposed surfaces.

C. Placing and Finishing:
   1. Wet foundation and inside form faces immediately prior to concrete placement.
   2. Fill all voids by hand tamping or internal vibration.
   3. Strike off to the required grade and float smooth.
   4. Hand-float top surface of curb face.
   5. Round joints and edges to 1/2-inch radii.
   6. Lightly brush all exposed surfaces to a uniform texture.
   7. Fill cavities with mortar when side forms are removed.

D. Slip-form Machine Placement:
   1. Placement by an extrusion type machine in lieu of fixed forms is permitted.
   2. Final product must meet standards for fixed-form placement.
   3. Hand finish as necessary to obtain specified finish and texture.

E. Curing and Protection:
   1. Provide curing for minimum 72 hour period after finishing.
   2. During cold weather, protect concrete from frost damage.
   3. Blanket Curing Method:
      a. Cover concrete with waterproof plastic after finishing.
      b. Envelop concrete and prevent water vapor loss.
      c. After curing, treat exposed surfaces with treating oil.
      d. Apply two coats totaling 0.06 gallon/square yard coverage.
   4. Membrane Curing Method:
      a. Coat all exposed surfaces with curing compound within 1 hour after finishing.
      b. Apply uniformly at a rate of 1 gallon per 150 square feet of surface area with an approved airless sprayer.
      c. Mix as required to maintain a homogenous mixture.
      d. Respray as directed to provide proper coating.

F. Joint Sealing: Joint sealing is not required.

G. Backfill Construction:
   1. Backfill and compact adjacent area with selected materials to the cross-section shown on the Drawings.
   2. Protect concrete from damage during backfill and compaction.

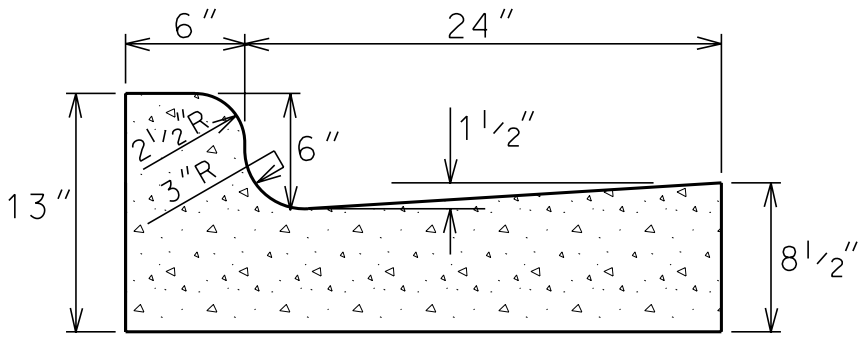
3.03 TOLERANCES

A. Finish gutter flowlines to eliminate low spots and avoid water entrapment.

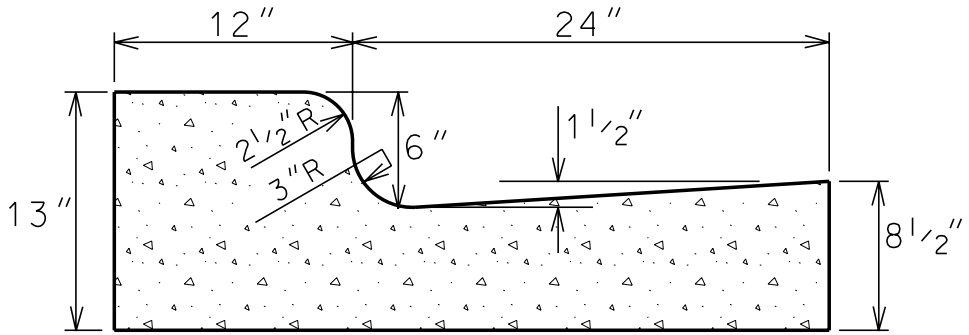
B. Deviations greater than 5/16-inch from a 10-foot straight edge on tangent lines or grades will be considered as unacceptable work.

C. Remove and replace unacceptable work as directed.

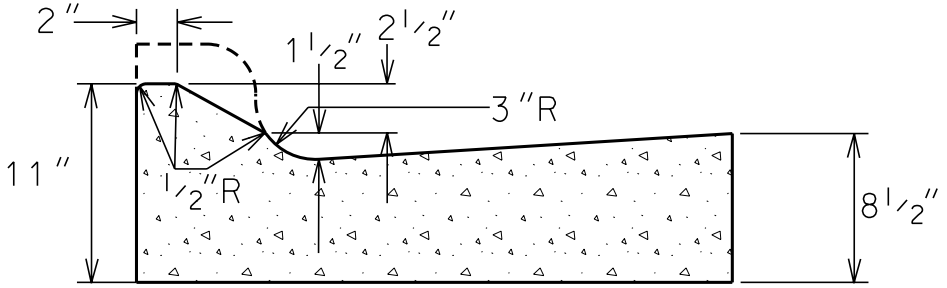
END OF SECTION



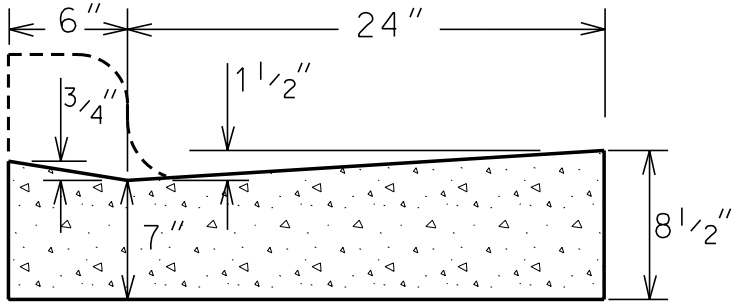
TYPE 'A' CONCRETE
CURB & GUTTER



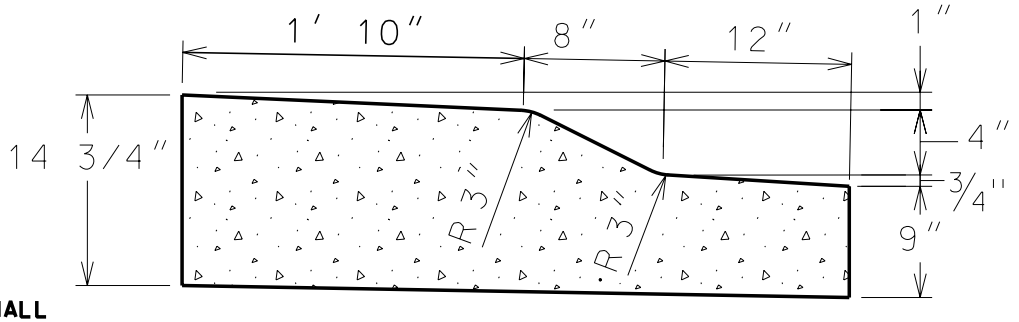
TYPE 'B' CONCRETE
CURB & GUTTER



TYPE 'A' MOUNTABLE CONCRETE CURB & GUTTER
(PAY AS TYPE 'A' CURB AND GUTTER)



DRIVEWAY SECTION TYPE 'A' CURB & GUTTER
(PAY AS TYPE 'A' CURB AND GUTTER)



TRAFFIC CIRCLE MOUNTABLE CONCRETE CURB & GUTTER

GENERAL NOTES:

LATERAL CONTRACTION JOINTS SHALL BE PLACED AT INTERVALS OF NOT MORE THAN 15′ NOR LESS THAN 6′ IN LENGTH. THE JOINTS SHALL BE A MINIMUM OF 3" IN DEPTH

EXPANSION JOINTS SHALL BE PLACED TRANSVERSLY AT RADIUS POINTS ON CURVES OF RADIUS 200′ OR LESS. AND AT ANGLE POINTS. OR AS DIRECTED BY THE ENGINEER. THE EXPANSION JOINT SHALL BE A ONE PIECE ASPHALTIC MATERIAL HAVING THE SAME DIMENSIONS AS CURB & GUTTER AT THAT STATION AND BE 1/2" THICK.

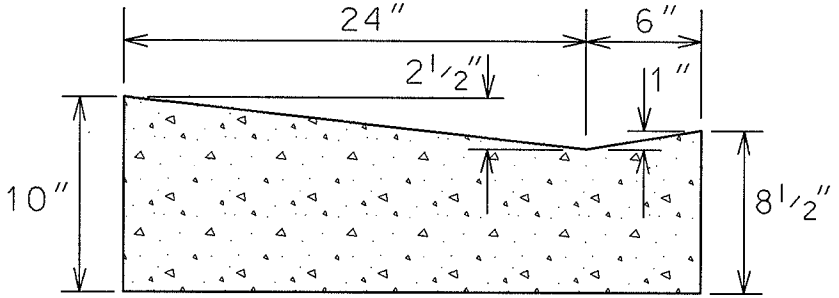
IN ALL CASES. CONCRETE CURB & GUTTER SHALL BE PLACED ON THOROUGHLY COMPACTED CRUSHED STONE

2009

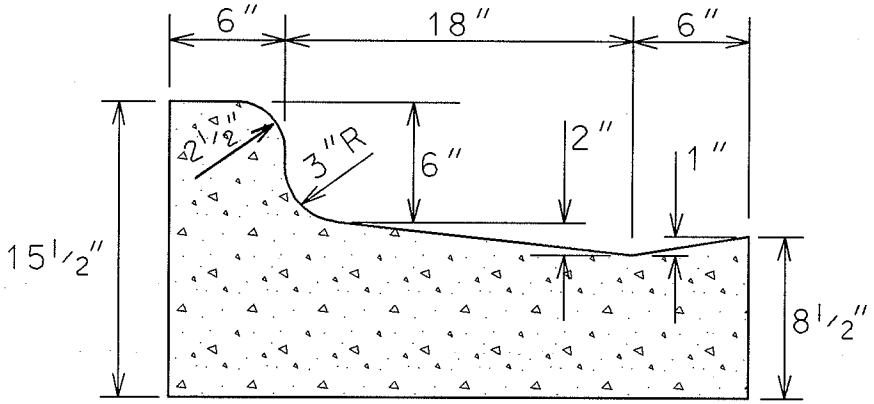
CITY OF MADISON
ENGINEERING DIVISION

MADISON STANDARD CONCRETE CURB & GUTTER

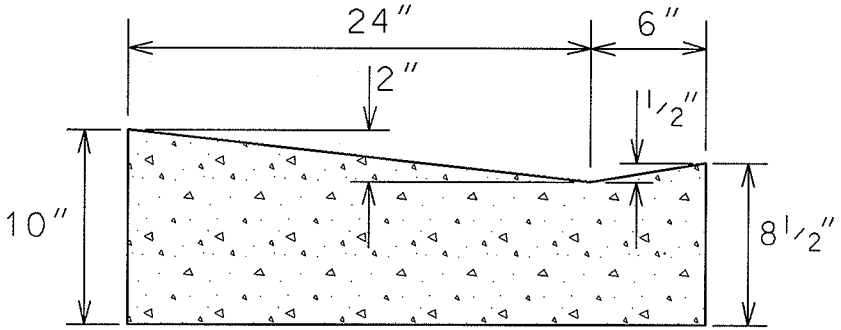
STANDARD DETAIL DRAWING 3.06



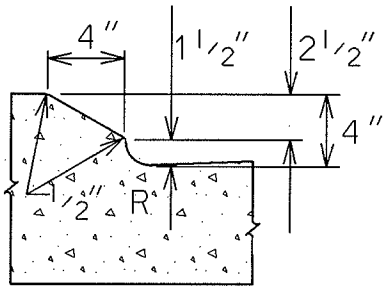
DRIVEWAY SECTION
CONCRETE CURB & GUTTER
TYPE 'X'
(PAY AS TYPE 'X' CURB & GUTTER)



TYPE 'X' CONCRETE
CURB & GUTTER



PEDESTRIAN RAMP SECTION
CONCRETE CURB & GUTTER
TYPE 'X'
(PAY AS TYPE 'X' CURB & GUTTER)



MOWER ACCESS
CURB & GUTTER
(PAY AS ADJACENT
CURB & GUTTER TYPE)

GENERAL NOTES:

LATERAL CONTRACTION JOINTS SHALL BE PLACED AT INTERVALS OF NOT MORE THAN 15' NOR LESS THAN 6' IN LENGTH. THE JOINTS SHALL BE A MINIMUM OF 3" IN DEPTH

EXPANSION JOINTS SHALL BE PLACED TRANSVERSLY AT RADIUS POINTS ON CURVES OF RADIUS 200' OR LESS, AND AT ANGLE POINTS, OR AS DIRECTED BY THE ENGINEER. THE EXPANSION JOINT SHALL BE A ONE PIECE ASPHALTIC MATERIAL HAVING THE SAME DIMENSIONS AS CURB & GUTTER AT THAT STATION AND BE 1/2" THICK.

IN ALL CASES, CONCRETE CURB & GUTTER SHALL BE PLACED ON THOROUGHLY COMPACTED CRUSHED STONE

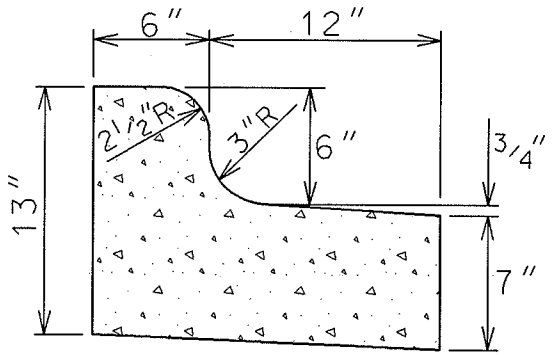
2004

CITY OF MADISON
ENGINEERING DIVISION

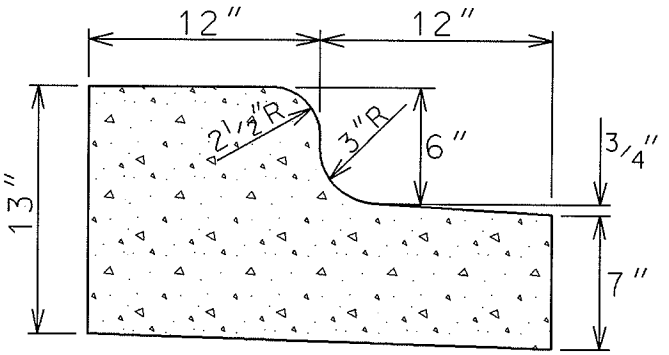
MADISON STANDARD
CONCRETE CURB & GUTTER

STANDARD DETAIL DRAWING 3.07

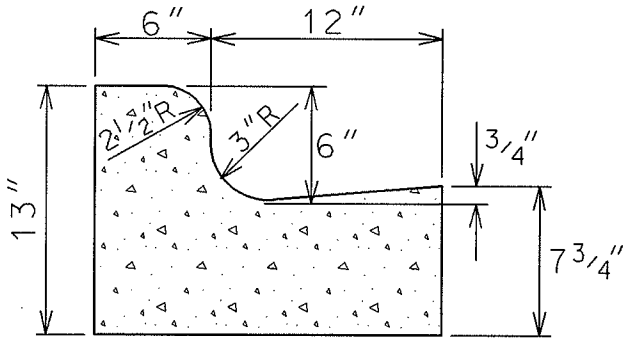
3.07



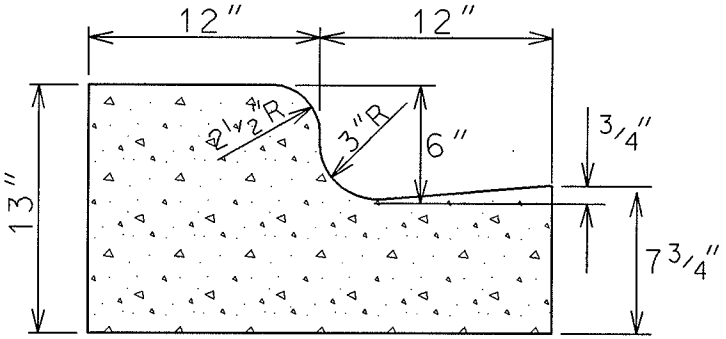
TYPE 'D' CONCRETE
CURB & GUTTER



TYPE 'E' CONCRETE
CURB & GUTTER



TYPE 'G' CONCRETE
CURB & GUTTER



TYPE 'H' CONCRETE
CURB & GUTTER

GENERAL NOTES:

LATERAL CONTRACTION JOINTS SHALL BE PLACED AT INTERVALS OF NOT MORE THAN 15' NOR LESS THAN 6' IN LENGTH. THE JOINTS SHALL BE A MINIMUM OF 3" IN DEPTH

EXPANSION JOINTS SHALL BE PLACED TRANSVERSLY AT RADIUS POINTS ON CURVES OF RADIUS 200' OR LESS, AND AT ANGLE POINTS, OR AS DIRECTED BY THE ENGINEER. THE EXPANSION JOINT SHALL BE A ONE PIECE ASPHALTIC MATERIAL HAVING THE SAME DIMENSIONS AS CURB & GUTTER AT THAT STATION AND BE 1/2" THICK.

IN ALL CASES, CONCRETE CURB & GUTTER SHALL BE PLACED ON THOROUGHLY COMPACTED CRUSHED STONE

2004

CITY OF MADISON
ENGINEERING DIVISION

MADISON STANDARD
CONCRETE CURB & GUTTER

STANDARD DETAIL DRAWING 3.08

SECTION 33 05 50

SURFACE FACILITY RESTORATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes restoration of surface facilities after utility construction as follows:
   1. Street surfaces.
   2. Base course.
   3. Curb and gutter.
   4. Sidewalks.
   5. Driveways.
   6. Shoulders.

B. Related Sections:
   1. Section 31 23 33 - Trench Excavation and Backfill

C. Method of Measurement:
   1. Aggregate Base:
      a. Measure by volume in inch - square yards.
      b. Multiply individual areas in square yards by specified depth in inches.
   2. Aggregate Surfacing: Measure by weight in tons of material acceptably placed.
   3. Asphaltic Surface:
      a. Measure by volume in inch - square yards.
      b. Multiply individual areas in square yards by specified depth in inches.
      c. Bid price includes bituminous material.
   4. Concrete Surface: Measure by area in square yards for each uniform depth.
   5. Curb and Gutter: Measure by length in linear feet.

D. Basis of Payment:
   1. Payment for acceptable quantities of Surface Facility Restoration items shall be at the contract unit price as listed on the Bid Form. All associated work items shall be considered incidental.

1.02 REFERENCES

A. WisDOT:
   1. 305 - Dense Graded Base
   2. 450 - General Requirements for Asphaltic Pavements
   3. 455 - Asphaltic Materials
   4. 460 - Hot Mix Asphalt Pavements
   5. 465 - Asphaltic Surface
   6. 501 - Concrete
   7. 601 - Concrete Curb and Gutter
   8. 602 - Concrete Sidewalks, Loading Zones, Safety Islands, and Steps

1.03 SUBMITTALS

A. Provide for each aggregate material:
   1. Name and location of source.
   2. Sample gradation.

B. Provide for asphaltic mixture:
   1. Mix design report.

1.04 SCHEDULING

A. Restore all surface facilities within 72 hours after removal.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregate Base Materials: WisDOT 305, 1 1/4-inch gradation.

B. Aggregate Surfacing Material: WisDOT 305, 3/4-inch gradation.

C. Tack Coat: WisDOT 455.

D. Asphaltic Patching Mixtures: WisDOT 465.

E. Concrete: WisDOT 501, Grade A.

PART 3 EXECUTION

3.01 PREPARATION

A. Asphaltic Surface:
   1. Saw cut existing bituminous to provide a clean straight edge.
   2. Place tack coat on all edges.

B. Concrete:
   1. Provide a clean straight edge on abutting concrete by breakage at an existing joint or by saw cutting.
   2. Install 1/2-inch preformed expansion joint against all abutting concrete.

3.02 CONSTRUCTION REQUIREMENTS

A. Aggregate Base:
   1. Place material to a uniform depth as specified.
   2. Mechanically compact to a Standard Proctor Density of 100 percent.

B. Aggregate Surfacing:
   1. Place material to a uniform depth as specified.
   2. Compact to a Standard Proctor Density of 100 percent.

C. Asphaltic Surfaces:
   1. Place adequate material to provide proper depth when compacted.
   2. Compact until all roller marks are eliminated and there is no further evidence of consolidation.
   3. Surface shall be flush with adjacent surfaces and within 1/8 inch of a 10-foot straight edge in all directions.
   4. Surface shall be smooth and free of open sections.

D. Asphaltic Curb:
   1. Place by means of an approved curb machine that shapes and compacts the mixture to the designated cross section.
   2. Place to staked line and grade.
   3. Finished curb shall be uniform in appearance and texture.

E. Concrete Curb and Gutter:
   1. Install forms to provide designated cross section.

2. Place and compact concrete in a manner to avoid segregation.
3. Provide a light brush finish on all exposed surfaces.

F. Concrete Surfaces:
1. Place and compact concrete in accordance with WisDOT 602.
2. Surface shall be flush with adjacent surfaces.
3. Provide a light brush finish on all exposed surfaces.

END OF SECTION

This Page Left Blank Intentionally

SECTION 33 11 00

WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Water main pipe and fittings.
   2. Valves and boxes.
   3. Hydrants.
   4. Services.
   5. Insulation.

B. Related Sections:
   1. Section 31 23 33 - Trench Excavation and Backfill
   2. Section 33 05 50 - Surface Facility Restoration

1.02 REFERENCES

A. ASTM:
   1. A126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings
   2. A536 - Ductile Iron Castings
   3. B88 - Seamless Copper Water Tube
   4. B152 - Copper Sheet, Strip, Plate, Rolled Bar
   5. D429 - Tests for Rubber Adhesion to Rigid Surfaces
   6. D2842 - Test for Water Absorption of Rigid Cellular Materials
   7. D1248 - Polyethylene Plastics Extrusion Materials for Wire and Cable
   8. F593 - Stainless Steel Bolts, Hex Cap Screws, and Studs
   9. F594 - Stainless Steel Nuts

B. AWWA:
   1. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
   2. C150 - Thickness Design of Ductile Iron Pipe
   3. C151 - Ductile-Iron Pipe, Centrifugally Cast for Water or other Liquids
   4. C153 - Ductile-Iron Compact Fittings for Water Service
   5. C502 - Dry-Barrel Fire Hydrants
   6. C504 - Rubber-Seated Butterfly Valves
   7. C509 - Resilient-Seated Gate Valves for Water Supply Service
   8. C515 - Reduced-Wall, Resilient-Seated Gate Valves, for Water Supply Service
   9. C600 - Installation of Ductile Iron Water Mains and their Appurtenances
   10. C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
   11. C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch for Water Distribution

1.03 SUBMITTALS

A. Submit Certificate of Compliance for products listed under Article 1.04.

B. Submit proposed method of joint conductivity.

1.04 QUALITY ASSURANCE

A. Provide Certificates of Compliance from the manufacturer certifying that the following products meet the respective requirements listed in Article 1.02:
   1. Water Main Piping
   2. Valves

3. Hydrants

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspection:
   1. Inspect all pipe and products during the unloading process.
   2. Notify Engineer of any cracked, flawed or otherwise defective products.
   3. Remove all products found to be defective by the Engineer from the Site.

B. Handling and Storage: Handling and storage of products shall be in accordance with Section 2.2 of AWWA C600.

PART 2 PRODUCTS

2.01 WATER MAIN PIPE

A. Ductile Iron: AWWA C151.

B. Cement-Mortar Lining: AWWA C104.

C. Thickness Class: 52.

D. Joints: Push-On.

E. Joint Conductivity:
   1. Conductive gaskets as manufactured by American Ductile Iron Pipe Co.
   2. Field Application Methods:
      a. Burndy - Thermoweld by Burndy Corp., Norwalk, Connecticut.
      b. Cadweld by Erico Products Co., Cleveland, Ohio.
   3. Copper Jumpers:
      a. Minimum 1/16-inch by 1/2-inch wide flat copper strip.
      b. Annealed round copper wire conforming to ASTM B152, Type DHP.
   4. Nuts and Bolts: Silicon Bronze.

2.02 FITTINGS

A. Ductile Iron: AWWA C153.

B. Cement-Mortar Lining: AWWA C104.

C. Joints: Mechanical with ASTM F593 and F594 type 304 Stainless Steel bolts and nuts.

2.03 VALVES AND BOXES (VALVES 12 INCHES AND SMALLER)

A. Gate Valves:
   1. Resilient Seated: AWWA C515.
   2. Working Pressure: 200 psi.
   3. Ends: Mechanical Joint with ASTM F593 and F594 type 304 Stainless Steel bolts and nuts.
   4. Operating Stem: Non-Rising with O-ring Seals.
   5. Operating Nut: 2-inch Square, Open Left.
   6. Markings to be cast on the bonnet or body:
      a. Open indicating arrow.
      b. Manufacturer’s name.
      c. Pressure rating.
      d. Year of manufacture.
      e. Size.
   7. Type: Kennedy, Mueller, Clow

B. Butterfly Valves (Valves 16 inches and larger):
   1. Rubber Seated: AWWA C504.
   2. Class: 150B.
   3. Body Type: Mechanical - Joint-End with ASTM F593 and F594 type 304 Stainless Steel bolts and nuts.
   4. Disc:
      a. 316 stainless steel edge
      b. 3-inch thru 24-inch: ASTM A126 Class B Cast Iron
      c. 30-inch and larger: ASTM A536 Ductile Iron
   5. Seat:
      a. 3-inch through 20-inch: Bond to body per ASTM D429, Method B.
      b. 24-inch and larger: Retain in body without use of metal retainers.
   6. Operator:
      a. Traveling nut actuator
      b. Open left.
   7. Markings to be cast on the body:
      a. Open indicating arrow.
      b. Manufacturer's name.
      c. Class.
      d. Year of manufacture.
      e. Size.
   8. Type: Kennedy, Mueller

C. Ball Valves:
   1. Provide 2-inch and smaller, 2-way, ball valves for use with 2-inch and smaller tube and piping systems.
      a. Body: Brass.
      b. Ball stem, packing washers, seat retainers, and ball retainers: Brass
      c. Port adapters, packing nut: Brass.
      d. Handle: Nylon.
      e. Ball seat: Teflon.
      f. Adapter and retainer seals: Teflon.

