## **CITY OF DE PERE**

# PROJECT 18-14

## PINE TRAIL CROSSING STREET AND UTILITY CONSTRUCTION

## BID DATE: AUGUST 30, 2018 @ 1:00 PM

Bid documents, including plans and specifications, are available for download at <u>www.QuestCDN.com</u>. The QuestCDN website can also be accessed through the City website at <u>www.de-pere.org</u>. On the homepage, click on the City Departments tab at the top, then click on Public Works, then Engineering, then Construction Projects, then 2018 Construction Projects. Download cost is \$10 for each contract. Bidding documents may be viewed on the QuestCDN website or at the Municipal Service Center.

Bid Tabs must be verified by staff prior to posting and will be available for viewing on the website within 7 days following the bid opening. Award information will be pending until approved by the Common Council.

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## AUGUST 16, 2018 – AUGUST 23, 2018

## CITY OF DE PERE

## **ADVERTISEMENT TO BID**

## **PROJECT 18-14**

## PINE TRAIL CROSSING STREET AND UTILITY CONSTRUCTION

Sealed proposals will be received by the Board of Public Works of the City of De Pere at the Municipal Service Center, 925 South Sixth Street, De Pere, Wisconsin 54115, until 1:00 PM. Thursday, August 30, 2018, at which time they will be publicly opened and read aloud.

Project 18-14 for which proposals are being sought includes the following approximate quantities:

- 4,600 LF New Sanitary Sewer (8-inch)
- 4,000 LF New Water Main (8-inch to 16-inch)
- 6,300 LF New Storm Sewer (8-inch to 34"x55"-inch)
- New Sanitary Sewer Lateral Installation (4-inch), and Associated Appurtenances
- New Water Service Installation (1-Inch) and Associated Appurtenances
- New Storm Sewer Lateral Installation (6-inch), and Associated Appurtenances
- 5,000 CY Unclassified Excavation
- 5,400 LF New Concrete Curb and Gutter
- 1,100 Tons Asphaltic Concrete Pavement Placement
- Erosion Control & Restoration
- New Lift Station Construction with 915 LF of 4-inch PVC Forcemain
- Pond Expansion Construction including 12,000 CY of Excavation

Complete digital project bidding documents are available for viewing and or downloading at <u>www.QuestCDN.com</u> or may be examined at the office of the Director of Public Works. Digital plan documents may be downloaded for \$10 by inputting Quest Project # 5914947 on Quest's Project Search page. The QuestCDN website can also be accessed through the City website at <u>www.de-pere.org</u>. On the homepage, click on the City Departments tab at the top, then click on Public Works, then Engineering, then Construction Projects, then 2018 Construction Projects.

Each proposal shall be accompanied by a certified check or bid bond in an amount equal to five percent (5%) of the bid, payable to the City of De Pere, as a guarantee that if the bid is accepted, the bidder will execute a contract and furnish a contract bond as set forth in the General Conditions of the City of De Pere. In case the bidder fails to file such contract and bond, the amount of the check or bid bond shall be forfeited to the City of De Pere as liquidated damages.

The letting of the contract is subject to the provisions of the following Wisconsin Statutes:

Section 62.15 regarding Public Works.

Section 66.0901(3) regarding Prequalification of Contractor.

Each bidder shall pre-qualify by submitting proof of responsibility on forms furnished by the Director of Public Works. Such forms shall be filed with the Director of Public Works no later than 4:00 P.M., Monday, August 27, 2018. Prospective bidders who have previously submitted such forms subsequent to January 1, 2018 will not be required to separately submit such form for this project.

The City of De Pere reserves the right to reject any or all bids, to waive any informalities in bidding and to accept any proposal which the Common Council deems most favorable to the interest of the City of De Pere.

Dated this 16<sup>th</sup> day of August 2018.

Board of Public Works City of De Pere Eric Rakers, P.E. City Engineer

Project 18-14

## SECTION 00 21 13 INSTRUCTIONS TO BIDDERS

## ARTICLE 1 – DEFINED TERMS

1.1 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

None

## ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

- 2.1 Complete sets of the Bidding documents in the number and for the deposit sum, if any, stated in the Advertisement or Invitation to Bid may be obtained as stated in the Advertisement for bids.
- 2.2 Complete sets of Bidding Documents shall be used in preparing Bids; Owner does not assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.3 Owner, in providing the Bidding Documents on the terms stated in the Advertisement for Bids, does so only for the purpose of obtaining Bids for the Work and does not confer a license or grant for any other use.

## ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.1 In accordance with Section 66.0901(3), each bidder shall pre-qualify by submitting proof of responsibility on forms furnished by the Director of Public Works. Such forms shall be filed with the Director of Public Works as stated in the advertisement for Bids. Prospective bidders who have previously submitted such forms after January 1<sup>st</sup> of this year will not be required to separately submit such form for this project.

## ARTICLE 4 – EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA AND SITE

- 4.1 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in the General Conditions.
- 4.2 Underground Facilities
  - A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.3 Subsurface and Physical Conditions

A. The technical data includes:

- 1. No reports of explorations or tests of subsurface conditions at or contiguous to the Site, or drawings of physical conditions relating to existing surface or subsurface structures at the Site, are known to Owner.
- B. Limited Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Contractor may not rely upon or make any claim against Owner, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
  - 1. the completeness of such reports and drawings for Contractor's purposes, including but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
  - 2. Other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
  - 3. Any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.
- 4.4 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.
- 4.5 Reference is made to Section 01 10 00: Summary of Work, for work that will be completed and for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other portions thereof related to price) for such other work.
- 4.6 It is the responsibility of each Bidder before submitted a Bid to:
  - A. Examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda;
  - B. Visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;
  - C. Become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work;
  - D. Obtain and carefully study (or accept consequences of not doing so) all examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect

cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

- E. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;
- F. Become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;
- G. Correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawing identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;
- H. Promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies, that bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and
- I. Determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.
- 4.7 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and, procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

## ARTICLE 5 – SITE AND OTHER AREAS

5.1 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

## ARTICLE 6 – INTERPRETATIONS AND ADDENDA

- 6.1 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than ten days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 6.2 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner and Engineer.

## ARTICLE 7 – BID SECURITY

- 7.1 A Bid shall be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder's maximum Bid price and in the form of a certified check or bank money order or Bid bond (on the form attached) issued by a surety meeting the requirements of the General Conditions. Submittal of a Bid Bond on a form other than the Bid Bond form included in the Bidding Documents may be cause for rejection of Bid.
- 7.2 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner per the General Conditions.
- 7.3 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven days after the Bid opening.

## ARTICLE 8 – CONTRACT TIMES

8.1 The number of days within which, or the dates by which, Milestones are to be achieved and the Work is to be substantially completed and ready for final payment are set forth in the Bid Form and Summary of Work.

## ARTICLE 9 – LIQUIDATED DAMAGES

9.1 Provisions for liquidated damages are set forth in the General Conditions.

## ARTICLE 10 - SUBSTITUTE AND "OR-EQUAL" ITEMS

10.1 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a

substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Bid Form and Summary of Work.

## ARTICLE 11 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.1 The Bidder shall submit with the Bid to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, in which case apparent Successful Bidder shall submit an acceptable substitute, Bidder's Bid price will be increased ( or decreased) by the difference in cost occasioned by such substitution, and

Owner may consider such price adjustment in evaluating Bids and making the Contract award.

- 11.2 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposed to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner subject to revocation of such acceptance after the Effective Date of the Agreement.
- 11.3 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

## ARTICLE 12 – PREPARATION OF BID

- 12.1 The Bid form is included with the Bidding documents.
- 12.2 All blanks on the Bid Form shall be completed by printing in ink or by typewrite and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each alternative, and unit price item listed therein, or the words "No Bid," "No Change," or "Not Applicable" entered.
- 12.3 A Bid by a corporation shall be executed in the corporate name by the president or a vicepresident or other corporate office accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporations shall be shown below the seal.
- 12.4 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

- 12.5 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown below the signature.
- 12.6 A Bid by an individual shall show the Bidder's name and official address.
- 12.7 A Bid by a joint venture shall be executed by each joint venture in the manner indicated on the Bid Form. The official address of the joint venture shall be shown below the signature.
- 12.8 All names shall be typed or printed in ink below the signatures.
- 12.9 The Bid shall contain an acknowledgement of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
- 12.10 The address and telephone number for communications regarding the Bid shall be shown.
- 12.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

## ARTICLE 13 – BASIS OF BID; COMPARISON OF BIDS

- 13.1 Unit Price
  - A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.
  - B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accord with the General Conditions.
  - C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

## ARTICLE 14 – SUBMITTAL OF BID

14.1 A Bid shall be submitted no later than date and time prescribed and at place indicated in Advertisement for Bids and shall be enclosed in a plainly marked package with the Project title (and, if applicable, designated portion of the Project for which the Bid is submitted), name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to City of De Pere, Municipal Service Center, 925 S. Sixth Street, De Pere, WI 54115.

Electronically transmitted Bids will not be accepted.

14.2 See Bid Form for a list of documents typically required to be submitted with the Bid.

## ARTICLE 15 – MODIFICATION AND WITHDRAWAL OF BID

- 15.1 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.
- 15.2 If within 24 hours after Bids are opened, any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

## ARTICLE 16 – OPENING BIDS

16.1 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

## ARTICLE 17 – BIDS REMAIN SUBJECT TO ACCEPTANCE

17.1 All bids will remain subject to acceptance for the period of time stated in the General Conditions, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

## ARTICLE 18 - EVALUATION OF BIDS AND AWARD OF CONTRACT

- 18.1 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.
- 18.2 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.
- 18.3 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

- 18.4 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Supplier, and other individuals or entities proposed for those portions of the Work for which the identify of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.
- 18.5 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.
- 18.6 Bidder agrees to waive any claim it has or may have against the Owner and the respective employees arising out of or in connection with the administration, evaluation or recommendation of any Bid.
- 18.7 If the Contract is to be awarded, Owner will award the Contract to the lowest responsible responsive Bidder whose Bid is in the best interests of the Project.

## ARTICLE 19 – CONTRACT SECURITY AND INSURANCE

19.1 The General Conditions set forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds and a certificate of insurance.

## ARTICLE 20 - SIGNING OF AGREEMENT

20.1 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 10 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of Drawings with appropriate identification.

## END OF SECTION

## SECTION 00 41 13

## CITY OF DE PERE

## **BID FORM**

## **PROJECT 18-14**

This bid, submitted by the undersigned Bidder to the City of De Pere, in accordance with the Advertisement or Invitation to Bid, which will be received until 1:00 PM. on Thursday, August 30, 2018 is to furnish and deliver all materials, and to perform and do all work on the project designated, by May 31, 2019.

Bidder has examined and carefully prepared the bid from the plans and specifications and has checked the same in detail before submitting said proposal or bid; and that said bidder or bidder's agents, officer or employees have not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with this proposal or bid.

Bidder has examined and carefully studied the Bidding Documents, other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Addendum No.

Addendum Date

BASIS OF BID:

Bidder will complete the Work in accordance with the Contract documents for the following prices (s):

As stated in the attached Unit Price Bid Schedule.

Unit Prices have been computed in accordance with the General Conditions.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

TOTAL BID PRICE: \$\_\_\_\_\_

-	NTS TO THIS BID ollowing documents are submitted with and m Required Bid Security Unit Price Bid Schedule Proposed Products Form Tabulation of Subcontractors	ade a condition of this Bid: (Section 00 41 43) (Section 00 43 33) (Section 00 43 36)
BID SUBMIT	TAL	
This Bid is su	bmitted by	of,,
The Bidder, b	eing duly sworn, does dispose that they are a	n authorized representative of
Bidder, if Bid	der is:	
<u>An Individual</u> Name (typed )	or printed):	
Bv:		
<i>Dy</i>	(Individual's signature)	
	ss as:	
A Partnership		
Partnership N	ame:	<u> </u>
By:		
Name (typed	(Signature of general partner – attach evider or printed):	
A Corporation	<u>1</u>	
Corporation N	Jame:	
State of Incor	poration:	
Type (Genera	l Business, Professional, Service, Limited Lia	ability):
By:	(Cianatura, attach avidance of out	· · · · · ·

Name (typed or printed):	
Title:	
(CORPORATE SEA	L)
Attest	
Date of Qualification to do business in Wisconsin is/_	
Joint Venture	
Name of Joint Venture:	
First Joint Venturer Name:	(SEAL)
By:(Signature of first joint venture partner – att	
(Signature of first joint venture partner – at	tach evidence of authority to sign)
Name (typed or printed):	
Title:	
Second Joint Venturer Name:	(SEAL)
By:	
(Signature of second joint venture partner –	- attach evidence of authority to sign)
Name (typed or printed):	
Title:	
(Each joint venture must sign. Manner of signing f corporation that is a party to joint venture should be in man	for each individual, partnership, and
Bidder's Business Address	
Phone No.	Fax No.
E-mail	_
SUBMITTED on, 20	
State Contractor License No.	(if applicable).

## SECTION 00 41 43

## CITY OF DE PERE PROJECT 18-14 BID SCHEDULE – UNIT PRICE

ITEM	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT BID	
SANITA	SANITARY SEWER					
SS-01	Provide 8" PVC Sanitary Sewer (Granular Backfill)	LF	2,900	\$	\$	
SS-02	Provide 8" PVC Sanitary Sewer (Natural Backfill)	LF	1,200	\$	\$	
SS-03	Provide 8" PVC Sanitary Sewer Lateral (Ryan Road)	LF	15	\$	\$	
SS-04	Provide 4" PVC Sanitary Sewer Force Main (Granular Backfill)	LF	50	\$	\$	
SS-05	Provide 4" PVC Sanitary Force Main (Natural Backfill)	LF	900	\$	\$	
SS-06	Provide 4" PVC Sanitary Sewer Lateral	LF	1,800	\$	\$	
SS-07	Provide 8"x4" Sanitary Wye	EA	61	\$	\$	
SS-08	Provide Sanitary Riser	VF	5	\$	\$	
SS-09	Provide 4' Diameter Sanitary Sewer Manhole	VF	170	\$	\$	
SS-10	Provide Lift Station	LS	1	\$	\$	
SS-11	Core Drill Into Existing Sanitary Manhole	EA	1	\$	\$	
STORM SEWER						
ST-01	Provide 34"X55" RCP Class III Storm Sewer	LF	80	\$	\$	
ST-02	Provide 30" RCP Class III, PVC or PP Storm Sewer	LF	1,650	\$	\$	
ST-03	Provide 24" RCP Class III, PVC or PP Storm Sewer	LF	170	\$	\$	
ST-04	Provide 21" RCP Class III, PVC or PP Storm Sewer	LF	240	\$	\$	

ITEM	ail Crossing Street and Utility Co ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT BID
STORM	SEWER (CONTINUED)	•			
	Provide 18" RCP Class III,				
ST-05	PVC or PP Storm Sewer	LF	420	\$	\$
	Provide 15" RCP Class III or				
ST-06	PVC Storm Sewer	LF	160	\$	\$
	Provide 12" RCP Class III or				
CT 07	PVC Storm Sewer	E A	2 200	¢	¢
ST-07	(Granular Backfill)	EA	2,300	\$	\$
	Provide 12" RCP Class III or PVC Storm Sewer				
ST-08	(Natural Backfill)	LF	425	\$	\$
51-00		LI	423	φ	φ
ST-09	Provide 8" PVC Storm Sewer	LF	1,200	\$	\$
	Provide 6" PVC Storm Sewer			т	T
ST-10	Lateral	LF	1,450	\$	\$
81 10	Provide 24"x6" Storm Branch		1,100	· · · · · · · · · · · · · · · · · · ·	· · ·
ST-11	or Inserta Tee	EA	2	\$	\$
×1 11	Provide 18"x6" Storm Branch			· · · · · · · · · · · · · · · · · · ·	· · ·
ST-12	or Inserta Tee	EA	1	\$	\$
~	Provide 12"x6" Storm Branch			т	T
ST-13	or Inserta Tee	EA	25	\$	\$
~	Provide 8"x6" Storm Branch or			т	T
ST-14	Inserta Tee	EA	10	\$	\$
	Provide 5' Diameter Storm			·	·
ST-15	Manhole	VF	60	\$	\$
	Provide 4' Diameter Storm			·	·
ST-16	Manhole	VF	125	\$	\$
				·	·
ST-17	Provide Type A Inlet	EA	7	\$	\$
	· · · · ·				
ST-18	Provide Type B Inlet	EA	28	\$	\$
	· · · · ·				
ST-19	Provide 34"x55" RCP Endwall	EA	2	\$	\$
ST-20	Provide 30" RCP Endwall	EA	1	\$	\$
ST-21	Provide 12" RCP Endwall	EA	4	\$	\$

## **City of De Pere**

## Project 18-14 Pine Trail Crossing Street and Utility Construction

ITEM	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT BID
WATER MAIN					
W-01	Provide 16" PVC Water Main (Granular Backfill)	LF	5	\$	\$
W-02	Provide 12" PVC Water Main (Natural Backfill)	LF	430	\$	\$
W-03	Provide 8" PVC Water Main (Granular Backfill)	LF	190	\$	\$
W-04	Provide 8" PVC Water Main (Natural Backfill)	LF	2,900	\$	\$
W-05	Provide 8" PVC Water Service (Ryan Road)	LF	80	\$	\$
W-06	Provide 1" HDPE Water Service	LF	1,600	\$	\$
W-07	Directional Drill 1" HDPE Water Service (Ryan Road)	LF	530	\$	\$
W-08	Provide 1" Corporation and Curb Stop	EA	61	\$	\$
W-09	Provide 8" Gate Valve	EA	9	\$	\$
W-10	Provide 6" Gate Valve	EA	1	\$	\$
W-11	Provide Connection to Existing Water Main	EA	2	\$	\$
W-12	Provide Hydrant (6.5' Bury)	EA	6	\$	\$
W-13	Provide 6" PVC Hydrant Lead Provide Water Service Offset	LF	30	\$	\$
W-14	(Ryan Road)	EA	1	\$	\$
SIREE	Γ AND DRAINAGE				
SD-01	Provide Clearing and Grubbing	LS	1	\$	\$
SD-02	Unclassified Excavation	CY	5,040	\$	\$
SD-03	Unclassified Excavation (Pond)	CY	12,810	\$	\$
SD-04	Backyard Swale Ditching Provide 1 <sup>1</sup> / <sub>4</sub> " Crushed	SY	350	\$	\$
SD-05	Aggregate Base Course	TON	8,200	\$	\$

## Project 18-14

ITEM	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT BID
STREET	<b>FAND DRAINAGE (CONTINU</b>	ED)			
	Provide Asphaltic Concrete Pavement Type 4 LT 58-28 (Upper Layer)				
SD-06	(Lot 8 & Outlot 1)	TON	70	\$	\$
SD-07	Provide Asphaltic Concrete Pavement Type 3 LT 58-28 (Lower Layer)	TON	1,150	\$	\$
SD-08	Provide 24" Concrete Curb and Gutter (Slip Form)	LF	5,500	\$	\$
SD-09	Remove and Replace 9-Inch Concrete Pavement with Integral Curb	SY	85	\$	\$
SD-10	Provide 6" Concrete Sidewalk and Driveway	SY	20	\$	\$
SD-11	Provide 4" Concrete Sidewalk	SY	60	\$	\$
SD-12	Provide #4 Reinforcement Bars	LF	3,600	\$	\$
SD-13	Drilled Tie Bars	EA	60	\$	\$
SD-14	Landscaping – Topsoil, Seed, Fertilizer and Mulch	SY	33,500	\$	\$
SPECIA	L CONSTRUCTION			I	1
SC-01	Pipe Foundation Stabilization	CY	100	\$	\$
SC-02	Provide Silt Fence	LF	650	\$	\$
SC-03	Inlet Protection Type B	EA	35	\$	\$
SC-04	Provide Heavy Rip Rap w/ Geotextile Fabric (Type HR) (Pond)	SY	20	\$	\$
SC-05	Provide Heavy Rip Rap w/ Geotextile Fabric (Type HR)	SY	20	\$	\$
SC-06	Tracking Pad	EA	3	\$	\$
SC-07	Install, Maintain, & Remove Rock Filled Erosion Control Bags	EA	100	\$	\$
			PRO	JECT TOTAL	\$

## SECTION 00 43 13

## CITY OF DE PERE

## **BID BOND**

KNOW ALL MEN BY THESE PRESENTS: That \_\_\_\_\_\_,

as Principal, hereinafter called Principal, and \_\_\_\_\_,

as Surety, hereinafter called Surety, are held and firmly bound unto the City of De Pere, a municipal corporation of the State of Wisconsin, as Obligee, hereinafter called City, in the amount of

dollars (\$\_\_\_\_\_) for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presence.

WHEREAS, Principal has made a proposal to the City for furnishing all materials, labor, tools, equipment and incidentals necessary to complete the work of Project 18-14 in accordance with drawings and specifications prepared by the Director of Public Works of said City, which proposal is by reference made a part hereof, and is hereinafter referred to as the BID.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall be awarded the contract for said project and Principal shall enter into a contract in accordance with the BID, then this obligation shall be null and void; otherwise it shall remain in full force and effect, provided that:

- 1. The liability of Surety shall in no event exceed the penalty of this bond.
- 2. Any suits at law or proceedings, in equity brought or to be brought against Surety to recover any claim hereunder shall be executed within six (6) months from the date of this instrument.

Signed and sealed this \_\_\_\_\_\_ day of \_\_\_\_\_\_, 20\_\_\_\_.

In the presence of:

WITNESS

PRINCIPAL (SEAL)

WITNESS

SURETY (SEAL)

## **SECTION 00 43 33**

## **PROPOSED PRODUCTS FORM**

The following is a list of material, type or model numbers and manufacturers used in the preparation of this proposal and to be used on this project:

ITEM	<u>MATERIAL</u>		<u>SUPPLIER</u>
Water main (PVC)		-	
Valves		-	
Hydrants		_	
Manholes		_	
Inlets / Catch Basins		_	
Storm Sewer (PVC/RCP)		_	
Sanitary Sewer (PVC)		_	

## **SECTION 00 43 36**

## TABULATION OF SUBCONTRACTORS

The following information is submitted which gives the name, business address, and portion of work for each subcontractor that will be used in the work if the bidder is awarded the contract, and no subcontractor doing work in excess of one-half of one percent of the total amount of the bid and who is not listed will be used without the written approval of the Engineer. Additional numbered pages outlining this portion of the proposal may be attached to this page.

NAME

**BUSINESS ADDRESS** 

PORTION OF WORK

## SECTION 00 51 00 NOTICE OF AWARD

(Contractor) (Contractor Name) (Address) (Address)

Project Description: 18-14 Pine Trail Crossing Street and Utility Construction

The City has considered the proposal submitted by you dated August 30, 2018 for the above-described project in response to its Advertisement for Bids dated August 16, 2018 and August 23, 2018.

You are hereby notified that the Common Council of the City of De Pere has accepted your bid of (Contract Amount \$\_\_\_\_\_.00).

You are required to execute the Contract and furnish the required Performance Bond, Payment Bond and Certificates of Insurance within ten (10) calendar days from the date of this notice to you.

If you fail to execute said Agreement and to furnish said bonds within ten (10) days from the date of this notice, said City will be entitled to consider all your rights arising out of the City's acceptance of your bid as abandoned and as a forfeiture of your Bid Bond. The City will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the City.

Dated this \_\_th day of \_\_\_\_\_2018.

## DEPARTMENT OF PUBLIC WORKS

BY: Eric P. Rakers, P.E. City Engineer

## ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by:

\_\_\_\_\_, this the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_

By:\_\_\_\_\_

Title:\_\_\_\_\_

## SECTION 00 52 13 CONTRACT

This Contract, made and entered into this day \_\_\_\_\_\_ (date to be affixed by City), by and between (Contractor Name), hereinafter called Contractor, and the City of De Pere, a municipal corporation of the State of Wisconsin, hereinafter called City.

WITNESSETH: That, in consideration of the covenants and agreements herein contained, to be performed by the parties hereto, and of the payments hereinafter agreed to be made, it is mutually agreed as follows:

#### ARTICLE I - SCOPE OF WORK

The Contractor shall furnish all materials and all equipment and labor necessary, and perform all work shown on the drawings and described in the specifications for the project entitled **Project Number and Name**, all in accordance with the requirements and provisions of the following documents, which are hereby made a part of this Contract:

- (a) Advertisement for Bids, dated  $(1^{st} Advertising Date)$  and  $(2^{nd} Advertising Date)$ .
- (b) Drawings designated for Project Number and Name dated (1<sup>st</sup> Advertising Date).
- (c) City of De Pere 2018 Construction Specifications.
- (d) Special Provisions dated (1<sup>st</sup> Advertising Date)
- (e) Proposal submitted by (Contractor Name) dated Bid Date.
- (f) Addenda No. dated

#### ARTICLE II - TIME OF COMPLETION

- (a) The work to be performed under the Contract shall be commenced within (number spelled out)
   (\_\_) calendar days after receipt of written notice to proceed. The work shall be completed within (Number spelled out) (\_\_) calendar days ) or (specific calendar dates) after receipt of Notice to Proceed.
- (b) Time is of the essence with respect to the date of completion herein above stated. Failure to complete the work within the number of calendar days stated in this Article, or interim dates included in the work sequence in Section 01 10 00, Summary of Work, including any extensions granted thereto, shall entitle the City to deduct from the monies due the Contractor an amount equal to Update based on 00 70 00 General Conditions (Page 22)(\$) per day for each calendar day of delay in the completion of the work. Such amount shall be considered and treated not as a penalty but as liquidated damages, which the City will sustain, by failure of the Contractor to complete the work within the time stated.

#### ARTICLE III - PAYMENT

(a) The Contract Sum. The City shall pay to the Contractor for the performance of the Contract the amounts determined for the total number of each of the following units of work completed at the

## Project 18-14

## **Pine Trail Crossing Street and Utility Construction**

unit price stated thereafter. The number of units contained in this schedule is approximate only, and the final payment shall be made for the actual number of units that are incorporated in or made necessary by the work covered by the Contract.

- (b) Progress Payments. The City shall make payments on account of the Contract as follows:
  - 1. On not later than the third Friday day of every month the Contractor shall present to the City an invoice covering an estimate of the amount and proportionate value of the work done as verified by the City under each item of work that has been completed from the start of the job up to and including the third Friday of the preceding month, and the value of the work so completed determined in accordance with the schedule of unit prices for such items, together with such supporting evidence as may be required. This invoice shall also include an allowance for the cost of such materials and equipment required in the permanent work as have been delivered to the site but not as yet incorporated in the work.
  - 2. On not later than the second week of the following month, the City shall, after deducting previous payments made, pay to the Contractor 95% of the amount of the approved invoice, retaining 5% of the estimate of work done until 50% of the work has been completed. At 50% completion of the work, the previous retainage shall not yet be paid, but further partial payments shall be made in full to the contractor without additional retainage being taken unless the engineer certifies that the work is not proceeding satisfactorily. If the work is not proceeding satisfactorily, additional amounts may be retained. After substantial completion, an amount retained may be paid to the contractor, keeping retained only such amount as is needed for the remaining work.
  - 3. The Contractor shall notify the City in writing when all work under this Contract has been completed. Upon receipt of such notice the City shall, within a reasonable time, make the final inspection and issue a final certificate stating that the work provided for in this Contract has been completed and is accepted under the terms and conditions thereof, and that the entire balance due the Contractor as noted in said final certificate is due and payable. Before issuance of the final certificate the Contractor shall submit evidence satisfactory to the City that payrolls, material bills, and other indebtedness connected with the work under this Contract have been paid.

The City shall make final payment as soon after issuance of the final certificate as practicable.

## ARTICLE IV – CONTRACT DOCUMENTS

- (a) Contents
  - 1. The Contract documents consist of the following:
    - a. This Contract (pages 00 52 13-1 to 0052-13-2, inclusive).
    - b. Payment bond (pages 00 61 13-1 to 00 61 13-2, inclusive).
    - c. Performance bond (page 00 61 16-1).
    - d. General Conditions (pages 00 70 00-1 to 00 70 00-27, inclusive).
    - e. Specifications as listed in the table of contents of the Project Manual.
    - f. Drawings consisting of \_\_\_\_ sheets with each sheet bearing the following general title: \_\_\_\_[or] the Drawings listed on attached sheet index.\_\_\_
    - g. Addenda (numbers \_\_\_\_ to \_\_\_\_ inclusive), dated\_\_\_\_\_.
    - h. Exhibits to this Agreement (enumerated as follows):
      - 1) Contractor's Bid (pages 00 41 13-1 to 00 41 13-3, inclusive).
      - 2) Bid Schedule Unit Prices (Pages 00 41 43-1).
      - 3) Proposed Products Form (Page 00 43 33-1)

- 4) Tabulation of Subcontractors (page 00 43 36-1).
- 5) Documentation submitted by Contractor prior to Notice of Award (00 51 00-1)
- i. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
  - 1) Notice to Proceed (Page 00 55 00-1).
  - 2) Change Orders.
- 2. The documents listed in Paragraph (a) Contents, are attached to this Agreement (except as expressly noted otherwise above).
- 3. There are no Contract Documents other than those listed above in this Article IV.

IN WITNESS WHEREOF, the parties hereto have executed this Contract, the day and year first written above.

(WITNESS)	(CONTRACTOR) (SEAL
(WITNESS)	BY:
(*********	(TITLE)
	BY:
	(TITLE)
	CITY OF DE PERE (SEAL)
Approved as to Form By:	(City Attorney)

(COMPTROLLER)

BY:_		
	(MAYOR)	

BY:\_\_\_\_

(CLERK-TREASURER)

## SECTION 00 55 00 NOTICE TO PROCEED

Date: \_\_\_\_

(CONTRACTOR NAME) (ADDRESS) (ADDRESS)

PROJECT: (PROJECT NUMBER AND NAME)

You are hereby notified to commence work in accordance with the CONTRACT dated \_\_\_\_\_\_, within ten (10) days of this Notice. All work under this contract shall be completed within \_\_\_\_\_(NUMBER IN WORDS) (\_\_#) consecutive days from the start of construction or \_\_\_\_\_(DATE) whichever comes first.

Department of Public Works

By: Eric P. Rakers, P.E. Title: City Engineer

## ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by

\_\_\_\_\_, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_.

Company Name

Signature

BY: \_\_\_\_\_

Printed Name

TITLE: \_\_\_\_\_

## SECTION 00 61 13

## CITY OF DE PERE

## PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That (CONTRACTOR NAME), as Principal, hereinafter called Contractor, and \_\_\_\_\_\_

WHEREAS, Contractor has by written agreement dated \_\_\_\_\_\_ (date to be affixed by City) entered into a contract with City for Project (PROJECT NUMBER), in accordance with drawings and specifications prepared by the Director of Public Works of said City, which contract is by reference made a part hereof, and is hereinafter referred to as the CONTRACT.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly make payments to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the CONTRACT, then this obligation shall be null and void; otherwise it shall remain in full force and effect, subject, however, to the following conditions.

- 1. A claimant is defined as one having a direct contract with Contractor or with a subcontractor of Contractor for labor, material, or both, used or reasonably required for use in the performance of the contract, labor and material being construed to include that part of water, gas, power, lights, heat, oil, gasoline, telephone service, or rental of equipment directly applicable to the contract.
- 2. The above named Contractor and Surety hereby jointly and severally agree with the City that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant may sue on this bond for the use of such claimant in the name of the City, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon, provided, however, that the City shall not be liable for the payment of any costs or expenses of any such suit.
- 3. No suit or action shall be commenced hereunder by any claimant:
  - a. Unless claimant shall have given written notice to any two of the following: The Contractor, the City, or the Surety above named, within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished,

or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail, postage prepaid, in an envelope addressed to the Contractor, City, or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in

which legal process may be served in the State of Wisconsin, save that such service need not be made by a public officer.

- b. After the expiration of one (1) year following the date on which Contractor ceased work on said CONTRACT.
- c. Other than in a state court of competent jurisdiction in and for the County or other political subdivision of the state in which the project, or any part thereof, is situated, or in the United States District Court for the district in which the project, or any part thereof, is situated, and not elsewhere.
- 4. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens, which may be filed or recorded against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.

SIGNED AND SEALED THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 20\_\_\_.

In Presence of:

(WITNESS)

(CONTRACTOR)

(WITNESS)

(SURETY)

#### SECTION 00 61 16

## **CITY OF DE PERE**

#### **PERFORMANCE BOND**

KNOW ALL MEN BY THESE PRESENTS: That (CONTRACTOR'S NAME), as Principal, hereinafter called Contractor, and \_\_\_\_\_\_

\_\_\_\_\_\_, as Surety, hereinafter called Surety, are held and firmly bound unto the City of De Pere, a municipal corporation of the State of Wisconsin, as Obligee, hereinafter called City, in the amount of \_\_\_\_\_\_(AMOUNT WRITTEN OUT) (\$\_\_\_\_\_) for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assign, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated \_\_\_\_\_\_ (date to be affixed by City), entered into a contract with the City for Project (#), in accordance with drawings and specifications prepared by the Director of Public Works of said City, which contract is by reference made a part hereof, and is hereinafter referred to as the CONTRACT.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Contractor shall promptly and faithfully perform said CONTRACT, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Whenever Contractor shall be, and declared by the City to be in default under the CONTRACT, the City having performed City's obligations there under, the Surety may promptly remedy the default, or shall promptly

- 1. Complete the CONTRACT in accordance with its terms and conditions or
- 2. Obtain a bid or bids for submission to City for completing the CONTRACT in accordance with its terms and conditions, and upon determination by the City and Surety of the lowest responsible bidder, arrange for a contract between such bidder and City make available as work progresses (even though there should be a default or succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price" as used in this paragraph shall mean the total amount payable by City to Contractor under the CONTRACT and any amendments thereto, less the amount properly paid by City to Contractor.

Any suit under this bond must be instituted before the expiration of two (2) years from the date on which final payment under the CONTRACT falls due. No right of action shall accrue on this bond to or for the use of any person or corporation other than the owner named herein or the heirs, executors, administrators or successors of City.

SIGNED AND SEALED THIS	_ DAY OF,	20
n the Presence of:		
(WITNESS)	(CONTRACTOR)	(SEAL)
(WITNESS)	(SURETY)	(SEAL)

**City of De Pere** 

## Project # Project Name:

City of De Pere

#### Contractor's Application for Payment No.

Application Period:	Application Date:
Owner: City of De Pere	Contractor:
	Contractor's Project No.:

APPLICATION FOR PAYMENT

Approved Chang	e Orders		1. ORIGINAL CONTRACT PRICE:	
Number	Additions	Deductions	2. Net change by Change Orders and Written Amendments (+ or -):	\$0.00
			3. CURRENT CONTRACT PRICE (Line 1 plus Line 2):	\$0.00
			4. Total completed and stored to date Column H on Progress Estimate:      5. Retainage (per Agreement):	\$0.00
			A. Work Completed - Column H (95% up to 50% of Contract or 2.5% of     100% of Contract )	\$0.00
Total	\$0.00	\$	100 6. AMOUNT ELIGIBLE TO DATE (Line 4 minus 5)	\$0.00
		2	7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)	\$0.00
NET CHANGE B	Y CHANGE ORDERS:	\$(	008. AMOUNT DUE THIS APPLICATION (Line 6 minus Line 7)	\$0.00

CONTRACTOR'S CERTIFICATION	8	Payment of:	\$	
The undersigned Contractor certifies that:(1) all pr payments received from Owner on account of Wor have been applied on account to discharge Contra	k done under Contract		(Line 8 or other - attach explanation of other amount)	
obligations incurred in connection with Work cover Payment; (2) title of all Work, materials and equipr Work or otherwise listed in or covered by this Appl pass to Owner at time of payment free and clear o	ed by prior Applicaions for nent incorporated in said ication for Payment will	is recommended by:	(Contractor)	(Date)
interests and encumbrances (except such as are c acceptable to Owner indemnifying Owner against a interest or encumbrances); and (3) all Work cover Payment is in accordance with the Contract Docum	overe d by a Bond any such Liens, security ed by the Applicaton for	Payment of:	\$ (Line 8 or other - attach explanation of other amount)	
		is recommended by:		
By:	Date:		(Owner)	(Date)

## **SECTION 00 65 16**

## CERTIFICATE OF SUBSTANTIAL COMPLETION

Project:	
Owner:	Owner's Contract No.:
Contractor:	

This [tentative] [definitive] Certificate of Substantial Completion applies to:

□All Work under the Contract Documents: □The following specified portions of the Work:

Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Contractor and Engineer, and found to be substantially complete. The Date of Substantial completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

A [tentative] [definitive] list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as provided in the Contract Documents except as amended as follows:

Amended Responsibilities
--------------------------

 $\Box$  Not Amended

Owner's Amended Responsibilities:

Contractor's Amended Responsibilities:

The following documents are attached to and made part of this Certificate:

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Executed by Engineer

Date

Accepted by Contractor

Date

## SECTION 01 10 00 SUMMARY OF WORK

## PART 1 – GENERAL

## 1.1 SUMMARY

## A. Section Includes

- 1. References
- 2. Work Covered by the Contract Documents
- 3. Work Sequence
- 4. Use of Premises
- 5. Warranty
- 6. Work By Others
- 7. Project Utility Sources
- 8. Miscellaneous Provisions

## 1.2 **REFERENCES**

- A. General Specifications The work under this contract shall be in accordance with the City of De Pere, 2018 Construction Specifications and these Special Provisions and plans, and the latest edition of the Wisconsin Department of Transportation Standards Specifications for Highway and Structure Construction, where referenced in the City Specifications.
- B. Definitions. Any reference to the "state" or the "department" in said standard Specifications shall mean the "City of De Pere" for the purposes of this contract.
- C. Industry Standards
  - 1. Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
  - 2. Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
  - 3. If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.
  - 4. The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements.
  - 5. Each section of the specifications generally includes a list of reference standards normally referred to in that respective section. The purpose of this list is to furnish the Contractor with a list of standards normally used for outlining the quality control

desired on the project. The lists are not intended to be complete or all inclusive, but only a general reference of standards that are regularly referred to.

6. Each entity engaged in construction on the Project shall be familiar with industry standards applicable to it construction activity. Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required construction activity, obtain copies directly from the publication source and make them available on request.

## 1.3 WORK COVERED BY THE CONTRACT DOCUMENTS

## A. Project Identification

- 1. Project Location
  - a. Ryan Road from 450 feet south of Diversity Drive to 750 feet north of Destiny Drive
  - b. Destiny Drive from Scarlet Oak Trail to 500' east of Ryan Road
  - c. Scarlet Oak Trail from loop north of Destiny Drive to 500' south of Destiny Drive.
  - d. Pond Construction at Parcel ED-R28-2.
- Work will be performed under the following prime contract:
   a. Project 18-14 Pine Trail Crossing Street and Utility Construction

## B. The Work includes:

- 1. Water main and associated appurtenances installation.
- 2. Storm sewer and associated appurtenances installation.
- 3. Sanitary sewer and associated appurtenances installation.
- 4. Curb and Gutter installation
- 5. Asphalt concrete paving
- 6. Terrace restoration.
- 7. Lift Station construction.
- 8. Clearing and grubbing.
- 9. Unclassified excavation for roadway construction and pond expansion
- 10. Rip Rap
- 11. Grading
- 12. Ditching
- 13. Erosion Control

## 1.4 WORK SEQUENCE

- A. Conduct construction activities to maintain access to businesses and residences throughout construction. Gravel access driveway must be maintained to serve 2700 Ryan Road.
- B. Topsoil, seed, and mulch shall be completed prior to asphaltic concrete pavement placement.

- C. This project will be taken to the Board of Public Works on Monday, September 10, 2018 and then to Common Council on Tuesday, September 18, 2018 for consideration of award.
- D. The anticipated start of construction is Monday, October 1, 2018.
- E. Work shall be staged to meet the following interim deadlines:
  - 1. Provide utility service to the multi-family lot off of Ryan Road by October 31, 2018. Service does not require lift station operation.
  - 2. Provide utility service, excavation, and crushed aggregate base course to Diversity Drive by November 30, 2018.
  - 3. Provide utility service, excavation, and crushed aggregate base course to west Scarlet Oak Trail by December 28, 2018.
  - 4. Provide utility service, excavation, and crushed aggregate base course to east Scarlet Oak Trail and Ryan Road by March 29, 2019.
- F. The curb and gutter installation and asphaltic concrete pavement binder surface shall be installed the following spring. Curb and gutter and asphalt binder installation shall be completed by Friday, May 31, 2019.
- G. All water main tracer wire is to be tested prior to paving.

# 1.5 USE OF PREMISES

- A. Contractor shall have full use of the premises for construction operations, including use of the Project Site, as allowed by law, ordinances, permits, easement agreements and the Contract documents.
- B. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of the Project.
- C. The Project Site is limited to property boundaries, rights-of-way, easements, and other areas designated in the Contract Documents.
- D. Provide protection and safekeeping of material and products stored on or off the premises.
- E. Move any stored material or products which interfere with operations of Owner or other Contractors.

#### 1.6 WARRANTY

A. The Contractor warrants and guarantees to the City that all work shall be in accordance with the Contract Documents and will not be defective. Prompt notice of all defects will be given to the Contractor. All defective work, whether or not in place, may be rejected, corrected or accepted as provided in this proposal.

B. If within one (1) year after the date of contract work completion or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents or by a special provision of the Contract Documents, any work is found to be defective, the Contractor shall comply in accordance with the City's written instructions. These written instructions will include either correcting such defective work or, if it has been rejected by the City, removing it from the site and replacing it with non-defective work. If the Contractor does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk or loss or damage, the City may have the defective work corrected or the rejected work removed and replaced. All direct and indirect costs of correction or removal and replacement of defective work, including compensation for additional professional services, shall be paid by the Contractor.

# 1.8 PROJECT UTILITY SOURCES

- A. Green Bay Metropolitan Sewer District (NEW Water), Lisa Sarau, (<u>lsarau@newwater.us</u>) (920-438-1039)
- B. AT&T, Joe Kassab, (jk572k@att.com) (920-735-3206)
- C. Wisconsin Public Service, Bob Laskowski, (<u>rtlaskowski@wisconsinpublicservice.com</u>) (920-617-2775)
- D. Charter, Vince Albin, (vince.albin@charter.com) (920-378-0444)
- E. Nsight, Rick Vincent, (<u>rick.vincent@nsight.com</u>) (920-617-7316)
- F. TDS Metrocom, Steve Jakubiec, (steve.jakubiec@tdstelecom.com) (920-882-4166)
- G. Net-Lec (Mi-Tech Services), Dennis Lafave, (<u>dlafave@mi-tech.us</u>) (920-619-9774)
- H. Level3 (Mi-Tech Services), Chris Kraus, (ckraus@mi-tech.us) (414-550-6201)

#### 1.9 MISCELLANEOUS PROVISIONS

- A. Notification to Residents The Contractor shall individually notify all residents and businesses 2-weeks prior to the start of operations, giving an estimated time that vehicle movement will be limited or prohibited. Property owners shall be notified 24-hours prior to closing a drive.
- B. Provide a traffic control plan for the following locations:
  - 1. The utility work being completed on Ryan Road.
  - 2. The forcemain construction on Diversity Drive.
- C. Ingress and egress to the site for delivery of materials, hauling of excavation, daily construction activities and all vehicular traffic shall on Diversity Drive to CTH PP (S. Broadway Street).

PART 2 – PRODUCTS

PART 3 – EXECUTION

# END OF SECTION

# **SECTION 01 22 01**

# MEASUREMENT AND PAYMENT SANITARY SEWER

#### PART 1 – GENERAL

#### 1.1 SUMMARY

A.	Section includes:		Bid Item Nos.
	1.	Sanitary Sewer Mains (Granular Backfill)	SS-01, SS-04
	2.	Sanitary Sewer Mains (Natural Backfill)	SS-02, SS-05
	3.	Sanitary Sewer Laterals	SS-03, SS-06
	4.	Sanitary Sewer Service Branches	SS-07
	5.	Sanitary Sewer Risers	SS-08
	6.	Sanitary Sewer Manholes	SS-09
	7.	Provide Lift Station	SS-10
	8.	Core Drill Existing Manhole	SS-11

#### B. Unit Prices include:

- Defined work for each Unit Price Item which will provide a functionally complete Project when combined with all unit price items. If there are specific work items which the Contractor believes are not identified in any Unit Price Item, but is required to provide a functionally complete Project, then the identified specific work items shall be included in the appropriate Unit Price Item.
- 2. The method of measurement for payment.
- 3. The price per unit for payment.

# 1.2 GENERAL WORK ITEMS

- A. Include with the appropriate Unit Price Item the following work items which are common to the Unit Price Items for sanitary sewer systems.
- B. If there is a specific Unit Price Item for any of the following items, then the work item shall be included with that specific unit price item.
  - 1. Traffic Control.
  - 2. Sawcutting asphalt and/or concrete.
  - 3. Removal, hauling and disposal of surface materials including road pavement, curb and gutter, sidewalk, driveways and other pavement surfaces in the trench area and as shown on the drawings.
  - 4. Dewatering.
  - 5. Bypass pumping.
  - 6. Excavation.
  - 7. Open Trench installation method (unless bid item specifies other method).

- 8. Pipe Bedding.
- 9. Backfilling and compacting native obtained from the excavation.
- 10. Supplying, hauling, backfilling and compacting granular material.
- 11. Loading, hauling and disposing of surplus excavated material.
- 12. Landscaping turf establishment surface restoration and trees and bushes damaged during construction.
- 13. Maintenance, protection, replacement and/or repair of facilities not designated for alteration on the Site beyond the limits identified.
- 14. Site access requirements including temporary aggregate material as required for local traffic access.
- 15. If crossing or undermining of existing public or private utility, then include:
  - a. Maintaining the utility in service.
  - b. Replacing of existing utilities, if damaged.
  - c. Providing support and bedding material.
- 16. Dust control.
- 17. Remove and replace existing mailboxes and traffic signs.
- 18. Restroom facilities
- 19. Easement and right-of-way requirements.
- 20. Construction staking and other survey work not provide by the Engineer.
- 21. Regulatory requirements.
- 22. Preconstruction videotaping and video equipment.
- 23. Quality assurance and quality control testing and inspections.
- 24. Shop drawings and other submittals.

# 1.3 SANITARY SEWER MAINS (GRANULAR BACKFILL)

- A. The unit price for Sanitary Sewer Main (Granular Backfill) work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Sanitary sewer pipe and fittings of material stated in the Unit Price Bid Schedule and installed using the open trench method.
  - 3. Excavation, breakdown and removal of abandoned piping inside the trench area, including plugging of existing connections.
  - 4. Excavation, breakdown and removal of abandoned pipeline structures inside the trench area, including plugging of existing connections.
- B. Measurement of payment will be the actual horizontal length along the centerline of the installed sewer from centerline of the manhole to centerline of manhole with no deductions for manholes, sewer services branches and other fittings.
- C. The unit of measurement for payment is linear feet.

# 1.4 SANITARY SEWER MAINS (NATURAL BACKFILL)

- A. The unit price for Sanitary Sewer Main (Natural Backfill) work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Sanitary sewer pipe and fittings of material stated in the Unit Price Bid Schedule and installed using the open trench method.
  - 3. Excavation, breakdown and removal of abandoned piping inside the trench area, including plugging of existing connections.
  - 4. Excavation, breakdown and removal of abandoned pipeline structures inside the trench area, including plugging of existing connections
- B. Measurement of payment will be the actual horizontal length along the centerline of the installed sewer from centerline of the manhole to centerline of manhole with no deductions for manholes, sewer services branches and other fittings.
- C. The unit of measurement for payment is linear feet.

# 1.5 SANITARY SEWER LATERALS

- A. The unit price for Sanitary Sewer Laterals work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Sanitary sewer lateral pipe and fittings of the material stated in the Unit Price Bid Schedule and installed using the open trench method.
  - 3. Watertight plug in the end of the sewer service lateral or connection including transition coupling to the existing building sewer lateral.
  - 4. Tracer wire.
  - 5. Install an  $8' 4'' \times 4''$  board at the end of the lateral.
- B. Measurement of payment will be the actual horizontal length along the centerline of the installed sewer service lateral pipe (excluding risers) from centerline of the service branch to the end of the pipe at the right of way, easement or existing sewer service lateral with no deductions for fittings.
- C. The unit of measurement for payment is linear feet.

# 1.6 SANITARY SEWER SERVICE BRANCHES

- A. The unit price for Sanitary Sewer Service Branches work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Sanitary sewer service branches of same material strength or better than sanitary sewer main pipe.

- 3. Installation along with the sanitary sewer main pipe installation.
- 4. Plug (where required).
- B. Measurement for payment will be the actual number installed.
- C. The unit of measurement for payment is each.

# 1.7 SANITARY SEWER RISERS

- A. The unit price for Sanitary Sewer Risers work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Sanitary sewer riser pipe and fittings of material stated in the Unit Price Bid Schedule and installed using the open trench method.
  - 3. Risers to be installed at the right of way.
  - 4. Tracer wire.
- B. Measurement for payment will be the actual length of pipe along the centerline of the installed sewer service riser pipe from centerline of fitting to centerline of fitting having a vertical rise of 45 degrees or greater with no deductions for fittings.
- C. The unit of measurement for payment is linear feet.

# 1.8 SANITARY SEWER MANHOLES

- A. The unit price for Sanitary Sewer Manholes work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Precast reinforced concrete components.
  - 3. Joint flexible gasket material.
  - 4. Resilient flexible connector between the manhole structure and the sewer pipe.
  - 5. Adjusting rings and bituminous plastic cement sealant at chimney.
  - 6. Manhole steps.
  - 7. Manhole frame and cover (Neenah Foundry R-1500 Manhole Cover with Non-Rocking Lid or equal). Sanitary Sewer manhole covers shall have gaskets and concealed pick holes.
  - 8. Bedding material.
  - 9. Sewer pipe stub with connections and watertight plug (where required).
  - 10. Final casting adjustment.
- B. Measurement for payment will be the distance from the invert of the lowest sewer to the top of the frame and cover as set.

C. The unit of measurement for payment is vertical feet.

# 1.9 PROVIDE LIFT STATION

- A. The unit price for Provide Lift Station work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Construction of a new lift station and associated appurtenances as outlined in Lift Station Specifications provided by Robert E. Lee & Associates, Inc.
  - 3. Providing connections to City purchased generator.
- B. Measurement for payment will not be made.
- C. The unit of measurement for payment is lump sum.

# 1.10 CORE DRILLING TO EXISTING SANITARY MANHOLE

- A. The unit price for Core Drilling to Existing Sanitary Manhole work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Core drilling into existing sanitary sewer manhole (where required).
  - 3. Install A-Lok boot.
  - 4. Reform flow line in existing sanitary manhole.
- B. Measurement for payment will be the actual number complete.
- C. The unit of measurement for payment is each.

# END OF SECTION

# **SECTION 01 22 02**

# MEASUREMENT AND PAYMENT STORM SEWER

#### PART 1 – GENERAL

#### 1.1 **SUMMARY**

- A. Section includes: Bid Item Nos. ST-01, ST-02, ST-03, ST-04 1. Storm Sewer Mains (Granular Backfill) ST-05, ST-06, ST-07, ST-09 2. Storm Sewer Mains (Natural Backfill) **ST-08** 3. Storm Sewer Laterals **ST-10** 4. Storm Sewer Service Branches ST-11, ST-12, ST-13, ST-14 ST-15, ST-16 5. Storm Sewer Manholes 6. Catch Basin/Inlets ST-17, ST-18
  - 7. Flared End Section

ST-19, ST-20, ST-21

- B. Unit Prices include:
  - 1. Defined work for each Unit Price Item which will provide a functionally complete Project when combined with all unit price items. If there are specific work items which the Contractor believes are not identified in any Unit Price Item, but is required to provide a functionally complete Project, then the identified specific work items shall be included in the appropriate Unit Price Item.
  - 2. The method of measurement for payment.
  - 3. The price per unit for payment.

#### 1.2 GENERAL WORK ITEMS

- A. Include with the appropriate Unit Price Item the following work items which are common to the Unit Price Items for storm sewer systems.
- B. If there is a specific Unit Price Item for any of the following items, then the work item shall be included with that specific unit price item.
  - 1. Traffic Control.
  - 2. Sawcutting asphalt and/or concrete.
  - 3. Removal, hauling and disposal of surface materials including road pavement, curb and gutter, sidewalk, driveways and other pavement surfaces in the trench area and as shown on the drawings.
  - 4. Dewatering.
  - 5. Excavation.
  - 6. Open Trench installation method (unless bid item specifies other method).

- 7. Pipe Bedding.
- 8. Backfilling and compacting native obtained from the excavation.
- 9. Supplying, hauling, backfilling and compacting granular material.
- 10. Loading, hauling and disposing of surplus excavated material.
- 11. Landscaping turf establishment surface restoration and trees and bushes damaged during construction.
- 12. Maintenance, protection, replacement and/or repair of facilities not designated for alteration on the Site beyond the limits identified.
- 13. Site access requirements including temporary aggregate material as required for local traffic access.
- 14. If crossing or undermining of existing public or private utility, then include:
  - a. Maintaining the utility in service.
  - b. Replacing of existing utilities, if damaged.
  - c. Providing support and bedding material.
- 15. Dust control.
- 16. Remove and replace existing mailboxes and traffic signs.
- 17. Restroom facilities
- 18. Easement and right-of-way requirements.
- 19. Construction staking and other survey work not provide by the Engineer.
- 20. Regulatory requirements.
- 21. Preconstruction videotaping and video equipment.
- 22. Quality assurance and quality control testing and inspections.
- 23. Shop drawings and other submittals.

#### 1.3 STORM SEWER MAINS (GRANULAR BACKFILL)

- A. The unit price for Storm Sewer Main (Granular Backfill) work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Storm sewer pipe and fittings of material stated in the Unit Price Bid Schedule and installed using the open trench method.
  - 3. Excavation, breakdown and removal of abandoned piping inside the trench area, including plugging of existing connections.
  - 4. Excavation, breakdown and removal of abandoned pipeline structures inside the trench area, including plugging of existing connections.
- B. Measurement of payment will be the actual horizontal length along the centerline of the installed sewer from centerline of the manhole to centerline of manhole with no deductions for manholes, sewer services branches and other fittings.
- C. The unit of measurement for payment is linear feet.

# 1.4 STORM SEWER MAINS (NATURAL BACKFILL)

- A. The unit price for Storm Sewer Main (Natural Backfill) work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Storm sewer pipe and fittings of material stated in the Unit Price Bid Schedule and installed using the open trench method.
  - 3. Excavation, breakdown and removal of abandoned piping inside the trench area, including plugging of existing connections.
  - 4. Excavation, breakdown and removal of abandoned pipeline structures inside the trench area, including plugging of existing connections
- B. Measurement of payment will be the actual horizontal length along the centerline of the installed sewer from centerline of the manhole to centerline of manhole with no deductions for manholes, sewer services branches and other fittings.
- C. The unit of measurement for payment is linear feet.

# 1.5 STORM SEWER LATERALS

- A. The unit price for Storm Sewer Laterals work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Storm sewer lateral pipe and fittings of the material stated in the Unit Price Bid Schedule and installed using the open trench method.
  - 3. Watertight plug in the end of the sewer service lateral or connection including transition coupling to the existing building sewer lateral.
  - 4. Tracer wire.
  - 5. Installed an  $8' 4'' \times 4''$  board at the end of the lateral.
- B. Measurement of payment will be the actual horizontal length along the centerline of the installed sewer service lateral pipe from centerline of the service branch to the end of the pipe at the right of way, easement or existing sewer service lateral with no deductions for fittings.
- C. The unit of measurement for payment is linear feet.

# 1.6 STORM SEWER SERVICE BRANCHES

- A. The unit price for Storm Sewer Service Branches work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Storm sewer service branches of same material strength or better than storm sewer main pipe (where required).
  - 3. Core drilling into concrete storm sewer main (where required).

- 4. Installation along with the storm sewer main pipe installation.
- 5. Plug (where required).
- B. Measurement for payment will be the actual number installed.
- C. The unit of measurement for payment is each.

# 1.7 STORM SEWER MANHOLES

- A. The unit price for Storm Sewer Manholes work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Precast reinforced concrete components.
  - 3. Joint flexible gasket material.
  - 4. Grout seal between the manhole and structure and the sewer pipe.
  - 5. Adjusting rings and bituminous plastic cement sealant at chimney.
  - 6. Manhole steps.
  - 7. Manhole frame and cover.
  - 8. Bedding material.
  - 9. Sewer pipe stub with connections and watertight plug (where required).
  - 10. Final casting adjustment.
- B. Measurement for payment will be the distance from the invert of the lowest sewer to the top of the frame and cover as set.
- C. The unit of measurement for payment is vertical feet.

# 1.8 CATCH BASIN/INLETS

- A. The unit price for Catch Basin/Inlets work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Precast reinforced concrete components.
  - 3. Joint flexible gasket material.
  - 4. Grout seal between the catch basin/inlet structure and the sewer pipe.
  - 5. Adjusting rings grouted in place.
  - 6. Casting frame and grate.
  - 7. Bedding material.
  - 8. Supply and install 6 to 10 feet of 4 inch flexible perforated plastic pipe with geotextile wrap subgrade drain.
  - 9. Sand fill and Class "B" concrete floor and flow line.
  - 10. Temporary cover over catch basin/inlet to prevent eroded materials from entering.
  - 11. Final casting adjustment.

- B. Measurement for payment will be the actual number installed.
- C. The unit of measurement for payment is each.

# 1.9 FLARED END SECTION

- A. The unit price for Reinforced Concrete Apron Endwall includes:
  - 1. General Work Items of Article 1.2.
  - 2. Precast concrete components.
  - 3. Anchors to storm sewer pipe.
- B. Measurement for payment will be the actual number installed.
- C. The unit of measurement for payment is each.

# END OF SECTION

# SECTION 01 22 03

#### MEASUREMENT AND PAYMENT WATER SYSTEM

#### PART 1 – GENERAL

#### 1.1 SUMMARY

А.	Section includes:		Bid Item Nos:
	1.	Water Mains (Granular Backfill)	W-01, W-03
	2.	Water Mains (Natural Backfill)	W-02, W-04
	3.	Water Services	W-05, W-06, W-07
	4.	Corporation and Curb Stop	W-08
	5.	Valves	W-09, W-10
	6.	Connection to Existing Water Mains	W-11
	7.	Fire Hydrant	W-12
	8.	Hydrant Lead	W-13
	9.	Water Service Offset	

#### B. Unit Prices include:

- 1. Defined work for each Unit Price Item which will provide a functionally complete Project when combined with all unit price items. If there are specific work items which the Contractor believes are not identified in any Unit Price Item, but is required to provide a functionally complete Project, then the identified specific work items shall be included in the appropriate Unit Price Item.
- 2. The method of measurement for payment.
- 3. The price per unit for payment.

#### 1.2 GENERAL WORK ITEMS

- A. Include with the appropriate Unit Price Item the following work items which are common to the Unit Price Items for water systems.
- B. If there is a specific Unit Price Item for any of the following items, then the work item shall be included with that specific unit price item.
- 1. Traffic Control.
  - 2. Sawcutting asphalt and/or concrete.
  - 3. Removal, hauling and disposal of surface materials including road pavement, curb and gutter, sidewalk, driveways and other pavement surfaces in the trench area and as shown on the drawings.
  - 4. Dewatering.
  - 5. Excavation.

- 6. Open Trench installation method (unless bid item specifies other method).
- 7. Pipe Bedding.
- 8. Backfilling and compacting native obtained from the excavation.
- 9. Supplying, hauling, backfilling and compacting granular material.
- 10. Loading, hauling and disposing of surplus excavated material.
- 11. Landscaping turf establishment surface restoration and trees and bushes damaged during construction.
- 12. Maintenance, protection, replacement and/or repair of facilities not designated for alteration on the Site beyond the limits identified.
- 13. Site access requirements including temporary aggregate material as required for local traffic access.
- 14. Bulkhead and abandoned existing water main with flowable fill as shown on Drawings.
- 15. If crossing or undermining of existing public or private utility, then include:
  - a. Maintaining the utility in service.
  - b. Replacing of existing utilities, if damaged.
  - c. Providing support and bedding material.
- 16. Dust control.
- 17. Remove and replace existing mailboxes and traffic signs.
- 18. Restroom facilities
- 19. Easement and right-of-way requirements.
- 20. Construction staking and other survey work not provide by the Engineer.
- 21. Regulatory requirements.
- 22. Preconstruction videotaping and video equipment.
- 23. Quality assurance and quality control testing and inspections.
- 24. Shop drawings and other submittals.

# 1.3 WATER MAINS (GRANULAR BACKFILL)

- A. The unit price for Water Main (Granular Backfill) work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Water pipe and fittings of material stated in the Unit Price Bid Schedule and installed using the open trench method.
  - 3. Ductile or cast iron fittings.
  - 4. Tracer wire.
  - 5. Polyethylene encasement of ductile iron or cast iron pipe and fittings.
  - 6. Blocking and joint restraints.
  - 7. Disinfection of pipelines.
- B. Measurement of payment will be the actual horizontal length along the centerline of the installed water main with no deductions for fittings and valves.

C. The unit of measurement for payment is linear feet.

# 1.4 WATER MAINS (NATURAL BACKFILL)

- A. The unit price for Water Main (Natural Backfill) work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Water pipe and fittings of material stated in the Unit Price Bid Schedule and installed using the open trench method.
  - 3. Ductile or cast iron fittings.
  - 4. Tracer wire.
  - 5. Polyethylene encasement of ductile iron or cast iron pipe and fittings.
  - 6. Blocking and joint restraint.
  - 7. Disinfection of pipelines.
- B. Measurement of payment will be the actual horizontal length along the centerline of the installed water main with no deductions for fittings and valves.
- C. The unit of measurement for payment is linear feet.

# 1.5 WATER SERVICES

- A. The unit price for Water Services work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Pipe and fittings of material stated in the Unit Price Bid Schedule.
  - 3. Tracer wire.
  - 4. Disinfection of pipelines.
  - 5. Installed an 8'- 4"x4" board at the end of the lateral.
  - 6. Directional drilling of water services on Ryan Road.
- B. Measurement of payment will be the actual horizontal length along the centerline of the installed water service with no deductions for fittings and curb stops.
- C. The unit of measurement for payment is linear feet.

# 1.6 CORPORATION AND CURB STOPS

- A. The unit price for Corporation and Curb Stops work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Supply curb stops and curb boxes.
  - 3. Connection to existing water service (where required).

- 4. Installation of curb stops and curb boxes.
- 5. Tracer wire.
- B. Measurement for payment will be the actual number installed.
- C. The unit of measurement for payment is each.

# 1.7 VALVES

- A. The unit price for Valves work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Valve.
  - 3. Valve box.
  - 4. Polyethylene encasement.
  - 5. Stem.
  - 6. Bedding material.
- B. Measurement for payment will be the actual number installed.
- C. The unit of measurement for payment is each.

# 1.8 CONNECTIONS TO EXISTING WATER MAINS

- A. The unit price for Connection to Existing Water Mains work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Locating existing water main.
  - 3. Connection to the end of existing pipe.
    - a. Remove existing plug.
    - b. Direct connection to end of existing pipe.
    - c. Transition fittings, if required.
- B. Measurement for payment will be the actual number installed.
- C. The unit of measurement for payment is each.

# 1.9 FIRE HYDRANTS

- A. The unit price for Fire Hydrants work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Fire hydrant complete of the specified bury depth.
  - 3. Blocking and joint restraints.

- 4. Hydrant wrenches.
- 5. Hydrant markers.
- 6. Polyethylene encasement.
- 7. Drainage pit.
- 8. Disinfection of hydrant.
- 9. Tracer wire.
- 10. Tracer wire access box.
- B. Measurement for payment will be the actual number installed.
- C. The unit of measurement for payment is each.

# 1.10 HYDRANTS LEADS

- A. The unit price for Hydrants Leads work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Pipe and fittings of material stated in the Unit Price Bid Schedule.
  - 3. Blocking and joint restraints.
  - 4. Tracer wire
  - 5. Disinfection of pipeline.
- B. Measurement for payment will be the actual horizontal length along the centerline of the installed from the centerline of the water main to the centerline of the hydrant with no deductions for fittings and valves.
- C. The unit of measurement for payment is linear feet.

# 1.11 WATER SERVICE OFFSET

- A. The unit price for Water Service Offset work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Ductile iron fittings and PVC pipe.
  - 3. Tracer Wire.
  - 4. Polyethylene encasement of ductile iron pipe and fittings.
  - 5. Blocking and joint restraints.
- B. Measurement for payment will be the actual number installed.
- C. The unit of measurement for payment is each and includes the pipe and fittings from vertical bend to vertical bend at the offset location.

# **SECTION 01 22 04**

#### MEASUREMENT AND PAYMENT STREET AND DRAINAGE CONSTRUCTION

#### PART 1 – GENERAL

#### 1.1 SUMMARY

A.	Section includes:		Bid Item Nos.
	1.	Clearing and Grubbing.	SD-01
	2.	Topsoil and Unclassified Excavation.	SD-02, SD-03
	3.	Backyard Swale Ditching	SD-04
	4.	Crushed Aggregate Base and Surface Course	SD-05
	5.	Asphaltic Concrete Pavement	SD-06, SD-07
	6.	Portland Cement Concrete Curb and Gutter	SD-08
	7.	Portland Cement Concrete Pavement	SD-09
	8.	Portland Cement Concrete Driveway and Sidewalk	SD-10, SD-11
	9.	Deformed Reinforcement Bars	SD-12
	10. Drilled Tie Bars		SD-13
	11.	Landscaping – Topsoil, Seed, Fertilize, and Mulch	SD-14

#### B. Unit Prices include:

- Defined work for each Unit Price Item which will provide a functionally complete Project when combined with all unit price items. If there are specific work items which the Contractor believes are not identified in any Unit Price Item, but is required to provide a functionally complete Project, then the identified specific work items shall be included in the appropriate Unit Price Item.
- 2. The method of measurement for payment.
- 3. The price per unit for payment.

#### 1.2 GENERAL WORK ITEMS

- A. Include with the appropriate Unit Price Item the following work items which are common to the Unit Price Items for street and drainage systems.
- B. If there is a specific Unit Price Item for any of the following items, then the work item shall be included with that specific unit price item.
  - 1. Traffic Control.
  - 2. Sawcutting asphalt and/or concrete.
  - 3. Removal, hauling and disposal of surface materials including road pavement, curb and gutter, sidewalk, driveways and other pavement surfaces in the trench area and as shown on the drawings.

- 4. Maintenance, protection, replacement and/or repair of facilities not designated for alteration on the Site.
- 5. Site access requirements including temporary aggregate material as required for local traffic access.
- 6. Dust control.
- 7. Remove and replace existing mailboxes and traffic signs.
- 8. Restroom facilities.
- 9. Construction staking and other survey work not provide by the Owner.
- 10. Regulatory requirements.
- 11. Quality assurance and quality control testing and inspections.
- 12. Final casting and valve box adjustment.
- 13. Shop drawings and other submittals.

# 1.3 CLEARING AND GRUBBING

- A. The unit price for Clearing and Grubbing work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Cutting and disposing of trees, brush, windfalls, logs and other vegetation.
  - 3. Removing and disposing of roots, stumps, stubs, logs and other timber.
  - 4. Stripping and stockpiling topsoil.
- B. Measurement of payment will not be made.
- C. The unit of measurement for payment is lump sum.

# 1.4 TOPSOIL AND UNCLASSIFIED EXCAVATION

- A. The unit price for Topsoil and Unclassified Excavation work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Removal of topsoil to depth available.
  - 3. Hauling and stockpiling topsoil.
  - 4. Excavation to subgrades shown on the Drawings.
  - 5. Hauling of unclassified material.
  - 6. Placing unclassified material in fill areas to subgrades shown on the Drawings and the subgrade required for placement of topsoil.
  - 7. Compaction of subgrade and fill areas.
  - 8. Test rolling subgrade.
  - 9. Excavation of undercut areas for placing topsoil.
  - 10. Respreading topsoil to final grades shown on the Drawings.
  - 11. Disposal of surplus topsoil, unclassified material and unsuitable material.

- 12. Preparation of disposal site and transportation of material over an Engineer approved haul route from the site including all loading and dumping of material
- 13. Finish grading.
- B. Measurement of payment will not be made unless there is a change in project scope. The estimated quantity represents the computed volume by comparing the triangulated surfaces and will be the basis for payment.
- C. The unit of measurement for payment is cubic yards.

# 1.5 BACKYARD SWALE DITCHING

- A. The unit price for Backyard Swale Ditching work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Removal of topsoil to depth available.
  - 3. Hauling and stockpiling topsoil.
  - 4. Excavation to subgrades shown on the drawings.
  - 5. Hauling of unclassified material.
  - 6. Placing unclassified material in fill areas to subgrades shown on the Drawings and the subgrade required for placement of topsoil.
  - 7. Compaction of subgrade and fill areas.
  - 8. Excavation of undercut areas for placing topsoil.
  - 9. Respreading topsoil to final grades shown on the Drawings.
  - 10. Disposal of surplus topsoil, unclassified material and unsuitable material.
  - 11. Preparation of disposal site and transportation of material over an Engineer approved haul route from the site including all loading and dumping of material.
  - 12. Finish grading.
- B. Measurement of payment will be the length and width of the area to be ditched for backyard swales.
- C. The unit of measurement for payment is square yards.

# 1.6 CRUSHED AGGREGATE BASE AND SURFACE COURSE

- A. The unit price for Crushed Aggregate Base and Surface Course work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Aggregate material.
  - 3. Preparation of foundation.
  - 4. Placing and compacting to thickness and width shown on the Drawings or specified elsewhere.

- 5. Maintenance until surface pavement is constructed.
- 6. Preparation of crushed aggregate base for paving.
- 7. Adjustment of manholes and valve boxes to proposed finish road grade.
- B. Measurement of payment will be the actual amount of material required and incorporated in the work verified by submitting to the Engineer delivery tickets provide with each load showing the weight measured on a certified scale, type of material, the date delivered and the project name. Aggregates in excess of seven (7) percent total moisture determined based on the dry mass of the aggregates will have moisture content in excess of seven (7) percent deducted from the measured weight.
- C. The unit of measurement for payment is tons.

# 1.7 ASPHALTIC CONCRETE PAVEMENT

- A. The unit price for Asphaltic Concrete Pavement work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Asphaltic concrete mixture, tack coat and other required materials
  - 3. Surface preparation.
  - 4. Provide tack coat on base material.
  - 5. Saw cutting and/or mill adjacent and abutting pavement surfaces.
  - 6. Asphaltic concrete placement and compaction to thickness and width shown on the drawings or specified elsewhere.
  - 7. Tack coat between asphaltic concrete courses and abutting pavements.
- B. Measurement for payment will be the actual amount of material required and incorporated in the work verified by submitting to the Engineer delivery tickets provided with each load showing the weight measured on a certified scale, type of material, the date delivered and the project name.
- C. The Unit Price shall be adjusted for deficiencies for less than minimum density represented by the average lot density of five nuclear density tests of 750 tons of asphaltic concrete placed as shown in the following table:

Density Deficiency-Percent of Unit Price for Payment			
%Lot Density Below			
Specified Minimum	WisDOT Mixes		
From 0.5-1.0 inclusive	98%		
From 1.1-1.5 inclusive	95%		
From 1.6-2.0 inclusive	91%		
From 2.1-2.5 inclusive	85%		
From 2.6-3.0 inclusive	70%		
More than 3.0	0%		

D. The unit of measurement for payment is tons.

# 1.8 PORTLAND CEMENT CONCRETE CURB AND GUTTER

- A. The unit price for Portland Cement Concrete Curb and Gutter work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Providing Portland cement concrete mixture of size shown in the drawings or specified elsewhere.
  - 3. Providing expansion joints.
  - 4. Providing curing.
  - 5. Existing curb and gutter removal.
  - 6. Subgrade preparation.
  - 7. Provide crushed aggregate base.
  - 8. Fine grading of subgrade.
  - 9. Providing contraction joints.
  - 10. Driveway entrances and handicap ramp entrances.
  - 11. Adjustment of catch basin/inlets.
  - 12. Finishing.
  - 13. Protection.
  - 14. Restoration behind the curb.
- B. Measurement for payment will be along the flow line of the gutter and through inlets/catch basins.
- C. The unit of measurement for payment is linear feet.

# 1.9 PORTLAND CEMENT CONCRETE PAVEMENT

- A. The unit price for Portland Cement Concrete Pavement work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Furnish all labor, tools, equipment and services.
  - 3. Providing Portland cement concrete mixture of thickness shown in the drawings or specified elsewhere.
  - 4. Surface preparation.
  - 5. Providing reinforcement including tie bars and dowel bars.
  - 6. Joint sealing.
  - 7. Providing curing.
  - 8. Concrete sealing with linseed oil.
  - 9. Fine grading of subgrade.
  - 10. Providing expansion joints and contraction joints.

- 11. Adjustment of manholes, water valves, inlets/catch basin and other structures to finish grade.
- 12. Finishing.
- 13. Protection.
- B. Measurement for payment will be length and width of areas paved. Concrete curb and gutter will be measured separately, regardless if the curb is installed with integral curb. Curb and gutter will be paid per linear foot for 24" width. The width and length will be subtracted from the concrete pavement area if integral curb is constructed.
- C. The unit of measurement for payment is square yard.

# 1.10 PORTLAND CEMENT CONCRETE DRIVEWAY AND SIDEWALK

- A. The unit price for Portland Cement Concrete Sidewalk and Driveway work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Providing Portland cement concrete mixture of thickness shown in the drawings or specified elsewhere.
  - 3. Providing reinforcement.
  - 4. Providing expansion joint.
  - 5. Providing curing.
  - 6. Existing pavement removal.
  - 7. Subgrade preparation.
  - 8. Providing contraction joints.
  - 9. Handicap ramps.
  - 10. Sidewalk steps.
  - 11. Saw cutting adjacent surfaces.
  - 12. Finishing.
  - 13. Protection.
  - 14. Restoration.
- B. Measurement for payment will be the average horizontal length and width of the concrete placed.
- C. The unit of measurement for payment is square yards.

#### 1.11 DEFORMED REINFORCEMENT BARS

- A. The unit price for Deformed Reinforcement Bars work includes:
  - 1. General Work Items of Article 1.2.

- 2. Supply and install 2 number 4 deformed reinforcement bars over all trenches that fall under any portion of the concrete curb and gutter, sidewalk, and driveway being constructed.
- B. Measurement for payment will be the horizontal length of each bar installed.
  - 1. This item applies to concrete curb and gutter, sidewalk, and driveway.
  - 2. This item does not apply to concrete pavement and patches.
- C. The unit of measurement for payment is each.

# 1.12 DRILLED TIE BARS

- A. The unit price for Drill Tie Bars work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Providing and installing tie bars and dowel bars, including coating.
  - 3. For drilling holes in concrete not placed under the contract.
  - 4. For epoxying or driving.
- B. Measurement for payment will be the actual number of bars installed.
  - 1. This item applies to concrete sidewalk.
  - 2. This item does not apply to concrete pavement and patches.
- C. The unit of measurement for payment is each.

# 1.13 LANDSCAPING- TOPSOIL, SEED, FERTILIZE AND MULCH

- A. The unit price for Landscaping- Topsoil, Seed, Fertilize, and Mulch work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Provide 4" topsoil or salvaged topsoil.
  - 3. Provide seed.
  - 4. Provide fertilizer.
  - 5. Provide mulch.
  - 6. Provide maintenance.
- B. Measurement for payment will be the width and length not greater than the road right of way, not greater than the easement and not greater than 15 feet beyond the top of either side of ditches outside the right of way.
  - 1. This item does not include ditching, which is included with the Ditching bid item
- C. The unit of measurement for payment is square yard.

# END OF SECTION

# **SECTION 01 22 05**

#### MEASUREMENT AND PAYMENT SPECIAL CONSTRUCTION

#### PART 1 – GENERAL

#### 1.1 SUMMARY

А.	Section includes:		Bid Item Nos.
	1.	Pipe Foundation Stabilization	SC-01
	2.	Silt Fence Erosion Control	SC-02
	3.	Inlet Protection Erosion Control	SC-03
	4.	Rip Rap Erosion Control	SC-04, SC-05
	5.	Tracking Pad	SC-06
	6.	Erosion Control Bags	SC-07

- B. Unit Prices include:
  - Defined work for each Unit Price Item which will provide a functionally complete Project when combined with all unit price items. If there are specific work items which the Contractor believes are not identified in any Unit Price Item, but is required to provide a functionally complete Project, then the identified specific work items shall be included in the appropriate Unit Price Item.
  - 2. The method of measurement for payment.
  - 3. The price per unit for payment.

#### 1.2 GENERAL WORK ITEMS

- A. Include with the appropriate Unit Price Item the following work items which are common to the Unit Price Items for special construction.
- B. If there is a specific Unit Price Item for any of the following items, then the work item shall be included with that specific unit price item.
  - 1. Traffic Control.
  - 2. Loading, hauling and disposing of surplus material.
  - 3. Maintenance, protection, replacement and/or repair of facilities not designated for alteration on the Site beyond the limits identified.
  - 4. Dust control.
  - 5. Restroom facilities.
  - 6. Construction staking and other survey work not provide by the Engineer.
  - 7. Regulatory requirements.
  - 8. Quality assurance and quality control testing and inspections.
  - 9. Shop drawings and other submittals.

# 1.3 PIPE FOUNDATION STABILIZATION

- A. The unit price for Pipe Foundation Stabilization work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Excavation below the limits of the pipe bedding with the bottom of the excavation wider than the top with 1:1 side slopes.
  - 3. Dewatering.
  - 4. Soil Class A-7 or A-8 aggregate material.
  - 5. Loading, hauling and disposing of surplus excavated material.
- B. Measurement of payment will be the volume calculated based on:
  - 1. The actual depth from 4" below the bottom of pipe to the bottom of the aggregate material placed.
  - 2. The bottom width is the actual width not to exceed the pipe outside diameter plus 24" plus1:1 side slopes.
  - 3. The top width is the pipe outside diameter plus 24".
- C. The unit of measurement for payment is cubic yards.
- 1.4 SILT FENCE EROSION CONTROL
  - A. The unit price for Silt Fence Erosion Control work includes:
    - 1. General Work Items of Article 1.2.
    - 2. Provide fabric and post.
    - 3. Excavate to anchor fabric and compact soil or provide soil class C-3 to anchor the fabric.
    - 4. Inspection and maintenance of the installed silt fence.
    - 5. Removal of the silt fence.
    - 6. Finish grading.
    - 7. Topsoil, seeding, fertilizing, and mulching area in the vicinity of the removed silt fence which does not have established turf.
  - B. Measurement of payment will be the actual horizontal length installed.
  - C. The unit of measurement for payment is linear feet.

# 1.5 INLET PROTECTION EROSION CONTROL

- A. The unit price for Inlet Protection Erosion Control work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Provide geotextile and wood materials for type shown on the Drawings.
  - 3. Placing inlet protection system.
  - 4. Inspection and maintenance of the installed inlet protection.
  - 5. Removal of the inlet protection.
  - 6. Cleaning debris buildup around inlet.
- B. Measurement for payment will be actual number of inlet protection erosion control installed.
- C. The unit of measurement for payment is each.
- 1.6 RIP RAP EROSION CONTROL
  - A. The unit price for Rip Rap Erosion Control work includes:
    - 1. General Work Items of Article 1.2.
    - 2. Provide rip rap material and geotextile fabric.
    - 3. Excavate and place rip rap material.
  - B. Measurement for payment will be the actual area installed.
  - C. The unit of measurement for payment is square yards.

# 1.7 TRACKING PAD

- A. The unit price for Tracking Pad work includes:
  - 1. General Work Items of Article 1.2.
  - 2. Install to the dimensions as shown on the drawing or specified elsewhere.
  - 3. Providing filter fabric.
  - 4. Providing crushed aggregate base course (3 inch clear stone).
  - 5. Daily maintenance of aggregate.
  - 6. Removal of aggregate and restore with topsoil, seed, fertilizer and mulch.
- B. Measurement for payment will be the actual number of tracking pads installed.
- C. The unit of measurement for payment is each.

## 1.8 EROSION CONTROL BAGS

# A. The unit price for Erosion Control Bags work includes:

- 1. General Work Items of Article 1.2.
- 2. Provide rock filled erosion control bags.
- 3. Excavate and embed the erosion control bags.
- 4. Inspection and maintenance of the installed bags.
- 5. Removal of the erosion control bags.
- 6. Finish grading.
- 7. Topsoil, seeding, fertilizing, and mulching area in the vicinity of the removed erosion control bales which does not have established turf.
- B. Measurement of payment will the actual number of erosion control bags installed.
- C. The unit of measurement for payment is each.