D. Sampling Faucets
   1. Provide smooth nosed sampling faucet consisting of a downturned Y.inch copper pipe elbow of 4 inch length suitable for bacteriological sampling and torching, connected to 1/2-inch pipe inlet connection and tee or lever handle isolation valve.

E. Altitude Valves:
   1. Globe style sixteen inch, two way flow altitude valve
   2. Install valve as shown on drawings with following:
      a. All standard valve features.
      b. Dry drain provisions
      c. Reservoir sensing line of % inch insulated copper line to inlet riser pipe with isolation valves.
   3. Type: Cla-Val Model 210

F. Boxes:
   1. Cast Iron, 5-1/4-inch shaft.
   2. Vertical, 3 piece, Buffalo type.
   3. Box length to provide for 8 feet of pipe cover.
   4. Adjustable to 6 inches up or down from standard box length.
   5. Type: Bringham and Taylor

2.04 HYDRANTS

A. Refer to the City of Madison's Standard Specifications for installation details.

B. Dry Barrel: AWWA C502.

C. Waterous Pacer WB67 or equal.

D. Hose Connections: 2 each at 2-1/2-inch diameter.

E. Steamer Connection: 1 each at 4-1/2-inch diameter.

F. Threads: National Standard.

G. Operating Stem: Open Left with O-ring Seals.

H. Traffic flange.

I. Hub: 6-inch Mechanical Joint with ASTM F593 and F594 type 304 Stainless Steel bolts and nuts.

J. Main Valve Opening: 5-inch diameter.

K. Barrel Diameter: 5-inch.

L. Drain to operate only when hydrant is closed.

M. Bury Depth: 8 feet (ground to bottom of hub).

N. Minimum Nozzle Height (from flange): 16 inches.

O. Cap Nuts: Pentagon.

P. Color: Red.

Q. Provide permanent markings which indicate:
   1. Manufacturer's name.
   2. Year of manufacture.
   3. Bury depth.

2.05 SAMPLING FAUCET

A. Provide smooth nosed sampling faucet consisting of a downturned Y.inch copper pipe elbow of 4 inch length suitable for bacteriological sampling and torching, connected to 1/2-inch pipe inlet connection and tee or lever handle isolation valve.

2.06 SERVICE PIPE

A. Copper: ASTM B88.

B. Type: K, Soft.

2.07 CORPORATION STOPS

A. Type: For 1" Use Mueller H-9971, For 1-2" Use Mueller H-9971.
   1. Inlet: AWWA taper thread.
   2. Outlet: Copper flare straight connection.

2.08 CURB STOPS AND BOXES

A. Valve:
   1. Type: Mueller H-15154 Mark II Oriseal, or equal.
      a. Inlet: Copper Service Thread.
      b. Outlet: Copper Service Thread.

B. Box:
   1. Type: Bingham and Taylor 94F or equal.
   2. Length: 7 feet.
   3. Upper Section Diameter: 2 ½ inch
   4. Adjustable to 6 inches up or down from specified length.
   5. Provide stationary rod and guide rings.

2.09 INSULATION

A. Rigid, extruded polystyrene board insulation.

B. Thermal Resistance (R): 5.0.

C. Thickness: 2-inch.

D. Board Size: 48-inch by 96-inch.

E. Compressive Strength: Minimum 25 psi.

F. Water Absorption in accordance with ASTM D2842: 0.1 percent by volume, maximum.

G. Edges: Square.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Connection to Existing System:
   1. Pressure Tap:
      a. Install tap in location shown on the Drawings.
      b. Use approved tapping machine designed specifically for tapping under pressure.
      c. Install tapping sleeve and gate valve as part of assembly.
      d. Install blocking as required.
   2. Cut-In Connection:
      a. Isolate segment of pipe to be cut and drain water from the line.
      b. Connect tee and sleeve assembly to pipe ends.
      c. Install blocking as required.
   3. Connect to Inplace Fitting:
      a. Isolate segment of inplace pipe and remove blocking as required.
      b. Remove plug and drain water from the line.
      c. Install blocking as required.

B. Pipe Installation:
   1. Install pipe at the alignment and grade shown on the Drawings.
   2. Provide a minimum of 8 feet of cover over the pipe.
   3. Install appurtenances in the locations shown on the Drawings.
   4. Remove all dirt and foreign material from the pipe interior prior to installation.
   5. See Section 31 23 33 for pipe foundation and backfill procedures.
   6. See Section 31 23 33 in case of conflicts with existing pipes.

C. Valve and Box Installation:
   1. Verify that subgrade material is adequate to support valve assembly.
   2. Install valves with stems vertical and plumb.
   3. Install boxes plumb and centered over the valve nut.
   4. Verify that box remains plumb and centered during backfill.
   5. Adjust box cover to required grade.

D. Hydrant Installation:
   1. Verify that subgrade material is adequate to support hydrant.
   2. Place thrust block, crushed rock and tar paper in accordance with Drawing details.
   3. Install and maintain hydrant in a plumb position.
   4. Where groundwater is present, plug drain hole and affix “Pump After Use” tag to the hydrant.

E. Joint Conductivity:
   1. Provide electrical bond across all joints between pipes and appurtenances.
   2. Install copper jumpers by either shop or field applications.
   3. Fasten multiple jumper strips with silicon bronze bolts and nuts.
   4. Welding:
      a. Grind surfaces to be welded to remove coating and oxide and to provide clean metal surface.
      b. Use metallic-arc process for stop applications.
      c. Use exothermic process for field applications.
      d. Refinish welded area with protective coating after connection is made.

F. Thrust Restraint:
   1. Install thrust restraints at all bends, tees and plugs.
   2. Concrete Blocking:
      a. Place between the fitting and undisturbed trench wall.
      b. Minimum thickness: 12 inches.
      c. Minimum area in square feet shall be in accordance with the following:

Pipe	Tee or Plug	1/4 Bend	1/32 and 1/8 Bend	1/16 Bend
6-inch	2.9	3.1	1.6	0.8
8-inch	3.7	5.3	2.9	1.4
10-inch	5.7	8.1	4.4	2.2
12-inch	8.1	13.4	6.6	3.2
16-inch	15.1	21.4	11.6	5.9
20-inch	23.2	30.2	18.1	9.3
24-inch	33.6	48.5	26.1	13.3

      d. Size blocking based on the larger main.
      e. Verify that bolts are accessible after concrete is poured.
   3. Restrained Joints:
      a. Submit method and type to Engineer for approval.
      b. Install in accordance with “Thrust Restraint Design for Ductile Iron Pipe”.

G. Service Installation:
   1. Curb Stop and Box:
      a. Install at the location shown on the Drawings.
      b. Verify that subgrade material is adequate to support the curb box assembly.
      c. Install boxes plumb and centered over the tee head.
      d. Verify that box remains plumb and properly aligned during backfill.
      e. Adjust box cover to required grade.
      f. Key all curb stops after backfill to ensure proper operation.

3.02 FIELD QUALITY CONTROL

A. Perform the following tests upon completion of the system and prior to being placed into service:
   1. Pressure and Leakage Test:
      a. Perform pressure and leakage test in accordance with AWWA C600.
      b. Test Pressure: 150 psi.
      c. Test Duration: 2 hours.
      d. Gage Requirements:
         1) Size: 4-1/2-inch dial.
         2) Range: 0 to 200 psi.

3) Gradation: 2 psi.
4) Accuracy: 1/2 percent.

e. Do not allow pressure to vary more than 5 psi during the test.
f. Do not allow pressure to vary more than 2 psi during the last hour of the test.
g. Allowable Leakage: One-half of the volume allowed by AWWA C600 in accordance with the following:

$$L = \frac{SD\sqrt{P}}{266{,}400}$$

L = Allowable Leakage in Gallons Per Hour

S = Length of Pipe Tested in Feet

D = Nominal Diameter of Pipe in Inches

P = Average Test Pressure During Test in Pounds/Square Inch (Gage)

2. Testing Services:
   a. Perform separate pressure and leakage test on the services with the corporation stops open.
   b. Test Pressure: 100 psi.
   c. Allowable Leakage: None.
   d. At Contractor's option, service testing may be done concurrent with main testing.
3. Electrical Conductivity Test:
   a. Perform electrical conductivity test to verify that electrical thawing of the system may be accomplished by Owner.
   b. Test Parameters:
      1) Perform test within 1 week after pressure testing.
      2) Perform test after back-filling is completed and while line is at normal operating pressure.
      3) Test Current: 350 amperes DC plus or minus 10 percent.
      4) Test Duration: 5 minutes.
      5) Test between hydrants in segments of convenient length.
   c. Procedures:
      1) Furnish DC current source, cable and all required equipment of adequate capacity to accomplish the test.
      2) Clamp cables to hydrant flange bolts.
      3) Conduct test with hydrant in the open position and caps on.
      4) Measure current continuously throughout the test with a DC ammeter hooked on a cable lead.
      5) Start test at minimum current level and increase to test level.
      6) Drain hydrant and tighten caps after test.
   d. Failure and Correction:
      1) Failure of a segment shall be determined by current measurements that are insufficient, intermittent or unsteady.
      2) Isolate and correct defective contact points as indicated by failed tests.
      3) Retest failed segments after correction.

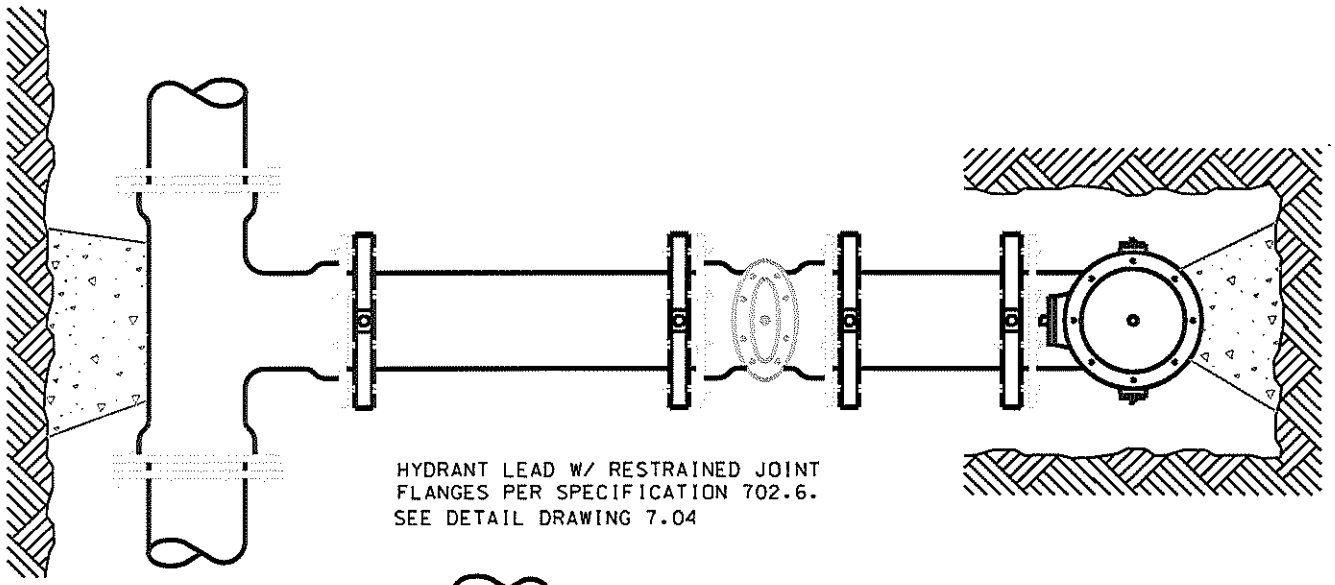
3.03 DISINFECTION

A. Disinfect all newly installed water mains, appurtenances and services in accordance with AWWA C651.
   1. Tablet or Continuous Feed Method:
      a. Hold chlorine solution in pipe for a minimum period of 24 hours.
         1) Initial dosage: 50 ppm minimum.
         2) Residual dosage after hold period: 10 ppm minimum.

B. Flush system within 24 hours after disinfection is completed.

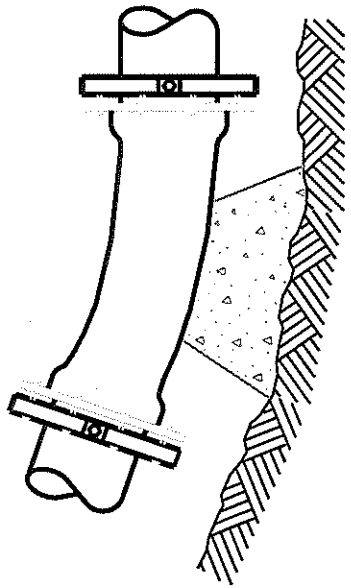
C. Sampling and Testing:
   1. After final flushing, obtain 2 sets of samples taken a minimum of 24 hours apart.
   2. Each sample set shall include:
      a. One sample for every 1,200 feet of main.
      b. One sample at each dead-end.
      c. Ensure that 1 sample is obtained from each branch of main.
      d. Minimum sample required: 2
   3. Perform coliform tests on each sample.
   4. Rechlorinate if any sample tests positive for coliform.

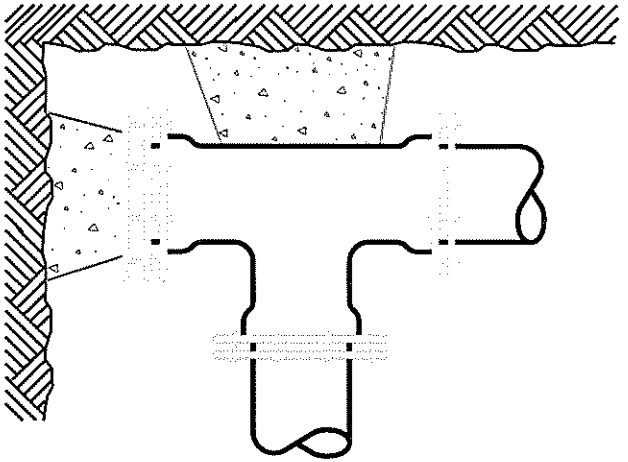
END OF SECTION

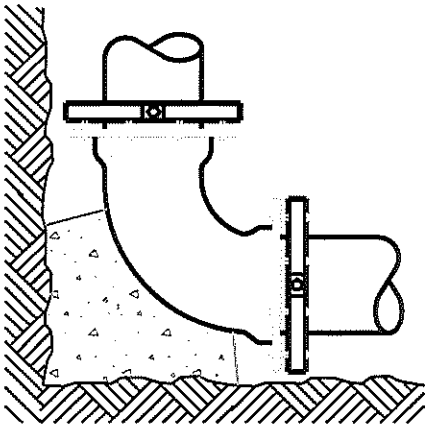


HYDRANT LEAD W/ RESTRAINED JOINT FLANGES PER SPECIFICATION 702.6. SEE DETAIL DRAWING 7.04

REQUIRED BEARING AREA PER MASTER SPECIFICATIONS SECTION 703.







NOTE: ALL PIPES BENDS SHALL HAVE RESTRAINED JOINT FLANGES PER SPECIFICATION 702.6. IN ADDITION TO CONCRETE THRUST BLOCKING.

DENOTES UNDISTURBED SOIL

DENOTES POURED CONCRETE

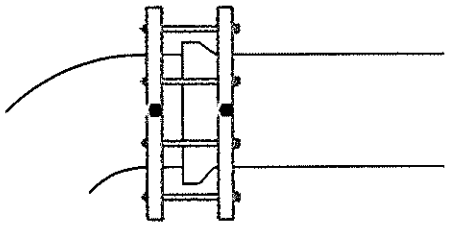
REVISED 1/2008

CITY OF MADISON
WATER UTILITY

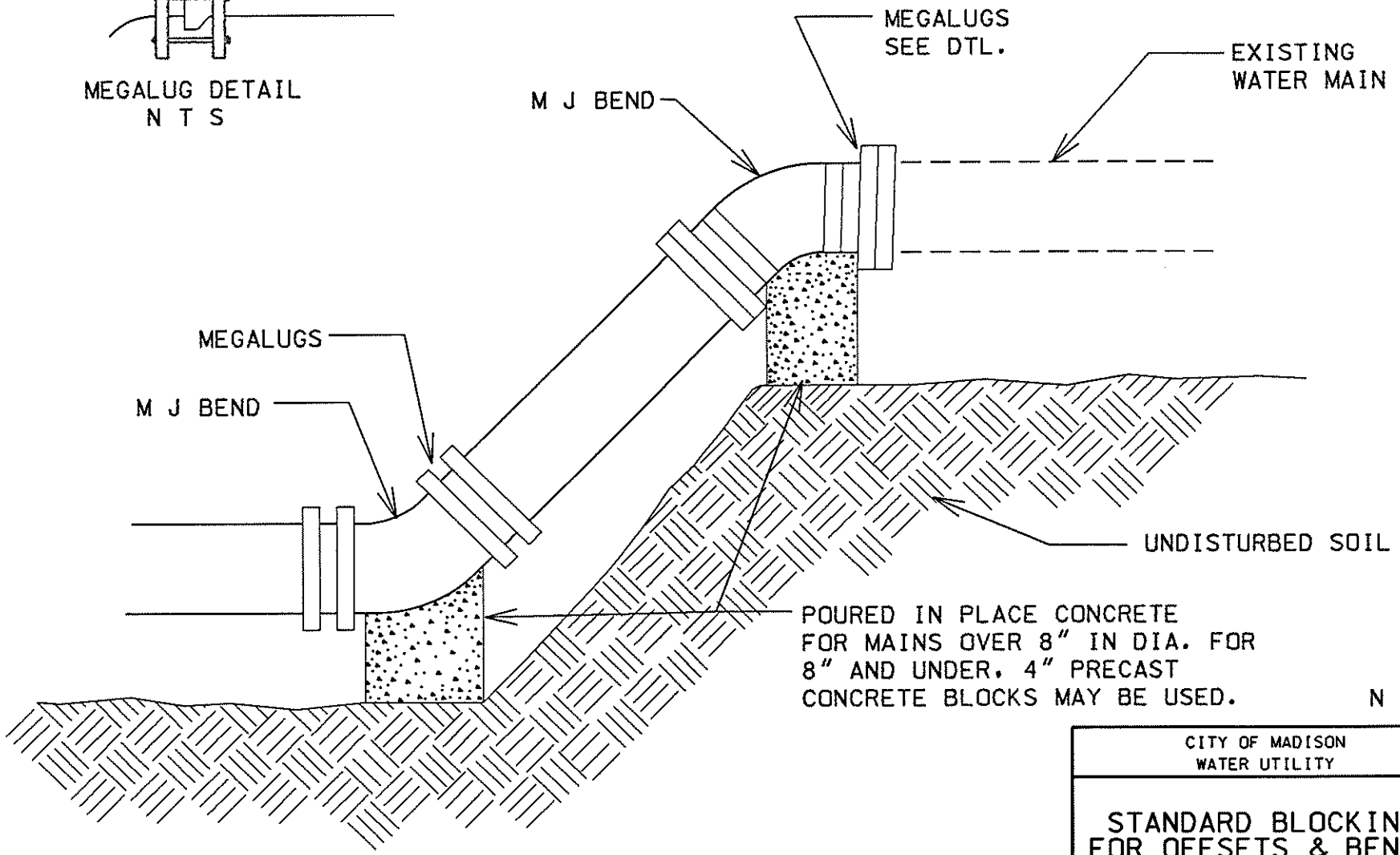
STANDARD THRUST BLOCKING

STANDARD DETAIL DRAWING 7.03

7.03



MEGALUG DETAIL
N T S



N T S

CITY OF MADISON
WATER UTILITY

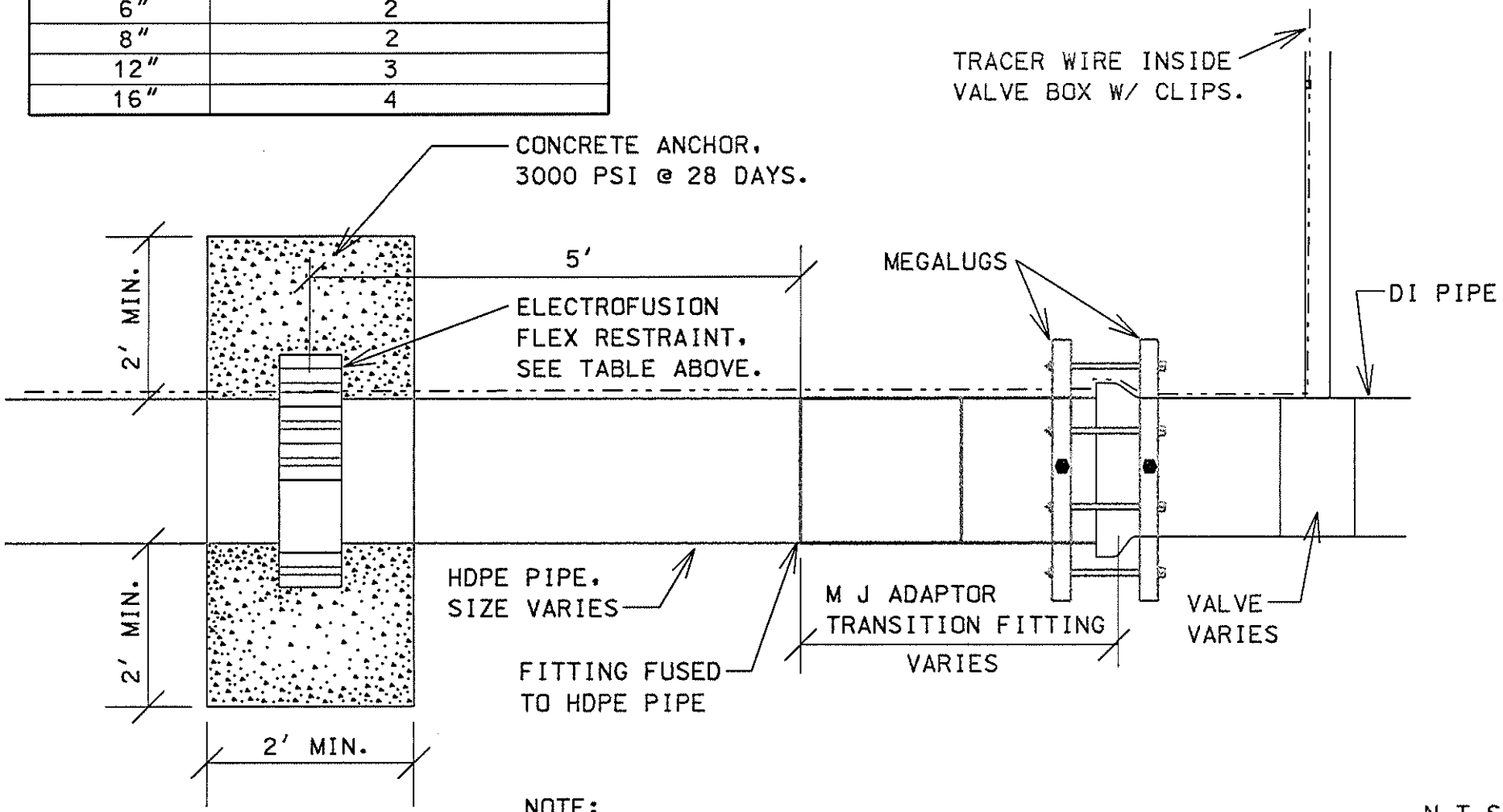
STANDARD BLOCKING FOR OFFSETS & BENDS

STANDARD DETAIL DRAWING 7.10

1/2012 TLR

7.10

PIPE SIZE	NO. OF FLEX RESTRAINTS
6"	2
8"	2
12"	3
16"	4



NOTE:
CONCRETE ANCHOR TO COMPLY W/ ARTICLE 301 IN THE STANDARD SPECS.

SEE PIPE MANUFACTURERS STANDARDS FOR ADDITIONAL INFORMATION. FIELD ENGINEER MUST APPROVE VARIANCES.

N T S

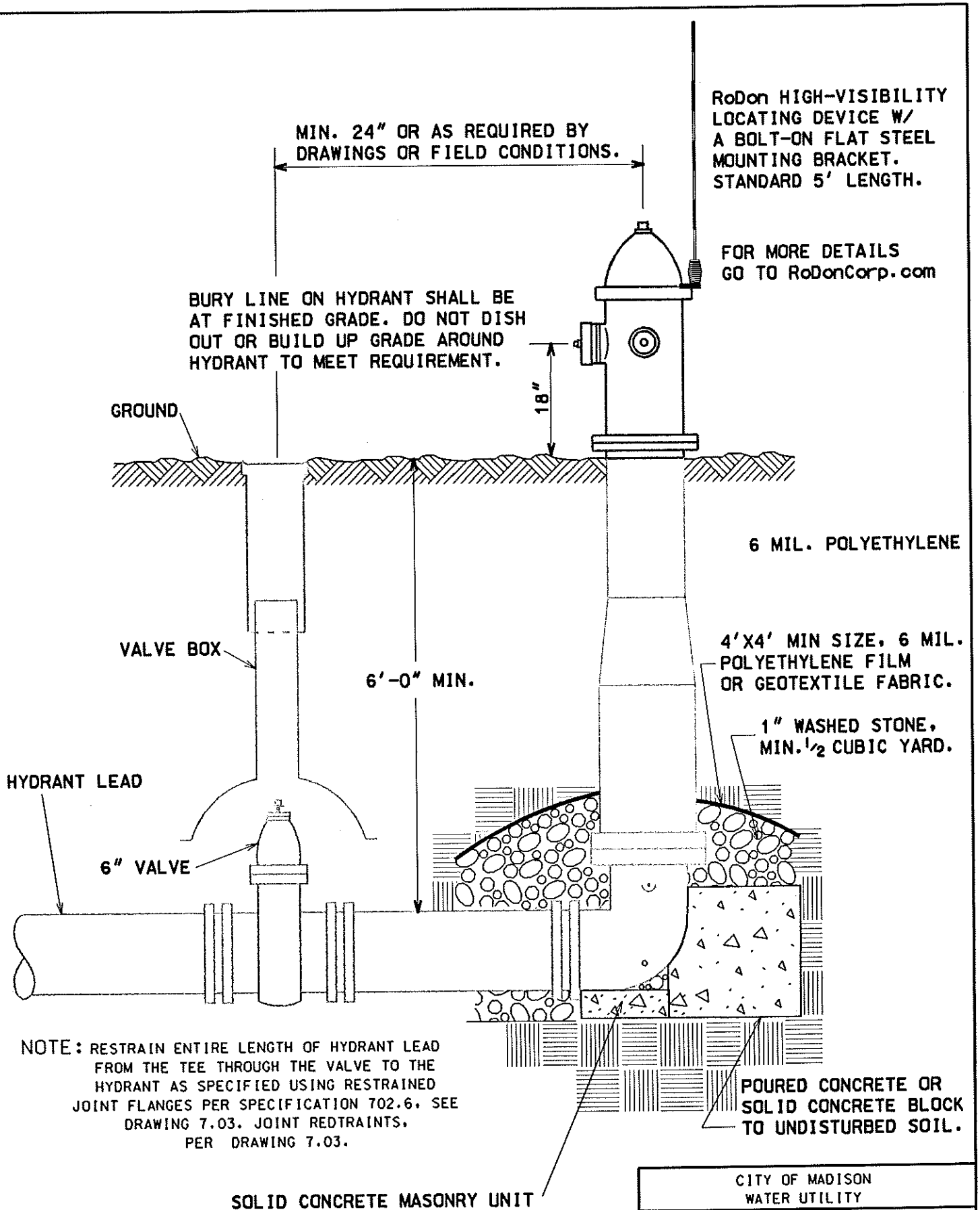
1/2012 TLR

CITY OF MADISON
WATER UTILITY

STANDARD HDPE PIPE RESTRAINTS

STANDARD DETAIL DRAWING 7.08

7.08



NOTE: RESTRAIN ENTIRE LENGTH OF HYDRANT LEAD FROM THE TEE THROUGH THE VALVE TO THE HYDRANT AS SPECIFIED USING RESTRAINED JOINT FLANGES PER SPECIFICATION 702.6. SEE DRAWING 7.03. JOINT REDTRAINTS, PER DRAWING 7.03.

CITY OF MADISON
WATER UTILITY

TYPICAL HYDRANT INSTALLATION

STANDARD DETAIL DRAWING 7.04

REVISED 12/2009

SECTION 33 11 01

HYDRODYNAMIC MIXING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. The Hydrodynamic Mixing System (HMS) shall be a passive multi-port manifold pipe that utilizes multiple NSF61 Certified Variable Orifice Duckbill Check Valve Inlet Nozzles and Wafer Style Outlet Check Valves. The system shall accomplish complete mixing of the tank water volume passively, without the use of mechanical pumps or blowers or other equipment with motor drives or continuously moving parts, such as mechanical mixers.

B. The variable orifice duckbill valves and wafer check valves shall be NSF61 Certified. NSF61 approved/Certified materials will not be accepted in lieu of valve certification.

C. All hydraulic and mixing calculations pertaining to the HMS shall originate and be certified and sealed by a professional engineer from the duckbill valve manufacturer. Calculations provided by parties other than the duckbill valve manufacturer are not allowed.

D. The HMS manufacturer shall be responsible for designing the HMS in accordance with the hydraulic characteristics of this specific tank and must submit all certifications, test reports, drawings, and design calculations listed in the “Submittals” section. System submittals that do not contain this information shall not be considered as a viable Hydrodynamic Mixing System (HMS) and shall not be accepted as an equivalent to this system specification.

E. The complete Hydrodynamic Mixing System (HMS) shall be supplied by the variable orifice duckbill valve manufacturer to maintain single source responsibility for the system. The complete system shall be defined as all piping and appurtenances within the tank downstream of the tank penetration. Appurtenances include pipe, fittings, horizontal and vertical pipe supports, expansion joints, variable orifice duckbill check valves, and any other equipment specified within this section of the specifications. Approved manufacturer is Red Valve/Tideflex Technologies, Carnegie, PA 15106.

1.02 SUBMITTALS

A. Independent CFD Modeling Validation
   1. The mixing system designer/supplier must supply data or report from at least one project where an independent company conducted CFD modeling on their mixing system design and the modeling results verified the design achieved complete mixing.

1.03 FULL SCALE TRACER STUDY VALIDATION

A. The mixing system designer/supplier must supply data or report from at least one project where a full scale tracer study using calcium chloride was conducted on a circular reservoir and the tracer study verified their mixing system design achieved complete mixing

1.04 NSF61 CERTIFICATION

A. Copy of the NSF61 Certified listing for the valves used in the Hydraulic Mixing System (HMS).

B. The valves themselves must be NSF61 certified, not just the elastomer used in construction of the valves. NSF61 approved/certified materials will not be accepted in lieu of valve certification.

1.05 TEST REPORT ON ELASTOMER EXPOSURE TO CHLORINE AND CHLORAMINE

A. Copy of test report from an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 “Standard Test Method for Rubber Property – Effect of Liquids.”

1.06 SYSTEM INSTALLATION DRAWINGS

A. The HMS manufacturer shall be responsible for providing engineering installation drawings of the complete manifold piping system as supplied by the manufacturer. These drawings shall include plan view piping arrangement, sections and elevations as required, support bracket installation details, duckbill nozzle orientation details, and all dimensions required for locating the system within the specified dimensions of the tank.

B. Six (6) sets of plans shall be provided to the Engineer for review and approval.

C. Two (2) sets of final fabrication and installation drawings shall be included with the shipment of the manifold piping equipment.

1.07 HYDRAULIC AND MIXING CALCULATIONS

A. All Design Calculations, curves, and reference information listed below must originate and be submitted by the duckbill valve manufacturer. Calculations, curves, and reference information provided by contractors relating to the HMS are not allowed. The duckbill valve manufacturer must include within the submittal package the following design calculations, curves, and reference information:

1. Calculations showing the fill time required, under isothermal conditions, for the HMS system to achieve complete mix of the reservoir volume at minimum, average and peak fill rates. Complete mixing defined as 95% homogenous solution. The theory and equations used in calculating the mixing times must be as described in the Rossman, L.A. and W.M. Grayman (1999) reference.

2. A representative Computational Fluid Dynamics (CFD) model evaluation of the proposed HMS system configuration applied within a reservoir of similar geometry. Model output documentation shall include all design variables applied for the simulation, plot of the 3-D geometry showing the mesh definition, velocity magnitude vector and contour plots at different cross-sections throughout the water volume, simulated tracer animations showing the spatial and temporal distribution of inlet water in real time during the fill cycle.

3. Hydraulic calculations showing the resulting jet velocities of each inlet nozzle at minimum, average, and peak fill rates.

4. Hydraulic calculations showing the flow distribution among all inlet ports at minimum, average, and peak fill rates.

5. Manifold hydraulic calculations showing the total headloss of the HMS at minimum, average, and peak fill and draw rates. Headloss shall include all minor losses and headloss of nozzles and outlet check valves.

6. Hydraulic curves showing thrust vs. flow for the inlet nozzles.

7. Hydraulic curves for each outlet check valves showing headloss vs. flow.

8. Calculations showing the terminal rise height of the jets that discharge at an angle above horizontal. The terminal rise height shall be calculated assuming 10ºF and 20ºF colder inlet water and calculated at minimum, average and peak fill rates. The theory and equations used to calculate the terminal rise height shall be included.

9. If the calculations and supporting data provided do not show compliance with the hydrodynamic requirements of the system as interpreted by the Engineer or Owner then the submittal shall be rejected.

PART 2 PRODUCTS

2.01 VARIABLE ORIFICE DUCKBILL INLET NOZZLES

A. Inlet ports/nozzles shall be duckbill-style check valves that allow fluid to enter the reservoir during fill cycles and prevent flow in the reverse direction through the nozzle during draw periods. Inlet ports/nozzles may not be fixed-diameter ports or pipes.

B. The duckbill valves shall be NSF61 Certified. NSF61 approved/Certified materials will not be accepted in lieu of valve certification.

C. Inlet ports/nozzles shall have a variable diameter vs. flow hydraulic profile that provides a non-linear jet velocity vs. flow characteristic and a linear headloss vs. flow characteristic. The hydraulic characteristics of the duckbill valves shall be defined by “Hydraulic Code”.

D. The inlet ports/nozzles shall discharge an elliptically shaped jet. The nozzle must have been modeled by an independent laboratory using Laser Induced Fluorescence (LIF).

E. Manufacturer shall have conducted independent hydraulic testing to determine headloss and jet velocity characteristics on a minimum of eight (8) sizes of duckbill valves ranging from 2” through 48”. The testing must include multiple constructions (stiffness) within each size and must have been conducted for free discharge (discharge to atmosphere) and submerged conditions.

F. Manufacturer shall have conducted an independent hydraulic test where multiple valves (at least four) of the same size and construction (stiffness) were tested to validate the submitted headloss characteristics and to prove the repeatability of the manufacturing process to produce the same hydraulic characteristics.

G. Manufacturer shall have conducted independent hydraulic testing to study the flow distribution characteristics of duckbill valves installed on multiport manifolds.

H. Manufacturer to have conducted Finite Element Analysis (FEA) on various duckbill valves to determine deflection, stress, and strain characteristics under various load conditions. Modeling must have been done for flowing conditions (positive differential pressure) and reverse differential pressure.

I. Manufacturer must have conducted in-house backpressure testing on duckbill valves ranging from ¾” to 48”.

J. Manufacturer shall have at least fifteen (15) years experience in the manufacturing of “duckbill” style elastomeric valves.

K. Manufacturer must have duckbill valves installed on manifold piping systems in at least 100 distribution system reservoirs.

L. Manufacturer must have representative inspection videos showing the duckbill valves discharging water into the reservoir during an initial fill (unsubmerged). Manufacturer must also have representative underwater inspection videos showing the operation of the valves when submerged. Representative videos can be submitted upon request from the engineer.

M. The duckbill style nozzles shall be one-piece elastomer matrix with internal fabric reinforcing designed to produce the required discharge velocity and minimum headloss requirements as stipulated in the Submittals section. The flange portion shall be an integral portion of the nozzle with fabric reinforcing spanning across the joint between the flange and nozzle body.

N. The elastomer used in construction of the duckbill valves must have been tested by an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 “Standard Test Method for Rubber Property – Effect of Liquids.”

O. The manufacturer’s name, plant location, serial number and product part number which designates nozzle size, material and construction specifications shall be bonded onto the surface of the nozzle.

2.02 OUTLET CHECK VALVES

A. The outlet flow valves shall be perforated disc type with elastomeric membrane.

B. The valves shall be NSF61 Certified. NSF61 approved/Certified materials will not be accepted in lieu of valve certification.

C. The perforated disc shall be fabricated of stainless steel plate with welded support gussets. The disc shall be flanged and drilled to mate with ANSI B16.1, Class 125/ANSI B16.5 Class 150 flanges. The disc shall have three (3) tapped holes used for fastening the membrane and support rod to the disc with stainless steel bolts, nuts, and lock washers. The top of the disc shall be tapped and supplied with lifting eyebolt for installation.

D. The membrane shall be circular, one piece rubber construction with fabric reinforcement. The diameter of the membrane shall allow adequate clearance between the membrane O.D. and the pipe I.D. The membrane shall be vulcanized with a specified convex radius to produce a compression set to allow the membrane to seal against the perforated disc at low reverse differential pressure.

E. The support rod shall be stainless steel and drilled with three (3) longitudinal holes to allow fastening of rod to membrane and perforated disc.

F. When line pressure inside the valve exceeds the backpressure outside the valve, the line pressure forces the membrane to open, allowing flow to pass through the perforations in the disc. When backpressure exceeds the line pressure, the membrane seats on the perforated disc preventing backflow.

G. The valve allows flow out of the reservoir during draw cycles and prevents flow into the reservoir during fill cycles.

H. The elastomer used in construction of the membrane must have been tested by an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 “Standard Test Method for Rubber Property – Effect of Liquids.”

I. The manufacturer’s name, plant location, serial number and product part number which designates membrane size, material and construction specifications shall be bonded onto the surface of the membrane.

2.03 CARBON STEEL PIPE AND FITTINGS

A. Carbon steel pipe and fittings shall conform to the associated standards listed in Section 3.0: Reference Standards.

B. Dimensions for carbon steel fittings shall conform to AWWA C110, unless otherwise specified.

C. Wall thickness for carbon steel pipe and fittings shall be specified by Schedule conforming to ANSI B36.10-1985.

D. Wall thickness and dimensions of carbon steel tubing shall be given in exact dimensions in fractions of an inch, not by gage number.

E. All flanges shall be carbon steel ring flanges conforming to AWWA C207 Class D. Flange drilling pattern shall be in accordance with ANSI B16.1/B16.5 standards.

F. Ring flanges shall be continuously welded on both sides.

G. Welding of carbon steel pipe and fittings shall be in accordance with the Reference standards.

H. All butt welds shall be fully penetrated with gas shielding to the interior and exterior of the joint.

I. Welded cross-sections shall have a thickness equal to or greater than the welded material.

J. Field welding of carbon steel pipe and fittings will not be allowed unless approved by the Engineer.

K. All welded joints shall be free of sharp edges and burrs.

L. Coating of the inside of carbon steel pipe and fittings is not required, unless otherwise specified. Coating of the outside of carbon steel pipe and fittings shall be performed in the field, by the contractor, following installation of the manifold piping system. Surface preparation and coating procedures shall be in accordance with standards listed in Coatings specification

PART 3 EXECUTION

3.01 INSTALL HMS SYSTEM IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS.

END OF SECTION

This Page Left Blank Intentionally

SECTION 33 16 13.16
WIRE OR STRAND WOUND, PRESTRESSED CONCRETE TANK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. This section specifies the design qualifications for the Tank Contractor and requirements for the construction of a tank with an AWWA D110 Type III wire or strand wound, prestressed, concrete circular core wall, and pilasters; including all site work, excavation, reinforcing, concrete work, appurtenances, disinfection, testing, and backfill directly related to the tank unless otherwise specified.
   2. The Tank Contractor shall furnish all labor, materials, tools, and equipment necessary to construct, disinfect and test the wire or strand wound, prestressed concrete tank and appurtenances as indicated on the drawings, and as specified.

B. Related Sections:
   1. Section 03 31 20 - Concrete Foundation for Storage Tanks
   2. Section 09 97 13 - Coating Systems for Water Storage Tanks
   3. Section 33 16 30 - Disinfection of Water Storage Facilities
   4. Section 33 16 60 - Riser Insulation for Water Storage Tanks
   5. Section 03 30 00 - Cast In Place Concrete

1.02 REFERENCES

A. The latest version of the following Specifications, Codes and Standards are referenced in this section.
   1. ACI 301 - Standard Specification for Structural Concrete
   2. ACI 318 - Building Code Requirements for Structural Concrete
   3. AWWA C652 - Disinfection of Water Storage Facilities
   4. NSF 61 - Standard for Drinking Water System Components
   5. OSHA 29 CFR - Part 1926 Safety and Health Regulations for Construction
   6. ACI 305 Hot Weather Concreting
   7. ACI 306 Cold Weather Concreting
   8. ACI 372R Design and Construction of Circular Wire- and Strand Wrapped Prestressed Concrete Structures
   9. ACI 506R Guide to Shotcrete
   10. ASTM A185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
   11. ASTM A416 Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
   12. ASTM A421/A421M Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete
   13. ASTM A475 Standard Specification for Zinc-Coated Steel Wire Strand
   14. ASTM A821 Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks
   15. ASTM C1116/C1116M Standard Specification for Fiber-Reinforced Concrete and Shotcrete
   16. ASCE Standard 7 Minimum Design Loads for Buildings and Other Structures
   17. AWWA D110 Wire and Strand Wound, Circular, Prestressed Concrete Water Tanks
   18. US Army Corps of Engineers Specification CRD-C-572, Specification for PVC Waterstop

1.03 QUALIFICATIONS OF TANK SUPPLIER

A. Singular Responsibility: It is the intent of this specification to require single party responsibility for the design and the construction of the tank. The tank design and construction shall be performed by an established Tank Contractor of recognized ability, having at least ten years of experience in the design and construction of tanks with an AWWA D110 Type III wire or strand wound prestressed concrete core wall as specified herein. The design and construction of all aspects of the foundation, floor slab, wall, prestressing, shotcrete and dome roof of the wire or strand wound circular prestressed tank shall

be performed by the Tank Contractor. The Tank Contractor may subcontract labor for reinforcing steel installation and for concrete slab placement under the Tank Contractor's direct supervision.

B. All tank work shall be performed by a company that specializes in the design and construction of wire or strand wound prestressed concrete tanks using the method of circumferential prestress reinforcing and with proven capability of meeting all the requirements of these specifications. No company is considered qualified unless it has designed and built in its own name or under one of its divisions at least twenty AWWA D110 prestressed concrete tanks with a Type III core wall in the last ten years. The company shall have in its own name or under one of its divisions, at least five tanks with an AWWA D110 Type III core wall that are located within seismic zone zero per AWWA D110-04 and have been in successful service for at least five years. Experience in the design and construction of tanks with a Type I, II or IV core wall is not acceptable.

C. The Tank Contractor shall have in its employ a design professional engineer with a minimum of ten years of experience, registered in the state of Wisconsin. The design engineer shall have been the engineer of record for a minimum of ten tanks with an AWWA D110 Type III core wall. The design engineer shall have designed a minimum of five tanks with an AWWA D110 Type III core wall in seismic zone zero per AWWA D110-04 in the past five years.

D. The Tank Contractor shall have in its employ for this project a team consisting of a tank superintendent, project manager, certified shotcrete foreman, prestressing foreman, and precast erection foreman, each of whom shall have constructed a minimum of three tanks with an AWWA D110 Type III core wall and a capacity of 1.0 MG or greater.

E. Experience in the design and construction of tanks with an AWWA D110 Type I, Type II or Type IV core wall, tanks having a fixed wall base, mild-steel reinforced tank core wall or tank core wall incorporating internal stressing systems is not acceptable.

1.04 DESCRIPTION

A. The prestressed concrete tank shall be designed and constructed in accordance with the provisions of AWWA D110 Standard for Wire or Strand Wound Circular Prestressed-Concrete Water Tanks, Type III core wall, ACI 350, ACI 350.3, ASCE 7 and IBC.

B. Horizontal prestressing shall be continuous. Discontinuous prestressing tendons or strands will not be allowed.

C. The Tank Contractor shall use the following loadings and requirements in the design calculation:
   1. General Design Requirements:
      a. Dead load shall be the estimated weight of all permanent construction.
      b. Water load shall be the weight of water when the tank is filled to overflow.
      c. Include an allowance of 40 pounds per square foot on the horizontal projection for the pressure resulting from the snow load.
      d. Include allowances for pressures resulting from a 100-mph wind load on all surfaces in accordance with AWWA D100, Section 3.14.
      e. No corrosion allowance is required.
      f. Design for seismic zone zero is required.
      g. Allowable Soil Bearing Capacity: Contractor shall refer to Section 00 31 32 Geotechnical Data.
      h. All openings in the support structure shall be properly reinforced. Loads imposed by openings in the base of the support structure shall be accommodated in the foundation design.
      i. The overturning moment used in designing the support structure and foundation shall include the moment due to eccentricity of the gravity loads caused by deflection of the structure under wind or seismic conditions (i.e. P-Delta effect).
   2. Operating Parameters (Lower Tank):
      a. Maximum capacity within operating range: 1,000,000 gallons.
      b. Maximum fill rate: 3,500 gpm.
      c. Maximum discharge rate: 3,500 gpm.

d. Elevations:
    1) Overflow/top capacity level: 1080.00 feet.
    2) Bottom Capacity Line: 1015.00 feet.
    3) Top of Foundation: 1015.00 feet.
    4) Final Ground: 1014.25 feet.
e. Inlet Riser Diameter: 16 inches.
f. Outlet Riser Diameter: 16 inches
g. Overflow Riser Diameter: 12 inches.
h. Overflow Weir Box Minimum Weir Length: Contractor to submit calculations.
i. Overflow weir, box, and piping shall be able to fully discharge the maximum fill rate with no more than 4 inches of hydraulic head above the overflow elevation.

3. Operating Parameters (Upper Tank):
    a. Maximum capacity within operating range: 300,000 gallons.
    b. Maximum fill rate: 3,500 gpm.
    c. Maximum discharge rate: 3,500 gpm.
    d. Elevations:
        1) Overflow/top capacity level: 1140.00 feet.
        2) Bottom Capacity Line: 1119.00 feet.
        3) Top of Foundation: 1015.00 feet.
        4) Final Ground: 1014.25 feet.
    e. Inlet Riser Diameter: 12 inches.
    f. Outlet Riser Diameter: 12 inches
    g. Overflow Riser Diameter: 10 inches.
    h. Overflow Weir Box Minimum Weir Length: Contractor to submit calculations.
    i. Overflow weir, box, and piping shall be able to fully discharge the maximum fill rate with no more than 4 inches of hydraulic head above the overflow elevation.
4. Foundation Loads: The tank foundation shall be proportioned so that soil pressure shall be less than the soil bearing capacity. Contractor shall refer to Section 00 31 32 Geotechnical Data.

D. Seismic Criteria.
1. Seismic design shall be based on the applicable sections of AWWA D110-04, ACI 350.3, ASCE 7, TID 7024 and the local jurisdictional building code. The comparative value of 80% as specified in ASCE 7, Section 15.4.1 paragraph 6 shall be used to determine the total base shear from ASCE 7. Impulsive and convective forces, as well as, fluid spectral velocity shall be calculated utilizing each code and the maximum value of each component shall be used to calculate the total base shear.
2. AWWA D110-04 Design Criteria: Seismic Zone “0” Zero.
3. Sloshing Height: The sloshing height shall be calculated using AWWA D110, but need not exceed the fluid displacement calculation when determined using ACI 350.3, TID 7024 or ASCE 7. The effects of the “sloshing wave” shall be accounted for by increasing the freeboard between the normal operating surface and the underside of the roof, or a roof capable of resisting the uplift of such a wave designed. A minimum freeboard height of 11 inches above the design liquid level shall be utilized. Any confined portion of the convective (sloshing) mass shall be calculated and applied as an additional impulsive mass.
4. Dynamic Effects of Backfill: Seismic design shall consider the additive effects of the dynamic backfill loading.
5. Base Restraint Cable Design:
    a. When allowable shear resistance of the bearing pad is less than the total base shear obtained from the maximum values of impulsive and convective components and the dynamic effects of backfill, base restraint cables shall be utilized. The allowable cable stress is 0.75 fpu
    b. For the total base shear obtained from the loading conditions of ASCE 7 that incorporate an overstrength factor (Omega Factor), the allowable bearing pad shear or seismic cable stress (if required by design) shall be increased by 20%. The Omega factor shall be incorporated in accordance with ASCE 7 for all loading cases.

E. Wind Loads: Shall be as required by ASCE 7

F. The Tank Contractor shall design the composite concrete wall with steel diaphragm and closure steel slot plate in combination with vertical mild steel reinforcement based on the following design criteria and requirements:
   1. The prestressed tank wall shall be considered as a cylindrical shell with partial edge restraint.
   2. The prestressed tank wall shall be reinforced vertically by deformed steel reinforcing bars. The steel diaphragm can be taken as effective vertical reinforcing.
   3. The prestressed tank wall shall be of precast construction. The minimum core wall thickness shall be 4 inches. The core wall is that area of the wall interior to all circumferential prestressing. Shotcrete or cast-in-place concrete core walls are not permitted.
   4. For wire wound tanks, a stress plate shall be required at all above grade locations where prestress wires are displaced 24 inches or greater. The stress plate shall be designed to transfer stress across the opening.
   5. No reduction in ring compression or tension in the wall will be taken due to restraint at the bottom.
   6. The long-term prestressing losses caused by shrinkage, creep, and relaxation in the prestressed reinforcement of the tank walls shall not be assumed less than 25,000 psi.
   7. Lateral soil pressures shall not be considered in resisting seismically generated shear forces between the wall footing and the wall.