# END OF SECTION

# SECTION 01 29 00

### **PAYMENT PROCEDURES**

#### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. This section includes:
  - 1. Administrative and procedural requirements necessary to prepare and process Applications for Payment

#### 1.2 SCHEDULE OF VALUES

A. Unit Price work will be the Schedule of Values used as the basis for reviewing Applications for Payment.

#### 1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as recommended by the Engineer and approved by Owner.
- B. The date for each progress payment should be the 3rd Tuesday of each month. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends the 4<sup>th</sup> Friday of the Month.
- C. Use forms provided by Engineer for Applications for Payment. Sample copy of the Application for Payment and Continuation Sheet is included in Section 00 62 76.

#### D. Application Preparation Procedures

- 1. When requested by the Contractor, the Engineer will determine the actual quantities and classifications of Unit Price Work performed.
  - a. Preliminary determinations will be reviewed with the Contractor before completing Application for Payment.
  - b. Engineer will complete the Application for Payment based on Engineer's decision on actual quantities and classifications.
  - c. Engineer will submit three original copies of Application for Payment to Contractor for certification of all three original copies.
  - d. Contractor shall submit signed Application for payment to Owner for approval within time frame agreed to at the Preconstruction Conference.
- 2. If payment is requested for materials and equipment not incorporated in the Work, then the following shall be submitted with the Application for Payment:
  - a. Evidence that materials and equipment are suitably stored at the site or at another location agreed to in writing.
  - b. A bill of sale, invoice, or other documentation warranting that the materials and equipment are free and clear of all liens.
  - c. Evidence that the materials and equipment are covered by property insurance.

- 3. Complete every entry on form. Execute by a person authorized to sign legal documents on behalf of Contractor.
- E. With each Application for Payment, submit waivers of liens from subcontractors and suppliers for the construction period covered by the previous application.
  - 1. Submit partial waivers on each item for amount requested before deduction for retainage on each item.
  - 2. When an application shows completion for an item, submit final or full waivers.
  - 3. Owner reserves the right to designate which entities involved in the Work shall submit waivers.
  - 4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application.
  - 5. Submit waivers of lien on forms executed in a manner acceptable to Owner.
- F. The following administrative actions and submittals shall precede or coincide with submittal of first Application for Payment:
  - 1. List of subcontractors.
  - 2. Schedule of Values (For Lump Sum Work).
  - 3. Contractor's construction schedule.
- G. Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted including, but not limited, to the following:
  - 1. Evidence of completion of Project closeout requirements.
  - 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  - 3. Updated final statement, accounting for final changes to the Contract Sum.
  - 4. Consent of Surety to Final Payment.
  - 5. Final lien waivers as evidence that claims have been settled.
  - 6. Final liquidated damages settlement statement.

# PART 2 – PRODUCTS

PART 3 – EXECUTION

# END OF SECTION

# SECTION 01 32 33 CONSTRUCTION PHOTOGRAPHS

# PART 1 – GENERAL

#### 1.1 SUMMARY

A. Section Includes:1. Photographs for utility construction sites.

#### 1.2 SUBMITTALS

- A. Submit electronic files of each photographic view within seven (7) days of taking photographs.
- 1.3 QUALITY ASSURANCE
  - A. Photographs are to be submitted to the Engineer for approval prior to the start of construction.

#### PART 2 – PRODUCTS

#### PART 3 – EXECUTION

#### 3.1 UTILITY AND STREET CONSTRUCTION SITES

- A. Prior to start of construction provide sufficient photographs to adequately show the existing facilities and conditions within and adjacent to the construction Site to serve as a guide for final restoration including:
  - 1. Roads including shoulders and/or curb and gutter.
  - 2. Sidewalks, parking areas, and driveways.
  - 3. Utility structures.
  - 4. Landscaping including signs, plantings, walls, fences, trees, shrubbery, etc.
  - 5. Mail boxes.
  - 6. Drainage facilities including culverts, inlets, ditches.
  - 7. Building structures.
- B. During construction provide sufficient photographs (a minimum of one per 100 feet of installed utility) to adequately show construction means, methods, and Site conditions including:
  - 1. Crossings of other utilities.
  - 2. Exposure of existing structures.
  - 3. Soil conditions.

#### END OF SECTION

### SECTION 01 33 00

### SUBMITTALS

#### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for submittals:
  - 1. Progress Schedule
  - 2. Schedule of Shop Drawings and Sample Submittals
  - 3. Shop Drawings
- B. Failure to meet Submittal requirements to the satisfaction of the Engineer will constitute unsatisfactory performance of the work in accordance with the Contract Documents, therefore, the Engineer may recommend to the Owner that all or a portion of payments requested during the corresponding pay period be withheld until these requirements are met.

#### 1.2 SUBMITTAL PROCEDURES

A. Coordination

Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

- 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
- 2. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.
  - a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
- 3. To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
  - a. Allow two weeks for initial submittal.
  - b. Allow two weeks for reprocessing each submittal.
  - c. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the work to permit processing.
- B. Submittal Preparation

Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

- 1. Assign a reference number to each submittal and re-submittal.
- 2. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.

- 3. Include the following information on the label for processing and recording action taken.
  - a. Project name.
  - b. Date.
  - c. Name and address of the Engineer.
  - d. Name and address of the Contractor.
  - e. Name and address of the subcontractor.
  - f. Name and address of the supplier.
  - g. Name of the manufacturer.
  - h. Number and title of appropriate Specification Section.
  - i. Drawing number and detail references, as appropriate.
- 4. Each submittal shall be stamped by the Contractor indicating that submittal was reviewed for conformance with the Contract Documents. The Engineer will not accept unstamped submittals.
- C. Submittal Transmittal

Package each submittal appropriately for transmittal and handling. Transmit each submittal to the Engineer. The Engineer will not accept submittals received from sources other than the Contractor.

1. On the transmittal, record relevant information and requests for Engineer action. On a form, or separate sheet, record deviations from Contract Document requirements, including variations, limitations, and justifications. Include Contractor's certification that information complies with Contract Document requirements.

# 1.3 CONTRACTOR'S PROGRESS SCHEDULE

- A. Prepare and submit to the Engineer within 10 days after the Effective Date of the Agreement, four copies of a preliminary progress schedule of the work activities form Notice to Proceed until Substantial Completion.
  - 1. Provide sufficient detail of the work activities comprising the schedule to assure adequate planning and execution of the work, such that in the judgment of the Engineer, it provides an appropriate basis for monitoring and evaluation of the progress of the work. A work activity is defined as an activity which requires substantial time and resources (manpower, equipment, and/or material) to complete and must be performed before the contract is considered complete.
  - 2. The schedule shall indicate the sequence of work activities. Identify each activity with a description, start date, completion date and duration. Include, but do not limit to the following items, as appropriate to this contract:
    - a. Shop drawing review by the Engineer.
    - b. Excavation and grading.
    - c. Asphalt and concrete placement sequence.
    - d. Restoration.
    - e. Construction of various segments of utilities.
    - f. Subcontractor's items of work.
    - g. Allowance for inclement weather.
    - h. Contract interfaces, date of Substantial Completion.
    - i. Interfacing and sequencing with existing facilities and utilities.

- j. Sequencing of major construction activities.
- k. Milestones and completion dates.

# B. Distribution

Following response to the initial submittal, print and distribute copies of the revised construction schedule to the Engineer, Subcontractors, and other parties required to comply with scheduled dates. When revisions are made, distribute to the same parties. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.

# C. Schedule Updating

Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

#### D. Punch List

Prepare and submit to the Engineer within 10 days after substantial completion a detailed progress schedule for outstanding work and punch list items.

# 1.4 SCHEDULE OF SHOP DRAWINGS AND SAMPLE SUBMITTALS

- A. Submit four (4) hard copies or electronic copies of preliminary submittal schedule in accordance with the General Conditions of the Contract and as follows:
  - 1. Coordinate submittal schedule with the subcontractors, Schedule of Values, and of products as well as the Contractor's Progress Schedule.
  - 2. Prepare the schedule in chronological order. Provide the following information: a. Scheduled date for the first submittal.
    - b. Related Section number.
    - c. Submittal category (Shop Drawings, Product Data, or Samples).
    - d. Name of the subcontractor.
    - e. Description of the part of the work covered.
    - f. Scheduled date for the Engineer's final release or approval.
- B. Distribution

Following response to the preliminary submittal schedule, print and distribute copies of the revised submittal schedule to the Engineer, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the field office.

- 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.
- C. Schedule Updating

Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

# 1.5 SHOP DRAWINGS

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- B. Collect product data into a single submittal for each element of construction of system. Product data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
  - 1. Mark each copy to show actual product to be provided. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
    - a. Manufacturer's printed recommendations.
    - b. Compliance with trade association standards.
    - c. Compliance with recognized testing agency standards.
    - d. Application of testing agency labels and seals.
    - e. Notation of dimensions verified by field measurement.
    - f. Notation of coordination requirements.
- C. Do not use shop drawings without an appropriate final stamp indicating action taken.
- D. Submittals

Submit four (4) copies of each required submittal. The Engineer will retain two copies, and return the others to the Contractor marked with action taken and corrections or modifications required.

E. Distribution

Furnish copies of reviewed submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms. Maintain one copy at the project site for reference.

1. Do not proceed with installation until a copy of the Shop drawing is in the Installer's possession.

2. Do not permit use of unmarked copies of the Shop Drawing in connection with construction.

#### 1.6 ENGINEER'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Engineer will review each submittal, mark to indicate action taken, and return promptly. The Engineer will stamp each submittal with a uniform action stamp. The Engineer will mark the stamp appropriately to indicate the action taken, as follows:

- 1. "No Exceptions Taken": The work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents.
- 2. "Make Corrections Noted": The work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents.
- 3. "Amend and Resubmit": Do not proceed with work covered by the submittal. Resubmit without delay. Do not use, or allow others to use, submittals marked "Amend and Resubmit" at the Project Site or elsewhere where work is in progress.
- "Rejected See Remarks": Do not proceed with work covered by the submittal. Resubmit without delay. Do not use, or allow others to use, submittals marked "Rejected and Resubmit" at the Project Site or elsewhere where work is in progress.
- B. Unsolicited Submittals The Engineer/Architect will return unsolicited submittals to the sender without action.

PART 2 – PRODUCTS

PART 3 – EXECUTION

#### END OF SECTION

#### SECTION 01 41 00

#### **REGULATORY REQUIREMENTS**

#### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. Section Includes
  - 1. Underground Utilities
  - 2. Property Monuments
  - 3. Traffic Control
  - 4. Permits for Project

#### 1.2 UNDERGROUND UTILITIES

A. Under the provisions of Wisconsin Statutes, Section 182.0175, all contractors, subcontractors, and any firm or individual intending to do work on this contract shall contact all utility firms in the affected area of construction a minimum of three (3)working days prior to beginning construction so that affected utilities will be located and marked.

#### 1.3 PROPERTY MONUMENTS

- A. Protect iron pipe monuments from movement.
- B. The cost of replacement of any monuments moved or destroyed during construction shall be the Contractor's responsibility.
- C. Perpetuation of destroyed or moved monuments shall be performed in accordance with state statutes by a registered land surveyor.

#### 1.4 TRAFFIC CONTROL

- A. Provide traffic control facilities including barricades, signs, lights, warning devices, pavement markings, flaggers, etc.
- B. Construct and use traffic control facilities in accordance with the U.S. D. O. T. Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways.
- C. Maintain traffic control devices as required to properly safeguard the public travel through final completion, including during periods of suspension of work.

#### 1.5 PERMITS FOR PROJECT

- A. The following permits are being obtained by the owner:
  - 1. WDNR Water Main Extension
  - 2. WDNR WRAPP (Storm Water Notice of Intent)

- 3. WDNR Sanitary Sewer Extension
- 4. Brown County Fox River Trail
- 5. Army Corps of Engineers
- B. Any costs associated with violations pertaining to the WRAPP permit will be the responsibility of the Contractor.

PART 2 – PRODUCTS (Not used)

PART 3 – EXECUTION (Not used)

#### END OF SECTION

#### Project 18-14 Pine Trail Crossing Street and Utility Construction

#### SECTION 01 71 23

#### FIELD ENGINEERING

#### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. Section Includes
  - 1. Engineering Surveys Provided by the Engineer
  - 2. Engineering Surveys Provided by the Contractor

#### 1.2 SUBMITTALS

- A. None
- PART 2 PRODUCTS (Not Used)

#### PART 3 – EXECUTION

#### 3.1 PREPARATION

- A. Investigate and verify the existence and location of site improvements, utilities, and other existing facilities.
- B. Before construction, verity the location of invert elevations at points of connection of sanitary sewer, storm sewer, water piping and underground electrical services.
- C. Furnish information to the Engineer and the appropriate utility regarding conflicts that are necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction.
- D. Provide the Engineer two working days advance notification when ready for engineering surveys for construction to be provided by the Engineer.

#### 3.2 ENGINEERING SURVEYS TO BE PROVIDE BY THE ENGINEER

#### A. General

- 1. Establish benchmarks for construction as shown on the drawings.
- 2. Establish control points as shown on the drawings.
- B. Gravity Sewer Systems and Water Distribution Systems.
  - 1. Provide construction reference stakes set for pipe construction location at critical changes in horizontal and vertical alignment.
  - 2. Provide construction stakes for location of pipe at connections.

- C. New Road Construction
  - 1. Provide construction slope intercept stakes for horizontal and vertical alignment on each side of the road base on each cross section in the cross section sheets for requests received at least 72 hours before the related work begins.
  - 2. Provide construction reference stakes for subgrade at a minimum of 50 foot intervals and maximum of 100 foot intervals on tangents. Provide construction reference stakes for subgrade at 25 foot intervals within vertical and horizontal curves. Provide a reference line stake at each location.
  - 3. Provide construction reference stakes for top of crushed aggregate at a minimum of 50 foot intervals and maximum of 100 foot intervals on tangents. Provide construction reference stakes for top of crushed aggregate at 25 foot intervals within vertical and horizontal curves. Provide a reference or centerline stake.

#### 3.3 ENGINEERING SURVEYS TO BE PROVIDED BY THE CONTRACTOR

- A. General
  - 1. Locate, preserve and protect established construction reference stakes, benchmarks and control points.
  - 2. Locate, preserve and protect property corners and section corner monuments. If moved or destroyed due to Contractor negligence, then replace in accordance with state requirements; some of which are referenced in the "Regulatory Requirements".
  - 3. Provide additional construction staking as necessary to complete construction based on the construction reference stakes provided by the Engineer and the Drawings.
  - 4. Before beginning with necessary construction staking, verify the information shown on the Drawings, in relation to the established construction reference stakes, bench marks, control points and property corners. Notify the Engineer of any discrepancies.
  - 5. Remove construction reference stakes when directed by the Engineer.
- B. Gravity Sewer Systems and Water Distribution Systems.
  - 1. Provide any intermediate construction reference points as required to verify installation at the line and grade established and locate appurtenant structures.
  - 2. Check the line and grade with construction reference stakes at each pipe length.
- C. New Road Construction
  - 1. Provide additional construction reference stakes necessary to establish location and grade in accordance with the plans.

#### END OF SECTION

#### SECTION 33 00 05

#### DOUBLE AND TRIPLE WALLED POLYPROPYLENE PIPE

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Double walled polypropylene pipe for mainline gravity storm sewer.
  - 2. Triple walled polypropylene pipe for mainline gravity storm sewer.
- B. The products described are not installed under this Section.

#### 1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
     F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining
  - Plastic Pipe
  - 3. F2736 Standard Specification for 6 to 27 in. (152 To 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe And Double Wall Pipe
  - 4. F2764 Standard Specification for 30 to 60 in. [750 to 1500 mm] Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications

#### 1.3 SUBMITTALS

- A. Submit the following:
  - 1. Certification of productions date of all materials.
  - 2. Manufacturer's certification that the materials delivered were manufactured, sampled, tested, and inspected in accordance with this specifications and appropriate referenced standards.
  - 3. Product data sheet.
  - 4. Manufacturer's recommendations for assembly.

#### 1.4 QUALITY ASSURANCE

- A. Make pipe available to the Engineer's Representative for inspection.
- B. Pipe shall be considered defective and will be rejected when:
  - 1. Pitted or cratered.
  - 2. Flaking.
  - 3. Straightness varies more than  $\frac{1}{2}$  inch in 10 feet.
  - 4. Any defect which prevents assembly according to manufacturer's recommendations.
  - 5. Not utilized within twelve months of date of production.
  - 6. Pipe is not properly marked.

#### Project 18-14 Pine Trail Crossing Street and Utility Construction

- C. Material brands and/or pipe classes shall not be mixed.
- D. Pipe Marking pipe and fittings shall be marked as follows:
  - 1. Manufacturer's name, trademark or logo.
  - 2. Nominal size.
  - 3. Pipe stiffness designation, dimension ration, or schedule size and pressure class.
  - 4. ASTM specification designation.
  - 5. Production date.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inspect the pipe shipment to identify shifted loads, broken packaging or rough treatment, which could be an indication of damage.
- B. Unload the pipe in a manner which will not put stress on the pipe or strike anything causing damage.
- C. Place and store the pipe package units on level ground stacked no more than 8 feet high. Do not store close to heat sources.
- D. For onsite gasket installation on pipe, store gaskets away from excessive exposure to heat, direct sunlight, ozone, oil or grease.
- E. For gaskets installed on the pipe offsite, keep the protective wrap on gaskets until installation.
- F. Handle pipe in a manner to prevent impact blows, abrasion damage, gouging or cutting.
- G. When handling pipe in cold weather, provide additional care to prevent damage due to impact.

#### PART 2 – PRODUCTS

#### 2.1 NON-PRESSURE RATED PIPE

- A. Mainline Gravity Sewer and Sewer Services
  - 1. Pipe fittings and repair couplings shall be manufactured and tested in accordance with the following standards:
    - a. Sizes 8 inch through 27 inch and depths up to 20 feet: ASTM F2736, PSM SDR-35 PVC
    - b. Sizes 30 inch through 60 inch and depths up to 20 feet: ASTM F2764, PS46 PVC, T-1 minimum cell classification
  - 2. Pipe shall have a minimum pipe stiffness of 46 PSI.
  - 3. Minimum height of cover to the top of pipe to the existing elevation or proposed finished elevation (whichever is less) shall be two feet.
  - 4. Elastomeric Gaskets: Conform with ASTM F477
  - 5. Elastomeric Joints: Conform with ASTM D3212

- 6. Solvent Weld Joints: Not permitted.
- B. Sewer Services
  - 1. 4" and 6" pipe shall be Schedule 40 PVC and conform to section 33 00 02, Polyvinyl Chloride (PVC) Pipe and Fittings.
  - 2. Branch laterals shall be designed to accept SDR 35.

#### 2.2 DEFLECTION TEST REQUIREMENTS

- A. Deflection testing procedures shall conform to Section 01 45 23 10, Testing and Inspection of Pipeline and Appurtenances.
- B. The following table shall be used for the mandrel setting for Polypropylene Pipe:

Pipe Type	Pipe Diameter (Inches)	Minimum Inside Diameter (Inches)	Inside Diameter With 5% Deflection (Inches)
	12	11.90	11.31
	15	14.85	14.11
Dual Wall	18	17.93	17.03
Dual wall	21	20.79	19.75
	24	23.90	22.71
	30	29.79	28.30
	30	29.62	28.14
	36	35.40	33.63
Triple Wall	42	41.31	39.24
	48	47.31	44.94
	60	59.30	56.34

 Table 1

 SaniTite HP Recommended Mandrel Settings

END OF SECTION

# APPENDIX

# LIFT STATION CONSTRUCTION SPECIFICATIONS BY ROBERT E. LEE AND ASSOCIATES

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**DIVISION 00** 

PROCUREMENT AND CONTRACTING REQUIREMENTS

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#### SECTION 00 41 13.2 BASE BID, SUBSTITUTE, AND "OR EQUALS" SCHEDULE

At the time of bid, Bidder shall identify one or more proposed "or equals" and/or substitutes meeting the requirements of paragraph 6.05 of the General Conditions for the following items identifying the comparative cost with the specified "named" item. The purpose of this schedule is to identify any proposed substitute and "or equals" for these specific items.

If Engineer and Owner believe consideration of the proposed items will result in a cost savings, then the apparent low bidder shall submit sufficient information for evaluation; in accordance with paragraph 6.05 of the General Conditions.

The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement.

### Note: Contractor SHALL circle the named equipment manufacturer being provided under the base bid.

Specification Section	Named Equipment	Proposed Substitute "Or Equal"	Estimated Base Bid Price Adjustment Deduct From
26 32 10	Kohler, Cummins		\$
46 42 56.19	Flygt, Hydromatic		\$
			\$
			\$
			\$
			\$
			\$
			\$
			\$
			\$
			\$
			\$

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# 01

### **DIVISION 01**

**GENERAL REQUIREMENTS** 

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#### **SECTION 01 21 00**

#### ALLOWANCES

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section includes project allowances to cover items not precisely determined by the Owner prior to bidding. The allowances shall be included in bid price.
- B. Related Sections and Divisions: Applicable provisions of the General Conditions shall govern the work in this section.
- C. If the cost of materials, service or equipment exceeds that set forth above, the Contractor shall be reimbursed for the additional cost by the Owner. If the cost of materials, services or equipment is less than as set forth above, the Owner shall be credited for the difference between cost as stated below and actual cost.

#### 1.02 SCHEDULE OF ALLOWANCES

1.	Density and Concrete Testing		\$ 1,000
2.	Electrical Service		\$10,000
3.	Portable Trailer Mounted Generator		\$45,000
4.	Control Panel and SCADA System Modifications		<u>\$35,000</u>
		TOTAL	\$91,000

#### 1.03 ALLOWANCE DESCRIPTION

- A. Costs included in allowances: Cost of product to Contractor or Subcontractor, less applicable trade discounts; include delivery to site and applicable taxes.
- B. Compensation to the Contractor shall be for the direct costs only and shall not include any Contractor mark-ups on services or for service coordinating allowance items, except additional bond costs if the Allowance total is exceeded. Costs not included in the allowance: Unless specified otherwise, allowances DO NOT include costs for product handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; labor for installation and finishing. These costs SHALL BE included in the Base Bid Price and no demand for additional payment on account of any thereof will be valid.
- C. Engineer Responsibilities
  - 1. Consult with Contractor in consideration and selection of products, suppliers and installers.
  - 2. Select products in consultation with Owner and transmit decision to Contractor.
  - 3. Prepare change order, if required.
- D. Contractor Responsibilities
  - 1. On notification of selection by Engineer, execute purchase order with designated equipment supplier.
  - 2. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.

3. Promptly inspect products upon delivery for completeness, damage and defects. Submit claims for transportation damage.

#### 1.04 DENSITY AND CONCRETE TESTING ALLOWANCE

A. Costs included in allowance: Cost of engaging an inspection or testing firm, execution of inspection or tests, compliance with all federal and state safety code provisions, reporting results for conducting Owner-quality assurance testing only.

#### 1.05 ELECTRICAL SERVICE ALLOWANCE

- A. This allowance item covers the cost of a new electrical service for the lift station.
- B. If the actual costs exceed the allowance, the Contractor shall be reimbursed for the additional costs. If the actual costs are less, the Owner shall be credited for the difference between the allowance and the actual cost. Changes will be executed by a Change Order.

#### 1.06 PORTABLE TRAILER-MOUNTED GENERATOR ALLOWANCE

- A. This allowance item covers the cost of a new portable trailer-mounted generator in accordance with the plans and specifications.
- B. If the actual costs exceed the allowance, the contractor shall be reimbursed for the additional costs. If the actual costs are less, the Owner will be credited for the difference between the allowance and the actual cost. Changes will be executed by a Change Order.

#### 1.07 CONTROL PANEL AND SCADA SYSTEM MODIFICATIONS ALLOWANCE

- A. This allowance item covers the cost for provide a new lift station control panel, wet well instrumentation, and SCADA system modifications in accordance with the plans and specifications. All work for this allowance shall be contracted through P.J. Kortens and Company, Inc.
- B. If the actual costs exceed the allowance, the contractor shall be reimbursed for the additional costs. If the actual costs are less, the Owner will be credited for the difference between the allowance and the actual cost. Changes will be executed by a Change Order.

#### PART 2 - PRODUCTS

NOT APPLICABLE

#### PART 3 - EXECUTION

NOT APPLICABLE

- END OF SECTION -

#### SECTION 01 45 24

#### **TESTING AND INSPECTION OF PIPELINE CONSTRUCTION**

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section specifies various types of tests and inspection procedures to be used on installed pipelines for determining water and pressure tightness and alignment.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall apply to this section.
  - 2. Section 33 00 02, PVC Pipe and Fittings
  - 3. Section 33 00 03, HDPE Pipe and Fittings
  - 4. Section 33 11 00, Water Distribution Systems
  - 5. Section 33 31 00, Sanitary Sewer Systems
  - 6. Section 33 34 00, Force Main
  - 7. Section 40 05 13.19, Stainless Steel Pipe and Fittings
  - 8. Section 40 05 13.53, Ductile Iron Pipe
  - 9. Section 40 05 15, Methods and Materials for Piping Installation

#### 1.02 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM 02774 Standard Practice for underground installation of thermoplastic pressure piping.
  - 2. ASTM D3034 Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
  - 3. ASTM D3350-84 Polyethylene Plastic Pipe and Fittings Material
  - 4. ASTM F679S Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
  - 5. ASTM F1417 Installation Acceptance of Plastic Gravity Sewer Lines using low pressure air.
- B. American Water Works Association (AWWA):
  - 1. AWWA C651 Disinfecting Water mains
- C. American National Standards Institute (ANSI):
  - 1. ANSI B16.5-81 Pipe Flanges (150 lb.)
  - 2. AWWA C600 Installation of Ductile Iron Water Mains and their appurtenances.
- D. American Water Works Association (AWWA):
  - 1. AWWA C207-86 Standard for Steel Pipe Flanges for Waterworks Service Size 4 inches through 144 inches

#### PART 2 - PRODUCTS

#### NOT APPLICABLE

#### PART 3 - EXECUTION

- 3.01 PREPARATION OF PIPELINE BEFORE TESTING
- A. The pipes shall be clean of debris and materials prior to testing.
- B. Televising shall be performed immediately after cleaning.

#### 3.02 STANDARD GRAVITY PIPELINE INFILTRATION TEST

- A. Measurement of infiltrating flow utilizing weir or a dam with measuring container at downstream end of pipeline sector being tested.
- B. Conditions to Prevail Before Infiltration Test Commences
  - 1. Groundwater level shall produce a minimum positive head of 2 feet over all sections of pipeline being tested.
  - 2. Groundwater level shall be measured by the Contractor prior to the infiltration test utilizing a measurement method acceptable to Engineer.
  - 3. Weir or dam shall be in place 12 hours before measurement of flow.
  - 4. Any source of water, sewage or other liquid except infiltrating groundwater shall be eliminated before conducting test.
- C. Maximum Limits of Infiltration
  - 1. Infiltration shall be limited to the maximum allowed as specified in the section for Materials and Methods of Construction for the pipeline specified.
  - 2. When infiltration limits for gravity pipelines are not given in the appropriate section for Materials and Methods of Construction, the following limits shall apply:
    - a. Two hundred gallons in 24 hours for each inch of the diameter of pipe being tested, for every one mile of pipe.
    - b. Infiltration rate for manholes shall be computed using the total number of vertical feet of manhole expressed as the equivalent largest diameter sewer entering the manhole.
- D. Equipment and Personnel to be supplied by the Engineer
  - 1. Measuring weirs.
    - a. "V" notch 30°, 60°, or 90° with end contractions.
    - b. Sharp crested with edge ground to  $45^{\circ}$ .
    - c. Install in manhole or pipe in such a manner that leakage is zero.
    - d. Discharge for "V" notch weirs shall be based on the following formula:

When:

Q = Cu. ft. per second

C =.57

L = Width of notch in ft. at H distance above the apex.

H = Head of liquid above the apex of notch in feet.

- e. End contractions shall not be less than 3/4 L.
- 2. Shallow measuring vessel calibrated to gallons and tenths of gallons.

- 3. Stop watch with sweep hand indicating seconds and tenths of seconds (certified accurate by a state licensed watchmaker).
- 4. Sufficient personnel to conduct tests.
- 5. Either weir method or stopwatch and container method may be used at discretion of Engineer.
- E. Equipment and Personnel to be provided by Contract.
  - 1. Qualified observer.
  - 2. Personnel to assist in placing and removing weirs.
  - 3. Contractor responsible for safety during tests including:
    - a. Providing signs.
    - b. Providing safety equipment including safety equipment for confined entry.
    - c. Providing signalmen when necessary.

#### 3.03 STANDARD GRAVITY PIPELINE EXFILTRATION TEST

- A. The Contractor may perform an exfiltration test when groundwater level is less than 2 feet above sections of pipeline being tested.
- B. The following shall be completed prior to testing:
  - 1. Pipeline shall be tested with a minimum positive head of 2 feet in all sections.
  - 2. Pipeline and manholes shall be filled with water until the water level is a minimum of 2 feet above the highest section of pipe or a minimum of 2 feet above the groundwater level, whichever elevation is higher.
  - 3. Groundwater level shall be measured by the Contractor prior to the infiltration test utilizing a measurement method acceptable to Engineer.
- C. The following is the recommended test procedure:
  - 1. Plug section to be tested.
  - 2. Laterals on the line being tested shall be provided with a temporary cleanout to permit adequate release of trapped air in laterals.
  - 3. Fill line and manhole with water as per paragraph B.
  - 4. Let line stand for 12 hours adding water periodically to retain test level as it is reaching its maximum absorption and entrapped air is escaping.
  - 5. After 12 hours, refill line to test level and let stand for 1-hour test period.
  - 6. Measure and record loss of water in gallons per hour.
  - 7. Subtract manhole loss as previously determined, to get actual line loss.
  - 8. Repair and retest until results of final test hour are within allowable leakage limits.
- D. Exfiltration shall be limited to 8.34 gallons per hour per inch diameter per mile of pipe.
- 3.04 STANDARD PRESSURE AND LEAKAGE TEST FOR PRESSURIZED PIPELINES
- A. Measure drop in pressure and leakage from liquid filled and pressurized pipelines.
- B. Conditions to prevail before commencement of test.
  - 1. Disinfect all testing equipment and fittings.
  - 2. Backfill to at least minimum 4 feet compacted backfill material.
  - 3. Length of pipeline tested shall not exceed 2,000 feet.

- 3. Reaction backing shall achieve the required 28-day compressive strength prior to applying hydrostatic test pressures, and shall conform to all requirements of ACI 205, Hot Weather Concrete and ACI 306, Cold Weather Concrete.
- 4. Fill with water.
  - a. Fill each valved section with water slowly, expelling air completely from the pipeline, valves, and hydrants.
  - b. Where permanent air vents are not located at all high points or dead ends, Contractor shall install corporation cocks at such points so that air can be expelled as the line is filled with water.
    - 1) Close all these corporation cocks before applying pressure or leakage tests.
    - 2) At the conclusion of the leakage and pressure test, the corporation cocks shall be removed and plugged, or left in at the discretion of the Owner.
- 5. Pressurize to normal working pressure.
  - a. After test connections are made and pipeline is filled with water, the pipeline shall be subjected to water pressure normal for that segment of the system being tested.
  - b. Examine system for any visible leakage at this stage.
    - 1) Repair any visible leaks.
    - 2) Re-pressurize to normal working pressure and continue to repair and repressurize until all visible leaks have been stopped.

#### C. Pressure Test

- 1. Test pressure shall be not less than 150 lbs. per sq. inch at the lowest point of elevation of the segment being tested.
  - a. The minimum test pressures specified above may require that the installed system be tested in several segments in order to attain the proper pressure.
  - b. If test pressures other than indicated above are called for in the sections for Materials and Methods of Construction, those pressures shall be used.
- 2. Pressurize the system being tested to pressure required above by adding water with highpressure test pump.
- 3. Repair any visible leaks occurring due to test pressure application.
- 4. Repeat pressurizing of system to test pressure until no visible leaks can be found.
- 5. Duration of pressure test.
  - a. Test period shall be two continuous hours with no visible leaks occurring.
  - b. Pressure during test period shall be sustained.
- 6. Contractor shall provide pressure gauge with 4-inch face and snubber. Pressure shall read in one-pound increments.
- 7. If it is found unnecessary to add water during the duration of the pressure test, the leakage test may be waived with the approval of the Engineer.

#### D. Leakage Test

- 1. Leakage test shall be conducted after completion of the pressure test.
- 2. At the option of the Contractor, pressure and leakage tests may be run concurrently.
  - a. This option must have the approval of the Engineer.
  - b. If this option is agreed upon, then the test procedures required for pressure tests shall prevail for both pressure and leakage tests.
- 3. When leakage test is conducted after satisfactory completion of the pressure test, the test section shall be subjected to 100 pounds per square inch gauge pressure at the lowest elevation of the section of the main being tested.
  - a. If leakage test pressures other than indicated above are called for in the sections for Materials and Methods of Construction, those pressures shall be used.

- 4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section of it, necessary to maintain the specified leakage test pressure after the main has been filled with water and the air expelled.
  - a. Pressure during test period shall be sustained within plus or minus 5 lbs. of the required test pressure by adding water with test pump.
  - b. Meter the amount of water added.
- 5. Leakage shall not exceed the number of gallons per hour as determined by the following formula:

$$GPH = \underline{ND} \sqrt{\underline{P}}$$
 $7400$ 

When:

GPH = Gallons Per Hour

N = Number of Joints Under Test

D = Nominal Pipe Dia. in Inches

- P = Average Test Pressure in lbs/sq. in.
- 6. When the section under test contains various diameters of pipe, the available leakage will be the sum of the computed leakage for each size of pipe.
- 7. Should any test section fail to meet the leakage test, the Contractor shall immediately make the necessary repairs at his own expense.
- 8. Duration of final leakage test shall be one continuous hour with leakage within the allowable limits during the test hour.
- E. Contractor shall provide all equipment required to perform the test.

#### 3.05 LOW PRESSURE AIR TEST

- A. Contractor shall perform a low-pressure air test on gravity pipelines in lieu of infiltration or exfiltration tests when pipeline is not submerged in groundwater. Test shall conform to ASTM C828.
- B. Contractor shall provide all equipment required to perform the test.

#### C. Testing Procedure

- 1. Determine test time as follows:
  - a. Test times for pipeline segments with uniform pipe size shall be taken from test timetable list below for 8-inch through 36-inch nominal pipe sizes.
  - b. Test times for pipeline segments longer than those shown and/or of non-uniform pipe size shall be calculated utilizing appropriate formulas in ASTM C828.

PIPE DIAMETER "D" IN INCHES											
		8	10	12	15	18	21	24	27	30	36
	25	0.30	0.37	0.45	0.52	0.60	0.74	0.89	1.04	1.19	1.50
	50	0.59	0.74	0.89	1.04	1.20	1.49	1.78	2.08	2.39	3.01
	75	0.89	1.11	1.34	1.57	1.80	2.23	2.67	3.12	3.58	4.51
	100	1.19	1.48	1.78	2.09	2.40	2.97	3.56	4.16	4.77	6.01
	125	1.48	1.86	2.23	2.61	3.01	3.72	4.45	5.20	5.96	7.51
	150	1.78	2.23	2.67	3.13	3.61	4.46	5.34	6.24	7.16	9.02
	175	2.08	2.60	3.12	3.65	4.21	5.21	6.23	7.28	8.35	10.52
	200	2.37	2.97	3.56	4.17	4.81	5.95	7.12	8.32	9.54	12.02
		8	10	12	15	18	21	24	27	30	36
	225	2.67	3.34	4.01	4.70	5.41	6.69	8.01	9.36	10.73	13.52
	250	2.97	3.71	4.45	5.22	6.01	7.44	8.90	10.40	11.93	15.03
	275	3.26	4.08	4.90	5.74	6.61	8.18	9.79	11.44	13.12	16.53
	300	3.56	4.45	5.34	6.26	7.21	8.92	10.68	12.48	14.31	18.03
	325	3.86	4.82	5.79	6.78	7.81	9.67	11.58	13.52	15.50	19.53
	350	4.16	5.19	6.23	7.30	8.41	10.41	12.47	14.56	16.70	21.04
	375	4.45	5.57	6.68	7.83	9.02	11.16	13.36	15.60	17.89	22.54
	400	4.75	5.94	7.12	8.35	9.62	11.90	14.25	16.64	19.08	24.04
	425	5.05	6.31	7.57	8.87	10.22	12.64	15.14	17.68	20.27	25.54
	450	5.34	6.68	8.01	9.39	10.82	13.39	16.03	18.72	21.47	27.05
	475	5.64	7.05	8.46	9.91	11.42	14.13	16.92	19.76	22.66	28.55
	500	5.94	7.42	8.90	10.43	12.02	14.87	17.81	20.80	23.85	30.05
	525	6.23	7.79	9.35	10.96	12.62	15.62	18.70	21.84	25.04	31.55
	550	6.53	8.16	9.79	11.48	13.22	16.36	19.59	22.88	26.24	33.06
	575	6.83	8.53	10.24	12.00	13.82	17.10	20.48	23.93	27.43	34.56
	600	7.12	8.90	10.68	12.52	14.42	17.85	21.37	24.97	28.62	36.06
		C	Specif	fied test	time (	minutes	) requi	ed for	nrecourd	dron fr	3-1/2 to $2-1/2$ nsi

Test Timetable PIPE DIAMETER "D" IN INCHES

- c. Specified test time (minutes) required for pressure drop from 3-1/2 to 2-1/2 psi when testing one pipe diameter only.
- d. Interpolate test times for segment lengths not specifically listed.
- 2. Pressurize pipeline to 4.0 psi and allow to stabilize (stabilization of air temperature may cause pressure drop).
- 3. For pipe sizes larger than 36 inches, each individual pipe joint shall be tested at 4.0 PSI. Each joint shall be placed under pressure and shall remain under pressure for a minimum of 60 seconds with no pressure drop allowed.
- 4. When pressure has stabilized, start test at 3.5 psi and record time.
- 5. If pressure drops more than 1.0 psi during the determined test time, the test will be considered failed.
- D. Low Pressure Testing requirements are not applicable for relay projects where existing laterals are present.

#### 3.06 TELEVISING OF PIPELINES

A. Televising of pipelines shall be in accordance with Section 33 01 30.16, Sewer Cleaning and Televising.

#### 3.07 DEFLECTION TEST

- A. Perform deflection tests on all PVC and HDPE gravity pipelines.
- B. <u>Not less than 30 days</u> after the installation and backfilling of sewers, including any service connections, the Contractor shall, in the presence of the Engineer, test deflection of the pipe with a mandrel (Go-No-Go device). The mandrel shall be hand-pulled. All pipe with deflections in excess of 5% of the base internal diameter, as determined by ASTM D 3034, ASTM F 679, or ASTM F 794, shall be excavated, rerounded, backfilled and retested after an additional period of at least 30 days. Mandrels shall have nine ribs and be only hand-pulled through the test section. The Contractor shall furnish the mandrels. The length of the minimum radius portion of the mandrel shall not be less than one-third of the nominal diameter of the pipe tested. The pipe shall be flushed and cleaned by the Contractor prior to testing. No flow will be permitted in the pipe while testing for deflections.
  - 1. All expense for trenching, backfill, compaction, paving, and related work that is required because of failure to meet deflection test requirements shall be borne by the Contractor.
  - 2. Acceptance of plastic pipe sewers shall be made only after these deflection test requirements have been met.
- C. Mandrel sizes shall be in accordance to the following:
  - 1. PVC (5% Deflection)

	SDR35/PS46 SDR26/PS1						
Nominal		5% Deflection		5% Deflection			
Size		Mandrel Size		Mandrel Size			
(Inches)	Base ID	(Inches)	Base ID	(Inches)			
4	3.895	3.70	3.811	3.62			
6	5.742	5.45	5.612	5.33			
8	7.665	7.28	7.488	7.11			
10	9.563	9.08	9.342	8.87			
12	11.361	10.79	11.102	10.55			
15	13.898	13.20	13.575	12.90			
18	16.976	16.13	16.586	15.76			
21	20.004	19.00	19.545	18.57			
24	22.48	21.36	21.964	20.87			
27	25.327	24.06	24.744	23.51			
30	29.132	27.68	28.461	27.04			
36	34.869	33.13	34.120	32.41			
DUG UDDE	C C D L						

- 2. PVC, HDPE or C.C.F.M.P. (5% deflection)
  - A. Pipe sizes larger than 36-inch diameter deflection shall be physically measured within 1-inch of each joint and the midpoint of each pipe section. Deflection shall not exceed 5% of the manufacturers stated inside diameter for any given size.

#### 3.08 REPLACEMENT AND REPAIRS

A. The Contractor shall replace or repair any section of pipeline found to be defective so that the pipeline meets the requirements of the specification.

- A. The following shall be disinfected in accordance with AWWA C651:
  - 1. New water main construction.
  - 2. Existing water main when cut into or repaired.
- B. The lines shall be disinfected and flushed until the system is safe.
- C. At least one sample shall be collected from every 1,200 feet of water main, plus one set of samples from the end of each main and a minimum of one from each new branch.
- D. The Contractor shall provide the Owner with two copies of lab test results certifying that the water sampled is free of contamination tests shall be done prior to standard pressure and leakage test for pressurized pipelines and after completion of pressure and leakage test.

#### 3.10 TRACER WIRE TESTING

- A. Contractor shall test all tracer wire.
- B. A power source shall be provided which will transmit a measurable amount of DC current the length of the tracer wire or length of the test area. Current readings shall be taken with the test current "off", then "on" to differentiate between test current and stray current.
- C. If continuity is not achieved, the Contractor shall perform required repairs and repeat the test.

#### 3.11 BASIS OF PAYMENT

A. Testing of pipe segments in considered to be incidental to the work and payment for testing the piping segments is included in the cost to provide and install the pipe.

- END OF SECTION -

#### ATTACHMENT TO FORM

#### **EXAMPLE CALCULATION SHEET**

GIVEN:	Pi	=	10 psig
	$T_i$	=	$21.1 \ ^{\circ}\text{C} = 70 \ ^{\circ}\text{F}$

and at time t = 60 minutes

Pt	=	10.05 psig			
Tt	=	23.0 °C = 73°F			

Calculate Corrected Initial Pressure

 $P_{c} = \frac{(10.0 + 14.7)(23.0 + 273)}{(21.1 + 273)} - 14.7$ 

$$P_c = 24.85 - 14.7 = 10.15 \text{ psig}$$

Calculate Percent Pressure Loss

% Pressure Loss =  $\frac{10.15 - 10.05}{10.15} \times 100 = \frac{0.98\%}{10.15} < 1\%$  ok

Note: The difference between the corrected pressure reading  $(P_c)$  and the gauge reading  $(P_t)$  cannot differ by more than 1% of the corrected pressure reading  $(P_c)$  (i.e., .105 @ 10.5 psig) over a time interval of 60 minutes.

#### SANITARY SEWER LOW PRESSURE AIR TEST

PROJECT:		CONTRACTOR:	
LOCATION:		DATE:	
Test Location		Test Location	
MH #	To MH #	MH #	To MH #
Length of Main	Size of Main	Length of Main	Size of Main
Length of Lateral	Size of Lateral	Length of Lateral	Size of Lateral
Length of Main		Length of Main	
Length of Lateral		Length of Lateral	
Type of Pipe		Type of Pipe	
Req'd Holding Time		Req'd Holding Time	
Start Pressure		Start Pressure	
End Pressure		End Pressure	
Test: Pass	Fail	Test: Pass	Fail
No Go		No Go	
Witnessed By		Witnessed By	
Test Location		Test Location	
MH #	To MH #	MH #	To MH #
Length of Main	Size of Main	Length of Main	Size of Main
Length of Lateral	Size of Lateral	Length of Lateral	Size of Lateral
Length of Main		Length of Main	
Length of Lateral		Length of Lateral	
Type of Pipe		Type of Pipe	_
Req'd Holding Time		Req'd Holding Time	
Start Pressure		Start Pressure	
End Pressure		End Pressure	
Test: Pass	Fail	Test: Pass	Fail
No Go		No Go	
Witnessed By		Witnessed By	

#### HYDROSTATIC TEST REPORT

Project:				Contract:	
Location of Wate	r main:				
Date of Test:			Tested By:		
TEST SECTION:	• <u>•</u>				
Size (in.)	No. of Joints		Elevation	Allowable Leakage <sup>a</sup> (Gl	PH)
		High	Low		
			Total		
Type of Pipe and	Loints:			1	
	of Pipe Sections:			th:	
0 0					
Pressure applied a	at:"				
PRESSURE TES	<u>T:</u>				
Initial Test Pressu	ıre:	psi	Duration of Pressur	e Test:	hrs
Final Test Pressur	re:	psi	Pressure Drop Duri	ng Test:	psi
Remarks: <sup>c</sup>					
LEAKAGE TEST	<u>Γ:</u>				
Pressure During 7	Гest:	psi	Duration of Leakag	e Test	hrs
Allowable Leakag	ge of Test Section _		GP	H (Total from above)	
	Actual Leaka	ige	GP	Н	
Р	ercent of Allowable				
Leakage shall no	ot exceed the numb			ermined by the following form	ula:
		GP.	$H = \frac{ND}{7400} \bigvee_{P}$		
C N D P	When: GPH = Gallons Per F N = Number of Joint O = Nominal Pipe Di O = Average Test Pre location and elevati	Iour s Under Tes a. in Inches ssure in Ibs	st s s/sq. in.	essure	
				on of repair of any defects	
COMMENTS:			PASS	FAIL	

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#### **SECTION 01 60 00**

#### MATERIALS AND EQUIPMENT

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01 32 19, Submittals.
- 1.02 MATERIALS QUALITY ASSURANCE
- A. It is the intent of these specifications to procure a quality product by an established manufacturer of the latest design. All components of systems shall be engineered for long, continuous, uninterrupted service. The cost of the equipment shall include all royalties and costs arising from patents and licenses associated with furnishing the specified equipment.
- B. All materials shall be designed to withstand stresses encountered in continuous operation, fabrication and erection. All equipment shall be of corrosion-resistant materials or shall be suitably protected by the supplier with corrosion-resistant industrial coatings. Provisions shall be made for ease of lubrication, adjustment and replacement of parts.
- C. Material for which no detailed specifications are given shall:
  - 1. Meet the particular industry standard for the material used.
  - 2. Meet the specifications of ASTM, ANSI or SAE for metals and plastics for the use intended.
  - 3. Not be used unless it has previously been used for a like purpose for a sufficient length of time in the field or under field-simulated laboratory conditions to demonstrate its successful use.

#### D. Source Limitations

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

- 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 the Engineer/Architect to determine the most important product qualities to consider before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.
- E. Compatibility of Options

When the 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.

#### 1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
  - 1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Provide equipment and personnel to handle products by methods that avoid soiling or damage.
  - 4. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 5. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that quantities are correct, products are undamaged, and properly protected. Inform the Engineer or Owner before the inspection occurs, so that they may participate in the inspection if so desired.
  - 6. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units. Seals and labels shall be intact and legible.
  - 7. Store products in accordance with manufacturer's instructions. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
  - 8. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.
  - 9. Arrange for fabricated items or products stored outside to be placed on sloped supports above the ground. Items subject to deterioration shall be covered by weather proof sheet covering which is ventilated to prevent condensation.
  - 10. Store loose granular materials on solid surfaces which are well drained and prevent contamination by foreign matter.
  - 11. Arrange for periodic inspection of stored materials to insure that materials remain undamaged and are maintained under required conditions.
  - 12. All shipment, delivery and storage charges shall be at the expense of the contractor.

#### 1.04 MAINTENANCE OF STORAGE

- A. Contractor shall periodically inspect stored products on a scheduled basis.
- B. Contractor shall verify that storage facilities comply with manufacturer's product storage requirements, and verify that manufacturer required environmental conditions are maintained continually.
- C. Contractor shall verify that surfaces of products exposed to the elements are not adversely affected and that any weathering of finishes is acceptable under requirements of Contract Documents.
- D. Contractor shall perform scheduled maintenance of equipment in storage as recommended by the manufacturer. A record of the maintenance shall be kept and turned over to Engineer when the equipment is installed.

#### PART 2 – PRODUCTS - NOT APPLICABLE

#### PART 3 - EXECUTION

#### 3.01 INSPECTION

A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the Site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor's control.

#### 3.02 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
  - 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

#### 3.03 INSTALLATION REQUIREMENTS

- A. Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditions as directed by the respective manufacturers, unless otherwise specified.
- B. Erect equipment in neat workmanlike manner, align, level and adjust for satisfactory operation; install for easy maintenance, inspection, operation, and replacement.
- C. Mechanical equipment shall operate without objectionable noise or vibration. Piping shall be provided with flexible couplings to prevent noises or vibration transmission.
- D. After installation, Contractor shall protect all materials and equipment against weather, dust, moisture, and mechanical damage.
- E. Contractor shall be responsible for all damages that occur in connection with the care and protection of all materials and equipment until completion and final acceptance of the work by Owner. Damaged material and equipment shall be immediately removed form the site.

#### 3.04 FIELD QUALITY CONTROL

- A. Qualifications of Manufacturers Field Personnel
  - 1. Personnel shall be authorized by the manufacturer to erect start-up and initiate warranty of the equipment provided.
  - 2. Personnel shall come to the site with the required tools and electrical instruments.
  - 3. Personnel shall have full knowledge of electrical controls pertaining to the equipment and control panels furnished.
  - 4. Failure to provide personnel with full qualifications shall be cause for service trip to be disqualified as part of the requirements and may because for reimbursement for costs incurred by the Owner due to services required for a qualified start-up inspection.

#### - END OF SECTION -

#### SECTION 01 75 00

#### STARTUP, TESTING AND OPERATOR TRAINING

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work included: This section includes the procedures for checking, starting, and field testing of equipment and operator training after installation. The installation, startup, and testing tasks for a system shall be completed and approved by the Engineer before any operator training can be performed on that system.
- B. Related sections and division
  - 1. Applicable provisions of the general conditions shall govern the work in this section.
  - 2. Section 01 78 43, Equipment Installation, Startup, Testing and Training Checklists and Certifications and Receipt of Spare Parts
  - 3. Individual equipment specifications.
- 1.02 DEFINITIONS
- A. System: A system means the overall process, or a portion thereof, that performs a specific function. A system may consist of two or more subsystems as well as two or more types of equipment.
- B. Subsystem: A subsystem is a portion of a larger system.
- C. Functional Acceptance Test (FAT): Tests necessary to demonstrate that installed equipment and systems function as specified and operate in the manner intended.
- D. Startup: The process of placing a system in operation, including evaluation and verification of the operating characteristics of the system.

#### 1.03 SUBMITTALS

- A. Submit the following:
  - 1. Installation checklist and certification in accordance with Section 01 78 43 before start up testing is begun.
  - 2. Installation completion schedule.
  - 3. Functional Acceptance Test plan and test forms for each equipment item, subsystem, and system.
  - 4. Schedule for startup submitted a minimum of 14 days in advance of proposed start of startup testing.
  - 5. Approvable operation and maintenance manuals for each equipment item and system to be tested a minimum of 14 days before scheduled start up.
  - 6. Qualification and experience records of proposed manufacturer's representatives who will assist with equipment testing and with training sessions.
  - 7. Start-up period operation records.
  - 8. Start-up and training checklists and certifications in accordance with Section 01 78 43.

#### 1.04 INSTALLATION CHECK AND INITIAL TESTING

- A. Contractor's Responsibilities: The Contractor shall:
  - 1. Provide services of manufacturer's representatives of products and systems for checking, testing, and startup specified for each equipment item. Manufacturer's representatives shall be authorized by the manufacturer to perform start-up and initiate warranty of equipment provided. Personnel shall come to the job site with all the required tools and testing instruments required for their work and shall have full knowledge of electrical controls pertaining to equipment and control panels.
  - 2. Resolve assembly or installation problems attributable to, or associated with, the products and systems, whether or not specifically required in the Specifications.
  - 3. Clean up equipment and surrounding areas.
  - 4. Provide safe access to the work area to facilitate initial testing and any training activities.
  - 5. Confirm presence of any gauges, valves or other appurtenances required for proper operation and testing of the equipment.
  - 6. Check for proper rotation, alignment, speed, excessive vibration, and quiet operation.
  - 7. Promptly correct all defects noted during installation check at Contractor's expense.
  - 8. Perform initial equipment and system adjustment and calibrations with the assistance of manufacturer's representative. Conduct Functional Acceptance Testing as required to demonstrate suitability of equipment for startup and performance testing.
  - 9. Submit installation checklist and certification in accordance with Section 01 78 43. Submittal of the installation checklist, certifications, and functional acceptance testing is a prerequisite for startup and performance testing.

#### 1.05 STARTUP AND PERFORMANCE TESTING

- A. Contractor's Responsibilities: The Contractor shall:
  - 1. Prepare startup and testing schedule and incorporate startup and testing activities in the progress schedule for the work.
  - 2. Notify Engineer and respective equipment manufacturers at least 21 calendar days prior to the date when each equipment system is scheduled to be initially started; also submit testing plan stating schedule, quantity and source of utilities, chemicals, and other materials needed.
  - 3. Provide labor, materials, tools, instruments, and services for checking, start-up, and testing specified for each equipment item, except for items specified to be furnished by Owner. Instruments that may be required include, but are not limited to, flow meters and gauges for monitoring of performance, even if not otherwise specified.
  - 4. Provide services of manufacturers' representatives, subcontractors, electricians, instrumentation technicians, and pipe fitters. Designate one person (other than field superintendent) to be responsible for coordinating and expediting startup and testing responsibilities, and to be present during all pre-startup meetings and available to Owner's personnel during the startup and performance testing.
  - 5. Develop a standard testing log to be used as a record of testing of each equipment item and subsystem. This log shall:
    - a. Be subject to approval of Engineer,
    - b. Include equipment name and associated subsystems,
    - c. Have provisions for recording dates of completion for installation checking, inspection by manufacturer, verification of instrumentation and controls, and completion of subsystem tests, and
    - d. Provide space for any remaining problems with equipment and for signatures of Contractor and manufacturer's representative and Engineer indicating acceptance.

- 6. Furnish any spare parts and special tools specified for the respective equipment.
- 7. Furnish O & M information needed for O & M Manual.
- 8. Complete startup of all subsystems that may be associated with the system including but not limited to plumbing, electrical, instrumentation, and HVAC systems.
- 9. Provide safe access to the work area to facilitate startup and training activities.
- 10. Submit startup and performance testing checklist and certification in accordance with Section 01 78 43. Submittal and approval of the startup and performance checklist and certification is a prerequisite for acceptance of the system for substantial completion.
- B. Owner's Responsibilities: The Owner will:
  - 1. Furnish for Contractor's use during startup and testing:
    - a. Electrical power
    - b. Potable water
    - c. Non-potable water.
    - d. Process water.
  - 2. Provide sampling labor, materials, and laboratory analysis.
  - 3. Furnish Owner's representative to witness all tests.
- C. Startup Completion
  - 1. Startup of any portion is considered complete when, in the opinion of the Engineer, the system or designated subsystem has operated properly for seven continuous days without failure. The 7-day startup period is in addition to specified testing and training.
  - 2. Successful startup of all systems shall be accomplished prior to determination of substantial completion as defined in the General Conditions.
  - 3. Failure during startup shall include any of the following events:
    - a. Failure of Contractor to maintain 24-hour alarm response personnel during startup period.
    - b. Failure to meet specified performance requirements for more than four consecutive hours.
    - c. Failure of a system that is not permanently corrected within 4 hours after such failure occurs.
  - 4. "Permanently corrected" shall consist of all the following:
    - a. Work repaired and replaced to conform to specified requirements.
    - b. Parts and components replaced as recommended by original manufacturer and conforming to reviewed submittals.
    - c. Piping and valves properly installed and connected.
    - d. Wiring properly terminated and enclosed in raceways.
    - e. Accessories, including spare parts and lubricants, furnished as specified.
  - 5. Any failure shall halt the startup then in progress. Startup shall be restarted from the beginning after permanent corrections are made.
- D. Operation Period: The operation period begins when the facility has been substantially completed as defined in the General Conditions.
- 1.06 TRAINING OF OWNER'S PERSONNEL
- A. Installation Completion Schedule: Required for scheduling the training of Owner's operating personnel by equipment manufacturers.
  - 1. List estimated completion dates for the equipment and systems requiring services of manufacturers' representatives.

- 2. Submit the installation completion date for each equipment item or system not less than 21 calendar days prior to the time that associated equipment is installed and is in a suitable condition for training the Owner's personnel.
- 3. Revise the schedule to facilitate training of appropriate personnel, as deemed necessary by Owner, and to ensure full participation by manufacturers' representatives.
- B. Contractor's Personnel: Designate and provide Contractor's personnel to be responsible for coordinating and expediting training duties. The person(s) shall be present during training coordination meetings with the Owner and shall be familiar with the Operation and Maintenance (O&M) Manual information.
- C. Manufacturer's Representative: Contractor shall furnish manufacturer's representative(s) to provide detailed instructions to Owner's personnel for operation and maintenance of the specified equipment.
  - 1. Training services include shall include classroom instructions and onsite, hands-on instruction on the equipment as stated in the Specifications.
  - 2. Manufacturer's representative shall be familiar with O&M requirements as well as with the specified equipment and associated subsystems.
- D. Training Sessions: The Contractor shall provide Manufacturer's representative to conduct training sessions for each system.
  - 1. Initial classroom training shall include review of descriptive material and the O& M Manual. Review shall include but not be limited to routine and emergency operation of the equipment, instrumentation and controls and safety. Classroom training is a prerequisite for field training on the equipment.
  - 2. Field training shall be conducted on the equipment following successful startup. Filed training shall include but not be limited to hands-on operation of all controls and functions of the equipment and review of all maintenance and safety procedures.
  - 3. A classroom review session shall be held following completion of the field training to review the training and provide a forum for questions.
  - 4. The Owner reserves the right to videotape all training sessions, including manufacturer representatives' hands-on equipment instruction.
  - 5. Access to the Work Area: The Contractor shall provide safe access to the work area to facilitate training.

#### PART 2 -- PRODUCTS

#### NOT APPLICABLE

#### PART 3 -- EXECUTION

#### 3.01 PREPARATION FOR STARTUP AND PERFORMANCE TESTING

- A. Startup Preparation: Equipment shall be determined ready for startup based on the following:
  - 1. Notification by Contractor of readiness of equipment and systems for startup.
  - 2. Submittal of startup plan stating detailed procedures including quantity and source of utilities, chemicals, and other materials needed for each test.
  - 3. Submittal and acceptance of O & M Manuals incorporating review comments.
  - 4. Submittal of manufacturer's checklist and certification of proper installation.
  - 5. Submittal of completed functional acceptance test forms.
  - 6. Cleanliness of equipment, devices, connected work, and areas around the equipment.

- 7. Completion of startup for any associated subsystems.
- 8. Availability and acceptability of manufacturer's representative to assist testing of respective equipment and satisfactory fulfillment of other specified manufacturers' responsibilities.
- 9. Pre-testing Meeting: Contractor shall arrange a meeting with the Owner and Engineer to review the Contractor's detailed testing plan for each equipment item and system, at least 2 days prior to the first test run.
- B. Prior to Initial Testing of equipment:
  - 1. Inspect and clean equipment, devices, tanks, connected piping, and the surrounding area so they are free of foreign material.
  - 2. Provide safe access for Owner personnel to the system for observation of startup activities.
  - 3. Lubricate equipment in accordance with manufacturer's instructions.
  - 4. Turn rotating equipment by hand and check motor-driven equipment for correct rotation.
  - 5. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
  - 6. Check power supply to electric-powered equipment for correct voltage.
  - 7. Obtain manufacturer's certification of proper installation, where specified.
  - 8. Owner shall operate existing systems that have undergone successful startup.

#### 3.02 FUNCTIONAL TESTING

- A. Subsystem Tests: Startup and operate the individual components and subsystems that make up each equipment system. Functional testing of a complete system shall not begin until subsystem testing is completed to the Engineer's satisfaction.
- B. Equipment and System Tests: Contractors shall functionally test each separate piece of equipment, and each system requiring simultaneous operation of interdependent equipment, in accordance with the following procedures:
  - 1. Separate items of equipment demonstrated to function properly during subsystem testing shall require no further functional testing, if documentation of subsystem testing is accepted by Engineer.
  - 2. Functional testing of each system shall begin after subsystems and equipment units have been satisfactorily tested.
  - 3. Functional testing will begin at a time mutually agreed upon by the Engineer, Owner, manufacturer's representative(s), and Contractor.
    - a. The Owner or Engineer may be present during tests.
    - b. Notify Engineer, Owner, and manufacturer's representative at least 14 days prior to scheduled date of tests.
  - 4. Conduct functional testing until every equipment item in each system has demonstrated satisfactory operation. Demonstrate all operational features and controls while system and equipment operate in automatic modes.
  - 5. Startup testing of a system shall not be allowed until the initial testing of the complete system, including all subsystems in which the system operates, have been completed and documented in accordance with Section 01 78 43.
  - 6. If the Engineer accepts the installation and startup checklists and certifications, including functional testing of a system, the system may be scheduled for startup testing. If the Engineer determines that the functional tests do not meet the specifications, the system will be considered nonconforming.

#### 3.03 PERFORMANCE TESTING

- A. Performance testing shall use plant fluid or material that the equipment or system is designed to handle curing normal service conditions, unless otherwise specified.
- B. Equipment and Subsystem Tests: Contractor shall:
  - 1. Clean and check equipment and devices, as specified under Article TESTING PREPARATION, prior to starting equipment and subsystem performance tests.
  - 2. Performance testing will begin at a time mutually agreed upon by the Engineer, manufacturer's representative(s), and Contractor.
    - a. The Engineer will be present during tests.
    - b. Notify Engineer, Owner, and manufacturer's representative at least 14 days prior to scheduled date of performance testing and confirm the date 5 days prior to testing.
  - 3. Obtain supplies and materials, including water and chemicals; provide sufficient advance notice for suppliers.
  - 4. Operate the necessary equipment units as specified in the respective O & M Manuals for a continuous period of 24 hours.
  - 5. Follow Engineer-approved testing plan and detailed procedures specified for each equipment unit and subsystem including sample collection and analysis if required.
  - 6. Complete acceptable performance testing of all equipment and subsystems included in a system, and submit test documentation, before starting the system performance test.

#### END OF SECTION

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# SECTION 01 78 23

# **OPERATION AND MAINTENANCE DATA**

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section includes providing operation and maintenance data in accordance with this section and the individual equipment specifications.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Individual Equipment Specifications.

#### 1.02 SUBMITTALS

- A. Form and Format
  - 1. One (1) copy of the O&M Manual data shall be submitted in pdf format on a compact disk (CD) or a USB jump drive.
  - 2. Three (3) copies of the O&M Manual data must be bound within new, white, heavy-duty 3-ring presentation binders with clear-view overlay on the front, back and spine of the binder. Each O&M Manual data binder shall have two typed labels with the project name, REL Contract No., and O&M data name on both the binder fronts and binder spines. A minimum of 12-point font size with Times New Roman font style requested for the binder labels.
  - 3. Paper shall be 20-pound minimum for typed pages. Computer generated data shall be by laser printers.
  - 4. Each binder shall have a table of contents & directory. Tabbed divider sheets shall be white with typed labels that coincide with the table of contents. The tabs shall be in the same sequence as the table of contents and be readable from the left to the right.
  - 5. All tabbed divider sheets shall be heavy weight and have reinforced binder strip to maintain the long-term integrity of the paper.
  - 6. Large data sheets shall be folded and presented in an 8-1/2 inch x 11-inch pocket folder within each O&M Manual binder.
  - 7. Drawings, photographs, and envelopes shall be furnished with reinforced binder holes suitable for the above-mentioned binders and be labeled with appropriate identification.
  - 8. Photocopies shall be legible and suitable for photocopying. All materials shall be reproducible.
  - 9. All components of the submittal shall be typed.
- B. Schedule
  - 1. All four (4) copies of the operation and maintenance data shall be submitted prior to the project being 50% complete and prior to equipment installation.

#### 1.03 QUALITY ASSURANCE

A. The operation and maintenance data shall be prepared by trained personnel experienced in the operation and maintenance of the described products, equipment, materials, and finishes.

#### 1.04 CONTENTS

- A. Table of Contents
  - 1. Provide a table of contents with each operation and maintenance manual provided.
    - a. Provide a reinforced tabbed divider for each section listed in the table of contents. Main sections shall be numbers; sub-sections shall be letters.

#### B. Directory

- 1. For each item of equipment, list name, address, and telephone number of:
  - a. Contractor.
  - b. Engineer.
  - c. Manufacturer.
  - d. Supplier.
  - e. Local source of service
  - f. Local source for spare parts and replacement.
- C. Data to be Included:
  - 1. Include only product data sheets which are pertinent to the specific product of installation.
  - 2. Mark-up each product data sheet to:
    - a. Identify specific product or part installed.
    - b. Identify data applicable to installation.
    - c. Delete reference to inapplicable data.
  - 3. Supplement product data sheets with test and drawings as necessary to illustrate:
    - a. Relationship of component parts to equipment and processes.
      - b. Controls, regulation and accessories.
      - c. Capacities, performance curves, engineering data.
  - 4. Provide detailed operation and maintenance, troubleshooting and lubrication instructions for each component of equipment. Include disassembly, repair, reassembly and adjustment.
  - 5. Provide a complete parts list and spare parts stocking recommendations.
  - 6. Provide start-up and shutdown procedures in a logical and consistent format. Include all points of regulation and control (valves, switches).
  - 7. Describe normal and emergency operating procedures in detail.
  - 8. Provide all warranty information including any restrictions or precautions which might affect validity.
  - 9. Provide other data required under pertinent section of these specifications.
  - 10. Provide complete instrumentation loop diagrams with tabulated listing of all loop components.
  - 11. Submit as installed control diagrams by controls manufacturer before issuance of certificate of substantial completion.

# 1.05 EQUIPMENT MAINTENANCE DATA CARD

A. An "Equipment Maintenance Data Card" MUST be completed for each piece of equipment on the form provided.

# PART 2 – PRODUCTS

NOT APPLICABLE

# PART 3 – EXECUTION

NOT APPLICABLE

- END OF SECTION -

# Equipment No.

# EQUIPMENT MAINTENANCE DATA CARD

Unit							
Components:		Electrical					
Manufacturer: Equipment:							
Supplier:		Manufacturer:					
Installation Date:		Type:					
Capacity:		Serial No.:					
Model:			Amps: RPN				
Serial No.:		Phase: F	Frame: HP:				
Item	Work to be Done		Frequency	Time	Comments		

#### **SECTION 01 78 36**

#### WARRANTIES

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.
- B. Related Sections
  - 1. Applicable provisions of the General Conditions shall govern terms of the Contractor's special warranty of workmanship and materials.
  - 3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions 2 through 46.
- C. Disclaimers and Limitations Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

#### 1.02 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are 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 the Owner.

#### 1.03 WARRANTY REQUIREMENTS

- A. Starting date for all warranties shall be the date of Substantial Completion as indicated on Certificate of Substantial Completion, except that warranties for work completed after the date of substantial completion shall begin on date of acceptance of such work by the Owner.
- 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 Document. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life. D. Owner's Recourse

Written warranties made to the 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 the Owner can enforce such other duties, obligations, rights, or remedies.

E. The 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. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Prepare warranties as various components of the project are completed.

#### PART 2 - PRODUCTS

NOT APPLICABLE

#### PART 3 - EXECUTION

NOT APPLICABLE

- END OF SECTION -

#### SECTION 01 78 43

# EQUIPMENT, INSTALLATION, TRAINING AND RECEIPT FOR SPARE PARTS CHECKLISTS

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section includes completing the installation and training checklists.
- B. Related Sections and Divisions.
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. All related equipment specifications.

#### PART 2 - PRODUCTS

NOT APPLICABLE

#### PART 3 - EXECUTION

- 3.01 CHECKLISTS
- A. Contractor shall complete the Equipment Installation Checklist. Checklist shall be completed and submitted to the Engineer after installation.
- B. Contractor shall complete the Equipment Training Checklist. Checklist shall be completed and submitted to the Engineer after each day of training is completed.
- C. Contractor shall complete the receipt for Spare Parts/Equipment Checklist and submit to the Engineer.

- END OF SECTION -

Job Number\_

# Equipment Installation Checklist

Project						
Equipment						
Specification S	Specification Section					
I hereby certify the equipment supplier/manufacturer has inspected this equipment and that it has been properly installed, adjusted and calibrated. I further certify that this equipment may now be operated for test purposes and/or normal use.						
Manufacturer	's Representative					
Signature	Date					
Name (print)						
Representing						
Contractor						
Signature	Date					
Name (print)						
Representing						
Vendor Days U	Jsed					
Warranty Com	mencement Date: (check one)					
	Substantial Completion Date as Stated in Certificate					
	<ul> <li>Other Date</li></ul>					
This form shall be completed and submitted to ENGINEER prior to training of OWNER's personnel.						
The ENGINEER verifies the above "Vendor Days Used" and "Warranty Commencement Date".						
Signature Date						
Representing						

Attach equipment testing report including any vendor reports

Robert E. Lee & Associates, Inc.

Job Number \_\_\_\_

# Equipment Training Checklist

Project
Equipment
Specification Section
Critical Maintenance Training
I hereby certify that the equipment supplier/manufacturer has instructed OWNER's personnel in the start-up of this equipment and all critical maintenance necessary to operate equipment until post startup training.
Contractor Signature Date (Name/Representing)
Vendor Days Used
I hereby certify that my operating personnel received hrs. of instructions from
Operator Signature Date
Attendees:
Post Start-Up Training
I hereby certify that the equipment supplier/manufacturer has instructed Owner's personnel in the start-up, operation and maintenance of this equipment as required in this specification.
Contractor Signature Date (Name/Representing
Vendor Days Used
I hereby certify that my operating personnel received hrs. of instructions from
Operator Signature Date
Attendees:

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Robert E. Lee & Associates, Inc.

Job Number \_

# Receipt For Spare Parts/Equipment Checklist

Item:			
Contract Specifica	tion Section:		
Sub-Section:			
Page:	By:	Date:	

			Quantity			
Item	Item				Designated Storage	
No.	Description	Unit	Req.	Rec.	Location	Remarks

The above items have been stored or erected at the designated storage location. All quantities and items are in accordance with Contract Specification requirements.

Owner:	By:
	Title:
	Date:
Contractor:	By:
	Title:
	Ву:
Engineer: Robert E. Lee & Associates, Inc.	

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# 03

**DIVISION 03** 

CONCRETE

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# SECTION 03 11 00

### CONCRETE FORMWORK

#### PART 1 – GENERAL

#### 1.01 SECTION INCLUDES

A. This section covers the work necessary to furnish and install, complete, concrete formwork as specified herein.

#### 1.02 SUBMITTALS

- A. Shop Drawings: Furnish the following:
  - 1. Alternate Form Ties Tapered Through-Bolts: Proposed method of sealing form tie hole; coordinate with details shown.
  - 2. Samples: Prior to start of work, submit one sample each as follows:
    - a. Form liners.
    - b. Form ties.

#### 1.03 SEQUENCING AND SCHEDULING

A. Schedule work for embedded, buried, or other items of work that affects form layout before completing concrete formwork.

#### PART 2 – PRODUCTS

#### 2.01 FORM MATERIAL

- A. Wall Forms:
  - 1. General:
    - a. Form Surfaces: In "new and undamaged" condition of either plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel of sufficient strength and surface smoothness to produce specified finish.
    - b. Concrete Finish Requirements: As specified in Section 03 31 13, Concrete.
    - c. Design joints in forms to remain watertight and withstand placing pressures without bulging outward or creating surface patterns.
    - d. Do not use formwork that leaks mortar.
    - e. Where poor formwork is used and finish obtained is less than specified, upgrade finish to an acceptable finish at no additional cost.
    - f. Panel Deflections: Limit as required to achieve tolerances specified herein.
  - 2. Circular Structures:
    - a. Forms shall conform to circular shape of structure.
    - b. Straight panels may be substituted for circular forms if they do not exceed 2 feet in width and in addition to the requirements, each panel does not provide an angular deflection more than 3-1/2 degrees per joint, and do not conflict otherwise with these Specifications and/or Drawings.
  - 3. Rustications and Corner Strips: Non-absorbent material, compatible with form surface, fully sealed on all sides, to prohibit loss of paste or water between the two surfaces.
  - 4. Form Sealer:
    - a. Manufacturer:

- 1) Burke Co., Burke Uni-Kote.
- 2) Grace construction Materials Co., FormFilm.
- 3) Sternson Construction Products, Formaseal.
- 4) Or equal.

#### B. Column Forms:

- 1. Rectangular Columns: As specified for walls.
- C. All Other Forms: Materials as specified for wall forms, unless otherwise approved by Engineer.

### 2.02 FORM DESIGN AND WINDOWS

#### A. General:

- 1. Design formwork prior to fabrication, placing order, or use on jobs.
- 2. Design shall account for tolerances, form ties, finishes, architectural features, rebar supports, construction joint locations, and other non-structural formwork requirements specified.
- 3. Design formwork strong enough to hold high liquid heads without form distortion and to meet tolerances as specified herein. Coordinate form design with admixture company information and concrete slump.
- 4. Forms for walls shall contain pouring and observation windows to allow placement of concrete through windows or staged to allow visual observation at all times of fresh concrete to ensure correct placement and vibration.
- 5. Free Fall Limit of Concrete: As specified in Section 03 31 13, Concrete.
- 6. Structurally design forms, falsework, shoring, and other structural formwork and meet applicable safety regulations, current OSHA regulations, and other codes.
- 7. An engineer registered in State of Wisconsin shall prepare formwork, falsework, and shoring designs to meet these Specifications and to meet all federal and state requirements.
- 8. Make designs available to any governing agency upon request.
- 9. Meet applicable portions of ACI 347, ACI 318 current edition, and these specifications.

# 2.03 REINFORCING SPACERS AND REBAR SUPPORTS

- A. Columns:
  - 1. Provide a positive plastic tipped or stainless steel spacer between column reinforcing and column forms to ensure adequate cover.
- B. Walls: Provide a positive spacer between wall reinforcing and wall forms to ensure adequate cover.
- C. Floors and beams: Provide a positive plastic tipped or stainless steel support between reinforcing and slab or beam forms. Provide supports with sand plates supporting reinforcement for slabs on grade.

# 2.04 FORM TIES

- A. General:
  - 1. Inserts:
    - a. Conical or spherical type inserts.
    - b. Fixed so they remain in contact with forming material.

- c. Construct so no metal is within 1 inch of concrete surface when forms, inserts, and tie ends are removed.
- 2. Do not use wire ties.
- 3. Ties shall withstand form pressures and limit form deflection to specified tolerances.
- 4. Flat bar ties for panel forms shall have plastic or rubber inserts with minimum 1-inch depth and sufficient dimensions to permit proper patching of tie hole.
- B. Water Stop Ties:
  - 1. Provide for water-holding structures or dry structures with access such as basements, pipe tunnels, etc., that are below finish grade or whose wall is common to water holding basin or channel.
  - 2. Ties shall have either an integral steel water stop 0.103-inch thick and 0.625 inch in diameter tightly and continuously welded to tie, or neoprene water stop 3/16-inch thick and 15/16 inch in diameter whose center hole is 1/2 diameter of snap tie, or a molded plastic water stop of comparable size.
  - 3. Flat snap ties meeting these Specifications may be provided.
  - 4. Water Stop: Considerably larger in area than tie cross sectional area, oriented perpendicular to tie and symmetrical about center of tie.
  - 5. Construct ties to provide positive means of preventing rotation or disturbance of center portion of tie during removal of ends and prevent water leaking along tie.
- C. Alternate Form Ties Through-Bolts:
  - 1. Form ties consisting of tapered through-bolts as shown with minimum 1 inch in diameter at smallest end, or through-bolts utilizing a removable tapered sleeve of same minimum size may be provided as an option. Through hole requires preparation of concrete surface prior to patching; see detail.
  - 2. Elastic Vinyl Plug:
    - a. Size to allow insertion using insertion tool to elongate plug, place it at correction location, and allow plug to return to original length and diameter upon removal to form watertight seal.
    - b. Manufacturer:
      - 1) Dayton Sure-Grip and Shore Co., Miamisburg, OH, Dayton Sure Plug.
      - 2) Or equal.

# PART 3 – EXECUTION

# 3.01 INSTALLATION

- A. General:
  - 1. Notify engineer one full working day prior to concrete placement so forms can be inspected.
  - 2. Correct deflective work found in Engineer's inspection, prior to delivery of concrete.
- B. Wall Forms:
  - 1. Do not reuse form surfaces that have been damaged and are no longer in smooth "new and undamaged" condition unless otherwise approved in writing.
  - 2. Provide specified smooth form surfaces meeting tolerance requirements prior to each reuse.
- C. Forms to Support Form Liners For Architectural Concrete:

- 1. Build of materials and in a manner that is sufficiently rigid and strong to withstand, without excessive deflection, movement, or leakage, high hydraulic pressures resulting from rapid filling and heavy-high frequency vibration.
- 2. Limit deflection in formwork to 1/360 of each component span and tolerances specified herein.
- 3. Lay out form joints in a uniform pattern or as shown.

### D. Form Ties:

- 1. Locate on exposed surfaces in uniform pattern or as shown.
- 2. Construct so tie remains embedded in wall, except for removable portion at each end.

#### 3.02 FORM TOLERANCES

#### A. General:

- 1. Surface, design, and construct forms to meet ACI 318 and the following minimum tolerances for specified finishes.
- 2. Failure of forms to produce specified tolerances will be grounds for rejection of concrete work. Upgrade concrete finish or replace to meet specification requirements.
- B. Wall Tolerances:
  - 1. Straight Vertical or Horizontal Wall Surface: Flat planes within tolerance as specified herein.
  - 2. Surface Finish: As specified in Section 03 31 13, Concrete.
  - 3. Wall Type W-T1:
    - a. Plumb within 1/4 inch in any 10 feet or within 1 inch in entire height from top to bottom for walls over 40 feet high.
    - b. Depressions in Wall Surface: Maximum 5/16 inch when 10-foot straightedge is placed on high points in any direction or at any location.
    - c. Wall Thicknesses: Maximum 1/4-inch minus or 1/2 inch plus from dimension shown.
  - 4. Wall Type W-T2:

a. Plumb within 1/4 inch in any 10 feet or within 1/2 inch in entire height from top to bottom for walls over 20 feet high.

b. Depressions In Wall Surface: Maximum 1/8 inch when 10-foot straightedge is placed on high points in any direction or at any location.

c. Wall Thicknesses: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.

- C. Slab Tolerances:
  - 1. Exposed Slab Surfaces: Comprise of flat planes as shown or as required within tolerances specified herein.
  - 2. Slab Finish Tolerances and Slope Tolerances: Floor surface shall not have crowns so high as to prevent 10-foot straightedge from resting on end blocks, nor low spots that allow a block of twice the tolerance in thickness to pass under the supported 10-foot straightedge.
    - a. Slab Type S-T1: Steel gauge block thicknesses shall equal 5/16 inch.
    - b. Slab Type S-T2: Steel gauge block thicknesses shall equal 1/8 inch.
  - 3. Slab Type S-F1 and S-F2:

- a. Finish Slab Elevation: Within 1/2 inch of elevation specified except slabs which are designed and detailed to drain to floor drain or gutter shall adequately drain regardless of tolerances.
- b. Repair floor slopes in an approved manner if necessary to provide complete drainage.
- c. Thickness: Maximum 1/4 inch minus or 1/2 inch plus from thickness shown.
- D. Beams and Columns Tolerances:
  - 1. Exposed Straight Horizontal and Vertical Surfaces: Flat planes within specified tolerances.
  - 2. Beam Type B-T1:
    - a. Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
    - b. Elevations: Within 1/2 inch plus or minus except where tops of beams become part of finished slab. In this case, refer to slab tolerances.
  - 3. Column Type C-T2:
    - a. Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
    - b. Plumb within 1/4 inch in any 10 feet with maximum 1/2 inch out-of-plumb at top with respect to bottom.
- E. Forms for Sidewalks and Driveways:
  - 1. Standard steel forms or wood forms constructed and fastened to prevent movement.
  - 2. Set forms to true lines and grades, and securely stake in position.

#### 3.03 FORM SURFACE PREPARATION

- A. Thoroughly clean form surfaces in contact with concrete of previous concrete, dirt, and other surface contaminants prior to coating surface.
- B. Exposed Wood Forms in Contract with Concrete: Apply two full coats of specified form sealer.
- C. Steel Forms:
  - 1. Sandblast or otherwise remove mill scale and other ferrous deposits from contact surface of forms.
  - 2. Coat contact surfaces of forms with release agent.
  - 3. Release Agent: Prevent discoloration of concrete from rust, and nontoxic after 30 days.