G. Floor Slab
   1. The floor slab shall be designed as a membrane floor not less than 4 inches thick. Construction joints will only be allowed as shown on the shop drawings and as approved by the Engineer. Construction joints shall incorporate a horizontal 6 inch PVC waterstop.
   2. Wall footings may be constructed above or below floor grade. If required, the floor shall have thickened regions to facilitate transitions from under slab concrete pipe encasements into the floor, appurtenance loadings and temporary bracing requirements.
   3. Minimum cross sectional area ratio of floor reinforcement to concrete shall be in accordance with the following:
      a. For tanks with diameters less than 100 feet, provide 0.5%.
   4. Poly-propylene or cellulose fibers may be used at the Tank Contractor's discretion.

H. The dome roof shall have a rise to span ratio within the range of 1:8 to 1:14. The dome shall be fixed to the tank wall. Columns or interior supports will not be allowed. Dome design shall be based on elastic spherical shell analysis. The dome roof shall be of precast or cast-in-place construction. The precast dome shall have continuous reinforcement at circumferential slots and radial reinforcement throughout the precast dome panels and lapped within the circumferential slots. The cast-in-place dome roof shall have continuous reinforcement in both the radial and circumferential direction. The dome thickness shall be no less than 4 inches. The minimum cross sectional area ratio of dome reinforcement to concrete shall be 0.25 % in both the circumferential and radial directions. In the dome edge region two layers of non-prestressed reinforcing shall be provided in the meridional direction.

1.05 SUBMITTALS

A. Shop Drawings:
   1. Provide elevation and sectional view Drawings of the column, tank, and all appurtenant equipment and accessories.
   2. Indicate locations, dimensions, material specifications, and finish requirements.
   3. Drawings shall be sealed by a Professional Engineer licensed in the State of Wisconsin.

B. Construction Procedures:
   1. Provide design, detail Drawings, and procedures as follows:
      a. Tank: Shop and field weld procedures for all structural joints.

C. Design Data:
   1. Provide a head range/capacity table showing capacity of the tank in gallons at all levels in 1-foot increments.
   2. Provide a summary of the design for the foundation, column, tank, and other components, describing the design basis, loads, load combinations, and results.

D. Product Data: Provide manufacturer's descriptive information for appurtenant equipment and accessories that are not detailed on the Construction Drawings.

E. Reports/Certification:
   1. Provide documentation of all tests, inspections, and certifications required by this Section.
   2. Submit copies of welder's certification to Engineer prior to any welds being made.
   3. Upon Project completion, submit a written report certifying that the tank was inspected as required and providing the information required under AWWA D110.
   4. Provide proof of insurance for Professional Liability with a minimum limit of $1,000,000 each occurrence and aggregate.

F. Design Submittal after Execution of Contract
   1. Design calculations and drawings in quadruplicate, showing details and procedures of construction, shall be submitted to the Engineer for approval after execution of the Contract. After approval by the Engineer, one set of the drawings and calculations will be returned to the Tank Contractor, and any changes found necessary by the Engineer shall be made by the Tank Contractor.
   2. Approval by the Engineer of the drawings and calculations submitted by the Tank Contractor will not in any way relieve the Tank Contractor of full responsibility for the accuracy and completeness of the drawings and calculations.
   3. Design calculations and drawings shall be stamped by a professional engineer experienced in the design of AWWA D110, Type III wire or strand wound prestressed concrete tanks and registered in the state of Wisconsin.

G. Construction Submittals for Review Prior to Use
   1. Design proportions for all concrete and shotcrete. Concrete strengths of trial mixes.
   2. Admixtures to be used in the concrete or shotcrete and their purpose.
   3. Reinforcing steel shop drawings showing fabrication and placement.
   4. Catalog cuts or shop drawings of all appurtenances, i.e. hatch, vent, ladders, waterstops.

H. Operation/Maintenance: Provide operating instructions and maintenance procedures for the tank and applicable appurtenant equipment, mechanical components, and accessories. Provide as-built construction drawings, cleaning and painting instructions and a gage table and catalog cuts of equipment supplied.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handling and Shipping:
   1. Handle materials and fabricated components in a manner that will protect them from damage.
   2. Allow adequate cure time prior to stacking or shipping coated items.

B. Storage and Protection:
   1. Protect delivered materials and equipment from damage.
   2. Store items in well-drained areas and provide blocking to minimize contact with the ground.

1.07 SITE CONDITIONS

A. Location:
   1. See Drawings.
   2. Access to the Site is annotated in special provision section 107.1.

B. Services:
   1. Electric Power:
      a. Electric power is available at the Site.
      b. Contact Madison Gas & Electric for characteristics and fee.
   2. Water:
      a. Water is available at the Site.
      b. Contact Madison Water Utility for rates and procedures.

1.08 GUARANTEE

A. The tank manufacturer shall include an unconditional guarantee warranty for labor, tank materials, and coating. As a minimum, this warranty shall provide guarantee against defects in material or workmanship for the period of two (2) years. Following final acceptance of the project, the Contractor shall perform a two year anniversary inspection of the Facility. Said inspection cost shall be included in the bid. If inspection reveals that any work performed under this contract is faulty, repairs shall be If inspection reveals that any work performed under this contract is faulty, repairs shall be

PART 2 PRODUCTS

2.01 CONCRETE

A. Concrete shall conform to ACI 301.

B. Cement shall be Portland cement Type I or Type II.

C. Admixtures, other than air-entraining, superplasticizers, shrinkage reducing and water reducing admixtures will not be permitted unless approved by the Engineer.

D. Concrete for tank wall and dome construction shall have a minimum compressive strength of 4,000 psi at twenty-eight days and a maximum water to cementitious ratio of 0.42. All precast wall and dome concrete shall be air-entrained.

E. Concrete for the tank floor, footings, pipe encasement, and all other work shall have a minimum compressive strength of 4,000 psi at twenty-eight days, shall not be air-entrained and have a maximum water to cementitious ratio of 0.42. The coarse and fine aggregate shall meet the requirements of ASTM C33. Coarse aggregate shall be No. 467 with 100% passing the 1½ inch sieve. Superplasticizers, water-reducing, and shrinkage reducing (if applicable) admixtures shall be incorporated into the floor concrete. If fibers are used, they shall be virgin poly-propylene or cellulose fibers, Microfiber by Grace, Fibermesh 150 by Propex, UltraFiber 500 by Buckeye, or equal. Fiber lengths shall be a maximum of ¾ inches. The amount of fibers added to the concrete mix shall conform to the Manufacturer's recommendations.

F. Proportioning for concrete shall be in accordance with ACI 301.

G. All concrete shall have a maximum water soluble chloride ion concentration of 0.06% by weight of cementitious material.

2.02 SHOTCRETE

A. Shotcrete shall conform to ACI Standard 506, except as modified herein.

B. The wet mix process shall be employed for shotcreting.

C. Shotcrete used for covering prestressed wire or strand shall consist of not more than three parts sand to one part Portland cement by weight. Additional coats of shotcrete shall consist of not more than four parts sand to one part Portland cement by weight. Polypropylene fibers shall be included in the shotcrete used for the finish cover coat. Fibers shall be Fibercast 500 by Propex, Fibermesh or equal. Fibers shall be virgin polypropylene and comply with ASTM C-1116 performance level I. Fiber length shall be ¼ inch. The amount of the fibers added to the shotcrete used for the finish cover coat shall conform to the Manufacturer's recommendations. Fly ash may be incorporated into the finish cover coat. Fly ash shall conform to ASTM C618, Type F. Shotcrete shall have a minimum strength of 4,500 psi at twenty-eight days and have a maximum water to cementitious ratio of 0.42.

D. Rebound material shall not be reused in any form for shotcrete.

E. If used by the Tank Contractor, the total volumetric air content of the shotcrete before placement shall not exceed 7% (±1%) as determined by ASTM C-173 or ASTM C-231.

F. Fine Aggregates:
   1. The fineness modulus shall be between 2.7 and 3.0. A well-graded coarse sand shall be used for all shotcrete applications.
   2. The gradation for the fine aggregates shall adhere to the "Grading No. 1" requirements listed in "Table 1.1 – Grading Limits for Combined Aggregates" of ACI 506.

G. All shotcrete shall have a maximum water soluble chloride ion concentration of 0.06% by weight of cementitious material.

2.03 MORTAR FILL AND NON-SHRINK GROUT

A. Mortar fill and non-shrink grout shall have a minimum compressive strength of 4,000 psi at twenty-eight days, have a maximum water to cementitious ratio of 0.42 and meet all requirements for concrete contained in this specification.

B. Portland cement grout will not be accepted.

2.04 REINFORCING STEEL

A. Reinforcing steel shall be new billet steel Grade 60, as shown on the Drawings, meeting the requirements of ASTM A615. Welded wire fabric and weldable reinforcing steel shall conform to ASTM A185 and ASTM A706, respectively.

B. Reinforcing steel shall be accurately fabricated and shall be free from loose rust, scale, and contaminants, which reduce bond.

C. Reinforcing steel shall be accurately positioned on supports, spacers, hangers, or other reinforcements and shall be secured in place with wire ties or suitable clips. Rebar chair supports may be either steel with plastic tips, turned up legs or plastic.

D. Continuous reinforcing is required through floor and cast in place dome construction joints, where applicable.

2.05 BASE RESTRAINT CABLES

A. Where required by design, the tank designer shall use base restraint cables to resist earthquake and/or wind loads. Base restraint cables shall be hot-dipped galvanized seven-wire strand and shall be manufactured in accordance with ASTM A416 prior to galvanizing, and ASTM A475 after galvanizing. Only seven-wire strand will be allowed.

B. Hot-dipped galvanized seven-wire strand shall have a nominal strand diameter of 0.375 in, 0.50 in or 0.60 in. 0.375 inch diameter strand shall have an MUS after galvanization of 21.36 kips and a min. yield at 1% extension of 15.60 ksi. 0.50 inch diameter strand shall have an MUS after galvanization of 38.25 kips and a min. yield at 1% extension of 28.00 ksi. 0.60 inch diameter strand shall have an MUS after galvanization of 54.20 kips and a min. yield at 1% extension of 40.70 ksi. All strands shall have a minimum of weight of Zinc Coating of 0.85 oz/sq-ft.

C. Neoprene sleeves for base restraint cables shall be closed-cell conforming to ASTM D1056, Type 2, Class A, and Grade 3. The sleeves shall have a compression deflection limited to 25% at 9 to 13 psi, hardness of 60 to 80 durometer, a minimum tensile strength of 175 psi, a minimum elongation of 180%, and a maximum compressive set of 35%.

2.06 STEEL DIAPHRAGM

A. The steel diaphragm shall conform to ASTM A1008 and shall be a minimum thickness of 0.017 inches. It shall be vertically ribbed with reentrant angles. The back of the channels shall be wider than the front, providing a mechanical keyway anchorage with the concrete and shotcrete encasement.

B. The steel diaphragm shall extend to within 1 inch of the full height of the wall panel with no horizontal joints. Vertical joints within a wall panel shall be roll seamed or otherwise fastened in a fashion that results in a firm mechanical lock. Joints between wall panels that are not roll seamed shall be edge sealed with polysulfide or polyurethane sealant.

C. No punctures will be permitted in the diaphragm except those required for pipe sleeves, temporary construction openings, or special appurtenances. The Engineer shall approve details of the openings. All openings shall be completely edge sealed with polysulfide or polyurethane sealant.

D. Diaphragm steel may be considered as contributing to the vertical reinforcement of the wall.

E. Steel closure plates shall be used at wall slots between precast wall panels on the exterior face to create a continuous steel diaphragm.

2.07 CIRCUMFERENTIAL PRESTRESSING STEEL

A. Steel for prestressing shall either be cold drawn, high carbon wire or galvanized seven wire strand.

B. The wire shall meet the requirements of ASTM A821 and have a minimum ultimate tensile strength of 210,000 psi.

C. Galvanized strand shall meet the requirements of ASTM A416 prior to galvanizing with zinc coating for galvanizing meeting the requirements of ASTM A641/641M or ASTM A475. Each wire shall be individually hot-dipped galvanized before being stranded. The minimum weight of zinc coating per unit area of uncoated wire surface area shall be no less than 0.85 ounces per square foot.

D. Splices for horizontal prestressed reinforcement shall be ferrous material compatible with the reinforcement and shall develop the full strength of the wire or strand. Wire or strand splice and anchorage accessories shall not nick or otherwise damage the prestressing.

2.08 ELASTOMERIC MATERIALS

A. A 9 inch minimum waterstop with centerbulb shall be polyvinyl chloride meeting the requirements of the Corps of Engineers Specification CRD-C 572. Splices shall be made in accordance with the Manufacturer's recommendations subject to the approval of the Engineer. Waterstop shall be manufactured by Greenstreak Plastic Products Company, Inc., or equal.

B. Bearing pads shall be natural rubber or neoprene.
   1. Natural rubber bearing pads shall contain only virgin natural polyisoprene as the raw polymer and the physical properties shall comply with ASTM D2000 Line Call-Out M 4 AA 414 A1 3.
   2. Neoprene bearing pads shall have a hardness of 40 to 50 durometer, a minimum tensile strength of 1,500 psi, a minimum elongation of 500%, and a maximum compressive set of 50%. Pads shall meet the requirements of ASTM D2000 Line Call-Out M 2 BC 410 A1 4 B14 or M 2 BC 414 A14 C12 F17 for 40 durometer material.

C. Sponge filler shall be closed-cell neoprene or rubber conforming to ASTM D1056, Type 2, Class A, and Grade 1 or 3. Compression deflection limited to 25% at 2 to 5 psi.

D. Polysulfide or polyurethane sealant will be a two or three component elastomeric compound meeting the requirements of ASTM C920. Sealants shall have permanent characteristics of bond to metal surfaces, flexibility, and resistance to extrusion due to hydrostatic pressure. Air cured sealants shall not be used.

2.09 EXTERIOR COATINGS

A. A decorative coating shall be applied to the exterior dome surface using one coat of a cementitious based damp-proofing product such as “Tamoseal” or equal, and one coat of a non-cementitious, high build, 100% acrylic resin polymer such as “Tammscoat Smooth” textured protective coating, “Tnemec Envirocrete 156” or equal. A decorative coating shall be applied to the above grade exterior wall surfaces using two coats of a non-cementitious, high build, 100% acrylic resin polymer such as “Tammscoat Smooth” textured protective coating, “Tnemec Envirocrete 156” or equal. Contractor shall follow 3 color paint system as shown on the drawings.

2.10 APPURTENANCES

A. The Tank Contractor shall provide and install all appurtenances as shown on the drawings. Appurtenances shall include the following:
   1. Inlet-Outlet Piping.
   2. Overflow Piping and Weir.
   3. Roof Hatch: A 42 inch square aluminum hatch with lockable, hinged cover and curb frame. The hatch shall have a lift handle, padlock tab, padlock and a cover hold open mechanism. All hardware shall be aluminum or stainless steel. Locate hatch as shown on drawings.
   4. Roof Ventilator: Fiberglass or Aluminum, with fiberglass insect 20 x 20 screen, minimum diameter 2 feet.
   5. Interior Ladder: The ladder shall extend from the floor to the hatch. The ladder shall be made out of 6061-T6 Aluminum and have an OSHA-approved Stainless Steel fall prevention device (if required) consisting of a sliding, locking mechanism and safety belt. Location as shown on the drawings.
   6. Access Manway: A circular (2) two 30 inch diameter Type 304 stainless steel wall manway with a hinged cover. A Type 304 stainless steel grab bar and an aluminum ladder shall be installed at the manway location. Locate access manway as shown on drawings.
   7. Floor Sump: If shown on drawings, a minimum of one 2 feet square x 6 inch deep sump shall be provided in the tank floor. The sump may be at a drain pipe, outlet pipe or separate from the floor piping. Location of the sump as shown on the drawings.

2.11 MATERIALS

A. Fluid Conductors:
   1. The inlet/outlet water main and that section of vertical riser pipe below the floor shall be Class 56 Cement Lined Ductile Iron Pipe with mechanical joints in accordance with AWWA C110 and AWWA C115 and mechanical joints in accordance with ANSI A21.51, A21.4, and A21.11.
   2. All other internal and external piping shall be carbon steel fabricated from material meeting the requirements of ASTM A-53 and AWWA C200. Pipe material within tank shall be minimum standard weight wall thickness carbon steel. All fittings shall be smooth. Flow joints shall be screwed, welded or flanged.
   3. Pipe fittings and flange thickness shall be in accordance with the manufacturers certified pressure rating for the applicable service pressures. Design pressure rating shall be minimum 150 psi.
   4. Joints shall be screwed, welded or flanged.

2.12 COMPONENTS

A. Water Transmission:
   1. Silt Stop:
      a. Provide a minimum 6-inch high removable silt stop at the riser connection that is flush with the bowl floor.
   2. Riser Pipe:
      a. Support pipe by means of suitable galvanized steel brackets, guides, and hangars.
      b. Mount support devices on tower wall at minimum 20-foot intervals.
   3. Expansion Joint: Install in the vertical section of the riser just above the interior floor.

4. Riser Assembly:
    a. Install the following items on the riser pipe:
        1) Telemetry connection: 1/2-inch coupling with stainless steel nipple and isolation gate valve.
        2) Valve: See Drawings.
        3) Hose connection: Rated up to 250 psi. See Drawings.
        4) Pressure gage: See Section 26 16 01.
    b. Install items in locations readily accessible from the floor.

B. Safety and Access:
1. Roof Handrail: Provide handrail to enclose accessories located on roof.
2. Manholes and Hatches:
    a. Include watertight covers on each opening.
    b. Tank floor opening:
        1) Operable from ladder located on upper platform and designed to withstand the pressure of the tank contents without leakage.
        2) Include steel handwheel operator and threaded components.
    c. Roof openings:
        1) Minimum 4-inch curbs on hatches.
        2) Provide aluminum covers with 2-inch down-turned edges, stainless steel hardware, hold-open arm, handle, and hasp.
    d. Access tube hatch:
        1) Locate at top of access tube.
        2) Provide chain, hook, and inside handle.
        3) Provide a 6-inch vent with removable No. 4 stainless steel screen on hatch cover for access tube ventilation.
    e. Flanged exhaust hatch:
        1) Provided in roof adjacent to access tube.
        2) Constructed to allow exhaust fan to be bolted to the hatch for ventilation during painting.
        3) The pressure-vacuum vent may be mounted on the exhaust hatch.
    f. Painter rail hatch:
        1) Provided in roof and located to provide access to the interior painters rail near the shell.
        2) Provide handle and hasp.
    g. Painters manhole/vent:
        1) Locate near top of support wall and accessible from walkway.
        2) Provide access to the exterior painters rail and ventilation for the column.
3. Access Tube: Install tube centrally through the tank to provide access to the roof from the upper platform.
4. Grab Bar: Install in the roof adjacent to access tube hatch.
5. Ladders:
    a. Material:
        1) Tower ladders: Painted steel
        2) Access tube ladders: Painted steel
    b. Provide ladders in accordance with current U S Department of Labor, Occupational Safety and Health Administration (OSHA) regulations.
    c. Secure ladders to adjacent structures by brackets at maximum 10-foot intervals.
    d. Terminate ladders minimum 48 inches above platforms and landings.
6. Platforms and Landings:
    a. Minimum width: 4 feet
    b. Walking surface: Grating
    c. Provide handrails, mid-rails, and toe plates in accordance with OSHA regulations.
7. Ventilation:
    a. Tank vent:
        1) Material: stainless steel or aluminum components including support frame, screened area, and cap.
        2) Fasten support to flanged opening in tank roof.
        3) Provide cap to prevent entrance of wind-driven debris or precipitation.
        4) Provide minimum 4-inch distance between roof surface and vent cap.
        5) Install corrosion resistant No. 4 screen.

6) Maximum fill rate: 3500 gpm.
7) Maximum discharge rate: 3500 gpm.
8) Provide self-correcting mechanism for failsafe operation in the event of screen plugging.

b. Tower vent:
1) Include removable insect screen.
2) Install minimum of one vent near top of column.
3) Accessible from interior platform.

8. Painters and Inspection Rails:
a. Provide permanently installed painter rails attached to the underside of the roof suitable for rolling trolleys.
b. Provide exterior mounted painter rails near the top of the tower and accessible via the painters manhole/vent.
c. Provide an interior inspection rail located near the top of the tower interior and accessible from the walkway.

9. Ladder Safety Devices:
a. SAF-T-CLIMB Fall Prevention System as manufactured by North Specialty Products or equivalent.
b. Required components:
1) SAF-T-NOTCH Carrier Rail, Standard Galvanized, 726-101-001.
2) SAF-T-CLIMB Ladder Rung Clamps, Standard Galvanized 724-101-001.
3) SAF-T-LOK Sleeve, 702-100-001. Provide 3 each.
4) SAF-T-BELT, 728-200-001. Provide 3 OSHA approved harnesses.
c. Provide on the following ladders:
1) Ladders from grade to walkway.
2) Ladder inside the access tube from the walkway to the roof.

C. Drains:
1. Overflow Pipe:
a. Install weir box with vortex prevention at the overflow elevation.
b. Support pipe by means of suitable brackets, guides and hangars.
c. Mount supporting devices at maximum 20 intervals.
d. Slope horizontal runs to drain.
e. Install No. 4 stainless steel screen at discharge point.
f. Construct with steel material.
2. Tank Drain:
a. Provide 4 inch drain from the low point of the tank floor and connect to the overflow pipe.
b. Construct as shown on Drawing detail.
3. Condensate Drain:
a. Install drain line from the condensate platform to the overflow pipe.
b. Slope to drain.

2.13 ACCESSORIES

A. Antenna Conduit: Provide 4-inch conduit adjacent to access tube hatch as shown on Drawings.

B. Coax Support Hanger:
1. Provide coax support hangers in access tube as detailed on Drawings.
2. Coax support hanger by Fulton Technologies or equivalent.

C. Caulk: Sikaflex-1a, as manufactured by Sika Corporation, Lyndhurst, NJ, or approved equal.

2.14 PILASTER DOORS

A. Provide metal plated doors for each pilaster.

B. Provide lock, keyed to city lock system, for the door.

C. Provide electric strike with inside door release. To be compatible with city card reader system.

D. Locate city card reader system next to each door.

PART 3 EXECUTION

3.01 SAFETY

A. Every precaution shall be taken to keep personnel and visitors outside the prestressing area.

B. At no time shall anyone stand in the line of stressed wire or strand.

C. No personnel is allowed outside of the tank, other than the prestressing crew, within 100 feet from the wrapping operation. Additional precautions shall be taken by Tank Contractor should specified clearance not be available.

D. Where access to the site by unauthorized persons is outside the Tank Contractor’s control, while prestressing work is in progress, Tank Contractor shall erect protective fencing.

E. Tank Contractor to conform and enforce all Local and Federal OSHA safety rules and regulations.

3.02 EXAMINATION

A. Environmental Conditions: Prior to performing any work, verify the expected temperature, humidity, wind, and weather conditions are within the specified limitations for executing the work.

B. Tank Components: After completion of each major component and prior to proceeding with the next stage of construction, verify that tolerance inspections and material quality control tests conform to the requirements of Article 3.03.

3.03 FOUNDATION

A. General: The Contractor's bid price for the work shall include the design and placement of reinforced concrete foundations of structural mat or deep foundations. A professional engineer registered in the state of Wisconsin shall design the foundations. The design shall be based on the soil bearing values, minimum construction depths, and design recommendations in the Geotechnical Report. The foundations shown on the Plans are generic in nature and not intended to be used as the final design.

B. Subsurface Soil Investigation and Report: The Owner retained a geotechnical firm to perform a subsurface soil investigation of the proposed elevated water storage tank site. Borings were made and a report prepared. A copy of that Geotechnical Report has been included in Document 00 31 32.

C. Excavation, Backfill or Fill:
   1. All backfill or fill, as the case may be, shall be placed in strict accordance with the recommendations of the Geotechnical Report.
   2. The area around the footing excavations shall be graded to drain away from the excavated areas by the Contractor during construction of the footings. Extreme care shall be exercised to insure the surface runoff water does not enter the footings excavations.
   3. The Owner will employ the geotechnical firm that did the investigation to inspect and test the stripping, excavation, backfill and fill materials to ensure that the materials comply in their entirety with the moisture content and compaction recommendations included in the Geotechnical Report. The Owner will be responsible for costs involved in the testing and inspection.

D. Concrete Foundation:
   1. The foundation shall be designed by the Contractor and constructed of reinforced concrete with all necessary anchor bolts and connections. The design of the foundation, the specifications for the cement, aggregate, and the mixing and placement of the concrete shall all be in strict conformance with requirements of the latest revisions of ANSI A89.1 and standard No. 318 of the American Concrete Institute and of AWWA D-100, including Appendix. The minimum allowable

design compressive strength (28 days) of the concrete as determined from samples taken from the transportation unit at the point of discharge shall be not less than 4000 psi.

2. The Contractor shall pay for the collection and testing of cylinders for the strength test by an independent testing laboratory. If any tests shall fail this requirement as defined by Standard No. 318, ACI, the Contractor shall be responsible for paying for all additional testing ordered by the Owner through the Engineer to assure that the load carrying capacity of the structure is not jeopardized. If the requirements of Section 4.8.4.4 of ACI 318 are not met, the Owner, through the Engineer, shall order the Contractor to take action to correct the deficient work.

3.04 FLOOR

A. The floor and wall footings shall be constructed to the dimensions shown on the Approved Shop Drawings.

B. Prior to placement of the floor reinforcing, a 6 mil polyethylene moisture barrier shall be placed over the leveling base material. Joints in the polyethylene shall be overlapped a minimum of 6 inches.

C. Prior to placement of the floor concrete, all piping that penetrates the floor shall be set and encased in concrete.

D. The vertical waterstop shall be placed and supported so that the bottom of the center bulb is at the elevation of the top of the footing. The waterstop shall be supported without puncturing any portion of the waterstop other than pre-manufactured holes, grommets or hog rings for tying at 12 inches o.c. The waterstop shall be spliced using a thermostatically controlled sealing iron and each splice shall be successfully spark tested prior to encasement in concrete.

E. Floors over 20,000 sq. ft. in surface area, at the option of the Tank Contractor, may have one or more construction joints. Such construction joints shall be approved by the Engineer prior to placement and shall include a continuous waterstop and reinforcement through the joint.

F. The floor shall be cured by applying one coat of curing compound, curing blankets and/or flooding with water, and shall remain saturated for a minimum of seven days.

3.05 PRECAST WALL PANEL CONSTRUCTION AND ERECTION

A. The precast wall panel shall be constructed with a continuous waterproof steel diaphragm embedded in the exterior of the precast panel. Horizontal joints in the diaphragm will not be allowed.

B. No holes for form ties, nails, or other punctures will be permitted in the wall.

C. Temporary wall openings may be provided for access and removal of construction materials from the tank interior subject to the approval of the Engineer.

D. Wall beds shall be constructed to provide finished panels with the proper curvature of the tank.

E. Polyethylene sheeting shall be placed between successive pours to provide a high moisture environment and a long slow cure for the concrete.

F. The erecting crane and lifting equipment shall be capable of lifting and placing the precast panels to their proper location without causing damage to the panel.

G. The precast panels shall be erected to the correct vertical and circumferential alignment. The edges of adjoining panels shall not vary inwardly or outwardly by more than 3/8 inch and shall be placed to the tank radius within $\pm$ 3/8 inch.

H. Joints between precast wall panels shall be bridged with a 10 gauge steel plate edge sealed with polysulfide or polyurethane and filled with mortar as shown on the drawings. No through-wall ties will be permitted.

3.06 PRECAST DOME PANEL CONSTRUCTION AND ERECTION

A. Dome panel casting beds shall be constructed to provide finished dome panels with the proper dome curvature.

B. Polyethylene sheeting shall be placed between successive pours to provide a high moisture environment and a long slow cure for the concrete.

C. The erecting crane and lifting equipment shall be capable of lifting and placing the precast dome panels to their proper location without causing damage to the dome panel.

D. The precast dome panels shall be erected to the correct radial and circumferential alignment as indicated in the Approved Shop Drawings. Adjacent dome panel offsets shall be constructed to a tolerance of +/- 3/8 inch.

3.07 CAST-IN-PLACE DOME CONSTRUCTION

A. The dome shall be constructed to the dimensions and curvature provided on the Approved Shop Drawings.

B. Dome roof decking shall not vary from level, or the curvature shown, more than ¼ inch in 10 feet or ½ inch maximum in 20 feet or more.

C. The dome shall be constructed to the thickness shown on the Approved Shop Drawings. Screed rails shall be provided to insure proper curvature and reinforcing cover.

D. A curing compound which is compatible with the decorative coating systems shall be applied to the dome in accordance with the Manufacturer's recommendations. Water curing may be used in conjunction with the curing compound.

3.08 CONCRETE

A. All concrete shall be conveyed, placed, finished, and cured as required by pertinent ACI standards.

B. Finishes. The tank shall be given the following finishes:
   1. The floor slab shall receive a mechanical hard-trowel finish. The top of the wall footing, exterior to the waterstop, shall receive a steel trowel or magnesium trowel finish.
   2. The interior of the precast wall panels shall receive a light broom finish.
   3. The exterior of the dome shall receive a light broom finish. The interior of the dome shall receive a form finish.
   4. Exterior shotcrete shall receive a natural gun / nozzle finish.

3.09 SHOTCRETING

A. Weather Limitations
   1. Shotcrete shall not be placed in freezing weather without provisions for protection against freezing. Shotcrete placement can start without special protection when the temperature is 35 degrees Fahrenheit and rising, and shall be suspended when the temperature is 40 degrees Fahrenheit and falling. The surface to which the shotcrete is applied shall be free from frost. Cold weather shotcreting shall be in accordance with ACI 506, ACI 301 and ACI 306.
   2. Hot weather shotcreting shall be in accordance with the requirements of ACI 506, ACI 301 and ACI 305.

B. Coating of Steel Diaphragm
   1. The steel diaphragm shall be covered with a layer of shotcrete at least ½ inch thick prior to prestressing.
   2. Total minimum coating over the steel diaphragm shall be 1½ inches including diaphragm cover, wire or strand cover, and finish cover coat.

C. Coating Over Prestressing Wire or Strand
   1. Each prestress wire or strand shall be individually encased in shotcrete. Shotcrete thickness shall be sufficient to provide a clear cover over the wire and strand of at least ¼ inch and 3/8 inch, respectively.
   2. Finish cover coat shotcrete shall be applied as soon as practical after the last application of wire or strand coat.
   3. The minimum final shotcrete cover over the outermost prestressing wire or strand layer shall be 1 inch.

D. Placement of Shotcrete
   1. Shotcrete shall be applied by an ACI 506 certified nozzleman.
   2. Manually applied shotcrete shall be applied with the nozzle held at a small upward angle not exceeding five degrees and constantly moving during application in a smooth motion with the nozzle pointing in a radial direction toward the center of the tank. The nozzle distance from the prestressing shall be such that shotcrete does not build up or cover the front face of the wire or strand until the spaces behind and between the prestressing elements are filled.
   3. Unless applied by an automated shotcrete process, total cover coat thickness shall be controlled by shooting guide wires. Vertical wires shall be installed under tension and spaced no more than two feet apart to establish uniform and correct coating thickness. Monofilament line (100 lb. test) or 18 or 20 gauge high tensile strength steel wire shall be used. Guide wires shall be removed after placement of the cover coat.
   4. Shotcrete applied by an automated shotcrete process shall be applied using the wet mix only. Nozzles shall be kept mounted on power driven machinery enabling the nozzle to travel parallel to the surface to be sprayed at a uniform linear or bi-directional speed. The nozzle shall be kept at a uniform constant distance from the surface, always insuring a right angle spray of the material to the surface. The high velocity impact shall be developed pneumatically by injecting compressed air at the nozzle.

E. Curing
   1. Shotcrete shall be cured using water curing methods, sealing materials or curing compounds at the option of the Tank Contractor. Curing compounds shall not be used on surfaces to which decorative coatings, mortar or shotcrete is to be applied. Curing compounds used within the tank wall shall be suitable for use with potable water. Intermediate layers of shotcrete shall be kept damp by water curing or other means no sooner than twelve hours after the shotcrete has been applied.
   2. Water curing is not required should additional shotcrete be applied on the entire wall surface within the following twelve hours.
   3. Indiscriminate use of continuous water cure for intermediate layers shall be avoided.
   4. Complete shotcrete surfaces, which do not receive any additional coatings, may be water cured for a period of at least seven days by encapsulating the shotcrete inside of plastic sheeting.

F. Testing
   1. Testing of shotcrete shall be in accordance with ACI 506, except as specified herein. One test panel shall be made for each of the following operations: core wall, wire or strand cover, and cover coat. Test panels shall be made from the shotcrete as it is being placed, and shall, as nearly as possible, represent the material being applied. The method of making a test sample shall be as follows: A frame of wire fabric (1 foot square, 3 inches in depth) shall be secured to a plywood panel and hung or placed in the location where shotcrete is being placed. This form shall be filled in layers simultaneously with the nearby application. After twenty-four hours, the fabric and plywood backup shall be removed and the sample slab placed in a safe location at the site.
   2. The sample slab shall be moist cured in a manner identical with the regular surface application. The sample slab shall be sent to the testing laboratory. Nine 3 inch cubes shall be cut from the sample slab and subjected to compression tests in accordance with current ASTM Standards. Three cubes shall be tested at the age of seven days, three shall be tested at the age of twenty-eight days, and three shall be retained as spares. Testing shall be by an independent testing laboratory, approved by the Engineer and at the Tank Contractor's expense.
   3. At the Tank Contractor's option testing of shotcrete applied with an automated process shall be in accordance with ACI 301 and conform to Section 3.07.E "Concrete Testing" of these specifications in lieu of that indicated in Section 3.09.F.1.

3.10 CIRCUMFERENTIAL PRESTRESSING

A. Prestressing shall be performed utilizing continuous wire or strand. Prestressing wire/strand will be placed on the wall with a machine capable of consistently producing a stress in the wire/strand within a range of minus 7% to plus 7% of the stress required by the design. No circumferential movement of the prestressing along the tank wall will be permitted during or after stressing. Stressing may be accomplished by drawing the wire through a die or by another process that results in uninterrupted elongation, thus assuring uniform stress throughout its length and over the periphery of the tank.

B. Each coil of prestressing shall be temporarily anchored at sufficient intervals to minimize the loss of prestress in case a wire/strand breaks during wrapping.

C. Minimum clear space between prestressing wires is 5/16 inch or 1.5 wire diameters, whichever is greater. Minimum clear distance between prestressing strands is 3/8 inch or 1.5 strand diameters, whichever is greater. Any wires or strands not meeting the spacing requirements shall be respaced. Prestressing shall be placed no closer than 2 inches from the top of the wall, edges of openings, or inserts, nor closer than 3 inches from the base of walls or floors where radial movement may occur.

D. The band of prestressing normally required over the height of an opening shall be displaced into circumferential bands immediately above and below the opening to maintain the required prestressing force. Bundling of the prestressing steel shall be prohibited.

E. For wire wound tanks, a stress plate shall be used at all permanent wall penetrations above grade that results in displacement of wire/strand equal to or greater than 24 inches in height. The stress plate shall accommodate a portion of the prestressing normally required for the height of the opening. The remaining prestressing normally required shall be displaced into circumferential bands immediately above and below the penetration. The effect of banded prestressing shall be taken into account in the design.

F. Ends of individual coils shall be joined by suitable steel splicing devices capable of developing the full strength of the prestressing wire/strand.

G. The Tank Contractor shall furnish a calibrated stress recording device, which can be recalibrated, to be used in determining wire/strand stress levels on the wall during and after the prestressing process. At least one stress reading per vertical foot or one stress reading for every roll of prestressing, whichever is greater, shall be taken immediately after the wire or strand has been applied on the wall. Readings shall be recorded and shall refer to the applicable height and layer of the prestressing for which the stress is being taken. The Tank Contractor shall keep a written record of stress readings. All stress readings shall be made on straight lengths of wire/strand. If applied stresses fall below the design stress in the steel, additional wire or strand will be provided to bring the force on the core wall up to the required design force. If the stress in the steel is more than 7% over the required design stress, the wrapping operation should be discontinued, and satisfactory adjustment made to the stressing equipment before proceeding.

H. When a mechanical stressing system is utilized a continuous electronically (or substantial equivalent) monitored permanent recording of the applied force shall be made during the entire circumferential prestressing application. All such recordings shall be based on a continuous sensing of the applied force on the wire/strand between the tensioning system and the wall when, and as, the strand is being wrapped and laid on the wall.

3.11 DECORATIVE COATINGS

A. All exposed exterior dome surfaces shall be given a two-coat finish consisting of one coat of damp-proofing product such as “Tamoseal with AKKRO-7T” or equal, and one coat of “Tammscoat Smooth” or equal. If required in the Owner’s drawings, all exterior exposed wall surfaces shall be given a two-coat finish of a non-cementitious 100% acrylic such as “Tammscoat Smooth”, Tnemec Envirocrete 156 or equal. Work shall be performed by workmen skilled in the application of these types of products. The Manufacturer’s application instructions shall be submitted to the Engineer for approval. The Tank

Contractor shall confer with the Manufacturer's representatives regarding application techniques and shall follow the Manufacturer's instructions implicitly.

B. The concrete surface to be coated shall be clean, free of all laitance, dirt, grease, or other foreign materials. All defective surfaces shall be filled and/or repaired. Application shall be in full accordance with the Manufacturer's instructions or as amended by the Engineer.

C. The Owner shall select the color.

3.12 WATERTIGHTNESS TEST

A. Upon completion, the tank shall be tested to determine watertightness. The tank shall be filled with potable water to the maximum level. Water will be furnished to the tank by the owner. The test shall consist of measuring the liquid level over the next twenty-four hours to determine if any change has occurred. If a change is observed and exceeds the maximum allowance, the test shall be extended to a total of five days. If at the end of five days the average daily change has not exceeded the maximum allowance, the test shall be considered satisfactory.

B. The liquid volume loss for a period of twenty-four hours shall not exceed $1/20^{th}$ of 1% of the tank capacity, 0.0005 x tank volume. If the liquid volume loss exceeds this amount, it shall be considered excessive, and the tank shall be repaired and retested.

C. Damp spots will not be permitted at any location on the tank wall. Damp spots are defined as spots where moisture can be picked up on a dry hand. All such areas shall be repaired as necessary.

D. Damp spots or standing water on the footing may occur upon tank filling and are permissible within the allowable volume loss. Measurable flow in this area is not permissible and shall be corrected.

3.13 CLEAN-UP

A. The premises shall be kept clean and orderly at all times during the work. Upon completion of construction, the Tank Contractor shall remove or otherwise dispose of all rubbish and other materials caused by the construction operation. The Tank Contractor shall leave the premises in as good a condition as it was found.

3.14 FIELD QUALITY CONTROL

A. Concrete Testing & Inspecting:
   1. The evaluation and acceptance of concrete shall be in accordance with ACI 318.

3.15 COMPLETION OF WORK

A. Upon completion of the work, the Contractor shall remove construction equipment and temporary materials and dispose of all rubbish and other unsightly debris caused by operations and shall leave the premises in as good or better conditions than Contractor found them.

END OF SECTION

This Page Left Blank Intentionally

SECTION 33 16 20

WELDED STEEL WATER STORAGE TANKS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. This section includes furnishing all labor, material, tools and equipment necessary to design, fabricate, construct, inspect, test, and commission an Elevated Tank and related work including foundations, mechanical and appurtenances as shown on the drawings and specified herein.
   2. The work shall also include all labor new materials, and equipment necessary to clean, paint and disinfect the water storage tank as specified herein.

B. Related Sections:
   1. Section 03 31 20 - Concrete Foundation for Storage Tanks
   2. Section 09 97 13 - Coating Systems for Water Storage Tanks
   3. Section 33 16 30 - Disinfection of Water Storage Facilities
   4. Section 33 16 60 - Riser Insulation for Water Storage Tanks

1.02 REFERENCES

A. The latest version of the following Specifications, Codes and Standards are referenced in this section.
   1. ACI 301 - Standard Specification for Structural Concrete
   2. ACI 318 - Building Code Requirements for Structural Concrete
   3. D100 - AWWA Standard for Welded Steel Tanks for Water Storage
   4. AWWA C652 - Disinfection of Water Storage Facilities
   5. AWS D1.1 - Structural Welding Code – Steel
   6. NACE RP0178
   7. NSF 61 - Standard for Drinking Water System Components
   8. OSHA 29 CFR - Part 1926 Safety and Health Regulations for Construction

1.03 QUALIFICATIONS OF TANK SUPPLIER

A. Engineer's selection of dual tank construction for this facility has been predicated upon specific criteria, construction methods, and an optimum coating for resistance to internal and external tank corrosion. Deviations from the specified design, construction or coating details will not be permitted.

B. Bidder shall offer a new water tower as supplied from a manufacturer specializing in the design, fabrication and erection of dual tank construction. The manufacturer shall employ a staff of full time design engineers, and own and operate its steel fabrication facilities. Calculations for specified loads, foundation design, and complete structural calculations shall be performed by or under the supervision of stamped, and signed by a Professional Engineer licensed in the State of Wisconsin.

C. Strict adherence to the standards of design, fabrication, erection and product quality, and long term performance established in this Specification will be required by the Owner and Engineer.

D. Tank suppliers wishing to pre-qualify shall submit the following to the Engineer/Owner for consideration:
   1. Typical structure and foundation drawing(s).
   2. List of tank materials, appurtenances and tank coating specifications.
   3. List of 5 tanks presently in potable water service designed to AWWA D 100 Standard, of equal or greater size and character specified herein, operating satisfactorily for a minimum of 5 years, including the name and telephone number of Owner and Engineer.
   4. Only bids from tank suppliers who have successfully pre-qualified will be considered.

1.04 DESCRIPTION

A. Elevated Tank:
   1. The dual tank elevated structure shall consist of the following: foundation and upper and lower welded steel water tanks.
   2. To ensure an aesthetically pleasing tank the design shall minimize the number and total length of visible weld seams (shop and field). .

B. Operating Parameters (Lower Tank):
   1. Maximum capacity within operating range: 1,000,000 gallons.
   2. Maximum fill rate: 3,500 gpm.
   3. Maximum discharge rate: 3,500 gpm.
   4. Elevations:
      a. Overflow/top capacity level: 1080.00 feet.
      b. Bottom Capacity Line: 1015.00 feet.
      c. Top of Foundation: 1015.00 feet.
      d. Final Ground: 1014.25 feet.
   5. Inlet Riser Diameter: 16 inches.
   6. Outlet Riser Diameter: 16 inches
   7. Overflow Riser Diameter: 12 inches.
   8. Overflow Weir Box Minimum Weir Length: Contractor to submit calculations.
   9. Overflow weir, box, and piping shall be able to fully discharge the maximum fill rate with no more than 4 inches of hydraulic head above the overflow elevation.

C. Operating Parameters (Upper Tank):
   1. Maximum capacity within operating range: 300,000 gallons.
   2. Maximum fill rate: 3,500 gpm.
   3. Maximum discharge rate: 3,500 gpm.
   4. Elevations:
      a. Overflow/top capacity level: 1140.00 feet.
      b. Bottom Capacity Line: 1119.00 feet.
      c. Top of Foundation: 1015.00 feet.
      d. Final Ground: 1014.25 feet.
   5. Inlet Riser Diameter: 12 inches.
   6. Outlet Riser Diameter: 12 inches
   7. Overflow Riser Diameter: 10 inches.
   8. Overflow Weir Box Minimum Weir Length: Contractor to submit calculations.
   9. Overflow weir, box, and piping shall be able to fully discharge the maximum fill rate with no more than 4 inches of hydraulic head above the overflow elevation.

D. General Design Requirements:
   1. Dead load shall be the estimated weight of all permanent construction.
   2. Water load shall be the weight of water when the tank is filled to overflow.
   3. Include an allowance of 40 pounds per square foot on the horizontal projection for the pressure resulting from the snow load.
   4. Include allowances for pressures resulting from a 100-mph wind load on all surfaces in accordance with AWWA D100, Section 3.14.
   5. No corrosion allowance is required.
   6. Design for seismic zone zero is required.
   7. Allowable Soil Bearing Capacity: Contractor shall refer to Section 00 31 32 Geotechnical Data.
   8. The design for all sections of the steel tank shall be per the classes of materials and unit tension/compression stresses specified in AWWA D100-05. A design per Section 14 of AWWA D100-05 shall not be permitted.
   9. Shells designed by Method 2 or Method 3 of Sec. 3.4.3 of AWWA D100-05 shall be measured in accordance with Sec. 11.4.3.2.2 of AWWA D100-05. Documentation of the measurements and a certificate of compliance shall be provided.
   10. All openings in the support structure shall be properly reinforced. Loads imposed by openings in the base of the support structure shall be accommodated in the foundation design.

11. The overturning moment used in designing the support structure and foundation shall include the moment due to eccentricity of the gravity loads caused by deflection of the structure under wind or seismic conditions (i.e. P-Delta effect).
12. Unless otherwise noted, at junctions in plates where meridional forces are discontinuous such as cone to cylinder junctions, a tension or compression ring may be required to resist the radial forces generated. In these regions, the allowable stresses shall not exceed those specified in AWWA D100-05.

1.05 SUBMITTALS

A. Shop Drawings:
   1. Provide elevation and sectional view Drawings of the column, tank, and all appurtenant equipment and accessories.
   2. Indicate locations, dimensions, material specifications, and finish requirements.
   3. Drawings shall be sealed by a Professional Engineer licensed in the State of Wisconsin.

B. Construction Procedures:
   1. Provide design, detail Drawings, and procedures as follows:
      a. Tank: Shop and field weld procedures for all structural joints.

C. Design Data:
   1. Provide a head range/capacity table showing capacity of the tank in gallons at all levels in 1-foot increments.
   2. Provide a summary of the design for the foundation, column, tank, and other components, describing the design basis, loads, load combinations, and results.

D. Product Data: Provide manufacturer's descriptive information for appurtenant equipment and accessories that are not detailed on the Construction Drawings.

E. Reports/Certification:
   1. Provide documentation of all tests, inspections, and certifications required by this Section.
   2. Submit copies of welder's certification to Engineer prior to any welds being made.
   3. Upon Project completion, submit a written report certifying that the tank was inspected as required and providing the information required under AWWA D100, Section 11.2.1.
   4. Provide proof of insurance for Professional Liability with a minimum limit of $1,000,000 each occurrence and aggregate.

F. Operation/Maintenance: Provide operating instructions and maintenance procedures for the tank and applicable appurtenant equipment, mechanical components, and accessories. Provide as-built construction drawings, cleaning and painting instructions and a gage table and catalog cuts of equipment supplied.

1.06 QUALITY ASSURANCE

A. Radiographs: After acceptance of the tank structure, the radiographic film shall become the property of the Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling and Shipping:
   1. Handle materials and fabricated components in a manner that will protect them from damage.
   2. Allow adequate cure time prior to stacking or shipping coated items.

B. Storage and Protection:
   1. Protect delivered materials and equipment from damage.
   2. Store items in well-drained areas and provide blocking to minimize contact with the ground.

1.08 SITE CONDITIONS

A. Location:
   1. See Drawings.
   2. Access to the Site available via: See Section 01 11 00.

B. Services:
   1. Electric Power:
      a. Electric power is available at the Site.
      b. Contact Madison Gas & Electric for characteristics and fee.
   2. Water:
      a. Water is available at the Site.
      b. Contact Madison Water Utility for rates and procedures.

1.09 GUARANTEE

A. The tank manufacturer shall include an unconditional guarantee warranty for labor, tank materials, and coating. As a minimum, this warranty shall provide guarantee against defects in material or workmanship for the period of two (2) years. Following final acceptance of the project, the Contractor shall perform a two year anniversary inspection of the Facility. Said inspection cost shall be included in the bid. If inspection reveals that any work performed under this contract is faulty, repairs shall made at no cost to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:
   1. All materials provided shall be new, previously unused, in first class condition in compliance with AWWA D100, Section 2.
   2. Copper bearing steel is not required for this tank.

B. Fluid Conductors:
   1. The inlet/outlet water main and that section of vertical riser pipe below the floor shall be Class 56 Cement Lined Ductile Iron Pipe with mechanical joints in accordance with AWWA C110 and AWWA C115 and mechanical joints in accordance with ANSI A21.51, A21.4, and A21.11.
   2. All other internal and external piping shall be carbon steel fabricated from material meeting the requirements of ASTM A-53 and AWWA C200. Pipe material within tank shall be minimum standard weight wall thickness carbon steel. All fittings shall be smooth. Flow joints shall be screwed, welded or flanged.
   3. Pipe fittings and flange thickness shall be in accordance with the manufacturers certified pressure rating for the applicable service pressures. Design pressure rating shall be minimum 150 psi.
   4. Joints shall be screwed, welded or flanged.

2.02 COMPONENTS

A. Water Transmission:
   1. Silt Stop:
      a. Provide a minimum 6-inch high removable silt stop at the riser connection that is flush with the bowl floor.
   2. Riser Pipe:
      a. Support pipe by means of suitable galvanized steel brackets, guides, and hangars.
      b. Mount support devices on tower wall at minimum 20-foot intervals.
   3. Expansion Joint: Install in the vertical section of the riser just above the interior floor.
   4. Riser Assembly:
      a. Install the following items on the riser pipe:
         1) Telemetry connection: 1/2-inch coupling with stainless steel nipple and isolation gate valve.

2) Valve: See Drawings.
3) Pressure gage: See Section 26 16 01.

b. Install items in locations readily accessible from the floor.