#### 3.04 BEVELED EDGES (CHAMFER)

- A. Form 3/4-inch bevels at concrete edges, unless otherwise shown.
- B. Where beveled edges on existing adjacent structures are other than 3/4 inch, obtain Engineer's approval of size prior to placement of bevel form strip.
- 3.05 FORM REMOVAL
- A. Contractor shall assume responsibility for damage resulting form improper and premature removal of forms.
- B. Satisfy applicable OSHA requirements with regard to safety of personnel and property. W:\0400\0404\0404\432\TECHNICAL SPECS\_SW Pond\_Lift Stn\03 11 00 Concrete Formwork.docx REV. 11/10/03 CONCRETE FORMWORK

- C. Leave forms and shoring for elevated structural slabs or beams in place in accordance with ACI 318, Chapter 6, and until concrete has reached compressive strength equal to specified 28-day compressive strength as determined by test cylinders.
- D. Do not remove supports and reshore prior to obtaining adequate field cured cylinder results.

#### 3.06 CONCRETE FINISHES

- A. As specified in Section 03 31 13, Concrete.
- 3.07 BACKFILL AGAINST WALLS
- A. Do not backfill against walls until concrete has obtained compressive strength equal to specified 28-day compressive strength.
- B. Place backfill simultaneously on both sides of wall, where, required to prevent differential pressures.
- 3.08 FIELD TESTS
- A. Wall Finish Tolerances: Test for compliance with tolerances as specified.
- B. Slab Finish Tolerances and Slope Tolerances:
  - 1. Floor flatness measurements will be made the day after floor is finished and before shoring is removed, to eliminate effects of shrinkage, curling and deflection
  - 2. Support 10-foot long straightedge at each end with steel gauge blocks of thicknesses equal to specified tolerance.
  - 3. Compliance with designated limits in four of five consecutive measurements is satisfactory unless obvious faults are observed.
  - 4. A check for adequate slope and drainage will also be made to confirm compliance with these Specifications.
- 3.09 MANUFACTURER'S SERVICES
- A. Form Liner Manufacturer: Provide manufacturer's jobsite representative to assist with proper methods of application and use of form liner.

#### PART 4 – MEASUREMENT AND PAYMENT

- 4.01 LUMP SUM ITEMS
- A. Payment for work in this Section will be included as part of the lump sum bid.

#### - END OF SECTION -

# SECTION 03 15 13

#### WATERSTOPS

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. Work Included: This section includes providing waterstops for concrete construction.
  - 1. Related Sections and Divisions
    - a. Applicable provisions of the General Conditions shall govern the work in this section.
    - b. Section 03 31 13, Cast-In-Place Concrete.

#### 1.02 REFERENCE

- A. Corps of Engineers Specifications (CRD):
  - 1. CRD C572 Corps of Engineers Specifications for Polyvinyl Chloride Waterstops.
  - 2. ASTM D412.
- 1.03 SUBMITTALS
- A. Submit the following:
  - 1. Producer's certification that supplied material conforms to requirements of applicable specification for each type and size used.
  - 2. Producer's certification that supplied material will not contaminate a potable water system when used in construction of potable water tanks or reservoirs.
  - 3. Sample of each type and size of waterstop used when requested by Engineer.

#### PART 2-PRODUCTS

- 2.01 PVC WATERSTOP
- A. Polyvinyl chloride (PVC) waterstops shall be of the serrated type and conform to CRD C572.
- B. Waterstops shall meet the following minimum requirements.
  - 1. Tensile strength 1,800 PSI. Elongation 30 percent Shore a durometer 50
  - 2. Tests for materials shall be in accordance with ASTM D412. no reclaimed PVC will be allowed.
  - 3. PVC waterstops shall be ribbed with center bulb. Thickness shall be 3/16-inch for 6-inch waterstop and 3/8-inch for 9-inch waterstop thickness for labyrinth type waterstops shall be 3/16". Labyrinth waterstop shall meet the head pressure requirements as shown on the drawings.
- C. Available Manufacturers
  - 1. Greenstreak
  - 2. W.R. Meadows, Inc.

#### 2.02 HYDROPHILIC WATERSTOPS

- A. Use at construction joints where new concrete meets existing concrete as shown on the drawings.
- B. Material shall be non-bentonite modified chloroprene rubber.
- C. Waterstop shall be Greenstreak Hydrotite CJ-1020-2K-ADH with Leakmaster LV-1 adhesive or equal.

#### PART 3 - EXECUTION

#### 3.01 PVC WATERSTOP

- A. Preparation
  - 1. Keep waterstop material free of mud, oil or other surface contamination that adversely affect bonding capacity.
- B. Placement
  - 1. Provide waterstop in construction and expansion joints in:
    - a. Walls and slabs separating a dry interior from earth or liquid.
    - b. All walls and slabs of liquid holding tanks.
    - c. Other locations shown on plans.
  - 2. Do not embed center bulb.
  - 3. Do not nail split legs to bulkhead adjacent to bulb.
  - 4. Securely tie waterstops to reinforcement to prevent displacement while concrete is placed or consolidated.
    - a. Tie to reinforcing bars a minimum of every 12 inches.
    - b. Secure waterstops between last rib and end of waterstop.

#### C. Splicing

- 1. Use maximum practicable length in order that number of end joints will be held to a minimum.
- 2. When splicing is required, butt weld waterstops using thermostatically controlled electric heating tools.

#### 3.02 HYDROPHILIC WATERSTOPS

#### A. Preparation

- 1. Clean surfaces of all mud, laitance, oils or other surface contaminants.
- 2. Remove water from surfaces and dry to surface dry condition.

#### B. Placement

- 1. Provide at locations shown on plans.
- 2. Provide minimum confinement/cover or as required by manufacturer.
- 3. Protect from displacement while concrete is placed or consolidated.

# C. Splicing

- 1. Cut ends square with shears or sharp blade to fit splices together without overlaps.
- 2. Splices shall be sealed using cyanacrylate adhesive and leakmaster.
- 3. Seal watertight any exposed cells of hydrotite using leakmaster.
- 4. Follow approved manufacturer recommendations.

#### - END OF SECTION -

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# SECTION 03 21 00

#### CONCRETE REINFORCEMENT

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: Work includes furnishing, fabricating, and erecting all steel and fibers required for reinforcement of cast in place concrete as shown on the drawings.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 03 31 13, Cast In Place Concrete.
- 1.02 REFERENCES
- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A82 Steel Wire, Plain, for Concrete Reinforcement
  - 2. ASTM A185 Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
    - 3. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- B. American Concrete Institute (ACI):
  - 1.ACI 315Manual of Standard Practices for Detailing Reinforced Concrete<br/>Structures.
  - 2. ACI 318 Building Code Requirements for Structural Concrete.
- C. Concrete Reinforcing Steel Institute (CRSI):
  - 1. CRSI Manual of Standard Practice

#### 1.03 SUBMITTALS

- A. Submit the following:
  - 1. Before proceeding with the fabrication of the reinforcement, submit shop drawings showing the number, size, length, bending and arrangement of the reinforcement.
  - 2. All shop drawings shall be in accordance with ACI 315.
  - 3. Quality control submittals, when requested shall consist of a certified copy of each heat analysis performed by producer and certified copies of reinforcement strength tests.

#### 1.04 PRODUCT HANDLING

- A. Delivery:
  - 1. The reinforcement shall be delivered to the site bundled, tagged and marked.
  - 2. Metal tags indicating the bar size, lengths, and other pertinent information corresponding to markings shown on placement drawings shall be used.
- B. Storage:

- 1. The reinforcement shall be stored at the site in a manner to prevent damage and accumulation of dirt and excessive rust.
- 2. Protect reinforcing steel and welded wire fabric from surface contamination and from distortion.

# PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Reinforcing bars shall comply with ASTM A615, Grade 60, deformed. Reinforcing bars required to be welded shall be ASTM A 706 low alloy.
- B. Steel wire shall conform with ASTM A82, plain, cold-drawn steel.
- C. Welded wire fabric shall comply with ASTM A 185, welded steel wire fabric.
- D. Reinforcement supports including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement shall be:
  - 1. Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI manual.
  - 2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
  - 3. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).
  - 4. When the supports bear directly on the ground and it is not practical to use steel bar supports, precast concrete blocks may be used to support the bottom lift of the reinforcement. The precast blocks must be solid and of a higher strength than the concrete being placed. The blocks must provide adequate support to the reinforcement and be of proper height to provide reinforcing cover. The use of face brick, hollow concrete block, rocks, wood or other unapproved objects will not be permitted.
- E. Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs shall comply with ASTM C1116, Type III. Fibers shall be not less than <sup>3</sup>/<sub>4</sub>-inch long or greater than 1<sup>1</sup>/<sub>2</sub>-inch long as manufactured by Fibermesh or equal.

#### 2.02 FABRICATION

#### A. General:

- 1. Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances which comply with CRSI manual.
- 2. In case of fabrication error, do not rebend or straighten reinforcement in a manner that will weaken the material.
- 3. Unless otherwise noted, all end hooks dimensions shall conform with ACI standard hooks.
- B. Reinforcement with any of the following defects will not be permitted:
  - 1. Bar lengths, depths, and bends exceeding the specified tolerances.
  - 2. Bend or kinks not indicated on the drawings or final shop drawings.
  - 3. Bars with reduced cross section due to excessive rusting or other causes.

C. Fabricate to dimensions shown on plans and ACI 318.

#### PART 3 - EXECUTION

#### 3.01 PLACING REINFORCEMENT

- A. General Comply with the CRSI Manual's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.
  - 1. Avoiding cutting or puncturing vapor retard/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
  - 2. Bars partially embedded in concrete shall not be field bent except as shown on the plans or permitted by the Engineer.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers.
- D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Polypropylene fiber reinforcement for slabs may be used in lieu of WWF with engineer's approval. Use fiber reinforcement at a minimum rate of 1.5 pounds fiber per batch yard of concrete or greater if required by fiber manufacturer.

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### SECTION 03 31 13

# **CAST-IN-PLACE CONCRETE--STRUCTURES**

#### PART 1- GENERAL

#### 1.01 SUMMARY

#### A. Work Included:

- 1. All cast-in-place concrete materials and work.
- 2. Concrete admixtures.
- 3. Formwork for cast-in-place concrete.
- 4. Cleaning and finishing of formed surfaces.
- 5. Required testing and submittals.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern work in this section.
  - 2. Section 03 11 00, Concrete Form Work.
  - 3. Section 03 21 00, Concrete Reinforcement.
  - 4. Section 03 15 13, Waterstops.

#### 1.02 REFERENCES

- A. American Concrete Institute (ACI):
  - 1. ACI 211.1 Selecting Proportions for Normal and Heavy Weight Concrete.
  - 2. ACI 301 Specification for Structural Concrete for Buildings.
  - 3. ACI 302.1 Guide for Concrete Floor and Slab Construction.
  - 4. ACI 304 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
  - 5. ACI 305 Hot Weather Concreting.
  - 6. ACI 306 Cold Weather Concreting.
  - 7. ACI 308 Standard Practice for Curing Concrete.
  - 8. ACI 309 Standard Practice for Consolidation of Concrete.
  - 9. ACI 318 Building Code Requirements for Reinforced Concrete.
  - 10. ACI 347 Recommended Practice for Concrete Formwork.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM C31 Making and Curing Concrete Test Specimens in the Field.
  - 2. ASTM C33 Concrete Aggregates.
  - 3. ASTM C39 Compressive Strength of Cylindrical Concrete Specimens.
  - 4. ASTM C42 Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
  - 5. ASTM C94 Ready-Mixed Concrete.
  - 6. ASTM C143 Test for Slump of Portland Cement Concrete.
  - 7. ASTM C150 Portland Cement.
  - 8. ASTM C158 Test for Water Retention by Concrete Curing Materials.
  - 9. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete.
  - 10. ASTM C172 Standard Test Methods for Sampling Fresh Concrete.

11.	ASTM C173	Test Method for Air Content of Freshly Mixed Concrete by the Volumetric						
12.	ASTM C164	Method. Test Methods for Temperature of Freshly-Mixed Portland Cement						
		Concrete.						
13.	ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the						
		Pressure Method.						
14.	ASTM C260	Air Entraining Admixtures for Concrete.						
15.	ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete.						
16.	ASTM C494	Chemical Admixtures for Concrete.						
17.	ASTM C618	Fly Ash and Raw or Calcified Natural Pozzolans for Using Portland						
		Cement Concrete.						
18.	ASTM C1107	Packaged Dry, Hydraulic-Cement Grout (Non-shrink).						
19.	ASTM D994	M D994 Preformed Expansion Joint Filler for Concrete.						
20.	ASTM E329	Standard Recommended Practice for Inspection Testing Agencies						
		for Concrete, Steel, and Bituminous Materials as used in Construction.						

#### 1.03 SUBMITTALS

- A. Submit the following information:
  - 1. Gradation of fine and coarse aggregate ASTM C33.
  - 2. Specific gravity and dry rodded density of each aggregate.
  - 3. Test of deleterious substances in fine and coarse aggregate ASTM C33.
  - 4. Design mix for all mixes.
  - 5. 7 and 28-day compressive strengths for each concrete mix proposed.
  - 6. Certified mill test results for cement identifying brand, type, and chemistry of cement.
  - 7. Brand, type, principal ingredients and amount of each admixture.
  - 8. Field quality control test results.

# PART 2 - PRODUCTS

- 2.01 FORMWORK
- A. Form work shall be as specified in Section 03 11 00, Concrete Formwork.
- 2.02 PORTLAND CEMENT
- A. Portland cement shall conform to ASTM C150 and shall be Type I. Type III may be used only when approved by the Engineer. All Portland cement shall be from one supplier and mill.
- 2.03 FLY ASH
- A. Fly ash shall conform to ASTM C618, Class C or F. Loss on ignition shall not exceed 5 percent.

#### 2.04 ADMIXTURES

A. No admixtures shall contain calcium chloride, thiocyanates or more than 0.05% chloride ions. Written certification of these requirements by the admixture manufacturer shall be submitted to the Engineer for approval with the mix design.

#### B. Air-Entraining Admixture

ASTM C260 for exterior permanently exposed normal weight concrete and for all vehicular use areas; 5% to 7.5% as measured with air meter conforming to ASTM C173 or ASTM C231.

C. Water-Reducing Admixture

Use ASTM C494 Type A. To be used unless noted. Chloride ion content of admixture shall not exceed chloride ion content of municipal drinking water and shall be limited to produce no detrimental effect on other components, such as metal deck, reinforcing, metal conduit, and shall be verified by supplier. Follow the manufacturer's recommendations. Products shall be equal to:

"Pozzolith 220 N", Master Builders "WRDA 82", W. R. Grace

D. Water-Reducing Retarding Admixture

ASTM C494 Type D. Chloride ion content of admixture shall not exceed chloride ion content of municipal drinking water. Use only if acceptable to the Engineer. Products shall be equal to:

"Pozzolith 220 N", Master Builders "Daratard 17", W. R. Grace

E. Non-Corrosive, Non-Chloride Accelerator

ASTM C494, Type C or E. Chloride ion content of admixture shall not exceed chloride ion content of municipal drinking water. Product shall have been subjected to long-term testing (3 years duration, minimum), using an acceptable accelerated corrosion test method such as that using electrical potential measures. Use only if acceptable to the Engineer. Products shall be equal to:

"Pozzutec 20", Master Builders "Daraset 20", W. R. Grace

F. High Range Water Reducing Admixture (Superplasticizers)

ASTM C494 Type F or G. Chloride ion content of admixture shall not exceed chloride ion content of municipal drinking water and shall be limited to produce no detrimental effect on other components, such as metal deck, reinforcing, metal conduit, and shall be verified by supplier. Use only if acceptable to the Engineer. Products shall be equal to:

"Rheobuild 1000", Master Builders "Daracem-100", W. R. Grace

#### 2.05 WATER

A. Water shall be clean and free from deleterious amounts of acids, oils, alkali, organic matter and mineral substances.

#### 2.06 WATERSTOPS

A. Polyvinyl chloride (PVC) waterstops shall be as specified in Section 03 15 13.

#### 2.07 CURING MATERIALS

- A. Liquid Applied
  - 1. Liquid Membrane –Sonneborn Kure-N-Seal 25LV or equal. Apply upon completion of concrete finishing or form removal.
- B. Sheet or Membrane
  - 1. Plastic film, ASTM C171:
    - a. 10 mil thickness
    - b. White during warm weather.
    - c. Black during cold weather.
  - 2. Reinforced paper, ASTM C 17 1.
  - 3. Cotton mats, FS DDD-M-148.

#### 2.08 CONCRETE SPECIALTIES

- A. Vapor Barrier
  - 1. Vapor barrier shall be 6 mil polyethylene with joints lapped 6 inches and taped with a waterproof tape.
- B. Bonding Agents
  - 1. Epoxy resin bonding compounds shall be Concresive liquid LPL for horizontal applications and paste LPL for vertical applications, as applicable and as manufactured by Adhesive Engineering; or Sikadur 32, Hi-Mod as manufactured by the Sika Chemical Corporation, or equal.
  - 2. Use of all bonding compounds shall be as shown on the drawings or as specified. Application shall be as recommended by the manufacturer.
- C. Epoxy Anchoring System

Epoxy anchoring system shall be a two-part, epoxy-based system thoroughly blended in a disposal mixing nozzle attached to the cartridge. Systems shall be Epcon C6 by ITW Red Head, or equal.

#### 2.09 CONCRETE MIXES

- A. Test Mixes
  - 1. Have an approved commercial testing laboratory prepare design mixes for each class of concrete specified for use on job.
    - a. Design mixes in accordance with ACI 318 and ACI 211.1.
    - b. Laboratory shall make, cure, and test all specimens required by the applicable standards.
    - c. Design job-mixed concrete on the basis of water cement ratio.
    - d. Mixes shall be homogeneous, readily placeable, and uniformly workable.
  - 2. Mixes shall conform to the following requirements:

	28-day	Mar Cira		Min. Cement	Air	
	Comp. Str.	Max. Size	ASTM C33	Content **	Content	
Class	(PSI)	Aggregate	Aggregate	(Bags/C.Y.)	(%)*	Slump
A1	4000	1-1/2 inch	Size No. 4	5.5	5±1	3-inch - 4-inch
A2	4000	3/4 inch	Size No. 67	6.0	6±1	3-inch - 4 inch
A3	4000	3/8 inch	Size No. 8	6.0	$7-1/2\pm1$	3-inch - 4-inch
A4	4000	No. 16	Fine	7.0	8±1	6-inch Max.
<b>B</b> 1	3000	1-1/2 inch	Size No. 4	4.5	$5\pm1$	3-inch - 4-inch
B2	3000	3/4 inch	Size No. 67	4.75	6±1	3-inch - 4-inch

\*Required only where concrete is used for liquid containment or subject to freeze/thaw cycles. \*\*Minimum cement content applies to concrete in direct contact with earth or water.

- 3. When strength data from field experience or trial batches are not available, maximum permissible water-cement ratios shall be:
  - a. Non-air-entrained:
    - 1) Class A: 0.44
    - 2) Class B: 0.58
  - b. Air-entrained:
    - 1) Class A: 0.35
    - 2) Class B: 0.46
- 4. Maximum water/cement ratio when strength data from field experience or trial batches as required by ACI 318 are available:
  - a. Class A: 0.44
  - b. Class B: 0.58
- 5. Concrete which is to have a trowel-finished surface, maximum air content shall be 3%.
- 6. Fly ash may be substituted for cement on an equal weight basis up to a maximum of 20%.
- B. Structural Concrete Mix Proportioning
  - 1. Proportions of aggregate to cement shall be such as to produce a readily workable mixture with method of placement employed on job, but without allowing materials to segregate, or excess free water to collect on surface.
  - 2. Combined aggregates shall be such that weight of fine aggregate shall not be less than 30 percent nor more than 45 percent of total.
  - 3. Maximum size for coarse aggregate.
    - a. Not larger than one-fifth of narrowest dimension between sides of forms.
    - b. Not larger than one-third depth of slab.
    - c. Not larger than three-fourths of minimum clear spacing between reinforcing bars.
    - d. Not larger than  $1-\frac{1}{2}$  inch.
- C. Concrete Usage
  - 1. Class A4: Coating hardened concrete at construction joints, coating precast concrete plank prior to placement of bonded concrete topping, and optional first lift in forms with congested reinforcement and/or waterstop.
  - 2. Class A: All locations except where Class B is specified.
  - 3. Class B: Slabs reinforced with welded wire fabric, equipment bases, fence post footings, fillets in tanks, and where specifically stated in plans or specifications.

#### D. Mixing

- 1. Measure materials by weight in conformance with ASTM C94 and ACI 304.
- 2. Mix and deliver concrete in ready-mix equipment conforming to ASTM C94 and ACI 304.

# PART 3 - EXECUTION

- 3.01 FORM WORK
- A. Form work shall be as specified in Section 03 11 00, Concrete Formwork.
- 3.02 INSTALLING EMBEDDED ITEMS
- A. Encase pipes, anchor bolts, electrical conduits, steps, castings, and other inserts as shown on plans or as specified and finished by other trades.
- B. Place inserts in advance of pouring and brace to prevent movement during pouring process.
- C. Embedded conduits and pipes shall not be larger in outside dimension than one-third the overall thickness of wall, beam or slab.
- D. Embedded conduits and pipes shall not be spaced closer than 3 diameters or widths on center.

# 3.03 PLACEMENT OF CONCRETE

- A. Environmental Requirements
  - 1. Hot weather concreting.
    - a. Follow ACI 305 whenever mean surrounding air temperature equals or exceeds 80 degrees F (27 degrees C).
    - b. Do not place concrete whenever air temperature equals or exceeds 90 degrees F (32 degrees C).
  - 2. Cold weather concreting.
    - a. Follow ACI 306 whenever mean surrounding air temperature is below 40 degrees F (4.5 degrees C).
  - 3. Do not place concrete during rain, sleet, or snow, unless protection is provided.
- B. Placement of Concrete
  - 1. Conveying concrete.
    - a. Convey concrete from mixer to place of final deposit by methods that will prevent separation or loss of materials.
    - b. Equipment for chuting, pumping, or pneumatically conveying concrete shall be capable of providing a supply of concrete at site of Work without separation of ingredients and without interruptions sufficient to permit loss of plasticity between successive placements.
    - c. Unless otherwise approved, conform to ACI 304.
  - 2. Depositing concrete.
    - a. Deposit concrete as nearly as practicable to its final position to avoid segregation due to rehandling or flowing to its final position. Concrete shall not be dropped more than 6 feet unless a suitable chute or tube is used.

- b. Carry on concreting at such a rate that concrete is at all times plastic, and flows readily into spaces between reinforcing.
- c. Do not deposit concrete that has partially hardened or that has been contaminated by foreign materials.
- d. Do not use retempered or remixed concrete.
- e. After concreting is started, it shall be carried on as a continuous operation until placing of a panel or section is completed.
- f. Top surfaces of vertically formed lifts shall be generally level.
- g. Thoroughly consolidate concrete by suitable means during placement, and thoroughly work concrete around reinforcement and embedded fixtures, and into corners of forms.
- h. Vibrators may be used to aid placement, provided they are used under experienced supervision and forms have been designed to withstand their action.
- i. Unless otherwise approved, conform to ACI 304.

#### 3.04 CONSTRUCTION JOINTS

- A. Construction joints shall be located as shown on plans, or if not located, locate so as to not impair strength and appearance. Construction joints shall be perpendicular to main reinforcement and reinforcement shall be across the joint.
- B. Clean surface of hardened concrete and remove laitance and standing water. Roughen surface of concrete to 1/4-inch amplitude.
- C. Wet construction joints and coat with Class A4 concrete immediately before new concrete placement.

#### 3.05 CURING

- A. Maintain concrete surfaces moist for the first 7 days after placement.
- B. Under hot weather conditions, conform to ACI 305.
- C. Under cold weather conditions, conform to ACI 306.
- D. When a liquid-membrane-forming compound is used, protect exposed steel, key-ways or concrete to be surfaced from curing compound.
- E. During curing period, protect concrete from damaging mechanical disturbances, water flow, loading, shock, and vibration.
- F. Formed Surfaces
  - 1. Ceilings, walls, columns and beam sides may be cured by leaving forms in place, by wet cure, or by use of a liquid curing compound.
    - a. Spray surface of forms left in place during curing period as frequently as drying conditions may require to keep concrete surfaces moist. For vertical surfaces, apply water to run down on inside of forms, if necessary, to keep concrete surfaces moist.

- b. Apply liquid curing compound immediately after form removal. Apply at rate recommended by manufacturer.
- G. Slabs (Flatwork)
  - 1. Start curing activities as soon as free water has disappeared from surface of concrete after placing and finishing.
  - 2. Wet cure slabs, which are to be covered with bonded concrete topping.
  - 3. Cure other flatwork using a liquid curing compound or wet cure.
    - a. All floor surfaces shown in the room finish schedule to be exposed concrete shall receive 2 coats of sealing and hardening compound applied in strict accordance with manufacturers recommendations. The first coat is applied upon completion of finishing the concrete. The second coat is applied upon completion of final cleanup. All areas shall be clean and free from laitance, dust, grease or oil. Contractors shall verify compatibility of sealing-hardening compound with any previously applied curing compounds. All floor surfaces to receive finishes shall be water cured.

#### 3.06 CONCRETE WALL FINISHES

- A. Type W-1:
  - 1. Fill snap-tie holes with non-shrink, non-metallic grout.
  - 2. Knock off projections.
  - 3. Patch honeycomb areas and rock pockets. Small air holes (less than 1/2 inch) do not require patching.
- B. Type W-3:
  - 1. Fill snap-tie holes with approved non-shrink, non-metallic color matched grout.
  - 2. Grind off projections, fins, and rough spots.
  - 3. Repair other defects such as honeycomb areas, rock pockets, and rough spots resulting from form release agent failure or other reasons with color matched non-shrink grout.
  - 4. Where surfaces are required to be painted as shown on the painting schedules, the surfaces shall be sandblasted in addition to steps 1 through 3.
- C. Type W-4, Rubbed Wall Finish:
  - 1. Only water curing will be permitted on walls being rubbed unless an approved dissipating curing compound is approved.
  - 2. Grind off projections, fins, and rough spots.
  - 3. Repair defects such as honeycomb areas, rock pockets, and rough spots resulting from form release agent failure or other reasons.
  - 4. Perform rubbing immediately upon completion of curing operation, and finish no later than 5 days after curing has been completed.
  - 5. The mortar shall be a mixture of cement and silica sand in proportions used in concrete being finished.
    - a. Spread mortar uniformly over entire surface using a sponge float, filling air voids and imperfections level with adjacent concrete surface. It is the intent to provide a light texture finish on the concrete surface without "plastering" the surface. Finish wall uniformly by floating in a circular motion or pattern.
- D. Type W-5, Abrasive Blast Sandblast:

- 1. Intent of this procedure is to remove surface skin to a depth no more than 1/16 inch, and expose only fine aggregate and air holes near the surface, thus producing a uniform texture and matching approved sample or mockup panel.
- 2. Perform sandblasting within 7 days after end of curing period of concrete.
- 3. Sandblast areas at same age or within +2 days of same age.
- 4. The same person shall accomplish sandblasting on one structure.
- 5. Abrasive: Use clean silica sand free of foreign material sand supplied in sealed sacks.
- 6. Blast surface with 100 psi air pressure at rate of 2 to 3 square feet per minute with nozzle held approximately 2 feet from surface and perpendicular thereto.
- 7. Modification of procedure will acceptable if proven on sample and mockup panel.

#### 3.07 CONCRETE SLAB FINISHES

- A. General:
  - 1. Do not excessively use "jitterbugs" or other special tools designed for the purpose of forcing coarse aggregate away from the surface and allowing a layer of mortar to accumulate.
  - 2. Do not dust surfaces with dry materials.
  - 3. Thoroughly compact slabs and floors by vibration.
  - 4. Round off all edges of slabs and tops of walls with a steel edging tool, except where a cove or chambered finish is shown. Steel edging tool radius shall be 1/4-inch for all slabs subject to wheeled traffic.
  - 5. After applying the final floor finish and after curing as specified in Section "Curing," cover slabs with Visqueen or other material to keep floor clean and protect it from material and damage due to other construction work.
- B. Type S-1, Concrete Slab Finish Steel Troweled Finish:
  - 1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation shown.
  - 2. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, float to true, even plane with no coarse aggregate visible.
  - 3. Use sufficient pressure on floats to bring moisture to surface.
  - 4. After surface moisture has disappeared, trowel concrete to produce smooth, impervious surface, free from trowel marks.
  - 5. Burnish surface with an additional troweling. Final troweling shall produce a ringing sound from trowel.
  - 6. Do not use dry cement or additional water during troweling. Excessive troweling will not be permitted.
  - 7. Power finishing:
    - a. An approved power machine may be used in lieu of hand finishing for finishing concrete floors and slabs in accordance with directions of machine manufacturer.
    - b. Do not use power machine when concrete has not attained the necessary set to allow finishing without introducing high and low spots in slab.
- C. Type S-2, Slab Finish Float:
  - 1. Finish slabs to receive fill and mortar setting beds by screeding with straightedges to bring surface to required finish plane.
  - 2. Float slab to compact and seal surface.

- 3. Remove all laitance and leave surface clean.
- D. Type S-3, Ceilings:
  - 1. When forming is removed, grind off projections on underside of slab, repair rock pockets and honeycomb area defects including small shallow air pockets.
  - 2. If underside of slab is exposed to view finish as per W-4 or W-5.
- E. Type S-6, Sidewalk & Exterior Slab Finish:
  - 1. Slope walks down 1/4 inch per foot away from structures, unless otherwise shown.
  - 2. Strike off surface by means of strike board and float to a true plane.
  - 3. Broom surface at right angles to direction of traffic.
  - 4. Lay out surfaces in blocks with an approved grooving tool sawcut as shown or as directed by Engineer.
- F. Type S-7 for Clarifier
  - 1. Finish.
  - 2. Provide coarse broom finish for grout as specified or Section 03 60 00, Grout.
- G. Concrete Curb:
  - 1. Grade subgrade to proper elevation and compact.
  - 2. Securely stake and brace forms to true line at proper elevation.
  - 3. Place concrete as hereinbefore specified.
  - 4. Float top surface of curb smooth, and finish all discontinuous edges with steel edger.
  - 5. After concrete has taken its initial set, remove front form and give exposed surfaces an S-6 finish.

#### 3.08 CONCRETE FINISHES

- A. General
  - 1. Every type of concrete finishes and finish tolerances are listed even though some of the finishes are not used in this project so that the Contractor can see by comparison how each of required finish fits into the progressive finishes.
- B. Schedule of Concrete Finishes: The following schedule of concrete finishes is not intended to cover all areas of concrete finish, but to show some of the major areas of different types of finishes and tolerances.

#### **SCHEDULE OF CONCRETE FINISHES**

Area	Type of Finish	Required Form Tolerances
EXTERIOR WALL SURFACES		
Above grade when using a form liner (above a point 6"	W-5	W.B.
below finish grade)		
Above grade (above a point 6" below finish grade)	W-4	W.B.
Backfilled (below a point 6" below finish grade)	W-1	W.A.
INTERIOR WALL SURFACES		
Wet wells, basins, channels, and tanks	W-3	W.A.
Interior building walls	W-4	W.A.
EXTERIOR SLABS		
Roof slab (exposed and traffic use)	S-6	S.B.
Roof slab (backfilled above)	S-2	S.A.
Sidewalks, exterior slabs	S-6	S.A.
Stairs treads and landings	S-6	S.B.
INTERIOR SLABS		
Floor slab (building)	S-1	S.B.
Wet well, aeration basin, and channel	<b>S-1</b>	S.A.
Clarifiers	S-7	S.A.
Stairs and landings	S-6	S.A.
Ceilings	S-3	S.A.
BEAMS AND COLUMNS		
Beams	B-1 or B-2	B.A.
Columns	C-1 or C-2	C.A.
MISCELLANEOUS SURFACES		
Curbs	S-6	W.A.
Equipment pads (interior and exterior)	S-1 Horizontal Surfaces W-4 Vertical Surfaces	S.A.
Non-accessible wall surfaces	W-1	W.A.
3.09 BEAMS AND COLUMN FINISHES		
A. Type B-1:		
1. Knock off all fins and projections.		
2. Repair all rock pockets and honeycomb areas.		
B. Type B-2; exposed to view		
1. Grind beams to remove all form marks.		

- 1. Grind beams to remove all form marks.
- 2. Repair all rock pockets and honeycomb areas.
- 3. Finish as per type W-4.

#### C. Type C-1:

- 1. Knock off all fins and projections.
- 2. Repair all rock pockets and honeycomb areas.

- D. Type C-2; Exposed to view
  - 1. Grind column to remove all form marks.
  - 2. Repair all rock pockets and honeycomb area.
  - 3. Finish as per type W-4.

#### 3.10 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Sampling and testing for quality control during concrete placement shall conform to ASTM E329 and shall include the following:
  - 1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
    - a. Slump: ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
    - b. Air Content: ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
    - c. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 degrees F (4 degrees C) and below, when 80 degrees F (27 degrees C) and above, and one test for each set of compressive-strength specimens.
    - d. Compression Test Specimen: ASTM C31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
    - e. Compressive-Strength Tests: ASTM C39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
  - 2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch, if fewer than five are used.
  - 3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
  - 4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- B. Test results will be reported in writing to Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- C. Nondestructive Testing

Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

D. Additional Tests

The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

E. The cost of testing services shall be included in the lump sum base bid price.

#### 3.11 REPAIR OF LEAKS

- A. If leaks are observed, they shall be repaired as follows:
  - 1. Locate and mark leaking areas.
  - 2. The leaking areas shall be inspected for recommendations by a representative of a manufacturer that specializes in concrete repair systems.
  - 3. Recommendations shall be submitted for approval of the type of concrete repair method required to correct the leaking areas for the life of the tank.
  - 4. Upon approval of the concrete repair methods and materials, repair the leaking areas accordingly.
  - 5. After repair, the structure shall be re-tested as above. Testing and repair shall continue until all leaks or moist spots have disappeared to the satisfaction of the Engineer.

#### - END OF SECTION -

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## 05

### **DIVISION 05**

METALS

#### **SECTION 05 50 00**

#### METAL FABRICATIONS

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section included providing miscellaneous metal work including HVAC and electrical supports as shown on drawings, as specified herein, and as needed for complete installation.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 09 90 00, Painting and Special Coatings
  - 3.
- 1.02 REFERENCE STANDARDS
- A. American Society for Testing and Material (ASTM):
  - 1.
     ASTM A36
     Spec. for Structural Steel.
  - 2. ASTM A48 Gray Iron Castings.
  - 3. ASTM A53 Spec. for Welded and Seamless Steel Pipe.
  - 4. ASTM A123 Spec. for Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.
  - 5. ASTM A153 Spec. for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 6. ASTM A307 Spec. for Carbon Steel Externally and Internally Threaded Standard Fasteners.
  - 7. ASTM A325 Spec. for High-Strength Bolts for Structural Steel Joints.
  - 8. ASTM A500 Spec. for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - 9. ASTM A615 Spec. for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  - 10. ASTM D2146 Spec. for Propylene Plastic Molding and Extrusion Materials.
- B. American Welding Society (AWS):
  1. AWS D1.1 Structural Welding Code Steel.

#### 1.03 DELIVERY, STORAGE AND HANDLING

A. Tag miscellaneous metals including anchor bolts, concrete anchors, sleeves and bases for ease of identification at site.

#### 1.04 SUBMITTALS

- A. Submit the following:
  - 1. Material sizes, connections, anchors and painting.
  - 2. Installation procedures.

#### PART 2 - PRODUCTS

2.01 MATERIAL

- A. Steel Plates and Shapes shall conform to ASTM A36.
- B. Steel Pipe shall conform to ASTM A53, Grade B
- C. Structural Tubing shall conform to ASTM A500, Grade B
- D. Aluminum Structural Shapes and Plates shall conform to Alloy 6061-T6
- E. Interior Stainless shall conform to Type 304 or 316 Exterior or Submerged stainless steel shall be Type 316
- F. Connection Bolts:
  - 1. Structural Steel: ASTM A325.
  - 2. Wood: 316 Stainless Steel.
  - 3. Aluminum: 316 Stainless Steel.
- 2.02 FABRICATION & FINISH
- A. Connections
  - 1. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items required for fabrication and erection.
  - 2. Weld shop connections.
  - 3. Bolt or weld field connections.
- B. Workmanship
  - 1. Grind exposed welds to 1/8 inch minimum radius.
  - 2. Grind burrs, jagged edges, and surface defects smooth.
  - 3. Use bolt length such that bolt does not project more than  $\frac{1}{4}$  inch beyond face of nut.
- C. Galvanizing
  - 1. Galvanize after fabrication, in accordance with ASTM A123 or A153, as applicable.
  - 2. Ship and handle to avoid damaging zinc coating.
  - 3. Repair field damaged galvanizing as specified in 3.08 of this specification.
- D. Painting
  - 1. Painting shall be as specified in Section 09 90 00, Painting and Special Coatings.
- 2.03 MANHOLE STEPS
- A. Steps shall be steel reinforced plastic.
- B. Plastic shall be a polypropylene conforming to ASTM D2146.
- C. Reinforcement shall be a deformed <sup>1</sup>/<sub>2</sub> inch diameter bar (minimum) conforming to ASTM A615, Grade 60.
- D. Minimum design live load shall be a single concentrated load of 300 lbs. when in place.
- E. Minimal dimensions:
  - 1. 12 inches wide.

- 2. Project 5 to 7 inches from wall.
- 3. Space 16 inches on center.

#### 2.04 ANCHOR BOLTS

- A. Anchor bolts for equipment and machinery, where permanently anchored into concrete, shall be Type 316 stainless steel. The diameter, length, and any bend dimensions shall be as required by the equipment or machinery manufacturer. Unless otherwise required, use 3/4-inch minimum diameter and other geometry shown on the drawings. Furnish a minimum of two nuts and a washer of the same material for each bolt.
- B. Anchor bolt sleeves shall be polyethylene, length as required by the equipment or machinery manufacturer, Wilson Anchor Bolt Sleeve Co., or equal.

#### 2.05 STAINLESS STEEL FASTENERS LUBRICANT (ANTI-SEIZING)

A. Where stainless steel nuts and machined bolts, anchor bolts, concrete anchors, and all other threaded fasteners are used, Contractor shall apply an anti-seizing lubricant to the threads prior to making up the connections. The lubricant shall contain substantial amounts of molybdenum disulfide, graphite, mica, talic, or copper.

#### 2.06 ANCHORING SYSTEMS FOR CONCRETE

- A. Wedge Anchors:
  - 1. Wedge anchors shall be 100 percent 316 stainless steel and shall not be used below a point 1 foot 6 inches above the peak (maximum water surface in any water-holding structure. See adhesive anchors specified elsewhere in this Specification.
  - 2. Wedge anchors shall be 316 stainless steel, manufactured by ITT Phillips Drill Division, Michigan City, IN; Hilti Kwik-Bolt, stud type, manufactured by Hilti, Inc., Stamford, CT; Weg-It, stainless steel bolts, completely assembled, manufactured by Wej-It Corporation, Broomfield, CO; Parabolt Concrete Anchors, manufactured by Molly Division of Emhart Corp., Templ,e PA; or equal. Furnish sizes shown on Drawings. Provide ICBO (International Conference of Building Officials) or other similar building code organization recommendations regarding safe allowable design loads.

#### B. Expansion Anchors:

- 1. Expansion anchors shall be 316 stainless steel. In the wet or damp areas, use wedge anchors as specified above or epoxy anchors in submerged conditions as hereinafter specified; 316 stainless steel expansion anchors may be used as defined for stainless wedge anchors.
- 2. Self-drilling anchors, snap-off type or flush type. Provide anchors for use with stainless steel bolts. Non-drilling anchors shall be flush type for use with a bolt or stud type with projecting threaded stud. Provide ICBO or other similar code organizations' recommendations regarding safe allowable design loads. ITT Phillips Drill Division, Michigan City, IN; Hilti HDI Drop-In anchors, Hilti, Inc., Stamford, CT; or equal.
- C. Epoxy Anchors:
  - 1. Provide for anchoring metal components at or below a point 1 foot 6 inches above maximum water surface elevation in water-holding structures, or buried in earth conditions.

- 2. Anchor Rod: 316 stainless steel threaded rod free of grease, oil, or other deleterious material with a 45-degree chisel point.
- 3. Epoxy Adhesive:
  - a. Meet ASTM C 881, Type 1, Grade 3, Class A, B, or C.
  - b. Two-component, 100 percent solids, nonsag, paste, insensitive to moisture, designed to be used in adverse freeze/thaw environments, gray in color.
- 4. Mixed Epoxy Adhesive:
  - a. Nonsag paste consistency with ability to remain in a 1-inch diameter overhead drilled hole without runout, holding the following properties:
    - 1) Slant Shear Strength, ASTM C 881/882, No Failure In Bond Line, Dry/Moist Conditions: 5,000 psi.
    - 2) Compressive Strength, ASTM D 695: 14,000 psi minimum.
    - 3) Tensile Strength, ASTM D 695: 4,5000 psi.
    - 4) Heat Deflection Temperature, ASTM D 648: 136 degrees F, minimum.
- 5. Epoxy Adhesive Packaging:
  - a. Disposable, self-contained cartridge system capable of dispensing both epoxy components in the proper mixing ratio, and fit into a manually or pneumatically operated caulking gun.
  - b. Dispense components through a mixing nozzle that thoroughly mixes components and places epoxy at base of pre-drilled hole.
  - c. Mixing Nozzles: Disposable, manufactured in several sizes to accommodate sizes anchor rods.
  - d. Cartridge Markings: Include manufacturer's name, batch number, mix ratio by volume, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
- 6. Storage of Epoxy Adhesive:
  - a. Store epoxy cartridges on pallets or shelving in a covered storage area.
  - b. Control temperature above 60 degrees F and dispose of cartridges if shelf life has expired.
  - c. If stored at temperatures below 60 degrees F, test adhesive prior to use to determine if adhesive meets specified requirements.
- 7. Manufacturers:
  - a. Adhesives Technology Corp., 21850 88<sup>th</sup> Place South, Kent, WA 98031; Anchor-It Fastening Systems, HS 200 Epoxy Resin;
  - b. Or Equal.

#### 2.07 ANCHOR SYSTEMS FOR MASONRY WALLS

- A. Stainless steel sleeve anchor, Hilti HLC, or equal.
- B. Wedge anchors may be used in solid grouted masonry walls.
- C. Drive anchors are not acceptable.

#### 2.08 ANCHOR SYSTEMS FOR GYPSUM BOARD WALLS

A. Use Toggler bolt, Hilti, or equal.

#### 2.09 METAL WEIR PLATES, BAFFLES, AND SUPPORTS

A. Shall be 304 stainless steel, unless indicated otherwise, or furnished with equipment.

#### 2.10 ACCESS HATCHES

#### A. Frame

- 1. <sup>1</sup>/<sub>4</sub> inch min. channel aluminum with anchor flange around perimeter and neoprene cushion.
- 2. Bituminous coating on outside of frame.
- 3. Provide 1-1/2 inch drain coupling in the corner of the channel frame locate as shown on the plans. Provide all SCH. 40 PVC drainage piping as shown on the drawings.

#### B. Doors

- 1. <sup>1</sup>/<sub>4</sub>-inch minimum aluminum diamond plate, reinforced as required to support a 300 psf live load.
- 2. Counterbalanced for ease of operation.
- 3. Automatically lock in the open position.
- 4. Snap lock with removable handle.
- 5. Double leaf doors shall be fitted with 316 stainless steel chains on each end to guard opening when doors are open.
- 6. Access doors for valve vaults and meter vaults shall include ladder extension, Halliday L1E, Bilco "Ladder Up", or equal.
- C. Fall Protection Grating
  - 1. Hatches shall be provided with hinged, grating panel that operates independently of the access door. Panel shall be 300 PSI load rated, safety orange or yellow, lockable, and include a positive latch to maintain an upright position. Hinge shall be tamper proof. Panel shall be fiberglass or aluminum.
- D. Hardware
  - 1. Stainless Steel.

#### E. Guarantee

- 1. Manufacturer shall guarantee door to be free of defects in material and workmanship for period of five years.
- F. Acceptable Manufacturers
  - 1. Halliday, Bilco, or equal.

#### 2.11 CAST IRON CASTINGS

- A. Conform to the following:
  - 1. ASTM A48, Class 30.
  - 2. Free of blowholes, shrinkage, distortion, and other defects.
  - 3. Provide where shown on plans or schedule.
- B. Acceptable manufacturers.
  - 1. Neenah Foundry Company.
  - 2. East Jordan Iron Works, Inc.
  - 3. Or equal.
- 2.12 ALUMINUM CASTINGS

- A. Conform to the following:
  - 1. Free of blow holes.
  - 2. Free of blowholes, shrinkage, distortion, and other defects.
  - 3. Provide where shown on plans or schedule.
- B. Acceptable manufacturers.
  - 1. Neenah Foundry Company.
  - 2. East Jordan Iron Works, Inc.
  - 3. Or equal.

#### 2.13 ABRASIVE NOSINGS FOR CONCRETE STAIRS

- A. Except as otherwise indicated, provide flush type abrasive nosings on all stairs. Nosing shall consist of a homogeneous epoxy abrasive, with minimum 50 percent aluminum base. The epoxy abrasive shall extend over and form the curved front edge of the nosing to a depth of at least 1/2 inch. The base of the nosing shall be extruded aluminum alloy, 6063-T5, heat-treated. All aluminum surfaces in contact with concrete or dissimilar metals shall be coated as specified in Section 09 90 00, Painting.
- B. Anchoring system shall be double-set anchors consisting of two rows of integrally extruded anchors.
- C. Nosings shall be protected with a factory applied heavy-duty polyethylene cloth moisture-proof tape.
- D. Size shall be 3-inch wide by 3/8-inch thick by length which is 4 inches less than width of stair tread for cast-in-lace concrete stairs and 3/8 inches less than width of stair tread for concrete filled pan stairs.
- E. Color shall be as indicated in the Finish Schedule.
- F. Supply Spectra Type WP-3J and WP-3C as manufactured by Wooster Products, Inc.; Amcolun Type BF3 and DSA3 as manufactured by American Abrasive Metals Company; or equal. Use first type listed for concrete filled pan treads and second type for cast-in-place concrete treads.

#### 2.14 CHECKERED PLAT & FRAMES

A. Aluminum: Alloy 6061-T6, tread plate, thickness as indicated, 1/4-inch minimum, fasten all accessories by welding or stainless steel bolts or screws.

#### 2.15 MISCELLANEOUS ITEMS

- A. Fabricate and finish miscellaneous steel framing, supports and items, including but not limited to the following:
  - 1. Lintels—hot dip galvanized.
  - 2. Equipment bases--painted.
  - 3. Guard Posts—hot dip galvanized.
  - 4. Bar Screens—stainless steel.
- B. Use plates, shapes, bars and tubing of the material, size, shape and arrangement indicated on the plans.

#### 2.16 ALUMINUM STAIRS

- A. Provide as detailed on plans.
- B. Include components such as framing, platforms, hangers, columns, struts, clips, brackets, bearing plates and platforms.
- C. Close ends of stringers with plates, continuously welded and ground smooth.

#### 2.17 LADDERS

- A. All ladders utilized on the project shall be of aluminum construction, unless specifically indicated otherwise on the Drawings.
  - 1. Aluminum: Fabricate the aluminum ladders with rails and rod rungs as shown. Punch inside face of rails, pass rungs through the rails, and weld as shown on the drawing. Fabricate brackets for fastening the ladder to the wall and weld to the ladder. Ladder shall conform to the applicable requirements of OSHA, the State Basic Safety Code, or other regulatory authority. Hot-dip galvanize steel ladder after fabrication.
  - 2. Ladder Safety Post: All ladders installed beneath sidewalk doors, roof hatches, skylights, or other floor or roof openings shall be equipped with a telescoping tubular safety post, spring balanced and automatically locking in the raised position, with release level for unlocking. Post shall be same material as ladder and spring mechanism shall be corrosion-resistant steel alloy. Post shall be Halliday L1E, Bilco "Ladder Up" safety post, or equal.

#### PART 3 - EXECUTION

- 3.01 GENERAL
- A. Workmanship and finish of all metalwork specified under this section shall be the highest grade and equal to the best practice of modern shop[s for the respective work. Exposed surfaces shall have smooth finish and sharp, well-defined lines. Provide all necessary rabbets, lugs, and brackets so that the work can be assembled in a neat, substantial manner. Conceal fastenings where practical. Drill metalwork and countersink holes as required for attaching hardware or other materials. Fabricate materials as specified. Weld connections, except where bolting is directed. Items requiring special fabrication methods are mentioned herein. Fabrication of all other items shall be of equal quality. Methods of fabrication not otherwise specified or shown shall be adequate for the stresses and as directed by the Engineer.
- B. Grind all exposed edges of welds smooth on walkways, guardrails, handrails, stairways, channel door frames, steel column bases, and where indicated on the Drawings. All sharp edges shall be rounded to a 1/8-inch minimum radius; all burrs, jagged edges, and surface defects shall be ground smooth.
- C. Welds and adjacent areas shall be prepared such that there is 1) no undercutting or reverse ridges on the weld bead 2) no weld spatter on or adjacent to the weld or any other area to be painted, and 3) no sharp peaks or ridges along the weld bead. All embedded pieces of electrode or wire shall be ground flush with the adjacent surface of the weld bead.

1. Aluminum: Fabricate aluminum as shown, and in accordance with the Aluminum Association Standards and the manufacturer's recommendations as approved. Grind smooth sheared edges exposed in the finished work.

#### 3.02 WELDING

- A. The technique of welding employed, appearance, quality of welds made, and the methods of correcting defective work shall conform to codes for Arc and Gas Welding in Building Construction of the AWS and AISC. Surfaces to be welded shall be free from loose scale, rust, grease, paint, and other foreign material, except that mill scale, which will withstand vigorous wire brushing may remain. A light film of linseed oil may likewise be disregarded. No welding shall be done when the temperature of the base metal is lower than zero degrees F. Finished members shall be true to line and free from twists.
- B. All welding operators shall be qualified in accordance with the requirements of current AWS Standard Qualification Procedure D1.1, Chapter 5, and welders of structural and reinforcing steel shall be certified for all positions of welding in accordance with such procedure. Qualification test shall be run by a recognized testing laboratory at the Contractor's expense. Previous recent qualification by the State of Wisconsin will be acceptable.
- C. All welding operators shall be subject to examination for requalifications using the equipment, materials, and electrodes employed in the execution of the Contract work. Such requalification, if ordered by the Engineer, shall be done at the expense of the Contractor.
  - 1. Aluminum: Aluminum shall be welded with Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) processes in accordance with the manufacturer's recommendations as approved, and in accordance with the recommendations of the American Welding Society contained in the Welding Handbook, as last revised. Grind smooth all exposed aluminum welds.

#### 3.03 INSTALLATION OF FABRICATED METALWORK

- A. Install in accordance with the shop drawings, the Drawings, and these Specifications. Perform field welding and erection work by skilled mechanics. Install fabricated metalwork plumb or level as applicable. The completed installations shall, in all cases, be rigid, substantial, and neat in appearance. Erect structural steel in accordance with the applicable portions of AISC Code of Standard Practice, except as modified. Install commercially manufactured products in accordance with manufacturer's recommendations as approved.
- B. Aluminum: Erection of aluminum shall be in accordance with the Aluminum Association. Mill markings shall not be removed from concealed surfaces. Exposed surfaces not otherwise coated shall have the inked or painted identification marks removed after the material has been inspected an approved by the Engineer.

#### 3.04 ANCHOR BOLTS

A. All anchor bolts shall be accurately located and held in a place with templates at the time the concrete is poured.

#### 3.05 CONCRETE ANCHORS

A. Installation shall not begin until the concrete or masonry receiving the anchors has attained its design strength. An anchor shall not be installed closer than six times it diameter to either an

edge of the concrete or masonry, or to another anchor, unless specifically detailed otherwise on the Drawings. Install in strict conformance with manufacturer's written instructions. Use manufacturer's recommended drills and equipment.

B. Epoxy Anchors: Do not install when temperature of concrete is below 35 degrees F or above 110 degrees F.

#### 3.06 ABRASIVE NOSINGS

A. Provide abrasive nosings on all concrete steps not being supplied or coated with alternate type of nosing or nonskid material.

#### 3.07 ACCESS COVERS

A. Covers shall be accurately and substantially positioned prior to placing concrete, such that the covers are flush with the floor surface. The covers shall be protected from damage resulting from concrete placement. Exposed surfaces shall be thoroughly cleaned of all concrete spillage such that a clean, uniform appearance is achieved.

#### 3.08 GALVANIZING AND REPAIR

- A. Galvanizing of steelplates, shapes, bars (and products fabricated from these items, and strip 1/8inch thick or thicker, shall conform to ASTM A 123. Pipe, welded or seamless steel, shall conform to ASTM A 120. Material thinner than 1/8 inch shall either be galvanized before fabrication in conformance with the requirements of ASTM A 525, Coating Designation G 210; after fabrication, in conformance with the requirements of ASTM A 123, except that the weight of zinc coating shall average not less than 1.2 ounces per square foot of actual surface area with no individual specimen having a weight of less than 1.0 ounce. Unless otherwise provided, galvanizing shall be done before or after fabrication, for material which is thinner than 1/8 inch, at the option of the Contractor. Galvanizing will not be required for stainless steel, monel metal, and similar corrosion-resistant parts.
- B. All welded areas shall be thoroughly cleaned prior to galvanizing to remove all slag or other material that would interfere with the adherence of the zinc. When it is necessary to straighten any sections after galvanizing, such work shall be performed without damage to the zinc coating.
- C. Galvanizing of chain link fence fabric, when specified or shown on the Drawings, shall conform to ASTM A 117.
- D. In like manner, galvanizing of iron and steel hardware, and nuts and bolts, shall conform to ASTM A 153. Galvanizing shall be performed after fabrication. Galvanizing of tapped holes will not be required.
- E. Fabrication shall include all operations such as shearing, cutting, punching, forming, drilling, milling, bending, welding, and riveting.
- F. Components of bolted assemblies shall be galvanized separately before assembly.
- G. The minimum pitch diameter of the threaded portion of all bolts, anchor bars, or studs shall conform to ANSI B1.1, having Class 2A tolerance before galvanizing. After galvanizing, the

pitch diameter of the nuts or other internally threaded parts may be tapped over ANSI B1.1, Class 2B tolerance, by the following maximum amounts:

3/8 inch through 9/16 inch	0.016-inch oversize
5/8 inch through 1 inch	0.023-inch oversize
1-1/8 inch and larger	0.033-inch oversize

- H. Galvanized surfaces to be painted shall be prepared in the field in accordance with Section 09 90 00 Painting.
- I. Except for inlet grates not otherwise required to be welded, all edges of tightly contacting surfaces, where galvanized is required, shall be completely sealed by welding before galvanizing.
- J. Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired by solvent cleaning the damaged area (Steel Structures Painting Council SP 1) and hand or power tool (Steel Structures Painting Council SP 2 or SP 3) the damaged areas, removing all loose and cracked coating; after which the cleaned areas shall be painted with one of the following coatings:
  - 1. One coat of Inorganic Zinc Silicate (MIL-P-23236, Class 3).
  - 2. Two coats of Galvanizing Repair Paint (MIL-P-21035).
  - 3. Two coats of Zinc Dust Paint (MIL-E-15145, Formula 102).
- K. Paint shall be applied to a cleaned surface. Abrasive blasting is required for inorganic zinc silicate.

#### 3.09 ELECTROLYTIC PROTECTION

A. Where aluminum is in contact with dissimilar metals, or to be embedded in masonry or concrete, protect surfaces in accordance with Section 09 90 00, Painting. Allow paint to dry before installation of the material. Protect painted surfaces during installation; should coating become marred, prepare and touch up surface per paint manufacturer's instructions.

#### 3.10 PAINTING

A. Thoroughly clean all ferrous metal items and give a shop coat of metal primer. Preparation of surfaces and application of primer shall be in accordance with the paint manufacturer's printed directions and recommendations as approved; and in accordance with Section 09 90 00 Painting, utilizing the appropriate painting system.

#### 3.11 PREPARATION FOR SHIPMENT

A. Insofar as is practical, the items provided hereunder shall be factory assembled. The parts and assemblies that are necessity shipped unassembled, shall be packaged and clearly tagged in a manner that will protect the materials from damage, and facilitate the identification and final assembly in the field.

- END OF SECTION -

## 09

### **DIVISION 09**

**FINISHES** 

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#### **SECTION 09 90 00**

#### PAINTING AND SPECIAL COATINGS

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This section includes the methods and materials to be used for all exterior and interior painting work.
- 1.02 QUALITY ASSURANCE
- A. Materials shall be used in conformance with the instruction of the manufacturer or supplier.
- B. Where painting materials will come in contact with potable water, manufacturer shall provide current written acceptance for their coating system from the state's governing authority.
- C. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
- D. Perform surface preparation and painting in accordance with recommendations of SSPC PA 3, Guide to Safety in Paint Applications.
- 1.03 SUBMITTALS
- A. Submit the following data:
  - 1. Name of contractor or subcontractor who will perform painting, coating or surface preparation work.
  - 2. Name of manufacturer of coating materials together with a list of materials to be used and the mil thickness to be applied.
    - a. Material list shall give brand name and generic type.
    - b. Material list shall identify primer required.
  - 3. Supply two copies of color chart for Owner's selection.
- 1.04 JOB CONDITIONS
- A. Environmental Requirements.
  - 1. Temperature.
    - a. Follow manufacturer's instructions for system being applied.
  - 2. Atmospheric conditions.
    - a. Paint shall not be applied to wet or damp surfaces.
    - b. Paint shall not be applied during rain, snow, fog, or mist.
    - c. The temperature shall be at least 5 degrees above the dew point. Minimum application and substrate temperatures shall be as recommended by the manufacturer for the product being used.
    - d. Dew or moisture conditions should be anticipated and if such conditions are prevalent, exterior painting shall be delayed until conditions are dry.
    - e. Exterior painting should be completed well in advance of probable time of day condensation will occur, in order to permit the film an appreciable drying time prior to formation of moisture.

3. All piping, equipment, structures, and appurtenances shall be coated prior to being placed into service.

#### PART 2 - PRODUCT

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Wasser, PPG, Sherwin Williams, Devoe Coatings, International Coatings, or equal. All moisture-cured urethanes shall be Wasser.
- 2.02 PAINTING SYSTEMS

Table 1
Coating Systems For Application On Concrete And Concrete Block

System Type	Application	Generic Type	Finish Coat	Primer Coat	Min Dry mil Thickness	Surface Preparation
C-1	Concrete Concrete Block, in Corrosive Environments	Polyamide Epoxy	Polyamide Epoxy (Color as Selected by Owner)	Concrete: Self- priming Block: Polyamide Primer	6-8 mils DFT per coat	Concrete: Allow new concrete to cure for 28 days. Prepare surface per Section 03300 and per manufacturer's instructions. Temperature must be 50° and rising unless an approved accelerator is added.
						Block: Allow mortar to cure for 28 days. Level protrusions and splatter. All surfaces must be clean and dry.
						Concrete surface must be cured 28 days. Moisture content at the surface shall be less than 5 %.
C-2	Concrete Floors	Polyamide Epoxy	Polyamide Epoxy (Color as Selected by Owner)	Polyamide Epoxy (Color as Selected by Owner) Thinned per manufacturer's instructions	6-8 mils DFT per coat	Concrete: Allow new concrete to cure for 28 days. Prepare surface per Section 03300 and per manufacturer's instructions.
						All surfaces must be clean and dry.
						Concrete surface must be cured 28 days. Moisture content at the surface shall be less than 5 %.

System		Generic	Finish	Primer	Min Dry mil	Surface
Туре	Application	Туре	Coat	Coat	Thickness	Preparation
C-3	Interior Concrete Walls, Ceilings, and Concrete Block	Latex	Vinyl Acrylic Latex (Eggshell) Color as selected by owner.	Concrete and Concrete Block: Latex Block Filler	Concrete and Block: Block filler plus two finish coats. 150 sq. ft./gal primer coat 200 sq. ft./gal	Concrete: Allow new concrete to cure for 28 days. Brush-off blast. Block: Allow mortar to cure for 28 days. Level protrusions and splatter. All surfaces must
					finish coats	be clean and dry.
C-4	Exterior Concrete & Masonry	100% Acrylic Elastomeric	100% Acrylic Elastomeric	Acrylic Latex Alkali Resistant Primer	2 mils primer 7 mils per coat. 2 coats 16 total	Follow manufacturer's instructions
C-5	All Exposed, Nonsubmerged, Unpainted, Exterior Masonry Surfaces	Concrete Block and Brick: Silane based sealer.	NA	NA	NA	Note: Apply two coats per manufacturer recommendations
C-6	Below grade exterior building walls	Cold- applied tar damp- proofing	W.R. Meadows Sealmastic Brush or Spray-on	NA	NA	Concrete surface shall be clean & free of all loose material.
C-7	Concrete, submerged to 6 inches above high water line	Polyamide Epoxy	Polyamide Epoxy	Concrete: self priming	6 primer 6 finish 12 total	Concrete: Allow new concrete to cure for 28 days. Brush-off blast. Apply per manufacturer's instructions.
C-8	Concrete, chemical containment areas	Polyamide Epoxy	Polyamide Epoxy	Concrete: self priming	6 primer 6 finish 12 total	Concrete: Allow new concrete to cure for 28 days. Brush-off blast. Apply per manufacturer's instructions.

## Table 2 Coating Systems For Application On Metal And Plastic

System		Generic	Finish	Primer	Min Dry mil	Surface
Туре	Application	Туре	Coat	Coat	Thickness Per Coat	Preparation
M-1	Non-Submerged Indoors and Outdoors	Polyamide Epoxy and Urethane	(Color as Selected by Owner)			Steel SSPC-SP6
		(exterior only)	Interior: One coat Epoxy	One coat Epoxy	5 primer 5 finish 10 total	
			Exterior: One coat Urethane	One coat Epoxy	5 primer (epoxy) 3 finish (urethane) 8 total	
M-2	Submerged or Intermittently Submerged (Except potable water).	Polyamide Epoxy	Polyamide Epoxy	Polyamide Epoxy	4 Primer 6 Intermediate 6 Finish 16 total	Steel immersion. Service: SSPC-SP10
M-3	Electrolytic Protection for Aluminum	Polyamide Epoxy	Polyamide Epoxy	Polyamide Epoxy	6 Mils	SSPC-SP1 Solvent Cleaning

Table 3Coating System For Application On Piping Systems

System		Generic	Finish	Primer	Min Dry mil	Surface
Type Application		Туре	Coat	Coat	Thickness Per Coat	Preparation
P-1	Non Submerged Iron Steel & Plastic	Polyamide Epoxy	One Coat Epoxy	One Coat Epoxy	6 primer 6 finish	Iron & Steel: SSPC – SP6
	fion steer & r lastic	проху	Color as selected	Ероху	12 Total	510
			by Owner.			Factory apply universal primer verify compatibility with epoxy finishes
						Plastic: Solvent Clean all surfaces
P-2	Submerged Iron, Steel	Polyamide Epoxy	One Coat Epoxy	One Coat	4 primer 6 intermediate 6 finish 16 Total	SSPC-SP10
P-3	Non-submerged Iron & Steel Insulated Exposed	Polyamide & Acrylic Latex	Acrylic Latex Color as selected	Polyamide Epoxy	1 primer on piping 2 finish coats on insulation	All surfaces shall be clean & dry.
			by Owner.			

 Table 4

 Coating Systems For Application On Wood and Gypsum Wallboard

System Type	Application	Generic Type	Finish Coat	Primer Coat	Min Dry mil Thickness Per Coat	Surface Preparation
A-1	Interior Plaster or Drywall Surface	Latex	2 <sup>nd</sup> Coat: Satin, Latex enamel 3 <sup>rd</sup> Coat: Satin, Latex enamel "orange peel" finish.	1 <sup>st</sup> Coat: Vinyl latex Primer sealer.		Dry, Sanded
A-2	Exterior Stained Wood	Alkyd	2 <sup>nd</sup> Coat: Alkyd base semi- transparent or solid stain (Selection by Owner)	1 <sup>st</sup> Coat: Alkyd base semi- transparent or solid stain.		Dry, Sanded
A-3	Interior Stained Wood	Polyurethane	*3 <sup>rd</sup> Coat: Satin, polyurethane varnish finish *4 <sup>th</sup> Coat: Satin, polyurethane varnish finish *sand between coats	1 <sup>st</sup> Coat: Oil- Based Wood stain 2 <sup>nd</sup> Coat: Satin, polyurethane varnish finish		Fill open grained wood with paste wood filler tinted to shade of wood stain prior to staining.
A-4	Interior Painted Wood	Latex	2 <sup>nd</sup> Coat: Semi- gloss Latex enamel 3 <sup>rd</sup> Coat: Semi- gloss Latex enamel	1 <sup>st</sup> coat: Alkyd enamel undercoater		Dry, Sanded

#### PART 3 – EXECUTION

#### 3.01 COLOR CODING AND LABELING OF PIPING AND EQUIPMENT

- A. Color Coding
  - 1. Primer color shall be at least two shades lighter in color than the finish to facilitate adequate inspection of field application.
  - 2. The following color code shall be applied for all piping exposed to view in all installations.

installations.	
Aeration Air	OSHA Safety Green
Acid Drain and Vent	International Orange
Chemical Solutions	OHSA Safety Orange
Chlorine Solution & Vacuum	OSHA Safety Yellow
CONCENTRATED SLUDGE	BROWN
Potable Water	Blue
Digested Sludge	Brown
Equipment Drain	Gray
ENGINE EXHAUST	NOT COATED
Equipment Vent	Gray
Fuel Supply &Return	Black
Grit	Gray
Hot Water & Tempered Water	Blue
Instrument Air	OSHA Safety Green
Mixed Liquor	Brown
Nonpotable Water	Blue with 6-inch wide red bands at 30 inch on center
LIQUIFIED PROPANE GAS	ORANGE
Pumped Drainage	Gray
Polymer	Light Green
Pumped Sanitary Drainage	Gray
Return Activated Sludge	Brown
Raw Sewage	Gray
Roof Drain	Gray
Service Air	OSHA Safety Green
Sanitary Drain & Vent	Gray
Secondary Effluent	Light Gray
Sample	Gray
Supermatant	Brown
Sulfur Dioxide Solution & Vacuum	OSHA Safety Red
Secondary Sludge & Scum	Brown
Tank Drain	Gray
Waste Activated Sludge	Brown

- B. Pipeline Identification
  - 1. The Contractor shall furnish and apply pipeline identification labels, complete, as required by this section for new lines shown on piping drawings. Refer to related documents for symbols and label identification.
  - 2. Size of Markers:
    - a. Markers for 3-inch OD and larger pipe (including insulation) shall be 2-inch standard label, self-sticking with numbers and letters as called for herein.
    - b. Markers for pipe under 3-inch OD (including insulation) shall be 1-inch standard label, self-sticking with numbers and letters as called for herein.
  - 3. Application of Pipe Markers:
    - a. Apply marker at main valves to show proper identification of pipe contents.

- b. Use an arrow marker with each pipe content marker. The arrow shall always point away from the pipe marker and in the direction of flow. If flow can be in both directions, use a double-headed arrow marker.
- c. Apply marker and arrow marker at every point of pipe entry or exit where pipe goes through wall if visible.
- d. Identify long continuous lines with pipe and arrow marker approximately every 30 feet.
- e. On horizontal pipe apply markers on the two lower quarters of the pipe where view is unobstructed. In this position, markers are read at a glance from floor level; and dust will not obscure the marker.
- f. Apply pipe marker and arrow marker on each riser and "T" joint.
- g. Provide a minimum of two markers per room, crawl space, or compartment.
- 4. References:
  - a. Brady Self-Sticking Industrial Products Catalogue, or as approved, conforming to ANSI A13.1 "Identification of Pipe Systems."
- 5. Identification Code Tabulation:
  - a. Yellow background with black letters for ANSI classified inherently hazardous materials: flammable, explosive, chemically active or toxic, extreme temperature or pressure, or radioactive.
  - b. Green background with white letters for ANSI classified inherently low hazard liquid or liquid admixture materials.
  - c. Blue background with white letters for ANSI classified inherently low hazard gas or gaseous admixture materials.
  - d. Red background with white letters for ANSI classified fire quenching materials such as water (for firefighting), foam, C02, halon, etc.
- C. Unloading Station Signs
  - 1. Contractor shall install double sided permanent steel signs and supports at the truck unloading station(s).

#### 3.02 PROTECTION OF FINISHED WORK, EQUIPMENT AND ITEMS NOT TO BE PAINTED

- A. Protect with tarpaulin or drop cloth all floors, walls, glass, finished painted work and equipment from paint spatter or other damage that might result from this work.
- B. Remove, mask, or otherwise protect machines surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.
- C. Promptly remove all oil, paint and solvent waste rags from the site and legally dispose of them. Do not bum waste materials.
- D. Paint, varnish, and mixing cans shall not be placed on bare floors.
- E. Dirty, oily, and dusty covers shall not be used.
- F. No stains or spots shall remain after completion of painting.
- G. Remove hardware accessories, light fixtures, and similar items before painting.
  - 1. Replace above items after finish coat is applied.
  - 2. Masking may be utilized in lieu of removal of items.

- A. Application may be by spraying, brushing, or rolling.
  - 1. Method used shall be one as approved by material manufacturer for any one particular product.
  - 2. Notify Engineer/Architect before proceeding as to method to be employed.
  - 3. Spraying:
    - a. Care shall be taken that nozzles are as recommended by supplier for product being applied.
    - b. Air pressure recommended by product supplier shall be maintained.
  - 4. Brushing:
    - a. Brush in one direction then smooth at right angles to original brushing to produce a uniform thickness of coating.
  - 5. Thickness of Coating:
    - a. Where number of coats are indicated, it is intended to show the normal practice to obtain the proper dry mil thickness.
    - b. The dry mil film thickness shall be provided in all cases even though it may require more or less coatings than specified. Coating shall be applied in accordance with manufacturer's recommendations.
- B. Spray Painting Out of Doors
  - 1. Care should be taken that no spray falls on nearby structures.
  - 2. Spraying on exterior surfaces shall be confined to quiet days when it will not affect adjacent property.
  - 3. Contractor shall be responsible for any and all damage resulting from drifting spray.
- C. Ventilation when painting interior surfaces of tanks, pits, vaults or other enclosures.
  - 1. Contractor must provide adequate ventilation at all times.
  - 2. Ventilation shall be adequate to remove fumes, preventing injury to workmen, or possibility of accumulating volatile gases.

#### 3.04 PAINTING SCHEDULES

- A. Painting and coating work shall be performed in accordance with this specification, finish schedules shown on the plans, and as specified in corresponding specification section.
- B. The following surfaces shall be coated.
  - 1. New exposed ductile iron or steel pipe.
  - 2. New motors, bases, equipment, etc., contractor to verify compatibility with factory applied primer.
  - 3. New concrete surfaces as indicated on the plans.
  - 4. Finish schedule as indicated on plans.
- C. The following surfaces shall not be coated unless color coding is required by codes.
  - 1. Stainless Steel.
  - 2. Aluminum.
  - 3. Shop finished enameled surfaces.
  - 4. Galvanized steel (unless otherwise specified). Use galvanized steel primer if required to paint.

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# 10

**DIVISION 10** 

**SPECIALTIES** 

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#### **SECTION 10 14 00**

#### SIGNAGE

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: Provide plastic and metal signs as indicated.
- B. Related Sections and Divisions: Applicable provisions of the General Conditions shall govern work in this section.

#### 1.02 SUBMITTALS

- A. Submit the following:
  - 1. Indicate sign styles.
  - 2. Lettering font.
  - 3. Foreground and background colors.
  - 4. Locations.
  - 5. Overall dimensions of each sign.

#### PART 2 - PRODUCTS

- 2.01 CAUTION AND DANGER SIGNS
- A. Provide CAUTION and DANGER signs as listed on schedule.
- B. CAUTION signs shall be fiberglass with black letters on yellow background, Brady Systems, B-120, or equal.
- C. DANGER Signs shall be fiberglass with black letters and red and white Danger logo, Brady Systems, B-120, or equal.
- D. Sign sizes shall be as follows:
  - 1. A: 14-inch x 20-inch
  - 2. B: 10-inch x 14-inch
  - 3. C: 7-inch x 10-inch
  - 4. D:  $3-inch \times 5-inch$
- E. Sign types shall be as follows:

TYPE	<b>MESSAGE</b>	
I	"DANGER"	Automatic Equipment—May Start at Any Time
II	"DANGER"	480 Volts
III	"DANGER"	Non-Potable Water, Do Not Drink.
IV	"DANGER"	No Smoking
V	"CAUTION"	Ear Protection Require Beyond This Point
VI	"DANGER"	Keep Out – Wastewater Treatment Facility—No Trespassing
VII	"DANGER"	Chlorine Room—Poisonous Gas
VIII	"DANGER"	Sulfonator Room—Poisonous Gas

IX	"DANGER" Lockout Power at MCC Before Working on Equipment
Х	"DANGER" Confined Space. Enter by Permit Only.
XI	"DANGER" Non-Permit Confined Space. Authorized Personnel Only.

- XII "CAUTION" Check All Valves Prior to Operating
- 2.02 ROOM SIGNS
- A. Room signs shall be, W. H. Brady Co., B-909, or equal. Owner shall select Color.
- B. Sign shall incorporate handicap accessible symbol where applicable.
- 2.03 EQUIPMENT & VALVE TAGS
- A. Provide for equipment and valves with assigned tag numbers.
- B. Equipment tags:
  - 1. 2 inches minimum and 3 inches maximum high by 14 inches minimum and 18 inches maximum long.
  - 2. 2-ply plastic outdoor safety yellow, black letters, <sup>3</sup>/<sub>4</sub>-inch high minimum. Holes at end of each tag.
- C. Valve Tags:
  - 1. 2-inch round 2-ply plastic disks, outdoor safety yellow/black, 3/16-inch hold drilled at top, <sup>1</sup>/<sub>4</sub>-inch letters.
- D. Message on tags shall be equipment and valve names and tag number as shown in the plans and specifications or identified by owner.
- E. Attach equipment tags with stainless steel screws or rivets or self-adhesive tape.
- F. Attach valve tags using Seton or equal meter seals, 4-ply stainless steel with aluminum crimping seals, 12 inches in length.
- G. Equipment and valve tags shall be New Hermes Gravolply Ultra or equal.

#### PART 3 – EXECUTION

#### 3.01 INSTALLATION

- A. Caution and Danger Signs.
  - 1. Install signs after surfaces are finished, in locations as directed by the Engineer.
  - 2. Install signs in accordance with this specification and with manufacturer's instructions.
    - a. Interior clean, dry, flat surfaces: Mount signs using double coated foam tape.
    - b. Interior and exterior concrete and masonry surfaces: Mount signs using plastic anchors and stainless steel screws at each corner of sign. Provide plastic spacers on uneven surfaces so that sign is level and plumb.
    - c. Exterior metal surfaces: Mount signs using stainless steel self-tapping screws, one at each corner of sign.
    - d. Yard hydrants: Mount signs on aluminum, channel posts having 1/4-inch aluminum plates, same size as sign. Set post 4 feet into ground, embedded in 8-inch diameter concrete base.

#### Room Signs B.

- Provide room signs for all areas as shown on the drawings. 1.
- Install signs as directed by the Engineer. 2.

#### 3.02 **SCHEDULES**

- A.
- CAUTION and DANGER signsProvide CAUTION signs as follows:

TYPE	<b>SIZE</b>	LOCATION	<b>QUANTITY</b>
Х	В	Wet Well Hatch	1
XI	В	Valve Vault Hatch	1

- END OF SECTION -

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## 22

### **DIVISION 22**

PLUMBING

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#### SECTION 22 05 05

#### **GENERAL PIPING REQUIREMENTS**

#### PART 1 - GENERAL

#### 1.01 SUMMARY

A. Work included: This section includes the furnishing, installation and testing of piping systems, plumbing fixtures, and trim. Piping systems shall include pipe, pipe supports, anchors, fittings, valves and other appurtenances and the installation of in-line equipment and appurtenances furnished by others for process piping systems, plumbing systems and heating, ventilating and air conditioning systems.

#### B. Related Sections and Divisions:

- 1. Applicable provisions of the general conditions shall govern the work in this section.
- 2. Section 01 75 00 Starting, Testing and Operator Training.
- 3. Section 01 78 23 Operation and Maintenance Data
- 4. Section 09 90 00 Painting and Special Coating
- 5. Division 26 Electrical
- 6. Division 40 Process Integration

#### 1.02 CODES AND REGULATIONS

A. All piping work shall conform with all Federal and State and Local Codes and regulations. If codes or regulations conflict, the most stringent regulation shall apply.

#### 1.03 SUBMITTALS

- A. Submit shop drawings including but not limited to:
  - 1. Valves
  - 2. Floor Drains
  - 3. Piping
  - 4. Insulation
  - 5. Gauges
  - 6. Strainers
  - 7. Plumbing Fixtures
- B. Operation and maintenance manuals shall be provided in accordance with Section 01 78 23, Operation and Maintenance Data.
- C. Submit installation and training checklists in accordance with Section 01 78 43, Equipment, Installation, Training, and Receipt of Spare Parts Checklists.

#### 1.04 CUTTING & PATCHING

- A. All cutting and patching required to install the piping work shall be the responsibility of the Contractor.
- B. No beam or other structural member may be cut without the Engineer's approval.

#### 1.05 OPENINGS, CUTTING AND SLEEVES

- A. Sleeves shall be one inch larger than outside pipe diameter and of sufficient length to pass through entire floor or wall construction, including plaster. Sleeves shall be provided in accordance with Section 40 05 15, Methods and Materials for Pipeline Construction and the drawing details.
- B. Openings for piping in existing buildings shall be carefully drilled or cored to prevent unnecessary damage or weakening of any structural member. No structural member shall be cut without Engineer's approval. Chopping will not be permitted.
- C. Seal all openings between pipe and sleeve at each end with fiberglass and caulk opening with sealant. Provide seals at one end of sleeve passing through a fire rated wall or floor per Wisconsin Administrative Code.

#### 1.06 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

A. The work shall include all required water and drain connections to heating, ventilating, and air conditioning equipment, and any Owner's equipment requiring such connections.

#### 1.07 EQUIPMENT, INSTALLATION AND PROTECTION

- A. Erect equipment in neat workmanlike manner, align, level and adjust for satisfactory operation; install for easy maintenance, inspection, operation, and replacement.
- B. Mechanical equipment shall operate without objectionable noise or vibration. Piping shall be provided with flexible couplings to prevent noises or vibration transmission.
- C. The Contractor shall be responsible for care and protection of his work and equipment until installation is complete and accepted by the Owner.
- D. All open waste and vent piping must be capped air tight during construction to prevent foreign material from entering the sewer system or sewer gases from entering the building.

#### 1.08 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be new and of the make, type, size, and quality specified.
- 1.09 INSPECTION & TESTS
- A. The Contractor shall arrange for all necessary inspections and tests of piping systems as required by State and local authorities or as specified.

- B. The Contractor shall notify the Engineer when underground lines are ready for inspection and shall test all lines in the presence of the Engineer. After tests prove installation to be satisfactory, excavation may be backfilled.
- C. All labor and material for tests are the responsibility of the Contractor. All defective workmanship or equipment shall be replaced and retested at the Contractor's expense.
- D. Before testing piping systems, remove or isolate any equipment which may be damaged.
- E. Test all piping in accordance with Division 1.
- 1.10 CLEANING & DISINFECTION
- A. After satisfactory completion of pressure tests, before permanently connecting equipment, clean equipment thoroughly, blow and flush piping as required to remove foreign material.
- B. Disinfect all domestic water lines per the Wisconsin Administrative Code. Valve off and fill the system with a solution containing 50 PPM of chlorine and let stand for 24 hours or a solution containing 200 PPM of chlorine and let stand for 3 hours. Flush with clear water until no chlorine remains and test for bacteria. Submit report on final test indicating water sample free of bacteria.
- C. After all tests are made and the installed work found satisfactory, the contractor shall go over his work to clean all equipment, piping, conduit and leave all in a clean and complete working condition. Remove from site any and all debris that accumulated during installation of the work.
- D. All equipment specified with factory applied finish shall be wiped clean. If painted surface is scuffed or marred, touch up with paint approved for this service.

#### 1.11 IDENTIFICATION

A. All piping shall be painted and labeled in accordance with Section 09 90 00, Painting & Special Coatings.

#### 1.12 VALVE TAGS

- A. On completion of the work, furnish three glazed, framed, charts for all valves.
- B. The valve identification charts shall show numbers of valve locations and purpose of valve and shall agree with valves on record drawings.
- C. Attach to each valve a tag as described below. The numbers on the tags shall run consecutively to correspond with numbers on the chart. Tags shall be designated as follows: Cold Water (CW), Hot Water (HW), Hot Water Return (HWR), Non Potable Water (NPW), etc.
- D. Tags are to be brass or approved plastic material 2 inch diameter with 3/16 inch hole and 1 inch diameter brass ring. Numerals shall be 5/8 inch high and lettering shall be 1/4 inch high. If brass tags are used, the lettering shall be black. If plastic tags are used, they shall be black and white lettering. Tags shall be fastened to valve stems with short sections of beaded or linked brass chain.

E. The valve identification chart shall be typed. Provide copies of the valve chart in the maintenance manual.

#### PART 2 - PRODUCTS

- 2.01 GENERAL
- A. Approved manufacturer:1. Contractor's option with Engineer's concurrence.
- B. All materials and equipment furnished shall be current production of manufacturers regularly engaged in the manufacture of such items, and for which replacement parts are available. All materials and equipment shall be new (less than 1 year old when turned over to the Owner).
- C. Piping materials for the various piping and plumbing systems shall be in accordance with Section 40 05 15, Methods and Materials for Pipeline Construction.

#### 2.02 MANUFACTURERS

- A. Plumbing fixtures as manufactured by Kohler, American Standard, Crane, Eljer or equal.
- B. Brass products as manufactured by Engineered Brass Company, McGuire, Brasscraft, or equal.
- C. Faucets as manufactured by Chicago Faucet, Kohler Brass, Zurn Brass, Speakman Brass, or equal.
- D. Floor and wall cleanouts as manufactured by Schier, J.R. Smith, Josam, Zurn, Watts, or equal.
- E. Floor as manufactured by J.R. Smith, Josam, Zurn, Watts, or equal.
- F. Hose bibbs as manufactured by Woodford, Chicago, or equal.
- G. Emergency equipment as manufactured by Guardian, Bradley, Haws, Speakman, Encon, or equal.
- H. Insulation kits for barrier free lavatories and sinks as manufactured by Truebro, Inc., Brocar Products Inc., Pro Wrap, Insul-Guard, or equal.
- I. Water closet seats as manufactured by Bemis, Olsonite, Church or equal.
- 2.03 FINISHES
- A. All fixture colors to be white and finish to be chrome plated unless otherwise specified.
- B. Wall cleanouts to have flush stainless steel trim plate. Floor cleanouts to have nickel bronze covers.
- 2.04 PLUMBING FIXTURE LIST
- A. Water closets:
  - 1. WC-1: Kohler K-3481 Wellworth elongated toilet; Bemis 1955SS/C solid plastic seat; EBC No. CAH12X angle supply and stop with chrome plated escutcheon.

#### B. Lavatories:

- L-1: Kohler K-2196-4 Pennington lavatory; Chicago No. 802-VE2805CP faucet with No. 390 handles; Kohler K-77 15 perforated drain; EBC No. TA14O-B trap; EBC No. LA.H12K supplies with stops and chrome plated escutcheons.
- C. Emergency Eye Wash:
  - 1. EEW/SH-I: Guardian Model GCBF19O9 barrier free emergency eye/face wash shower station; 10" diameter stainless steel shower head; 1" U.S. made stay open brass ball valve epoxy powder coated orange stainless steel triangular pull handle; 1 ¼" schedule 40 brass pipe and fittings epoxy powder coated orange with floor flange epoxy powder coated orange (4) OS style spray heads shall have integral flip top dust covers with push type brass ball valve epoxy powder coated orange; 1¼" supply connection; emergency identification sign.

#### D. Hose Bibbs:

- 1. HB-1: Woodford #67 automatic draining hose bibb with integral vacuum breaker/backflow preventer.
- 2. HB-2: Woodford #24P-3/4 hose bibb with integral vacuum breaker/backflow preventer and metal wheel handle.
- E. Sampling Tap:
  - 1. Sampling tap shall be single sink faucet smooth end.
  - 2. Sampling tap shall be T&S Brass, Model B-0715, or equal.
- F. Utility Sink and Fixtures:
  - 1. Utility sink shall be a 20-gallon single compartment sink suitable for wall mounting including brackets, constructed of molded, structural plastic as manufactured by Fiat Products, or equal.
  - 2. Hot and cold water sink faucet and Chicago faucets Model 1100-GN8AE3-317AB
- 2.05 INSULATION
- A. All domestic hot, and cold water lines shall be insulated with nominal 1/2-inch wall thickness flexible elastomeric closed cell pipe insulation, Armstrong Armaflex, or approved equal (having flame spread rating of 25 or less).
- 2.06 VALVES
- A. Valves shall be as specified in Section 40 05 16.61 Valves Lift Stations.
- 2.07 VACUUM BREAKERS
- A. Vacuum breakers shall be atmospheric type, max. pressure 125 psi, max temp 212°F, meet ASSE Standards.
- B. Vacuum breaker shall be Appollo 30-203 for 1/2-inch and 30-204 for 3/4-inch.
- 2.08 GAUGES
- A. Acceptable manufacturers shall be Trerice, Ashcroft or equal.

- B. Furnish and install gauges where shown on the drawings or where required to perform start-up testing.
- C. All gauges shall be mounted such that they can be read from the floor.
- D. All gauges shall have pressure ranges as shown on the drawings. If no range is shown, the normal operating pressure shall fall between 50 and 80% of the full scale.
- E. All gauges shall be combination range gauges with inner scale in psi and outer scale in feet of water.
- F. All gauges for water and wastewater applications shall be a minimum 4-inch diameter stainless steel and liquid filled.
- G. Provide each gauge with a 316 stainless steel bourdon tube and a <sup>1</sup>/<sub>4</sub>-inch NPT bottom connection.
- H. Gauges for wastewater, sludge and chemical systems shall have factory installed diaphragm seals suitable for the application.
- I. Provide <sup>1</sup>/<sub>4</sub>-inch ball valve for isolation of all pressure gauges and switches.

#### 2.09 STRAINERS

- A. Acceptable manufacturers shall be Leslie Co or Bailey Co.
- B. Furnish and install strainers where shown on drawings. Size according to the drawings
- C. Unless otherwise noted provide cast iron 'Y' type strainers.
- D. Strainer shall have a bronze or carbon steel body rated for 125 psig.
- E. The strainer screen shall be 304 stainless steel or monel.
- F. The screen perforations shall be .045 inches for water service.
- G. Provide blow-off valve.

#### 2.10 FLEXIBLE CONNECTIONS

A. Provide twin spherical neoprene flexible connections with flange connections. Connectors shall be constructed of multiple layers of rubber and fabric reinforced with internally spirally wound tempered steel. Connectors shall be rated for 125 psig and 250°F operation. Flexible connection sizes and locations shall be as shown on the drawings.

#### 2.11 FLOOR DRAINS

- A. Floor drains shall be Zurn, or equal, as shown on the plans and in the Plumbing Fixture Schedule.
- B. Floor drains shall have 6-inch round, adjustable strainer top.

- C. Floor drains receiving pump drainage piping shall be provided with Zurn, or equal, funnel converter assembly.
- D. Provide polished bronze top grate for all floor drains.
- E. Each drain shall be provided with a trap.

#### 2.12 CLEAN OUTS

- A. Clean outs shall be Zurn, or equal, as shown on the plans and in the Plumbing Fixture Schedule.
- B. Each clean out shall have a dura-coated cast iron body, be adjustable to meet finished floor conditions, and be gas and watertight.
- C. Clean outs that are in elevated floors shall include a membrane flashing flange to prevent leakage to the lower floor.
- D. Provide brass covers for clean outs.
- 2.13 HANGERS AND SUPPORTS
- A. Hangers and supports shall be provided in accordance with Section 40 05 15, Methods and Materials for Process Piping Installation: Exposed.

#### PART 3 – EXECUTION

#### 3.01 INSTALLATION

- A. Unless otherwise specified, installation of piping shall be in accordance with Section 40 05 15, Methods and Materials for Process Piping Installation.
- B. The plumbing system shall be installed with hangers and supports in accordance with the Plumbing Code. Insulation saddles shall be used at supports of insulated piping.
- C. The plumbing system shall be installed in accordance with local plumbing requirements and applicable portions of Chapter SPS 382 of the Wisconsin Administrative Code. Where requirements conflict, the stricter standard shall apply.
- 3.02 FIELD QUALITY CONTROL
- A. Unless otherwise specified, testing shall be in accordance with Section 40 05 15, Methods and Materials for Process Piping Installation.
- B. Building drainage systems shall be tested and inspected in accordance with local requirements and Chapter SPS 382 of the Wisconsin Administrative Code hereinafter called Plumbing code

#### 3.03 FIELD MEASUREMENTS

A. Field verify all measurements. Do not base on contract drawings.

- B. Identify conflicts with the work of other trades prior to installation of work.
- C. Adjust system to satisfy field requirements.
- 3.04 DELIVERY, STORAGE AND HANDLING
- A. Receive, sign for and store all equipment in this section.
- B. Maintain original quality and condition of equipment while it is in storage.

#### 3.05 INSTALLATION

#### A. Floor Drains

- 1. Drains shall have "P" trap same size as drain. Set top perfectly level and at height to allow proper pitch of floors toward drain as scheduled on the drawing.
- 2. Provide safing material conforming to SPS 384.30(6) extending a minimum 12 inches beyond drain at all floor drains over excavated areas.
- B. Plumbing Fixtures
  - 1. Roughing-In Dimensions Install the fixtures to the roughing-in dimensions shown on the architectural plans.
- C. Water Closets
  - 1. Mounting: Closet bowl to be solidly fastened to closet carrier or floor flange by brass bolts with stainless steel caps. Closet bowl to have solid bearing on wall or floor. The closet bowl shall be thoroughly checked for level and for secure and substantial connection to the closet carrier or floor flange.
  - 2. Seal: Seal between closet bowl and closet carrier or floor flange to be made with molded wax ring gasket to ensure absolute gas and watertight seal.
  - 3. Water Connection: The water connection shall be made to the water closet with trim as specified. All exposed brass shall be chrome plated, and pipes to wall or floors shall be covered with chrome plated escutcheon plates and cover tube to fit pipe.
- D. Lavatories And Sinks
  - 1. Waste Connection Waste connection to be made with heavy chromium plated swing joint "P" traps. The "P" trap shall have standard iron pipe threads for connection to the building drainage system and slip joint with preformed neoprene or plastic gasket for connection to P.O. plug in lavatory.
  - 2. Escutcheon plates and cover tube of the proper size shall be installed between trap and wall.
  - 3. Water Connection The water connection shall be made to the lavatory with trim as specified. Rough-in all supply pipe stubs so that supply pipes to lavatory will run in a straight, vertical line from stops to faucets.
  - 4. All exposed pipe to walls or floors shall be chromium plated and have escutcheon plates.
- E. General
  - 1. All fixtures shall be set in a true and level manner with connection to soil, waste, vent, and water supply pipes. Adjust all valves, pack all stuffing boxes and leave work in a finished, clean and satisfactory working condition.

- 2. Protect all fixtures after they are set. This Division of the Work is responsible for them until the acceptance of the work, at which time all fixtures shall be in perfect condition and complete working order. Strictly advise all other Divisions to refrain from using toilets, especially before water connections have been made.
- 3. All bolting and fastening to walls, etc., must be with through type toggles and washer bolting. No screw and plug or expansion shield fastenings will be accepted. All fixture fastenings shall be made with steel bar supports and plates or other approved method.
- 4. At all wall hung lavatories and electric water coolers, Contractor must install thru going bolts in hole provided in bottom rear drapery to prevent lifting of front rim.
- 5. Seal all openings between floors, walls and fixtures with a mildew-resistant silicone sealant. Sealant shall be white for white fixtures and clear for colored fixtures.
- 6. Wall mounted fixtures shall be rigidly supported by a concealed hanger which is attached to structural members so that the load is not transmitted to the fixture drain connection or any other part of the plumbing system.
- 7. All countertop stainless steel sinks shall be set in a silicone caulk.
- F. Barrier Free Requirements
  - 1. All barrier free requirements shall comply with ICC/ANSI A 117.1 requirements and Wisconsin Building Code requirements.
  - 2. Water Closets: The height of barrier free water closets shall be 17" to 19" to the top of the toilet seat from finished floor. Flush controls shall be hand operated or automatic and shall be mounted on the wide side of the toilet area no more than 30" above the floor.
  - 3. Lavatories: Lavatories shall be mounted with the rim or counter surface no higher than 34" above finished floor and shall have a 29" clearance between finished floor and the bottom of the apron. Hot water and drain pipes under lavatories shall be insulated or otherwise configured to protect against contact and there shall be no sharp or abrasive surfaces under lavatories. Faucets shall have lever-operated, pushtype or sensor type controls and shall remain open at least 10 seconds.

#### 3.06 OWNER TRAINING

A. Provide minimum of one hour training on equipment operation.

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# 26

### **DIVISION 26**

ELECTRICAL

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#### **SECTION 26 05 00**

#### COMMON WORK RESULTS FOR ELECTRICAL

#### PART 1 GENERAL

#### 1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

#### 1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
  - 1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
    - a. NFPA 70 National Electrical Code.
  - 2. National Electrical Contractors Association (NECA), current edition.
    - a. NECA 1 Standard Practices for Good Workmanship in Electrical Contracting.

#### 1.03 DESCRIPTION OF WORK

- A. Furnish and install complete and operable electrical systems as indicated on the drawings and as specified herein
- B. Design Requirements:
  - 1. The table included in this section under Hardware Design Requirements specifies the usage requirements for the hardware and equipment specified in the following sections:
    - a. Section 26 05 29 Hangers and Supports for Electrical Systems
    - b. Section 26 05 34 Conduit
    - c. Section 26 05 37 Boxes
- C. Electrical Work Specified Elsewhere:
  - 1. Every attempt has been made to indicate in these specifications and drawings all work required under Division 26. However, there may be additional specific requirements in the specifications, drawings, or addenda of other trades which pertain to the work of this trade, and any such requirements are hereby made a part of the requirements for this trade.
- D. Design Intent:
  - 1. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.
  - 2. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or Drawings, the Contractor shall furnish the item, system, or workmanship that is the highest quality, largest, or most closely fits the design intent.
  - 3. Refer to the General Conditions of the Contract for further clarification of Design Intent.
  - 4. The details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

- 5. All sizes as given are minimum except as noted.
- 6. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to inspections, tests and approval from the commencement until the acceptance of the completed work.
- 7. Electrical requirements for equipment are based on design data. It shall be the responsibility of the Contractor to verify actual requirements with the provider of the equipment and adjust electrical installation based upon actual requirements.
- E. Substitution of Materials:
  - 1. Refer to General Conditions of the Contract.
  - 2. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the specified performance from the system into which these items are placed.
- F. Continuity Of Existing Services And Systems:
  - 1. No outages shall be permitted on existing systems except at the time and during the interval specified by the Owner and the Engineer. Any outage must be scheduled when the interruption causes the least interference with normal schedules and routines. No extra costs will be paid to the Contractor for such outages that must occur outside of regular weekly working hours.
  - 2. This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible.
- 1.04 RELATED SECTIONS
- A. Common Work Results for Electrical are applicable to all Division 26 sections.
- 1.05 SUBMITTALS
- A. Submit shop drawings in accordance with Division 01.
- B. Submittal Requirements for Division 26 Shop Drawings:
  - 1. Submit individual shop drawings for each section requiring submittal.
  - 2. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.
  - 3. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered or controlled equipment.
  - 4. Clearly notate any exceptions taken to these specifications.
  - 5. Do not release equipment for construction until submittal has been reviewed.
  - 6. Failure to comply with these requirements does not relieve the Contractor of responsibility for meeting the project schedule.
- C. Review of shop drawings constitutes acceptance of general design only and will not release the Contractor for fulfilling the terms and intent of the contract documents.
- D. Shop Drawings shall be prepared and submitted for the following work:
  - 1. Section 26 05 29 Hangers and Supports for Electrical Systems
  - 2. Section 26 05 34 Conduit
  - 3. Section 26 05 37 Boxes

- 4. Section 26 36 14 Portable Engine/Generator Set
- 5. Section 26 90 01 Lift Station Process Instrumentation & Control
- 1.06 FACTORY TESTING
- A. Refer to the requirements the individual technical sections.
- 1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS
- A. Submit operation & maintenance manuals and instructions in accordance with Division 01.
- B. Submittal Requirements for Division 26 Operation & Maintenance Manuals and Instructions:
  - 1. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
    - a. Copies of as-built submittals.
    - b. Wiring diagrams for electrically powered or controlled equipment
    - c. Records of tests performed to certify compliance with system requirements
    - d. Certificates of inspection by regulatory agencies
    - e. Parts lists for manufactured equipment
    - f. Preventive maintenance recommendations
    - g. Warranties
    - h. Additional information as indicated in the technical specification sections
    - i. 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.
- C. Operation & Maintenance Manuals and Instructions shall be prepared and submitted for the following equipment:
  - 1. Section 26 36 14 Portable Engine/Generator Set
  - 2. Section 26 90 01 Lift Station Instrumentation & Control
- 1.08 QUALITY ASSURANCE
- A. All work and materials shall conform to or exceed in every detail the applicable rules and requirements of the Wisconsin State Electrical Code Volumes 1 and 2, the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association standards, the National Electrical Safety Code, and present manufacturing standards (including NEMA).
- B. All work shall be performed under the direction of a State of Wisconsin Licensed Master Electrician.
- C. All materials shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system shall be so labeled.
- D. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
  - 1. Underwriters Laboratories Inc.

- 2. Electrical Testing Laboratories, Inc.
- E. Certificates And Inspections:
  - 1. Refer to the General Conditions of the Contract.
  - 2. Obtain and pay for all required inspections including but not limited to state or local electrical inspections and fuel tank inspections. Deliver original inspection certificates to the Engineer.
- 1.09 WARRANTY
- A. See Division 01 for additional requirements.
- 1.10 EXTRA MATERIALS
- A. See Division 01 for additional requirements.
- 1.11 DESIGN REQUIREMENTS
- A. The following table specifies the usage requirements for the hardware and equipment specified in the following sections:
  - 1. Section 26 05 29 Hangers and Supports for Electrical Systems
  - 2. Section 26 05 34 Conduit
  - 3. Section 26 05 37 Boxes

HARDWARE USAGE REQUIREMENTS					
ATMOSPHERE	CONSTRUCTION	CONDUIT	HARD WARE	BOXES	NOTES
General, Wet, New or Existing Construction	Exposed	RMCS	SS	NEMA 4X	1
Hazardous, Wet or Damp, New or Existing Construction	Exposed	RMCS	SS	NEMA 7	2
Underground, Wet, New or Existing Construction	Direct-Buried or Buried and Concrete Encased	RNC	N/A	N/A	3
NOTES:         1.       Applies to all exterior above-grade conduits and extending one foot below grade.         2.       Applies to new conduit systems in Class I. Division 1 and Class I. Division 2 rated areas					

- 2. Applies to new conduit systems in Class I, Division 1 and Class I, Division 2 rated areas.
- 3. Applies to all new below grade conduit systems.

#### PART 2 PRODUCTS

#### 2.01 ACCESS PANELS AND DOORS

- A. Lay-in Ceilings:
  - 1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration are sufficient; no additional access provisions are required unless specifically indicated.
- B. Drywall and Plaster Walls and Ceilings:
  - 1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for

use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needed service; minimum size is  $12 \times 12$  inch.

#### 2.02 SEALING AND FIRE-STOPPING

- A. Refer to Architectural requirements.
- B. Sealing and fire stopping of sleeves/openings between conduits, cable trays, wire ways, troughs, cable bus, bus duct, etc. and the structural or partition opening shall be the responsibility of the Contractor whose work penetrates the opening. Individuals skilled in such work shall perform the sealing and fire stopping.
- C. Whenever possible, avoid penetrations of fire and smoke rated partitions. When they cannot be avoided, verify that sufficient space is available for the penetration to be effectively fire and smoke stopped.
- D. Manufacturers:
  - 1. 3M, STI/SpecSeal, Tremco, or approved equal.
  - 2. The same manufacturer shall provide all fire stopping systems.
  - 3. The Contractor will be responsible for selecting the appropriate UL tested fire stop system for each application required on the project.
- E. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
- F. Contractor shall use fire stop putty, caulk sealant, intumescent wrap strips, intumescent fire stop collars, fire stop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
- 2.03 NON-RATED PENETRATIONS
- A. Conduit Penetrations Through Below Grade Walls:
  - 1. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.
- B. Conduit and Cable Tray Penetrations:
  - 1. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

#### PART 3 CONSTRUCTION METHODS

- 3.01 FIELD MEASUREMENTS
- A. The Contractor shall obtain from the appropriate trades and review shop drawings for all equipment requiring electrical connections.
- B. Field verify all measurements. Do not base electrical installation or equipment locations on the contract drawings.

- C. Identify conflicts with the work of other trades prior to installation of electrical system.
- D. Electrical installation shall be based upon shop drawing requirements and field verified measurements. Adjust electrical system installation to satisfy field requirements.
- 3.02 DELIVERY, STORAGE, AND HANDLING
- A. Accept electrical equipment on site. Inspect for damage.
- B. Protect electrical equipment from weather, corrosion, and entrance of debris.
- 3.03 INSTALLATION
- A. Excavation And Backfill:
  - 1. Perform all excavation and backfill work to accomplish indicated electrical systems installation in accordance with other sections of this specification.
- B. Concrete Work:
  - 1. Coordinate the quantity and location of all cast-in-place concrete work with the architectural drawings.
  - 2. All cast-in-place concrete will be performed by the General Contractor unless noted otherwise. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.
- C. Cutting And Patching:
  - 1. Cutting and patching shall be performed in accordance with the requirements for architectural work. Refer to other sections of these specifications.
- D. Building Access:
  - 1. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.
- E. Equipment Access:
  - 1. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish access doors and arrange for installation bt appropriate trades.
- F. Working Clearances:
  - 1. Minimum installed equipment working clearances as required by the NEC shall be maintained.
  - 2. Minimum required dedicated electrical equipment space as required by the NEC shall be maintained.
  - 3. Coordinate these requirements with the work of other trades.
  - 4. Identify conflicts with working space requirements prior to installation of equipment.
- G. Coordination:

- 1. Cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner. The Contractor shall check location of electrical outlets with respect to other installations before installing.
- 2. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, light fixtures, panel boards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.
- 3. Coordinate all work prior to installation. Any installed work that is not coordinated and that interferes with the work of another trade shall be removed or relocated at no additional cost to the Owner.
- 4. Verify the integrity of fire or smoke ratings where penetrations are required.
- H. Sleeves:
  - 1. Process Equipment Areas:
    - a. New poured concrete construction: cast in place, Schedule 40, PVC sleeve.
    - b. All other construction: core drill sleeve openings large enough to insert Schedule 40 PVC sleeve and grout around the sleeve.
    - c. Floor penetrations:
      - 1) Extend top of sleeve two inches above the floor.
      - 2) Where installation of sleeve in floor is not practical, provide two inch deep housekeeping pad extending three inches around cast in place conduits.
  - 2. Non-Process Equipment Areas:
    - a. Hollow walls: Schedule 40, PVC sleeves, grout around sleeve in masonry construction.
    - b. All other Areas: core drill sleeve openings large enough to insert Schedule 40 PVC sleeve and utilize the core drilled opening as the sleeve.
  - 3. Conduit Support:
    - a. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to the floor structure.
- I. Sealing And Firestopping:
  - 1. Fire and/or Smoke Penetrations:
    - a. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wire way, trough, etc.) penetrates a fire rated surface.
    - b. Where fire stop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Fire stop mortar alone is not adequate to support any substantial weight.
  - 2. Non-Rated Surfaces:
    - a. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
    - b. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
    - c. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions.

- d. At interior partitions, conduit penetrations are required to be sealed for all areas . Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.
- J. Housekeeping and Clean-up
  - 1. On a daily basis, clean up and remove all debris and rubbish resulting from work and repair all damage to new and existing equipment resulting from work.
  - 2. Remove all tools, excess material, and unused equipment from the site when job is complete.
- K. General Inspection and Cleaning of Electrical Equipment
  - 1. Inspect for physical damage and abnormal mechanical or electrical conditions.
  - 2. Any item found to be out of tolerance, or in any other way defective as a result of the required testing, shall be reported to the Engineer. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.
  - 3. Compare equipment nameplate information with the Contract Drawings and report any discrepancies.
  - 4. Verify proper auxiliary device operation and indicators.
  - 5. Check tightness of accessible bolted electrical joints. Use torque wrench method.
  - 6. Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.
  - 7. Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.
  - 8. Vacuum inside of panelboards, switchboards, switchgear, transformer core and coils, horizontal and vertical busducts, MCC's, control panels, and any other similar equipment
  - 9. Clean All Equipment:
    - a. Loosen attached particles and vacuum them away.
    - b. Remove any remaining packing material adhesives with suitable cleaning solution.
    - c. Touch-up factory applied finishes damaged during installation using manufacturer approved means to match original finish.
- 3.04 TESTING AND START-UP SERVICES
- A. Refer to the requirements the individual technical sections.
- 3.05 TRAINING
- A. Refer to the requirements the individual technical sections.

#### **END OF SECTION**

#### SECTION 26 05 02

#### UTILITY SERVICES

#### PART 1 GENERAL

#### 1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

#### 1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.
  - 1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards:
    - a. ANSI/NFPA 70 National Electrical Code (NEC) and state amendments thereto, Current Edition.
  - 2. National Electrical Contractors Association (NECA), Standard of Installation, Current Edition.
  - 3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
  - 4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.

#### 1.03 DESCRIPTION OF WORK

A. Provide and install complete and operable utility services as required on the drawings and as specified herein.

#### 1.04 UTILITY SERVICES

- A. Payment of Utility Company charges for service will be paid by an allowance of \$5000 which will be adjusted up or down by a change order to the Contract to reflect actual utility company invoices. Contractor handling charges, overhead, and mark-up shall be included in the base bid and are not included under this allowance.
- B. Arrange with Electric Utility for permanent electric service.
  - 1. Electric Service:

a.

- Utility Company: Wisconsin Public Service Corp..
  - 1) Contact person: Mark Anderson
  - 2) Phone number: 920-680-5344
- b. System Characteristics:
  - 1) Facility type: Lift Station.
  - 2) Required service voltage: 120/208V 3-phase, 4-wire.
  - 3) Required service size: 200A.

#### 1.05 RELATED WORK ELSEWHERE - NOT USED

#### 1.06 SHOP DRAWINGS

- A. Submit shop drawings in accordance with the requirements of Division 01.
- B. The following information shall be submitted specifically for utility services:
  - 1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
  - 2. Documentation required by utility company for approval.
- 1.07 FACTORY TESTING NOT USED
- 1.08 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS NOT USED
- 1.09 QUALITY ASSURANCE
- A. Service entrance and metering equipment provided under this section shall be UL Listed for the service intended and shall be approved by the utility company.
- B. All materials, equipment, and parts shall be new and unused of current manufacture.
- C. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

#### PART 2 PRODUCTS - NOT USED

#### PART 3 CONSTRUCTION METHODS

- 3.01 DIVISION OF WORK
- A. The Contractor shall be responsible for coordinating conductor marking and color coding requirements with control system equipment supplier(s).
- 3.02 FIELD MEASUREMENTS
- A. Verify existing conditions and dimensions.
- B. Verify that service equipment is ready to be connected and energized.
- C. Make arrangements with utility company and obtain required inspections before energizing service(s).
- D. Coordinate location of utility company facilities to ensure proper access is available.
- 3.03 DELIVERY, STORAGE, AND HANDLING NOT USED
- 3.04 INSTALLATION
- A. Install service entrance conduit and conductors in accordance with utility company instructions.
- B. Install metering equipment in accordance with utility company instructions.

#### END OF SECTION

#### **SECTION 26 05 19**

#### **BUILDING WIRE AND CABLE**

#### PART 1 GENERAL

#### 1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

#### 1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
  - 1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
    - a. NFPA 70 National Electrical Code.
  - 2. ASTM International, originally known as the American Society for Testing and Materials, Specifications and Standards, current edition:
    - a. ASTM B800-05 Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes-Annealed and Intermediate Tempers
    - b. ASTM B801-99 Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
  - 3. National Electrical Contractors Association (NECA), current edition.
    - a. NECA 1 Standard Practices for Good Workmanship in Electrical Contracting.
  - 4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
    - a. U.L. 44 Rubber-Insulated Wires and Cables.
      - b. U.L. 50 Enclosures for Electrical Equipment.
      - c. U.L. 83 Thermoplastic-Insulated Wires.
      - d. U.L. 514B Conduit, Tubing, and Cable Fittings.
      - e. U.L. 758 105 degree C Appliance Wiring Materials.
      - f. U.L. 854 Service Entrance Cables.
      - g. U.L. 1063 Machine-Tool Wires and Cables.
      - h. U.L. 1277 Type TC Power and Control Tray Cables.
      - i. U.L. 1569 Metal-Clad Cables
      - j. UL 1581 Vertical Tray.

#### 1.03 DESCRIPTION OF WORK

- A. Furnish and install complete and operable wire and cable systems as indicated on the drawings and as specified herein.
- 1.04 SUBMITTALS
- A. Submit shop drawings in accordance with Division 01.
- B. The following information shall be submitted specifically for wire and cable:
  - 1. Literature sufficient in scope to demonstrate compliance with the requirements of this specification.
  - 2. Clearly identify the types of wire and cable proposed.

#### 1.05 QUALITY ASSURANCE

- A. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.
- B. Wire and cable manufacturers shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development and production in accordance with ISO 9001.
- C. All materials, equipment, and parts shall be new and unused of current manufacture.
- D. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

#### PART 2 PRODUCTS

- 2.01 WIRE AND CABLE GENERAL PURPOSE (600V, COPPER)
- A. Manufacturer: Contractor option.
- B. General:
  - 1. THWN/THHN general purpose building wire insulated with polyvinyl chloride (PVC) and covered with protective sheath of nylon intended for lighting and power circuits at 600 volts or less, in residential, commercial and industrial buildings.
  - 2. The wire shall be suitable for 90 degree C maximum continuous conductor temperature in dry locations and 75 degree C in wet locations and listed by Underwriters Laboratories for use in accordance with the National Electrical Code.
- C. Conductors:
  - 1. Class B or Class C stranded, annealed uncoated copper per UL Standard 83 or 1063.
- D. Insulation:
  - 1. Each conductor shall be insulated with PVC and sheathed with nylon complying with the requirements of UL Standard 83 for Types THHN/THWN and UL Standard 1063 for Type MTW and CSA C22.2 No. 75 for T90 Nylon.
  - 2. Types THWN/THHN shall comply with the optional Gasoline and Oil Resistant rating of UL Standard 83. The insulation shall also comply with UL requirements for 105 degree C Appliance Wiring Material.
  - 3. The average thickness of PVC insulation, for a given conductor size, shall be as specified in UL Standard 83 for Types THWN or THHN. The minimum thickness at any point, of the PVC insulation, shall be not less than 90 percent of the specified average thickness.
  - 4. The minimum thickness at any point of the nylon sheath shall be as specified in UL Standard 83 for Types THWN or THHN.
  - 5. The PVC insulation shall be applied tightly to the conductor and shall be free-stripping.
- E. Identification:
  - 1. The wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL Symbol, type designations and optional ratings. The wire shall also be identified as C(UL) Type T90 Nylon or TWN75, FT1.
- F. Tests:

1. Wire shall be tested in accordance with the requirements of UL Standard 83 for Types THWN or THHN wire and for the optional Gasoline and Oil Resistant listings; as Type MTW to UL Standard 1063 (stranded items); as AWM to UL Standard 758 (stranded items); and as C(UL) Type T90 Nylon or TWN75.

#### G. Usage:

- 1. General use power wiring, minimum size No.12 AWG.
- 2. General use control wiring, minimum size No.14 AWG.
- 2.02 SHIELDED INSTRUMENTATION CABLE (300V)
- A. Manufacturer: CONTRACTOR option.
- B. General:
  - 1. Power limited tray cable two conductor, No.16 AWG (7x24) bare copper, PVC insulation, overall shield with No.18 AWG (7x26) tinned copper drain wire, PVC jacket with nylon ripcord.
- C. Electrical Characteristics:
  - 1. Max. Operating voltage: 300Vrms.
  - 2. Conductor DC resistance at 20 deg. C: 3.7 Ohms/1000 ft.
  - 3. Shield DC resistance at 20 degrees C: 5.1 Ohms/1000 ft.
  - 4. Capacitance between conductors at 1 kHz: 61 pF/ft.
  - 5. Capacitance between conductor and shield at 1 kHz: 114 pF/ft.
  - 6. Inductance: 0.19 uH/ft.
- D. Physical Characteristics:
  - 1. Temperature rating: -30 to 105 degrees C.
  - 2. Insulation material: PVC.
  - 3. Average insulation thickness: 0.016-in.
  - 4. Jacket material: Sun resistant PVC.
  - 5. Jacket thickness: 0.037-in. nominal.
  - 6. Shield: Aluminum/Polyester, 100 percent coverage.
  - 7. Overall lay length: 2-in. (6 twists/ft).
  - 8. Maximum pulling tension: 94 lbs.
  - 9. Minimum bend radius: 2.6-in.
  - 10. Flame resistance: UL 1581 vertical tray.
- E. Usage:
  - 1. Instrumentation cable.

#### PART 3 CONSTRUCTION METHODS

- 3.01 FIELD MEASUREMENTS
- A. Field verify all measurements. Do not base electrical installation or equipment locations on the contract drawings.
- B. Identify conflicts with the work of other trades prior to installation of electrical system.
- C. Adjust electrical system installation to satisfy field requirements.

#### 3.02 DELIVERY, STORAGE, AND HANDLING

- A. Accept electrical equipment on site. Inspect for damage.
- B. Protect electrical equipment from weather, corrosion, and entrance of debris.

#### 3.03 INSTALLATION

#### A. Pre-Installation:

- 1. Verify that interior of building has been protected from weather.
- 2. Verify that mechanical work likely to damage wire has been completed.
- 3. Completely and thoroughly swab raceway prior to installation.
- 4. Verify that field measurements are as shown on drawings.
- 5. Wire and cable routing shown on drawings is approximate unless dimensioned. Route wire and cable to satisfy project conditions.
- 6. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.
- 7. Determine required separation between cable and other work.
- 8. Determine cable routing to avoid interference with other work.
- 9. Any single conduit or raceway utilized for a feeder circuit shall contain only power conductors of a single feeder circuit. Do not combine feeder circuits without engineer's written approval.
- 10. Contract drawings indicate individual homerun equipment connections. Contractor may combine branch circuits of common types in single conduits provided the following conditions are met:
  - a. NEC requirements for conductor de-rating are satisfied.
  - b. Conduit fill does not exceed thirty percent. Ten percent fill shall be reserved for future use.
- 11. No more than eight 24VDC analog circuits may be combined in a single conduit unless specifically stated otherwise on the drawings.
- B. Conductor Sizing:
  - 1. Conductor sizes are based on copper unless otherwise noted.
  - 2. Use conductor not smaller than No.12 AWG for power and lighting circuits.
  - 3. Use No.10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.
  - 4. Where circuit wiring length exceeds length identified on the feeder schedule, increase wire size as needed to maintain a maximum voltage drop of three percent.
  - 5. Use conductor not smaller than No.14 AWG for control circuits.
  - 6. Unless shown otherwise on the contract drawings, power wiring shall be No.12 AWG.
- C. Wire Pulling:
  - 1. Pull all conductors into raceway at same time.
  - 2. No.4 AWG and larger wire and power cables shall lubricated with pulling lubricant to reduce pulling tension and abrasion damage. The lubricant shall be water or wax based containing no oils or greases that may adversely affect cable jackets.
  - 3. The minimum bend radius and maximum pulling tension ratings of the wire and cable shall not be exceeded.
- D. Splices and Terminations:
  - 1. Splices and terminations shall not be made within raceways.
  - 2. Clean conductor surfaces before splicing or terminating.

- 3. Make splices, taps, and terminations to carry full amp capacity of conductors with no perceptible temperature rise.
- 4. Insulated spring wire connectors may be used to splice 120V power circuits.
- 5. Control, communication, and data transmission wire and cable shall not be spliced.
- 6. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- 7. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- 8. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

#### E. Motors:

- 1. Motor wiring to motors less than 10 horsepower shall be spliced and terminated with fully insulated crimp-on end cap with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. "SkotchLocks" and similar devices shall not be used.
- 2. Motor wiring to motors 10 horsepower or larger shall be spliced and terminated with crimp-on ring terminal lugs, brass nuts, bolts and washers with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. "SkotchLocks" and similar devices shall not be used.
- F. Unshielded power cables:
  - 1. Unshielded power cables shall be spliced and terminated with crimp-on ring terminal lugs, brass nuts, bolts and washers with a layer of self-vulcanizing rubber tape, followed by five layers of vinyl electrical tape. "SkotchLocks" and similar devices shall not be used.
- 3.04 TESTING AND START-UP SERVICES
- A. Inspect wire for physical damage and proper connection.
- B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- C. Verify continuity of each conductor.
- D. Feeder or branch circuits with ampacity greater than 100 amperes shall be tested after installation to measure insulation resistance of each conductor.
- E. All equipment shall be disconnected and the wire ends shall be cleaned and dried.
- F. Connect Megohmeter between conductor and a grounded point in the enclosure and energize until the reading stabilizes.
- 3.05 TRAINING NOT USED

#### END OF SECTION

#### SECTION 26 05 26

#### **GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

#### PART 1 GENERAL

- 1.01 APPLICABLE PROVISIONS
- A. Applicable provisions of Division 01 shall govern the work of this section.

#### 1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
  - 1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
    - a. NFPA 70 National Electrical Code.
    - b. ANSI/NFPA 99 Health Care Facilities.
  - 2. National Electrical Contractors Association (NECA), current edition.
    - NECA 1 Standard Practices for Good Workmanship in Electrical Contracting.
  - 3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, Current Edition.
  - 4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, Current Edition.
  - 5. Institute of Electrical and Electronics Engineers (IEEE), Specifications and Standards, current edition:
    - a. IEEE 837 Standard for Qualifying Permanent Connections Used in Substation Grounding.

#### 1.03 DESCRIPTION OF WORK

- A. Furnish and install complete and operable grounding and bonding systems as indicated on the drawings and as specified herein.
- 1.04 RELATED SECTIONS NOT USED
- 1.05 SUBMITTALS NOT USED
- 1.06 FACTORY TESTING NOT USED
- 1.07 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED
- 1.08 QUALITY ASSURANCE
- A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms. Additional grounding electrodes shall be used to satisfy ground resistance requirements where required by earth conditions.

#### PART 2 PRODUCTS

- 2.01 ROD ELECTRODE
- A. Material: Copper-clad steel.
- B. Diameter: 3/4-inch minimum.
- C. Length: 10-feet minimum. Rod shall be driven at least 9.5-feet deep.
- D. Use one or more ground rods to obtain the minimum specified ground resistance. This applies to manholes, padmount switches, transformers, service entrances, and all other equipment requiring a supplemental grounding electrode. Minimum of three ground rods shall be used to ground the service entrance as indicated on plans.

#### 2.02 MECHANICAL CONNECTORS

- A. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of silicon bronze and supplied as a part of the connector body and shall be of the two bolt type.
- B. Split bolt connector types are not allowed.
- C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.
- D. Grounding access wells shall be provided for access to underground mechanical grounding connections. Access well shall be ANSI Tier rated for the area in which it is installed.
- 2.03 COMPRESSION CONNECTORS
- A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99 percent.
- B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.
- C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.
- D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.
- E. Each connector shall be factory filled with an oxide-inhibiting compound.
- 2.04 EXOTHERMIC CONNECTIONS
- A. Select the appropriate kit for specific types, sizes, and combinations of conductors and other items to be connected. Field personnel shall be trained in execution of welds.

#### 2.05 WIRE

- A. Material: Stranded copper (aluminum not permitted).
- B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.
- C. Manhole and Vault Bonding: No. 4/0 minimum.
- D. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

#### PART 3 CONSTRUCTION METHODS

#### 3.01 FIELD MEASUREMENTS

- A. Field verify all measurements. Do not base electrical installation or equipment locations on the contract drawings.
- B. Identify conflicts with the work of other trades prior to installation of electrical system.
- C. Adjust electrical system installation to satisfy field requirements.

#### 3.02 INSTALLATION

- A. General:
  - 1. Verify that final backfill and compaction has been completed before driving rod electrodes.
  - 2. Install products in accordance with manufacturer instructions.
  - 3. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
  - 4. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
  - 5. Attach grounds permanently before permanent building service is energized.
  - 6. Install rod electrodes at locations indicated or as required by local code, whichever requires the most rods. Install additional rod electrodes as required to achieve specified resistance to ground.
  - 7. Connect grounding electrode conductor and reinforcing steel in foundation footing. Bond steel together.
  - 8. Bond all conductive components to meet Regulatory Requirements.
  - 9. Bond together metal siding not attached to grounded structure; bond to ground.
  - 10. All separate ground wires shall be enclosed in rigid galvanized steel conduit and bonded at both ends to the rigid galvanized steel conduit with an approved fitting.
- B. Less than 600 volt system grounding:
  - 1. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.
  - 2. Copper grounding electrode conductor shall be sized as indicated or as required by NEC, whichever is larger and shall be extended from secondary service system neutral to street side of water meter, building steel, ground rod, and any concrete encased

electrodes. Bonding jumper shall be installed around water meter. Install conductor in separate rigid conduit. Bond conduit as described above.

- 3. Receptacle Grounding: All receptacles installed shall have a separate grounding contact.
- 4. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- 5. Bond together each metallic raceway, pipe, duct and other metal objects.
- 6. Equipment Grounding Conductor: Separate, insulated green conductor shall be installed within each raceway and cable tray, sized per NEC or as indicated in the contract documents whichever is larger. Terminate each end on suitable lug, bus, enclosure or bushing, per NEC. Install a ground wire from each device to the respective enclosure.
- 3.03 TESTING AND START-UP SERVICES
- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- 3.04 TRAINING NOT USED

#### **END OF SECTION**

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#### SECTION 26 05 29

#### HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

#### PART 1 GENERAL

#### 1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

#### 1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
  - 1. American Iron and Steel Institute (AISI), Specifications and Standards, current edition.
  - 2. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
    - a. NFPA 70 National Electrical Code.
  - 3. American Society for Testing and Materials (ASTM), Specifications and Standards, current edition:
    - a. ASTM A653 General Requirements for Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process.
    - b. ASTM A1011 Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Ally and High-Strength Low Alloy with Improved Formability (Formerly ASTM A570).
    - c. ASTM F1136 Standard Specification for Chromium/Zinc Corrosion Protective Coatings for Fasteners.
    - d. ASTM A907 Standard Specification for Steel, Sheet, and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled, Structural Quality.
    - e. ASTM B633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
  - 4. National Electrical Contractors Association (NECA), current edition.
    - a. NECA 1 Standard Practices for Good Workmanship in Electrical Contracting.
    - b. NECA 101 Standard for Installing Steel Conduit (Rigid, IMC, EMT).
  - 5. Metal Framing Manufacturers Association (MFMA), Specifications and Standards, current edition.

#### 1.03 DESCRIPTION OF WORK

A. Furnish and install supporting devices as indicated on the drawings, scheduled in Section 26 05 00, and as specified herein.

#### 1.04 SUBMITTALS

- A. Submit shop drawings in accordance with Division 01.
- B. The following information shall be submitted specifically for supporting devices:
  - 1. Submit outline drawings and dimensions for equipment support racks.

#### 1.05 QUALITY ASSURANCE

- A. Bolted framing channels and fittings shall have the manufacturers name, part number, and material heat code identification number stamped in the part itself for identification. Material certification sheets and test reports must be made available by the manufacturer upon request
- B. Stainless steel bolted framing parts shall be stamped to identify the material. Material certification sheets and test reports must be made available by the manufacturer upon request.
- C. All materials, equipment, and parts shall be new and unused of current manufacture.
- D. Contractor shall be responsible for providing all necessary accessories required for a complete and operable system.

#### PART 2 PRODUCTS

- 2.01 STRUT, CHANNELS, AND CONNECTORS
- A. Manufacturers:
  - 1. Cooper B-Line, Inc.
  - 2. or equal.

#### B. General:

- 1. Strut shall be 1-5/8-inches wide in varying heights and welded combinations as required to meet load capacities and designs indicated on the drawings.
- C. Materials and Finish:
  - 1. Aluminum: Strut shall be manufactured of extruded aluminum alloy 6063-T6. All fittings and hardware shall be zinc plated according to ASTM B633 (SC3 for fittings, SC1 for threaded hardware) for indoor use only. For outdoor use, all fittings and hardware shall be stainless steel Type 304.
  - 2. Hot-dip Galvanized Steel: Strut shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 and shall be hot-dip galvanized after fabrication in accordance with ASTM A123. Fittings shall be manufactured from steel meeting the minimum requirements of ASTM A907 SS, Grade 33, and hot-dip galvanized after fabrication in accordance with ASTM A123. All hardware shall be stainless steel Type 304 or chromium zinc ASTM F1136 Gr. 3. All hot-dip galvanized after fabrication products must be returned to point of manufacture after coating for inspection and removal of all sharp burrs.
  - 3. Stainless Steel: All strut, fittings and hardware shall be made of AISI Type 304 stainless steel.

#### 2.02 ANCHORS AND FASTENERS

- A. Concrete and Structural Elements: Use stainless steel precast insert system, expansion anchors and preset inserts.
- B. Steel Structural Elements: Use stainless steel beam clamps.
- C. Concrete Surfaces: Use stainless steel self-drilling anchors and expansion anchors.

- D. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
- E. Solid Masonry Walls: Use stainless steel expansion anchors and preset inserts.
- F. Sheet Metal: Use stainless steel sheet metal screws.
- G. Wood: Use stainless steel wood screws.
- H. All other fasteners: stainless steel screws, suitable for the required usage.

#### 2.03 HARDWARE

- A. Conduit and equipment supports, clamps, and other miscellaneous materails shall be constructed of the following materials as scheduled in Section 26 05 00.
  - 1. Steel.
  - 2. Zinc plated steel.
  - 3. Galvanized, malleable iron.
  - 4. PVC coated, galvanized, malleable iron.
  - 5. Stainless steel.
  - 6. PVC.

#### PART 3 CONSTRUCTION METHODS

- 3.01 FIELD MEASUREMENTS
- A. Field verify all measurements. Do not base locations and dimensions on the contract drawings.
- B. Identify conflicts with the work of other trades prior to installation of electrical equipment.
- C. Adjust equipment support rack installation to satisfy field requirements.
- 3.02 DELIVERY, STORAGE, AND HANDLING
- A. Accept supporting devices on site. Inspect for damage.
- B. Protect supporting devices from corrosion and damage. Do not install damaged materials.

#### 3.03 INSTALLATION

#### A. General:

- 1. Furnish and install supports and fasteners for all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.
- 2. Thoroughly clean and remove construction debris from installation.
- B. Strut Channel:
  - 1. Install strut in accordance with MFMA-102 "Guidelines for the Use of Metal Framing"; in accordance with equipment manufacturer's recommendations, and with recognized industry practices.
  - 2. Fabricate supports from channel. Rigidly weld members or use hexagon head bolts to present a neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

- 3. File and de-bur cut ends of galvanized support channel and spray paint with cold galvanized paint to prevent rusting.
- 4. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- C. Anchors and Fasteners:
  - 1. Provide anchors, fasteners, and supports in accordance with NECA "Standard Practices for Good Workmanship in Electrical Contracting".
  - 2. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit.
  - 3. Do not use spring steel clips and anchors.
  - 4. Do not use powder-actuated anchors.
  - 5. Obtain permission from Engineer before drilling or cutting structural members.
  - 6. Install surface-mounted cabinets and panelboards with minimum of four anchors.
  - 7. Use channel supports to stand cabinets and panelboards 1-5/8-inch off interior or exterior surfaces of exterior walls.
  - 8. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using anchors and fasteners.
  - 9. Install free-standing electrical equipment on 3-inch concrete pads unless indicated otherwise on the drawings.
  - 10. Use threaded rod, minimum size 3/8-inch, for supports where indicated on the drawings.
  - 11. Install products in accordance with manufacturer instructions.

#### END OF SECTION

## SECTION 26 05 34

## CONDUIT

#### PART 1 GENERAL

5.

#### 1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

#### 1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
  - 1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
    - a. ANSI C80.1 Electrical Rigid Steel Conduit (ERSC).
    - b. ANSI C80.3 Steel Electrical Metallic Tubing (EMT).
    - c. ANSI C80.5 Electrical Rigid Aluminum Conduit (ERAC).
    - d. NFPA 70 National Electrical Code.
  - 2. American Society for Testing and Materials (ASTM), Specifications and Standards, current edition:
    - a. ASTM F2160 Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter.
    - b. ASTM D2239 Polyethylene (PE) Plastic Pipe (SIDR) Based on Controlled Inside Diameter.
    - c. ASTM D3035 Polyethylene (PE) Plastic Pipe (SDR) Based on Controlled Outside Diameter.
    - d. ASTM D3350 Polyethylene Plastics Pipe and Fittings Materials.
  - 3. National Electrical Contractors Association (NECA), current edition.
    - a. NECA 1 Standard Practices for Good Workmanship in Electrical Contracting.
    - b. NECA 101 Standard for Installing Steel Conduit (Rigid, IMC, EMT).
  - 4. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
    - a. NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association.
    - b. NEMA RN 1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association.
    - c. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Tubing and Conduit; National Electrical Manufacturers Association.
    - d. NEMA TC 3 PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association.
    - e. NEMA TC 7 Smooth Wall Coilable Polyethylene Electrical Plastic Conduit.
    - Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
      - a. UL 1 Standard for Flexible Metal Conduit
      - b. UL 6 Electrical Rigid Metal Conduit Steel.
      - c. UL 6A Standard for Electrical Rigid Metal Conduit Aluminum and Stainless Steel.

- d. UL 651A Type EB and A Rigid PVC Conduit and HDPE conduit.
- e. UL 651B Continuous Length HDPE.
- f. UL 1660 Liquid-Tight Flexible Nonmetallic Conduit.
- g. UL 2239 Standard for Safety for Hardware for the Support of Conduit, Tubing, and Cable.

#### 1.03 DESCRIPTION OF WORK

- A. Furnish and install complete and operable conduit system as indicated on the drawings, scheduled in Section 26 05 00, and as specified herein.
- 1.04 SUBMITTALS
- A. Submit shop drawings in accordance with Division 01.
- B. Submit the following information specifically for conduit:
  - 1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
  - 2. Clearly identify the types of conduit and fittings proposed.
- 1.05 FACTORY TESTING NOT USED
- 1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED
- 1.07 QUALITY ASSURANCE
- A. All materials, equipment, and parts shall be new and unused of current manufacture.
- B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

#### 1.08 WARRANTY

- A. See Division 01 for additional requirements.
- 1.09 EXTRA MATERIALS
- A. See Division 01 for additional requirements.

#### PART 2 PRODUCTS

- 2.01 GALVANIZED RIGID METAL CONDUIT (TYPE RMCS)
- A. Manufacturer: Contractor option.
- B. Conduit:

- 1. Impact and crush resistant mild steel tube with an accurate circular cross section, a uniform wall thickness, a defect free interior surface, and a continuous welded seam.
- 2. Interior and exterior surfaces thoroughly and evenly coated with zinc using the hot-dip galvanizing process.
- 3. Top-coated with a compatible organic layer to inhibit white rust and increase corrosion resistance.
- 4. Factory cut threads, 0.75-inch taper per foot, protected after cutting with an application of molten zinc.
- C. Conduit Bodies:
  - 1. Ferrous metal construction electro-galvanized inside and out and coated with aluminum acrylic paint.
  - 2. Tapered, threaded hubs with integral bushing.
  - 3. Stainless steel hardware.
  - 4. Cover constructed of same material with solid gasket.

#### D. Fittings:

- 1. Ferrous metal construction electro-galvanized inside and out.
- 2. Components critical to performance such as set screws, split rings, and locknuts constructed of hardened steel or adequately designed to insure positive bonds.

## 2.02 RIGID NON-METALLIC CONDUIT (TYPE RNC)

- A. Manufacturer:
  - 1. Carlon.
    - 2. Or equal.
- B. Conduit:
  - 1. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
  - 2. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-2.
  - 3. The conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections, which could mar conductors or cables.
  - 4. Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity.
  - 5. Schedule 80 non-metallic conduit shall be used in locations subject to physical damage. Schedule 40 non-metallic conduit may be used in all other locations.
- C. Conduit Bodies:
  - 1. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.
  - 2. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-3.
  - 3. Stainless steel hardware.
  - 4. Cover constructed of same material with solid gasket.
- D. Fittings:
  - 1. Made from polyvinyl chloride compound (recognized by UL), which includes inert modifiers to improve weatherability and heat distortion.

2. Rated for use with 90 degree C conductors. Material shall comply with NEMA Specification TC-3.

## 2.03 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (TYPE LMFC)

- A. Manufacturer: CONTRACTOR option.
- B. Usage:
  - 1. Use in conjunction with galvanized rigid metal conduit.
  - 2. Use in conjunction with PVC coated galvanized rigid metal conduit.
  - 3. Use in conjunction with rigid aluminum conduit.

### C. Conduit:

- 1. Single strip, helically wound, galvanized steel core inside and outside with smooth interior surface with sunlight resistant thermoplastic jacket suitable for ambient environmental conditions conforming to applicable UL Standards.
- 2. Jacket shall be positively locked to core to prevent sleeving.
- 3. All runs of flexible conduit shall be as short as practicable, of the same size as the conduit it extends and with enough slack to reduce the effects of expansion and vibration.
- D. Fittings:
  - 1. Where used in conjunction with galvanized rigid metal conduit, connectors shall be malleable iron or steel, electro zinc plated, with insulated throat and taper threaded hub.
  - 2. Where used in conjunction with PVC coated galvanized rigid metal conduit connectors shall be malleable iron or steel, electro zinc plated and PVC coated, with insulated throat and taper threaded hub.
  - 3. Where used in conjunction with rigid aluminum conduit, connectors shall be aluminum, with insulated throat and taper threaded hub.
  - 4. Particular attention shall be given to maintaining ground bond and firm support through flexible connections.
  - 5. All fittings shall be liquid tight.

## PART 3 CONSTRUCTION METHODS

- 3.01 FIELD MEASUREMENTS
- A. The Contractor shall obtain from the appropriate trades and review shop drawings for all equipment requiring electrical connections. Conduit rough-in shall be based upon shop drawing requirements.
- B. The Contractor shall be responsible for coordinating conduit location and rough-in with actual equipment conditions and requirements.
- C. Field verify all measurements. Do not base conduit rough-in or equipment locations on the contract drawings.
- D. Identify conflicts with the work of other trades prior to installation of electrical equipment and conduit work.
- E. Adjust conduit system installation to satisfy field requirements.

#### 3.02 DELIVERY, STORAGE, AND HANDLING

- A. Accept conduit on site. Inspect for damage.
- B. Protect conduit from corrosion and entrance of debris.
- C. Store conduit above grade. Protect from environment with suitable covering.
- D. Protect PVC and PVC coated conduit from sunlight.
- 3.03 INSTALLATION

#### A. General:

- 1. Install conduit in accordance with NECA "Standard Practices for Good Workmanship in Electrical Contracting", all requirements of the NEC, and manufacturer recommended practices.
- 2. Arrange conduit to maintain headroom and present neat appearance.
- 3. Design raceway systems to minimize the number of fittings, couplings, kicks, and offsets.
- 4. Raceways located above lowest floor level:
  - a. Route conduit parallel and perpendicular to walls.
  - b. All raceways shall be level and straight.
  - c. Vertical conduits shall be plumb.
- 5. Raceways located in or under lowest level floor:
  - a. Route conduit in and under slab from point-to-point.
  - b. Do not cross conduits in slab.
- 6. Do not use flexible conduit in place of bends, conduit bodies, or expansion fittings.
- 7. Flexible conduit shall be used at all equipment terminations. Maximum length of 24inches unless specifically allowed otherwise by Engineer based upon field conditions.
- 8. Do not use cords for equipment connections unless specifically allowed otherwise by Engineer based upon field conditions.
- B. Raceway sizing:
  - 1. Size raceways as indicated on drawings.
  - 2. Where raceways sizes are not indicated on drawings, size in accordance with NEC requirements. Minimum size 3/4-inch.
  - 3. Exposed conduit runs not longer than 10-feet in length and terminating at a single device may be 1/2-inch unless prohibited by NEC.
- C. Raceway Installation:
  - 1. Maintain adequate clearance between conduit and piping.
  - 2. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
  - 3. Cut conduit square using saw or pipe cutter; de-burr cut ends.
  - 4. Bring conduit to shoulder of fittings; fasten securely.
  - 5. Use conduit hubs to fasten conduit to NEMA 4X and NEMA 12 boxes.
  - 6. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic factory elbows for bends in metal conduit larger than 2-inch size.
  - 7. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

- 8. Suitable pull string shall be installed in each empty conduit, sleeves and nipples excepted.
- 9. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- 10. Remove all debris and moisture from raceways prior to installing conductors.
- 11. Ground and bond conduit under provisions of Section 26 05 26.
- 12. Identify conduit under provisions of Section 26 05 53.
- 13. Install plastic coated conduit in accordance with manufacturer's instructions. All 90 degree bends shall be manufactured elbows. Touch-up PVC coating after installation.
- 14. All field cut threads shall be coated with Thomas & Betts Kopr-Shield prior to assembly.
- D. Structural Coordination:
  - 1. Suitable fittings, designed and listed for the purpose, shall be used to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.
  - 2. Install conduit to preserve fire resistance rating of partitions and other elements.
  - 3. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.
  - 4. Where conduit passes between areas subject to variable temperatures, seal conduits to prevent air interchange and condensation formation. Use conduit fitting specifically manufactured for this purpose.
- E. Raceway Support:
  - 1. General:
    - a. Arrange supports to prevent misalignment during wiring installation.
    - b. Do not permanently support conduit with wire or perforated pipe straps.
    - c. Remove wire used for temporary supports.
    - d. Do not attach conduit to ceiling support wires.
    - e. Channel, rod, and hardware shall comply with the requirements of Section 26 05 29.
  - 2. Hardware:
    - a. Construct conduit support rack with channel and rod to support conduits not supported from structure.
    - b. Support conduit with channel anchored to structure when conduit offset from structure is required.
    - c. Secure conduits to channel with pipe straps.
    - d. Support conduit from structure when conduit offset from structure is not required.
    - e. Secure conduits directly to structure with one-hole strap and conduit spacer.
- F. Conduit Separation:
  - 1. Separate conduit systems shall be used for the following circuit categories:
    - a. 120-volt power circuits.
    - b. 480-volt power circuits.
    - c. 120-volt control circuits.
    - d. 24 VDC analog control circuits.
    - e. Intrinsically safe control circuits.
    - f. UTP control cables.
    - g. Manufacturer supplied cables (for example, magnetic flow meter cables).
    - h. Radio frequency coaxial cables (for example, antenna cables).
    - i. Motor feeder circuits. Install only one motor feeder per conduit.

- 2. The contract drawings show individual homerun equipment connections. The Contractor may combine circuits of common types (as identified above) into single conduits provided the following conditions are met:
  - a. NEC requirements for conductor de-rating are satisfied.
  - b. Conduit fill does not exceed thirty percent. Ten percent fill shall be reserved for future use.
  - c. No more than eight 24VDC analog circuits are combined in a single conduit, unless specifically stated otherwise on the drawings.
- 3.04 TESTING AND START-UP SERVICES NOT USED
- 3.05 TRAINING NOT USED

### **END OF SECTION**

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## SECTION 26 05 37

## BOXES

#### PART 1 GENERAL

#### 1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

#### 1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
  - 1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
    - a. NFPA 70 National Electrical Code.
  - 2. National Electrical Contractors Association (NECA), current edition.
    - a. NECA 1 Standard Practices for Good Workmanship in Electrical Contracting.
    - b. NECA 101 Standard for Installing Steel Conduit (Rigid, IMC, EMT).
  - 3. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition.
    - a. NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association.
    - b. ANSI/NEMA OS 1 Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
    - c. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 4. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition.
- 1.03 DESCRIPTION OF WORK
- A. Furnish and install complete and operable box systems as indicated on the drawings, scheduled in Section 26 05 00, and as specified herein.
- 1.04 SUBMITTALS
- A. Submit shop drawings in accordance with Division 01.
- B. Submit the following information specifically for boxes:
  - 1. Manufacturer literature sufficient in scope to demonstrate compliance with the requirements of this specification.
  - 2. Clearly identify the types of boxes proposed.
- 1.05 FACTORY TESTING NOT USED
- 1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED
- 1.07 QUALITY ASSURANCE
- A. All materials, equipment, and parts shall be new and unused of current manufacture.

- B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.
- 1.08 WARRANTY
- A. See Division 01 for additional requirements.
- 1.09 EXTRA MATERIALS
- A. See Division 01 for additional requirements.

## PART 2 PRODUCTS

#### 2.01 OUTLET BOXES

- A. Cast Boxes:
  - 1. Cast ferralloy or aluminum, deep type, gasketed cover, threaded hubs.
  - 2. Suitable for surface or flush mounting with drywall, FRP panel, masonry block, and poured concrete wall and ceiling finishes.
- 2.02 PULL AND JUNCTION BOXES
- A. General:
  - 1. Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2 1/8th inches (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square (117 mm).
  - 2. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1 1/4" and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.
- B. Boxes Larger than 12 Inches (300 mm) in any dimension shall have a hinged cover, be rated NEMA 4X, and constructed of stainless steel.
- C. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flatflanged, surface-mounted junction box, UL listed as rain-tight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Cast Metal Boxes for Hazardous Locations: Type 7, cast malleable iron with drilled and tapped conduit entrance. Cast malleable iron cover, non-hinged with Type 316 stainless steel screws and gasketed.
- E. Cast Metal Boxes for Underground Installations: Type 4, inside flanged, recessed cover box for flush mounting, UL listed as rain tight. Hot dipped galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws. Cover Legend: ELECTRIC.

- F. Fiberglass Handholes for Underground Installations: Die- molded with pre-cut 6 x 6 inch (150 x 150 mm) cable entrance at center bottom of each side; fiberglass weatherproof cover with non-skid finish. Box and cover assemblies shall carry a minimum ASNI Tier 8 rating. Provide ANSI 22 rated box assemblies for boxes installed in paved areas.
- G. Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more capacity.
- H. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.
- I. Wireways shall not be used in lieu of junction boxes.

## PART 3 CONSTRUCTION METHODS

- 3.01 FIELD MEASUREMENTS
- A. The Contractor shall obtain from the appropriate trades and review shop drawings for all equipment requiring electrical connections. Box rough-in shall be based upon shop drawing requirements.
- B. The Contractor shall be responsible for coordinating box location and rough-in with actual equipment conditions and requirements.
- C. Field verify all measurements. Do not base box rough-in or equipment locations on the contract drawings.
- D. Identify conflicts with the work of other trades prior to installation of electrical equipment and conduit work.
- E. Adjust box locations to satisfy field requirements.
- 3.02 DELIVERY, STORAGE, AND HANDLING
- A. Accept boxes on site. Inspect for damage.
- B. Protect boxes from corrosion and entrance of debris.
- C. Store boxes above grade. Protect from environment with suitable covering.

#### 3.03 INSTALLATION

- A. General:
  - 1. Install conduit in accordance with NECA "Standard Practices for Good Workmanship in Electrical Contracting", all requirements of the NEC, and manufacturer recommended practices.
- B. Box Installation:
  - 1. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
  - 2. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
  - 3. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

- 4. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- 5. Use flush mounting outlet boxes in all areas.
- 6. 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.
- 7. Use gang box where more than one device is mounted together. Do not use sectional box.
- 8. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Include installation within 10 feet of location shown.
- 9. Position outlet boxes to locate luminaires as shown on lighting plans.
- 10. Adjust flush-mounting outlets to make front flush with finished wall material.
- 11. Install knockout closure in unused box opening.
- C. Structural Coordination:
  - 1. Install boxes to preserve fire resistance rating of partitions and other elements.
  - 2. Install flush mounting box without damaging wall insulation vapor barrier or reducing its effectiveness. Provide vapor box or vapor barrier hat for each box flush mounted in an exterior wall.
  - 3. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
  - 4. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- D. Box Support:
  - 1. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
  - 2. Use stamped steel bridges to fasten flush mounting outlet box between studs.
  - 3. Use adjustable stainless steel channel fasteners for hung ceiling outlet box.
  - 4. Do not fasten boxes to ceiling support wires.
  - 5. Support boxes independently of conduit.
- 3.04 TESTING AND START-UP SERVICES NOT USED
- 3.05 TRAINING NOT USED

## END OF SECTION

## **SECTION 26 05 53**

## **IDENTIFICATION FOR ELECTRICAL SYSTEMS**

## PART 1 GENERAL

- 1.01 APPLICABLE PROVISIONS
- A. Applicable provisions of Division 01 shall govern the work of this section.
- 1.02 APPLICABLE PUBLICATIONS
- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
  - 1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
    - a. NFPA 70 National Electrical Code.
    - b. ANSI Z535.4 Product Safety Signs and Labels.
  - 2. National Electrical Contractors Association (NECA), current edition.
    - a. NECA 1 Standard Practices for Good Workmanship in Electrical Contracting.
- 1.03 DESCRIPTION OF WORK
- A. Furnish and install electrical identification systems as indicated on the drawings and as specified herein.
- 1.04 SUBMITTALS NOT USED
- 1.05 FACTORY TESTING NOT USED
- 1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS- NOT USED
- 1.07 QUALITY ASSURANCE NOT USED
- 1.08 WARRANTY NOT USED
- 1.09 EXTRA MATERIALS NOT USED

## PART 2 PRODUCTS

- 2.01 NAMEPLATES
- A. Engraved two-layer laminated plastic, black letters on white background.
- B. Lettering:
  - 1. 1/4-inch letters for identifying individual equipment and loads.
  - 2. 1/2-inch letters for identifying grouped equipment and loads.
- 2.02 CONDUCTOR MARKING
- A. The ends of each conductor shall be marked with circuit number, motor number, wire or terminal number.

- B. Control system wire marking shall be coordinated with control system and equipment shop drawings.
- C. Labels shall be typed in black lettering with indelible ribbons on a white, heat shrink sleeve. Markers shall be shrunk around the wire to ensure a tight, non-slip bond with a compatible heat gun.
- D. Heat shrink wire markers shall be Brady Bradysleeve Type B-321 or B-322.
- 2.03 CONDUCTOR COLOR CODING
- A. Conductors No.6 AWG and smaller shall be provided with color coded insulation as described herein. Conductors larger than No.6 AWG may be color coded with appropriately colored Scotch No.35 tape at each end.
- B. Color Coding:
  - 1. 277/480 vac system shall be colored brown, orange, yellow, and gray for phases A, B, C, and neutral respectively.
  - 2. 120/208 vac system shall be colored black, red, blue, and white for phases A, B, C, and neutral respectively.
  - 3. 120/240 vac shall be colored black, red, and white for Line 1, Line 2, and neutral respectively.
  - 4. 120 vac control wiring shall be colored red.
  - 5. 24 VDC control wiring shall be colored purple and purple with white stripe for positive and negative conductors respectively.
  - 6. Intrinsically safe control wiring shall be colored light blue.
  - 7. Conductors within control cabinets and motor control centers which are supplied from an external source shall be colored yellow.
  - 8. Grounding conductor and equipment ground conductors shall be colored green.
- 2.04 CONDUIT MARKING
- A. Colored band markers shall be field painted.
- B. Color:
  - 1. 480 Volt System: Yellow.
  - 2. 208 Volt and 240 Volt System: White.
  - 3. Fire Alarm System: Red .
  - 4. Low Voltage Communication System: Black.
  - 5. Process Instrumentation and Control System: Blue.
- 2.05 EQUIPMENT, ENCLOSURE, AND CABINET WARNING SIGNS
- A. Electrical Voltage and Shock Hazard Signs
  - 1. Provide OSHA Voltage and Shock Hazard sign for each electrical enclosure, cabinet, or other piece of equipment that presents an electrical hazard under normal operating circumstances or presents an electrical hazard while the enclosure is open.
- B. Electrical Arc Flash Hazard Signs
  - 1. Provide Arc Flash Hazard sign for each electrical enclosure, cabinet, or other piece of equipment that presents an arc flash hazard in accordance with NEC and ANSI Z535.4.

- C. Electrical Source Signs
  - 1. Provide sign indicating voltage level and source for each component of the power distribution system and for all control panels.
  - 2. Provide indicating multiple sources where equipment is fed from multiple sources or where signal wiring is present that is powered from a source external to the equipment

#### PART 3 CONSTRUCTION METHODS

- 3.01 FIELD MEASUREMENTS NOT USED
- 3.02 DELIVERY, STORAGE, AND HANDLING NOT USED

#### 3.03 INSTALLATION

- A. Nameplates:
  - 1. Provide nameplates for grouped equipment such as panelboards, transformers, motor control centers, and control panels. Nameplate shall identify tag number, voltage, ampere rating, and description.
  - 2. Provide nameplates for individual equipment such as motor control center compartments, field instruments, and field control stations. Nameplate shall identify tag number and description.
  - 3. Provide nameplates for individual receptacles. Nameplate shall identify panel and circuit number supplying the receptacle.
  - 4. Provide nameplates for control cabinets and motor control center compartments which contain wiring supplied from an external source. Nameplate shall state: Multiple power sources within, verify all power supplies are disconnected before servicing equipment.
  - 5. Nameplates shall be secured to the front of equipment enclosures with stainless steel screws or rivets. Double sided tape will not be acceptable.
  - 6. Secure nameplates for flush mounted panelboards behind the panelboard door.
- B. Conductor Marking:
  - 1. Mark conductors at every termination and splice point.
  - 2. Mark conductors with wire numbers identified by control system supplier, with panel and circuit identification, or with MCC compartment and wire numbers.
- C. Conduit Marking:
  - 1. Furnish colored band markers for each conduit longer than six feet and mark each conduit a minimum of twenty feet on center.
- 3.04 TESTING AND START-UP SERVICES NOT USED
- 3.05 TRAINING NOT USED

## END OF SECTION

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## SECTION 26 36 14

## PORTABLE ENGINE/GENERATOR SET

#### PART 1 GENERAL

#### 1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 1 shall govern the work of this section.

#### 1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
  - 1. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
    - a. NFPA70 National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
    - b. NFPA99 Essential Electrical Systems for Health Care Facilities.
    - c. NFPA110 Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit; component level type tests will not substitute for this requirement.
  - 2. Canadian Standards Association (CSA), Specifications and Standards, current edition:
    - a. CSA C22.2, No. 14 M91 Industrial Control Equipment.
    - b. CSA 282, 1989 Emergency Electrical Power Supply for Buildings.
  - 3. International Electrotechnical Commission (IEC), Specifications and Standards, current edition:
    - a. IEC8528 part 4. Control Systems for Generator Sets.
  - 4. Institute of Electrical and Electronics Engineers, Specifications and Standards, current edition:
    - a. IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
  - 5. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition:
    - a. NEMA ICS10-1993 AC Generator sets.
  - 6. Underwriters Laboratories, Inc. (UL), Specifications and Standareds, current edition:
    - a. UL2200. The genset shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.

#### 1.03 DESCRIPTION OF WORK

- A. Provide complete factory assembled portable generator set equipment with standard analog controls and satisfying Tier 4 Emissions requirements. Engine generator shall be furnished and installed with all regulatory certifications as required and shall comply with all applicable emissions regulations in force at the time of purchase. Unit shall not require additional field certifications to be performed by the owner.
- B. Provide factory test, startup by a supplier authorized by the manufacturer, and on-site testing of the system.

- C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.
- D. The Work specified under this section shall be included as an allowance per Division 1 requirements. Contractor handling charges, overhead, and mark-up shall be included in the base bid and are not included under this allowance.
- 1.04 SHOP DRAWINGS
- A. Submit shop drawings in accordance with Division 1.
- B. General requirements specific to this section include:
  - 1. Submit complete and integrated document containing all equipment included under the scope of this section.
  - 2. Submittal shall be complete, neat, orderly, and indexed with tabbed dividers. Partial submittals will not be accepted.
  - 3. Include a complete list of proposed exceptions to and deviations from these specifications.
  - 4. Clarity and completeness are of prime importance. Acceptability of submittal drawings shall be at the sole discretion of the Engineer in regards to this requirement.
  - 5. Additional requirements for the various subsystems are specified in the corresponding sections.
- C. Submit the following information:
  - 1. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
  - 2. A paragraph-by-paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
  - 3. Manufacturer's certification of prototype testing.
  - 4. Manufacturer's published warranty documents.
  - 5. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
  - 6. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point to point manner.
  - 7. Manufacturer's installation instructions.

#### 1.05 FACTORY TESTING

- A. The generator set supplier shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.
- B. Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks' notice for testing.
- C. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be

acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady state governing, single step load pickup, and function of safety shutdowns.

#### 1.06 OPERATION & MAINTENANCE MANUALS AND INSTRUCTIONS

- A. Submit Operation & Maintenance Manuals and Instructions in accordance with Division 1.
- B. Submit final revised shop drawings incorporating any modifications made as a result of installation, start-up, operational testing, or for any other cause. Submit results of all field-testing and corrective actions taken for all operational parameters.
- C. Submit manufacturer's standard operation & maintenance information including installation manuals and safety instructions.
- D. Submit contact list identifying names, addresses, telephone numbers, and any additional contact information for each equipment service organization involved with the Standby Engine/Generator Set.
- E. Submit detailed operation and maintenance procedures for each major equipment item; include description of operation for all modes of operation, routine maintenance procedures, and trouble-shooting guide.
- F. Submit listing spare parts provided under this contract and of recommended additional spare parts not provided under this contract along with costs.

#### 1.07 QUALITY ASSURANCE

- A. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
- B. All materials, equipment, and parts shall be new and unused of current manufacture.
- C. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.
- D. The Standby Engine/Generator Set manufacturer shall have been engaged in the manufacture of generator sets for a minimum of ten years and shall have a factory trained service and parts organization located within 100 miles of the jobsite.
- E. All control equipment shall be the standard product of the engine/generator set manufacturer. Controls systems that are supplied by a subcontractor of the manufacturer and which are not incorporated into the standard documentation of the manufacturer will not be acceptable.

#### 1.08 WARRANTY

- A. The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

- C. The manufacturer of the generator set shall maintain service parts inventory at a central location that is accessible to the service location 24 hours per day, 365 days per year.
- D. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
- E. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

### PART 2 PRODUCTS

- 2.01 MANUFACTURER
- A. Acceptable Manufacturers
  - 1. Kohler Power Systems.
  - 2. Cummins/Onan.
- B. These specifications, installation design, and the storage facility design are based upon the first named manufacturer. If the contractor elects to supply a different manufacturer, then the contractor shall be responsible for adjusting the installation of the portable engine/generator set to satisfy the requirements of that manufacturer's equipment.
- C. Alternate equipment will only be considered if the following information is submitted ten days prior to the bid date:
  - 1. Certified dimensional data.
  - 2. Complete interconnecting wiring and piping diagrams.
  - 3. Manufacturer's certification of prototype testing.
  - 4. Load study/profile showing non-overloading of genset under steady-state conditions and during motor starting.
  - 5. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
  - 6. A paragraph-by-paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
  - 7. Short circuit study of the load circuits to verify that selective coordination occurs and that thermal-magnetic stresses on components will not exceed the specified ratings.
  - 8. Listing of similar projects and owner contact information for projects completed during the previous five years.

#### 2.02 GENERATOR SET

- A. Ratings
  - The generator set shall operate at 1800 rpm, 60 Hz at the following voltage:
     a. 208/120 volts AC, three-phase, four-wire.
  - 2. The generator set shall have minimum rating of 30kW, 37.5kVA at 0.8 PF, standby rating, based on site conditions of: Altitude 1000 feet, ambient temperatures up to 104 degrees F.
  - 3. The generator set rating shall be based on emergency/standby service.
- B. Performance

- 1. Voltage regulation shall be plus or minus 1.0 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
- 2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25 percent.
- 3. The engine-generator set shall be capable of single step load pick up of 100 percent nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
- 4. Peak motor starting capability at 0.3 power factor shall be 76 kVA at 35% voltage dip.
- 5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic.
- 6. Telephone influence factor shall be less than 40.
- C. Construction
  - 1. The engine generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a corrosion resistant battery tray with hold-down clamps within the rails.
- D. Connections
  - 1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations for the number and type cables shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
  - 2. Power connections to auxiliary devices shall be made at the devices, with connectors suitable for plug-in connection as shown on the drawings.
  - 3. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

## 2.03 ENGINE AND ENGINE EQUIPMENT

- A. The engine shall be diesel fueled, radiator and fan cooled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories.
- B. Engine accessories and features shall include:
  - 1. Complete engine fuel system, including all pressure regulators, strainers, and control valves. The fuel system shall be factory plumbed to the generator set.
  - 2. An electronic governor system shall provide automatic isochronous frequency regulation.
  - 3. Skid mounted radiator and cooling system rated for full load operation in 104 degrees F (40 degrees C) ambient as measured at the generator air inlet, based on 0.5 in H2O external static head. Radiator shall be sized based on a core temperature that is 20 degrees F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture. Rotating parts shall be guarded against accidental contact.
  - 4. Electric starter(s) capable of three complete cranking cycles without overheating.

- 5. Positive displacement, mechanical, full pressure, lubrication oil pump.
- 6. Full flow lubrication oil filters with replaceable spin on canister elements and dipstick oil level indicator.
- 7. Fuel filter with replaceable spin on canister element. Fuel cooler, suitable for operation of the generator set at full rated load in the ambient temperature specified shall be provided if required for operation due to the design of the engine and the installation.
- 8. Replaceable dry element air cleaner with restriction indicator.
- 9. Flexible supply and return fuel lines.
- 10. Engine mounted battery charging alternator, 40-ampere minimum, and solid state voltage regulator.
- 11. Coolant heater
  - a. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be 120V as shown on the project drawings and cord connected. The coolant heater shall be UL499 listed and labeled.
  - b. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
  - c. The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power cord connection shall be provided for a single AC power connection to the coolant heater system.
  - d. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100F (40C) in a 40F ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.
- 12. Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer.
- 13. Starting and Control Batteries shall be calcium/lead antimony type, 12 or 24 VDC, sized as recommended by the engine manufacturer, complete with battery cables and connectors.
- C. Battery Charger
  - 1. A UL listed/CSA certified 10-amp voltage regulated battery charger shall be provided for this engine generator set. The charger shall be mounted on the generator set assembly within the weatherproof enclosure. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of:
    - a. Loss of AC power red light.
    - b. Low battery voltage red light.
    - c. High battery voltage red light.
    - d. Power ON green light (no relay contact).
  - 2. Charger shall include an Analog DC voltmeter and ammeter, 12 hour equalize charge timer, and AC and DC fuses.
  - 3. Provide cord set for quick connection of battery charger to battery terminals.
  - 4. Battery Charger shall operate on 120VAC power and shall be cord connected.

#### 2.04 AC GENERATOR

- A. The AC generator shall be synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees Centigrade.
- B. Generator shall be capable of supplying single-phase output at full capacity rating and unity power factor.
- C. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below selected rated voltage.
- D. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single-phase or three-phase fault at approximately 300% of rated current for not more than 10 seconds.
- E. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.
- 2.05 ENGINE GENERATOR SET CONTROL
- A. A NEMA 1 enclosed control panel shall be mounted on the generator set with vibration isolators. The control shall be vibration isolated and prototype tested to verify the durability of all components under the vibration conditions encountered.
- B. The generator set mounted control shall include the following features and functions:
  - 1. Three-position control switch labeled RUN/OFF/AUTO. In the RUN position the generator set shall automatically start, and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
  - 2. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
  - 3. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power.
  - 4. Generator Set AC Output Metering: The generator set shall be provided with a metering set with the following features and functions:
    - a. Analog AC Voltmeter, dual range, 90 degree scale, 2% accuracy; Analog AC Ammeter, dual range, 90 degree scale, 2% accuracy; Analog Frequency/RPM meter, 45 65 Hz, 1350 1950 RPM, 90 degree scale, +/ 0.6 Hz accuracy.
    - b. Seven position phase selector switch with OFF position to allow meter display of current and voltage in each generator phase. When supplied with reconnectable generators, the meter panel shall be reconnectable for the voltage specified.
  - 5. Generator Set Alarm and Status Display: The generator set shall be provided with alarm and status indicating lamps to indicate non automatic generator status, and existing alarm and shutdown conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a

command to start from a remote location. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on the display panel:

- a. Low oil pressure (alarm).
- b. Low oil pressure (shutdown).
- c. Low coolant temperature (alarm).
- d. High coolant temperature (alarm).
- e. High coolant temperature (shutdown).
- f. Overcrank (shutdown).
- g. Overspeed (shutdown).
- h. Low fuel (alarm).
- i. In addition, provisions shall be made for indication of two customer specified alarm or shutdown conditions.
- 6. Engine Status Monitoring: The following devices shall be provided on the generator set control:
  - a. Engine oil pressure gauge.
  - b. Engine coolant temperature gauge.
  - c. Engine operation hour gauge.
  - d. Battery voltage (DC volts).
- 7. Engine Control Functions. The control system provided shall include a cycle cranking system, which shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods. Fail to start shall be indicated by operation of the overcrank alarm indication lamp. The control system shall also include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification.
- 8. Alternator Control Functions:
  - a. The generator set shall include an automatic voltage regulation system that is matched and prototype tested with the governing system provided. It shall be immune from misoperation due to load induced voltage waveform distortion and provide a pulse-width modulated output to the alternator exciter. The system shall include a torque matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of [58 59] HZ.
  - b. Voltage adjusting rheostat, locking screwdriver type, to adjust voltage +/ 5% from rated value.
- 9. Voltage Range Select Function:
  - a. The generator set shall be equipped with a full-load rated panel-mounted, rotary switch for de-energized reconnection of alternator leads to provide multiple, individually selectable output voltage levels.
- 10. The generator set shall be provided with one mounted main line circuit breaker for each selected output voltage, sized as follows:
  - For 208/120V 3-phase, 4-wire (wye) connection, 100A.
- 11. Circuit breakers shall be equipped with shunt trip and shall automatically open on a genset shutdown alarm.
- C. Sequence of Operation

a.