B. Safety and Access:
1. Roof Handrail: Provide handrail to enclose accessories located on roof.
2. Manholes and Hatches:
a. Include watertight covers on each opening.
b. Tank floor opening:
1) Operable from ladder located on upper platform and designed to withstand the pressure of the tank contents without leakage.
2) Include steel handwheel operator and threaded components.
c. Roof openings:
1) Minimum 4-inch curbs on hatches.
2) Provide aluminum covers with 2-inch down-turned edges, stainless steel hardware, hold-open arm, handle, and hasp.
d. Access tube hatch:
1) Locate at top of access tube.
2) Provide chain, hook, and inside handle.
3) Provide a 6-inch vent with removable No. 4 stainless steel screen on hatch cover for access tube ventilation.
e. Flanged exhaust hatch:
1) Provided in roof adjacent to access tube.
2) Constructed to allow exhaust fan to be bolted to the hatch for ventilation during painting.
3) The pressure-vacuum vent may be mounted on the exhaust hatch.
f. Painter rail hatch:
1) Provided in roof and located to provide access to the interior painters rail near the shell.
2) Provide handle and hasp.
g. Painters manhole/vent (2 required):
1) Locate near top of support wall and accessible from walkway.
2) Provide access to the exterior painters rail and ventilation for the column.
3. Access Tube: Install tube centrally through the tank to provide access to the roof from the upper platform.
4. Grab Bar: Install in the roof adjacent to access tube hatch.
5. Ladders:
a. Material:
1) Tower ladders: Painted steel
2) Access tube ladders: Painted steel
b. Provide ladders in accordance with current U S Department of Labor, Occupational Safety and Health Administration (OSHA) regulations.
c. Secure ladders to adjacent structures by brackets at maximum 10-foot intervals.
d. Terminate ladders minimum 48 inches above platforms and landings.
6. Platforms and Landings:
a. Minimum width: 4 feet
b. Walking surface: Grating
c. Provide handrails, mid-rails, and toe plates in accordance with OSHA regulations.
7. Ventilation:
a. Tank vent:
1) Material: stainless steel or aluminum components including support frame, screened area, and cap.
2) Fasten support to flanged opening in tank roof.
3) Provide cap to prevent entrance of wind-driven debris or precipitation.
4) Provide minimum 4-inch distance between roof surface and vent cap.
5) Install corrosion resistant No. 4 screen.
6) Maximum fill rate: 3500 gpm.
7) Maximum discharge rate: 3500 gpm.
8) Provide self-correcting mechanism for failsafe operation in the event of screen plugging.
b. Tower vent:
1) Include removable insect screen.

2) Install minimum of one vent near top of column.
3) Accessible from interior platform.

8. Painters and Inspection Rails:
   a. Provide permanently installed painter rails attached to the underside of the roof suitable for rolling trolleys.
   b. Provide exterior mounted painter rails near the top of the tower and accessible via the painters manhole/vent.
   c. Provide an interior inspection rail located near the top of the tower interior and accessible from the walkway.
9. Ladder Safety Devices:
   a. SAF-T-CLIMB Fall Prevention System as manufactured by North Specialty Products or equivalent.
   b. Required components:
      1) SAF-T-NOTCH Carrier Rail, Standard Galvanized, 726-101-001.
      2) SAF-T-CLIMB Ladder Rung Clamps, Standard Galvanized 724-101-001.
      3) SAF-T-LOK Sleeve, 702-100-001. Provide 3 each.
      4) SAF-T-BELT, 728-200-001. Provide 3 OSHA approved harnesses.
   c. Provide on the following ladders:
      1) Ladders from grade to walkway.
      2) Ladder inside the access tube from the walkway to the roof.

C. Drains:
1. Overflow Pipe:
   a. Install weir box with vortex prevention at the overflow elevation.
   b. Support pipe by means of suitable brackets, guides and hangars.
   c. Mount supporting devices at maximum 20 intervals.
   d. Slope horizontal runs to drain.
   e. Install No. 4 stainless steel screen at discharge point.
2. Tank Drain:
   a. On the lower 1,000,000 gallon tank provide 8 inch drain from the low point of the tank floor.
   b. On the upper 300,000 gallon tank provide 4 inch drain from the low point of the tank floor and connect to the overflow pipe.
   c. Construct as shown on Drawing detail.
3. Condensate Drain:
   a. Install drain line from the condensate platform to the overflow pipe.
   b. Slope to drain.

2.03 ACCESSORIES

A. Antenna Conduit: Provide conduits as shown on Drawings.

B. Coax Support Hanger:
1. Provide coax support hangers in access tube as detailed on Drawings.
2. Coax support hanger by Fulton Technologies or equivalent.

C. Caulk: Sikaflex-1a, as manufactured by Sika Corporation, Lyndhurst, NJ, or approved equal.

2.04 SOURCE QUALITY CONTROL

A. Mill Inspection:
1. Mill inspection by a commercial agency is required.
2. Provide copies of the mill test report

B. Shop Inspection:
1. Shop inspection by a commercial agency is required.
2. Provide inspection reports for stress carrying joint welds in accordance with AWWA D100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Environmental Conditions: Prior to performing any work, verify the expected temperature, humidity, wind, and weather conditions are within the specified limitations for executing the work.

B. Tank Components: After completion of each major component and prior to proceeding with the next stage of construction, verify that tolerance inspections and material quality control tests conform to the requirements of Article 3.03.

3.02 FOUNDATION

A. General: The Contractor's bid price for the work shall include the design and placement of reinforced concrete foundations of structural mat or deep foundations. A professional engineer registered in the state of Wisconsin shall design the foundations. The design shall be based on the soil bearing values, minimum construction depths, and design recommendations in the Geotechnical Report. The foundations shown on the Plans are generic in nature and not intended to be used as the final design.

B. Subsurface Soil Investigation and Report: The Owner retained a geotechnical firm to perform a subsurface soil investigation of the proposed elevated water storage tank site. Borings were made and a report prepared. A copy of that Geotechnical Report has been included in Document 00 31 32.

C. Excavation, Backfill or Fill:
   1. All backfill or fill, as the case may be, shall be placed in strict accordance with the recommendations of the Geotechnical Report.
   2. The area around the footing excavations shall be graded to drain away from the excavated areas by the Contractor during construction of the footings. Extreme care shall be exercised to insure the surface runoff water does not enter the footings excavations.
   3. The Owner will employ the geotechnical firm that did the investigation to inspect and test the stripping, excavation, backfill and fill materials to ensure that the materials comply in their entirety with the moisture content and compaction recommendations included in the Geotechnical Report. The Owner will be responsible for costs involved in the testing and inspection.

D. Concrete Foundation:
   1. The foundation shall be designed by the Contractor and constructed of reinforced concrete with all necessary anchor bolts and connections. The design of the foundation, the specifications for the cement, aggregate, and the mixing and placement of the concrete shall all be in strict conformance with requirements of the latest revisions of ANSI A89.1 and standard No. 318 of the American Concrete Institute and of AWWA D-100, including Appendix. The minimum allowable design compressive strength (28 days) of the concrete as determined from samples taken from the transportation unit at the point of discharge shall be not less than 4000 psi.
   2. The Contractor shall pay for the collection and testing of cylinders for the strength test by an independent testing laboratory. If any tests shall fail this requirement as defined by Standard No. 318, ACI, the Contractor shall be responsible for paying for all additional testing ordered by the Owner through the Engineer to assure that the load carrying capacity of the structure is not jeopardized. If the requirements of Section 4.8.4.4 of ACI 318 are not met, the Owner, through the Engineer, shall order the Contractor to take action to correct the deficient work.

3.03 STEEL TANK

A. Welding:
   1. Comply with AWWA D100, Section 8 - Welding for procedures and requirements.
   2. Grinding of weld contour shall approximate Condition ‘D’ of NACE Standard RPO178.
   3. Provide complete penetration on double welded butt joints subject to secondary stress for base materials greater than 3/8-inch thick.
   4. Seal weld all water compartment joints.
   5. No field welding shall be performed unless specifically approved by manufacturer and Engineer.

B. Fabrication: Comply with AWWA D100, Section 9 - Shop Fabrication for layout, cutting, forming, edge preparation and workmanship of components.

C. Erection:
   1. Comply with AWWA D100, Section 10 - Erection for procedures and general requirements.
   2. Handrail Installation
      a. Preassemble handrail on ground.
      b. Install handrail on tank roof as a complete unit.

D. Tolerances:
   1. Tank Tolerances: API 650, Section 5.5.
   2. Steel:
      a. Measure actual imperfections after welding.
      b. Deviation from theoretical conical surface: Maximum $0.032\sqrt{RT}$, when measured in the radial direction over length $4\sqrt{RT}$, where R is the radius normal to the plate surface at the point of consideration, and T is the plate thickness.

3.04 FIELD QUALITY CONTROL

A. Concrete Testing & Inspecting:
   1. The evaluation and acceptance of concrete shall be in accordance with ACI 318.

B. Steel Tank Testing & Inspection-degree intervals.
   1. Inspection Procedures: AWWA D100, Section 11 - Inspection.
      a. Provide field measurements of steel erection tolerance in the radial direction at 30-degree intervals.
      b. Tank Shell Joints:
         1) Inspect all complete joint penetration welded shell butt joints by the radiographic method.
         2) Inspect primary stress joints that cannot be radiographed by air carbon arc gouging.
         3) Prepare and submit a form identifying the following:
            a) The specific joint.
            b) Justification for the inspection.
            c) Recorded length.
            d) Findings.

C. Hydrostatic
   1. Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling tank to its overflow elevation.
   2. Any leaks disclosed by this test shall be corrected by the authorized dealer in accordance with the manufacturer's recommendations.
   3. Water required for testing shall be furnished by the Owner at the time of tank erection completion, and at no charge to the tank erector. Disposal of test water shall be the responsibility of the Owner. Cost of water and disposal for retesting shall be the responsibility of the tank erector.
   4. Labor and equipment necessary for hydrostatic tank testing is to be included in the price of the tank.

3.05 DISINFECTION

A. Standards
   1. The tank structure shall be disinfected at the time of testing by chlorination in accordance with Section 33 16 30.
   2. Disinfection shall not take place until tank sealant is fully cured.

3.06 COMPLETION OF WORK

A. Upon completion of the work, the Contractor shall remove construction equipment and temporary materials and dispose of all rubbish and other unsightly debris caused by operations and shall leave the premises in as good or better conditions than Contractor found them.

END OF SECTION

This Page Left Blank Intentionally

SECTION 33 16 30

DISINFECTION OF WATER STORAGE FACILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Disinfection materials.
   2. Facility preparation.
   3. Application of disinfectant.
   4. Disposal of chlorinated water.
   5. Sampling and testing for bacteria.

B. Related Sections:
   1. Section 09 97 13 - Coating Systems for Water Storage Tanks

1.02 REFERENCES

A. AWWA:
   1. C652 - Disinfection of Water Storage Facilities

1.03 SUBMITTALS

A. Post Construction - Contract Close-Out: Submit certified bacteriological and chlorine residual test results.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sodium Hypochlorite - Liquid

B. Calcium Hypochlorite - Granular or Tablet

PART 3 EXECUTION

3.01 PREPARATION

A. Screens:
   1. Prior to cleaning, remove all vents and overflow screens.
   2. Verify that screens are in satisfactory condition.
   3. After cleaning is completed replace all screens.

B. Cleaning:
   1. Remove all materials from the facility interior.
   2. Thoroughly clean all interior surfaces using a high pressure water jet. This may be performed coincidental to Method 2 disinfection.
   3. Remove all water, dirt and foreign material accumulated in the cleaning operation from the facility.

3.02 APPLICATION

A. Chlorinate facility in accordance with AWWA C652, Method 3 as follows:
   1. Add water and chlorine to the facility in the following amounts:
      a. Water: Fill to 5 percent of the total storage volume.
      b. Chlorine: Add to provide a 50 mg/l (available chlorine) solution.
   2. Hold the solution in the facility for a minimum of 6 hours.
   3. Admit potable water and fill to overflow.
   4. Hold facility full for a minimum of 24 hours.
   5. Purge highly-chlorinated water from drain piping.
   6. Verify that a free-chlorine residual of not less than 2 mg/l is present.
   7. Provide acceptable bacteriological testing.
   8. Deliver water to distribution system.

B. Disposal of Water:
   1. Prior to discharge or purging of chlorinated water, advise Owner of the time, quantity and concentration.
   2. If the concentration exceeds 10 mg/l, neutralize in accordance with Appendix B of AWWA C652 prior to discharge.

3.03 FIELD QUALITY CONTROL

A. Provide bacteriological sampling and testing as follows:
   1. Obtain samples from sample tap connected to storage facility or outlet piping at 24 hour intervals.
   2. Perform coliform and chlorine residual tests on samples by a certified laboratory.
   3. Obtain 2 successive negative coliform test results prior to placement of facility in service.
   4. Rechlorinate in accordance with 3.02 A if samples test positive for coliform, or if a 2 mg/l residual cannot be maintained.

END OF SECTION

SECTION 33 16 45

CATHODIC PROTECTION FOR WATER STORAGE TANKS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes installation of an automatically controlled impressed current cathodic protection system for corrosion control for the interior submerged surface of a new steel water storage tank.

1.02 REFERENCES

A. AWWA D104

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
   1. The criteria for protection shall be based on:
      a. A tank-to-water potential.
      b. IR drop free.
      c. Range of -0.850 volts to -1.050 volts relative to a stationary copper-copper sulfate reference electrode.
   2. This potential shall be measured free of the effect of voltage gradients (IR drops).
   3. Base system capacity and performance on:
      a. Total submerged surface area of the tank. Total surface area includes HWL in bowl and wet risers in elevated tanks, which are 30-inch diameter or larger.
      b. Type of coating and condition of coating.
      c. Total bare surface area to be protected will be a minimum of 25 percent of total surface area.
      d. Minimum current density of 0.5 MA/ft.^{2} bare surface area.
      e. Chemical analysis of water including resistivity expressed in ohm-cm.
      f. Susceptibility to icing.
      g. Minimum anode design life of 20 years.
      h. Selection, dimensions, and layout of system components specified in Section C.

B. Performance Requirements: System provider shall furnish self-addressed report cards to be completed by Owner. Report cards received by system provider during the guarantee and service period(s) shall be evaluated for system performance.

1.04 SUBMITTALS

A. Shop Drawings showing system design/ configuration.

B. Description of system components.

C. Copy of ANSI/NSF 6.1 classification for all system components located within the tank.

D. Owner's Maintenance Manual.

E. As-constructed Drawings.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Cathodic protection constructor shall have a minimum of 5 years of experience in installing and servicing the type of system described in this specification.

2. System shall be installed by personnel specifically trained by the constructor to provide all workmanship required for corrosion control performance.
3. All services shall be provided by a Corrosion Specialist who is accredited by the National Association of Corrosion Engineers International as a Senior Corrosion Technologist, Corrosion Specialist, or Cathodic Protection Specialist.
4. Corrosion Specialist shall provide services for:
    a. Design of system.
    b. Supervision of installation.
    c. Supervision of start-up testing.
    d. Review of reports.

1.06 WARRANTY

A. All workmanship, equipment, and materials shall be guaranteed for 2 years.

1.07 SYSTEM START-UP

A. After the system is installed and the tank is filled, provide start-up service which includes energizing, testing, and adjusting the system for optimum performance of the cathodic protection system. This start-up service shall be in accordance with ANSI/AWWA D104-97 Section 5.2 Testing, 5.2.1 Field Test for Type A, IR Drop-Free System.
    1. All tank-to-water potential measurements shall be conducted with a calibrated portable copper-copper sulfate reference electrode and a portable high impedance voltmeter.
    2. A minimum of 5 locations shall be measured.
    3. All test data shall be reviewed and evaluated by the Corrosion Specialist.

B. This start-up service shall be coordinated with Owner or his representative.

C. Final test and adjustment of the system shall be conducted approximately 24 months after start-up service.

1.08 MAINTENANCE

A. Provide service agreement for the type of system installed.
    1. Agreement shall include the annual service rate and a complete description of the scope of work proposed.
    2. Agreement for annual inspection and potential testing shall be in accordance with AWWA D104-97 Appendix C and include as a minimum:
        a. One annual job site visit.
        b. Tank-to-water potential measurements conducted at representative locations within the tank. A minimum of 5 locations shall be measured.
        c. Measurements shall be conducted with a portable, high impedance voltmeter and a calibrated copper-copper sulfate reference cell.
        d. Adjustments for optimum corrosion control shall be in accordance with criteria for protection.
        e. Data recorded shall provide sufficient information to evaluate the performance of the system relating to criteria for protection.
        f. In the event additional work is required, the constructor shall submit a report with recommendations for optimizing corrosion control.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Rectifier:
    1. Rectifier unit shall perform in accordance with ANSI/AWWA Standard D104-97 Section 4: 4.1.1.1.1., Type A, IR drop free system.
    2. Rectifier shall include:
        a. Transformer.

b. Selenium or silicon rectifying elements
c. Circuit breaker(s).
d. Lighting, surge, and overload protection.
e. Provision for air-cooling operation.
f. Voltmeter(s) and ammeter(s).
g. Weatherproof cabinet in accordance with NEMA 3R requirements.
h. Provision to vary current output from 0 percent to 100 percent of rated capacity.
i. Provisions for mounting, grounding, and locking.
j. Provision for 110-120 volt 60 H_2, single-phase AC power.
k. DC output capacity in volts and amperes in accordance with Design (Section B).
l. Number of circuits or separate rectifiers in accordance with Design (Section B).

3. Automatic controller shall be AWWA D104-97, Type A and shall adjust current output to compensate for changes in water level, temperature of water, water chemistry, and cathodic polarization, and shall include the following provisions:
   a. Utilize long-life reference electrode(s) mounted in tank.
   b. Monitor the tank-to-water potential, free of IR drop.
   c. Automatically adjust the tank-to-water potential, free of IR drop, to a preset value (Section B).
   d. Operate within 25MV of preset value.
   e. Limit current to a preset value.
   f. Utilize potential meter(s) to display tank-to-water potential, free of IR drop.

B. Long-life Reference Electrode(s):
1. The permanent reference electrode shall consist of a copper-copper sulfate electrode which is manufactured to remain stable (plus or minus 10MV) for a minimum of 10 years.
2. The reference electrode to lead wire connection shall be encapsulated to prevent water migration.
3. The stationary reference electrode shall be positioned in the tank water to provide the most representative measurements for the submerged surface area(s).

C. Anode Suspension System for Icing Tanks:
1. The anode suspension system shall be designed to be resistant to ice damage and in accordance with ANSI/AWWA Standard D104-97, Section 4.2.4.1.1 Type A, Horizontal System.
2. The anode suspension system shall consist of a minimum 5/16-inch polyester cord.
   a. The cord shall be secured to steel anchors welded to the sidewall of the tank bowl or to the exterior of the dry access column of spheroidal type tanks and the sidewall of wet risers which are 30-inch in diameter or larger.
   b. All cord to cord connections shall be tied and taped.

D. Anode Materials:
1. The anode materials shall be selected in accordance with Design (Section B) and shall consist of one of the following:
   a. Minimum 0.062-inch diameter platinized niobium with 25 micro inches of platinum. The wire anode shall be continuous with a maximum of 2 anode to header connections.
   b. Minimum 0.062-inch diameter titanium with a precious metal oxide coating. The wire anode shall be continuous with a maximum of 2 anode to header connections.
2. All anode to header cable connections shall be sealed to prevent water migration.

E. Pressure Entrance Fitting:
1. Icing Tanks:
   a. The pressure entrance fitting shall accommodate anode and reference electrode lead wires at the base of the tank or at the base of wet risers for elevated tanks, which are 30-inch diameter or larger.
   b. The fitting shall be manufactured to prevent leakage through the fitting and to prevent water migration through the wire insulation.
   c. The entrance fitting shall be sized for a maximum 1.5-inch Schedule 80 steel coupling.

F. Wiring:
1. All wiring within the tank shall be insulated to prevent copper conductor to water contact.
2. All wiring on the exterior of the tank shall be insulated and run in rigid conduit.

G. Hardware: All hardware used in conjunction with the system shall be protected against corrosion.

H. ANSI/NSF 61: All materials in contact with the water, or exposed to the interior of the tank, shall be classified in accordance with ANSI/NSF 61 Drinking Water System Components.

PART 3 EXECUTION

3.01 INSTALLATION

A. All work shall be in accordance with the following requirements:
   1. Components of the cathodic protection system shall be installed in the manner and at the locations as shown on Drawings.
   2. Pressure entrance fitting shall be installed in accordance with AWWA D100-96, Section 3.13.
   3. Welding, cutting, and coating shall be in accordance with AWWA Standards D100, D102, and D105.
   4. Materials and equipment shall be inspected prior to installation.
   5. Defective components shall be repaired or replaced.
      a. Electrical work shall be in accordance with the National Electrical Code.
      b. Lead wires shall be installed to prevent damage from abrasion.
      c. Electrical connections within the tank shall be sealed to prevent water migration.
   6. The rectifier shall be mounted at a convenient height (eye level) above grade for monitoring and service purposes.
      a. AC power to the rectifier will be provided by Owner.
   7. Work provided by the cathodic protection constructor shall be completed in a clean and safe manner.

END OF SECTION

SECTION 33 16 60

RISER INSULATION FOR WATER STORAGE TANKS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Piping insulation for riser.
   2. Jacketing.
   3. Accessories.

B. Related Sections:
   1. Section 33 16 20 - Welded Steel Water Storage Tanks

1.02 SUBMITTALS

A. Insulation and Jacketing:
   1. Product description and data.
   2. Manufacturer’s installation instructions.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturer.

B. Maintain temperature during and after installation for minimum period of 24 hours.

1.04 PROJECT CONDITIONS

A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe Insulation:
   1. Polyisocyanurate foam.
   2. Minimum Thickness: 4 inches.
   3. Molded to specified pipe size.
   4. CFC free.
   5. Density: 2.0 pounds per cubic foot.
   6. R-value: 5.3.
   7. Compressive strength: 23 psi.
   8. Dow Plastics, Trymer 2000, or equal.

B. Pipe Jackets:
   1. Aluminum sheet, 0.016-inch thickness.
   2. Field applied.
   3. Smooth finish.
   4. Longitudinal slip joints.
   5. 2-inch laps.
   6. Die shaped fitting covers with factory attached protective liner.
   7. Supply from same source as pipe insulation.

2.02 ACCESSORIES

A. Tie Wire: 16 gage with twisted ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that all pipe surfaces are clean, dry and free of foreign material.

3.02 INSTALLATION

A. Provide 4-inch insulation with aluminum jacket around the riser and appurtenances between the floor and the bowl.

B. Install materials in accordance with manufacturer's instructions.

C. Neatly finish insulation and jacket at protrusions and other interruptions.

D. Place tie wires on maximum 24-inch centers.

END OF SECTION

SECTION E: BIDDERS ACKNOWLEDGEMENT

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

Bidder must state a Unit Price and Total Bid for each item. The Total Bid for each item must be the product of quantity, by Unit Price. The Grand Total must be the sum of the Total Bids for the various items. In case of multiplication errors or addition errors, the Grand Total with corrected multiplication and/or addition shall determine the Grand Total bid for each contract. The Unit Price and Total Bid must be entered numerically in the spaces provided. All words and numbers shall be written in ink.

1. The undersigned having familiarized himself/herself with the Contract documents, including Advertisement for Bids, Instructions to Bidders, Form of Proposal, City of Madison Standard Specifications for Public Works Construction - 2014 Edition thereto, Form of Agreement, Form of Bond, and Addenda issued and attached to the plans and specifications on file in the office of the City Engineer, hereby proposes to provide and furnish all the labor, materials, tools, and expendable equipment necessary to perform and complete in a workmanlike manner the specified construction on this project for the City of Madison; all in accordance with the plans and specifications as prepared by the City Engineer, including Addenda to the Contract Nos. _____ through _____ issued thereto, at the prices for said work as contained in this proposal. (Electronic bids submittals shall acknowledge addendum under Section E and shall not acknowledge here)
2. If awarded the Contract, we will initiate action within seven (7) days after notification or in accordance with the date specified in the contract to begin work and will proceed with diligence to bring the project to full completion within the number of work days allowed in the Contract or by the calendar date stated in the Contract.
3. The undersigned Bidder or Contractor certifies that he/she is not a party to any contract, combination in form of trust or otherwise, or conspiracy in restraint of trade or commerce or any other violation of the anti-trust laws of the State of Wisconsin or of the United States, with respect to this bid or contract or otherwise.
4. I hereby certify that I have met the Bid Bond Requirements as specified in Section 102.5. *(IF BID BOND IS USED, IT SHALL BE SUBMITTED ON THE FORMS PROVIDED BY THE CITY. FAILURE TO DO SO MAY RESULT IN REJECTION OF THE BID).*
5. I hereby certify that all statements herein are made on behalf of _____ (name of corporation, partnership, or person submitting bid) a corporation organized and existing under the laws of the State of _____ a partnership consisting of _____; an individual trading as _____; of the City of _____ State of _____; that I have examined and carefully prepared this Proposal, from the plans and specifications and have checked the same in detail before submitting this Proposal; that I have fully authority to make such statements and submit this Proposal in (its, their) behalf; and that the said statements are true and correct.

_____
SIGNATURE

_____
TITLE, IF ANY

Sworn and subscribed to before me this
_____ day of _____, 20_____.

_____
(Notary Public or other officer authorized to administer oaths)
My Commission Expires _____
Bidders shall not add any conditions or qualifying statements to this Proposal.

SECTION F: DISCLOSURE OF OWNERSHIP & BEST VALUE CONTRACTING

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

State of Wisconsin
Department of Workforce Development
Equal Rights Division
Labor Standards Bureau

Disclosure of Ownership

Notice required under Section 15.04(1)(m), Wisconsin Statutes. The statutory authority for the use of this form is prescribed in Sections 66.0903(12)(d) and 103.49(7)(d), Wisconsin Statutes. The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes. Personal information you provide may be used for secondary purposes.

(1) On the date a contractor submits a bid to or completes negotiations with a state agency or local governmental unit, on a project subject to Section 66.0903 or 103.49, Wisconsin Statutes, the contractor shall disclose to such state agency or local governmental unit the name of any "other construction business", which the contractor, or a shareholder, officer or partner of the contractor, owns or has owned within the preceding three (3) years.

(2) The term "other construction business" means any business engaged in the erection, construction, remodeling, repairing, demolition, altering or painting and decorating of buildings, structures or facilities. It also means any business engaged in supplying mineral aggregate, or hauling excavated material or spoil as provided by Sections 66.0903(3), 103.49(2) and 103.50(2), Wisconsin Statutes.

(3) This form must ONLY be filed, with the state agency or local governmental unit that will be awarding the contract, if **both (A) and (B) are met**.

(A) The contractor, or a shareholder, officer or partner of the contractor:
(1) Owns at least a 25% interest in the "other construction business", indicated below, on the date the contractor submits a bid or completes negotiations.
(2) Or has owned at least a 25% interest in the "other construction business" at any time within the preceding three (3) years.

(B) The Wisconsin Department of Workforce Development (DWD) has determined that the "other construction business" has failed to pay the prevailing wage rate or time and one-half the required hourly basic rate of pay, for hours worked in excess of the prevailing hours of labor, to any employee at any time within the preceding three (3) years.

Other Construction Business

Not Applicable ☐

Name of Business			
Street Address or P O Box	City	State	Zip Code
Name of Business			
Street Address or P O Box	City	State	Zip Code
Name of Business			
Street Address or P O Box	City	State	Zip Code

I hereby state under penalty of perjury that the information, contained in this document, is true and accurate according to my knowledge and belief.

Print the Name of Authorized Officer	
Signature of Authorized Officer	Date Signed
Name of Corporation, Partnership or Sole Proprietorship	

Street Address or P O Box	City	State	Zip Code

If you have any questions call (608) 266-0028

ERD-7777-E (R. 09/2003)

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

Best Value Contracting

1. The Contractor shall indicate the non-apprenticeable trades used on this contract.

_____

_____

2. Madison General Ordinance (M.G.O.), 33.07(7), does provide for some exemptions from the active apprentice requirement. Apprenticeable trades are those trades considered apprenticeable by the State of Wisconsin. Please check applicable box if you are seeking an exemption.

☐ Contractor has a total skilled workforce of four or less individuals in all apprenticeable trades combined.

☐ No available trade training program; The Contractor has been rejected by the only available trade training program, or there is no trade training program within 90 miles.

☐ Contractor is not using an apprentice due to having a journey worker on layoff status, provided the journey worker was employed by the contractor in the past six months.

☐ First-time Contractor on City of Madison Public Works contract requests a onetime exemption but intends to comply on all future contracts and is taking steps typical of a "good faith" effort.

☐ Contractor has been in business less than one year.

☐ Contractor doesn't have enough journeyman trade workers to qualify for a trade training program in that respective trade

3. The Contractor shall indicate on the following section which apprenticeable trades are to be used on this contract. Compliance with active apprenticeship, to the extent required by M.G.O. 33.07(7), shall be satisfied by documentation from an applicable trade training body; an apprenticeship contract with the Wisconsin Department of Workforce Development or a similar agency in another state; or the U.S Department of Labor. This documentation is required prior to the Contractor beginning work on the project site.

☐ The Contractor has reviewed the list and shall not use any apprenticeable trades on this project.

LIST APPRENTICABLE TRADES (check all that apply to your work to be performed on this contract)

- ☐ BRICKLAYER
- ☐ CARPENTER
- ☐ CEMENT MASON / CONCRETE FINISHER
- ☐ CEMENT MASON (HEAVY HIGHWAY)
- ☐ CONSTRUCTION CRAFT LABORER
- ☐ DATA COMMUNICATION INSTALLER
- ☐ ELECTRICIAN
- ☐ ENVIRONMENTAL SYSTEMS TECHNICIAN / HVAC SERVICE TECH/HVAC INSTALL / SERVICE
- ☐ GLAZIER
- ☐ HEAVY EQUIPMENT OPERATOR / OPERATING ENGINEER
- ☐ INSULATION WORKER (HEAT & FROST)
- ☐ IRON WORKER
- ☐ IRON WORKER (ASSEMBLER, METAL BLDGS)
- ☐ PAINTER & DECORATOR
- ☐ PLASTERER
- ☐ PLUMBER
- ☐ RESIDENTIAL ELECTRICIAN
- ☐ ROOFER & WATER PROOFER
- ☐ SHEET METAL WORKER
- ☐ SPRINKLER FITTER
- ☐ STEAMFITTER
- ☐ STEAMFITTER (REFRIGERATION)
- ☐ STEAMFITTER (SERVICE)
- ☐ TAPER & FINISHER
- ☐ TELECOMMUNICATIONS (VOICE, DATA & VIDEO) INSTALLER-TECHNICIAN
- ☐ TILE SETTER

_____

NAME OF BIDDER

PROPOSAL

LAKEVIEW RESERVOIR REPLACEMENT

CONTRACT 7339

ITEM	TYPE OF WORK	ESTIMATED QUANTITES		UNIT PRICE BID	TOTAL BID
ACCOUNT NO. EW01-58310-810458-00-53W1809					
	Steel Tank Base Bid	1	LS		$
GRAND TOTAL (Steel Tank Base Bid)					
	Concrete Tank Base Bid	1	LS		$
GRAND TOTAL (Concrete Tank Base Bid)					
	Alternate A (Steel Tank) Alternate bid for all work in this contract with a contractor defined schedule starting April 1, 2015 with a substantial completion of July 1, 2016 and final completion August 1, 2016	1	LS		$
GRAND TOTAL (Alternate A)					
	Alternate B (Concrete Tank) Alternate bid for all work in this contract with a contractor defined schedule starting April 1, 2015 with a substantial completion of July 1, 2016 and final completion August 1, 2016	1	LS		$
GRAND TOTAL (Alternate B)					

Award will be made to the lowest responsible Base Bid.

SECTION G: BID BOND

KNOW ALL MEN BY THESE PRESENT, THAT _____ (a corporation of the State of _____) (individual), (partnership), hereinafter referred to as the "Principal") and _____, a corporation of the State of _____ (hereinafter referred to as the "Surety") and licensed to do business in the State of Wisconsin, are held and firmly bound unto the City of Madison, (hereinafter referred to as the "Obligee"), in the sum of five per cent (5%) of the amount of the total bid or bids of the Principal herein accepted by the Obligee, for the payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The conditions of this obligation are such that, whereas the Principal has submitted, to the City of Madison a certain bid, including the related alternate, and substitute bids attached hereto and hereby made a part hereof, to enter into a contract in writing for the construction of:

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

1. If said bid is rejected by the Obligee, then this obligation shall be void.

2. If said bid is accepted by the Obligee and the Principal shall execute and deliver a contract in the form specified by the Obligee (properly completed in accordance with said bid) and shall furnish a bond for his/her faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void.

   If said bid is accepted by the Obligee and the Principal shall fail to execute and deliver the contract and the performance and payment bond noted in 2. above executed by this Surety, or other Surety approved by the City of Madison, all within the time specified or any extension thereof, the Principal and Surety agree jointly and severally to forfeit to the Obligee as liquidated damages the sum mentioned above, it being understood that the liability of the Surety for any and all claims hereunder shall in no event exceed the sum of this obligation as stated, and it is further understood that the Principal and Surety reserve the right to recover from the Obligee that portion of the forfeited sum which exceed the actual liquidated damages incurred by the Obligee.

   The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Obligee may accept such bid, and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, on the day and year set forth below.

Seal

	Principal	Date
By:		
	Name of Surety	
By:		
		Date

This certifies that I have been duly licensed as an agent for the above company in Wisconsin under License No. _____ for the year _____, and appointed as attorney in fact with authority to execute this bid bond and the payment and performance bond referred to above, which power of attorney has not been revoked.

Date	Agent
	Address
	City, State and Zip Code
	Telephone Number

NOTE TO SURETY & PRINCIPAL

The bid submitted which this bond guarantees shall be rejected if the following instrument is not attached to this bond:

Power of Attorney showing that the agent of Surety is currently authorized to execute bonds on behalf of the Surety, and in the amounts referenced above.

Certificate of Biennial Bid Bond

TIME PERIOD - VALID (FROM/TO)
NAME OF SURETY
NAME OF CONTRACTOR
CERTIFICATE HOLDER City of Madison, Wisconsin

This is to certify that a biennial bid bond issued by the above-named Surety is currently on file with the City of Madison.

This certificate is issued as a matter of information and conveys no rights upon the certificate holder and does not amend, extend or alter the coverage of the biennial bid bond.

Cancellation: Should the above policy be cancelled before the expiration date, the issuing Surety will give thirty (30) days written notice to the certificate holder indicated above.

Signature of Authorized Contractor Representative

Date

SECTION H: AGREEMENT

THIS AGREEMENT made this _____ day of _____ in the year Two Thousand and Fourteen between _____ hereinafter called the Contractor, and the City of Madison, Wisconsin, hereinafter called the City.

WHEREAS, the Common Council of the said City of Madison under the provisions of a resolution adopted _____, and by virtue of authority vested in the said Council, has awarded to the Contractor the work of performing certain construction.

NOW, THEREFORE, the Contractor and the City, for the consideration hereinafter named, agree as follows:

1. **Scope of Work.** The Contractor shall, perform the construction, execution and completion of the following listed complete work or improvement in full compliance with the Plans, Specifications, Standard Specifications, Supplemental Specifications, Special Provisions and contract; perform all items of work covered or stipulated in the proposal; perform all altered or extra work; and shall furnish, unless otherwise provided in the contract, all materials, implements, machinery, equipment, tools, supplies, transportation, and labor necessary to the prosecution and completion of the work or improvements:

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

2. **Completion Date/Contract Time.** Construction work must begin within seven (7) calendar days after the date appearing on mailed written notice to do so shall have been sent to the Contractor and shall be carried on at a rate so as to secure full completion SEE SPECIAL PROVISIONS, the rate of progress and the time of completion being essential conditions of this Agreement.

3. **Contract Price.** The City shall pay to the Contractor at the times, in the manner and on the conditions set forth in said specifications, the sum of _____($_____) Dollars being the amount bid by such Contractor and which was awarded to him/her as provided by law.

4. **Wage Rates for Employees of Public Works Contractors**

   General and Authorization. The Contractor shall compensate its employees at the prevailing wage rate in accordance with section 66.0903, Wis. Stats., DWD 290 of the Wisconsin Administrative Code and as hereinafter provided unless otherwise noted in Section D: Special Provisions, Subsection 102.10 – Minimum Rate of Wage Scale.

   "Public Works" shall include building or work involving the erection, construction, remodeling, repairing or demolition of buildings, parking lots, highways, streets, bridges, sidewalks, street lighting, traffic signals, sanitary sewers, water mains and appurtenances, storm sewers, and the grading and landscaping of public lands.

   "Building or work" includes construction activity as distinguished from manufacturing, furnishing of materials, or servicing and maintenance work, except for the delivery of mineral aggregate such as sand, gravel, bituminous asphaltic concrete or stone which is incorporated into the work under contract with the City by depositing the material directly in final place from transporting vehicle.

   "Erection, construction, remodeling, repairing" means all types of work done on a particular building or work at the site thereof in the construction or development of the project, including without limitation, erecting, construction, remodeling, repairing, altering, painting, and decorating, the transporting of materials and supplies to or from the building or work done by the employees of the Contractor, Subcontractor, or Agent thereof, and the manufacturing or furnishing of materials, articles, supplies or equipment on the site of the building or work, by persons employed by the Contractor, Subcontractor, or Agent thereof.

"Employees working on the project" means laborers, workers, and mechanics employed directly upon the site of work.

"Laborers, Workers, and Mechanics" include pre-apprentices, helpers, trainees, learners and properly registered and indentured apprentices but exclude clerical, supervisory, and other personnel not performing manual labor.

Establishment of Wage Rates. The Department of Public Works shall periodically obtain a current schedule of prevailing wage rates from DWD. The schedule shall be used to establish the City of Madison Prevailing Wage Rate Schedule for Public Works Construction (prevailing wage rate). The Department of Public Works may include known increases to the prevailing wage rate which can be documented and are to occur on a future specific date. The prevailing wage rate shall be included in public works contracts subsequently negotiated or solicited by the City. Except for known increases contained within the schedule, the prevailing wage rate shall not change during the contract. The approved wage rate is attached hereto.

Workforce Profile. The Contractor shall, at the time of signature of the contract, notify the City Engineer in writing of the names and classifications of all the employees of the Contractor, Subcontractors, and Agents proposed for the work. In the alternative, the Contractor shall submit in writing the classifications of all the employees of the Contractor, Subcontractors and Agents and the total number of hours estimated in each classification for the work. This workforce profile(s) shall be reviewed by the City Engineer who may, within ten (10) days, object to the workforce profile(s) as not being reflective of that which would be required for the work. The Contractor may request that the workforce profile, or a portion of the workforce profile, be submitted after the signature of the contract but at least ten (10) days prior to the work commencing. Any costs or time loss resulting from modifications to the workforce profile as a result of the City Engineer's objections shall be the responsibility of the Contractor.

Payrolls and Records. The Contractor shall keep weekly payroll records setting forth the name, address, telephone number, classification, wage rate and fringe benefit package of all the employees who work on the contract, including the employees of the Contractor's subcontractors and agents. Such weekly payroll records must include the required information for all City contracts and all other contracts on which the employee worked during the week in which the employee worked on the contract. The Contractor shall also keep records of the individual time each employee worked on the project and for each day of the project. Such records shall also set forth the total number of hours of overtime credited to each such employee for each day and week and the amount of overtime pay received in that week. The records shall set forth the full weekly wages earned by each employee and the actual hourly wage paid to the employee.

The Contractor shall submit the weekly payroll records, including the records of the Contractor's subcontractors and agents, to the City Engineer for every week that work is being done on the contract. The submittal shall be within twenty-one (21) calendar days of the end of the Contractor's weekly pay period.

Employees shall receive the full amounts accrued at the time of the payment, computed at rates not less than those stated in the prevailing wage rate and each employee's rate shall be determined by the work that is done within the trade or occupation classification which should be properly assigned to the employee.

An employee's classification shall not be changed to a classification of a lesser rate during the contract. If, during the term of the contract, an employee works in a higher pay classification than the one which was previously properly assigned to the employee, then that employee shall be considered to be in the higher pay classification for the balance of the contract, receive the appropriate higher rate of pay, and she/he shall not receive a lesser rate during the balance of the contract. For purposes of clarification, it is noted that there is a distinct difference between working in a different classification with higher pay and doing work within a classification that has varying

rates of pay which are determined by the type of work that is done within the classification. For example, the classification “Operating Engineer” provides for different rates of pay for various classes of work and the Employer shall compensate an employee classified as an “Operating Engineer” based on the highest class of work that is done in one day. Therefore, an “Operating Engineer’s” rate may vary on a day to day basis depending on the type of work that is done, but it will never be less than the base rate of an “Operating Engineer”. Also, as a matter of clarification, it is recognized that an employee may work in a higher paying classification merely by chance and without prior intention, calculation or design. If such is the case and the performance of the work is truly incidental and the occurrence is infrequent, inconsequential and does not serve to undermine the single classification principle herein, then it may not be required that the employee be considered to be in the higher pay classification and receive the higher rate of pay for the duration of the contract. However, the Contractor is not precluded or prevented from paying the higher rate for the limited time that an employee performs work that is outside of the employee’s proper classification.

Questions regarding an employee’s classification, rate of pay or rate of pay within a classification, shall be resolved by reference to the established practice that predominates in the industry and on which the trade or occupation rate/classification is based. Rate of pay and classification disputes shall be resolved by relying upon practices established by collective bargaining agreements and guidelines used in such determination by appropriate recognized trade unions operating within the City of Madison.

The Contractor, its Subcontractors and Agents shall submit to interrogation regarding compliance with the provisions of this ordinance.

Mulcting of the employees by the Contractor, Subcontractor, and Agents on Public Works contracts, such as by kickbacks or other devices, is prohibited. The normal rate of wage of the employees of the Contractor, Subcontractor, and Agents shall not be reduced or otherwise diminished as a result of payment of the prevailing wage rate on a public works contract.

Hourly contributions. Hourly contributions shall be determined in accordance with the prevailing wage rate and with DWD. 290.01(10), Wis. Admin. Code.

Apprentices and Subjourney persons. Apprentices and sub journeypersons performing work on the project shall be compensated in accordance with the prevailing wage rate and with DWD 290.02, and 290.025, respectively, Wis. Admin. Code.

Straight Time Wages. The Contractor may pay straight time wages as determined by the prevailing wage rate and DWD 290.04, Wis. Admin. Code.

Overtime Wages. The Contractor shall pay overtime wages as required by the prevailing wage rate and DWD 290.05, Wis. Admin. Code.

Posting of Wage Rates and Hours. A clearly legible copy of the prevailing wage rate, together with the provisions of Sec. 66.0903(10)(a) and (11)(a), Wis. Stats., shall be kept posted in at least one conspicuous and easily accessible place at the project site by the Contractor and such notice shall remain posted during the full time any laborers, workers or mechanics are employed on the contract.

Evidence of Compliance by Contractor. Upon completion of the contract, the Contractor shall file with the Department of Public Works an affidavit stating:

a. That the Contractor has complied fully with the provisions and requirements of Sec. 66.0903(3), Wis. Stats., and Chapter DWD 290, Wis. Admin. Code; the Contractor has received evidence of compliance from each of the agents and subcontractors; and the names and addresses of all of the subcontractors and agents who worked on the contract.

b. That full and accurate records have been kept, which clearly indicate the name and trade or occupation of every laborer, worker or mechanic employed by the Contractor in connection with work on the project. The records shall show the number of hours worked by each employee and the actual wages paid therefore; where these records will be kept and the name, address and telephone number of the person who will be responsible for keeping them. The records shall be retained and made available for a period of at least three (3) years following the completion of the project of public works and shall not be removed without prior notification to the municipality.

Evidence of Compliance by Agent and Subcontractor. Each agent and subcontractor shall file with the Contractor, upon completion of their portion of the work on the contract an affidavit stating that all the provisions of Sec. 66.0903(3), Wis. Stats., have been fully complied with and that full and accurate records have been kept, which clearly indicate the name and trade or occupation of every laborer, worker or mechanic employed by the Contractor in connection with work on the project. The records shall show the number of hours worked by each employee and the actual wages paid therefore; where these records shall be kept and the name, address and telephone number of the person who shall be responsible for keeping them. The records shall be retained and made available for a period of at least three (3) years following the completion of the project of public works and shall not be removed without prior notification to the municipality.

Failure to Comply with the Prevailing Wage Rate. If the Contractor fails to comply with the prevailing wage rate, she/he shall be in default on the contract.

5. **Affirmative Action.** In the performance of the services under this Agreement the Contractor agrees not to discriminate against any employee or applicant because of race, religion, marital status, age, color, sex, disability, national origin or ancestry, income level or source of income, arrest record or conviction record, less than honorable discharge, physical appearance, sexual orientation, gender identity, political beliefs, or student status. The Contractor further agrees not to discriminate against any subcontractor or person who offers to subcontract on this contract because of race, religion, color, age, disability, sex, sexual orientation, gender identity or national origin.

The Contractor agrees that within thirty (30) days after the effective date of this agreement, the Contractor will provide to the City Affirmative Action Division certain workforce utilization statistics, using a form to be furnished by the City.

If the contract is still in effect, or if the City enters into a new agreement with the Contractor, within one year after the date on which the form was required to be provided, the Contractor will provide updated workforce information using a second form, also to be furnished by the City. The second form will be submitted to the City Affirmative Action Division no later than one year after the date on which the first form was required to be provided.

The Contractor further agrees that, for at least twelve (12) months after the effective date of this contract, it will notify the City Affirmative Action Division of each of its job openings at facilities in Dane County for which applicants not already employees of the Contractor are to be considered. The notice will include a job description, classification, qualifications and application procedures and deadlines. The Contractor agrees to interview and consider candidates referred by the Affirmative Action Division if the candidate meets the minimum qualification standards established by the Contractor, and if the referral is timely. A referral is timely if it is received by the Contractor on or before the date started in the notice.

Articles of Agreement
Article I

The Contractor shall take affirmative action in accordance with the provisions of this contract to insure that applicants are employed, and that employees are treated during employment without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national original and that the employer shall provide harassment free work environment for the

realization of the potential of each employee. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation and selection for training including apprenticeship insofar as it is within the control of the Contractor. The Contractor agrees to post in conspicuous places available to employees and applicants notices to be provided by the City setting out the provisions of the nondiscrimination clauses in this contract.

Article II

The Contractor shall in all solicitations or advertisements for employees placed by or on behalf of the Contractors state that all qualified or qualifiable applicants will be employed without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national origin.

Article III

The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding a notice to be provided by the City advising the labor union or worker's representative of the Contractor's equal employment opportunity and affirmative action commitments. Such notices shall be posted in conspicuous places available to employees and applicants for employment.

Article V

The Contractor agrees that it will comply with all provisions of the Affirmative Action Ordinance of the City of Madison, including the contract compliance requirements. The Contractor agrees to submit the model affirmative action plan for public works contractors in a form approved by the Affirmative Action Division Manager.

Article VI

The Contractor will maintain records as required by Section 39.02(9)(f) of the Madison General Ordinances and will provide the City Affirmative Action Division with access to such records and to persons who have relevant and necessary information, as provided in Section 39.02(9)(f). The City agrees to keep all such records confidential, except to the extent that public inspection is required by law.

Article VII

In the event of the Contractor's or subcontractor's failure to comply with the Equal Employment Opportunity and Affirmative Action Provisions of this contract or Section 39.03 and 39.02 of the Madison General Ordinances, it is agreed that the City at its option may do any or all of the following:

1. Cancel, terminate or suspend this Contract in whole or in part.

2. Declare the Contractor ineligible for further City contracts until the Affirmative Action requirements are met.

3. Recover on behalf of the City from the prime Contractor 0.5 percent of the contract award price for each week that such party fails or refuses to comply, in the nature of liquidated damages, but not to exceed a total of five percent (5%) of the contract price, or five thousand dollars ($5,000), whichever is less. Under public works contracts, if a subcontractor is in noncompliance, the City may recover liquidated damages from the prime Contractor in the manner described above. The preceding sentence shall not be construed to prohibit a prime Contractor from recovering the amount of such damage from the non-complying subcontractor.

Article VIII

The Contractor shall include the above provisions of this contract in every subcontract so that such provisions will be binding upon each subcontractor. The Contractor shall take such action with respect to any subcontractor as necessary to enforce such provisions, including sanctions provided for noncompliance.

Article IX

The Contractor shall allow the maximum feasible opportunity to small business enterprises to compete for any subcontracts entered into pursuant to this contract. (In federally funded contracts the terms “DBE, MBE and WBE” shall be substituted for the term “small business” in this Article.)

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

IN WITNESS WHEREOF, the Contractor has hereunto set his/her hand and seal and the City has caused these presents to be sealed with its corporate seal and to be subscribed by its Mayor and City Clerk the day and year first above written.

Countersigned:

_____
Company Name

_____ _____
Witness Date President Date

_____ _____
Witness Date Secretary Date

CITY OF MADISON, WISCONSIN

Provisions have been made to pay the liability that will accrue under this contract.

Approved as to form:

_____ _____
Finance Director City Attorney

Signed this _____ day of _____, 20____

_____ _____
Witness Mayor Date

_____ _____
Witness City Clerk Date

SECTION I: PAYMENT AND PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____ as principal, and _____ Company of _____as surety, are held and firmly bound unto the City of Madison, Wisconsin, in the sum of _____($_____) Dollars, lawful money of the United States, for the payment of which sum to the City of Madison, we hereby bind ourselves and our respective executors and administrators firmly by these presents.

The condition of this Bond is such that if the above bounden shall on his/her part fully and faithfully perform all of the terms of the Contract entered into between him/herself and the City of Madison for the construction of:

LAKEVIEW RESERVOIR REPLACEMENT PROJECT
CONTRACT NO. 7339

in Madison, Wisconsin, and shall pay all claims for labor performed and material furnished in the prosecution of said work, and save the City harmless from all claims for damages because of negligence in the prosecution of said work, and shall save harmless the said City from all claims for compensation (under Chapter 102, Wisconsin Statutes) of employees and employees of subcontractor, then this Bond is to be void, otherwise of full force, virtue and effect.

Signed and sealed this _____day of _____

Countersigned:

_____
Company Name (Principal)

_____ _____
Witness President Seal

_____
Secretary

Approved as to form:

_____
Surety Seal
☐ Salary Employee ☐ Commission

_____ By _____
City Attorney Attorney-in-Fact

This certifies that I have been duly licensed as an agent for the above company in Wisconsin under License No. _____ for the year 20_____, and appointed as attorney-in-fact with authority to execute this payment and performance bond which power of attorney has not been revoked.