- 1. Generator set shall start on receipt of a manual start signal at the generator control panel.
- 2. The generator set control shall initiate the starting sequence for the generator set.
- 3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to

prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

- 4. When all start signals have been removed from the generator set, the generator set control shall switch off the excitation system and shall shut down.
- 5. A start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

## 2.06 PORTABLE ENGINE EXHAUST SYSTEM

- A. Exhaust system shall comply with and be factory certified to all applicable regulatory requirements for portable diesel fueled engines in effect at the time of purchase. Install exhaust system according to the engine manufacturer's recommendations and applicable codes and standards.
- B. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.
- C. Provide stainless steel, seamless flexible exhaust manifold connector.

## 2.07 PORTABLE DIESEL ENGINE FUEL SYSTEM

- A. Diesel fuel sub-base tank
  - 1. Manufacturer shall be Tramont, or equal. Equal manufacturers shall have a minimum ten years' experience in the design and construction of Underwriters Laboratories (UL) listed sub base tank systems.
  - 2. Tank construction:
    - a. Fuel tank shall be sized based upon the fuel requirements of the genset to provide a minimum of twenty-four hours of genset runtime at full rated standby output capacity.
    - b. Sub base tank shall be constructed in accordance with Flammable and Combustible Liquids Code, NFPA 30; The Standard for Installation and use of Stationary Combustible Engine and Gas Turbines, NFPA 37; and The Standard for Emergency and Standby Power Systems, NFPA 110.
    - c. Sub base tank shall be rectangular in shape.
    - d. Sub base tank shall include reinforced steel box channel for generator support, with load rating of 5,000 lbs. per genset mounting hole location. Full height gussets shall be provided at genset mounting holes.
    - e. Sub base tank shall be pressure washed with an iron phosphate solution. Interior shall be coated with a solvent-based film rust preventative, providing inter-operational protection.
    - f. Sub base tank shall be shipped with a certificate of Structural/Mechanical Integrity, certifying that it has met standards through rigorous testing and has demonstrated specified capabilities.
    - g. Sub base tank shall include a welded steel containment basin, sized at a minimum of 110% of the tank capacity to prevent escape of fuel into the environment in the event of a tank rupture.
    - h. Sub base tank shall include a direct-reading fuel level gauge.
    - i. A fuel containment basin leak detector switch shall be provided.
  - 3. Tank fittings:

- a. Appropriately sized NPT fuel supply.
- b. Fuel return fitting.
- c. 1-1/4" NPT for normal vent.
- d. NPT for emergency vent, sized as appropriate.
- e. 2" NPT for manual fill with containment and audible fill alarm.
- f. NPT for level gauge, sized as appropriate.
- g. 3/8" NPT basin drain.
- h. 2" NPT for level alarm.
- i. NPT fitting for leak detection alarm.
- 4. Tank venting:
  - a. Normal venting shall be sized at 1-1/4" NPT for tanks through 2,499 gallons (1-1/2" NPT for 2,500 to 3,000 gallons; 2" NPT for 3,001 to 10,000 gallons) in accordance with The American Petroleum Institute Standard No. 2000, for venting atmospheric and low pressure storage tanks. Tank shall be provided with atmospheric (normal) vent cap with screen.
  - b. The emergency vent NPT fitting shall be sized to accommodate the total capacity of both normal and emergency vents, and is not less than that derived from NFPA 30, Table 2-8, based on wetted surface area of the tank (calculated based on 100% of primary tank). A zinc-plated emergency pressure relief vent cap shall be furnished. The vent shall be spring-pressure operated. Opening pressure shall be 0.5 psig; full opening pressure shall be 2.5 psig. Limits shall be marked on top of each vent. A second emergency vent fitting shall be provided for the secondary containment portion of the tank if applicable.
- 5. Testing
  - a. Primary tank sections shall be pressurized at 3-5 psi and leak-checked to ensure integrity of sub base weld seams per UL-142 standards. Containment basin shall be leak-checked by means of weld penetrant and ultraviolet light.
- B. State of Wisconsin licensed installer shall install tank.
- 2.08 PORTABLE ENGINE/GENERATOR SET TRAILER
- A. Manufacturer shall be Tramont, or equal. Equal manufacturers shall have a minimum ten years' experience in the design and construction of Underwriters Laboratories (UL) listed sub base tank systems.
- B. Trailer Design and Construction
  - 1. Trailers shall include integral sub base (generator base) tank.
  - 2. Trailer design and construction shall include the following:
    - a. Tandem axle/single axle.
    - b. Load rated for the combined weight of the genset, fuel tank, fuel, housing, and accessories.
    - c. All steel, heavy formed channel construction (tongue and side).
    - d. Integral cross-members at genset mounting points.
    - e. Trailer tongue shall be bolt-on extension of side channels with a cross-member providing triangulation support point for standard tongue jack and continuing to an adjustable hitch.
    - f. Heavy-duty tongue jack.
    - g. Fenders constructed of formed steel and bolted to side channels. Non-skid material on top surface of fenders.
    - h. Torflex hydraulic/electric brake axle bolted to trailer frame.

- i. 15/16" tire and wheel assemblies shall conform to axle.
- j. 2-5/16" adjustable height ball coupler (or 2" ball or 3" pintle eye). Coordinate requirements with owner.
- k. Heavy-duty safety chains, including slip hook.
- 1. Two 5,000 lb. rear stabilizer jack stands bolted to rear cross-member.
- m. ICC lighting with (6) wire connector. Electrical components meet Department of Transportation requirements, including rear taillights, reflectors and wire harness.
- n. Tongue mounted, waterproof hinged and gasketed storage box with lockable side-mounted hasp.
- o. Trailer and accessories shall be chemically cleaned. Trailer finished with epoxy primer coat and gloss black acrylic enamel paint.

### 2.09 POWER CONNECTION CORD SETS

- A. Generator set manufacturer shall provide one cord set, type W, 50-foot length as follows:
   1. Four-conductor (plus ground) cable rated for 100A at voltage of 208/120VAC.
- B. Cord set shall include cord end connectors (plugs) manufactured by Cooper/Crouse-Hinds for connection to generator and to load-end receptacle. Generator set manufacturer shall provide matching mating receptacles for both ends of the cord set. The source receptacle shall be factory installed on the generator enclosure. The load-end receptacle shall be turned over to the Electrical Contractor for installation on control panel at service location indicated:
  - 1. Voltage: 208/120V (three-phase, four-wire):
    - a. Generator (source-side) receptacle to be installed on portable generator: 100A, Style 1, 4-wire, 4-pole, AR1041.
    - b. Source-side cord-end connector plug: 100A, Style 1, 4-wire, 4-pole, APJ10477.
    - c. Load-side cord-end connector (plug): 100A, Style 1, 4-wire, 4-pole, reverse service, APJ10477-S22.
    - d. One service (load-side) receptacle for installation at lift station: 100A, Style 1, reverse service, 4-wire, 4-pole, AR1041-S22 with angle adapter and backbox.
  - 2. Cord-end connector/plugs shall be provided with threaded covers for protection.
  - 3. Receptacles shall be provided with spring-loaded gasketed weatherproof flip covers.
  - 4. Cord-end connector (plug) and receptacles shall be permanently marked with indicated output voltage and corresponding color band.

## 2.10 OUTDOOR WEATHER-PROTECTIVE SOUND ATTENUATING HOUSING

- A. The generator set shall be provided with a sound-attenuated housing which allows the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound pressure level of the generator set while operating at full rated load to a maximum of 67 dBA at any location 7 meters from the generator set in a free field environment. Housing configuration and materials used may be of any suitable design which meets application needs, except that acoustical materials used shall be oil and water resistant. No foam materials shall be used unless they can be demonstrated to have the same durability and life as fiberglass.
- B. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and pad-lockable door latches shall be provided for all doors. Door hinges shall be stainless steel.

- C. The enclosure shall be provided with an exhaust silencer that is mounted inside of the enclosure, and allows the generator set package to meet specified sound level requirements. Grille on top of enclosure shall be removable and silencer and exhaust shall include a removable rain cap and rain shield to allow easy connection of flexible exhaust hose to building exhaust pipe.
- D. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color. All surfaces of all metal parts shall be primed and painted.
- E. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.
- F. Enclosure shall protect against entry of rodents, birds, and other wildlife. All openings shall be plugged, sealed, screened or otherwise protected against bird or animal entry.

#### 2.11 ACCESSORIES

A. Provide supply of consumables (air cleaner, oil filter, etc) in sufficient quantity to last for one year from the date of substantial completion.

### PART 3 CONSTRUCTION METHODS

- 3.01 DIVISION OF WORK
- A. The Contractor shall have overall system responsibility and shall provide all materials and labor necessary provide a complete and operable system and comply with all requirements of this section.
- B. The engine/generator set manufacturer shall be responsible for certifying the correctness of installation for all work related to the standby power system regardless of who performs the installation work.
- C. The contract drawings are diagrammatic in nature; it shall be the responsibility of the manufacturer to supplement the contract drawings and complete the final design of the standby power system and to coordinate exact requirements with the installing contractors.

#### 3.02 FIELD MEASUREMENTS

A. Field verify with exact measurements, the available mounting space for standby power system equipment. Identify deficiencies prior to beginning installation.

#### 3.03 DELIVERY STORAGE AND HANDLING

- A. It shall be the responsibility of the installing contractor to receive all standby power system equipment at the job site. Carefully inspect all equipment for damage prior to accepting from the shipping agency. Do not accept shipment if damage is evident.
- B. Exercise due diligence in storing, protecting, and moving standby power system equipment. Damaged or worn equipment will not be accepted and will be replaced at no additional cost to the Owner.

#### 3.04 INSTALLATION

- A. Install equipment in locations as indicated on the contract documents. Adjust locations as needed to ensure operability, serviceability, and compliance with all applicable codes and standards.
- B. Installation shall be completely tested prior to start-up. This work includes verification of all field wiring continuity and proper termination of wiring.
- C. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.
- D. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
- E. Installation of equipment shall include furnishing and installing all fuel piping and vent piping as required. The tank installer shall perform this work under the supervision of the equipment supplier.
- F. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
- G. Equipment shall be initially started and operated by representatives of the manufacturer.
- H. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.
- 3.05 TESTING AND START-UP SERVICES
- A. Standby power system supplier shall provide installation and start-up services required to place the complete system into operation.
- B. The complete installation shall be tested for compliance with the specification following completion of all site work. Representatives of the manufacturer shall conduct testing, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.
- C. Installation acceptance tests to be conducted on site shall include a "cold start" test and a onestep rated load pickup test in accordance with NFPA 110.
- D. Test alarm and shutdown circuits by simulating conditions. Adjust output voltage and engine speed.
- E. Verify fuel system installation and capacity.

F. Provide for one technician follow-up visit within one month of commissioning to consult with owner and make any final adjustments, corrections, or repairs.

#### 3.06 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 2 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

## **END OF SECTION**

## SECTION 26 90 01

## LIFT STATION INSTRUMENTATION & CONTROL

## PART 1 GENERAL

#### 1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern the work of this section.

#### 1.02 APPLICABLE PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent applicable.
  - 1. American National Standards Institute/Instrument Society of America (ANSI/ISA), Specifications and Standards, current edition:
    - a. ANSI/ISA-5.1-1984 Instrumentation Symbols and Identification.
  - 2. American National Standards Institute/National Fire Protection Agency (ANSI/NFPA), Specifications and Standards, current edition:
    - a. NFPA 70 National Electrical Code.
  - Canadian Standards Association (CSA), Specifications and Standards, current edition:
     a. CSA C22.2, Industrial Control Equipment.
  - 4. CUL Underwriter's Laboratories of Canada.
  - 5. International Electrotechnical Commission (IEC), Specifications and Standards, current edition:
    - a. IEC 60529 Classification of Degrees of Protection Provided by Enclosures
  - 6. National Electrical Manufacturers Association (NEMA), Specifications and Standards, current edition:
    - a. NEMA ICS 2 Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
  - 7. Underwriters Laboratories, Inc. (UL), Specifications and Standards, current edition:
    - a. UL508 Industrial Control Equipment.
    - b. UL508A Industrial Control Panels.
    - c. UL 698 Industrial Control Equipment for Use in Hazardous (Classified) Locations
    - d. UL 698A Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations
    - e. UL 913 Intrinsically Safe Specification.
    - f. UL94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

#### 1.03 DESCRIPTION OF WORK

- A. The work specified herein shall include the furnishing of all materials, equipment, labor, and supervision necessary to fabricate, install, start-up, and test a complete and operable Lift Station Instrumentation and Control System.
- B. The labor specified herein includes but is not limited to engineering, software development, panel fabrication, equipment calibration and adjustment, testing, training, and documentation.

- C. This section identifies the overall functional requirements for the Lift Station Instrumentation and Control System.
- D. This section includes modifications to the existing SCADA system and radio frequency communication network.
- E. This section includes coordination with the work of other sections. It shall be the responsibility of the system integrator specified under this section to execute this coordination during the shop drawing submittal phase of the work. Additional costs due to inadequate coordination as required herein shall be borne solely by this contractor.
- F. This section includes coordination with electrical contractor to ensure that the proper number of raceways and conductors are installed. It shall be the responsibility of the system integrator to coordinate this work with the installing electrician. Additional costs due to inadequate coordination as required herein shall be borne solely by this contractor.
- G. The Work specified under this section shall be included as an allowance per Division 1 requirements. Contractor handling charges, overhead, and mark-up shall be included in the base bid and are not included under this allowance.
- 1.04 SUBMITTALS
- A. Submit shop drawings in accordance with Division 01.
- B. Submit the following information specifically for Lift Station Instrumentation and Control:
   1. General requirements specific to this section include:
  - a. Submit complete and integrated document containing all equipment included under the scope of this section.
  - b. Submittal shall be complete, neat, orderly, and indexed with tabbed dividers. Partial submittals will not be accepted.
  - c. Include a complete list of proposed exceptions to and deviations from these specifications.
  - d. Clarity and completeness are of prime importance. Acceptability of submittal drawings shall be at the sole discretion of the Engineer in regards to this requirement.
  - 2. Submit the following information:
    - a. Bill of Materials:
      - 1) Complete listing of all components identifying exact make and model, quantity, and description.
    - b. Component Data Sheets:
      - 1) Detailed listing for each type of device, identifying Engineer's tag number, manufacturer, model, options, ranges, and other information necessary to supplement component catalog cut sheets and clearly show compliance with these specifications.
    - c. Component Catalog Cut sheets:
      - 1) Manufacturer's standard catalog information.
    - d. Control Panel Construction Drawings:
      - 1) Scaled drawings of all control panels and enclosures.
      - 2) Front panel elevation complete with nameplate legend.
      - 3) Back panel elevation complete with schedule of devices.
    - e. Control Panel Schematic Wiring Diagrams:
      - 1) Ladder type schematic diagrams.

- 2) Show all devices requiring electrical connections.
- 3) Identify all wire and terminal numbers.
- 4) Identify PLC I/O addresses.
- 5) Reference Engineer's tag number where assigned.
- 6) Cross-reference all relay contacts and coils.
- 7) Identify switching action on all switching devices.
- 8) Common diagrams will not be accepted.
- f. Analog Loop Diagrams:
  - 1) Show all devices requiring electrical connections.
  - 2) Identify all wire and terminal numbers.
  - 3) Identify PLC I/O addresses.
  - 4) Identify location of loop power supply.
  - 5) Identify field devices, back-of-panel devices, and front-of panel devices.
  - 6) Show tabular summary of transmitter output capability, input impedance of each receiver, total loop impedance, and reserve output capacity.
  - 7) Reference Engineer's tag number where assigned.
  - 8) Common diagrams will not be accepted.
- g. Control Panel Power and Environmental Requirements:
  - 1) Identify voltage and ampacity requirements.
  - 2) Show sizing calculations for environmental controls (ventilation, heat, air conditioning).
- h. Interconnecting Wiring Diagrams:
  - 1) Show all interconnections between control panels and field devices.
  - 2) Identify all wire and terminal numbers, including field terminal junction box terminals.
- i. Control Device Installation Details:
  - 1) Supplement contract documents with additional details necessary for proper installation of control devices.
- j. Configuration Documentation:
  - 1) Submit complete, documented configuration data for all configurable controllers.

#### 1.05 FACTORY TESTING

- A. The entire Lift Station Control System shall be assembled at the manufacturer's facility and tested to the greatest extent possible. This test shall include demonstration of proper system operation. Document the results of this test in writing and submit to the Engineer.
- B. The Engineer and Owner may witness the factory acceptance test. Schedule test date a minimum of two weeks in advance to allow attendance by the Engineer and the Owner.
- C. Correct any deficiencies identified during the test prior to shipping the control system to the job site.
- 1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS
- A. Submit operation & maintenance manuals and instructions in accordance with Division 01.
- B. Submit the following information specifically for Lift Station Instrumentation and Control:
  - 1. Submit final revised shop drawings incorporating any modifications made as a result of factory test, installation, start-up, operational testing, or for any other cause. Submit

results of all field-testing and corrective actions taken for all discrete control devices and for all analog control devices. Submit analog device calibration data sheets.

- 2. Submit manufacturers' standard operation & maintenance information including installation manuals and safety instructions.
- 3. Submit contact list identifying names, addresses, telephone numbers, and any additional contact information for each equipment service organization involved with the Process Instrumentation and Control System.
- 4. Submit detailed operation and maintenance procedures for each major equipment item; include description of operation for all modes of operation, routine maintenance procedures, and trouble-shooting guide.
- 5. Submit listing spare parts provided under this contract and of recommended additional spare parts not provided under this contract along with costs.

## 1.07 QUALITY ASSURANCE

- A. All materials, equipment, and parts shall be new and unused of current manufacture.
- B. System supplier shall be responsible for providing all necessary accessories required for a complete and operable system.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- D. Products: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.
- E. Control panels shall be constructed in accordance with UL 508 and UL698A standards and shall bear the UL listing.
- F. Control panel shall be marked in accordance with NEC requirements to identify it as being suitable for use as service equipment.
- 1.08 WARRANTY
- A. See Division 01 for additional requirements.

## PART 2 PRODUCTS

## 2.01 SYSTEM INTEGRATOR

- A. The system integrator shall be a firm specializing in the integration of control systems with documented experience in the detailed design, construction, configuration, and maintenance of PLC based control systems and motor control centers for the water/wastewater utility market. System Integration firms that are able to document compliance with the following requirements will be considered an equal to the named system integrators.
  - 1. The system integration firm has completed projects for at least five municipal customers, two of which must be similar in scope and approach to this project.
  - 2. To demonstrate financial stability, the system integration firm has completed a minimum of four past projects, each with an individual contract cost in excess of \$500,000.
  - 3. To demonstrate technical capability, the system integration firm shall employs an onstaff, full-time employee that is a State of Wisconsin Licensed Professional Engineer and also employs an engineering staff of not less than five engineers with no less than a

combined experience of no less than 100 years designing, constructing, and configuring process control systems.

- 4. The system integration firm shall have an active \$1,000,000 Professional Liability Insurance Policy.
- 5. The system integrator shall be factory authorized to commission Drives, PLC's and MCC's, and to be an authorized Rockwell Strategic Provider with full development software to modify and create new applications in the specified HMI software.
- B. Acceptable system integrators include
  - 1. P.J. Kortens and Company, Inc., contact Mark Hoff, telephone number 920-730-9023.

## 2.02 ENVIRONMENTAL REQUIREMENTS

## A. Enclosure:

- 1. NEMA 3R insulated enclosure constructed of 12 or 14 gauge 304SS and suitable for mounting as shown on the drawings.
- 2. 12 gauge enclosures have 10 gauge backs Floor stands are welded to enclosure
- 3. Seams continuously welded and ground smooth, no holes or knockouts
- 4. Strong, rigid construction with body stiffeners
- 5. Gasketed overlapping doors eliminate need for center post
- 6. Painted steel back-panel for equipment mounting.
- 7. Dead front, three-point latch, gasketed exterior door, with padlocking attachment and full-length piano type hinge.
- 8. Aluminum or stainless steel inner door for mounting of all pilot devices.
- 9. Self-grounding latch system with double seal provides maximum protection against leakage.
- 10. Latch rods have rollers for easier door closing.
- 11. Heavy duty lifting eyes are Type 316 stainless steel
- 12. Data pocket, provided on door with 3-point latches, is high-impact thermoplastic
- 13. Collar studs for mounting optional panel
- 14. Ground studs in body of enclosure
- 15. Bonding provision on doors
- 16. Drip shield kit
- 17. Finish:
  - a. Enclosures are unpainted. Front, sides, top, and back have smooth No.4 brushed finish
  - b. Steel sub-panels are painted white
- B. Temperature Control:
  - 1. Thermostatically controlled, fan-forced heater, sized to maintain equipment-operating temperature inside panel.
  - 2. Thermostatically controlled condensation heater sized to prevent condensation inside panel or any panel components.
  - 3. Filtered ventilation fan(s) where needed and sized to dissipate heat generated by components located within control panel.
- C. Corrosion Protection:
  - 1. Vapor phase protective corrosion inhibitor selected based upon interior volume of enclosure.

#### 2.03 ELECTRICAL REQUIREMENTS

#### A. Service Entrance:

- 1. Suitable for electric service as shown on the drawings.
- 2. Main circuit breaker and short circuit current rating, suitable for the ampacity and available fault current identified on the drawings.
- B. Lightning/Surge Protection
  - 1. A 100kA lightning arrestor shall be supplied and connected to each line of the incoming side of the power input terminals. The arrestor shall protect the panel components from damage due to lightning strikes on the incoming power line.
  - 2. A three phase surge capacitor shall be supplied and connected to each line of the incoming side of the power input terminals. The capacitor shall provide supplemental protection of the panel components from damage due to surges on the incoming power line.
- C. Phase Failure Relay
  - 1. Relay voltage sensing for under voltage, phase reversal, phase unbalance and phase loss.
- D. Uninterruptible Power Supply:
  - 1. Control Panel and control system shall incorporate an Uninterruptible Power Supply (UPS) capable of sustaining control system, telemetry system and alarm system operation for a minimum of thirty minutes.
- 2.04 CONTROL POWER:
- A. 208/120V, 3-Phase, 4-Wire System (refer to contract drawings).
  - 1. Grounded 208-120V control power transformer with two primary fuses and one secondary fuse.
  - 2. Size transformer to accommodate control panel loads and other station loads as identified on the drawings.
  - 3. Single-pole circuit breakers as needed for control panel loads.
  - 4. Single and multi-pole circuit breakers for other station loads as identified on the drawings.
- 2.05 MISCELLANEOUS:
- A. Interior-mounted, individually protected, GFCI duplex outlet, Hubbell #GFR8300HILU, or equal.
- B. Exterior-mounted, individually protected, GFCI duplex outlet, Hubbell #GFR8300HILU, or equal.
- C. Interior mounted light with control panel door switch.
- 2.06 CONTROL SYSTEM FUNCTIONAL REQUIREMENTS
- A. General:
  - 1. Float switches and hardwired control shall provide backup wet well level control.
- B. Power Monitoring

- 1. Power fail relay provided under this section shall detect CONTROL POWER FAIL condition when 120VAC control power circuit fails.
- 2. Uninterruptible Power Supply is provided under this section. Provide relay logic as necessary to generate common UPS FAULT signal.
- 3. Phase failure relay provided under this section shall detect abnormal conditions and generate PHASE FAIL signal to prevent motor operation under any abnormal condition. Motors shall restart upon restoration of proper voltage and phase. Normal motor starting voltage dip shall not cause phase failure relay to trip motor.
- C. Raw Wastewater Pump Motor Control:
  - 1. Each pump shall be equipped with the following pilot control devices:
    - a. Hand-Off-Auto selector switch.
    - b. Required Pilot Light (Amber).
    - c. Run Pilot Light (Green).
    - d. Fail Pilot Light (Red).
    - e. High Temperature Pilot Light (Red).
    - f. Seal Fail Pilot Light (Amber).
    - g. Reset Pushbutton.
    - h. Runtime Totalizer (Seven digit, accurate to 0.01 hours).
  - 2. In Hand position pump shall run continuously. In Auto position pump shall run in response to signals from wet well level control system. Auxiliary contact shall monitor IN AUTO position.
  - 3. Required light shall be energized when wet well level control system calls pump to run.
  - 4. Run light shall be energized by run signal.
  - 5. Motor overload shall provide motor protection. Auxiliary contacts shall monitor the following motor data functions: RUN and MOTOR OVERLOAD.
  - 6. Fail light shall be energized by a discrepancy between required and run conditions after an adjustable time delay. Fail condition shall prevent pump from running and shall require local reset.
  - 7. High temperature light shall be energized by pump high temperature sensor. Provide adjustable time delay to prevent nuisance alarms after power outage. Provide interface relay compatible with pump requirements. High temperature condition shall prevent pump from running and shall require local reset.
  - 8. Seal fail light shall be energized by pump seal fail sensor. Provide interface relay compatible with pump requirements. Seal fail light shall provide indication only.
  - 9. Display the following status conditions: IN AUTO, REQUIRED, RUN, and MOTOR OVERLOAD.
- D. Local Control Functions:
  - 1. Three intrinsically safe float switches provided under this section shall detect the following Lift Station WET WELL LEVEL conditions:
    - a. High Level/LAG pump ON.
    - b. Lead Pump ON.
    - c. Low Level/pumps OFF.
  - 2. Provide intrinsically safe relay for each discrete float switch.
  - 3. Submersible level transmitter shall detect wet well level.
  - 4. Provide intrinsically safe barrier for level sensor.
  - 5. Provide surge protection in panel for each analog signal circuit.
- E. Provide selector switch on deadfront door for wet well control: Normal/Back-up.
- F. Normal Wet Well Level Control:

- 1. Programmable Logic controller and submersible level transducer shall be the primary level control in the wet well. This system shall have a minimum of the following setpoints accessible via the operator interface terminal:
  - a. High Level Alarm Setpoint.
  - b. Lag Pump On Setpoint.
  - c. Lead Pump On Setpoint.
  - d. Lag Pump Off Setpoint.
  - e. Lead Pump Off Setpoint.
  - f. Low Level Alarm Setpoint. (redundant pumps off)
- G. Backup Wet Well Level Control:
  - 1. The following pilot devices shall be incorporated into the backup wet well level control system:
    - a. High Float Level Alarm Pilot Light (Red).
    - b. Low Float Level Alarm Pilot Light (Red).
    - c. Back-up Control Active Pilot Light (Red).
    - d. Back-up Control Reset Pushbutton.
  - 2. High Float Level alarm pilot light shall be energized by high level float. High level float shall be a normally closed contact float switch.
  - 3. If the normal level control fails and the wetwell level drops to the low alarm float, the operating pump(s) shall be deactivated.
  - 4. Low Float Level alarm pilot light shall be energized by low level float.
  - 5. HIGH FLOAT LEVEL and LOW FLOAT LEVEL conditions shall generate BACKUP CONTROL ACTIVE signal after adjustable time delay (0 to 30 seconds) and shall illuminate the Back-up Control Active Pilot Light.
  - 6. Normal wet well level control shall be disabled when back-up level control is activated.
  - 7. In backup control, the Lead pump ON float shall start Pump No.1 after the delay as long as the low level float condition is not active.
  - 8. In backup control the High Level float shall activate adjustable Pump No.2 ON delay timer (0 to 60 seconds). Pump No.2 REQUIRED signal shall be generated after the delay time has expired only if the High Level Float remains active (rising wetwell level).
  - 9. Operating pump(s) shall be deactivated when the wetwell level falls to the low float.
  - 10. Back-up Wet Well Level Control shall require manual reset. Normal wet well level control shall be restored by depressing the Backup Control Reset pushbutton when both the HIGH FLOAT LEVEL and LOW FLOAT LEVEL conditions are not active.
- H. Human Machine Interface
  - 1. Display available parameters, including pump run times, alarm status, setpoints, and calculated daily, yesterday's and cumulative flow totals.
  - 2. Provide operator adjustability of all set-points as described above.
  - 3. Display alarm history, including time and date stamp, in reverse chronological order.
  - 4. Display instantaneous flow and totalized flow.
    - a. Display totalized flow for each pump and combination of pumps.
    - b. Display totalized flow for all pumps.
  - 5. Provide data logging for future Compact Flash Card or USB download in.CSV format of pump run times, alarm status, setpoints, and calculated daily, yesterday's and cumulative flow totals.
- I. Alarming:
  - 1. Weatherproof alarm light with LED lamp, weatherproof alarm horn, and weatherproof silence pushbutton shall be mounted on panel exterior.

- 2. The following conditions shall activate the alarm system:
  - a. Pump No.1 Call-to-Run Fail.
  - b. Pump No.1 Motor High Temperature.
  - c. Pump No.1 Seal Fail.
  - d. Pump No.2 Call-to-Run Fail.
  - e. Pump No.2 Motor High Temperature.
  - f. Pump No.2 Seal Fail.
  - g. Wetwell High Level Alarm (float switch).
  - h. Wetwell Low Level Alarm (float switch).
  - i. Backup Level Control System Active.
  - j. Power Phase Fail.
  - k. Control Power Fail.
  - l. UPS Fault.
- J. Remote Monitoring, SCADA system:
  - 1. SCADA system programmable logic controller system shall provide remote monitoring of the following status and alarms for future communication with the SCADA radio:
    - a. Pump No.1 In Auto.
    - b. Pump No.1 Run.
    - c. Pump No.1 Call-to-Run Fail.
    - e. Pump No.1 Motor High Temperature.
    - f. Pump No.1 Seal Fail.
    - g. Pump No.1 Motor Overload
    - h. Pump No.2 In Auto.
    - i. Pump No.2 Run.
    - j. Pump No.2 Call-to-Run Fail.
    - 1. Pump No.2 Motor High Temperature.
    - m. Pump No.2 Seal Fail.
    - n. Pump No.2 Motor Overload
    - o. Wet Well Level.
    - p. Wetwell High Level Alarm (float switch).
    - q. Wetwell Low Level Alarm (float switch).
    - r. Backup Level Control System Active.
    - s. Power Phase Fail.
    - t. Control Power Fail.
    - u. UPS Fault.

#### 2.07 SCADA SYSTEM AND RADIO COMMUNICATIONS

#### A. Summary of System Improvements:

- Radio communications will be provided under a separate contract.
  - a. Maintain space in panel, minimum 18" x 12" for future SCADA radio, surge suppressor, and antenna cable. Panel to have access on side of panel to accommodate antenna cable exit. See plans.
- 2.08 MAJOR COMPONENTS

1.

- A. Enclosure shall be Hoffman, or equal.
- B. Lightning arrestor shall be Square D SDSA Series, or equal.
- C. Surge capacitor shall be Delta CA Series, or equal.

- D. Motor Controllers:
  - 1. Magnetic starters through NEMA Size 9 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring. Each starter shall have one (1) NO auxiliary contact
  - 2. Coils shall be permanently marked with voltage, frequency and part number
  - 3. NEMA Size 00 through 2 starters shall be suitable for the addition of at least six (6) external auxiliary contacts of any arrangement normally open or normally closed. Size 3 through 8 starters shall be suitable for the addition of up to eight (8) external auxiliary contacts of any arrangement normally open or normally closed
  - 4. Motor starter units shall have a 3-pole manual reset solid-state overload relays with alarm contacts and providing Class 20 operation with the following protection features:
    - a. Over current.
    - b. Phase loss.
    - c. Ground fault.
    - d. Jam protection.
  - 5. Where under-current protection is indicated for motors, provide second solid-state relay with adjustable trip current setting (40-100% of rated) to detect under current condition and alarm as shown.
- E. Circuit breakers shall be Square D, Cutler-Hammer, or equal.
- F. Programmable logic controller system shall be Allen-Bradley Micrologix 1400.
- G. Operator Interface shall be a minimum 5" high brightness touch screen, Beijer T7BR, Pro-face AGP3300-U1-D24, IDEC HG High Performance Series, or equal. Display shall be easily viewable in full daylight.
- H. Ethernet switch shall be industrial 5-port switch designed for control panel installation, Hirschmann, Phoenix Contact, or equal.
- I. Pilot devices shall be Allen Bradley Bulletin 800T/800H, or equal.
  - 1. 30mm, oil tight
  - 2. Indicating Lights: push-to-test.
- J. Phase failure relay shall be Symcom Motor Saver, or equal.
- K. Relays shall be Allen Bradley, or equal.
  - 1. General Purpose: Bulletin 700-HB
  - 2. Solid State: Bulletin 700-SH
- L. Timing relays shall be Allen Bradley Bulletin 700-HS, or equal.
- M. Uninterruptible Power Supply shall be PULS Dimension DC-UPS, or equal.
  - 1. Internal Battery type: Sealed, lead-acid; maintenance free
  - 2. Provide dry contacts for monitoring Ready, Buffering (in use), and Replace Battery status.
  - 3. Warranty: 3 year comprehensive, including battery.
- N. Intrinsically safe relays shall be Diversified Electronics, Inc. Model ISO-120-xx, or equal.
- O. Intrinsically safe barriers shall be non-zener type, PR Electronics, or equal.

- P. Submersible Level Element and Transmitter shall be manufactured by Sigma Controls, Model 6100, Or equal.
- Q. Float switches shall be Anchor Scientific, Non-mercury Rotofloat-SST, or equal, complete with 15-pound anchor, nylon coated stainless steel rope, and clamps. Float Switches shall be provided with adequate cable length to reach the Lift Station Control Panel without splices and to provide slack cable as shown on drawings.
- R. Alarm strobe shall be weatherproof, red in color, and constructed of shatter- proof polycarbonate material. The strobe shall utilize a Xenon flash tube and shall contain internal timing and trigger circuits. Unit shall be U.L. Listed and manufactured by Edwards Signal, 94 Series, or equal.

#### PART 3 CONSTRUCTION METHODS

#### 3.01 DIVISION OF WORK

- A. The Contractor shall have overall system responsibility and shall provide all materials and labor necessary to provide a complete and operable system and comply with all requirements of this section.
- B. It shall be the responsibility of the Contractor and the Lift Station Control System supplier to coordinate various installation aspects including but not limited to the following:
  - 1. Proper type, size, and number of raceways and signal wiring.
  - 2. Proper type, size, and number of raceways and power wiring,
  - 3. Proper installation including working clearances based on actual as-built physical dimensions of electrical panels and enclosures.
  - 4. Shipping schedules for timely installation of equipment.
  - 5. Conduit entrance requirements.
  - 6. Proper special cable lengths required for field instruments.
  - 7. Wire numbering methodology for all field wiring.
- C. The Lift Station Instrumentation and Control System supplier shall be responsible for certifying the correctness of installation for all work related to the lift station instrumentation and control system regardless of who performs the installation work.
- D. The contract drawings are diagrammatic in nature; it shall be the responsibility of the supplier to supplement the contract drawings and complete the final design of the instrumentation and control system and to coordinate exact requirements with the installing contractors.

#### 3.02 CONTROL PANEL CONSTRUCTION

- A. General requirements
  - 1. Fabricate, install instruments, plumb and wire in factory.
  - 2. Test wiring and plumbing prior to shipment.
  - 3. Make external connections by way of numbered terminal blocks.
  - 4. Separate electrical components from pneumatic components by metal barriers.
  - 5. Conform to ISA standards.

#### B. Fabrication

1. Panel cutouts for instruments and other devices, such as lights and switches, shall be cut, punched, or drilled and smoothly finished with rounded edges.

- 2. Provide steel angle stiffeners on back of panel face to prevent panel deflection under instrument loading or operation.
- 3. Provide internal structural steel framework for instrument support purposes and panel bracing. Internal framework shall permit lifting of panel without racking or distortion.
- C. Control circuit wiring:
  - 1. No more than 20 devices on any single circuit.
  - 2. Where multiple units perform parallel operations, do not group all devices on the same branch circuit; the purpose is to prevent the failure of any single branch circuit from shutting down at entire operation.
  - 3. Do not exceed the ampacity of the branch circuit.
  - 4. Panel service outlet shall be fed from a separate branch circuit.
  - 5. Provide 120-volt ac plugmold and 3-wire plug-in line cords for all panel components powered by 120-volt ac power.
- D. Instrument Location:
  - 1. Locate instruments designated for back-of-panel mounting in manner to allow for maintenance and adjustment.
  - 2. Instrument mounting height shall not exceed 6 ft-6 in. Minimum height shall be 4 ft-0 in.
- E. Nameplates:
  - 1. All front of panel pilot devices shall be equipped with manufacturer provided service legend indicating function of device.
  - 2. All other front of panel devices shall have laminated plastic nameplates with 3/16-inch high characters. Unless otherwise noted, color shall be white with black letters.
  - 3. Each panel shall be provided with a face mounted laminated nameplate. Unless otherwise noted, color shall be white with black letters 1/2-inch high.
- F. Output Signal Fusing:
  - 1. Provide appropriately sized fuses for all output signals to devices located external to the panel in accordance with the following requirements:
    - a. Maximum fuse size: 5A
    - b. Separate fuse for each device
    - c. Fuses shall be installed in indicating type fuse holder terminal blocks.
- G. Wiring:
  - 1. Wiring within panels, consoles, racks, and cabinets shall meet the following requirements:
    - a. Wires for ac circuits shall be 300-volt, Type MTW stranded copper and shall be sized for the current to be carried but not smaller than No. 16 AWG.
    - b. Wires for analog signal circuits shall be 300-volt stranded copper and shall be twisted shielded pairs not smaller than No. 18 AWG.
    - c. Wires for other dc circuits shall be 300-volt, Type MTW stranded copper not smaller than No. 18 AWG.
    - d. Wiring shall be numbered and tagged at each termination. Wire tags shall be snap-on or slip on PVC wire markers with legible machine printed markings and numbers. Adhesive or taped-on tags are not acceptable.
    - e. Wiring for special signals such as communications, digital data, and multiplexed signals shall use manufacturer's standard cables.
  - 2. Terminal blocks for panels, consoles, racks, and cabinets shall meet the following requirements:

- a. Wire all spare or unused panel mounted elements to their panels terminal blocks.
- b. Provide open construction terminal blocks for wiring that is entirely internal to the panel.
- c. Provide isolation switch terminal blocks for all wiring that is not entirely internal to the panel.
- d. Rail mount individual terminals to create a complete assembly. Provide terminals constructed such that jumpers can be installed with no loss of space on terminal or rail.
- e. Size all terminal block components to allow insertion of all necessary wire sizes and types. Supply terminal blocks with marking system allowing the use of preprinted or field-marked tags.
- f. Provide power distribution blocks for distribution of control panel power at voltages exceeding 120VAC.
- g. Provide CSA certified and UL approved terminal blocks manufactured by Allen Bradley, or equal.

#### H. Grounding

1. Panels, consoles, racks, and cabinets shall be provided with an isolated copper grounding bus for all signal and shield ground connections. This ground bus shall be grounded at a common single ground point. The signal grounding system shall meet National Electrical Code requirements.

#### I. Power Supplies:

- 1. Provide dc power supplies as required to power instruments requiring external dc power, including two-wire transmitters and dc relays.
- 2. Power supplies shall be suitable for intrinsically safe circuits where two-wire transmitters are located in a hazardous area.
- J. Intrinsically safe circuits
  - 1. Conductors of intrinsically safe circuits shall be separated from conductors of nonintrinsically safe by a minimum distance of two inches. Provide separate wiring compartments for intrinsically safe and non-intrinsically safe terminals. Physical barriers shall be grounded metal or insulating partitions and all wiring shall be secured.
  - 2. Provide intrinsically safe relays and barriers in accordance with Class I, Division 1 requirements of the National Electric Code where shown or specified.
- K. Electrical transient protection
  - 1. All electrical and electronic elements of the Control System shall be protected against damage due to electrical transients induced in interconnecting lines from lightning discharges and nearby electrical systems.

#### 3.03 FIELD MEASUREMENTS

- A. Field verify with exact measurements, the available mounting space for control system equipment. Identify deficiencies prior to beginning installation.
- B. Where ranges are indicated on the contract documents, they are to be considered preliminary. Field-verify the exact ranges required based on field conditions.

#### 3.04 DELIVERY STORAGE AND HANDLING

- A. It shall be the responsibility of the installing contractor to receive lift station control system equipment at the job site. Carefully inspect all equipment for damage prior to accepting from the shipping agency. Do not accept shipment if damage is evident.
- B. Exercise due diligence in storing, protecting, and moving lift station control system equipment. Damaged or worn equipment will not be accepted and will be replaced at no additional cost to the Owner.

#### 3.05 INSTALLATION

- A. Install equipment in locations as indicated on the contract documents. Adjust locations as needed to ensure operability, serviceability, and compliance with all applicable codes and standards.
- B. Installation shall be completely tested prior to start-up. This work includes verification of all field wiring continuity and proper termination of wiring.
- 3.06 TESTING AND START-UP SERVICES
- A. Lift station control system manufacturer shall provide installation and start-up services required to place the complete system into operation.
- B. Each signal and function shall be fully tested. These tests shall be based on actual operation of primary elements and verification of proper control system response. Submit test results as part of Operations and Maintenance Manual.
- C. Record calibrations of all analog devices.
- D. Demonstrate proper operation of the lift station control system to the Owner and in the presence of the Engineer.
- 3.07 TRAINING
- A. Training shall be suitable for operations personnel with limited knowledge of electrical components.
- B. Provide one instructor day of operator training at the job site. Training shall consist of operations instruction and maintenance/trouble-shooting instruction.
  - 1. Operations instruction shall identify all control loops with description of all interlocks, interface with other loops, and operational input requirements. Describe procedures for re-starting the system.
  - 2. Maintenance instruction shall identify periodic maintenance that can be performed by the operator. Provide description of procedures and locations for replacement of consumable devices such as fuses and for checking the calibration or operation of devices.
  - 3. Trouble-shooting instruction shall identify simple procedures and methods for identifying potential causes in the event of failures.

#### **END OF SECTION**

## 33

### **DIVISION 33**

UTILITIES

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#### SECTION 33 01 30.16

#### **SEWER CLEANING & TELEVISING**

#### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Work included: This section includes cleaning and televising for sanitary sewer lines.
- B. Contractor shall submit television inspection logs and DVD recordings.
- C. **HOBART ONLY:** The engineer and the Village of Hobart must be notified a minimum of three working days prior to the commencement of any testing, to allow the Village to schedule personnel to observe the testing.

#### PART 2 – PRODUCTS - NOT APPLICABLE

#### PART 3 - INSTALLATION

- 3.01 SEWER LINE CLEANING
- A. High-Velocity Jet Equipment shall be used on this project. All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. The equipment shall carry its own water tank.
- B. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage exists and the cleaning effort shall be abandoned.
- C. Roots shall be removed in the designated sections where root intrusion is a problem. Any work done to remove roots in a section shall be documented in the report. Documentation shall include the locations in the pipe segment where roots were removed and the procedure, which was used to remove the roots.
- D. All sludge, dirt, sand, rock, grease, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment, shall not be permitted. A vacuum truck shall be used to remove accumulations of material.
- E. All solids or semi-solids resulting from the cleaning operations shall be removed from the site and disposed of at a site designated by the Owner. All materials shall be removed from the site no less often than at the end of each workday. Under no circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers and as approved by the Owner.

- F. If the Contractor requires water for cleaning operations from hydrants, the Contractor shall make arrangements with the local water utility and shall use only fire hydrants designated by the responsible water utility. The Owner will pay all costs associated with use of this water. The Contractor shall provide backflow preventers at the hydrants to prevent contamination of the water system.
- G. Acceptance of sewer line cleaning shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the Owner. If TV inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspect the sewer line until the cleaning is shown to be satisfactory.

#### 3.02 SEWER TELEVISING

- A. All designated sewer sections shall be visually inspected by means of closed-circuit color television.
- B. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. The camera shall be capable of radial view for inspection of the top, bottom, and sides of pipe and for looking up lateral connections. The camera shall be mounted on adjustable skids, or self propelled, to keep it in the center of the pie. Lighting of the camera shall be supplied by a lamp on the camera, capable of being dimmed or brightened remotely form the control panel. The lighting system shall be capable of lighting the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions and shall have a minimum of 650 lines of resolution and tested at 400 psi. The view seen by the televising camera shall be transmitted to a monitor of not less than 17 inches. The camera, television monitor, and other components of the DVD system shall be capable of producing a picture quality satisfactory to the Engineer; and if unsatisfactory, the equipment shall be removed and no payment will be made for an unsatisfactory inspection.
- C. The television camera shall be moved through the line in either direction at a uniform rate, stopping when necessary to insure proper documentation of the sewer's condition but in no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds (or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions) shall be used to move the camera through the sewer line. If, during the inspection operation the television camera will not pass through the entire sewer section, the Contractor shall re-setup his equipment in a manner so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire sewer section, the inspection shall be considered complete and no additional inspection work will be required. All costs for re-setup due to an obstruction in the sewer that will not allow the camera to pass shall be considered incidental. If the camera becomes submerged due to a sag in the pipe, a high velocity jet will be utilized to pull water away from the camera lens.
- D. The location meter, for accurately recording the location of the television camera with respect to the reference manhole, shall be a direct reading, above ground, friction clamp device or other suitable equipment. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. The meter shall be capable of reducing readings for reverse movement of the camera and shall be capable of being manually re-zeroed for each new setup. Footage shall be shown on the DVD data view and recorded at all times.

- E. The logs shall be typed or computer printed and acceptable to the Owner. Printed location records shall be kept by the contractor and will clearly show the location, in relation to adjacent manholes, of each infiltration point discovered by the television camera. An estimate of the flow rate of observed infiltration points shall be made and recorded. In addition, other points of significance such as locations of building sewer laterals, joints, unusual conditions, roots, storm sewer connections, collapsed sections, presence of scale and corrosion, and other discernible features will be recorded and two (2) copies of such records shall be supplied to the Owner.
- F. The purpose of tape recording shall be to supply a visual and audio record of the condition of the lines that may be replayed both daily and at future presentations. DVD recording playback shall be at the same speed that it was recorded. Upon completion of the work, all discs recorded during the television inspection shall become the property of the Owner. Cost of DVDs shall be included in the unit price bid. A complete recording shall be made of each line televised. A voice recording on DVDs shall make brief and informative comments on the sewer conditions.
  - 1. DVDs shall include the following information:
    - a. Visual (on screen in corner):
      - 1) Report number.
      - 2) Date of television inspection.
      - 3) Sewer section and number.
      - 4) Current distance along reach (tape counter footage).
      - 5) Printed labels on DVD container and DVD disc with location information, date, format information, and other descriptive information.
    - b. Audio:
      - 1) Date and time of television inspection, operator name, name of overlying or adjacent street, and manhole numbers.
      - 2) Verbal confirmation of sewer section and television direction in relation to direction of flow.
      - 3) Verbal description of pipe size, type, and pipe joint length.
      - 4) Verbal description and location of each service connection and pipe defect.
      - 5) Type of weather during inspection.
  - 2. Television inspection logs shall include, but are not limited to, the following:
    - a. Date, time, city, street, basin, sewer section, reference manhole number, name of operator, inspector, and weather conditions.
    - b. Pipe diameter, pipe material, section length, depth of pipe, length between joints, and corresponding DVD identification.
    - c. Location of each point of leakage.
    - d. Location of each service connection.
    - e. Location of any damaged sections, nature of damage, and location with respect to pipe axis.
    - f. Deflection in alignment of grade of pipe.
- G. Acceptance of televising shall be made upon the successful completion of the project and shall be to the satisfaction of the Owner. If the recordings show the inspection to be unsatisfactory, the Contractor shall be required to re-inspect the sewer line.

#### **SECTION 4 – PAYMENT**

A. Payment shall be based on following: Line cleaning and television inspection of the sewer lines shall be incidental to the appropriate bid item.

- END OF SECTION -

#### SECTION 33 32 19

#### SUBMERSIBLE PUMP LIFT STATION

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work included: This section includes providing integral valve vault lift station in accordance with the drawings and specifications.
- B. Section includes the following to provide a complete submersible pump lift station:
  - 1. Pre-cast wet well.
  - 2. Pre-cast valve manhole.
  - 3. Non-clog submersible centrifugal wastewater pumps.
  - 4. Pump mounting and guide systems.
  - 5. Piping, fittings and valves.
  - 6. Electrical switchgear and electrical service.
  - 7. System instrumentation and controls.
  - 8. Control panels.
  - 9. Telemetry system.
  - 10. Installation and start-up.
- C. Related sections and divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01 75 00, Start-up, Testing and Operator Training.
  - 3. Section 01 78 23, Operation and Maintenance Data.
  - 4. Section 40 05 13.53, Ductile Iron Pipe.
  - 5. Section 05 50 50, Metal Fabrications.
  - 6. Section 09 90 00, Painting and Special Coatings.
  - 7. Section 10 14 00, Signage.
  - 8. Section 01 78 43, Equipment, Installation, Training, and Receipt for Spare Parts Checklists.
  - 9. Section 46 42 56.19, Submersible Centrifugal Pumps.
  - 10. Section 40 05 15, Methods & Materials for Pipe Installation
  - 11. Section 40 05 16.61, Valves Lift Stations.
  - 12. Section 40 05 13.10, Buried Piping and Appurtenances.
  - 13. Division 26, Electrical.

#### 1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A48 Standard Specification for Gray Iron Castings 2. Standard Specification for Deformed and Plain -Carbon- Steel ASTM A615 Bars for Concrete Reinforcement Standard Specification for Joints for Concrete Pipe and Manholes, 3. ASTM C443 Using Rubber Gaskets Standard Specification for Circular Precast Reinforced Concrete 4. ASTM C478 Manhole Sections 5. **ASTM C923** Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes, and Laterals

- 6. ASTM D41 01 Standard Specification for Polypropylene Injection and Extrusion Materials
- B. Federal Specifications (FS):
  1. FS SS-C-153C Cement, Bituminous, Plastic
- C. American National Standards Institute (ANSI):
  - 1. ANSI A21.10 Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch for Water and Other Liquids.
- D. National Electric Code (NEC)
- E. NEMA Electrical Standards
- F. Underwriter's Laboratory
- 1.03 SUBMITTALS
- A. Submit the following:
  - 1. Shop drawings including complete assembly and installation drawings.
  - 2. Integral wet well/valve manhole with all openings shown and located.
  - 3. Manufacturers certification that manholes were manufactured in accordance with designated reference standards with test results and date of tests.
  - 4. Descriptive information on material and equipment.
  - 5. Assembled electrical and control equipment drawings for all components.
  - 6. Pump information including:
    - a. Name of manufacturer.
    - b. Type and model.
    - c. Design rotative speed.
    - d. Weight of pump and motor assembly.
    - e. Complete performance curves showing:
      - 1.) Flow
        - 2.) Total Design Head
        - 3.) Efficiency
        - 4.) Brake Horsepower
    - f. Materials of construction and cross-sectional drawing.
    - g. Pump mounting and guide system.
  - 7. Submit two (2) copies of a report documenting the field testing results to the Engineer
- C. Operation and maintenance manuals shall be provided in accordance with Section 01 78 23, Operation and Maintenance Data.

#### PART 2 - PRODUCTS

#### 2.01 PRECAST REINFORCED CONCRETE WET WELL AND VALVE MANHOLE

- A. Pre-cast reinforced concrete components in accordance with ASTM C478.
- B. The integral valve vault area shall be fabricated of pre-cast concrete with minimum inside dimensions as shown on the contract drawings. The lift station shall be designed for installation in a ground water table 3 feet below the top of lift station slab. Watertight joint wall sleeves shall be provided where the joints are made to the inlet and discharge lines. The joint shall also be so

designed to absorb any vibration, distortion, and normal settling and maintain a leak-proof seal. The rubber gasket element shall be constructed of poly-isoprene or natural rubber to the requirements of ASTM C923. The gasket shall have a minimum tensile strength of 1600 psi and a minimum thickness of 0.275 inches.

- C. The valve chamber shall be furnished as an integral part of the pump chamber. The top of the chamber shall include an aluminum hatch. The valve vault shall provide complete isolation from the wastewater wet well. Concrete supplier shall determine the thickness of the base, transition, and cover sections and supply structural calculations stamped by a registered professional engineer. A factory representative shall be on site to witness station installation and offer on-site technical assistance. The concrete supplier shall have a minimum of three years experience in the manufacturing of pre-cast integral valve vault structures.
- D. Each piece of the station shall be cast from a one piece mold. The use of connecting form ties which may result in corrosion or leakage points is not acceptable. The rectangular box transition piece shall each be a single pour section. All lift station joints shall have bell and spigot connections in conformance with ASTM C478. Station to be supplied with all necessary bitumastic joint sealant.
- E. The concrete supplier's manufacturing facility shall be certified by the National Precast Concrete Association and a copy of certification shall be included with the submittal documents.
- F. Joints shall be in accordance with ASTM C443 with 1-1/4-inch thick butyl gasket.
- G. Tops shall withstand AASHTO H-20 loadings.
- H. Plastic cement sealant shall be in accordance with Federal Specification SS-C-153C.
- I. Connectors between manhole structure and pipes shall be in accordance with ASTM C923.
- J. Access hatches shall be provided as specified in Section 05 06 50, Metal Fabrications.
- K. Entrance Danger Signs
  - 1. Signage shall be as specified in Section 10 14 00, Signage.
  - 2. Signs shall be installed on the outside of the wetwell hatch and the outside of the valve vault hatch.

#### 2.02 SURFACE COATINGS

- A. Interior concrete surfaces of wet well, exterior concrete surfaces of valve vault, and all piping, which is not stainless steel or PVC, shall receive two coats of moisture cured urethane per Specification Section, 09 90 00, Painting and Special Coatings. Each coat shall have a minimum dry film thickness of 5-7 mils. Total mil thickness shall be 10-14 mils.
- B. Pumps shall receive a standard factory applied coating suitable for submerged condition in raw municipal wastewater as specified in Section 09 90 00, Painting & Special Coatings.

#### 2.03 PUMPING EQUIPMENT

A. Pump shall be as specified in Section 46 42 56.19, Submersible Centrifugal Pumps.

#### 2.04 PORTABLE DIVIT CRANE

- A. Provide portable davit cranes and top of slab mounting base assemblies as shown on the plans for removing the submersible pumps. Crane shall have a minimum capacity of 1,000 pounds in operating position. Model and capacity shall be verified by pump manufacturer and modified as required.
- B. Cranes shall have hand winch operation and adjustable boom.
- C. Crane shall be supplied with all necessary equipment for operation.
- D. Crane shall be fabricated out of 304 stainless steel.
- E. Lifting cable shall be 304 stainless steel. The top end of the cable shall be supplied with a ball as required to connect to winch spool. Cable shall be designed for weight of mixer plus lifting load and a minimum safety factor of 2.0. A stainless steel hook for the cable assembly shall be provided to support the cable assembly when the top end of the cable is not connected to the hoist.
- 2.05 PRESSURE GAUGES
- A. Acceptable manufacturers shall be Trerice, Ashcroft or equal.
- B. Furnish and install gauges where shown on the drawings or where required to perform start-up testing.
- C. All gauges shall have pressure ranges as shown on the drawings.
- D. All gauges for lift station applications shall be a minimum 2<sup>1</sup>/<sub>2</sub>-inch diameter stainless steel, liquid filled, and equipped with factory installed diaphragm seals.
- E. Provide each gauge with a 316 stainless steel bourdon tube and a <sup>1</sup>/<sub>4</sub>-inch NPT bottom connection.
- 2.06 PIPING INSTALLATION
- A. Piping installation shall be as specified in Section 40 05 15, Methods & Materials for Piping Installations.
- 2.07 ELECTRICAL AND CONTROL SYSTEMS
- A. Control panel shall be provided by P. J. Kortens and Company, Inc., through an allowance item.
- B. Refer to Division 26 for electrical/control description.

#### PART 3 - EXECUTION

- 3.01 Installation
- A. Install in accordance with the shop drawings and manufacturer's recommendations. After installation, demonstrate trouble free operation in presence of the Engineer.

- B. Install the wet well, valve manhole and piping at alignment and grades shown on the drawings in accordance with the specification backfilling and compacting requirements.
- C. Piping, fittings and valves shall be installed per alignment shown on the drawings with proper support and restraint on all pipe, valves, joints and fittings.
- D. The pump and pump guides shall be installed and anchored with stainless steel anchors per manufacturer's recommendations.
- E. Each motor power cable and control cable shall be in a separate conduit with sealed junction boxes below the control panel.
- 3.02 Field Testing
- A. All necessary precautions recommended by the Manufacturer and as specified herein shall be followed to ensure that the wet well and piping connected thereto is completely clean and free of any debris, dirt, or other foreign materials which could clog the pumps, piping and interfere with operation.
- B. Field testing shall be conducted on the equipment provided. Each pump shall be subjected to an operational test before acceptance as follows:
  - 1. The pump shall be properly installed in the wet well, firmly upon its discharge connection. After determination (a) proper service voltage is being supplied, and (b) proper rotation of the impeller. No cooling by forced or circulated air shall be allowed.
  - 2. Pump shall be demonstrated to operate without excessive noise, vibration, and without overheating at its rated condition.
  - 3. All components and operation sequences of the lift station, as specified herein, shall be tested in the field to verify proper operation in accordance with this specification. Each operation and alarm condition shall be satisfactorily performed and documented on the lift station alarm test form.
- C. All testing shall be performed under the supervision of the Manufacturer's representative in the presence of the Engineer.
- D. Engineer shall be notified in advance of any field tests.
- E. The field test must meet the performance requirements as described in this specification. Tests shall be extended or repeated if, in the opinion of the Engineer, additional time is needed to make observations.
- F. All defects noted during the field test shall be corrected promptly at the expense of the Manufacturer.
  - 1. When necessary, the field test shall be repeated until the requirements of the specification have been met.
  - 2. All testing and modifications required to the meet the specification shall be at the expense of the Manufacturer.
- G. If the Manufacturer is unable to demonstrate by the field test results that the equipment conforms to the requirements of the specification, the equipment shall be rejected and replaced with acceptable equipment at the Manufacturer's expense.

- H. Minimum start-up time for operator training and final adjustment by the Manufacturer shall be one (2) days with one (2) trips.
- I. The time for start-up and operator training and final adjustment shall be designated by the Owner and shall be within the one-year warranty period after final acceptance of equipment by the Owner.
- J. Qualifications of Start-Up Personnel
  - 1. Personnel shall be authorized by the Manufacturer to start-up and initiate the warranty of the equipment being provided.
  - 2. Personnel shall come to the site with the required tools to complete start-up.
  - 3. Personnel shall have full working knowledge of the equipment being provided.
  - 4. Failure to provide personnel with full qualifications shall be cause for service trip to be disqualified as part of the requirements and shall be cause for reimbursement costs incurred by the Owner due to services required for start-up inspections.

#### - END OF SECTION -

Lift Station Alarm Test Form Date:					
Location: Rim Elevation:					
Contractor:					
Alarm/Status Signals	Activated at local panel	Signal telemetered	Dialer Activated	Depth	Elevation
High-water alarm tested w/float					
Pump No. 1 fail					
Pump No. 2 fail					
Power fail					
L.S. Level					
L.S. High Level					
L.S. Low Level					
Pump No. 1 Run					
Pump No. 1 Fail					
Pump No. 1 Seal Fail					

Pump No. 1 High Temp.					
Pump No. 2 Run					
Pump No. 2 Fail					
Pump No. 2 Seal Fail					
Pump No. 2 High Temp.					
Back-Up Mode On					
Signed by the Contractor: Date:				_	

#### LIFT STATION START-UP CHECKLIST

Project No Contractor:		Date:			
Lift Station Location:		By:			
LIFT STATION PERFORMANCE					
		Pump No. 1	Pump No. 2		
TDH (discharge gauge reading)		· · ·			
Amp					
Tach (rpm)					
Drawdown Time (secs)	-				
Flow Calculation from drawdown (gpm)					
$(3.1416 \text{ x r}^2 \text{ x drawdown in feet x } 7.48 \div \text{time})$					
Flow meter reading (gpm)					
Hour meter reading at end of start-up					
Note: Check results with efficiency curve on the pump performance	chart				
Pump No. 1 Pump No. 2		-			
LIFT STATION CYCLING TEST		GENERAL CHECKLIST			
High-level alarm functions when flooded.		Bolts tightened.			
Both pumps start up in flooded condition.		Conduit secure.			
All pumps off functions under pumping condition.		Check valves free.			
Low-level alarm functions.		Pump rotation.			
Lead pump starts automatically.		Touch-up paint.			
Lead pump stops automatically.	bump stops automatically. Ualves		Valves operational.		
Lead pump starts, alternating pumps automatically.		Valves in working position.			
Lead pumps stops automatically.		Wetwell & pipe coating.			
Lead pumps starts automatically.		Telemetering operational.			
Lag pumps starts automatically.		Emergency equipment operational.			
		Туре			
All pumps off automatically.		Phase convertor balanced			

#### **SECTION 33 34 00**

#### FORCEMAIN

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section includes furnishing and installing all pipe and fittings for the forcemain as shown on the contract drawings, as specified, and as directed by the Engineer.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01 45 24, Testing and Inspection of Pipeline Construction.
  - 3. Section 31 23 33, Trenching, Backfill and Compaction.
  - 4. Section 31 25 00, Erosion and Sediment Control.
  - 5. Section 33 00 02, PVC Pipe and Fittings.
  - 6. Section 33 00 03, HDPE Pipe and Fittings.
  - 7. Section 40 05 13.10, Buried Piping and Appurtenances.
  - 8. Section 40 05 13.53, Ductile Iron Pipe.
- 1.02 REFERENCE STANDARDS
- A. American Society for Testing and Materials (ASTM)
- B. American Water Works Association (AWWA).
- C. American National Standards Institute (ANSI).
- 1.03 SUBMITTALS
- A. Submit the following:
  - 1. Product literature and catalog cuts of materials to be supplied to relate these materials to the specifications.
  - 2. One copy of test reports.

#### PART 2 - PRODUCTS

2.01 PIPE MATERIAL

a.

1.

- A. Pressure Sewer (4 Inches and larger)
  - Pipe and joints shall meet one of the following minimums:
    - Pipe sizes 4-inch through 12-inch:
      - 1) AWWA C900, pressure Class 150, thickness Class DR 18.
      - 2) ASTM D2241, pressure Class 250, thickness Class SDR 17.
  - 2. Elastomeric Joints: ASTM D3139
- 2.02 POLYETHYLENE ENCASEMENT
- A. Polyethylene encasement shall conform with AWWA C105.

- B. Polyethylene encasement shall be Class C Black, Type 1, and Grade E-1.
- C. Thickness shall be 8 mils minimum.
- 2.03 TRACER WIRE
- A. Provide the following:
  - 1. Tracer wire shall be No. 10 AWG, stranded stainless steel, with HWPE insulation rated for direct burial service for all borings. No splices are permitted.
  - 2. Tracer wire shall be No. 10 AWG, solid copper, or No. 12 AWG stranded stainless steel, with HWPE insulation rated for direct burial service for open cut.
- B. Tracer wire splices stainless steel and copper wire shall be Dryconn waterproof connectors by King Innovation or Snakebite Connectors by Copperhead Industries. In lieu of connectors, connections for copper wire may be soldered. Soldered connection shall be coated with 3M Scotchkote electricians coating and then securely taped.
- C. Tracer wire signal connection box shall be three-piece, 5<sup>1</sup>/<sub>4</sub>-inch cast iron valve box with top marked, "Water" as manufactured by Clow, Tyler, or equal.
- 2.04 PIPE BEDDING AND BACKFILLING
- A. Trenching, backfilling and compaction shall be in accordance with Section 31 23 33, Trenching, Backfilling and Compaction and standard details on the drawings.
- 2.05 THRUST BLOCKING
- A. Thrust blocks shall be constructed of concrete having a minimum 28-day compressive strength of 2,000 psi. Hardwood blocking may be used if approved by the Engineer.
- B. The minimum cement content shall be 4<sup>1</sup>/<sub>2</sub> bags of cement per cubic yard of concrete. The allowable slump shall be 4 to 5 inches
- C. Blocking shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground shall be as shown or required by the Engineer.
- D. Thrust blocks shall, unless otherwise specified or required, be placed so that the pipe and fitting joints will be accessible for repair.
- E. A piece of 15-pound building paper or other approved material shall be placed between the cap or plug and the concrete.
- 2.06 JOINT RESTRAINT MATERIAL
- A. Rods shall be <sup>3</sup>/<sub>4</sub>-inch diameter, Type 304, or 316 Stainless Steel.
- B. Underground clamps shall conform to the following:
  - 1. <sup>1</sup>/<sub>2</sub>-inch x 2 inches flat bar stock clamps, Astral Corp., or equal.
  - 2. Clamps shall include retainer washer.
- C. Bolts shall be 5/8-inch diameter, stainless steel.

- D. Megalugs, by EBAA iron may be used for joint restraint.
- 2.07 PIPE COUPLINGS
- A. Mechanical pipe couplings shall be Desser Style 162, or equal.
- 2.08 BUILT UP MASTIC COATINGS
- A. Coating shall be Tape coat, TC Mastic, or equal.

#### PART 3 - EXECUTION

- 3.01 GENERAL
- A. Before excavation of trenches is begun, the Contactor shall uncover the end of the existing main to which the new main is to be connected. This will permit adjustments in line and grade and avoid the use of extra fittings. The exposed end of an existing main must be protected and blocked by the Contractor to prevent the blowing out of the plug or cap at the end of the main.
- B. The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench. Extreme care shall be exercised by the Contractor in handling all pipe, fittings, and special castings to prevent breakage and coating damage. Any significant damage to coating shall be repaired before installation. Under no circumstances shall pipe or fittings be dropped into the trench or so handled as to receive hard blows or jolts. All mud or concentration of dirt shall be removed prior to installation.
- C. Every precaution shall be taken to prevent foreign materials from entering the pipe while it is being placed in the line. If the pipe-laying crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During the laying operations, no debris, tools, clothing, or other material shall be placed in the pipe.
- D. At all times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means accepted by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry. No pipe shall be laid in water or when trench conditions are unsuitable.

#### 3.02 PIPE INSTALLATION

- A. Pipe installation shall conform with Section 31 23 33, Trenching, Backfilling and Compaction and bedding details shown on the drawings.
  - 2. Lay pipe to line and depth shown on plans. Unless otherwise stated, pipe shall be laid with the bell ends facing the direction of laying. When grade exceeds two feet per hundred feet, the bells shall face upgrade.
  - 3. When the depth is not shown on the plans, bury the pipe with 6.5 feet of cover as determined from the top of pipe to finished ground elevation.

- 4. Keep pipe and fittings free of debris and foreign matter. The interior of all pipes shall be clean before being installed. The Contractor shall provide the necessary means to wipe, brush, swab, or air blast to remove foreign matter.
- 5. Assemble all joints in accordance with manufacturer's recommendations.
- 6. Utilize full lengths of pipe, except at fittings.
- 7. Provide thrust blocking and restraints at the following locations:
- 1. Bend deflecting  $11\frac{1}{2}$  degrees or more.
- 2. Valves and tees.
- 3. Plugs and caps.
- H. When it is necessary to interrupt an existing system to complete construction, adhere to the following:
  - 1. No controls or appurtenances shall be operated without the Owner's consent or direction.
  - 2. Work requiring interruption of existing service shall be done at the Owner's convenience and normal working schedule.
- 3.03 POLYETHYLENE ENCASEMENT
- A. Wrap all below ground metal in accordance with AWWA C105, including:
  - 1. Ductile iron pipe.
  - 2. Fittings, valves, and valve boxes.
  - 3. All metal restraining devices.
- 3.04 TRACER WIRE
- A. Run tracer wire along pipe when PVC or polyethylene pipe is used.
- B. Tape wire to each length of pipe at a minimum of two points.
- C. Tracer wire shall be tested prior to acceptance of project.
- D. Maximum distance for tracer wire shall be 2,000 feet.

#### 3.05 PROTECTION OF BURIED METAL SURFACES

- A. All steel clamps, rods, bolts, and other metal accessories using reaction anchorage or joint harness and all mechanical pipe couplings, flanges, and sleeves installed underground shall be protected.
- B. Surfaces shall be cleaned by wire brushing immediately prior to application of the mastic.
- C. The mastic shall be molded firmly to encase all bolts, nuts, clamps, straps and flanges, and built-up to a uniform surface over the entire fitting.
- D. The built-up surface shall be applied in full accordance with manufacturer's recommendations.

- E. All buried metal surfaces with built up mastic protection shall be wrapped with polyethylene encasement.
- 3.06 JOINING PIPE OF DIFFERENT MATERIAL OR OUTSIDE DIAMETER
- A. Where specified or required, pipes of different material or outside diameter shall be joined with mechanical pipe couplings.
- B. Couplings shall be suitable for the intended service and shall be installed in accordance with the manufacturer's instructions.
- C. The Contractor shall submit details of proposed coupling for Engineer's review.

#### 3.07 CONTRACTOR RECORD KEEPING

- A. Measure and record the following:
  - 1. Service locations: Point of origin and terminus.
  - 2. Valve and fitting locations.
- 3.08 PIPE TESTING
- A. Perform pipe testing in accordance with Section 01 45 24, Testing and Inspection of Pipeline Construction.
- 3.09 CUTTING OF PIPE
- A. Pipe shall be cut at right angles to the centerline of the pipe. Cutting shall be done in a neat workmanlike manner without damage to the pipe and to leave a smooth end. All pipes shall be cut for use with rubber gasket joints shall be tapered by grinding or filling about 1/8 inch back at an angle of approximately 30 degrees with the centerline of the pipe, and any sharp or rough edges shall be removed.
- 3.10 OBSTRUCTION IN LINE OR GRADE
- A. Whenever it becomes necessary to lay a main over, under or around a known obstruction, the Contractor shall furnish and install the required fittings. The laying of such fittings will be paid for at the unit price bid for each size of main. No additional compensation will be paid to the Contractor for any expenses incurred because of such obstruction.
- B. When an unknown underground structure interferes with the work and an alteration of the plan is required, the Engineer will issue a written order for such altered work, specifying the basis of payment or credit for such altered work.

- END OF SECTION -

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#### SECTION 33 42 13

#### CORRUGATED METAL CULVERT PIPE

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section includes furnishing and installing corrugated metal pipe and fittings.
- B. Size of pipe, gage, fittings, and coatings required shall be as shown on the drawings.
- 1.02 REFERENCE STANDARDS
- A. Standards listed in this section refer to latest revision.
- B. American Society for Testing and Materials (ASTM)
  - 1. A760 Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drawing.
- C. American Association of State Highway and Transportation Officials (AASHTO)
  - 1. M36 Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Draws.
- 1.03 QUALITY ASSURANCE
- A. Inspections
  - 1. Inspections shall be made to reject pipe that fails to conform to these specifications.
  - 2. Pipe and fittings shall be inspected by the Contractor before use.
  - 3. Pipe and fittings shall be available for inspection by Engineer at place of manufacture, jobsite, or any other point of delivery.
- B. Pipe shall be rejected for any of the following:
  - 1. Uneven laps.
  - 2. Variation from a straight centerline of more than  $\frac{1}{2}$  inch.
  - 3. Ragged or diagonal sheared edges.
  - 4. Loose bolts or rivets.
  - 5. Fasteners which are unevenly lined.
  - 6. Poorly formed seams.
  - 7. Illegible brand marking.
  - 8. Poorly formed seams
  - 9. Dents or bends in the metal.
  - 10. Elliptical shape on round pipe.
    - a. The average inside diameter of the pipe shall not vary more than <sup>1</sup>/<sub>2</sub> inch or 1 percent, whichever is greater. Measurement shall be on the inside crest of the corrugations.
- C. Replace all rejected pipe.

- D. Rejected pipe shall be clearly marked "REJECTED" with OSHA yellow paint.
- 1.04 PRODUCT DELIVERY

#### A. Marking

The following shall be painted on each piece of pipe:

- 1. Manufacturer's name or trademark.
- 2. Date of manufacture.
- 3. Pipe size.

#### B. Shipping

- 1. Pipe and fittings shall be packaged to prevent damage during shipping.
- 2. Fittings shall be on pallets.
- 3. All loading or unloading shall be done with lifts to avoid shock.
- 4. No materials shall be dropped.

#### C. Storage

- 1. Provide safe storage for material.
- 2. Interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter.
- 3. Fittings shall be stored in a manner that will allow them to drain and protect them from freezing.

#### 1.05 SUBMITTALS

- A. Submit the following:
  - 1. Shop drawings for sectional plate pipe, sectional plate arches, or sectional plate pipe arches consisting of shop details, erection, and other working plans showing dimensions, sizes of material fittings, details, and other information necessary for the complete fabrication and erection of the metal work.
  - 2. A certificate setting forth the name or brand of metal to be furnished and a typical or average analysis showing the percent of carbon, manganese, phosphorus, sulfur, silicon, copper, and any other elements specified for the particular kind of base metal.

#### PART 2 - PRODUCTS

#### 2.01 MANUFACTURE

- A. All pipe, fittings, and joints shall be manufactured per Standard M36.
- B. Unless otherwise specified, dimensions, sheet thickness and minimum sheet gages for aluminum coated (type 2) round pipe shall be as follows:

#### **CORRUGATED ALUMINUM COATED (TYPE 2) PIPE DIMENSIONS AND GAGES**

Nominal Size (Inches)	Minimum Gage Number	Sheet Thickness (Inches)	Area-Square <u>Feet</u>
<u>(intenes)</u> 6	18	0.048	$\frac{1}{0.20}$
8	16	0.060	0.35
10	16	0.060	0.55
12	16	0.060	0.79
15	16	0.060	1.23
18	16	0.060	1.77
21	16	0.060	2.41
24	14	0.075	3.14
30	14	0.075	4.91
36	12	0.105	7.07
42	12	0.105	9.62
48	12	0.105	12.57
54	12	0.105	15.90
60	8	0.167	19.64

Unless otherwise specified dimensions, sheet thickness and minimum sheet gage for aluminum С coated (type 2) arch pipe shall be as follows:

Pipe	Equivalent				Sheet	
Arch Size	Diameter	Span	Rise	Minimum	Thickness	Area-Square
(Inches)	(Inch)	(Inch)	(Inch)	Gage No.	(Inch)	Feet
17x13	15	17	13	16	0.060	1.1
21x15	18	21	15	16	0.060	1.5
24x18	21	24	18	16	0.060	2.2
28x20	24	28	20	14	0.075	2.8
35x24	30	35	24	14	0.075	4.4
42x29	36	42	29	12	0.105	6.4
49x33	42	49	33	12	0.105	8.7
57x38	48	57	38	12	0.105	11.4
64x43	54	64	43	12	0.105	14.3
71x47	60	71	47	10	0.167	17.6

#### **CORRUGATED ALUMINUM COATED (TYPE 2) PIPE ARCH DIMENSIONS AND GAGES**

#### 2.02 MATERIALS

- A. Culverts and Underdrain
  - 1. Materials shall meet Standard M218.
  - 2. All rivets, bolts, and nuts shall be hot dip galvanized.
  - 3. All rivets shall conform to Standard A31 Grade A.
  - 4. **Pipe Seams:** 
    - a. Bolts shall conform to Standard A449.
    - Nuts shall conform to Standard A563 Grade C. b.

- 5. Connecting band bolts shall conform to Standard A307 Grade A.
- B. Field Assembled Structures
  - 1. Materials shall meet Standard M167.
  - 2. Bolts shall meet Standard M164.
- C. Couplers
  - 1. Couplers shall be made of the same material as the pipe.
  - 2. Coupler thickness shall not be less than 0.052 inch nor more than 0.109 inch.
  - 3. The coupler corrugations shall mesh with the pipe corrugations.
  - 4. Coupler width shall be:
    - a. Greater than 7 inches for 30-inch diameter and smaller.
    - b. Greater than 12 inches for 36-inch to 96-inch diameter.
    - c. Greater than 24 inches for 102-inch to 120-inch diameter.
- D. Fittings shall be manufactured to the standard dimensions shown in Figures 38 and 39 of the Installation Manual of the National Corrugated Steel Pipe Association.
- E. Coatings
  - 1. Bituminous coating, (when shown on plans) shall be applied per Standard M190.
  - 2. Polymeric coatings, (when shown on plans) shall be applied per Standards M245 and M246.

#### PART 3 - EXECUTION

- 301 INSTALLATION
- A. Installation shall be made per the recommendations of the Installation Manual for Corrugated Steel Drainage Structures of the National Corrugated Steel Pipe Association.
- B. Bedding and backfilling shall be performed in accordance with Section 31 23 33, "Trenching, Backfilling and Compacting."
- 3.02 COATINGS
- A Field applied coatings shall meet Standard M243.
- B. Where the spelter coating has been damaged by cutting or welding, the damaged area shall be wire brushed and painted with two coats of zinc dust-zinc oxide paint.

- END OF SECTION -

# 40

**DIVISION 40** 

**PROCESS INTEGRATION** 

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#### SECTION 40 05 13.19

#### STAINLESS STEEL PIPE AND FITTINGS

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section covers the work necessary to furnish and install, complete, the stainless steel pipe and fittings.
- B. Related sections and divisions.
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01 45 24, Testing and Inspection of Pipeline Construction.
  - 3. Section 40 05 15, Methods and Material for Process Piping Installation: Exposed.
- 1.02 REFERENCE STANDARDS
- A. American Society Testing and Materials (ASTM)
- B. AISI 316L

#### PART 2 – PRODUCTS

- 2.01 GENERAL SERVICE
- A. Pipe: Stainless steel, pickled and passivated, ASTM A 778F TP304L, "as welded" grade, unless otherwise specified thereinafter.
  - 1. 3-inch and Smaller: ASTM A312, TP304, Schedule 40S, seamless.
  - 2. 3<sup>1</sup>/<sub>2</sub>-inch and Larger: Schedule 10S.
  - 3. After fabrication, all stainless steel assemblies and parts shall be passivated by immersion in a pickling solution of from 5% to 25% of nitric acid (65% strength) and 1% to 3% hydrofluoric acid (60% strength), both by volume, in water at a bath temperature of 120°F to 140°F for a minimum of 10 to 15 minutes, as determined by test. Scrubbing shall be completed as required. Immediate final thorough rinsing shall be completed in clean hot water followed by drying. Parts shall be free of iron particles or other foreign material.
- B. Joints:
  - 1. 3-inch and Smaller: Screwed or Welded.
  - 2. 3<sup>1</sup>/<sub>2</sub>-inch and Larger: Butt welded or flanged.
- C. Fittings:
  - Screwed, stainless steel, rated 1,000 pound CWP, forgings conforming to ASTM A182, Grade F316 or barstock to ASTM A276, Type 304, dimensions conforming to ANSI B16.3 for 150-pound SWP maileable iron screwed fittings.
  - 2. Butt welding type, stainless steel, pickled and passivated schedule to match piping, ASTM A774, Type 304L, conforming to MSS SP-43; "as welded" grade; all ells LR, unless otherwise designated.