_____ _____
Date Agent Signature

SECTION J: PREVAILING WAGE RATES

This Page Left Blank Intentionally

PREVAILING WAGE RATE DETERMINATION
Issued by the State of Wisconsin
Department of Workforce Development
Pursuant to s. 66.0903, Wis. Stats.
Issued On: 01/06/2014
Amended On: 02/28/2014

DETERMINATION NUMBER:	201400001
EXPIRATION DATE:	Prime Contracts MUST Be Awarded or Negotiated On Or Before 12/31/2014. If NOT, You MUST Reapply.
PROJECT NAME:	ALL PUBLIC WORKS PROJECTS UNDER SEC 66.0903, STATS - CITY OF MADISON
PROJECT LOCATION:	MADISON CITY, DANE COUNTY, WI
CONTRACTING AGENCY:	CITY OF MADISON-ENGINEERING

CLASSIFICATION:	Contractors are responsible for correctly classifying their workers. Either call the Department of Workforce Development (DWD) with trade or classification questions or consult DWD's Dictionary of Occupational Classifications & Work Descriptions on the DWD website at: dwd.wisconsin.gov/er/prevailing_wage_rate/Dictionary/dictionary_main.htm.
OVERTIME:	Time and one-half must be paid for all hours worked: - over 10 hours per day on prevailing wage projects - over 40 hours per calendar week - Saturday and Sunday - on all of the following holidays: January 1; the last Monday in May; July 4; the 1st Monday in September; the 4th Thursday in November; December 25; - The day before if January 1, July 4 or December 25 falls on a Saturday; - The day following if January 1, July 4 or December 25 falls on a Sunday. Apply the time and one-half overtime calculation to whichever is higher between the Hourly Basic Rate listed on this project determination or the employee's regular hourly rate of pay. Add any applicable Premium or DOT Premium to the Hourly Basic Rate before calculating overtime. A DOT Premium (discussed below) may supersede this time and one-half requirement.
FUTURE INCREASE:	When a specific trade or occupation requires a future increase, you MUST add the full hourly increase to the "TOTAL" on the effective date(s) indicated for the specific trade or occupation.
PREMIUM PAY:	If indicated for a specific trade or occupation, the full amount of such pay MUST be added to the "HOURLY BASIC RATE OF PAY" indicated for such trade or occupation, whevenever such pay is applicable.
DOT PREMIUM:	This premium only applies to highway and bridge projects owned by the Wisconsin Department of Transportation and to the project type heading "Airport Pavement or State Highway Construction." DO NOT apply the premium calculation under any other project type on this determination.
APPRENTICES:	Pay apprentices a percentage of the applicable journeyperson's hourly basic rate of pay and hourly fringe benefit contributions specified in this determination. Obtain the appropriate percentage from each apprentice's contract or indenture.
SUBJOURNEY:	Subjourney wage rates may be available for some of the trades or occupations indicated below with the exception of laborers, truck drivers and heavy equipment operators. Any employer interested in using a subjourney classification on this project MUST complete Form ERD-10880 and request the applicable wage rate from the Department of Workforce Development PRIOR to using the subjourney worker on this project.

This document **MUST BE POSTED** by the **CONTRACTING AGENCY** in at least one conspicuous and easily accessible place **on the site of the project** . A local governmental unit may post this document at the place normally used to post public notices if there is no common site on the project. This document **MUST** remain posted during the entire time any worker is employed on the project and **MUST** be physically incorporated into the specifications and all contracts and subcontracts. If you have any questions, please write to the Equal Rights Division, Labor Standards Bureau, P.O. Box 8928, Madison, Wisconsin 53708 or call (608) 266-6861.

The following statutory provisions apply to local governmental unit projects of public works and are set forth below pursuant to the requirements of s. 66.0903(8), Stats.

s. 66.0903 (1) (f) & s. 103.49 (1) (c) "PREVAILING HOURS OF LABOR" for any trade or occupation in any area means 10 hours per day and 40 hours per week and may not include any hours worked on a Saturday or Sunday or on any of the following holidays:

1. January 1.
2. The last Monday in May.
3. July 4.
4. The first Monday in September.
5. The 4th Thursday in November.
6. December 25.
7. The day before if January 1, July 4 or December 25 falls on a Saturday.
8. The day following if January 1, July 4 or December 25 falls on a Sunday.

s. 66.0903 (10) RECORDS; INSPECTION; ENFORCEMENT.
(a) Each contractor, subcontractor, or contractor's or subcontractor's agent performing work on a project of public works that is subject to this section shall keep full and accurate records clearly indicating the name and trade or occupation of every person performing the work described in sub. (4) and an accurate record of the number of hours worked by each of those persons and the actual wages paid for the hours worked.

s. 66.0903 (11) LIABILITY AND PENALTIES.
(a) 1. Any contractor, subcontractor, or contractor's or subcontractor's agent who fails to pay the prevailing wage rate determined by the department under sub. (3) or who pays less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor is liable to any affected employee in the amount of his or her unpaid wages or his or her unpaid overtime compensation and in an additional amount as liquidated damages as provided under subd. 2., 3., whichever is applicable.
2. If the department determines upon inspection under sub. (10) (b) or (c) that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the department shall order the contractor to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages within a period specified by the department in the order.
3. In addition to or in lieu of recovering the liability specified in subd. 1. as provided in subd. 2., any employee for and in behalf of that employee and other employees similarly situated may commence an action to recover that liability in any court of competent jurisdiction. If the court finds that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the court shall order the contractor, subcontractor, or agent to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages.
5. No employee may be a party plaintiff to an action under subd. 3. unless the employee consents in writing to become a party and the consent is filed in the court in which the action is brought. Notwithstanding s. 814.04 (1), the court shall, in addition to any judgment awarded to the plaintiff, allow reasonable attorney fees and costs to be paid by the defendant.

BUILDING OR HEAVY CONSTRUCTION

Includes sheltered enclosures with walk-in access for the purpose of housing persons, employees, machinery, equipment or supplies and non-sheltered work such as canals, dams, dikes, reservoirs, storage tanks, etc. A sheltered enclosure need not be "habitable" in order to be considered a building. The installation of machinery and/or equipment, both above and below grade level, does not change a project's character as a building. On-site grading, utility work and landscaping are included within this definition. Residential buildings of four (4) stories or less, agricultural buildings, parking lots and driveways are NOT included within this definition.

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer	30.48	15.90	46.38
102	Boilermaker Future Increase(s): Add $1.50/hr on 1/01/2015; Add $1.50/hr. on 01/01/2016	32.05	28.04	60.09
103	Bricklayer, Blocklayer or Stonemason Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.01	17.35	49.36
104	Cabinet Installer	30.48	15.90	46.38
105	Carpenter	30.48	15.90	46.38
106	Carpet Layer or Soft Floor Coverer	30.48	15.90	46.38
107	Cement Finisher	31.58	16.13	47.71
108	Drywall Taper or Finisher	24.80	16.60	41.40
109	Electrician Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	34.07	19.25	53.32
110	Elevator Constructor	42.86	23.84	66.70
111	Fence Erector	24.72	0.00	24.72
112	Fire Sprinkler Fitter	36.07	18.73	54.80
113	Glazier	38.03	13.42	51.45
114	Heat or Frost Insulator	33.68	24.31	57.99
115	Insulator (Batt or Blown)	15.00	9.50	24.50
116	Ironworker	31.25	19.46	50.71
117	Lather	30.48	15.90	46.38

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
118	Line Constructor (Electrical)	38.25	17.31	55.56
119	Marble Finisher	26.89	19.18	46.07
120	Marble Mason	32.01	17.35	49.36
121	Metal Building Erector	22.00	10.00	32.00
122	Millwright	32.11	15.95	48.06
123	Overhead Door Installer	20.95	4.94	25.89
124	Painter	24.50	16.60	41.10
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.98	15.90	46.88
127	Pipeline Fuser or Welder (Gas or Utility)	30.79	19.74	50.53
129	Plasterer	31.03	17.71	48.74
130	Plumber Future Increase(s): Add $1/hr on 6/1/2014.	36.42	16.87	53.29
132	Refrigeration Mechanic	41.60	16.71	58.31
133	Roofer or Waterproofer	29.40	6.25	35.65
134	Sheet Metal Worker	34.45	22.57	57.02
135	Steamfitter Future Increase(s): Add $1.70/hr on 6/1/2014.	42.95	17.81	60.76
137	Teledata Technician or Installer Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	22.25	12.24	34.49
138	Temperature Control Installer	32.94	18.80	51.74
139	Terrazzo Finisher	26.89	19.18	46.07
140	Terrazzo Mechanic	30.20	18.42	48.62
141	Tile Finisher	23.85	17.18	41.03
142	Tile Setter	29.81	17.18	46.99
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	34.48	15.90	50.38
146	Well Driller or Pump Installer	25.32	15.65	40.97
147	Siding Installer	25.92	18.04	43.96

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.16	14.34	43.50
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	32.39	18.46	50.85
203	Three or More Axle	18.00	22.88	40.88
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	18.00	22.88	40.88
207	Truck Mechanic	18.00	22.88	40.88

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Premium Increase(s): Add $1.00/hr for certified welder; Add $.25/hr for mason tender	24.21	14.63	38.84
302	Asbestos Abatement Worker	24.36	14.44	38.80
303	Landscaper	21.01	9.37	30.38
310	Gas or Utility Pipeline Laborer (Other Than Sewer and Water)	21.01	13.63	34.64
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased) Premium Increase(s): DOT PREMIUMS: Pay two times the hourly basic rate on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	18.33	13.65	31.98
314	Railroad Track Laborer	23.46	3.30	26.76
315	Final Construction Clean-Up Worker	16.00	0.00	16.00

HEAVY EQUIPMENT OPERATORS
SITE PREPARATION, UTILITY OR LANDSCAPING WORK ONLY

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
501	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Milling Machine; Boring Machine (Directional, Horizontal or Vertical); Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Backhoe (Track Type) Having a Mfgr's Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Crane, Shovel, Dragline, Clamshells; Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Grader or Motor Patrol; Master Mechanic; Mechanic or Welder; Robotic Tool Carrier (With or Without Attachments); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Tractor (Scraper, Dozer, Pusher, Loader); Trencher (Wheel Type or Chain Type Having Over 8 Inch Bucket).	33.42	18.96	52.38
502	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Environmental Burner; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Jeep Digger; Screed (Milling Machine); Skid Rig; Straddle Carrier or Travel Lift; Stump Chipper; Trencher (Wheel Type or Chain Type Having 8 Inch Bucket & Under).	32.89	18.96	51.85
503	Air Compressor (&/or 400 CFM or Over); Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Greaser; High Pressure Utility Locating Machine (Daylighting Machine); Mulcher; Oiler; Post Hole Digger or Driver; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.	30.82	18.96	49.78
504	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
505	Work Performed on the Great Lakes Including Crane or Backhoe Operator; Assistant Hydraulic Dredge Engineer; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder; 70 Ton & Over Tug Operator. Premium Increase(s): Add $.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).	41.65	21.71	63.36
506	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	37.10	21.57	58.67

507	Work Performed on the Great Lakes Including Deck Equipment Operator, Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	34.50	20.04	54.54

HEAVY EQUIPMENT OPERATORS
EXCLUDING SITE PREPARATION, UTILITY, PAVING LANDSCAPING WORK

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
508	Boring Machine (Directional); Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Premium Increase(s): Add $.50/hr for >200 Ton / Add $1/hr at 300 Ton / Add $1.50/hr at 400 Ton / Add $2/hr at 500 Ton & Over.	35.62	18.96	54.58
509	Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Boring Machine (Horizontal or Vertical); Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Pile Driver; Versi Lifts, Tri-Lifts & Gantrys (20,000 Lbs. & Over).	36.35	6.95	43.30
510	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Dredge (NOT Performing Work on the Great Lakes); Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Hydro-Blaster (10,000 PSI or Over); Milling Machine; Skid Rig; Traveling Crane (Bridge Type).	33.42	18.96	52.38
511	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Environmental Burner; Gantrys (Under 20,000 Lbs.); Grader or Motor Patrol; High Pressure Utility Locating Machine (Daylighting Machine); Manhoist; Material or Stack Hoist; Mechanic or Welder; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tining or Curing Machine; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket).	32.89	18.96	51.85

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
512	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Grout Pump; Hoist (Tugger, Automatic); Industrial Locomotives; Jeep Digger; Lift Slab Machine; Mulcher; Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames.	30.82	18.96	49.78
513	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Boatmen (NOT Performing Work on the Great Lakes); Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Elevator; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Forklift; Generator (&/or 150 KW or Over); Greaser; Heaters (Mechanical); Loading Machine (Conveyor); Oiler; Post Hole Digger or Driver; Prestress Machine; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.	24.19	17.89	42.08
514	Gas or Utility Pipeline, Except Sewer & Water (Primary Equipment).	36.34	21.14	57.48
515	Gas or Utility Pipeline, Except Sewer & Water (Secondary Equipment). Future Increase(s): Add $1.60/hr on 06/01/2014; Add $1.65/hr on 06/01/2015.	32.32	18.55	50.87
516	Fiber Optic Cable Equipment Future Increase(s): Add $1.75/hr on 02/01/2014.	27.89	17.20	45.09

SEWER, WATER OR TUNNEL CONSTRUCTION

Includes those projects that primarily involve public sewer or water distribution, transmission or collection systems and related tunnel work (excluding buildings).

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	35.10	18.40	53.50
105	Carpenter Future Increase(s): Add $1.25/hr on 6/2/2014. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	33.68	19.81	53.49
107	Cement Finisher Future Increase(s): Add $1.87 on 6/1/14; Add $1.87 on 6/1/15; Add $1.75 on 6/1/16. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	33.51	16.13	49.64
109	Electrician Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.82	22.61	55.43
111	Fence Erector	24.72	0.00	24.72
116	Ironworker	31.25	19.46	50.71
118	Line Constructor (Electrical)	38.25	17.31	55.56
125	Pavement Marking Operator	16.00	7.35	23.35
126	Piledriver	30.98	15.90	46.88
130	Plumber	33.75	14.07	47.82
135	Steamfitter	42.45	16.71	59.16
137	Teledata Technician or Installer	21.89	11.85	33.74

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	38.80	20.17	58.97
146	Well Driller or Pump Installer	25.32	15.65	40.97
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.16	14.34	43.50
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	30.00	15.00	45.00
203	Three or More Axle	16.00	7.35	23.35
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	16.00	7.35	23.35
207	Truck Mechanic	16.00	7.35	23.35

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Premium Increase(s): Add $.20 for blaster, bracer, manhole builder, caulker, bottomman and power tool; Add $.55 for pipelayer; Add $1.00 for tunnel work 0-15 lbs. compressed air; Add $2.00 for over 15-30 lbs. compressed air; Add $3.00 for over 30 lbs. compressed air.	25.60	14.62	40.22
303	Landscaper	25.28	11.46	36.74
304	Flagperson or Traffic Control Person	24.70	10.72	35.42
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	12.67	30.98
314	Railroad Track Laborer	23.46	3.30	26.76

HEAVY EQUIPMENT OPERATORS
SEWER, WATER OR TUNNEL WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
521	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Master Mechanic; Pile Driver. Premium Increase(s): Add $.25/hr for all >45 Ton lifting capacity cranes	34.62	18.96	53.58
522	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Spreader & Distributor; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Dredge (NOT Performing Work on the Great Lakes); Milling Machine; Skid Rig; Telehandler; Traveling Crane (Bridge Type).	33.42	18.96	52.38
523	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Boring Machine (Horizontal or Vertical); Bulldozer or Endloader (Over 40 hp); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Manhoist; Material or Stack Hoist; Mechanic or Welder; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket).	32.89	18.96	51.85

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
524	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Environmental Burner; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Hoist (Tugger, Automatic); Grout Pump; Jeep Digger; Lift Slab Machine; Mulcher; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Tining or Curing Machine; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames. Future Increase(s): Add $1.05/hr on 6/2/2014; Add $1.55/hr on 6/1/2015. Premium Increase(s): Add $.25/hr for operating tower crane.	35.11	19.45	54.56
525	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Loading Machine (Conveyor); Post Hole Digger or Driver; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.	30.19	20.94	51.13
526	Boiler (Temporary Heat); Forklift; Greaser; Oiler.	24.19	17.89	42.08
527	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
528	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	38.80	20.17	58.97
529	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	34.50	20.04	54.54
530	Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under), Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	34.50	20.04	54.54

AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION

Includes all airport projects (excluding buildings) and all projects awarded by the Wisconsin Department of Transportation (excluding buildings).

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	32.01	17.35	49.36
105	Carpenter	30.48	15.90	46.38
107	Cement Finisher Future Increase(s): Add $1.87 on 6/1/14; Add $1.87 on 6/1/15; Add $1.75 on 6/1/16. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	33.51	16.13	49.64
109	Electrician Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	34.07	19.25	53.32
111	Fence Erector	24.72	0.00	24.72
116	Ironworker	31.25	19.46	50.71
118	Line Constructor (Electrical)	38.25	17.31	55.56
124	Painter	21.87	11.37	33.24
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.98	15.90	46.88
133	Roofer or Waterproofer	29.40	6.25	35.65
137	Teledata Technician or Installer	21.89	11.85	33.74
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	34.48	15.90	50.38
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	34.43	15.24	49.67
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	35.50	15.89	51.39

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	34.22	19.90	54.12
203	Three or More Axle Future Increase(s): Add $1.30/hr on 6/1/2014. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	24.52	17.77	42.29
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $1.75/hr on 6/1/14); Add $1.25/hr on 6/1/15); Add $1.30/hr on 6/1/16); Add $1.25/hr on 6/1/17. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	29.27	20.40	49.67
205	Pavement Marking Vehicle	23.31	17.13	40.44
206	Shadow or Pilot Vehicle	34.22	19.90	54.12
207	Truck Mechanic	23.31	17.13	40.44

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Future Increase(s): Add $1.60/hr on 6/1/2014. Premium Increase(s): Add $.10/hr for topman, air tool operator, vibrator or tamper operator (mechanical hand operated), chain saw operator and demolition burning torch laborer; Add $.15/hr for bituminous worker (raker and luteman), formsetter (curb, sidewalk and pavement) and strike off man; Add $.20/hr for blaster and powderman; Add $.25/hr for bottomman; Add $.35/hr for line and grade specialist; Add $.45/hr for pipelayer. / DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	29.32	14.63	43.95
302	Asbestos Abatement Worker	24.36	14.44	38.80
303	Landscaper Future Increase(s): Add $1.60/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	29.32	14.63	43.95
304	Flagperson or Traffic Control Person Future Increase(s): Add $1.60/hr on 6/1/2014. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	25.67	14.63	40.30
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	12.67	30.98
314	Railroad Track Laborer	23.46	3.30	26.76

HEAVY EQUIPMENT OPERATORS
AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
531	Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Traveling Crane (Bridge Type). Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	36.72	20.40	57.12
532	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs., & Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	36.22	20.40	56.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
533	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boatmen (NOT Performing Work on the Great Lakes); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, VIbratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane WIth a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames. Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	35.72	20.40	56.12

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
534	Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or WIthout Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	35.46	20.40	55.86
535	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	35.17	20.40	55.57
536	Fiber Optic Cable Equipment.	26.69	16.65	43.34
537	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
538	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	38.80	20.17	58.97

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
539	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	34.50	20.04	54.54
540	Work Performed on the Great Lakes Including Deck Equipment Operator, Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks-Great Lakes ONLY.	34.50	20.04	54.54

LOCAL STREET OR MISCELLANEOUS PAVING CONSTRUCTION

Includes roads, streets, alleys, trails, bridges, paths, racetracks, parking lots and driveways (except residential or agricultural), public sidewalks or other similar projects (excluding projects awarded by the Wisconsin Department of Transportation).

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	32.01	17.35	49.36
105	Carpenter	32.93	19.93	52.86
107	Cement Finisher	31.48	15.68	47.16
109	Electrician	31.27	22.81	54.08
111	Fence Erector	24.72	0.00	24.72
116	Ironworker	31.25	19.46	50.71
118	Line Constructor (Electrical)	38.25	17.31	55.56
124	Painter	24.50	16.60	41.10
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.98	15.90	46.88
133	Roofer or Waterproofer	29.40	6.25	35.65
137	Teledata Technician or Installer	21.89	11.85	33.74
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	38.80	20.17	58.97
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	34.43	15.24	49.67
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	30.00	15.00	45.00

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
203	Three or More Axle	17.00	0.00	17.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	17.00	0.00	17.00
206	Shadow or Pilot Vehicle	30.00	15.00	45.00
207	Truck Mechanic	17.00	0.00	17.00

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	28.07	13.25	41.32
303	Landscaper Future Increase(s): Add $1.60/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	29.04	14.63	43.67
304	Flagperson or Traffic Control Person	24.70	10.72	35.42
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	12.67	30.98
314	Railroad Track Laborer	23.46	3.30	26.76

HEAVY EQUIPMENT OPERATORS
CONCRETE PAVEMENT OR BRIDGE WORK

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
541	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	36.72	20.40	57.12
542	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Crane, Tower Crane Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	36.22	20.40	56.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
543	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames. Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	35.72	20.40	56.12
544	Backfiller; Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (WIth or Without Attachments); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine.	33.96	19.79	53.75
545	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack.	30.32	18.46	48.78
546	Fiber Optic Cable Equipment.	26.69	16.65	43.34

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
547	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
548	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	38.80	20.17	58.97
549	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or more); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	34.50	20.04	54.54
550	Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	34.50	20.04	54.54

HEAVY EQUIPMENT OPERATORS
ASPHALT PAVEMENT OR OTHER WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
551	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads and/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic.	35.12	18.46	53.58
552	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	36.22	20.40	56.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
553	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Laser/Screed; Concrete Slipform Placer Curb & Gutter Machine; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames.	32.89	18.96	51.85
554	Backfiller; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self-Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler.	33.67	19.48	53.15
555	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	35.17	20.40	55.57
556	Fiber Optic Cable Equipment.	26.69	16.65	43.34

RESIDENTIAL OR AGRICULTURAL CONSTRUCTION

Includes single family houses or apartment buildings of no more than four (4) stories in height and all buildings, structures or facilities that are primarily used for agricultural or farming purposes, excluding commercial buildings. For classification purposes, the exterior height of a residential building, in terms of stories, is the primary consideration. All incidental items such as site work, driveways, parking lots, private sidewalks, private septic systems or sewer and water laterals connected to a public system and swimming pools are included within this definition. Residential buildings of five (5) stories and above are NOT included within this definition.

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer Future Increase(s): Add $1.25/hr on 6/2/2014.	33.68	19.81	53.49
102	Boilermaker	26.00	4.73	30.73
103	Bricklayer, Blocklayer or Stonemason	32.01	13.26	45.27
104	Cabinet Installer	22.00	1.05	23.05
105	Carpenter	30.48	3.24	33.72
106	Carpet Layer or Soft Floor Coverer	23.68	3.20	26.88
107	Cement Finisher	20.93	5.94	26.87
108	Drywall Taper or Finisher	22.50	0.88	23.38
109	Electrician	27.50	7.47	34.97
110	Elevator Constructor	42.86	23.84	66.70
111	Fence Erector	18.52	4.89	23.41
112	Fire Sprinkler Fitter	52.82	5.54	58.36
113	Glazier	38.03	13.42	51.45
114	Heat or Frost Insulator	30.00	0.00	30.00
115	Insulator (Batt or Blown)	19.00	14.33	33.33
116	Ironworker	31.25	19.46	50.71
117	Lather	30.48	3.24	33.72
119	Marble Finisher	26.89	19.18	46.07
120	Marble Mason	32.01	13.26	45.27
121	Metal Building Erector	17.00	3.82	20.82
123	Overhead Door Installer	12.00	0.00	12.00
124	Painter	20.00	4.22	24.22

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
125	Pavement Marking Operator	30.00	0.00	30.00
129	Plasterer	25.00	0.00	25.00
130	Plumber	30.00	10.62	40.62
132	Refrigeration Mechanic	19.75	8.56	28.31
133	Roofer or Waterproofer	17.00	3.72	20.72
134	Sheet Metal Worker	21.03	3.40	24.43
135	Steamfitter	31.72	16.10	47.82
137	Teledata Technician or Installer	24.75	8.09	32.84
138	Temperature Control Installer	22.50	0.70	23.20
139	Terrazzo Finisher	26.89	19.18	46.07
140	Terrazzo Mechanic	30.20	18.42	48.62
141	Tile Finisher	23.77	16.50	40.27
142	Tile Setter	21.00	0.00	21.00
143	Tuckpointer, Caulker or Cleaner	32.50	0.02	32.52
146	Well Driller or Pump Installer	27.60	5.80	33.40
147	Siding Installer	20.18	0.00	20.18

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	28.05	4.16	32.21
203	Three or More Axle	18.00	2.37	20.37
205	Pavement Marking Vehicle	18.00	2.37	20.37
207	Truck Mechanic	19.00	1.85	20.85

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	18.14	10.16	28.30
302	Asbestos Abatement Worker	17.00	3.86	20.86

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
303	Landscaper	30.00	0.00	30.00
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	12.67	30.98
315	Final Construction Clean-Up Worker	16.00	0.00	16.00

HEAVY EQUIPMENT OPERATORS
RESIDENTIAL OR AGRICULTURAL CONSTRUCTION

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
557	Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type); Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, VIbratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & DIstributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Crane, Shovel, Dragline, Clamshells; Forestry Equipment, TImbco, Tree Shear, Tub Grinder, Processor; Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type); WInches & A-Frames.	29.70	20.08	49.78
558	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Backfiller; Belting, Burlap, Texturing Machine; Boiler (Temporary Heat); Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & LIght Equipment); Concrete Finishing Machine (Road Type); Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Jeep Digger; Lift Slab Machine; Mulcher; Oiler; Post Hole Digger or Driver; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Roller (Rubber Tire, 5 Tons or Under); Screed (Milling Machine); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Stump Chipper; Telehandler; Vibratory Hammer or Extractor, Power Pack.	29.70	16.00	45.70

********** END OF RATES **********