#### D. Flanges:

- 1. Forged stainless steel, ASTM A182, Grade F304L, slip-on type, faced and drilled 150pound, 1 1/16-inch raised face, ANSI 316.5 standard.
- E. Stub Ends: Stainless steel, ASTM A240, Type 304L, as welded grade, conforming to MSS-SP43, or flared nipples, schedule to match pipe.
- F. Bolting:
  - 1. Type 304 stainless, ASTM A193, Grade B8M hex head bolts and ASTM A194, Grade 8M hex head nuts.
  - 2. When mating flange on valves or equipment is cast iron, use stainless bolts.
- G. Gaskets: Gaskets shall be 1/8-inch thick neoprene rubber, durometer hardness No. 80, 1500 psi minimum tensile strength, 125 percent minimum elongation, flat ring type with RF flanges and full-face type with FF flanges, Garlock Style 7797, or equal.
- H. Thread Lubricant: Teflon tape.
- I. Covered Welding Electrodes;
  - 1. For Shielded Metal Arc Process:
    - a. For Type 304L Pipe: AWS 5.4, E309 CB
- J. Welding Rod and Bare Electrodes:
  - 1. For Gas Tungsten Arc or Gas Metal Arc Processes:
    - a. For Type 304L Pipe: AWS 5.9, ER 309 C3.

#### PART 3 - EXECUTION

#### 3.01 WELDING

- A. In accordance with latest editions of Section IX, ASME Boiler and Pressure Vessel Code and the American National Standard Code for Pressure Piping, ANSI and B31.3, as applicable.
- B. Flanges shall be shop welded to the pipe. All welding shall be by the shielded arc, inert gas, MIG or TIG method. Filler wire shall be added to all welds to provide for a cross section of weld metal equal to, or greater than, the parent metal. Butt welds shall have full penetration to the interior surface and gas shielding shall be provided to the interior and exterior of the joint.
- C. Interior weld beads shall be smooth, evenly distributed when an interior projection not exceeding 1 16-inch beyond the pipe I.D. The outside weld area shall be wire brushed. Brushes shall be of stainless steel and used only on stainless steel. All discoloration and deposits left by welding shall be removed by pickling.
- D. All field welding of stainless steel pipe shall be minimized and subject to the approval of Engineer. Field welding shall be shielded metal arch (SMAW). All field welding shall be accomplished by certified welders and using procedures in accordance with ASME Section 9. All field welds shall be wire brushed after completion and grinding shall be provided as required. All field welds shall be passivated with Bradford Derustit, or equal solution.

#### 3.02 WELDING PROCEDURE QUALIFICATIONS

A. Furnish Engineer for prior review, procedure specifications, and qualification records of welding procedures for all pipe welding to be performed under this section, in accordance with Section IX, Article II of the ASME Boiler and Pressure Vessel Code.

#### 3.03 WELDING PERFORMANCE QUALIFICATIONS

- A. All welders and welding operators shall be qualified at the Contractor's sole expense by an ASME-approved testing laboratory before performing any welding under this section. Qualification tests shall be in accordance with Section IX, Article III of the ASME Boiler and Pressure Vessel Code. Welders and welding operators shall be qualified for making groove welds in Type 304 and 304L stainless steel pipe in position 5g for each welding process to be used.
- B. Prior to the start of the work, Contractor shall submit a list of the welders he proposes using and the type of welding for which each has been qualified.
- C. Qualification tests may be waived if evidence of prior qualification is deemed suitable by the Engineer. Contractor shall retest any welders at any time Engineer considers the quality of the welder's work substandard. When Engineer request the retest of a previously qualified welder, the labor costs for the retest will be at the owner's expense if the welder successfully passes the test. If the welder fails the retest, all cost shall be at the contractor's expense.

#### 3.04 IDENTIFICATION OF WELDS

A. Each weld shall be marked with a symbol, which identifies the person who made the weld.

#### 3.05 FABRICATION

- A. End Preparation: Pipe edges shall be prepared by machine shaping or cutting with an aluminum oxide blade. Oxygen or arc cutting are acceptable only if the cut is reasonably smooth and true and all slag is removed either by chipping or grinding. Beveled ends for butt welding shall conform to ANSI B16.25.
- B. Cleaning: Surfaces shall be clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding. Prior to welding, wire brush joints to be welded with stainless steel wire brushes or stainless steel wool.
- C. Alignment and Spacing: Align ends to be joined within existing commercial tolerances on diameters, wall thicknesses, and out-of-roundness. Root opening of the joint shall be as stated in the procedure specification.
- D. Procedure:
  - 1. The direct current, reverse polarity, shielded metal arc or gas metal arc processes or direct current, straight polarity, gas tungsten-arc process shall be used for all field welding. Shop fabrication shall be in accordance with the submitted welding procedure qualifications.

- 2. No welding shall be performed if there is impingement of any rain, snow, sleet, or high wind on the weld area, or if the ambient temperature is below 32 degrees F. If the ambient is less than 32 degrees F, local preheating to a temperature warm to the hand is required.
- 3. Tack welds shall be thoroughly cleaned to avoid porosity or pinholing in the cover pass and shall be small enough to be readily fused into the succeeding bead.
- 4. Tack welds, if not made by a qualified welder using the same procedure as for the completed weld, must be completely removed. Tack welds, which are removed, shall be made with an electrode that is the same as, or equivalent to, the electrode to be used for the first weld pass. Tack welds, which have cracked, shall be removed.
- 5. Each layer of deposited weld metal shall be thoroughly cleaned prior to the deposition of each additional layer of weld metal, including the final pass, with a power-driven stainless steel wire brush. Surface defects, which will affect the soundness of weld, shall be chipped out or ground out.
- 6. Welds shall be free of cracks, incomplete penetration, weld undercutting, excessive weld reinforcement, porosity, slag inclusions and other defects in excess of the limits prescribed in Chapter V of ANSI B31.3, as applicable.
- 7. Branch connections shall be fitted and groove-welded in accordance with the details described and shown in Chapter V of ANSI B31.3, as applicable.
- 8. Screwed joints shall be made with fitting threads and pipe threads accurately conforming to the requirements of ANSI 32.1 for standard taper pipe threads. The Contractor shall use clean and sharp dies to provide an accurate thread profile, free of ridges and burrs. Back-welding of joints will not be permitted to remedy joints failing pressure tests. Joints failing the pressure test shall be replaced with a crewed joint, which passes the test, or the Contractor may replace the materials with low carbon stainless steel conforming to the requirements of welding pipe and welding fittings, at the Contractor's option. Welding shall be as specified herein.
- E. Testing: All lines shall be tested at the pressures listed in the Piping System Specification and by the procedures listed there in. Test procedures hall be as specified in Section 01 45 24, Testing and Inspection of Pipeline Construction.
- F. Supports and Hangers:
  - All hanger-pipe contact surfaces shall have a dielectric barrier consisting of neoprene rubber wrapping or plastic coated hangers. Hangers shall be as specified in Section 40 05 15, Methods and Material for Process Piping Installation: Exposed, except spacing shall be as follows:

Pipe Size	Maximum Support/Hanger Span	Minimum Rod Size Single Rod Hanger
1-inch and Smaller	6 feet	<sup>1</sup> /4-inch
1 <sup>1</sup> /2-inch thru 4-inch	8 feet	<sup>1</sup> /4-inch
6-inch	8 feet	3/8-inch
8-inch and 10-inch	10 feet	3/8-inch
12-inch	10 feet	<sup>1</sup> /2-inch
14-inch	12 feet	<sup>1</sup> /2-inch
16-inch	12 feet	5/8-inch
18-inch and 20-inch	14 feet	<sup>3</sup> /4-inch
24-inch	14 feet	7/8-inch

2. The load rating of universal concrete inserts shall not be less than that of the hanger rods they support.

- END OF SECTION -

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## SECTION 40 05 15

## METHODS AND MATERIALS FOR PIPING INSTALLATION

## PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section defines the methods and materials for process piping installation. Provide all labor, materials, tools, and equipment to install the process plant piping.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01 32 19, Submittals.
  - 3. Section 01 45 24, Testing & Inspection of Pipeline Construction.
  - 4. Section 40 05 13.53, Ductile Iron Pipe.
  - 5. Section 40 05 13.13, Steel Pipe.
  - 6. Section 40 05 13.19, Stainless Steel Pipe.
  - 7. Section 40 05 13.73, PVC Plastic Pipe.
  - 8. Section 05 06 50, Metal Fabrications.
  - 9. Section 09 90 00, Painting & Special Coatings.

#### 1.02 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 32 19, Submittals including:
  - 1. Product data for couplings, expansion joints, and wall seals.
  - 2. Drawings for all types of hangers, joints, supports, and materials used in the piping system.
  - 3. Piping drawings that show piping layout, couplers, adaptors, wall pipe, sleeves, etc.

#### 1.03 DESIGN REQUIREMENTS

- A. Pipe supports and hangers.
  - 1. Design, size, and locate piping support systems throughout facility, whether shown or not.
  - 2. Piping supports are shown only where specific types and locations are required; additional pipe supports may be required.
  - 3. Meet requirements of MSS SP 58, MSS SP 89, and ASME B31.1 or as specified.
  - 4. Pipe support systems shall be designed for gravity and thrust loads imposed by weight of pipes or internal pressures, including weight of fluid in pipes and insulation.
  - 5. Seismic loads and wind loads in accordance with governing codes and as shown on drawings.
  - 6. Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support.
  - 7. Use existing supports and/or hangers to support new piping only if contractor can prove supports and/or are adequate for additional load, if strengthened to support additional load, or as stated on drawings.
  - 8. Special supports and hangers may be required for cases where standard catalog supports are inapplicable.

- 9. Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.
- 10. Protect insulation at all support and hanger locations.

## PART 2 - PRODUCTS

- 2.01 PIPING MATERIAL SCHEDULE
- A. All pipe and fittings for process piping shall be in accordance with the schedules at the end of this section.
- 2.02 VALVES
- A. All valves shall be as shown on the drawings and shall conform to section: "Valves."
- 2.03 PIPING MATERIAL SPECIFICATIONS
- A. Refer to Section 40 05 13.53 for ductile iron pipe.
- B. Refer to Section 40 05 13.13 for steel pipe.
- C. Refer to Section 40 05 13.19 for stainless steel pipe.
- D. Refer to Section 40 05 13.73 for PVC plastic pipe.
- E. Refer to Section 40 05 13.74, Polyethylene Pipe.
- F. Refer to CPVC pipe section.
- 2.04 PIPING RELATED MATERIALS
- A. Bolts and Nuts
  - 1. Carbon steel standard treated bolts and studs conforming to ASTM A307, Grade B, and nuts conforming to ASTM A563, Grade B. Stainless steel bolts & nuts grade 316 shall be used where specified and indicated on the drawings.
- B. Gaskets
  - 1. Blended natural/SBR red rubber, 1/8-inch thick sheet packing 70-85 shore durometer.
- 2.05 COUPLINGS AND ADAPTORS
- A. Mechanical couplings used for joining plain end of pipe of the same diameter shall be Dresser style 38, or equal.
- B. Mechanical couplings for joining steel, plastic, or ductile iron pipe of different outside diameters up to 1/4 inch difference shall be Dresser style 162, or equal.
- C. Mechanical couplings for joining steel, plastic, or ductile iron pipe of different outside diameters larger than 3/4 inch difference shall be reducing coupling Dresser style 62, Rockwell style 415, or equal. Compression coupling for joining small diameter pipe shall be Dresser style 68, or equal.

- D. Expansion joint couplings used in absorbing concentrated pipe movement for steel and cast iron pipe shall be Dresser style 63, or equal.
- E. Flanged coupling adaptors used for joining plain end pipe to flanged valves and fittings for steel or cast iron pipe shall be Dresser style 128, or equal.
- F. Restrained flanged coupling adaptors used for joining plain end pipe to flanged valves and fittings for ductile iron pipe shall be EBAA Iron Series 2100, or equal.
- 2.06 EXPANSION JOINTS
- A. Acceptable manufacturer shall be General Rubber Series 1100, or equal.
- B. Flexible connections shall be provided as shown on the plans for all pumps, blowers, and other items of equipment, which may induce vibration to the piping system.
- C. Flexible connector shall be neoprene, except for aeration blowers shall be EPDM.
- D. Joints shall allow a minimum of 0.625 inches pipe expansion, 0.25 inches pipe compression.
- E. Flexible connectors shall be constructed with a filled arch to eliminate sedimentation of solids in the arch area.
- F. Tie rods shall be provided at all flexible connectors and expansion joints on pump discharge. These tie rods shall be of sufficient number and strength to restrain the connection at test pressure as required. Use a minimum of two 5/8-inch diameter tie rods at all connections.
- G. Reducing flanged expansion joints (eccentric and concentric) used shall be General Rubber, Series 1100 GR/ER, or equal.

## 2.07 WALL SLEEVES AND SEALS

- A. All process piping passing through below ground or water bearing concrete walls shall be installed utilizing wall pipe. Wall pipe castings shall have mechanical joints on the building exterior & flange joint on the building interior.
- B. All process piping passing through above ground concrete or masonry walls shall be installed utilizing wall sleeves or stainless steel sleeves as shown on the drawings. When sleeves are used the gap between the sleeve and the pipe shall be large enough to accommodate the specified insulation or at a minimum two inches larger than the pipe.
- C. Where pipes pass through interior walls or floors use stainless steel sleeves two inches larger than outside diameter of the pipe. A gap between the sleeve and the pipe shall be sealed using the specified sealant.
- D. Rotary drilled holes can be used for pipe penetrations through existing walls. For exterior of water bearing walls, the annular space between outside surfaces of the pipes passing through the drilled hole and the interior surfaces of the wall sleeves shall have a watertight seal.
  - 1. The annular space shall be sealed by a modular mechanical type unit consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between

the pipe and wall opening. The modular unit shall form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. Compression of the unit shall cause the rubber sealing elements to expand and provide a watertight seal. All hardware shall be 316 stainless steel.

### 2.08 MECHANICAL PIPE SUPPORT DEVICES

A. Manufacturers shall be Grinnell, Cooper B-Line, or equal. All pipe support devices used on this project shall conform to the details in this section. Each pipe support shall consist of a pipe attachment (PA-1 through PA-16) or pipe guide (PG-1 through PG-3) and the appropriate structural attachment (SA-1 through SA-15). All pipe supports, hangers, and anchors shall be type 304 stainless steel. Upon approval by the Engineer, hot dipped galvanized pipe supports and hangers may be acceptable if stainless steel is not available. Pipe supports & hangers for pipe larger than 12-inches are as detailed on the drawings.

#### B. Concrete Inserts

- 1. Concrete inserts shall be provided at locations to support piping where structural steel supports are not readily available. Inserts shall be located so that total load on any insert does not exceed the manufacturer's recommended maximum load. The location of all inserts shall be approved by the Engineer.
- 2. Where it is necessary to anchor supports to hardened concrete or completed masonry, expansion anchors shall be used. All expansion anchors shall type 316 stainless steel and be sized as required for the service with a minimum safety factor of five.
- 3. Continuous slot inserts shall be Grinnell figure SG200, or equal.
- 4. Individual inserts shall be Grinnell figure 282, hot dipped galvanized, or approved equal.

#### C. Precast Prestressed Concrete

1. Where it is necessary to anchor supports to precast prestressed concrete, a steel plate of sufficient size shall be anchored to the upper surface. A hole of proper size shall be provided in the center of the plate for the support rod. The plate shall be placed over a field drilled hole through the precast prestressed concrete. The hole shall be drilled and the plate anchored as approved by the precast manufacturer and Engineer.

#### D. Pipe Hangers

- 1. All piping shall be so installed so that it will be free to expand and contract without creating undue stresses in the piping system. All supports and hangers shall be so constructed and adjusted to allow for proper pitch of pipes. Where grooved and shouldered type joints and couplings are used, a hanger shall be placed within 2' of each side of the fittings to keep the pipes in alignment.
- 2. All hangers shall be stainless steel. In all cases, the contractor shall provide enough supports of the proper type to insure a functional and safe piping system. If the contractor proposes to use different pipe material or different joint fittings, he shall provide any additional hangers or supports necessary at no additional cost to the Owner.
- 3 Hangers used on copper pipe placed directly on the pipe shall be copper or stainless steel.
- 4. All hanger rods 24 inches or shorter shall be continuous thread type. All rods shall be stainless steel.
- 5. All structural steel, angles, rods, channels, etc. used for pipe hangers shall be hot dipped galvanized after fabrication or shall be stainless steel.
- 6. Hangers for fiberglass reinforced plastic (FRP) pipe shall be saddle type.
- 7. Trapeze hangers shall be constructed of angle, channel or other structural shapes type 304 stainless steel or hot dipped galvanized with flat surfaces for point of support. The

support member shall be of sufficient weight to avoid deflections which may cause undue stresses on the pipes being supported. The hangers shall be constructed to permit vertical adjustment of at least 1½ inches after installation.

- 8. Pipe hangers shall be as detailed at the end of this section or as shown on the drawings.
- E. Vertical Pipe Supports
  - 1. Vertical pipe supports shall be constructed of 316 stainless steel equipped with pipe saddle supports at the top and flanged at the floor.
  - 2. The pipe saddle support shall be adjustable to approximately  $2\frac{1}{2}$  inches.
  - 3. Vertical pipe supports shall be as detailed at the end of this section or as shown on the drawings.
- F. Anchors
  - 1. For suspended piping, anchors shall be centered, as closely as possible, between expansion joints and between elbows and expansion joints. Anchors shall hold the pipe securely and shall be sufficiently rigid to force expansion and contraction movement to take place at expansion joints and elbows.
  - 2. Anchorage shall be provided as required to resist thrusts due to changes in diameter or direction or dead ending of pipe line. Anchorage shall be required wherever bending stresses exceed the allowable for the pipe.

## 2.09 FIBERGLASS/COMPOSITE PIPE AND EQUIPMENT SUPPORT SYSTEMS

- A. General
  - 1. The fiberglass/composite pipe and equipment support systems includes but is not limited to: channel framing (strut) and accessories, fasteners and hanging systems, pipe clamps, clevis hangers and attachments.
  - 2. All composite materials shall have a maximum frame spread of 25 or less, per ASTM E84 (Class I flame spread) and shall have UV additive.
  - 3. All composite materials shall be FRP vinyl ester.

#### B. Design

1. All pipe support shall be designed based on the manufacturer's recommendations.

#### C. Clamps and Hangers

1. All pipe clamps and hangers shall be designed for rigid PVC coated steel, schedule 40 or schedule 80 PVC or CPVC and filament wound fiberglass pipe or conduit.

#### D. Fasteners

1. All fasteners shall be pultruded vinyl ester rod with ground threads and compression molded vinyl ester nuts. If bolts are not available from the manufacturer, they can be field fabricated from FRP threaded rod and nuts.

#### E. Channel

1. All channel shall be manufactured by the pultrusion process and contain a minimum of 50% glass by weight.

#### F. Field cutting

1. All field cutting shall be sealed by manufacturer's sealing products.

#### G. Manufacturer's

1. Enduro or equal.

#### 2.10 PIPE INSULATION

- A. General
  - 1. Insulation products shall be manufactured by Armstrong, CertainTeed, Knauf, Manville, Owens-Coming, Partek, Pittsburgh Coming, Rubatex, Spoule or Engineer approved equal.
  - 2. Insulation materials shall be compatible with stainless steel equipment, tanks and piping and shall be guaranteed not to cause stress corrosion cracking of stainless steel or copper tubing.
  - 3. Asbestos and asbestos bearing materials shall not be used.
  - 4. All products including vapor barriers and adhesives shall conform to NFPA 90A and 255 and shall have a flame spread rating less than 25, fuel contributed rating less than 50 and a smoke developed rating less than 50.
  - 5. All material shall be fire retardant, moisture resistant, mildew resistance, vermin proof and suitable for the temperatures to which they are applied.
  - 6. All material shall be delivered in good condition, and the packages and insulation shall be plainly marked with manufacturer's identification label.
- B. Pipe Insulation Materials
  - 1. Piping insulation includes insulating material, protective jackets, flashing, and other materials as required for a complete and waterproof system. Insulation shall be provided as shown on the drawings and as specified in the Piping System Specification Sheets. Surfaces to be insulated include piping and related vessels and appurtenances.
    - a) Low Temperature Insulation

Insulation for low temperature applications (-30°F to 75°F) shall be flexible unicellular type conforming to Fed. Spec. HH-I-573, Class 1. Adhesive and accessories shall be as recommended by the manufacturer.

- b) Medium Temperature Insulation Insulation for medium temperature applications (76°F to 370°F) shall be fiberglass conforming to the requirements of ASTM 1393 & ASTM C1136 Type I All Service Jacket (ASJ). Adhesive and accessories shall be as recommended by the manufacturer.
- c) High Temperature Insulation

Insulation for high temperature applications (1200°F) shall be calcium silicate type conforming to the requirements of Fed. Spec. HH-I-523, Type II. Adhesives and accessories shall be as recommended by the manufacturer.

d) Protective Jacket

A protective jacket shall be provided for all heated surface insulation. Protective jackets shall be fabricated from aluminum, stainless steel, or laminated polyvinyl materials as specified.

SYSTEM 1) Aluminum Jacket

Aluminum jacket shall be provided for heated surfaces and piping larger than 8 inches in diameter. The jacket shall be constructed of plain finish aluminum sheet conforming to ASTM B209, alloy 5005, with a minimum temper of H16. The jacket shall be 36 inches minimum width and shall be 0.020-inch thick on surfaces 14 inches in diameter or larger and 0.016inch thick on smaller diameter surfaces. The jacket shall be provided with an impermeable water barrier on the inside. The jacket should be held in place with aluminum rivets. The spacing and quantity of rivets shall be such that there are no gaps in the jacket and all seams are tight.

SYSTEM 2) Stainless Steel Jacket

Stainless steel jacket shall be provided for heated surfaces and piping larger than 8 inches in diameter. The jacket shall be constructed of embossed 304 stainless steel. The jacket shall be 36 inches minimum width and shall be 0.020-inch thick on surfaces 14 inches in diameter or larger and 0.016-inch thick on smaller diameter surfaces. The jacket shall be provided with an impermeable water barrier on the inside. The jacket should be held in place with stainless steel rivets. The spacing and quantity of the rivets shall be such that there are no gaps in the jacket and all seams are tight.

SYSTEM 3) Laminated Polyvinyl Jacket

Laminated polyvinyl Jacket shall be provided for heated piping 8 inches in diameter and smaller. The jacket shall be polyvinyl chloride. Jacket color shall be selected from the manufacturer's standard colors. Joint tape shall be vinyl, 10 mils thick. Fittings, valves, flanges, and other similar items shall be jacketed with 15 mils thick premold PVC. PVC jacketing and type shall be spray-coated to match PVC jacket color.

e) Shields

Shields for the protection of chilled surface insulation shall be 16-gauge galvanized steel sheet, 9 inches long and formed into a half cylinder.

f) Flashing

Flashing shall include aluminum caps, sealant and reinforcing as required. Aluminum cap shall be 0.020-inch thick and shall be cut to completely cover the insulation. Sealant for surfaces heated up to 370°F shall be constructed from silicone based material. Sealants for hotter surfaces shall be as recommended by the high temperature insulation manufacturer. Sealants for low temperature insulation shall consist of manufacturer's adhesive.

Reinforcement shall not be required for low temperature flashing. Reinforcement in flashing heated to 370°F shall be nylon fabric. Reinforcement in flashing for hotter surfaces shall be wire mesh or as recommended by the high temperature insulation manufacturer.

- C. Jackets and Specialties
  - 1. Provide matching smooth finish fitting covers or field fabricate from jacket material.

## PART 3 - EXECUTION

- 3.01 GENERAL
- A. Pipe, fittings, specialties and material used are to be carefully inspected for defects and thoroughly cleaned before installation.
- B. It shall be the responsibility of the Contractor to coordinate the work with all other trades to insure proper scheduling of inter-related work so as not to cause unnecessary delays or upset the treatment plant process to the extent that they violate their permit.
- C. Contractor supplying pipe, fittings, and valves shall be responsible for coordinating the diameter, drilling, and pressure rating of flanges for all valve and equipment connections.

- D. Gauges, valves or any other equipment located in walls, above ceilings or in any other inaccessible location shall have access provided. In plaster or masonry, Contractor shall provide metal access doors. Acoustical ceilings shall be provided with removable panels and marker tabs on each panel.
- E. The drawings are diagrammatic as to what is required. The Contractor shall consult the architectural, structural, electrical and other mechanical drawings for true dimensions, details, obstructions, and conflicts.
- F. Dimensions given in figures shall take precedence over scaled dimensions. The architectural plans shall take precedence over mechanical and electrical plans.
- G. Piping drawings are drawn for maximum clarity and are not necessarily intended to indicate a dimensional location. Piping shall be grouped on walls and ceilings and shall be coordinated and run with other mechanical and electrical work to allow a neat and workmanlike finished appearance.
- H. Install pipe runs in straight lines parallel to or at right angles to the walls, floors, or other pipe runs.
- I. Do not run pipe through structural beams.
- J. Installed piping shall not interfere with the operation or accessibility of doors or windows, shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of any equipment.
- K. All pipe passing through roof shall have flashing.
- 3.02 CONNECTIONS TO PUMPS, VESSELS AND EQUIPMENT
- A. Piping shall be erected and supported in a manner that shall not put undue strain on pumps, tanks or equipment.
- B. The procedure for connection of piping to equipment shall be as follows:
  - 1. After the equipment has been set and grouted, the pipe shall be run to the equipment without making any tight connections to flanges.
  - 2. Flat faced flanges and full-face gaskets shall be used on piping connecting to valves and equipment with flat flanges. Raised faces of standard flanges may be machined off flat to accomplish this.
  - 3. Flanges shall be checked by the Owner's representative to assure that no strain is placed on the equipment. If pipe is not in correct alignment, the piping shall be removed and corrected. The correction in alignment shall not be made while the pipe is connected to the equipment.
  - 4. No piping shall be connected to equipment until sufficient permanent support has been installed.
- C. After alignment is found to be correct by the Owner's representative, the flanges shall be bolted up.
  - 1. The Owner's representative will observe the dial indicators on the coupling. If the piping has moved the equipment alignment in excess of the 0.005 inch T.I.R. allowable, the

piping will be reworked until no strain is exerted on the equipment by the pipe. If the piping has thrown the equipment out of alignment, the coupling shall be realigned to within the 0.005-inch maximum tolerance.

- 2. Any equipment realignment work due to excessive strain caused by piping shall be at the piping contractor's expense.
- D. After the equipment has been in service, tested at operating temperatures and with the lines and equipment still hot, flanged connections to pumps, tanks and equipment shall be loosened and checked for alignment, position, expansion and strain applied to the equipment and make any adjustments necessary, and secure approval of the Owner's representative before reconnecting.

#### 3.03 DRAIN CONNECTIONS AND CLEANOUTS

- A. Drain connections and suitable valves shall be provided for all equipment and piping (pumps, tanks, etc.) and for all piping systems at low points in the system for draining for freeze protection and also for rapid draining of the system for maintenance work.
- B. Drain valves shall be located as close as possible to process lines to prevent dead legs.

#### 3.04 VALVES

- A. Install valves to be accessible with valve operators at a convenient location for operation.
- B. Chain wheel operators shall be supplied and installed on valves which are higher than six feet above floors.

#### 3.05 COUPLING AND ADAPTORS

A. Pipe shall be cut clean with smooth ends such that a space is left between pipe ends of not less than 1/4-inch or more than 1 inch. Mechanical couplings shall be carefully installed in strict accordance with the manufacturer's recommendation and shall be suitably restrained to prevent movement. The pipe shall be furnished with plain ends which are smooth and round for a distance of at least 10 inch from each end.

#### 3.06 EXPANSION JOINTS

- A. Expansion joints shall be adequately supported to prevent stress on joint.
- B Vertical supports shall be located within 3 pipe diameters of the connection and shall be provided on each side of the connection.

#### 3.07 WALL PIPES AND SLEEVES

- A. Wall pipe shall be furnished and installed true to grade, line, position and plumb or level and shall be maintained during construction by the Contract. Wall pipe shall be placed in position before concrete is poured to insure a watertight anchored connection between the concrete and wall pipe. The wall pipe shall be placed so that the intermediate collar is centered in the wall and shall be carefully aligned.
- B. Wall pipe shall be set in the form with the bolt holes and ranges straddling the centerlines horizontally and vertically.

- C. Pipe sleeves shall be installed flush with finished surfaces.
- D. The annular space on all interior sleeves shall be stuffed and caulked.

## 3.08 PIPE SUPPORTS

- A. Contractor shall design, furnish and install all pipe supports including auxiliary steel, structure attachments, pipe attachments, brackets, trapeze hangers, hanger rods and accessories such as turnbuckles, eye nuts, concrete anchors, inserts, etc. necessary to support the piping systems from the buildings, structures and utility bridges.
  - 1. The design and location of the pipe supports shall be in accordance with this specification and the drawings.
  - 2. Pipe supports shall not be attached to vessels or equipment without the prior written approval of the Owner's representative.
  - 3. Drilling, welding, cutting, and other operations required to attach the piping to such structures shall be a part of these specifications. No structural members shall be drilled or cut into without permission of the Owner's representative and the type contour, etc. of the hole or cut should be specified. No torch cutting will be permitted.
  - 4. Pipe hangers shall not be located closer than 6 inches from equipment or pipelines operated at temperatures greater than 450°F.
  - 5. Any detailed sketches or takeoffs required in connection with the work of pipe erection shall be submitted for approval.
  - 6. Pipe supports shall allow vertical adjustment for pitch and thermal expansion.
  - 7. Uninsulated piping such as stainless steel, copper, etc. shall be installed with isolation shields of like material to prevent galvanic action. Hangers of like material or PVC coated hangers (for piping less than 2½ inches) may also be used.
- B. All supports shall be designed to meet all static and operational conditions to which the piping system and connected equipment will be subjected. For supports specified to be designed in accordance with ANSI B31.1, the loads should not be based on increasing the allowable stress level in hanger components by 20%, as allowed by the code.
- C. Where supports are not designed and detailed on the drawings, contractor's supports designer shall analyze and determine the piping loads and movements that will exist at any time, including all applicable forces acting simultaneously, and shall design and detail the supports in accordance with the conditions.
- D. Hangers shall be designed for installation in the cold position such that the hanger rod is vertical when pipe moves to the hot operating position. The maximum vertical offset between pin-to-pin connections when cold shall be 4 degrees.
- E. Where it is necessary to weld to existing structural steel members to carry pipe supports, anchors, etc. the welds for securing the plates to the structural members shall in all cases be parallel to the length and located at web of the structural member. Welding across the flange of existing structural steel members is not permitted. All welding to building structural steel shall be performed by welders qualified in accordance with AWS D1.1, applicable Building Codes, and the welding section of these specifications.
- F. In addition to spacing schedule, support pipe as follows:

- 1. At each change in direction.
- 2. On each side of large valves.
- 3. Within 5 feet of each equipment connection.
- 4. At all branches or risers.
- 5. At all floor openings.
- 6. Minimum of one support for each length of cast iron or ductile iron pipe.

#### 3.09 PIPE INSULATION

#### A. Piping Insulation Installation

1. Insulation shall be applied over clean, dry surfaces, with all joints butted firmly together. Double layer insulation, where required, shall be applied with section joints staggered. All equipment, tanks, valves, flanges, unions, expansion joints, rigid and flexible couplings and fittings shall be strengthened with reinforcing and insulating cement. Insulation for all of the above items except large equipment and vessels and welded fittings shall be attached to the insulation jacket halves to allow removal without causing damage to adjacent insulation.

Chilled surface insulation shall be provided with metal shields at each pipe support. Shield inside face shall be coated with insulation adhesive to prevent movement. No strapping will be required. The pipe insulation shall be provided with additional support at each shield. The use of rigid insulation sections will be acceptable. The use of wood or cork inserts is subject to approval.

2. Protective Jacket

Jacketing and insulation for heated surfaces shall be interrupted at hangers, anchors, pipe guides, and other support elements, and only that clearance between insulation system and support element which is required to permit a workmanlike installation of the required flashing shall be provided.

- Laminated Polyvinyl Jacket
   Laminated polyvinyl jacket shall be applied with all joints taped in conformance with the manufacturer's instructions subject to acceptance by the Engineer.
- b. Aluminum Jacketing
  - 1) Pipe and Large Surface Jacketing

Pipe and large surface jacketing shall have longitudinal joints of either the interlocking type or lapping type. The exposed edge of the longitudinal lap shall be crimped tightly to form a stiffened ½-inch hem. Longitudinal joints shall be hidden from view if tightly to form a stiffened ½-inch hem. Longitudinal joints shall be hidden from view if practicable. Longitudinal joints shall be located in the lower half of the pipe and lapped 2 inches so as to shed water.

End Joints shall be lapped with adjacent jackets 2 inches and strapped. End joints on sloping or vertical runs shall be lapped so as to shed water.

All jackets shall be held in place by at least one strap at the end joints and one strap at midsection and by as many other straps as required to prevent initial or subsequent distortion of the lapped edge. On flat jacket surfaces where straps cannot be used to close joints, screws shall be used at a maximum spacing of 6 inches. 2) Fittings and Other Jacketing

Fittings and other jacketing shall be furnished in half sections and shall be fastened as required for pipe jacketing. Jackets shall not be applied until insulating cement has dried.

## 3. Flashing

Flashing shall be provided at all jacket penetrations and at all jacket terminations.

A heavy tack coat of sealant shall be troweled over the insulation, extending over jacket edge 1-inch and onto pipe or protrusion 2 inches. Reinforcement shall be smoothly stretched over the tack coat after clipping to fit over pipe and jacket. Clipped reinforcing shall be strapped with a continuous band of reinforcing to prevent curling. Sealant shall then be troweled over the reinforcement to a minimum thickness of 1/8-inch.

Aluminum caps shall be formed to fit over the adjacent jacketing and to completely cover coated insulation. Cap shall be held in place with a jacket strap.

On high temperature surfaces, fabricated aluminum caps cemented and tightly clamped to the pipe and strapped to the jacketing may be used following approval.

Pipe Size	Low Temp	Med Temp	High Temp*
1/2" to 2"	1″	1″	1-1/2″
2-1/2" to 4"	1″	1-1/2″	2″
6" to 12"		2″	3″

4. Insulation Thickness

\*All engine generator exhaust piping and silencer shall be insulated with a minimum of 3 inches of high temperature insulation.

## 5. Miscellaneous:

- a. In cases where the insulation extends below grade to cover heat traced lines, the insulation shall be covered with 0.020 inch thick 316 stainless steel jacket. All joints on the jacket shall be sealed with waterproof mastic and then the jacket shall receive two coats of "Tape Coat" to make the underground portion of the insulation completely watertight.
- b. No drain plug or drain openings shall be insulated.
- c. Any protrusions through pipe insulation such as instrumentation connections, uninsulated pipe connections, supports or electrical tracing cables shall be carefully sealed for the appropriate service.
- d. Certain smaller piping systems (or smaller sized pipe runs) are only shown diagrammatically, or may be specified to terminate at a certain point not shown physically on the drawings. Contractor shall furnish and install insulation for such piping in order to complete the system whether physically shown or not.
- e. Insulation, three (3) inches and over in total thickness shall be applied in two layers with staggered joints unless otherwise specifically approved.
- f. All projecting hanger lugs on piping for working temperatures of 300°F and above shall be properly covered with insulation to maintain an outside surface temperature of not more than 175°F.
- g. The Contractor shall weld clip angles, studs, etc. to vertical runs of pipe as

may be required to properly support the insulation. Submit welding procedures to the Owner's representative for review prior to welding.

h. The Contractor shall provide necessary flashings, sleeves, boots, clamps, sealants, etc. for roof, floor and wall penetrations requiring a watertight or weathertight seal. Submit details to the Owner's representative for review prior to installation.

#### 3.10 PIPING IDENTIFICATION

A. Identify piping and direction of flow so piping can be painted and labeled in accordance with Section 09 90 00, Painting and Special Coatings.

#### 3.11 DIELECTRONICS

A. Use dielectric unions at the junction of all dissimilar piping. Gasket material shall be No. 5, Steam.

#### 3.12 CLEAN-UP

- A. All surfaces required to be painted shall be cleaned and degreased.
- B. Remove all debris, tools, scaffolding, trash and excess materials from the site.

#### 3.13 TESTING

- A. All process plant piping shall be tested in accordance with Section 01 45 24, Testing & Inspection of Pipeline Construction.
- B. The Contractor shall notify the Owner's representative prior to all pipe testing.

#### - END OF SECTION -

			TABLE '/	۹'							
PIPE	DESIGN	ROD SIZE BASED ON	MAXIMUM SPAN, IN FEET FOR PIPES NOT IN RACKS, SEE NOTE 2								
SIZE	WEIGHT	SINGLE ROD, SEE NOTE 1	STEEL COPPER		PLASTIC SEE NOTE 3	CAST IRON SEE NOTE 4					
3/8" - 3/4"	275 LBS	3/8"	5	5	CONTINUOUS						
1"	275 LBS	3/8"	7	6	5						
1-1/4"	300 LBS	3/8"	7	7	5						
1-1/2"	300 LBS	3/8"	9	8	5						
2"	325 LBS	3/8"	10	8	4	PRESSURE					
2-1/2"	375 LBS	1/2"	10	9	6	PIPE 12 FT					
3"	575 LBS	1/2"	10	10	7	SOIL PIPE					
4"	600 LBS	5/8"	10	10	7	12 FT					
6"	750 LBS	3/4"	10	10	9						
8"	950 LBS	7/8"	10	10	9						
10"	1200 LBS	7/8"	10								
12"	1450 LBS	7/8"	10								

#### NOTES:

1. Rod size is based on carrying single pipe. When more than one pipe is to be supported, rods shall be sized using design weights to determine total load.

2. Where modularly spaced inserts are required. Pipes shall be supported at the insert module no special inserts shall be allowed for individual pipe supports unless specifically detailed or authorized by the engineer.

3. Spacing based on schedule 80 at 100°F. Schedule 40 or higher temperatures require shortened spans. See MFR's recommendations.

4. There shall be at least one hanger per pipe length located as close to the bell as possible.

5. See typical support rod, Attachment 'H', for pipes subject to horizontal movement (service temperatures  $33^{\circ}F - 55^{\circ}F$  and  $120^{\circ}F - 450^{\circ}F$ ).

6. Use turnbuckle, WSS Type 13, for PA-3 and PA-7.

7. Design weights refer to the pipe size shown supported at the spacing listed and shall be used for design of all special hanger systems.

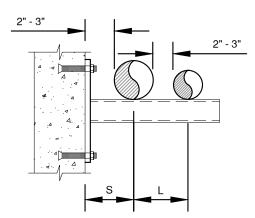
	TABLE 'B'																	
SERVICE CONDITION								TES	PIPE	ATT	ACH	HMEN MEN CE CC	TS SI				N	
SERVICE TEM	PER	ATURE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
33°F - 55°F	٦	INSULATED OR				Х	Х	Х	Х	Х	Х			Х		Х		Х
120°F - 450°F	5	UNINSULATED	Х	Х	Х	Х	Х		Х	Х	Х	Х	Х	X	Х	Х		Х
60°F - 115°F		UNINSULATED	X	Х		X	Х					Х	Х		Х	Х	Х	Х
PIPING MATER	RIAL	S																
STEEL			Х	Х	Х	Х	Х	Х		Х	Х	Х	Х	Х	Х	Х		Х
COPPER				Х					Х	Х	Х	Х	Х	X	Х			
PLASTIC			Х	Х								Х	Х		Х			Х
CAST IRON	CAST IRON			Х	Х					Х	Х	Х	Х	X	Х		Х	Х

NOTES:

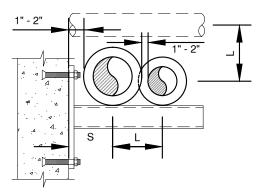
1. Asterisk indicates pipe attachments that require special treatment when used with copper pipe. Refer to individual details above.

2. For service other than those shown in Table 'B', pipe attachments shall be as selected by the engineer

## PIPE SPACING SCHEDULE



## PIPES WITHOUT FLANGES



## **PIPES WITH FLANGES**

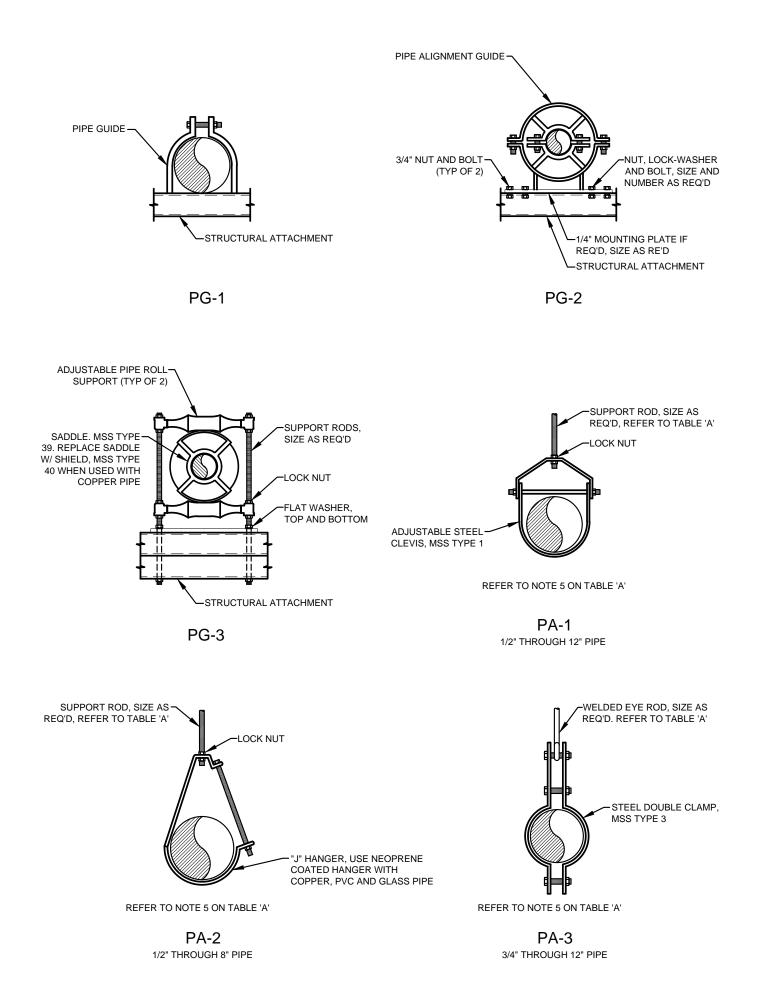
CE	PIPE CENTER-TO-SURFACE DIMENSION 'S'											
	CLEARANCE											
2 T	O 3 I	NCHES	1 TO 2 INCHES									
PI			PIPE WITH FLANGE RATING (150 PSI)									
	2	4	4									
	3	4	5									
Ē	4	5	6									
ZE	6	6	7									
I S	8	7	8									
I dic	10	8	9									
AL	12	9	11									
Z I	14	9	12									
NOMINAL PIPE SIZE (IN.)	16	10	13									
	18	11	14									
	20	12	15									
	24	14	17									

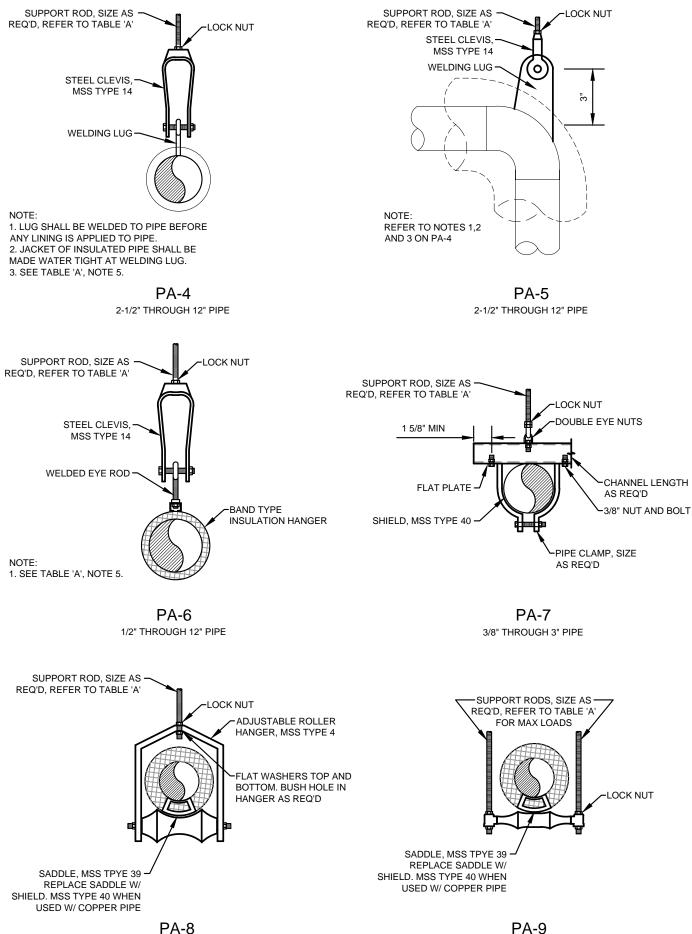
P	PIPE LINES WITHOUT FLANGES - DIMENSION 'L'												
$\square$	NOMINAL PIPE SIZE (IN.)												
	$\overline{\ }$	2	3	4	6	8	10	12	14	16	18	20	24
	2	5	5	6	7	8	9	10	11	12	13	14	16
	3	5	6	6	8	9	10	11	11	12	13	14	16
Ξ.	4	6	6	7	8	9	10	11	12	13	14	15	17
SIZE	6	7	8	8	9	10	11	12	13	14	15	16	18
IS I	8	8	9	9	10	11	12	13	14	15	16	17	19
PIPE	10	9	10	10	11	12	13	14	15	16	17	18	20
	12	10	11	11	12	13	14	15	16	17	18	19	21
NOMINAL	14	11	11	12	13	14	15	16	16	17	18	19	21
Į	16	12	12	13	14	15	16	17	17	18	19	20	22
2	18	13	13	14	15	16	17	18	18	19	20	21	23
	20	14	14	15	16	17	18	19	19	20	21	22	24
	24	16	16	17	18	19	20	21	21	22	23	24	26

	PIPE LINES WITH FLANGES - DIMENSION 'L'													
	150 & 150 PSI, FLANGED													
$\square$		NOMINAL PIPE SIZE (IN.)												
	$\overline{\ }$	2	3	4	6	8	10	12	14	16	18	20	24	
	2	6												
	3	6	7											
Ż	4	7	8	8										
ZE	6	8	9	9	10									
S.	8	9	10	10	12	13								
NOMINAL PIPE SIZE (IN.)	10	11	11	12	13	14	15							
<b>⊢</b>	12	12	13	13	14	15	16	17						
Ĩ	14	13	14	14	15	16	17	18	19					
ģ	16	14	15	15	17	18	19	20	20	21				
2	18	15	16	16	17	18	19	20	21	22	23			
	20	16	17	17	19	20	21	22	22	23	24	25		
	24	19	19	20	21	22	23	24	24	25	26	27	29	

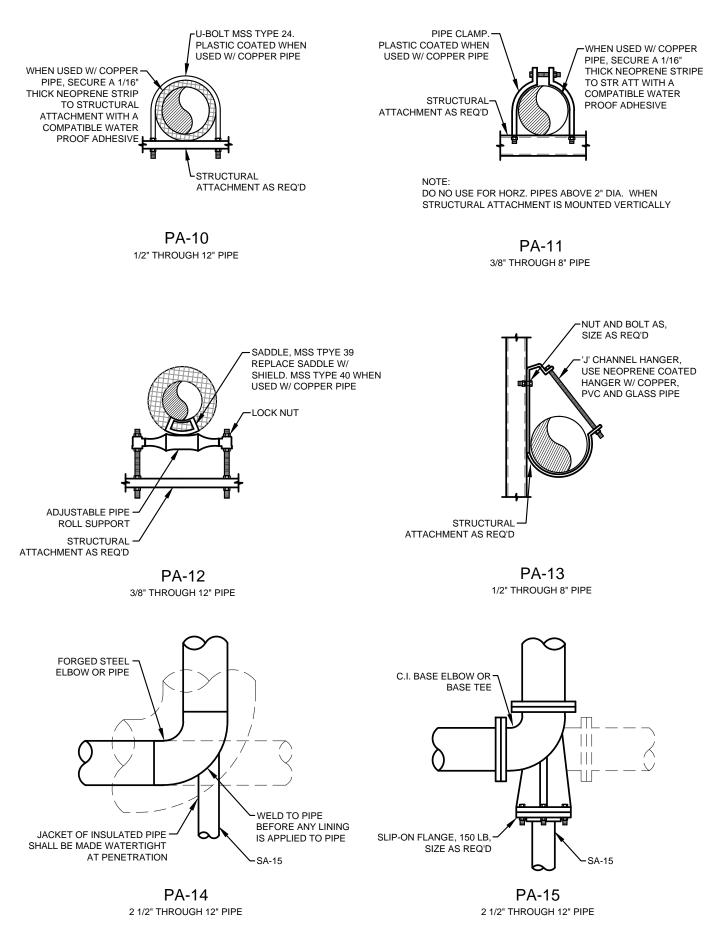
NOTE:

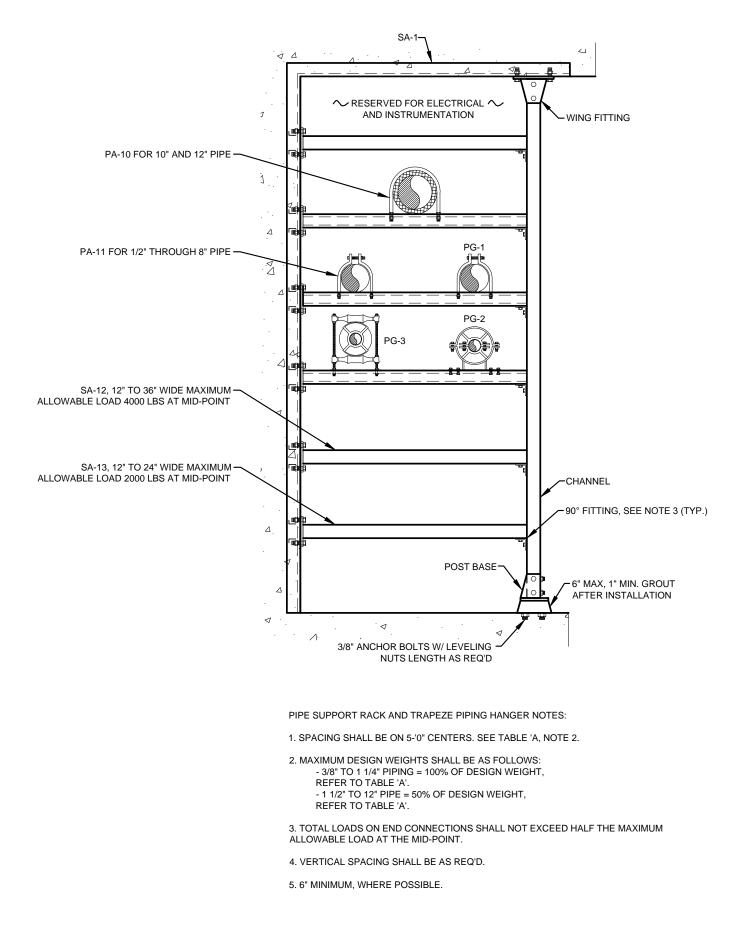
1. TABLES GIVE THE MINIMUM SPACING. INCREASE THESE DIMENSIONS FOR INSULATION AND IF THERMAL MOVEMENT WOULD REDUCE CLEARANCE.



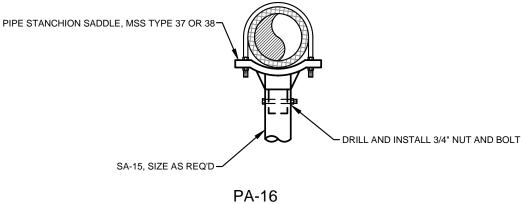


3/8" THROUGH 12" PIPE

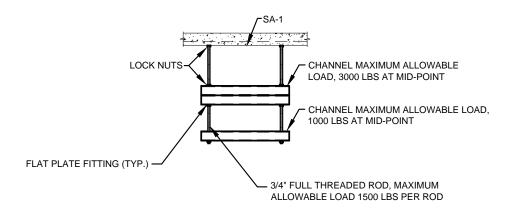




#### TYPICAL PIPE SUPPORT RACK







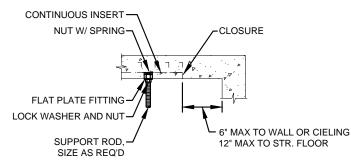
## TYPICAL TRAPEZE PIPE HANGER

NOTES:

1. MSS REFERS TO THE MFR'S STANDARDIZATION SOCIETY OF THE VALUE AND FITTING INDUSTRY, STANDARD PRACTICE SP58 AND SP69.

2. FITTINGS SHALL NOT BE LESS THAN MSS CL 8

3. WHERE NO REFERENCE TO PIPE SUPPORT SYSTEMS IS GIVEN ON THE DRAWINGS, THE CONTRACTOR SHALL USE AN APPROPRIATE SYSTEM AS DIRECTED BY THE ENGINEER, REFER TO TABLE 'B'.



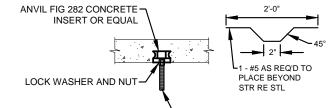
NOTE:

INSERT MAY BE USED WITH BOLTS AND SUPPORT RODS UP TO 3/4".

CAPACITY: 3/8" THROUGH 12" PIPE (8" THROUGH 12" MUST BE SUPPORTED WITH 3/4" RODS). LOAD SHALL NOT EXCEED 1500 LBS/FT OF INSERT LENGTH. USE DESIGN WEIGHTS SHOWN IN TABLE 'A' TO DETERMINE TOTAL LOAD.

SPACING: INSERTS SHALL BE INSTALLED ON 5'-0" CENTERS IN WALLS AND CEILINGS OF TUNNELS. GALLERIES AND ROOMS BELOW GRADE WHERE INDICATED ON DETAIL DRAWINGS IF SPACING OTHER THAN 5'-0" IS REQ'D. IT WILL BE INDICATED ON THE DRAWING

> SA-1 SEE NOTE 5, TABLE 'A'



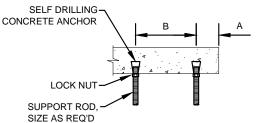
-SUPPORT ROD, SIZE AS REQ'D

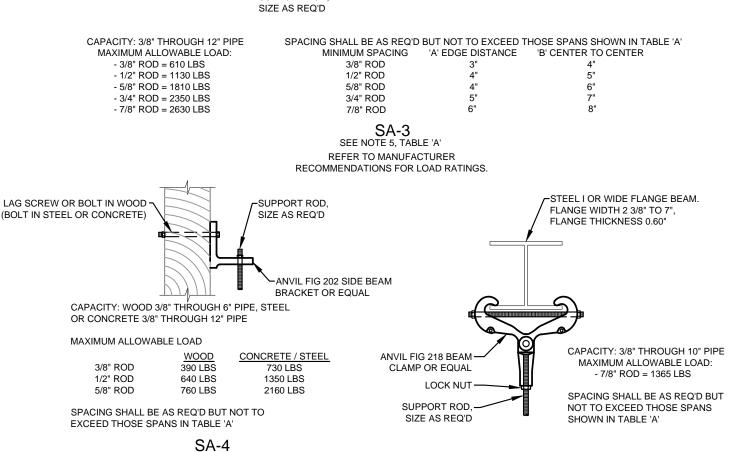
CAPACITY: 3/8" THROUGH 12" PIPE MAXIMUM ALLOWABLE LOAD: - 3/8" ROD = 730 LBS - 1/2" ROD = 1130 LBS - 5/8" - 7/8" RODS = 1140 LBS

SPACING SHALL BE AS REQ'D BUT NOT TO EXCEED THOSE SPANS SHOWN IN TABLE 'A'

SA-2

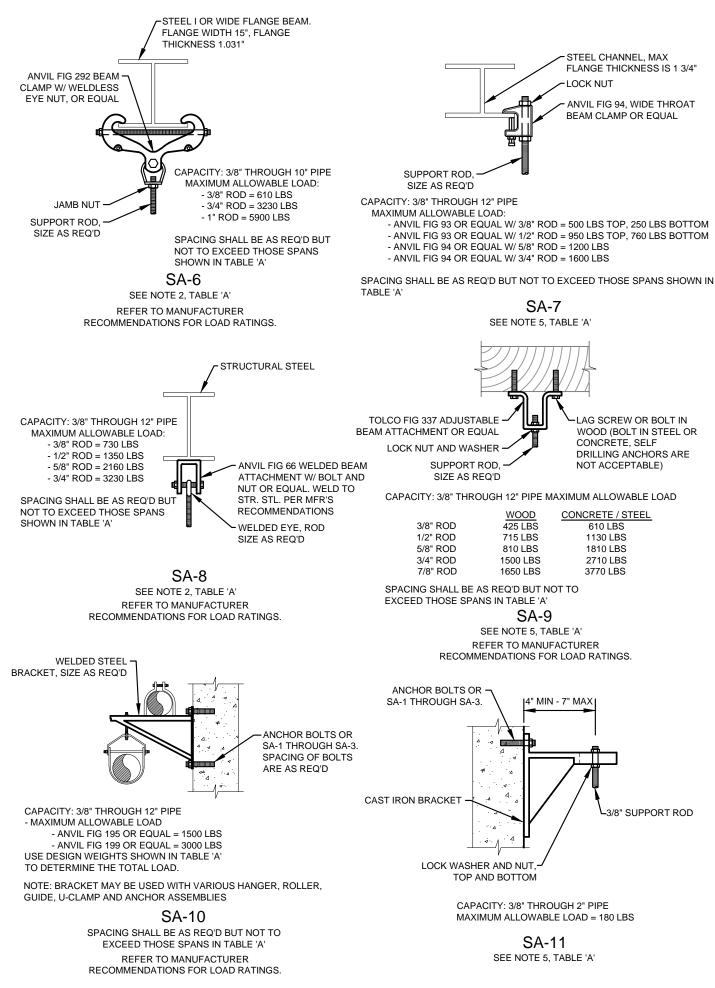
SEE NOTE 5, TABLE 'A' REFER TO MANUFACTURER RECOMMENDATIONS FOR LOAD RATINGS.

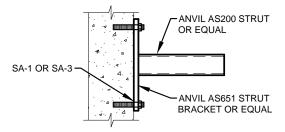




SEE NOTE 5, TABLE 'A'

REFER TO MANUFACTURER RECOMMENDATIONS FOR LOAD RATINGS. SA-5 REFER TO MANUFACTURER RECOMMENDATIONS FOR LOAD RATINGS.





CAPACITY W/ LOAD AT THE END

BRACKET MAY BE USED WITH VARIOUS HANGER, ROLLER, GUIDE AND CLAMP ASSEMBLIES

CAPACITY W/ A UNIFORM LOAD

CAPACITY 3/8" THROUGH 8" PIPE

GENERAL NOTES

SPANS SHOWN IN TABLE 'A'

SPACING SHALL BE AS REQ'D BUT NOT TO EXCEED THOSE

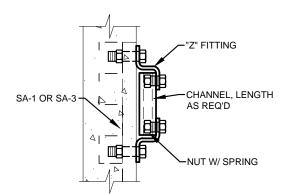
SA-14

1. LOADS FOR SIZING ALL COMPONENTS SHALL BE

<u>L</u> 6"	LOAD 1200 LBS	<u>L</u> 6"	LOAD 425 LBS
12"	600 LBS	12"	235 LBS
18"	400 LBS	18"	165 LBS
24"	300 LBS	24"	125 LBS

SPACING SHALL BE AS REQ'D BUT NOT TO EXCEED THOSE SPANS SHOWN IN TABLE 'A'

#### SA-12 REFER TO MANUFACTURER RECOMMENDATIONS FOR LOAD RATINGS.



SA ANVIL 90° 4-HOLE BRACKET

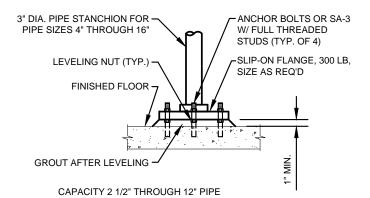
BRACKET MAY BE USED WITH VARIOUS HANGER, ROLLER, GUIDE AND CLAMP ASSEMBLIES

CAPACITY W/ A UNIFORM LOAD MOUNTED WITH 12GA CHANNEL IS 2000 LBS

SPACING SHALL BE AS REQ'D BUT NOT TO EXCEED THOSE SPANS SHOWN IN TABLE 'A'

SA-13

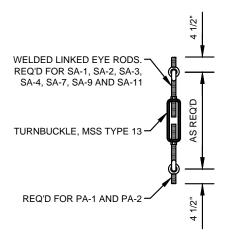
REFER TO MANUFACTURER RECOMMENDATIONS FOR LOAD RATINGS.



SPACING SHALL BE AS REQ'D BUT NOT TO EXCEED THOSE SPANS SHOWN IN TABLE 'A'

SA-15

TYPICAL SUPPORT ROD FOR PIPES SUBJECT TO HORIZONTAL MOVEMENT SEE NOTE 5, TABLE 'A'

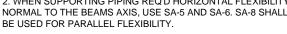


2. WHEN SUPPORTING PIPING REQ'D HORIZONTAL FLEXIBILITY NORMAL TO THE BEAMS AXIS, USE SA-5 AND SA-6. SA-8 SHALL

DETERMINED USING THE DESIGN LOADS SHOWN IN TABLE 'A'.

3. ALL COMPONENTS OF STRUCTURAL ATTACHMENTS SHALL

BE HOT DIPPED GALVANIZED.



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## **PIPING SYSTEM SPECIFICATION**

RAW WASTEWATER	1
SANITARY DRAIN AND VENT	2

## **PIPING SYSTEM SPECIFICATION**

SERVICE						SYM	IBOL			
	RAW WAS	TEWATER					RW			
FLUID					EST MEI	DIUM				
W	ASTEWATER		$\square AIR \square WATER \square \_$							
		TES	ST DUI	RATION						
				1		MIN.				
	PRESSURE -				ERAT	URE °F				
WORK		TES		NO	RMAL		MAX			
50	75	150	)		60		75			
	F	PIPE AND FI	TTING	SPECIFIC	CATION					
PIPE										
SIZE	EXPOSURE		PIPE			FI	TTINGS			
3" &	EXPOSED	Type 304 St	tainless	steel,	Type 3	04 Stat	inless steel, screwed			
Smaller		screwed or v			or weld	led				
	BURIED	Polyethylen	e heat t	fused	Polveth	vlene	heat fused			
	EMBEDDED	1 of jeth jien					neur ruseu			
	ENCASED									
4" &	EXPOSED	SCH 10 Typ	be 304 s	tainless	SCH 10	) Type	304 stainless steel,			
Larger		steel, screwe			screwed or welded.					
		joints.								
	BURIED		10 Type 304 stainless			SCH 10 Type 304 stainless				
	EMBEDDED	steel, screw	ed or wo	elded	welded.					
	ENCASED	joints.								
		1	E SPEC	IFICATIO						
SIZE	EXPOSURE	TYPE	-		PECIFI	CATI	ON			
3" &	Exposed	Isolating		tric Plug						
Smaller		Throttling		tric Plug			•			
411 0		Check	-	check with	h lever an	d weig	ght			
4" &	Exposed	Isolating		ntric Plug						
Larger		Throttling		tric Plug	1					
		Check		-	ith lever and weight					
	Buried	Isolating	Eccen							
DENGADE	[ []		T1		1	1	- 1			
REMARK	S: Buried valves	s snall nave Cl	ow Tyle	er or equal t	Inree piec	e vaiv	e oox			

## **PIPING SYSTEM SPECIFICATION**

SERVICE	SANITARY	DRAIN AND		-		SYI	MBOL SD, SV			
FLUID					T MI	EDIUM	,			
	EWATER AND	AIR A	IR							
			Γ DURA							
					(	<u>50</u> MIN	•			
	PRESSURE -	PSIG		Т	EM	PERAT	TURE °F			
WORK	MAX	TEST	1	NOR	MAL	1	MAX			
		3 PSI								
	Р	IPE AND FIT	TING S	PECIFICA	TIO	N				
PIPE SIZE	EXPOSURE	I	PIPE			F	ITTINGS			
Less than 1 <sup>1</sup> / <sub>2</sub> "	EXPOSED						C DWV, solvent			
	BURIED EMBEDDED ENCASED	SCH 40 PVC DWV SCI wel				CH 40 PVC DWV, solvent eld				
11⁄2" - 8"	EXPOSED	SCH 40 PVC	DWV	:	SCH 40 PVC, solvent weld					
	BURIED EMBEDDED ENCASED	SCH 40 PVC	SCH 40 PVC DWV SCH weld			H 40 PVC DWV, solvent d				
		VALVE	SPECIF	ICATION						
SIZE	EXPOSURE	ТҮРЕ		SP	ECII	FICAT	ION			
REMARK	<b>S</b> :	<u> </u>								

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## SECTION 40 05 16.61

## VALVES – LIFT STATIONS

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section includes providing valves in size and type shown on plans and on the Piping System Specification Sheets.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01 78 23, Operation and Maintenance Data.
  - 3. Section 01 78 43, Installation and Training Checklist.
  - 4. Division 26, Electrical.
  - 5. Division 46, Water and Wastewater Equipment.

#### 1.02 REFERENCE STANDARDS

- A. American Water Works Association (AWWA):
  - 1. AWWA C111 Spec. for Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
  - 2. AWWA C515 Spec. for manufacturing compliance for ductile iron castings.
  - 3. AWWA C550 Spec. for fusion bonded epoxy coating.
  - 4. AWWA C509 Spec. for elastomeric and cellular performed gasket & sealing material.
  - 5. AWWA C606 Standard for grooved ductile iron pipe ends.
  - 6. AWWA C504 Standard for rubber seated gate valve.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A48 Spec. for Gray Iron Castings.
  - 2. ASTM A126 Spec. for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - 3. ASTM A743 Spec. for Corrosion-Resistant Iron-Chromium, Iron-Chromium Nickel, and Nickel-Base Alloy Castings for General Application.
  - 4. ASTM A296 Spec. for Stainless Steel, Type 304 or 316.
  - 5. ASTM D1784 Spec. for PVC cell classification 12454A.
  - 6. ASTM D1784 Spec. for CPVC cell classification 23567A.
  - 7. ASTM A351 Spec. for stainless steel valve body.
  - 8. ASTM A240 Spec. for chromium & chromium nickel stainless steel plate, sheet and strip.
  - 9. ASTM B30 Spec. for copper alloys.
- C. American National Standards Institute (ANSI):
  - 1. ANSI B18.2.1 General & dimensional Data Cap Screws & Boots.
  - 2. ANSI B16.5 Dimensions for flanges

- A. Submit the following:
  - 1. Shop drawings including assembly and installation drawings and materials of construction.
  - 2. Product data including:
    - a. Name of manufacturer.
    - b. Type and model.
  - 3. Parts and Dimensional Drawings
    - a. Product bulletins as applicable.
  - 4. Operation and maintenance manuals.
- B. Submit two (2) copies of a report documenting the field testing to the Engineer.

## PART 2 - PRODUCTS

- 2.01 GENERAL
- A. Like equipment shall be the end produce of one manufacturer.
- B. Valves shall include all necessary actuators, operating handwheels, chain wheels, extension stems, worm and gear operators, operating nuts, chains, wrenches, floor stands, and other accessories to allow complete operation from the intended operating level.
- C. Valves shall be suitable for the intended service. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service.
- D. Valves shall be the same size as the adjoining pipe unless otherwise shown.
- E. Manufacturer and the size of the valve shall be identified on valve, a permanently attached plate in raised letters, or on the valve casting.
- F. Valve manufacturer shall provide valve maximum torque limits and coordinate with valve actuator manufacturer to insure maximum torque is not exceeded.
- H. Use or reuse of components and materials without the traceable certification is prohibited.
- 2.02 VALVES
- A. Plug Valves
  - 1. Eccentric Plug Valves 3 inches and smaller.
    - a. Shall be of the non-lubricated type with attached wrench lever manual operator, rates 175-pound WOG. Valves shall have a cast iron body with screwed ends, balanced plug coated with Hycar or neoprene elastomer, and O-ring seals.
    - b. Manufacturers and Products:
      - 1) DeZurik Water Controls PEC; or equal.
  - 2. Eccentric Plug Valves 4-inch through 24-inch
    - a. Nonlubricated type rated 1/3 psig CWP, drip-tight shutoff with pressure from either direction, cast-iron body, exposed service flanged ends per ASME B16.1 or grooved ends in accordance with AWWA C606 for rigid joints, buried service mechanical joint ends, AWWA Standard C111.

- b. Bodies shall be of ASTM A126 Class B cast iron. Bodies in 4-inch (100 mm) and larger valves shall be furnished with a 1/8-inch (3mm) welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.
- c. Plug shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be Chloroprene (CR) or resilient facing suitable for application.
- d. Bearings shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF8M in <sup>1</sup>/<sub>2</sub>-inch through 36 inches (15-900 mm) sizes. In valves larger than 36-inch (900mm), the upper and lower plug journals shall be fitted with ASTM A-240 type 316 stainless sleeves with bearings of ASTM B30, Alloy C95400 aluminum bronze. Non-metallic bearings shall not be acceptable.
- e. Shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the actuator or bonnet from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.
- f. Pressure ratings shall be 175 psi (1210 kPa) on sizes ½ inch through 12-inch (15-300 mm) and 150 psi (1030 kPa) for 14-inch to 72-inch (350-1800mm). Every valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.
- g. Operators:
  - 1) Less than 6-inch valves: Wrench lever manual.
  - 2) 6-inch and larger valves: totally enclosed, geared, manual operator with handwheel, 2-inch nut, or chain wheel. Size operator for 1.5 times the maximum operating shutoff pressure differential for direct and reverse pressure, whichever is higher.
  - 3) For buried service, all sizes. Provide completely sealed operator filled with heavy lubricant and 2-inch nut.
- h. Manufacturers and Products:
  - 1) DeZurik PEC or equal.
- B. Check Valves
  - 1. Swing Check Valve with Lever and Weight 2 inches and larger.
    - a. Ductile iron body and bolted flange cover, flanged ends. The swing check valve shall be Class 150 with a working pressure of 150 psi. Valve body, cover flange, disc, and disc arm material shall be ductile iron conforming to ASTM A536, Grade 65-42-12. Body seat ring, disc stem, pivot shaft, and pivot shaft retaining pin material shall be Type 304 stainless steel conforming to ASTM A582, Condition A. The valve shall have a Buna-N resilient seat. The interior and exterior of the valve shall have a fusion bonded epoxy coating. The swing check valve shall be equipped with a side mounted lever and weight. The valve shall provide an efficient flow path with an area equal to or greater than the area of the nominal valve size.
    - b. Manufacturers and Products:
      - 1) APCO series CVS-250/250A or equal.

### C. Ball Valves:

- 1. Stainless Steel Ball Valve 2 Inches or Smaller:
  - a. Two-piece, full port, ASTM A351 CF8M stainless steel body and end pieces, Type 316 stainless steel ball, NPT threaded ends, reinforced PTFE seats seals, and packing, adjustable packing gland, blowout-proof stainless steel stem, stainless steel lever operator with vinyl grip, rated 800 psig to 1,000 psi CWP.
  - b. Manufacturers and Products:
    - 1) Nibco; T-580-S6-R-66-LL, or equal.
- D. Air Release and Vacuum Break Valves
  - 1. Combination Air Release and Vacuum Break Valve
    - Combination air valve, single body, double orifice. Valve a. shall allow large volumes of air to escape out of large orifice when filling the pipeline and allow large volumes of air to enter the large orifice when draining the pipeline to break the vacuum. Valve shall allow trapped pockets of air to automatically exit the pipeline through the small orifice when the pipeline is operating under pressure. Valve shall provide watertight shutoff to prevent discharge of water. The air release and vacuum break valve shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in HDPE - stainless steel nozzle and woven dirt inhibitor screen, nitrile rubber seals and natural rubber seat. The valve shall have an integral "anti-surge" orifice mechanism, which shall operate automatically to limit transient pressure rise or shock induced by closure to less than 2 x valve rated working pressure. The intake orifice area shall be equal to the nominal size of the valve. Large orifice sealing shall be effected by the flat face of the control float seating against a nitrile rubber "0" ring housed in a dovetail groove circumferentially surrounding the orifice. Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seal is prevented. The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to twice the designed working pressure. Connection to the valve inlet shall be facilitated by flanged ends conforming to ANSI B16.1 Class 125 Standards. Flanged ends shall be supplied with the requisite number of stainless steel screwed studs inserted for alignment to the specified standard. Nuts, washers or jointing gaskets shall be excluded. Valve shall operate to a maximum operating pressure of 150 psi and minimum pressure of 0 psi.
    - b. Each air release and vacuum break valve shall be provided with an isolation valve. Each air release and vacuum break valve shall be subjected to the following factory tests in the order represented. Hydrostatic test to 2X maximum rated working pressure. Low head leak test to 7 psi. Small orifice function test at maximum rated working pressure.
    - c. Size shall be as shown on plans.
    - d. Manufacturers and Products:
      - 1) Vent-O-Mat or equal.
- E. LP and Natural Gas Valves
  - 1. Natural Gas Shut-off Valves 2<sup>1</sup>/<sub>2</sub>-inch and smaller

- a. Plug valve, cast-iron body, threaded ends, bronze plug ball, full or conventional port, Teflon seat, blowout-proof stem, two-piece construction, suitable for 150 psig working pressure, U.L. listed for use as natural gas shut-off.
- b. 2<sup>1</sup>/<sub>2</sub>-inch through 4-inch: Cast iron body, flanged ends, bronze bearings, electroless nickel-plated cast iron plug with Hycar resilient plug seal, Buna-N stem seal packing, lever actuator, 175 psi W.O.G., U.L. listed for use as natural gas shut-off. 5-inch and larger: Cast iron body, flanged ends, stainless steel bearings, resilient faced plugs, totally enclosed hand wheel actuators, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.
- c. Manufacturers and Products:
  - 1) DeZurik, Homestead, Rockwell, Walworth or approved equal.
- 2. Gas Pressure Regulators 2-inch and smaller:
  - a. Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20°F to 150°F.

#### 2.06 VALVE BOXES AND EXTENSION STEMS

- A. Acceptable manufacturer shall be Clow, Tyler, or equal.
- B. Valve boxes shall be three-piece assembly constructed of cast iron in accordance with ASTM A48, Class B.
- C. Valve box diameter shall be  $5\frac{1}{4}$  inches.
- D. All valves shall be provided with extended stem terminated a maximum of 12-inches below grade, provide stainless steel, or hot dipped galvanized extension stems.
- E. Provide a 2-inch square operating nut.
- F. Provide one 4-foot long wrench for operation.
- G. Provide valve box hangers by Adaptor, Inc., or equal.
- H. Cast the wood water, sewage, gas, or drain into the top of the lid or label with a stainless steel tag permanently attached to the inside of the lid.

#### 2.07 VALVE OPERATORS

- A. All valves shall open by turning counter-clockwise, unless otherwise shown or specified.
- B. Size operators and actuators to operate valves under full operating head and velocities.
- C. Worm and gear operators for manually operated valves:
  - 1. Provide a totally enclosed design.
  - 2. Provide a self-locking type to prevent the disc or plug from creeping.
  - 3. Self-locking worm gears:
    - a. One-piece design of AWWA gear bronze material, accurately machine cut.
    - b. Provide a hardened alloy steel worm, with thread round and polished.
  - 4. Provide proper lubricant for the reduction gearing.
  - 5. Provide with position indicators to show the position of the valve disc or plug.
  - 6. Paint the hand wheels the same color as the valve and associated pipeline.

- 7. Gera operators shall be provided by all valves in buried or submerged operation.
- D. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs, and washer shall be stainless steel.
- 2.08 FLOOR BOXES AND EXTENSION STEMS
- A. Provide a Clow F-5695, Neenah Foundry R 7506, or equal floor box.
- B. Provide valve extension stems where required to locate the operating nut in the floor box within 3 inches of the finished floor.
- C. Provide a 2-inch square operating nut.
- D. Provide all necessary anchor bolts in Type 304 stainless steel.
- E. Provide Type 304 stainless steel valve extension stems for submerged extension stem installations.
- F. Provide galvanized or epoxy coated steel valve extension stems for all non-submerged extension stem installations.

## PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with shop drawings and manufacturer's recommendations. After installation demonstrate trouble-free operation in the presence of the Engineer.
- 3.02 FIELD QUALITY CONTROL
- A. Field tests shall be conducted on the unit identified above.
  - 1. Field tests shall be conducted when appropriate process liquid is available.
  - 2. Field test shall be conducted by manufacturer's representative in the presence of the Engineer.
  - 3. Engineer shall be notified in advance of any field tests.
- B. All defects noted during tests shall be corrected promptly at the expense of the manufacturer.
  - 1. When necessary, field test shall be repeated until requirements of specifications have been met.
  - 2. All testing and modifications to equipment required to meet specification shall be at the expense of the manufacturer.
- C. When manufacturer is unable to demonstrate by test results that equipment conforms to requirements of specifications. The equipment shall be rejected and replaced with acceptable units at the manufacturer's expense.
- D. Minimum start-up operator training and final adjustment service by manufacturer shall be 1 day with a minimum of 1 trip.

- E. The time for start-up, operator training and final adjustment shall be designated by the Owner and shall be within the one year guarantee period after final acceptance.
- F. Qualifications of Start-up Personnel
  - 1. Personnel shall be authorized by the manufacturer to start-up and initiate warranty of the equipment provided.
  - 2. Personnel shall come to the site with the required tools and electrical instruments.
  - 3. Personnel shall have full knowledge of electrical controls pertaining to the equipment and control panels furnished.
  - 4. Failure to provide personnel with full qualifications shall be cause for service trip to be disqualified as part of requirements and may be cause for reimbursement for costs incurred by the Owner due to services required for start-up inspections.

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# 46

## **DIVISION 46**

WATER AND WASTEWATER EQUIPMENT

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#### SECTION 46 42 56.19

#### SUBMERSIBLE CENTRIFUGAL PUMPS

#### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Work Included: This section includes furnishing and installing submersible centrifugal pumps and accessories in accordance with the plans and specifications.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern work in this section.
  - 2. Section 01 75 00 Starting, Testing and Operator Training
  - 3. Section 01 78 23 Operation and Maintenance Data
  - 4. Section 01 78 43 Equipment, Installation, Training and Receipt of Spare Parts Checklists
  - 5. Division 26 Electrical

#### 1.02 REFERENCED STANDARDS

- A. American Society for Testing and Materials (ASTM):
   1. ASTM A48 Standard Specification for Gray Iron Castings
- B. American National Standards Institute (ANSI):
  - 1. ANSI A2 1. 10 Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch for Water and Other Liquids
  - 2. ANSI B16.1 Pipe Flanges and Flanged Fittings
- C. Hydraulics Institute Standards.
- D. Anti-Friction Bearing Manufacturer's Association (AFBMA):
   1. Std 9-1978 Load Ratings and Fatigue Life for Ball Bearings
- E. National Electric Code (NEC)
- F. NEMA Electrical Standards
- G. Underwriter's Laboratory
- 1.03 SUBMITTALS
- A. Submit the following in accordance with Section 01 32 19, Submittals:
  - 1. Shop drawings including assembly and installation drawings and naturals of construction.
  - 2. Assembled electrical and control equipment drawings for all components.
  - 3. Pump data including:
    - a. Name of manufacturer.
    - b. Type and model.
    - c. Design rotative speed.

- d. Weight of pump including motor.
- e. Electrical requirements
- f. Complete certified pump performance curves showing:
  - (1) Flow.
  - (2) Total Design Head.
  - (3) Net Positive Suction Head Requirements.
  - (4) Efficiency.
  - (5) Brake Horsepower.
- g. Materials of construction and cross-sectional drawing.
- 4. Field testing and start-up report.
- B. Submit operation and maintenance in accordance with Section 01 78 23, Operation and Maintenance Manuals.
- C. Submit installation and training checklists in accordance with Section 01 78 43, "Equipment, Installation, Training, and Receipt of Spare Parts Checklists."

## PART 2 - PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Hydromatic, Flygt, or equal.
- 2.02 PUMP

A.

	<u>Requirements</u>	Pumping Syste
1.	Type of liquid to be handled.	Raw Wastewa
2.	No. of pumps.	2
3.	Type of drive.	Constant Spec
4.	Design Conditions	
	(1) Flow, GPM	80
	(2) TDH, feet	15
5.	Pump RPM maximum.	1150
6.	Maximum motor horsepower.	3
7.	Voltage, phase.	208, 3
8.	Minimum efficiency % at design flow, RPM, TDH	30
9.	Minimum spherical solids passed, inches.	3.0

#### B. General

- 1. The pump shall be capable of handling unscreened, municipal wastewater.
- 2. The design shall be such that the pump unit will automatically and firmly connect to the discharge piping when lowered into place on its mating discharge connection, permanently installed in the wet well.
- 3. The pump system shall be designed to permit surface level removal of the pumping unit for inspection or service without dewatering the wet well or interrupting operation of the other units.
- 4. Each pump shall be fitted with a stainless steel chain or cable of adequate strength and length to permit raising and lowering the pump for inspection or removal.

- 5. The pump, with its appurtenances and cable, shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65 feet.
- 6. Each pump shall be designed so that reverse rotation will not cause damage to the unit.
- C. Pump Construction
  - 1. General
    - a. All major parts including motor, seal housing, sliding guide brackets, impeller and volute shall be gray cast iron in accordance with ASTM A48, Class 25.
    - b. All surfaces in contact with wastewater shall be protected by a coating resistant to wastewater.
    - c. All exposed bolts, nuts and other fasteners shall be 300 series stainless steel.
    - d. The pump discharge shall be fitted with standard ANSI A21.10, 125 pound flange, forced and drilled.
  - 2. Impeller
    - a. The impeller shall be of the dynamically balanced self-cleaning, semi-open channel or vortex design.
    - b. The impeller shall be non-clogging design, capable of handling 3-inch solids, fibrous material, and other matter found in wastewater applications.
    - c. Construct with a long throughlet without acute turns.
    - d. The impeller shall be dynamically balanced without deforming or weakening it. The impeller shall be a slip fit to the shaft.
    - e. Volute case wear ring of 230 brass or stainless steel shall be provided which is easily field replaceable.
  - 3. Shaft Seal System
    - a. Each pump shall be provided with a mechanical rotating shaft seal system running in an oil reservoir having separate, constantly hydro-dynamically lubricated lapped seal faces. The (lower) seal unit between the pump and oil chamber shall contain one stationary and one positively driven rotating tungsten-carbide ring. The (upper) seal unit between the oil sump and motor housing shall contain one stationary ceramic ring and one positively driven rotating carbon ring. Each interface shall be held in contact by its own spring system supplemented by external liquid pressures.
    - b. The seals shall require neither maintenance nor adjustment and shall be easily inspected and replaceable.
    - c. The shaft sealing system shall be capable of operating submerged to depths of, or pressures equivalent to 65 feet. No seal damage shall result from operating the pumping unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication.
  - 4. Guide Bracket and Discharge Connection
    - a. A sliding guide bracket shall be an integral part of the pump unit.
    - b. The volute casing shall have a machined discharge flange to automatically and firmly connect with the cast iron discharge connection, which, when bolted to the floor of the sump and discharge line, will receive the pump discharge connecting flange without the need of adjustment, fasteners, clamps or similar devices.
    - c. Installation of pump unit to the discharge connection shall be the result of a simple linear motion the pump unit guided by no less than two guide bars.
    - d. No other motion of the pump unit, such as tilting or rotating, shall be required. Sealing of the discharge interface by means of a diaphragm, o-ring or other devices will not be considered acceptable nor equal to a metal to metal contact of

the pump discharge flange and mating discharge connection specified and required. No portion of the pump unit shall bear directly on the floor of the wet well. There shall be no more than one 90° bend allowed between the volute discharge flange and station piping.

- 5. Tolerances and Mating Surfaces
  - a. Tolerances of all parts shall be such that allow replacement of any part without additional machining as required to ensure sealing as described above. No secondary sealing compounds greases or other devices shall be used.
  - b. All mating surfaces of major parts shall be machined and fitted with nitrile o-rings where watertight sealing is required. Machining and fittings shall be such that sealing is accomplished by automatic compression in two planes and o-ring contact made on four surfaces, without the requirement of specific torque limits to affect this. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered adequate or equal.
- 6. Cooling System
  - a. Each unit shall be provided with an adequately designed cooling system. Thermal radiators integral to the stator housing cast in one unit are acceptable.
  - b. Where water jackets alone or in conjunction with radiators are used, separate circulation shall be provided. Cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provisions for external cooling and flushing shall be provided.
- 7. Pump Data Plates
  - a. Attach stainless steel data plates to each pump. Each data plate shall contain the following information:
    - (1) Manufacturer's name
    - (2) Pump model and size
    - (3) Serial number
    - (4) Flow Rate
    - (5) Design TDH
    - (6) Speed
    - (7) Motor horsepower
    - (8) Voltage and Phase
    - (9) Amperage
    - (10) Service Factor
    - (11) Impeller diameter and type

#### 2.03 PUMP GUIDES

- A. Each unit shall be furnished with complete guides for pump installation and removal. Guide system shall be of stainless steel material and include the following:
  - 1. Upper guide holder and level sensor cable holder.
  - 2. Intermediate guide brackets.
  - 3. Lower guide bar holders shall be integral with the discharge connection.
  - 4. Guide bars shall be 2 inch stainless steel pipe.
  - 5. Guide system shall be of non-sparking design for explosion proof environment.
  - 6. Wet wells of greater than 15 feet in depth shall require stainless steel intermediate supports.

7. Each pump shall be furnished with a minimum <sup>1</sup>/<sub>4</sub> inch stainless steel chain for lifting. The chain shall have quick disconnects at each end for attachment to the pump and lifting hook.

#### 2.04 MOTOR AND CABLE

- A. Pump, motor and cable shall be explosion proof and shall be UL approved for Class 1, Division 1, Group D service.
- B. The pump motor shall be housed in a watertight casing and shall have moisture resistant Class F 155°C insulation. The motor shall be NEMA Design B, premium efficient with 1.15 nameplate service factor. Motor shall be air cooled or oil cooled induction type, and designed for continuous duty. Motors shall be wired to operate at voltage and phase shown in part 2.02 Pump, at 60 hertz.
- C. The cable entry water seal design shall be such that precludes specific torque requirements to insure a watertight and submersible seal. The cable entry junction box and motor shall be separated by a stator lead sealing gland or terminal board which shall insulate the motor interior from foreign materials gaining access through the pump top.
- D. Pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing and configuration shall conform to NEC specifications rated SO, STO or better for pump motors and shall be adequate size to allow motor voltage conversion without replacing the cable.
- E. Furnish electrical cable(s), power and signal of sufficient length to go to the electrical connection point at the local control panel.
- F. Provide integral thermal sensors (one for each phase). Embed in stator to monitor stator temperature. Switches shall be wired in series and two leads brought up to the pump control panel.
- G. Provide integral moisture sensor in oil chamber or stator housing to detect seal or casing leakage. Two leads shall be brought up with cable to the pump control panel.
- H. Conductivity switch monitor shall be provided by pump supplier with pump. Conductivity switch monitor shall be installed in the control panel.
- I. A suitable thrust bearing shall be incorporated in the motor to be capable of carrying the weight of all rotating parts and the hydraulic thrust of the pump. Bearings shall have a minimum B-10 life of 50,000 hours.
- J. The cable shall have a factory installed rubber boot on the end to protect it during transit.
- K. The pump shall be non-overloading without the use of the service factor along the entire pump curve. Horsepower load shall not exceed nameplate rating of motor for full pump curve from shutoff to maximum runout capacity.

#### 2.05 ELECTRICAL AND CONTROL SYSTEMS

A. Pump control panel and associated equipment shall be provided as specified in Division 26.

#### PART 3 - EXECUTION

#### 3.01 INSTALLATION

A. Install in accordance with the shop drawings and manufacturer's recommendations. Submit installation checklist in accordance with Section 01 78 43, Equipment Checklists.

#### 3.02 FIELD TESTING

- A. Field testing shall be conducted on the equipment provided in accordance with Section 01 75 00 Startup, Testing and Operator Training. Each pump shall be subjected to a performance test before acceptance. Submit startup and performance checklist and certification upon completion of the testing.
- B. All defects noted during the field test shall be corrected promptly at the expense of the Contractor.
  - 1. When necessary, the field test shall be repeated until the requirements of the specifications have been met.
  - 2. All testing and modifications required to the meet the specifications shall be at the expense of the Contractor.
- C. If the testing fails to demonstrate that the equipment conforms to the requirements of the specification, the equipment shall be rejected and replaced with acceptable equipment at the Contractor's expense.
- D. Minimum time for installation, startup, and operator training by the Manufacturer's representative shall be one (1) day with one (1) trip.
- E. The time for operator training shall be designated by the Owner and shall be within the one-year warranty period after final acceptance of equipment by the Owner. Submit equipment training checklist in accordance with Section 01 78 43, Equipment Checklists and Certifications.

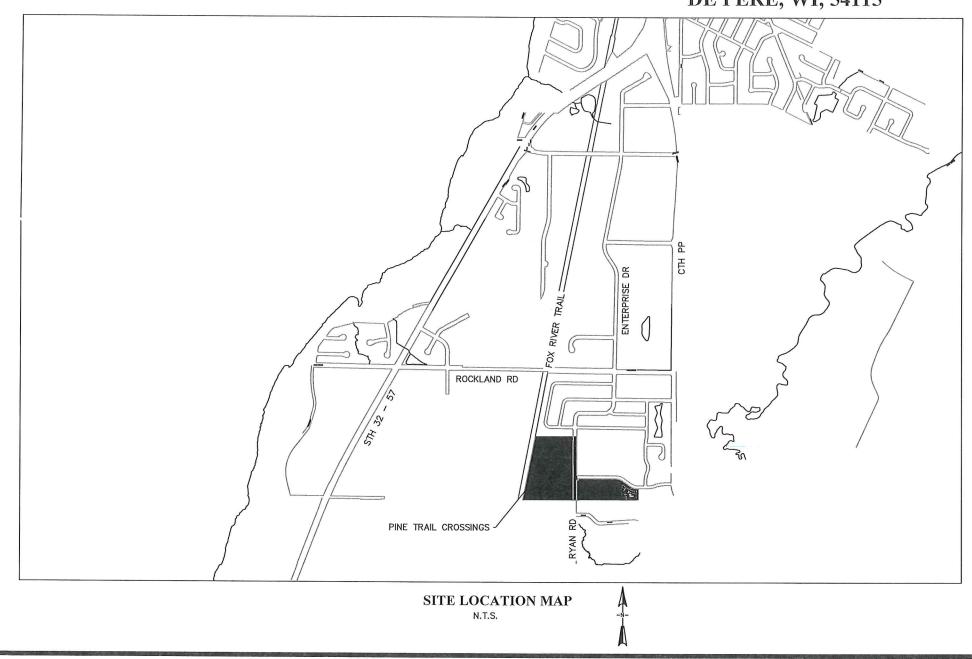
- END OF SECTION -

# PROJECT# 18-14 PINE TRAIL CROSSING UTILITY AND STREET CONSTRUCTION

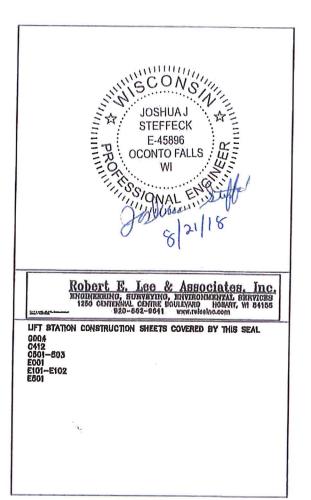
**CITY OF DE PERE** 

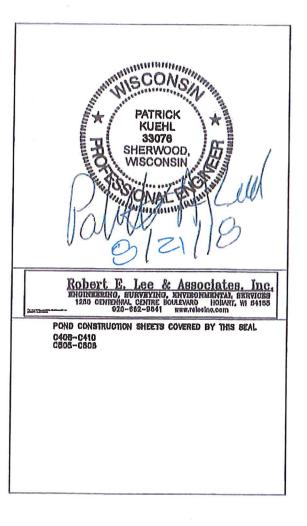


ENGINEER DIVISION 925 S. SIXTH ST DE PERE, WI, 54115



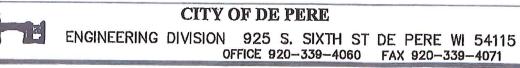
SHEET NO.	DESCRIPTION						
G001	TITLE SHEET						
G002	SIGNATURES AND ENGINEERS SEALS						
G003-G004	STANDARD ABBREVIATION & SYMBOLS						
G005	PROJECT SHEETS LAYOUT						
G006	TYPICAL SECTIONS						
C101-C103	DIVERSITY DRIVE PLAN AND PROFILE SANITARY AND WATER SHEETS						
C104-C108	SCARLET OAK PLAN AND PROFILE SANITARY AND WATER SHEETS						
c109-c110	RYAN ROAD PLAN AND PROFILE SANITARY AND WATER SHEETS						
C111-C112	DIVERSITY DRIVE PLAN AND PROFILE STORM AND STREET SHEETS						
C113-C117	SCARLET OAK PLAN AND PROFILE STORM AND STREET SHEETS						
C118-C119	RYAN ROAD PLAN AND PROFILE STORM AND STREET SHEETS						
C120-C121	POND EASEMENT PLAN AND PROFILE STORM AND STREET SHEETS						
C122-C124	PROPERTY LINE PLAN AND PROFILE STORM SEWER SHEETS						
C125	DRIVEWAY AND PATH PLAN AND PROFILE SHEET						
C301-C310	DIVERSITY DRIVE CROSS SECTIONS						
C311-C336	SCARLET OAK TRAIL CROSS SECTIONS						
C401	DEMOLITION PLAN						
402-C404	EROSION CONTROL PLAN						
405-C407	SITE GRADING PLAN						
C408-C410	POND GRADING PLAN						
C411	INTERSECTIONS GRADES						
C412	LIFT STATION SITE PLAN						
501-C503	LIFT STATION DETAILS						
504-C506	EROSION CONTROL DETAILS						
E001	ELECTRICAL SYMBOLS & ABBREVIATIONS						
E101-E102	LIFT STATION ELECTRICAL PLAN						
E501	LIFT STATION ELECTRICAL DETAILS						
	CITY OF DE PERE						
	BOARD OF PUBLIC WORKS						
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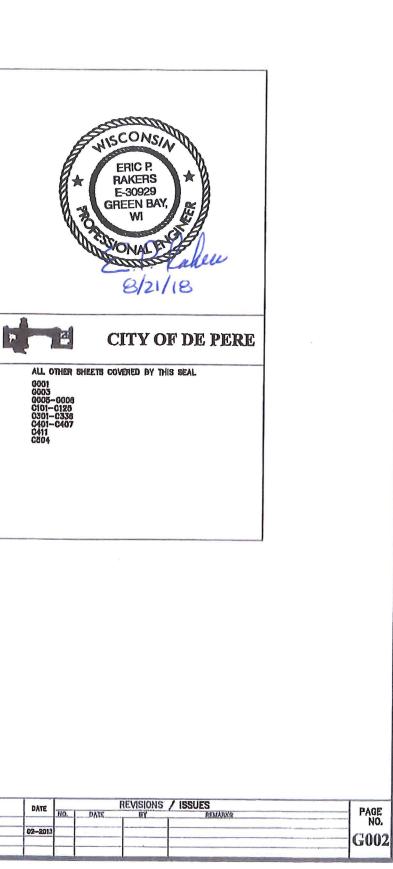


SIGNATURES AND ENGINEER SEALS

AME;	PINE TRAIL CROSSING UTILITY AND BIREET CONSTRUCTION	BURVEYED	
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#### LIST OF STANDARD ABBREVIATIONS

R

RCP REBAR REL REM REQD

RL ROW RP RR RT SSALV SAN SB SDWK SE SFLDR ST SSD STA STD STA STD STM STP STRUCT SW TAN

T TEL TEMP TLE TOC TOW TRANS TYP UG USH VC VBC VPI VPC VPT W WW WMO WTP WV

WWTP YD

ADT	AVERAGE DAILY TRAFFIC
AGGR	AGGREGATE
AH	AHEAD
ASPH	ASPHALT
в/в	BACK TO BACK
BARR	BARRICADE
BC	BACK OF CURB
BK	BACK
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BSMT	BASEMENT
C	
C&G	CURB AND GUTTER
c/c	CENTER TO CENTER
CABC	CRUSHED AGGREGATE BASE COURSE
CB	CATCH BASIN
CE	CONSTRUCTION ENTRANCE
CI CL	CAST IRON PIPE CENTERLINE
CMP	CORRUGATED METAL PIPE
CNTY	COUNTY
CO	CLEANOUT
CONC	CONCRETE
CONSTR	CONSTRUCTION
CONSTR JT	CONSTRUCTION JOINT
CP	CONTROL POINT
CTH	COUNTY TRUNK HIGHWAY
CTRL JT	CONTROL JOINT
CTV	CABLE TV
CY	CUBIC YARD
D	DEPTH
DIA	DIAMETER
DI	DUCTILE IRON PIPE
DISCH	DISCHARGE
DW	DRIVEWAY
E	EAST (SEE ELEC BELOW)
EA	EACH
EB	EASTBOUND
EBS	EXCAVATION BELOW SUBGRADE
ECS	EXTERNAL CHIMNEY SEAL
EL	ELEVATION
ELEC	ELECTRIC (E WHEN USED IN LINE STYLE)
EMB	EMBANKMENT
ENTR	
EP	EDGE OF PAVEMENT
EW EXC	ENDWALL
EXIST	EXCAVATION EXISTING
F	FILL
, F/F	FACE TO FACE
FDN	FOUNDATION
FE	FIELD ENTRANCE
FERT	FERTILIZER
FIN GR	FINISHED GRADE
FL	FLOWLINE
FO	FIBER OPTIC
FT	FOOT
FTG	FOOTING
G	GAS
GV	GAS VALVE
GW	GUY WIRE
HDPE	HIGH DENSITY POLYETHYLENE
HR	HANDICAP RAMP
HSE	HOUSE HEIGHT
HT HYD	HYDRANT
	INTERSECTION ANGLE
ics	INTERNAL CHIMNEY SEAL
ID	INSIDE DIAMETER
IN	INCH
INL	INLET
INTERS	INTERSECTION
INV	INVERT
IP	IRON PIPE OR PIN
JCT	JUNCTION
L	LENGTH (OF CURVE)
LC	LONG CHORD OF CURVE
LP	LIGHTPOLE
LS	LIFT STATION OR LUMP SUM
LT	LEFT
MAINT	MAINTENANCE
MATL	
	MATERIAL
МВ МН	MAILBOX
МН	MAILBOX MANHOLE
	MAILBOX
МН	MAILBOX MANHOLE

NORTH	
NORTHBOUND	
NORMAL CROWN NORTHEAST	
NUMBER	
NOT TO SCALE NORTHWEST	
OIL AND CHIP OBLITERATE	
OUTSIDE DIAMETER	
POINT OF CURVATURE POINT OF COMPOUND CURVE	
PORTLAND CEMENT CONCRETE	
PEDESTAL PERMANENT LIMITED EASEMENT	
PAVEMENT PRIVATE ENTRANCE	
POINT OF INTERSECTION	
PRE-FORMED JOINT FILLER PROPERTY LINE	
POINT OF CURVE	
POINT ON TANGENT POLYETHYLENE	
POINT OF REVERSE CURVATURE	
PROJECT PROPOSED	
POUND PER SQUARE INCH	
POINT OF TANGENCY POLYVINYL CHLORIDE	
RANGE OR RADIUS	
REINFORCED CONCRETE PIPE REINFORCEMENT BAR	
RELOCATE	
REMAINING REQUIRED	
REFERENCE LINE RIGHT OF WAY	
REFERENCE POINT	
RAILROAD RIGHT	
RETAINING WALL	
SOUTH SALVAGE	
SANITARY	
SOUTHBOUND SIDEWALK	
SOUTHEAST	
SQUARE FEET SHOULDER	
SQUARE YARD	
STORM SEWER STOPPING SIGHT DISTANCE	
STATION STANDARD	
STANDARD STATE HIGHWAY TRUNK	
STORM SEWAGE TREATMENT PLANT	
STRUCTURE OR STRUCTURAL	
SOUTHWEST TANGENT	
TOWN (T WHEN USED FOR TELEPHONE LINE)	
TELEPHONE TEMPORARY	
TEMPORARY LIMITED EASEMENT	
TOP OF CURB TOP OF WATER	
TRANSITION	
TYPICAL UNDERGROUND	
US HIGHWAY	
VERTICAL CURVE VERTICAL	
VOLUME	
VERTICAL POINT OF CURVATURE VERTICAL POINT OF INTERSECTION	
VERTICAL POINT OF REVERSE CURVE VERTICAL POINT OF TANGENCY	
WEST	
WESTBOUND WATERMAIN	
WATER SHUTOFF VALVE	
WATER TREATMENT PLANT WATER VALVE	
WASTE WATER TREATMENT PLANT	
YARD	
CRE	Γ
SIXTH ST DE PERE WI 54115	
	•

BUSH CATCH BASIN E ENSTING SANTARY SEVER LINE CATCH SANT ARY SEVER LINE CATCH BASIN E ENSTING SANT ARY SEVER LINE CATCH BASIN E ENSTING STORM SEVER LINE E ENSTING SANT ARY LATER ALL STORM SEVER LINE E ENSTING SANT ARY LATER ALL STORM SEVER LINE E ENSTING SANT ARY LATER ALL STORM SEVER LINE E ENSTING SANT ARY LATER ALL STORM SEVER LINE E ENSTING SANT ARY SEVER LINE E EXISTING STORM SEVER LINE E EX	CRIPTION SYMBO	DESCRIPTION	SYMBOL
BUSH CACH BASN CALL AND		D	PLAN
CATCH BASIN  CARLE TV 60X  CAR	Č		(SIZE AND MATERIAL)
OUTCH DATA     PROPOSED SATINARY SEVER LINE     Semilar Severe		EXISTING SANTARY SEWER LI	IL San 100'-8" PVC SAN
ELECTRICAL BOX     EXISTING STORM SEWER LINE		PROPOSED SANITARY SEWER	San
EROSION CONTROL - INELT       ■       ●       ●       PROPOSED STORM SEWER LINE       100"-6" PVC SI         FIELD INLET       ●       ●       ●       EXISTING WATER MAIN LINE       100"-6" PVC MI (T         GAS VALVE       ●       ●       ●       PROPOSED STORM SEWER LINE       100"-6" PVC MI (T         GAS VALVE       ●       ●       ●       PROPOSED WATER MAIN LINE       100"-6" PVC MI (T         GAS VALVE       ●       ●       ●       PROPOSED WATER MAIN LINE       100"-6" PVC MI (T         HODART       ●       ●       ●       PROPOSED WATER MAIN LINE       100"-6" PVC MI (T       ●         INDRANCE       ●       ●       ●       EXISTING ELEPHONE LINE       100"-6" PVC MI (T       ● <t< td=""><td></td><td>EXISTING STORM SEWER LINE</td><td>, , ,</td></t<>		EXISTING STORM SEWER LINE	, , ,
FIELD INLET       Image: Construction of the construle of the construction of the construle of the constru		PROPOSED STORM SEWER LIN	100'-8" PVC STM
GAS VALVE       F			(SIZE AND MATERIAL)
HEDGE       Image: Construction of the constr		EXISTING WATER MAIN LINE	W
HYDRANT EXITING CLECTRICAL LINE CLECTRICAL LINE CLECTRICAL LINE CLECTRICAL LINE CLECTRICAL LINE CLECTRICAL LINE CLICHTOR CAS MAIN LINE CLECTRICAL LINE CLICHTOR CLICHTOR CAS MAIN LINE CLICHTOR CLICHTOR CLICHTOR CAS MAIN LINE CLICHTOR CLICHTOR CAS MAIN LINE CLICHTOR		PROPOSED WATER MAIN LINE	100 - 8 PVC WM (TEE-BEND)
IRON PIPE O O EXISTING GAS MAIN LINE GAS MAI	200	EXISTING ELECTRICAL LINE	E E
LIGHTPOLE  ANALOLE SANTARY  ANALOLE ELECTRIC ANALOLE SANTARY  ANALOLE  ANALOLE SANTARY  ANALOLE  ANALON BRANCE ANALOLE			
AALBOX ME AANHOLE ELECTRIC C AANHOLE SANTARY C AANHOLE STORM C AANHOLE C AA		EXISTING GAS MAIN LINE	- U U
MANHOLE ELECTRIC E EXISTING CABLE TV LINE TV L	·	EXISTING TELEPHONE LINE	- T T
MANHOLE SANITARY       S       S       EXISTING SANITARY LATERAL       S         MANHOLE STORM       S       S       EXISTING SANITARY LATERAL       S         MONTORING WELL       MM       S       S       EXISTING WATER SERVICE       W         YOWER POLE       MM       S       S       EXISTING WATER SERVICE       W       S         SIGN BASE       X       PROPERTY LINE       PL       PL       PL       PL       PL         SIGN AL HEAD, TRAFFIC SIGNAL       Image: S       S<		EXISTING CABLE TV LINE	TV
MANHOLE STORM		EXISTING SANITARY LATERAL	San
MONTORING WELL       MM         POWER POLE       RIGHT OF WAY         SIGN BASE       RIGHT OF WAY         SIGN BASE       RIGHT OF WAY         SIGN BASE       SIGN TER SERVICE         SIGN L HEAD, TRAFFIC SIGNAL       Image: Signal Action of the service o			
COMER POLE     Comerce of the control     PROPERTY LINE     PL     PL     PL       SIGN BASE     SIGN TRAFFIC SIGNAL     PROPERTY LINE     PL     PL     PL       SIGNAL HEAD, TRAFFIC SIGNAL     PROFILE     SILT FENCE EROSION CONTROL     PL     PROFILE       SIGNAL HEAD, TRAFFIC SIGNAL FEAD, TRAFFIC SIGNAL     PROFILE     FO     PROFILE       SIGNAL HEAD, TRAFFIC SIGNAL     PROFILE     FO     PROFILE       FELEPHONE MANHOLE     Image: Comercial Strain S		EXISTING WATER SERVICE	W
SIGN BASE		RIGHT OF WAY	ROW ROW
SIGN SILT FENCE EROSION CONTROL SILT FENCE EROSION CONTROL STANDARD, PEDESTAL BASE STANDARD, PEDESTAL BASE EXISTING FIBER OPTIC FO STANDARD, PEDESTAL BASE STUMP STANDARD FIBER OPTIC FO STUMP FILEPHONE MANHOLE STELEPHONE MANHOLE STANDARD FIBER OPTIC FO TELEPHONE PEDESTAL EXISTING SANITARY SEWER LINE STUDY SEWER LINE STAND MATERA WELL SO STANDARD SEVERTICE VALVE SEVER		PROPERTY LINE	PL PL
SIGNAL HEAD, TRAFFIC SIGNAL			
NORNAL HEAD, TRAFFIC SIGNAL       Image: Construction of the const		SILI FENCE EROSION CONTRO	<u>U</u> UU
NOLE, TRANSFORMER BASE       STUMP       PROFILE         STUMP       Image: Stump base       Image: Stump base       PROFILE         TELEPHONE MANHOLE       Image: Stump base       Image: Stump base       Image: Stump base         TELEPHONE PEDESTAL       Image: Stump base       Image: Stump base       Image: Stump base         TELEPHONE PEDESTAL       Image: Stump base       Image: Stump base       Image: Stump base       Image: Stump base         VelL       Image: Stump base	~ (:	EXISTING FIBER OPTIC	FO
TELEPHONE MANHOLE       PROFILE         TELEPHONE PEDESTAL       Image: Comparison of the pedestal is the pedestal of the pedestal of the pedestal is the pedestal of the pedications and plans, specifications for       PROPOse of the pedications for         PROPOse of the pedication standards specification standards specifications for       Image: Pedication standards specifications for       Image: Pedication standards specifications for			
TELEPHONE MANHOLE       Image: Contract shall be in reversion reversion reversion shall be in reversion revers			PROFIL F
TREE       EXISTING SANITARY SEWER LINE       INCLAND MATERA         WELL       100'-8" PVC SAN       100'-8" PVC SAN         WATER SERVICE VALVE       INCLAND MATERA       INCLAND MATERA         WATER VALVE       INCLAND MATERA       INCLAND MATERA         RAL CONSTRUCTION NOTES:       INCLAND MATERA       INCLAND MATERA         ELEVATIONS ARE REFERENCED TO NAVD 88.       PROPOSED STORM SEWER LINE       INCLAND MATERA         WORK UNDER THIS CONTRACT SHALL BE IN RDANCE WITH THE CITY OF DE PERE, CURRENT TRUCTION SPECIFICATIONS AND THESE SPECIAL ISIONS AND PLANS, AND THE LATEST ADDITION HE WISCONSIN DEPARTMENT OF SPORTATION STANDARDS SPECIFICATIONS FOR       INCLAND MATERA	MANHOLE 🔞		TROFILE
VELL       Image: Construction of the special	PEDESTAL		(SIZE AND MATERIAL)
WATER SERVICE VALVE   PROPOSED SANITARY SEWER LINE  WATER VALVE  WATER VALVE  WATER VALVE  WATER VALVE  WATER VALVE  CISZE AND MATERIA  EXISTING STORM SEWER LINE  CISZE AND MATERIA  EXISTING STORM SEWER LINE  100'-8" PVC STM CI  CISZE AND MATERIA  IO0'-8" PVC STM CI  CISZE AND MATERIA  IO0'-8" PVC STM CI  CISZE AND MATERIA  IO0'-8" PVC STM CI  CISZE AND MATERIA  PROPOSED STORM SEWER LINE  IO0'-8" PVC STM CI  CISZE AND MATERIA  PROPOSED STORM SEWER LINE  IO0'-8" PVC STM CI  CISZE AND MATERIA  PROPOSED STORM SEWER LINE  PROPOSE 8" P  PROPO	to the second	EXISTING SANITARY SEWER LI	IE
WATER VALVE SERVICE VALVE (SIZE AND MATERIA WATER VALVE (SIZE AND MATERIA RAL CONSTRUCTION NOTES: ELEVATIONS ARE REFERENCED TO NAVD 88. WORK UNDER THIS CONTRACT SHALL BE IN RDANCE WITH THE CITY OF DE PERE, CURRENT ITRUCTION SPECIFICATIONS AND THESE SPECIAL ISIONS AND PLANS, AND THE LATEST ADDITION HE WISCONSIN DEPARTMENT OF SPORTATION STANDARDS SPECIFICATIONS FOR PROPOSE 8" P	<b>®</b>		100'-8" PVC SAN @ 0.40%
EXISTING STORM SEWER LINE EXISTING STORM SEWER LINE TRUCTION SARE REFERENCED TO NAVD 88. WORK UNDER THIS CONTRACT SHALL BE IN RDANCE WITH THE CITY OF DE PERE, CURRENT TRUCTION SPECIFICATIONS AND THESE SPECIAL SIONS AND PLANS, AND THE LATEST ADDITION IE WISCONSIN DEPARTMENT OF SPORTATION STANDARDS SPECIFICATIONS FOR PROPOSE 8" P		PROPOSED SANITARY SEWER	JNE
RAL CONSTRUCTION NOTES:         ELEVATIONS ARE REFERENCED TO NAVD 88.         WORK UNDER THIS CONTRACT SHALL BE IN         WORK UNDER THIS CONTRACT SHALL BE IN         BRDANCE WITH THE CITY OF DE PERE, CURRENT         STRUCTION SPECIFICATIONS AND THESE SPECIAL         AND PLANS, AND THE LATEST ADDITION         HE WISCONSIN DEPARTMENT OF         SPORTATION STANDARDS SPECIFICATIONS FOR	<u>-</u> 🛛		(SIZE AND MATERIAL)
ELEVATIONS ARE REFERENCED TO NAVD 88. PROPOSED STORM SEWER LINE (SIZE AND MATERIA SPOCIFICATIONS AND THESE SPECIAL EXISTING WATER MAIN LINE (SIZE AND MATERIA SPOCIFICATIONS AND THE LATEST ADDITION HE WISCONSIN DEPARTMENT OF SPORTATION STANDARDS SPECIFICATIONS FOR PROPOSE 8" P	DNSTRUCTION NOTES		
WORK UNDER THIS CONTRACT SHALL BE IN RDANCE WITH THE CITY OF DE PERE, CURRENT TRUCTION SPECIFICATIONS AND THESE SPECIAL ISIONS AND PLANS, AND THE LATEST ADDITION HE WISCONSIN DEPARTMENT OF SPORTATION STANDARDS SPECIFICATIONS FOR PROPOSE 8" P		PROPOSED STORM SEWER LIN	100'-8" PVC STM @ 1.0%
RDANCE WITH THE CITY OF DE PERE, CURRENT TRUCTION SPECIFICATIONS AND THESE SPECIAL ISIONS AND PLANS, AND THE LATEST ADDITION HE WISCONSIN DEPARTMENT OF SPORTATION STANDARDS SPECIFICATIONS FOR PROPOSE 8" P	THIS CONTRACT SHALL BE IN		
SIONS AND PLANS, AND THE LATEST ADDITION IE WISCONSIN DEPARTMENT OF SPORTATION STANDARDS SPECIFICATIONS FOR PROPOSE 8" P	H THE CITY OF DE PERE, CURRENT PECIFICATIONS AND THESE SPECIAL	EXISTING WATER MAIN LINE	(SIZE AND MATERIAL)
SPORTATION STANDARDS SPECIFICATIONS FOR	PLANS, AND THE LATEST ADDITION N DEPARTMENT OF		
AT AND STRUCTURE CONSTRUCTION	STANDARDS SPECIFICATIONS FOR RUCTURE CONSTRUCTION	PROPOSED WATER MAIN LINE	
FICATIONS, LATEST EDITION, WHERE	ATEST EDITION, WHERE		
EROSION CONTROL MEASURES SHALL BE IN			
E PRIOR TO CONSTRUCTION AND SHALL IRM TO THE WISCONSIN DEPARTMENT OF	WISCONSIN DEPARTMENT OF		
RAL RESOURCES CONSTRUCTION SITE EROSION ROL AND TECHNICAL STANDARDS. PATCH SYMBOLS		DATION ON DOLO	

ASPHALT PATCH

CONCRETE PATCH

SURVEYED

DRAWN

DESIGNED

CHECKED

BY

BK

NAME: PINE TRAIL CROSSING UTILITY AND STREET CONSTRUCTION

18–14

PROJECT #

LEVATIONS OF ALL UTILITIES. WHETHER SHOWN OR NOT, FROM THE OWNERS OF THE RESPECTIVE UTILITIES. ALL UTILITIES OWNERS SHALL BE NOTIFIED BY THE CONTRACTOR 72 HOURS PRIOR TO EXCAVATION. **CITY OF DE PE STANDARD ABBREVIATIONS** ENGINEERING DIVISION 925 S. SIXTH ST DE PERE WI 54115 AND SYMBOLS OFFICE 920-339-4060 FAX 920-339-4071

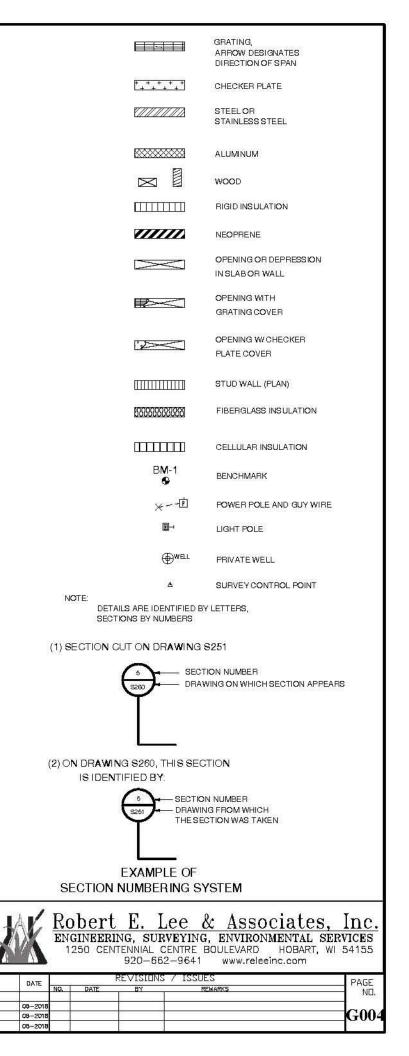
4.

EXISTING UTILITIES SHOWN ON THE PLANS ARE APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING EXACT LOCATIONS AND

#### PATCH SYMBOLS

DATE		F	REVISIONS	/ ISSUES	PAGE
2	NO.	DATE	BY	REMARKS	
					- NO.
02-2013					C003
					70003

	GATE VALVE	12X24	FIRST DIMENSION DUCT SIDE SHOWN SECOND DIMENSION SIDE NOT SHOWN	101	DOOR NUMBER
	BUTTERFLY VALVE			101	ROOMNUMBER
	GLOBE VALVE	$\ge$	SUPPLY OR OUTSIDE AIR DUCT	(8' STD	PIPING DESIGNATION
	NEEDLE VALVE		EX HAUST OR RETURN AIR DUCT	P12346	EQUIPMENT DESIGNATION
$\rightarrow$	PLUG VALVE		a na panahanan kata na kata na kata kata kata kata		
	BALLVALVE		AIR TURNING VANES IN DUCT		
	CENTER GUIDE CHECK VALVE		OPPOSED BLADE VOLUME DAMPER		- CENTERLINE
-//-	CHECK VALVE		FIRE DAMPER		SECTION OUTLINE OR
-ko-	BALL CHECK VALVE		FLEXIBLE DUCT CONNECTION		BOUNDARY
	DIAPHRAGMVALVE	FLOW	EXTRACTOR		= HANDRAIL
	KNIFE GATE VALVE		WALL LOUVER		- GRAVEL SURFACE (PLAN)
	ACTUATED VALVE, S-SOLENOID,	(W X H)	EXHAUST OR RETURN AIR GRILLE OR	<u>- 111 - 111 - 111</u>	
	M-MOTOR, P-PNEUMATIC	] CFM	REGISTER (W X H = WIDTH X HEIGHT, INCHES)	745	EXISTING GRADE CONTOURS
	REGULATING VALVE		SUPPLY GRILLE OR REGISTER, (W X H = WIDTH X HEIGHT, INCHES)	13	<sup>(3)</sup> FINISH GRADE CONTOURS
	POWER OPERATED VALVE FOR VALVE SEE SPECS		CENTRIFUGAL PUMP, FAN, BLOWER	X 110.5	FINISH GRADE SPOT ELEVATION
$\leq$	ANGLE VALVE	-0-	OR METERING PUMP	1. <b>-</b>	- SWALE OR DITCH
Å -₩-	RELIEF VALVE	FE	FLOW METER, OR ELEMENT	3:1	- SLOPE (3 HORZ, TO 1 VERT.)
	THERMOSTATICALLY CONTROLLED VALVE	FL	FLOW SWITCH		JOINT FILLER
ц Ц		$\Box \Phi$	THERMOMETER	• OR	- PVC WATER STOP
Ŭ	ROTAMETER	P	PRESSURE GAUGE	1 	
	STRAINER PIPELINE FLUSHING COCK CONNECTION	PS	PRESSURE SWITCH	<u> XXXXX</u>	
	INSULATED PIPE	$\Box \Box$	HOSE RACK		
	FLANGED JOINT	۲	UTILITY STATION (PLAN)	TP-1	SOIL BORING OR TEST PIT AND DESIGNATION
	GROOVED PIPE COUPLINGS	T	THERMOSTAT		SLIDE GATE OPENING
	FLANGED COUPLING ADAPTER	— <u>O</u> —	SANITARY MANHOLE		AND DESIGNATION
<u>*−∔⊒</u> −−>		<u> </u>	CONNECTING LINES, SINGLE LINE SCHEMATIC DIAGRAMS		REINFORCEMENT IN SECTION
≈─₩── ₅†==‡-ぇ	MECHANICAL PIPE COUPLING	<u> </u>	NON-CONNECTING LINES, SINGLE		REINFORCEMENT PLAN OR ELEVATION
	FLEXIBLE RUBBER COUPLING	C/L	CENTERLINE	RAMA	
	STAINLESS STEEL FLEXIBLE COUPLING	-~~~-	FLEXIBLE PIPE CONNECTION	1.1.1.1.1.1.	
<u> </u>	SANITARY TRAP	@	(SINGLE LINE PIPE) AT		
	DIRECTION OF FLOW	&	AND	<u>kerininis</u>	OR PLASTER
	UNION	DIA.	DIAMETER		BRICK
	REDUCER OR INCREASER	L	ANGLE	<i>[]]]]]</i>	BRICK (PLAN OR SECTION)
+	MANUAL AIR VENT	P	PLATE OR PROPERTY LINE	V///	CONCRETE BLOCK
	CITY OF DE PERE			NA	MEI PINE TRAIL CROSSING SUBDIVISION STREET AND
ENG	INEERING DIVISION 925 S. SIXTH ST DE PEF	RE WI 54115	SYMBOLS AND ABBREVIATIONS	PF	UTILITY CONSTRUCTION SURVEYED
		0-339-4071			18-14 DESIGNED CHECKED

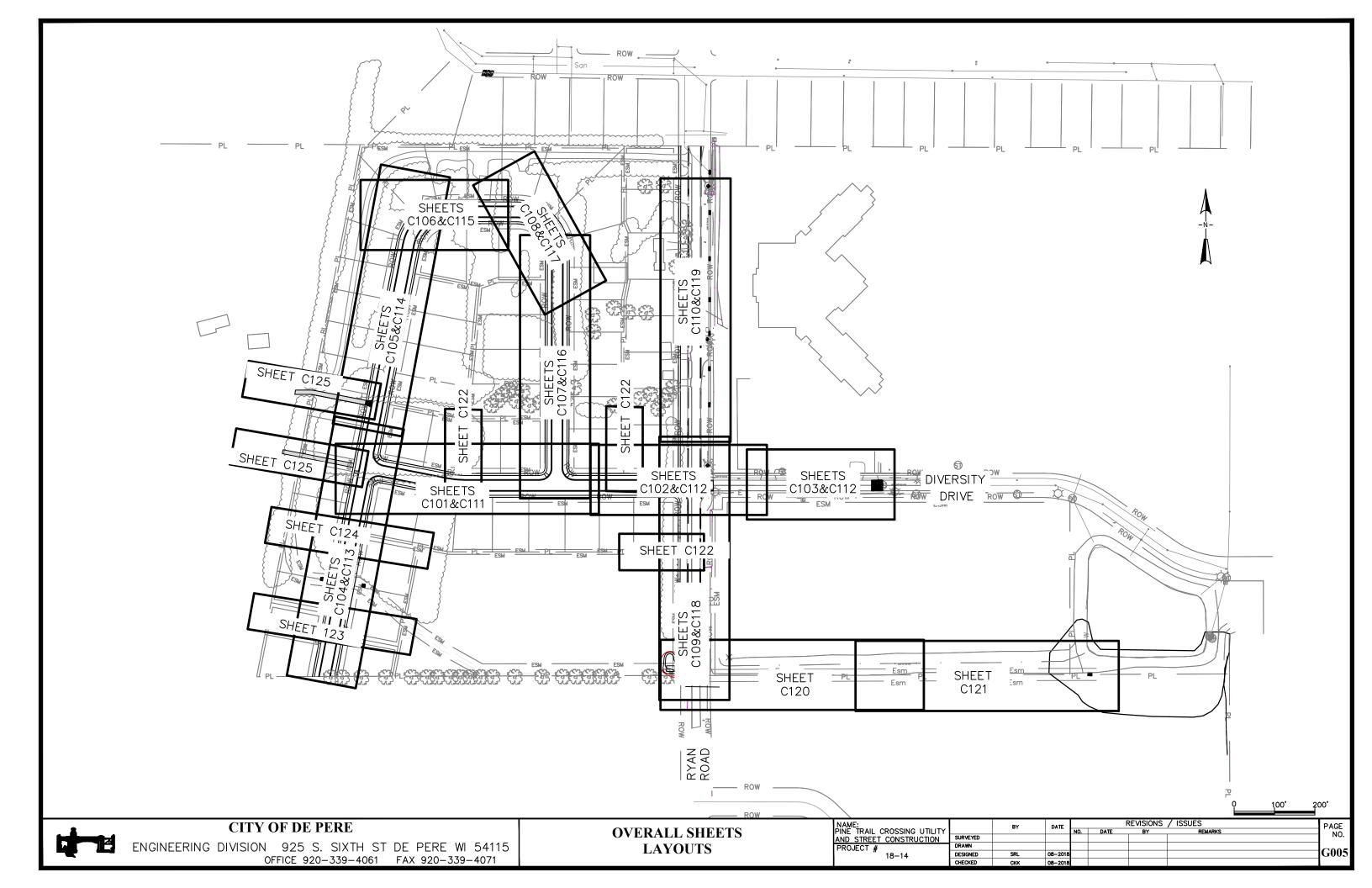


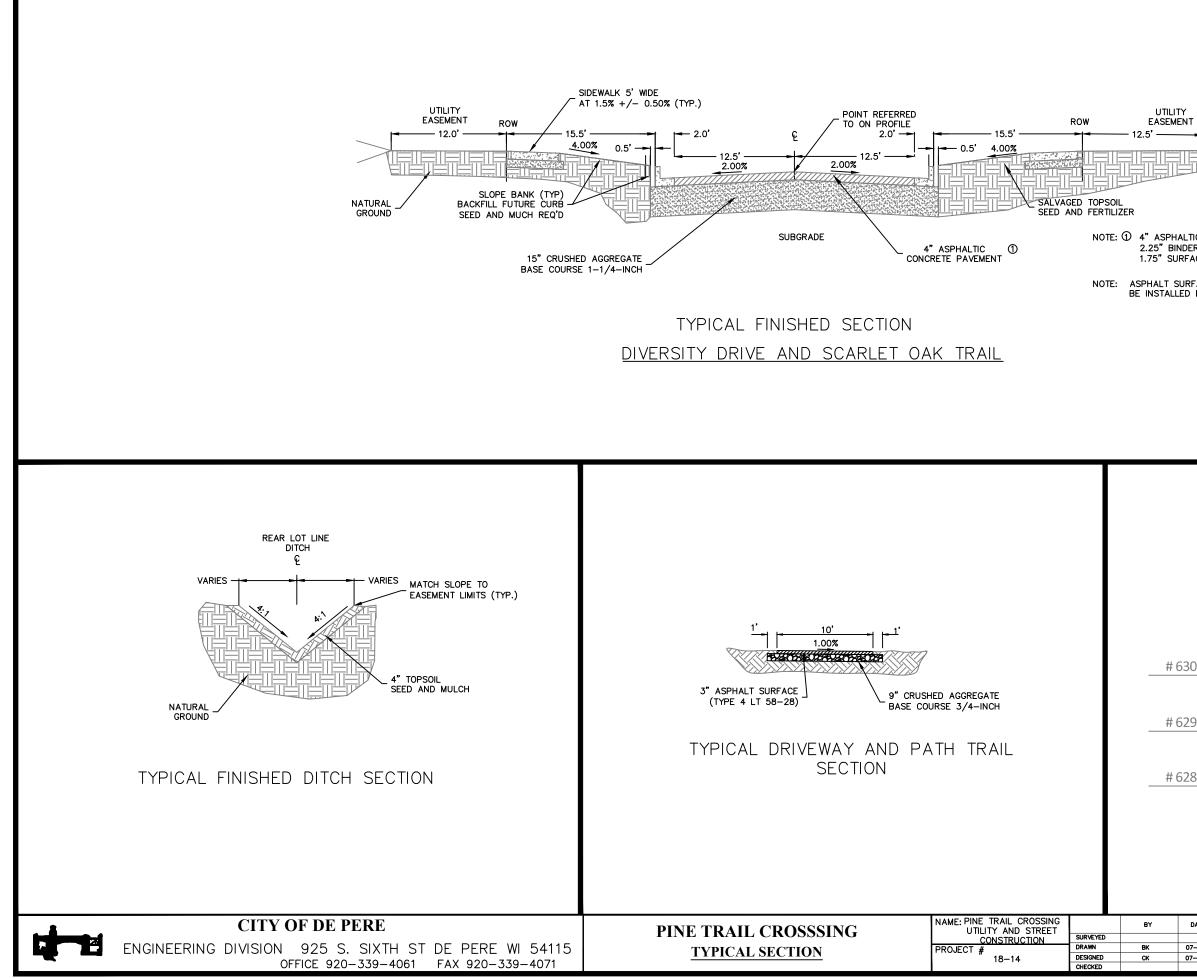
BY

RLB

JJS

LGN





GRADE TO MATCH EXISTING (TYP)

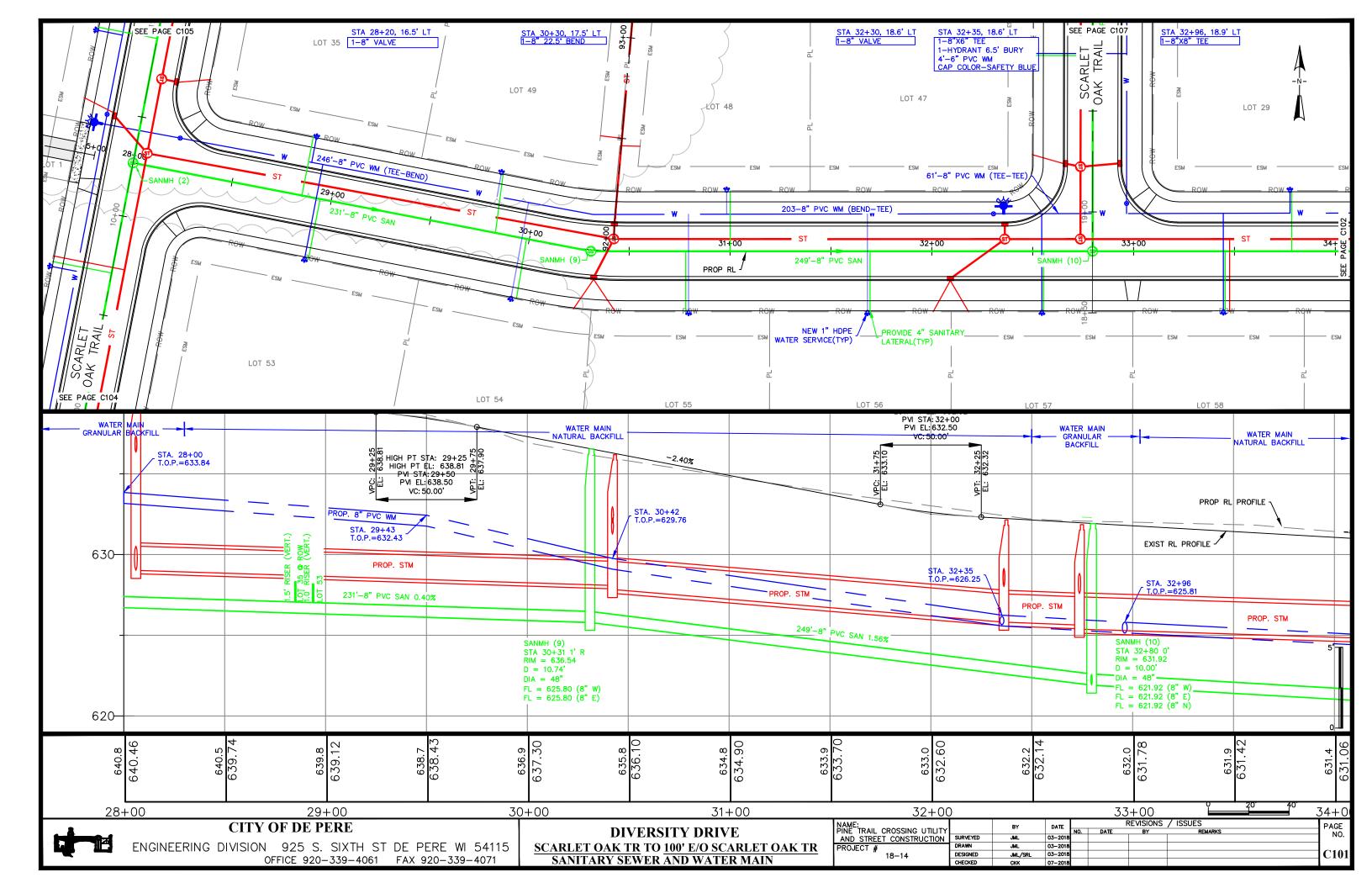
NOTE: ① 4" ASPHALTIC CONCRETE PAVEMENT CONSISTS OF 2.25" BINDER COURSE: 3 LT 58-28 S 1.75" SURFACE COURSE: 4 LT 58-28 S

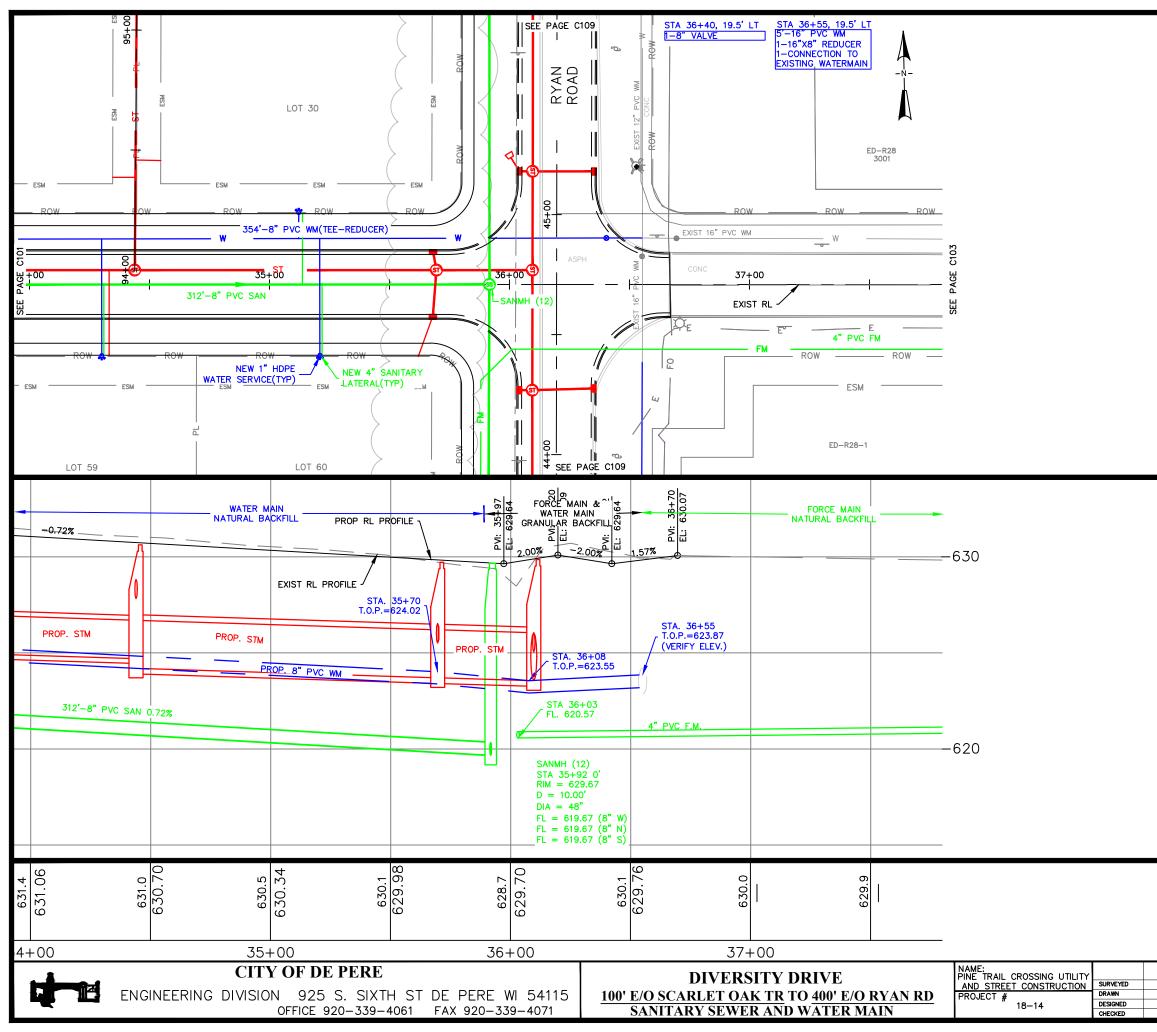
NOTE: ASPHALT SURFACE COURSE AND SIDEWALKS TO BE INSTALLED BY OTHERS.

#### PINE TRAIL CROSSING BENCH MARKS AT EXISTING HYD.

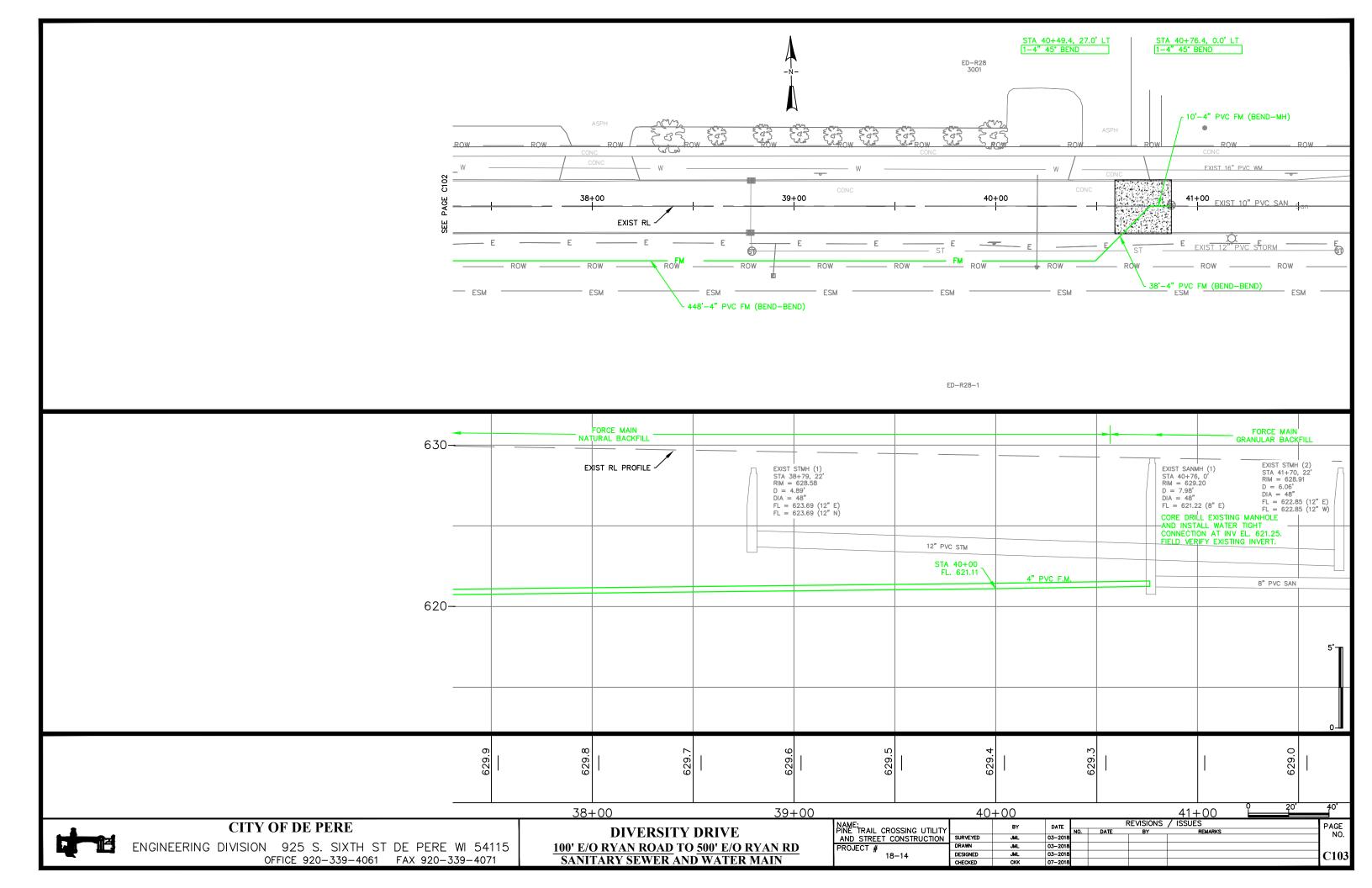
# 630	At Diversity Dr	Top Nut	45+20	33' Rt
	First Hyd North of			
# 629	Diversity Dr.	Top Nut	48+32	32' Rt
	Second Hyd North of			
# 628	Diversity Dr.	Top Nut	52+13	33' Rt

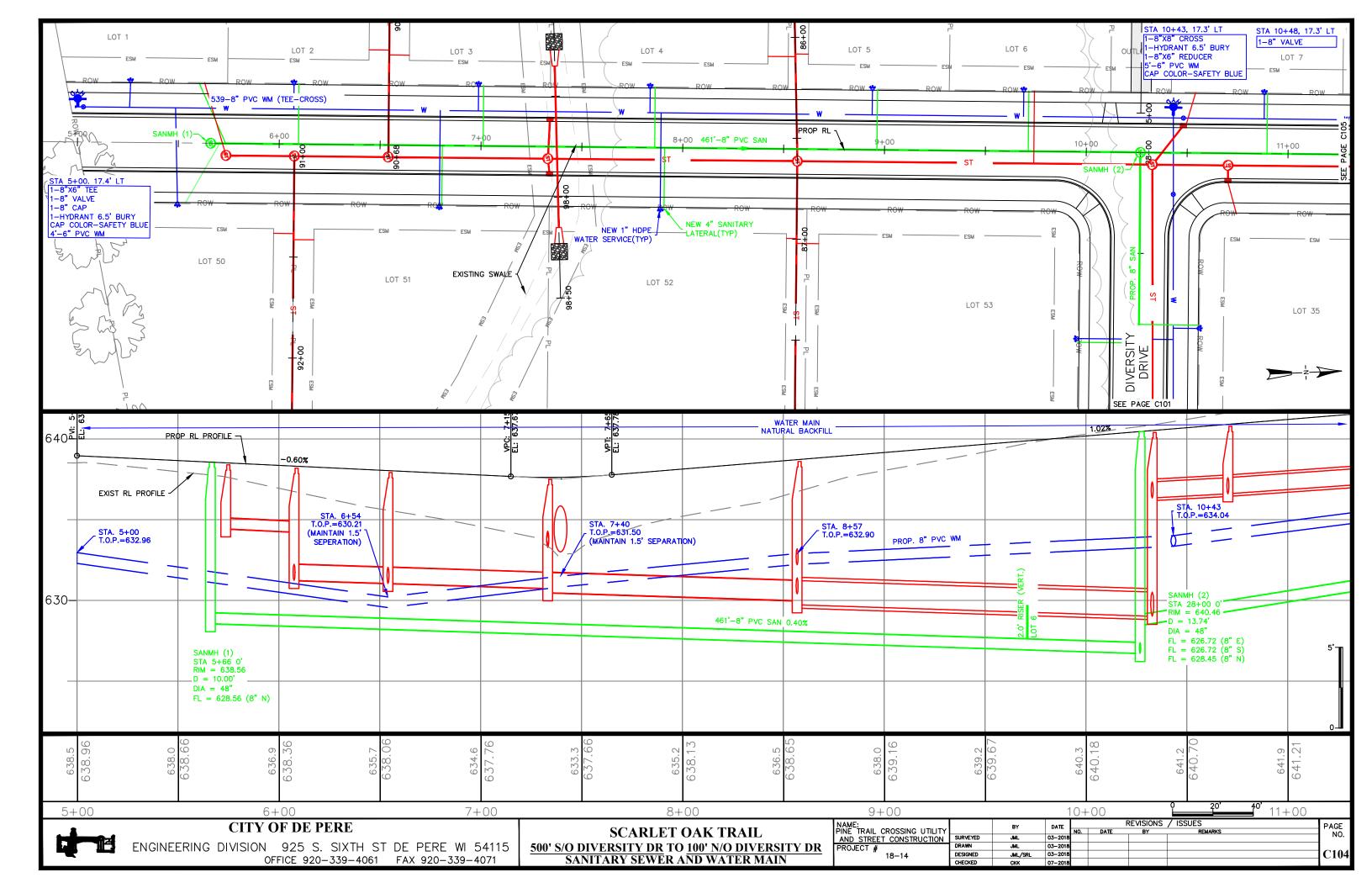
DATE		REVISIONS / ISSUES								
DAIL	NO.	DATE	BY	REMARKS	PAGE					
					NO.					
07–18					COOC					
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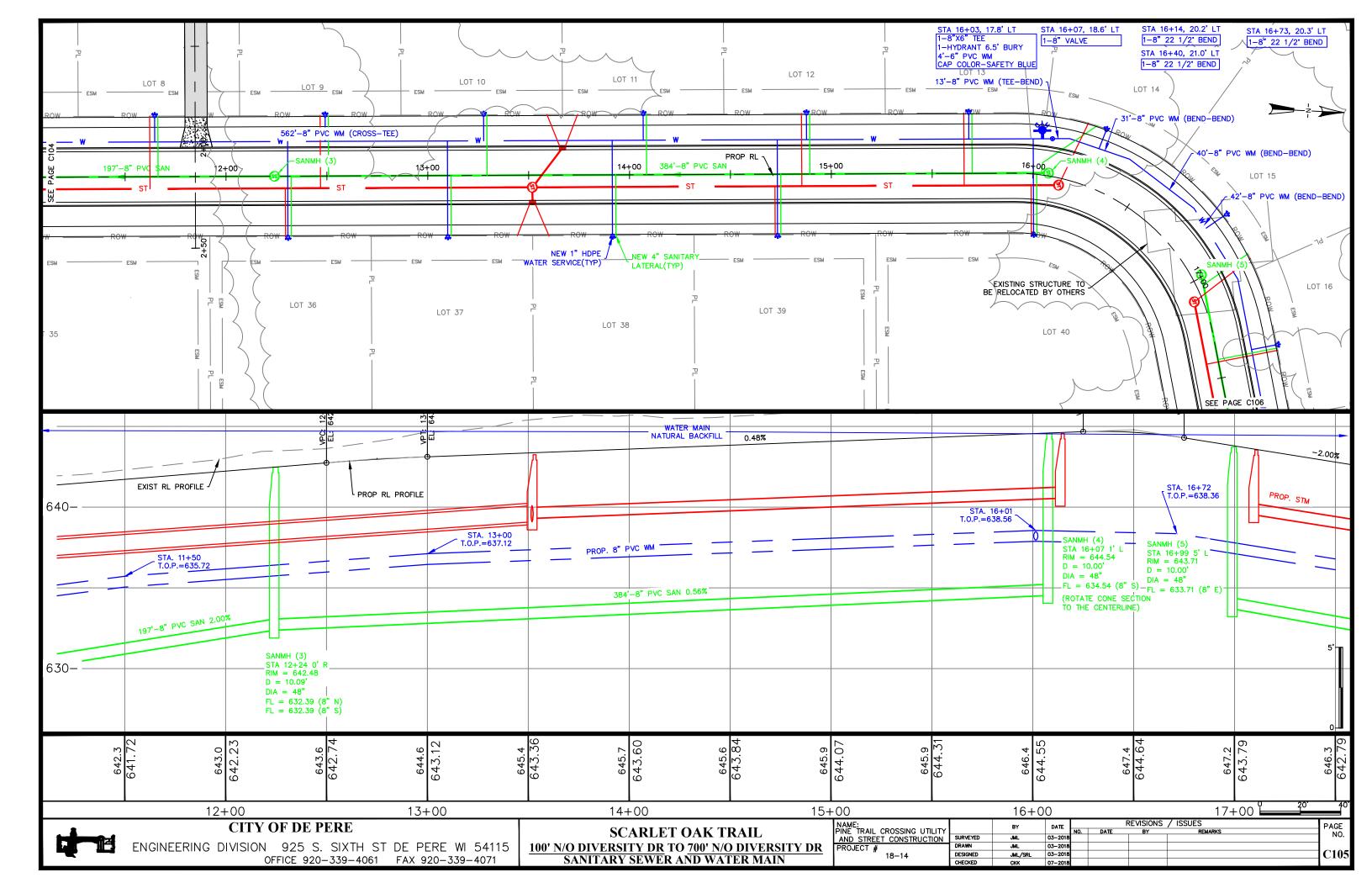


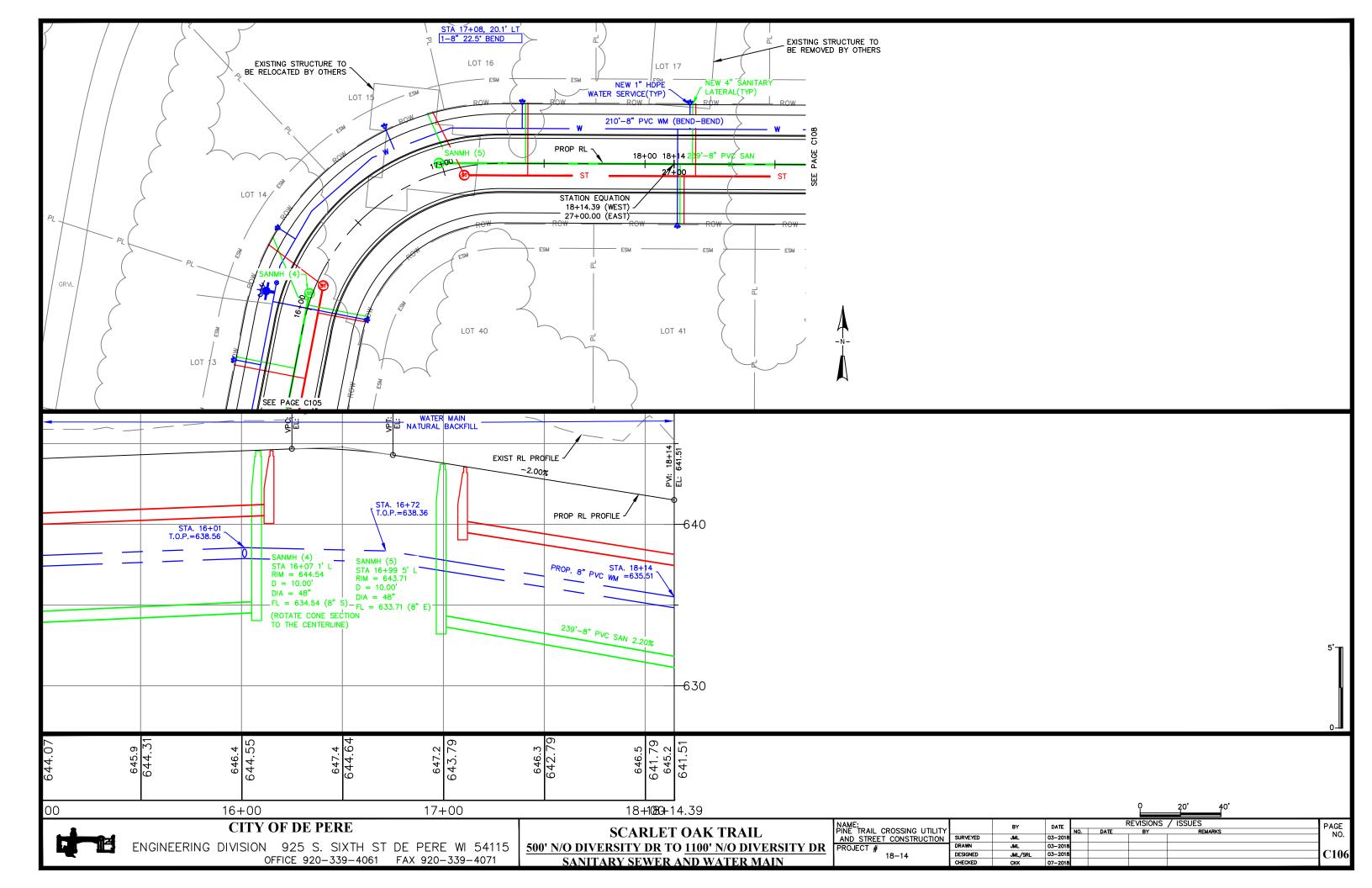


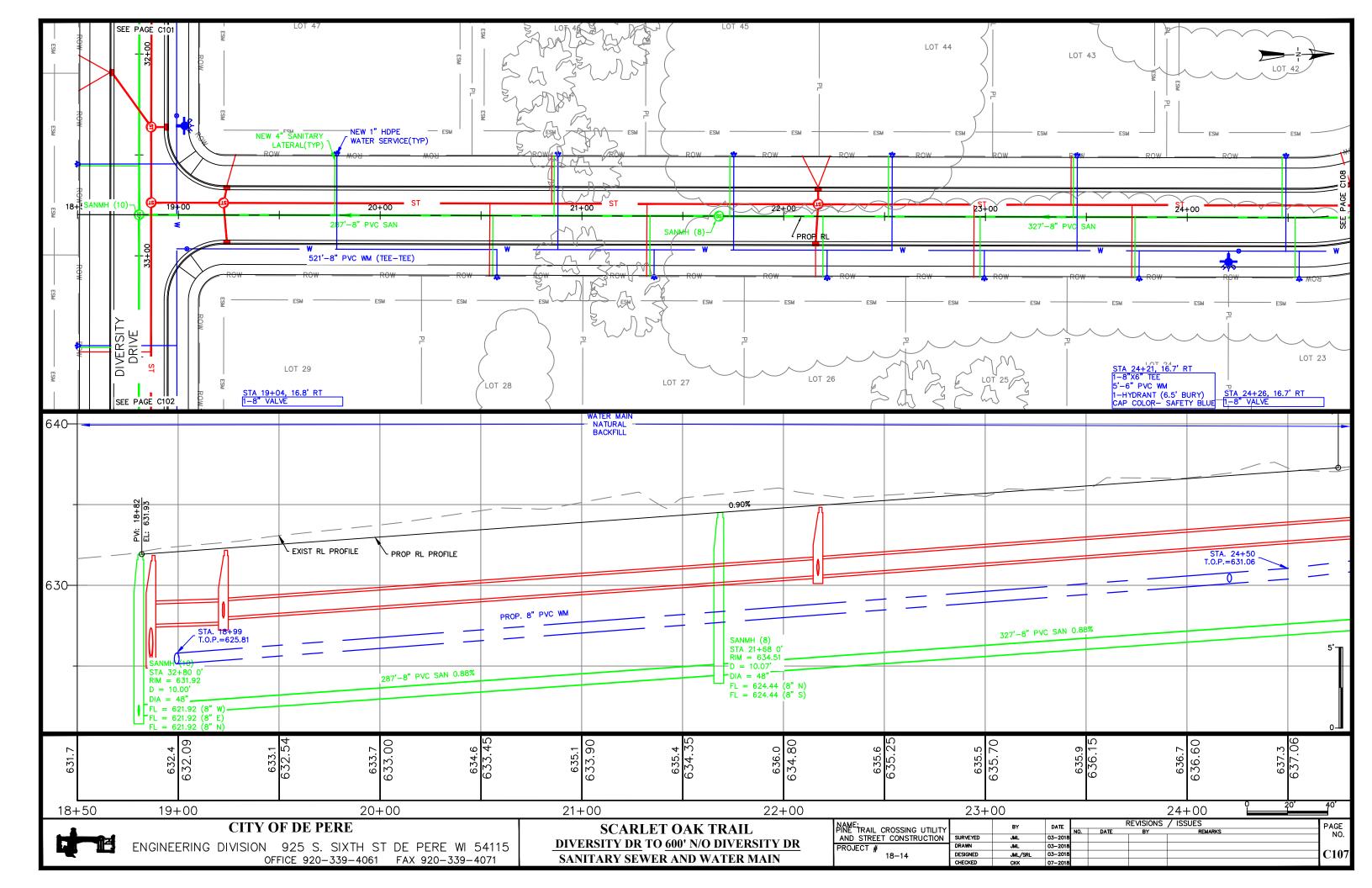
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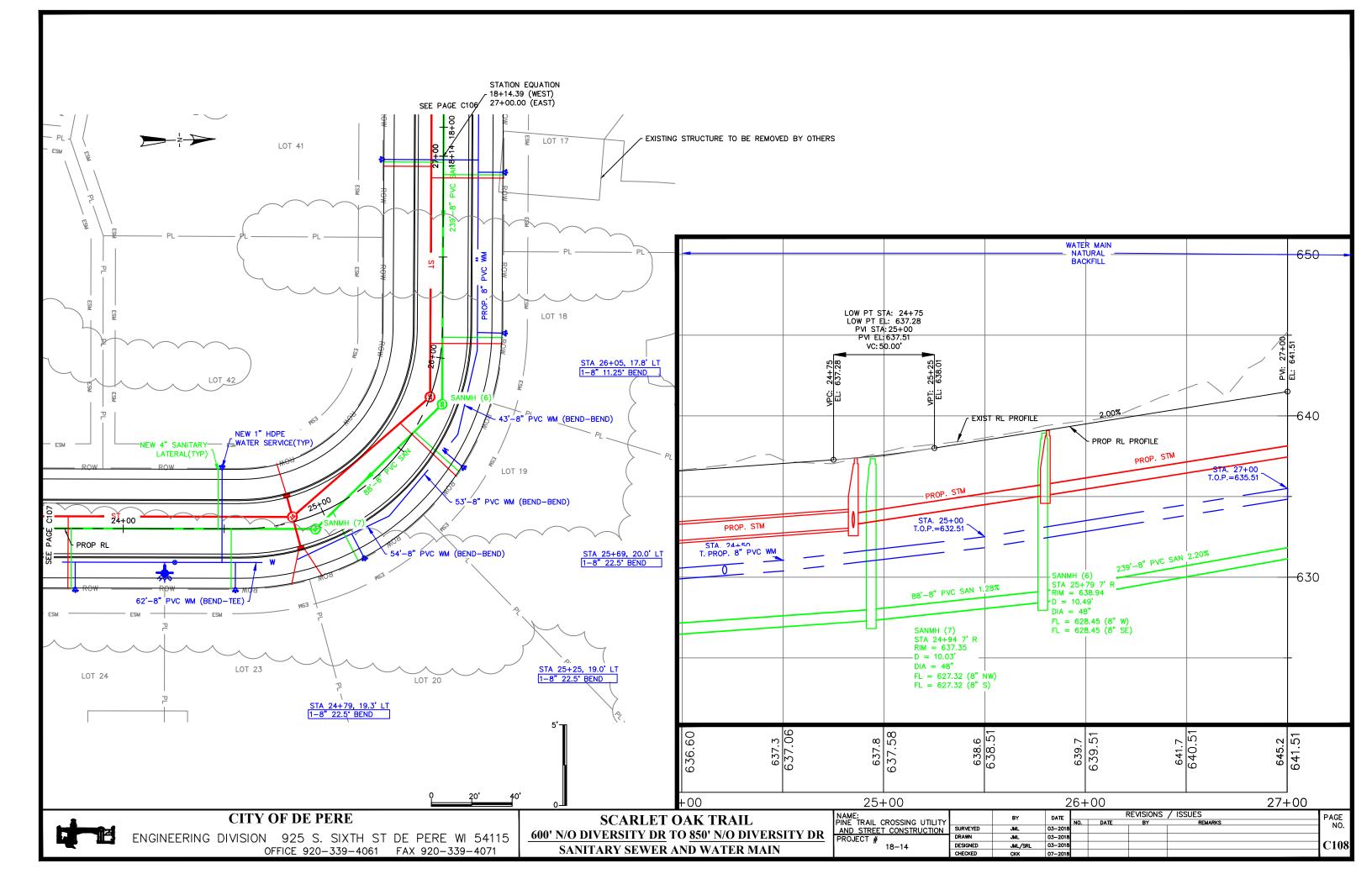


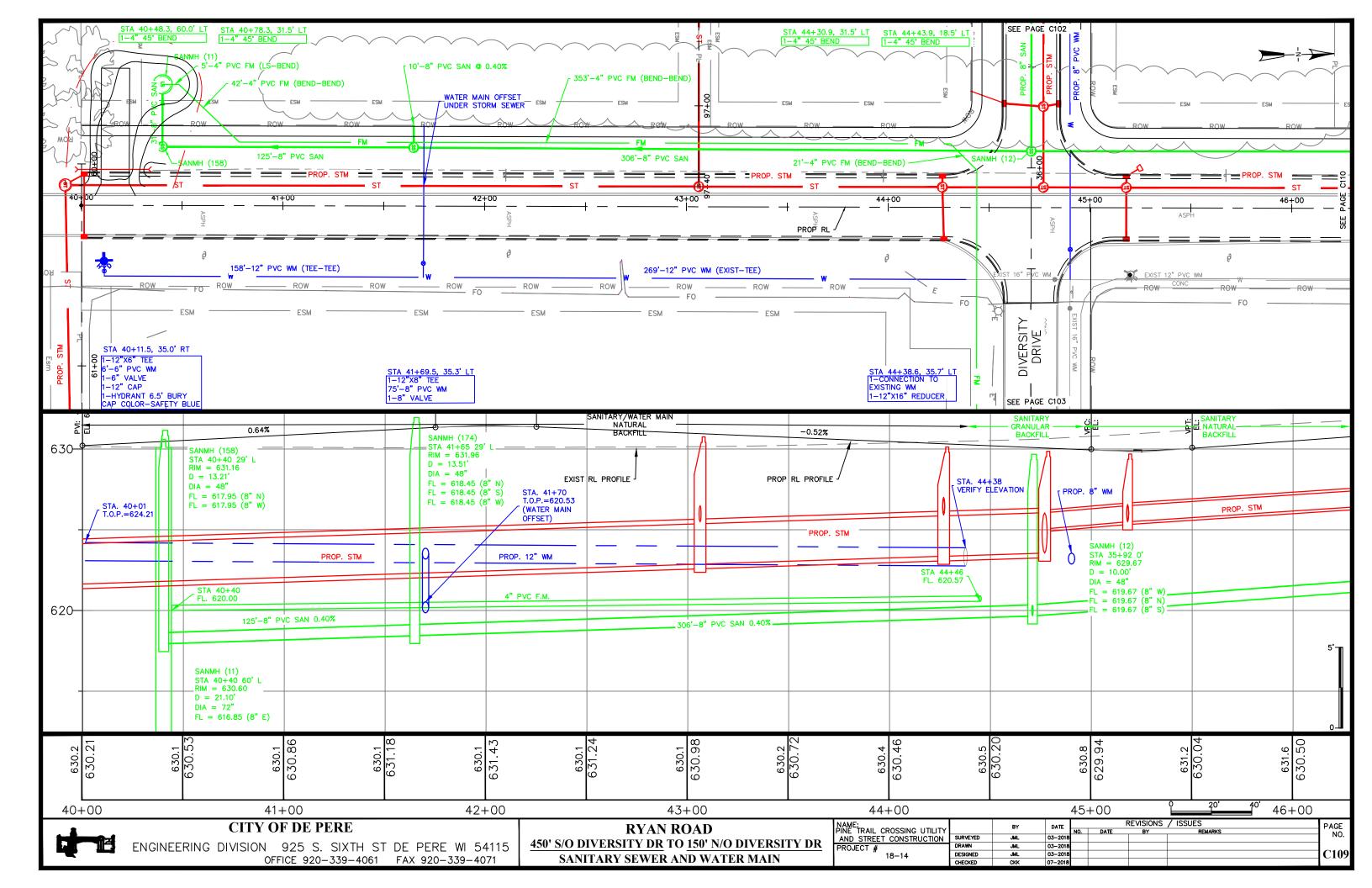


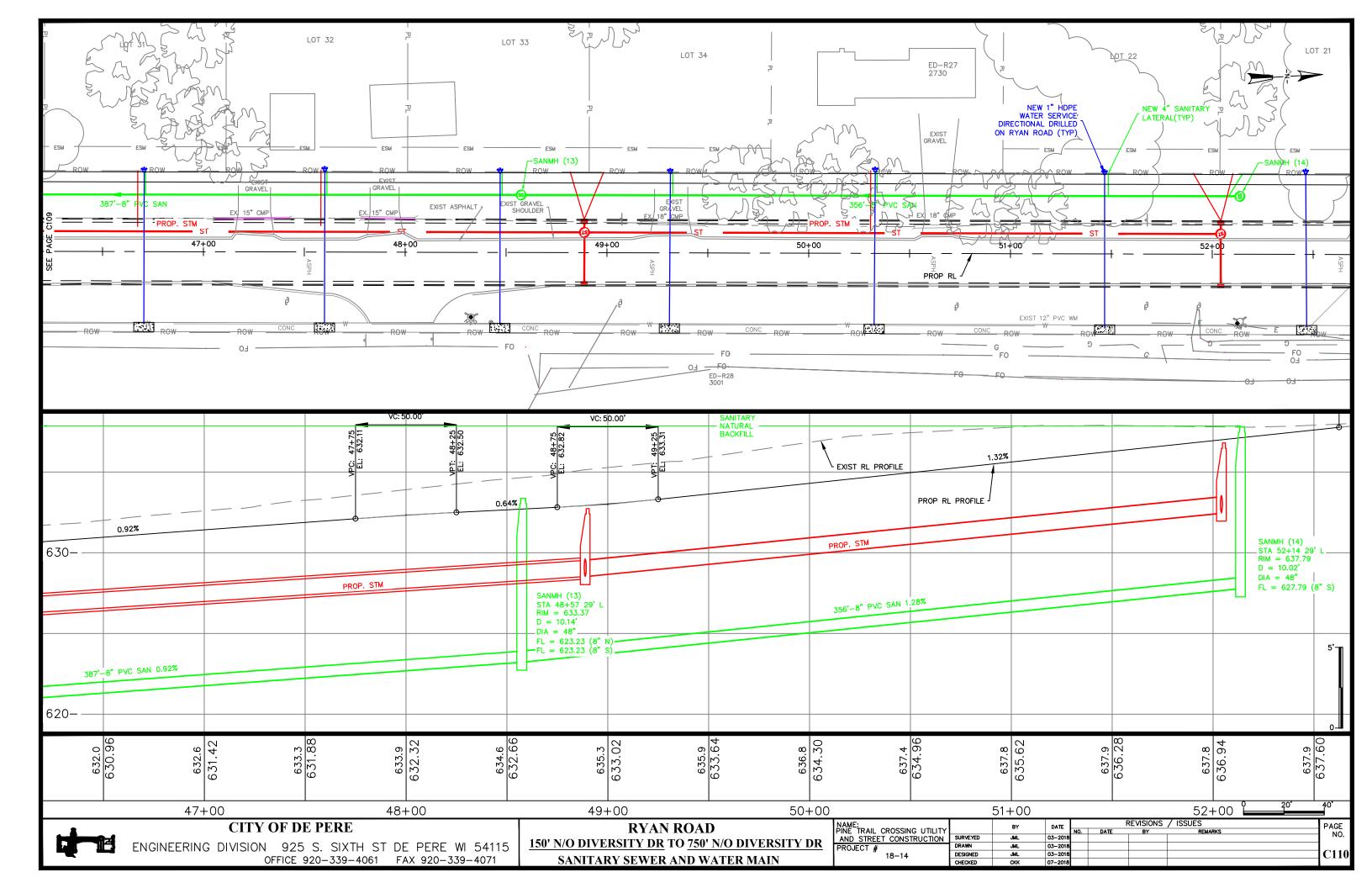


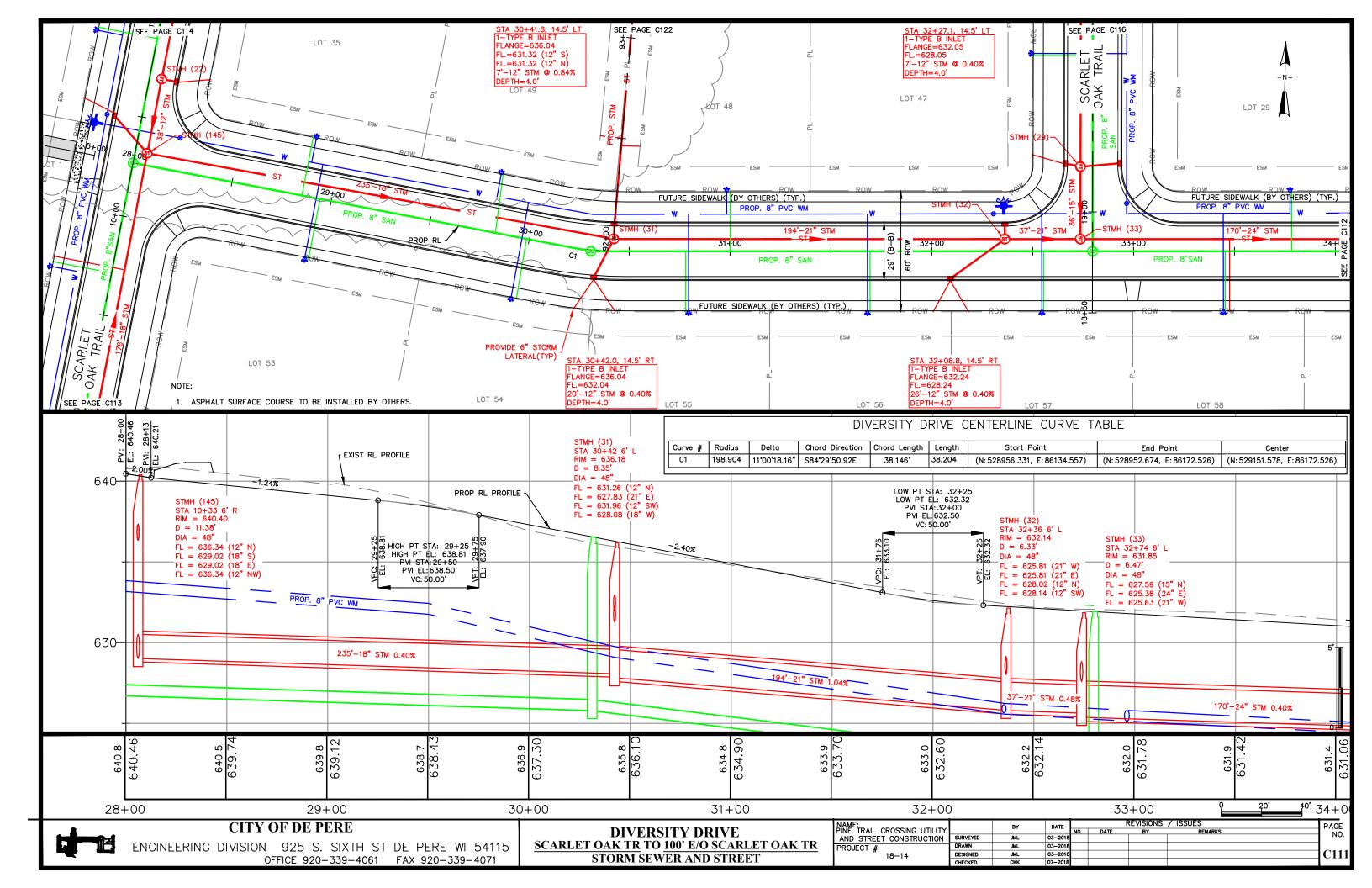


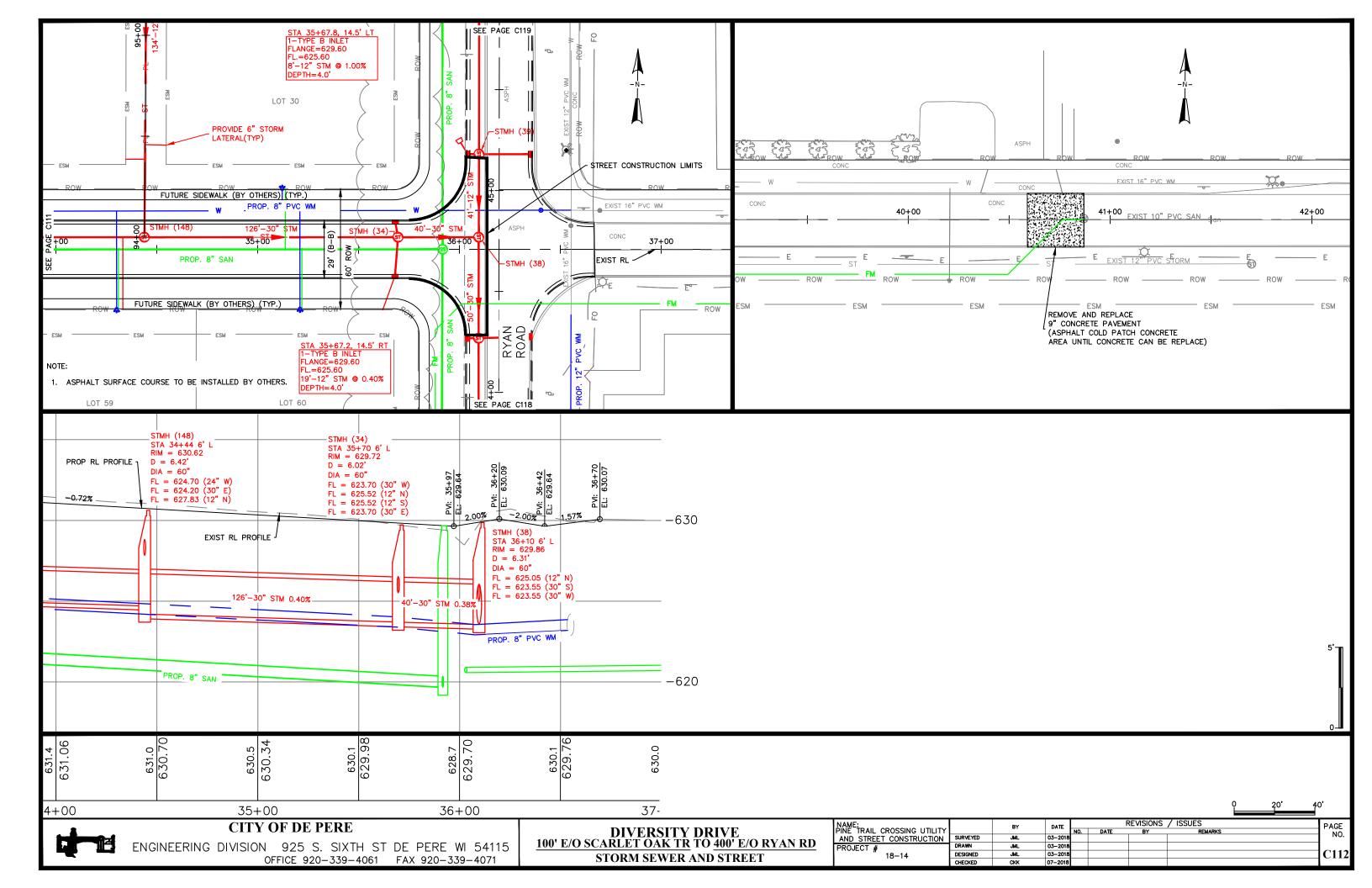


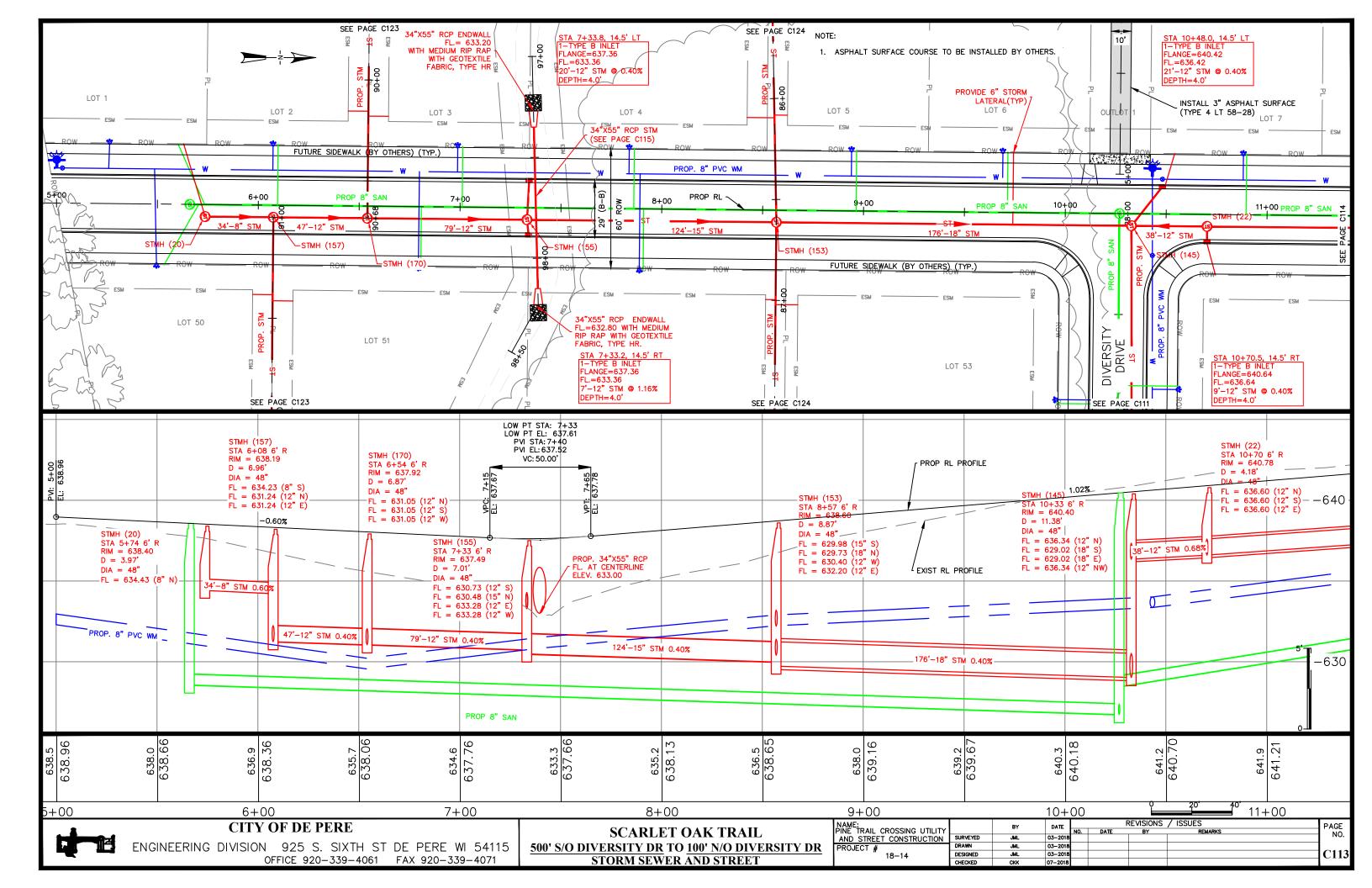


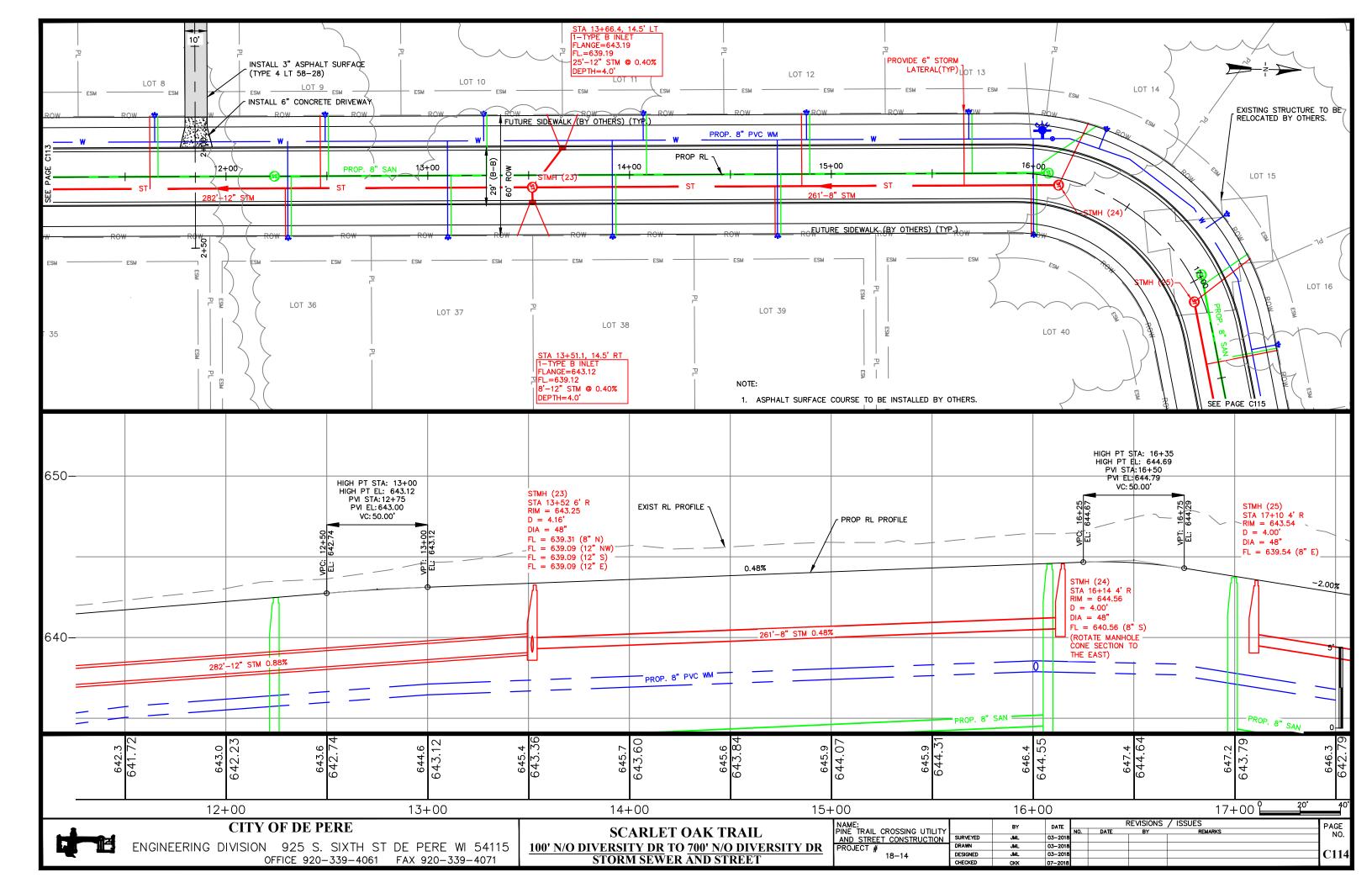


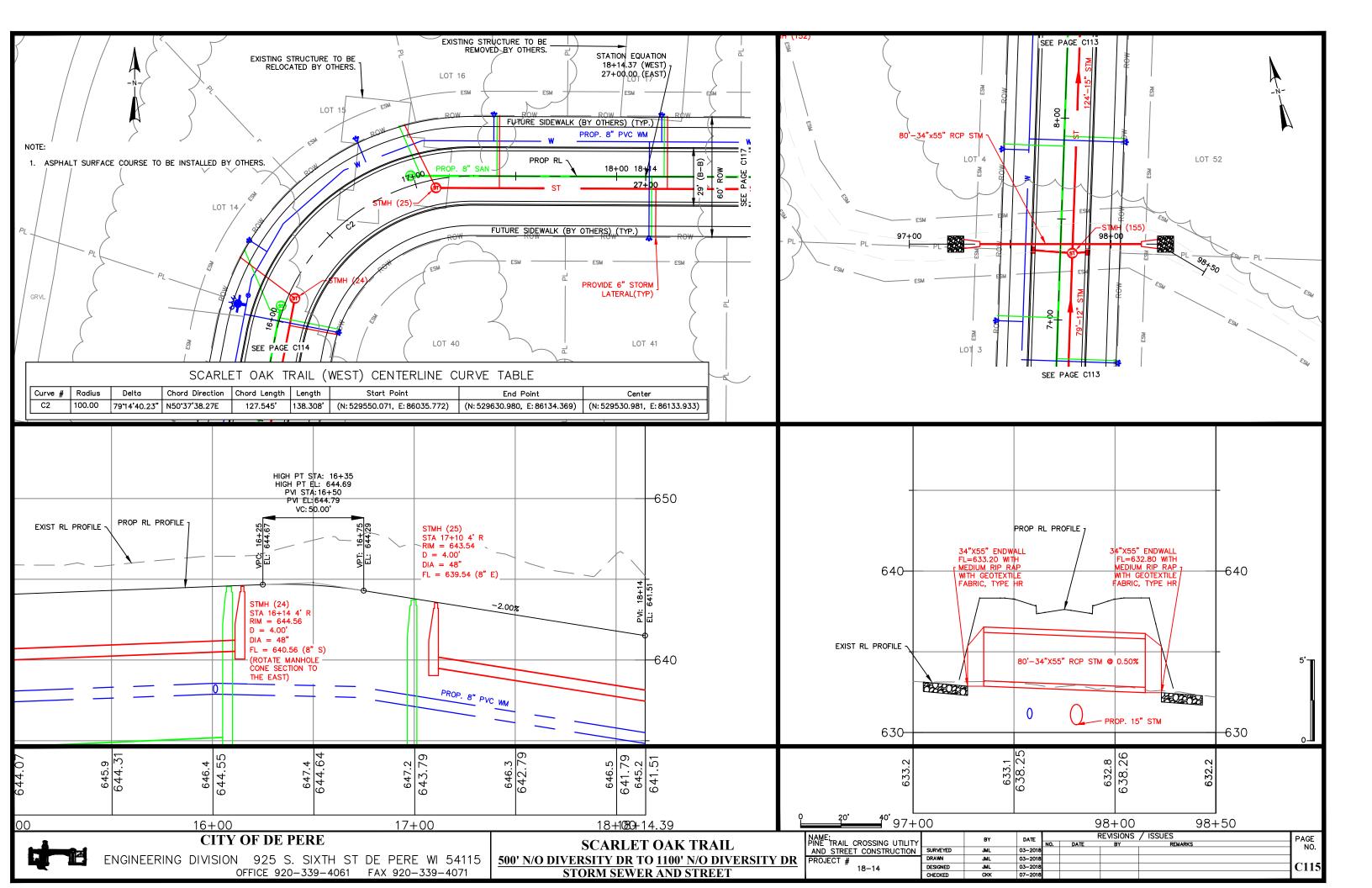


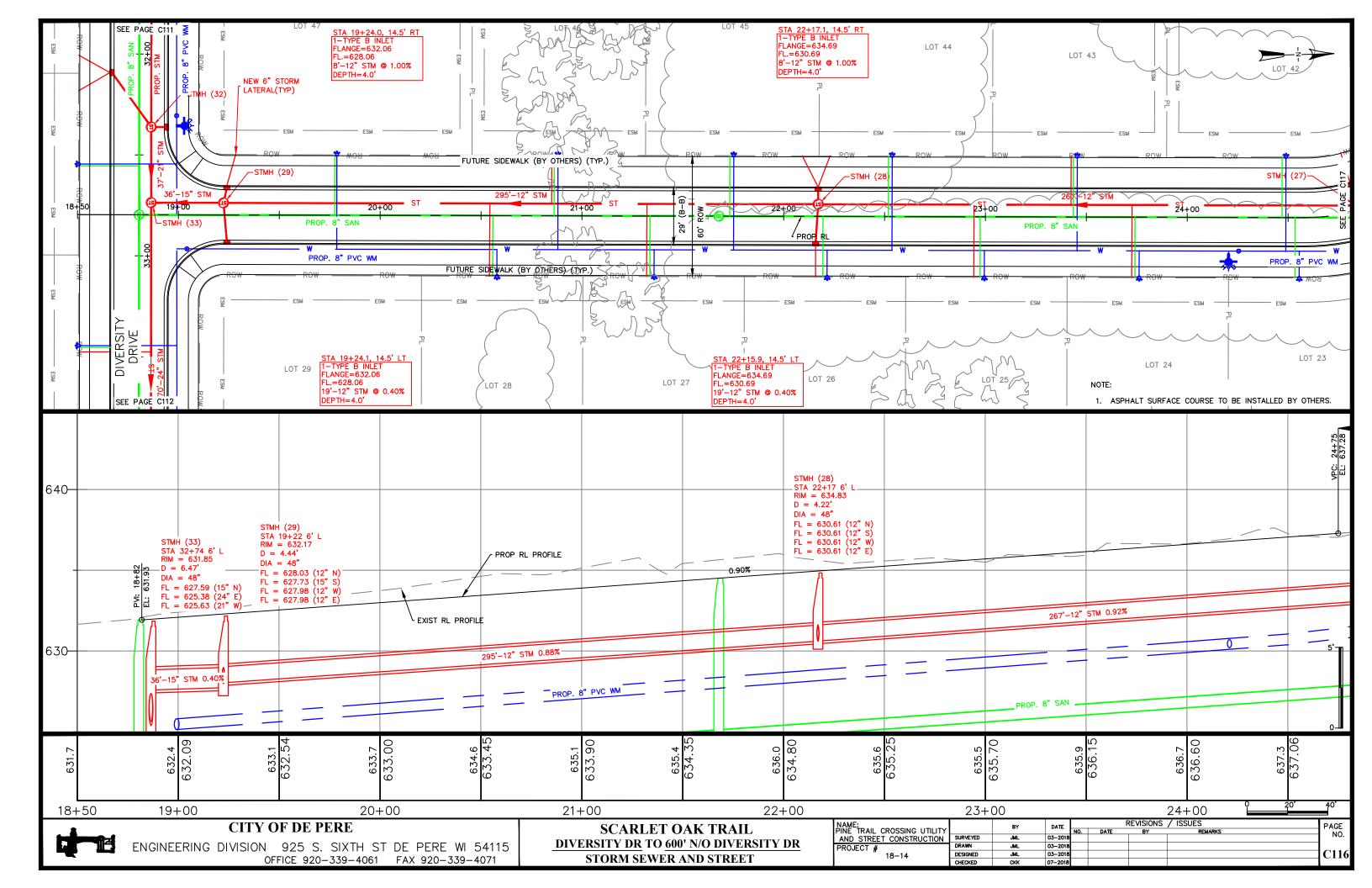


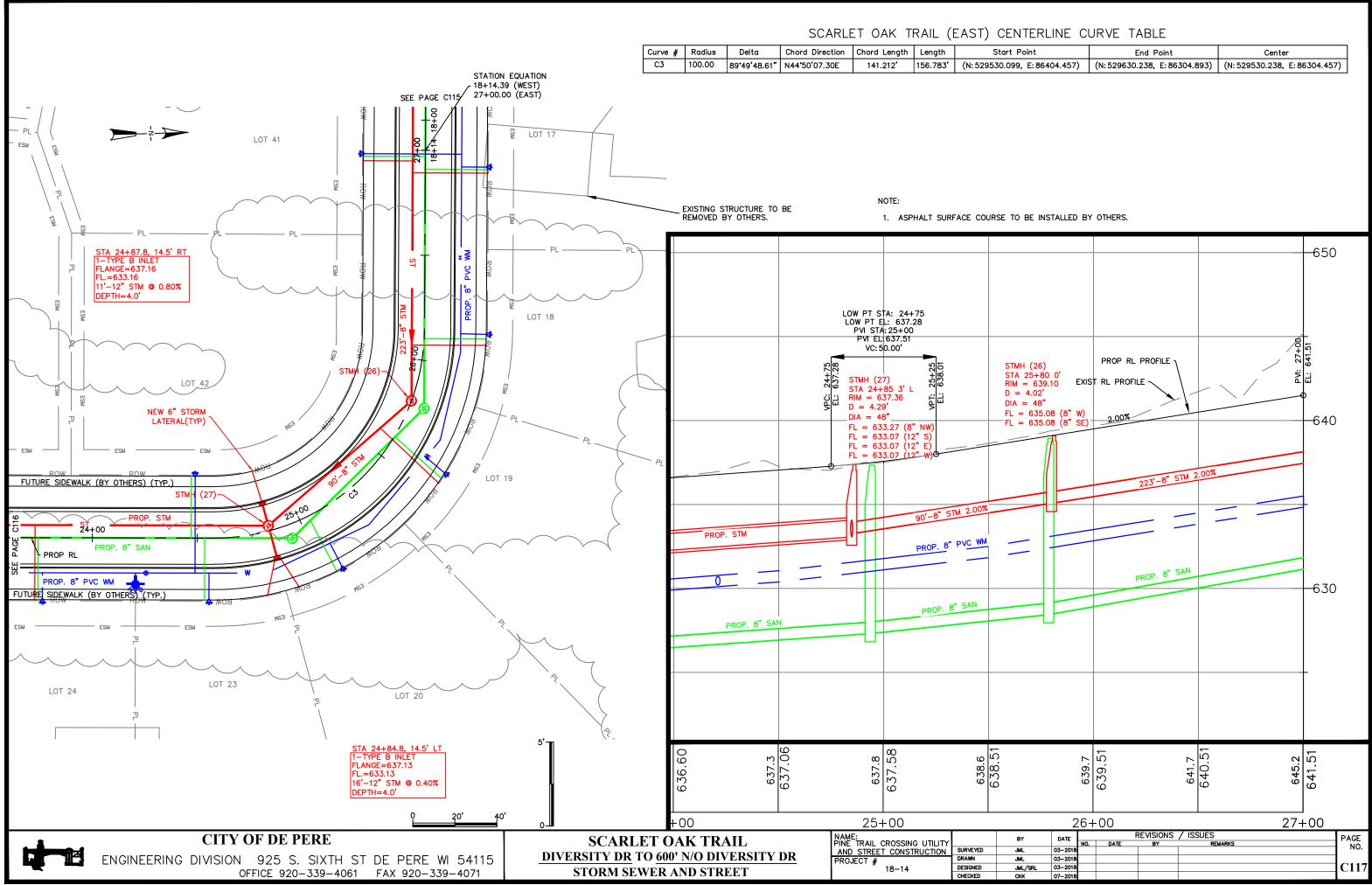




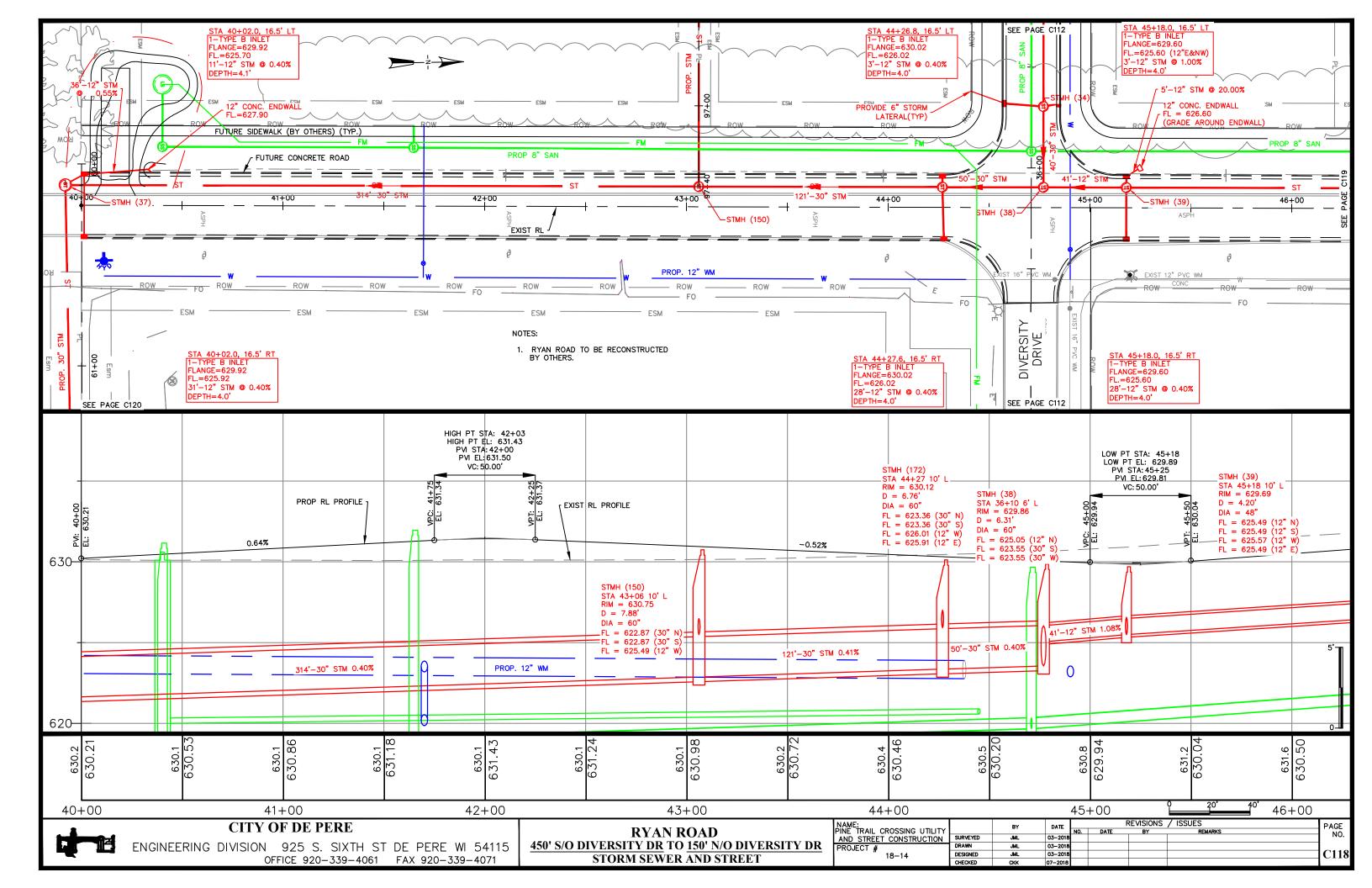


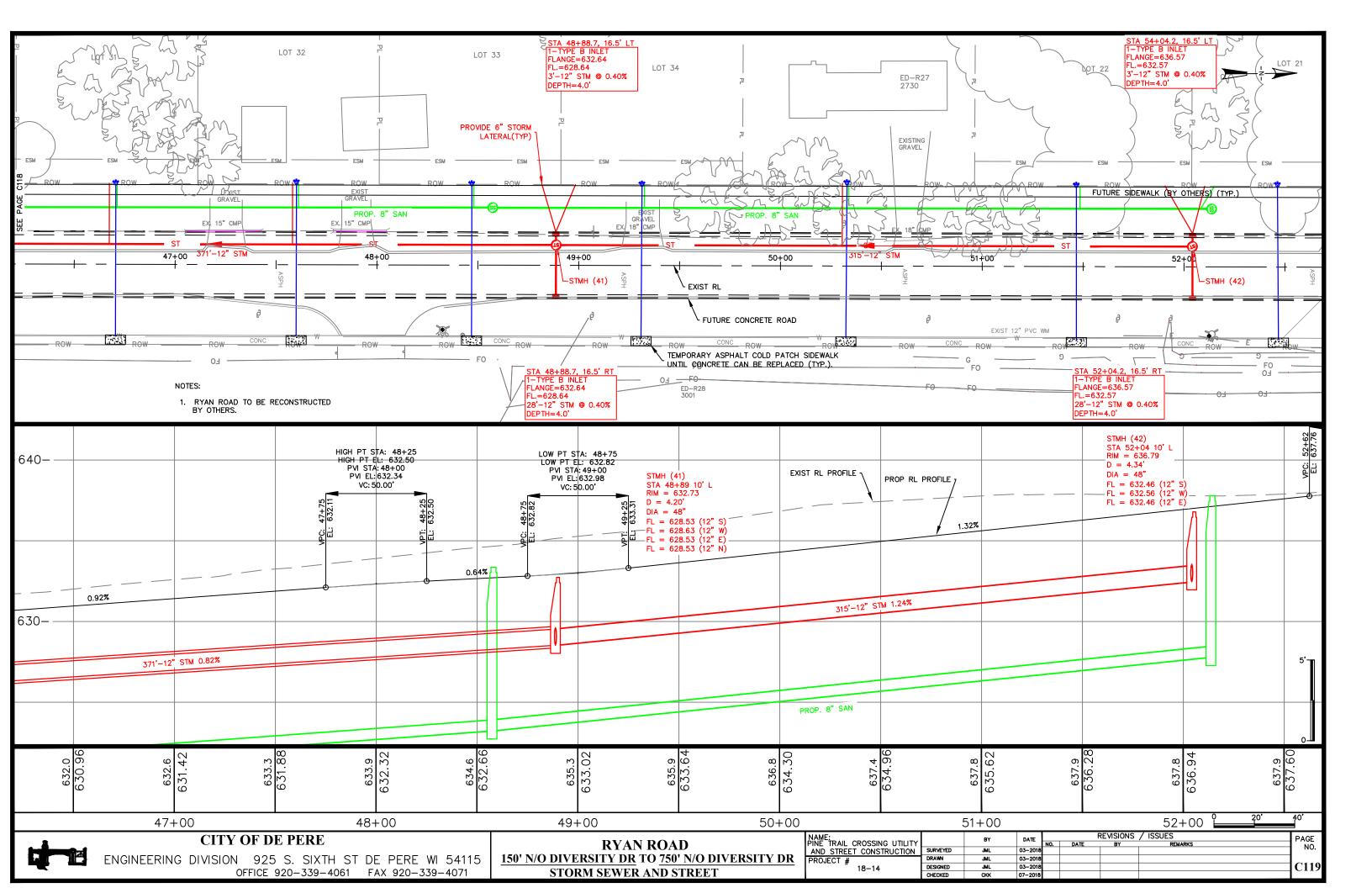


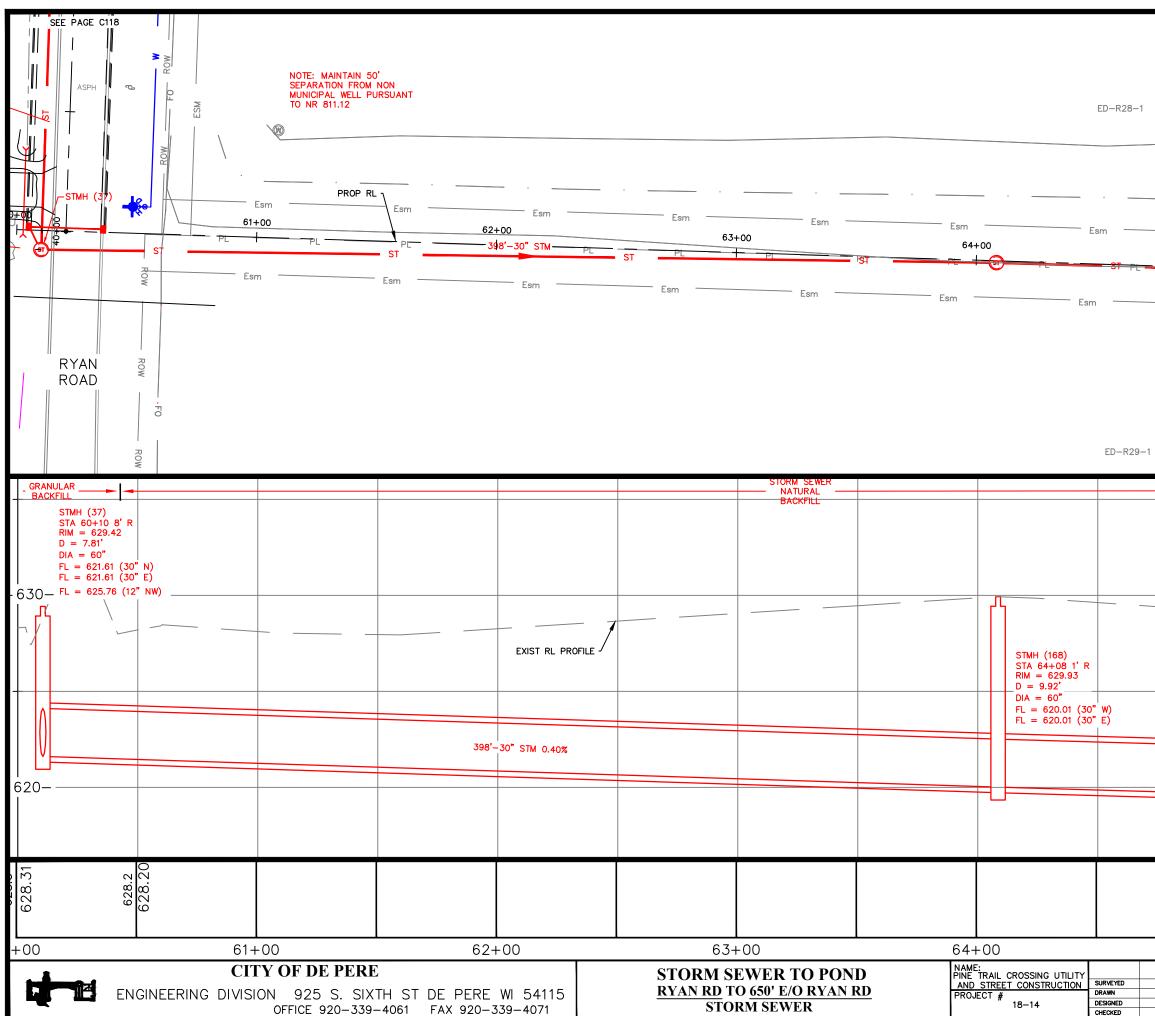




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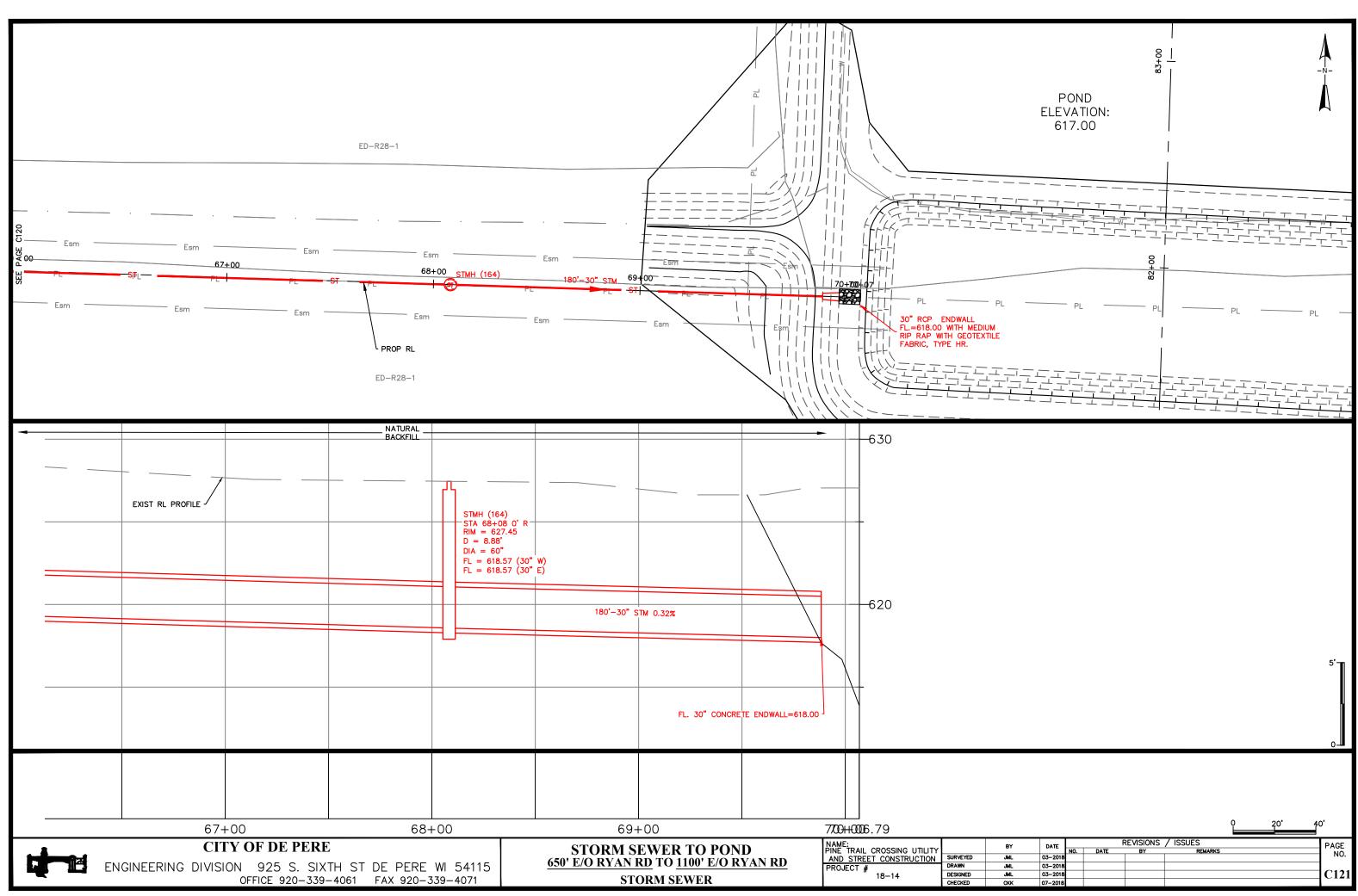




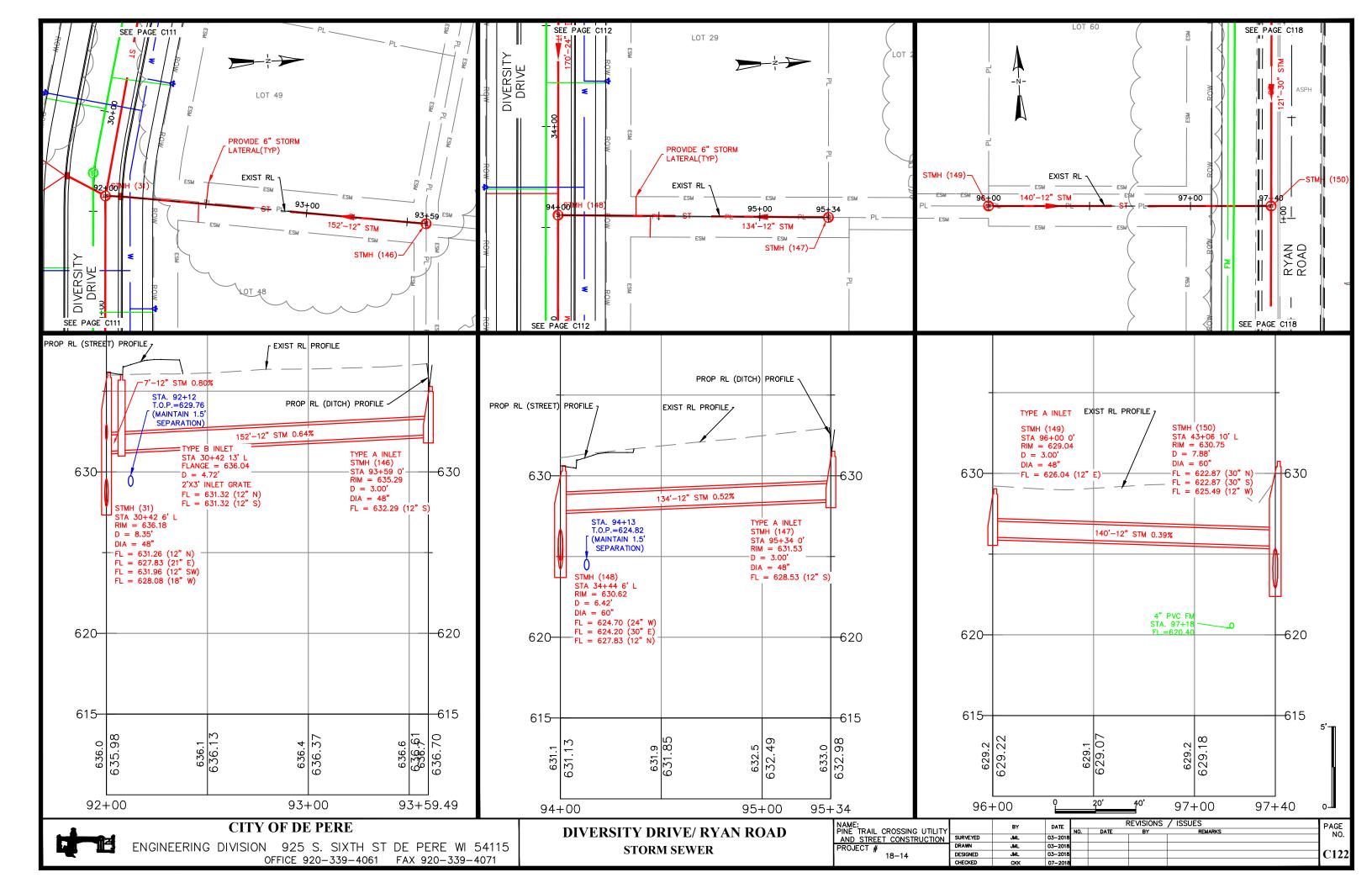


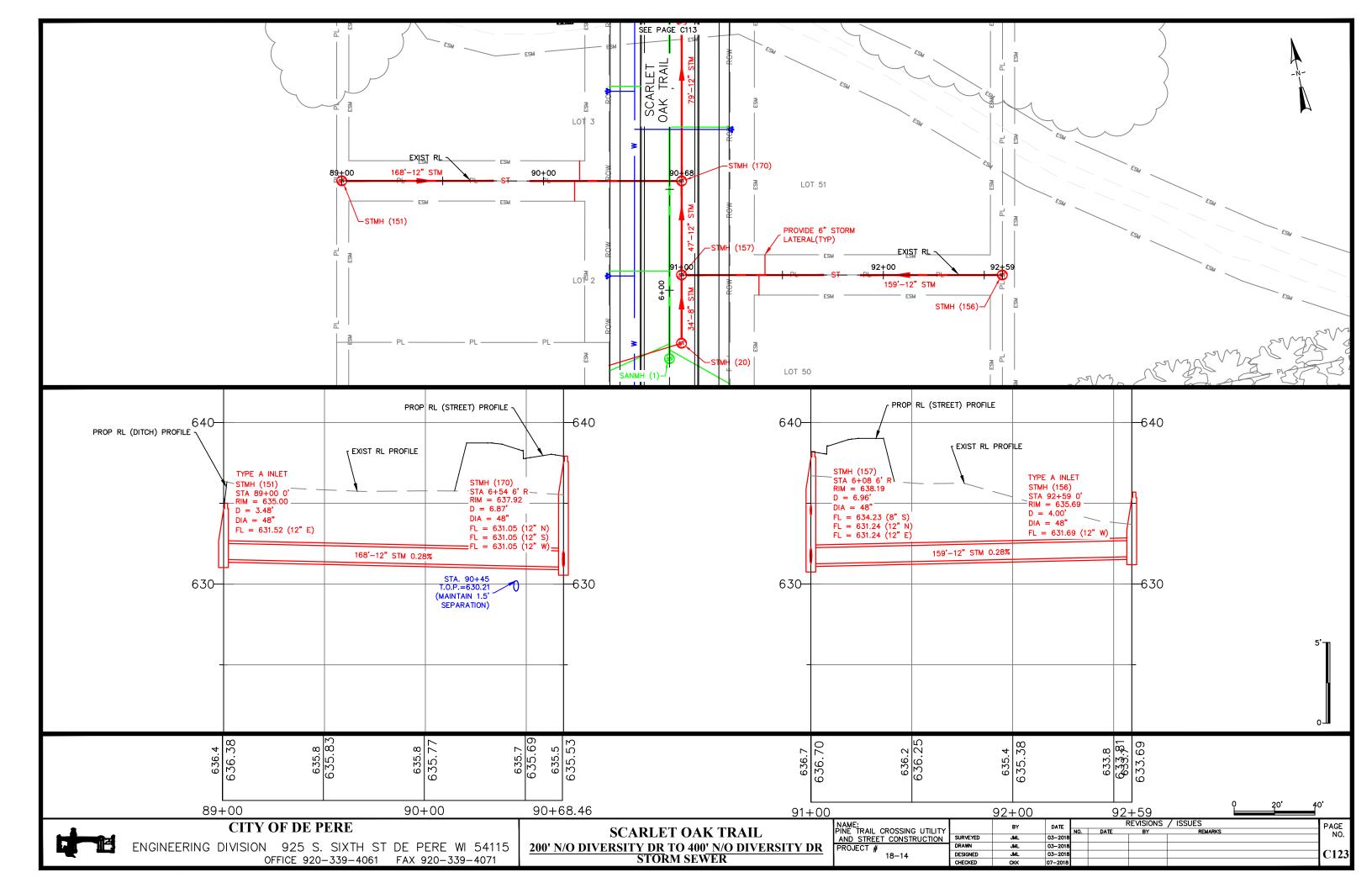
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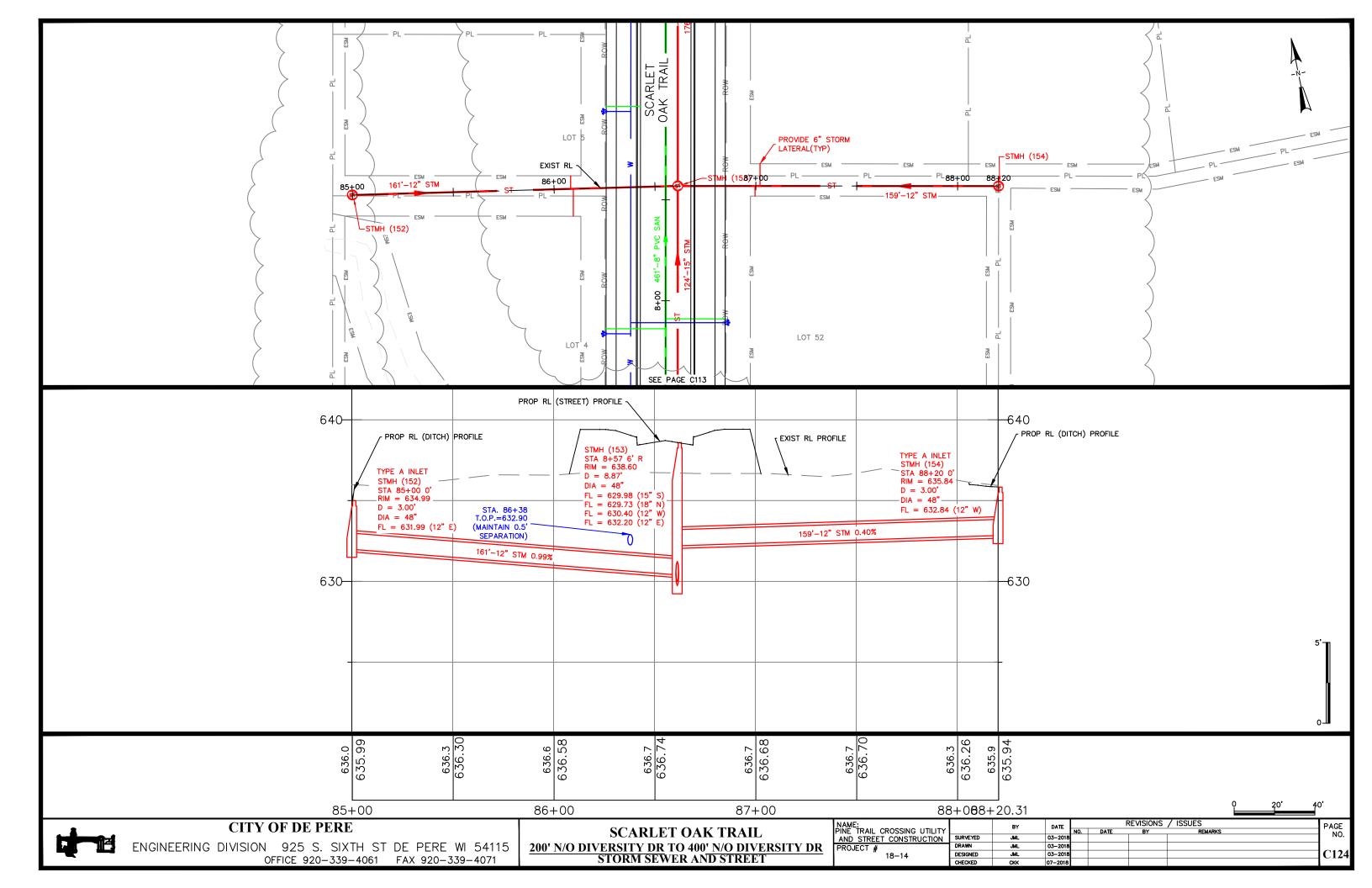
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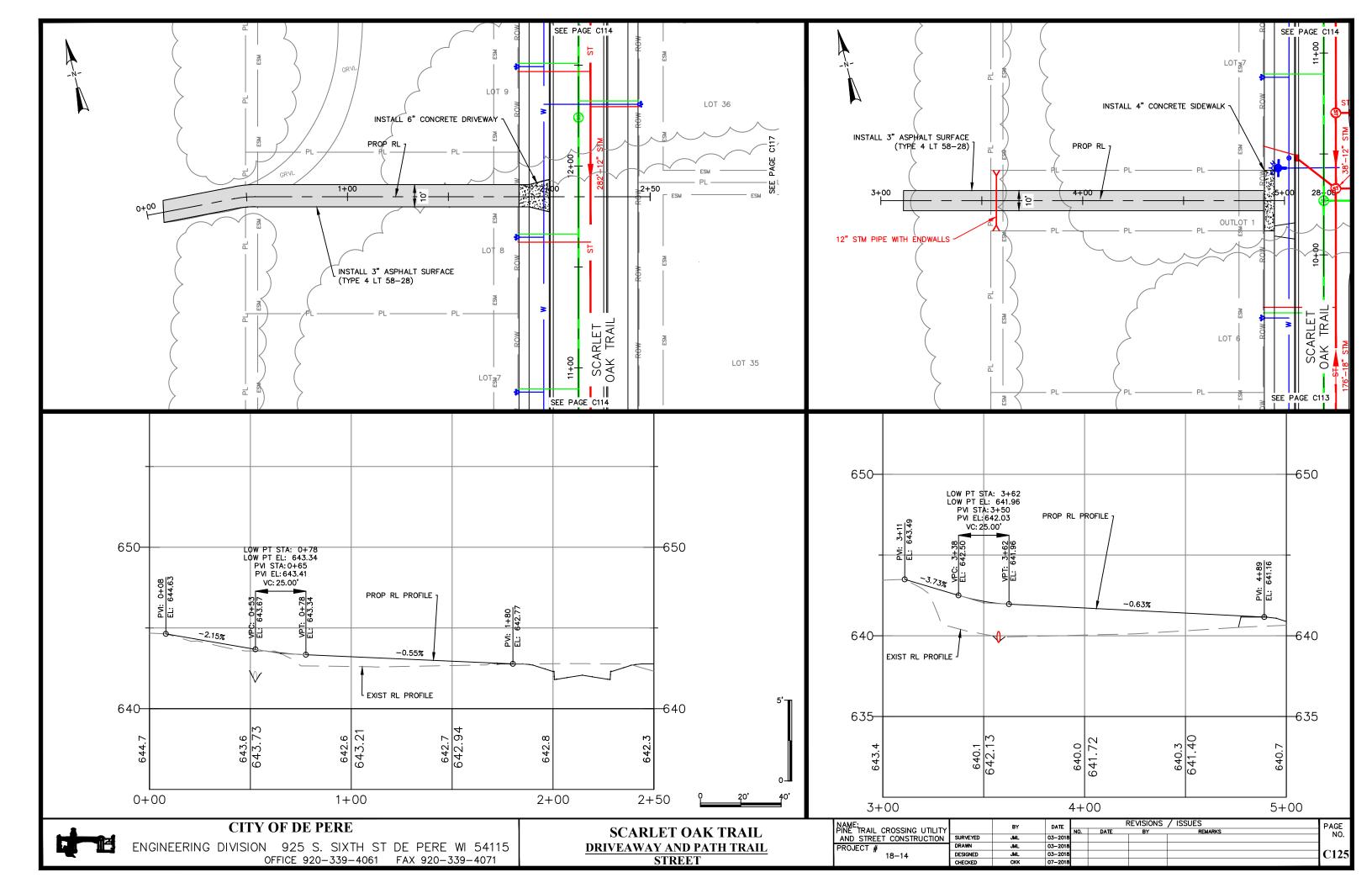


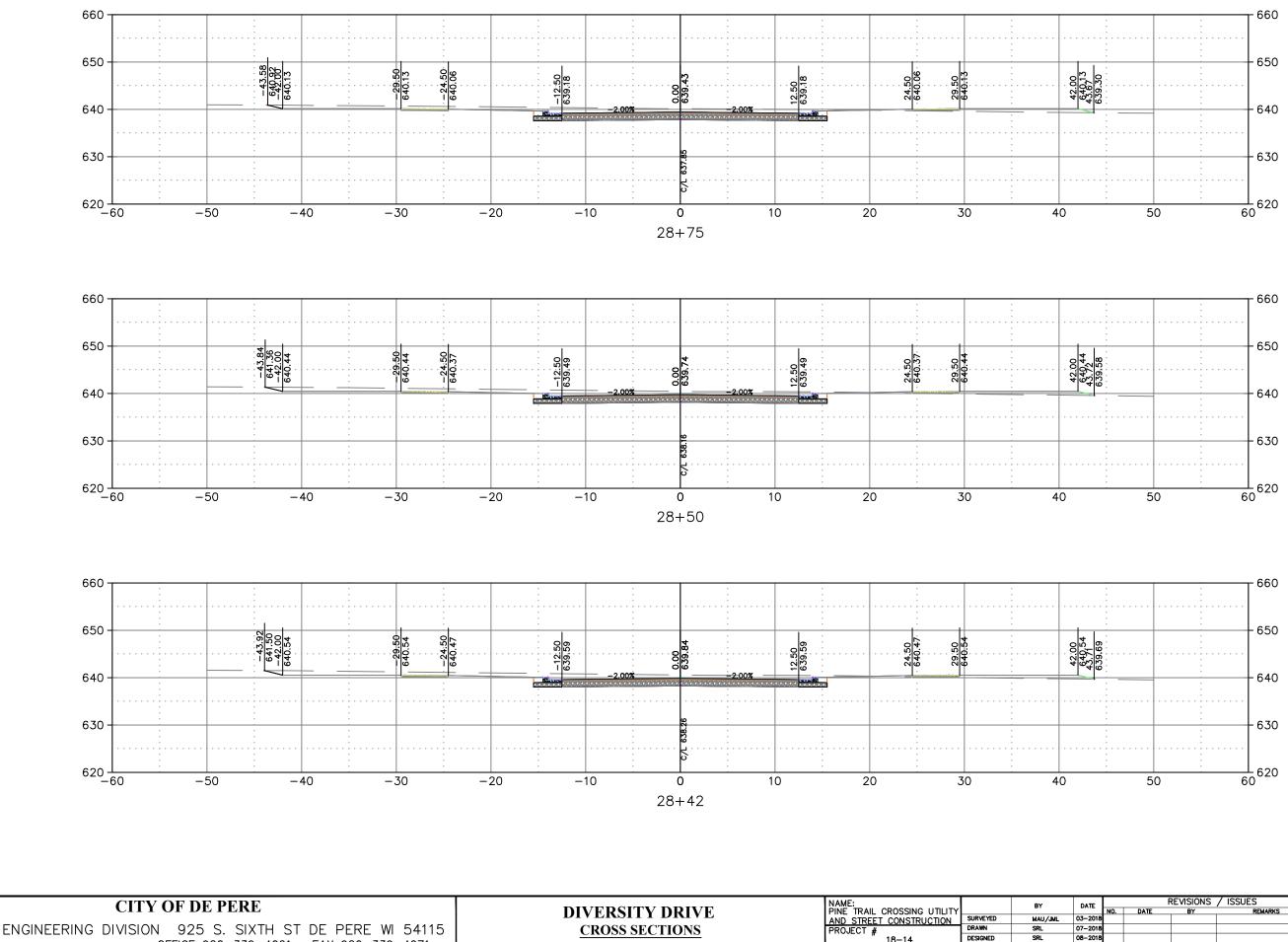
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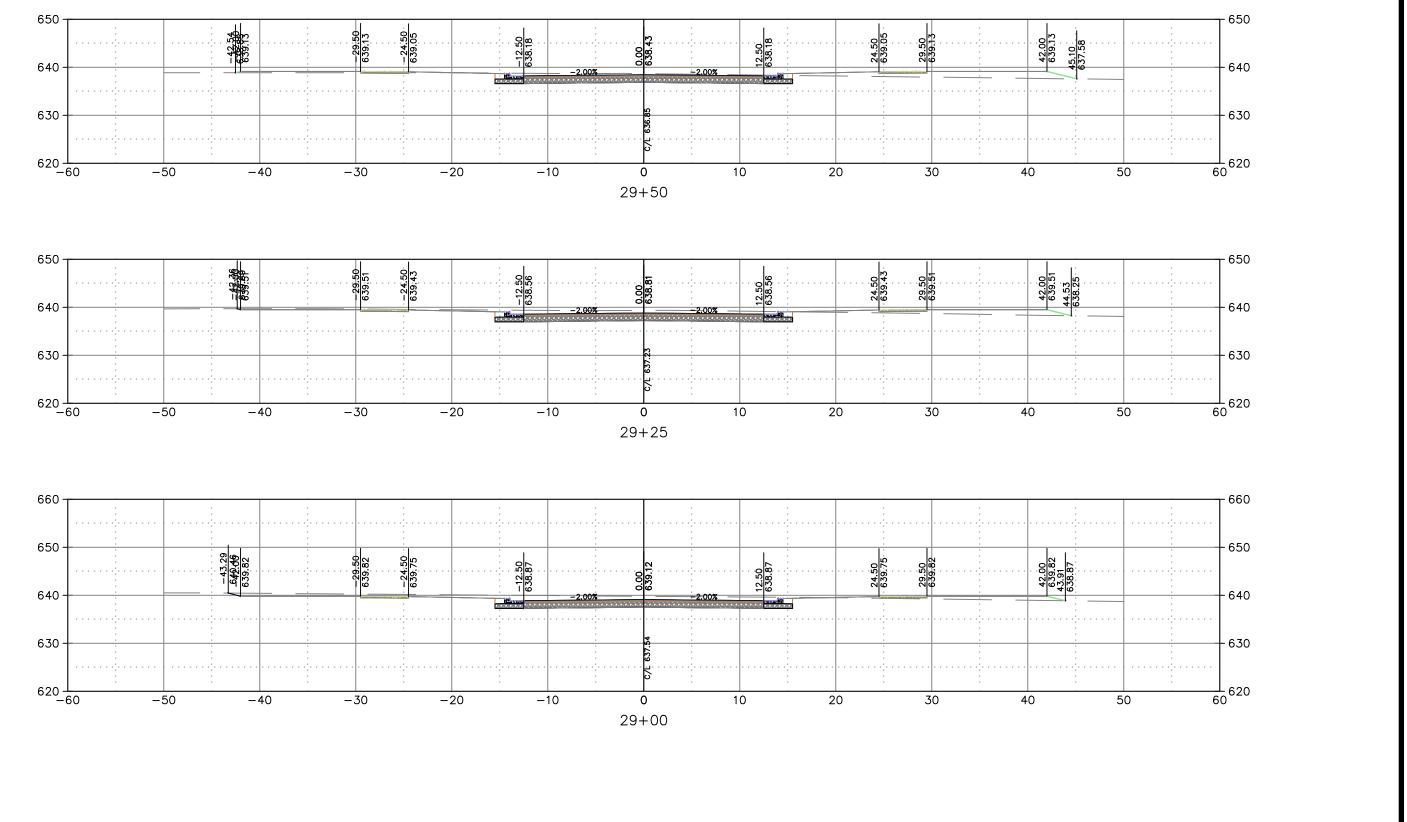


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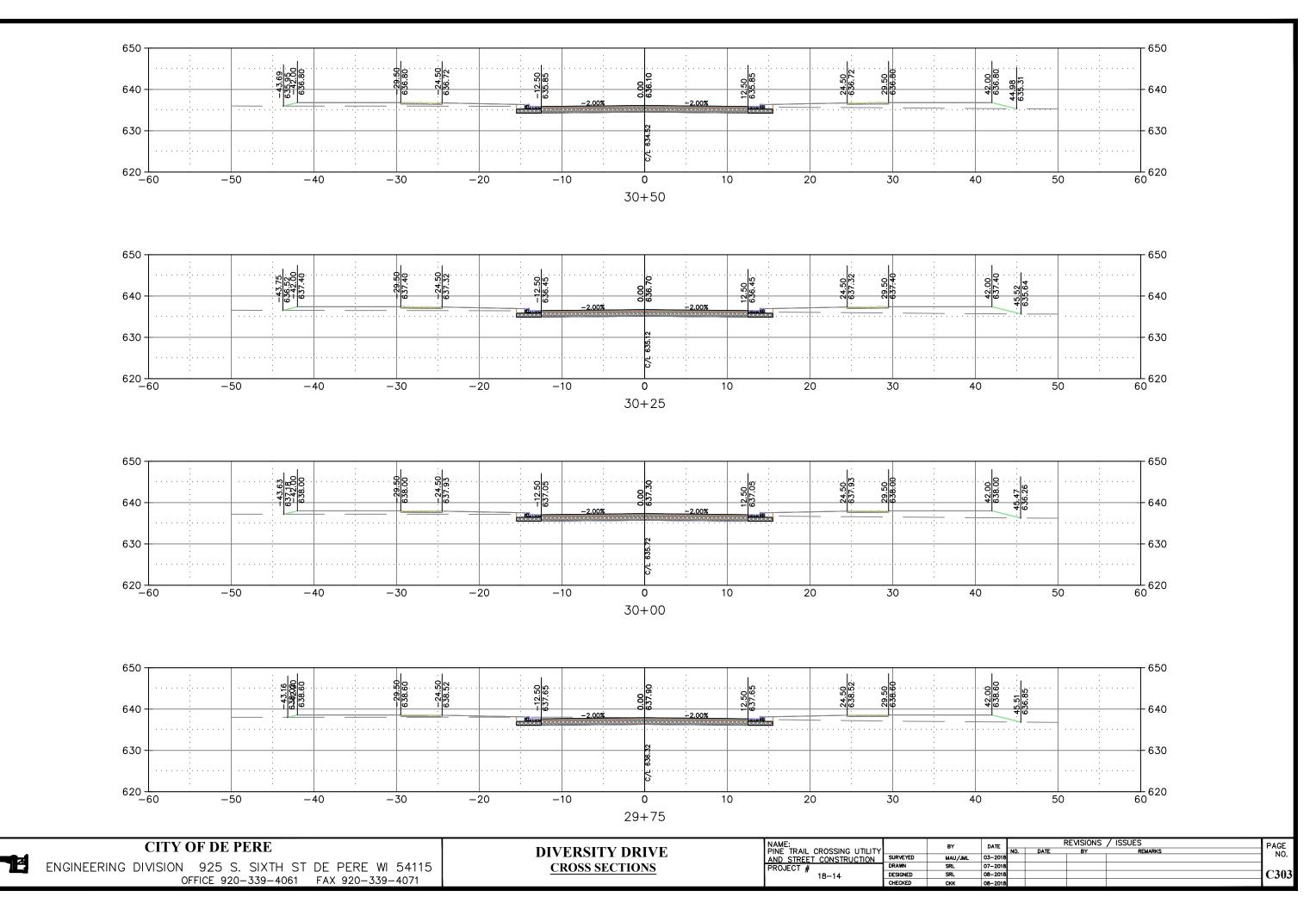
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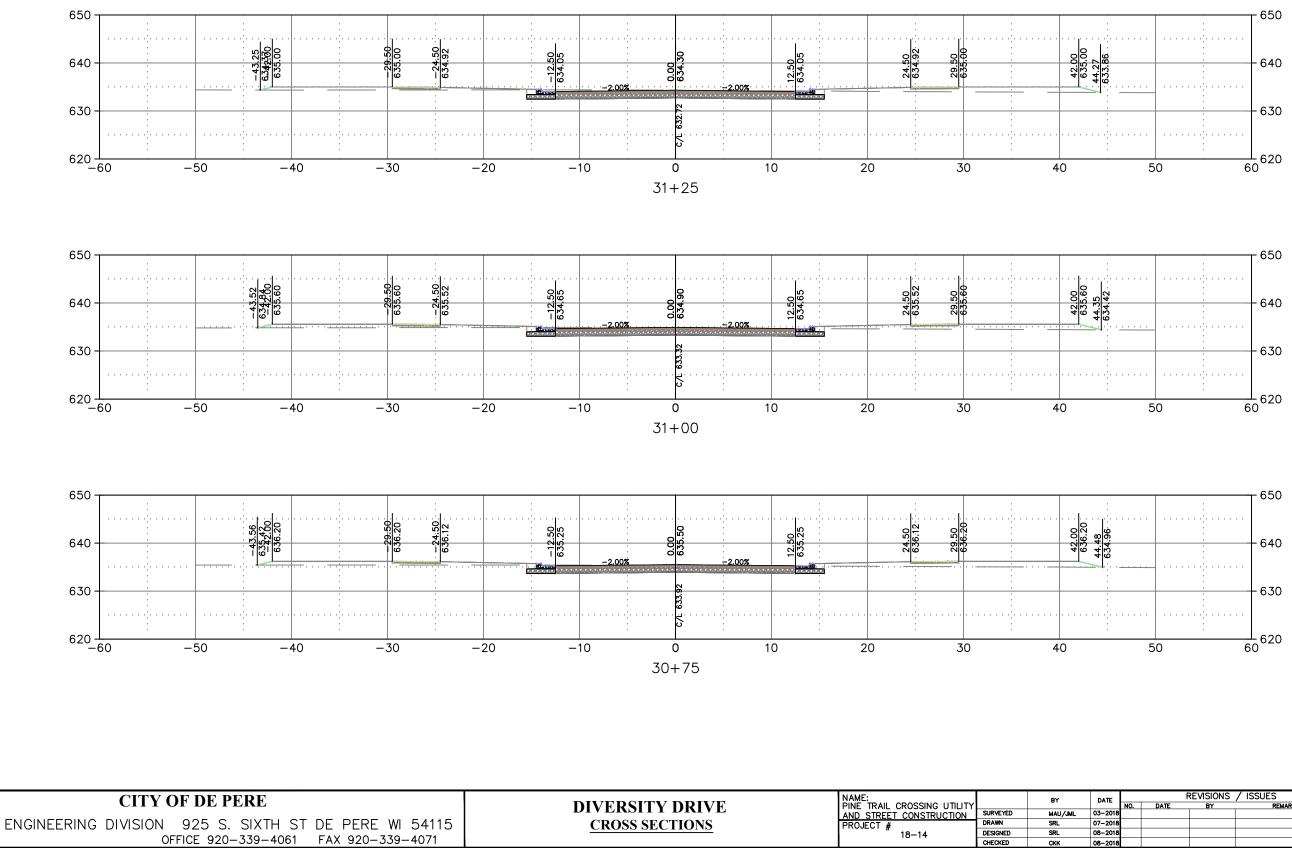
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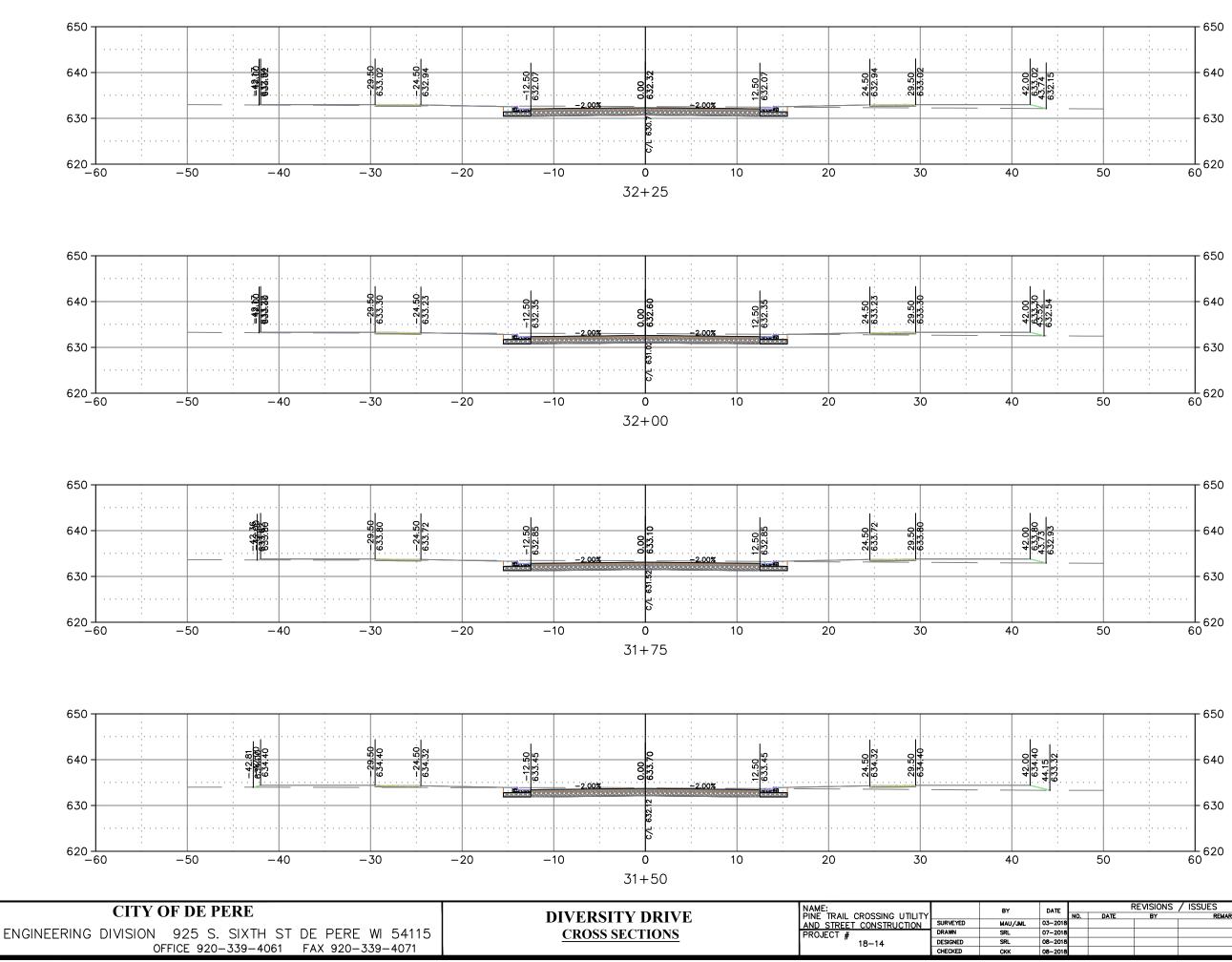


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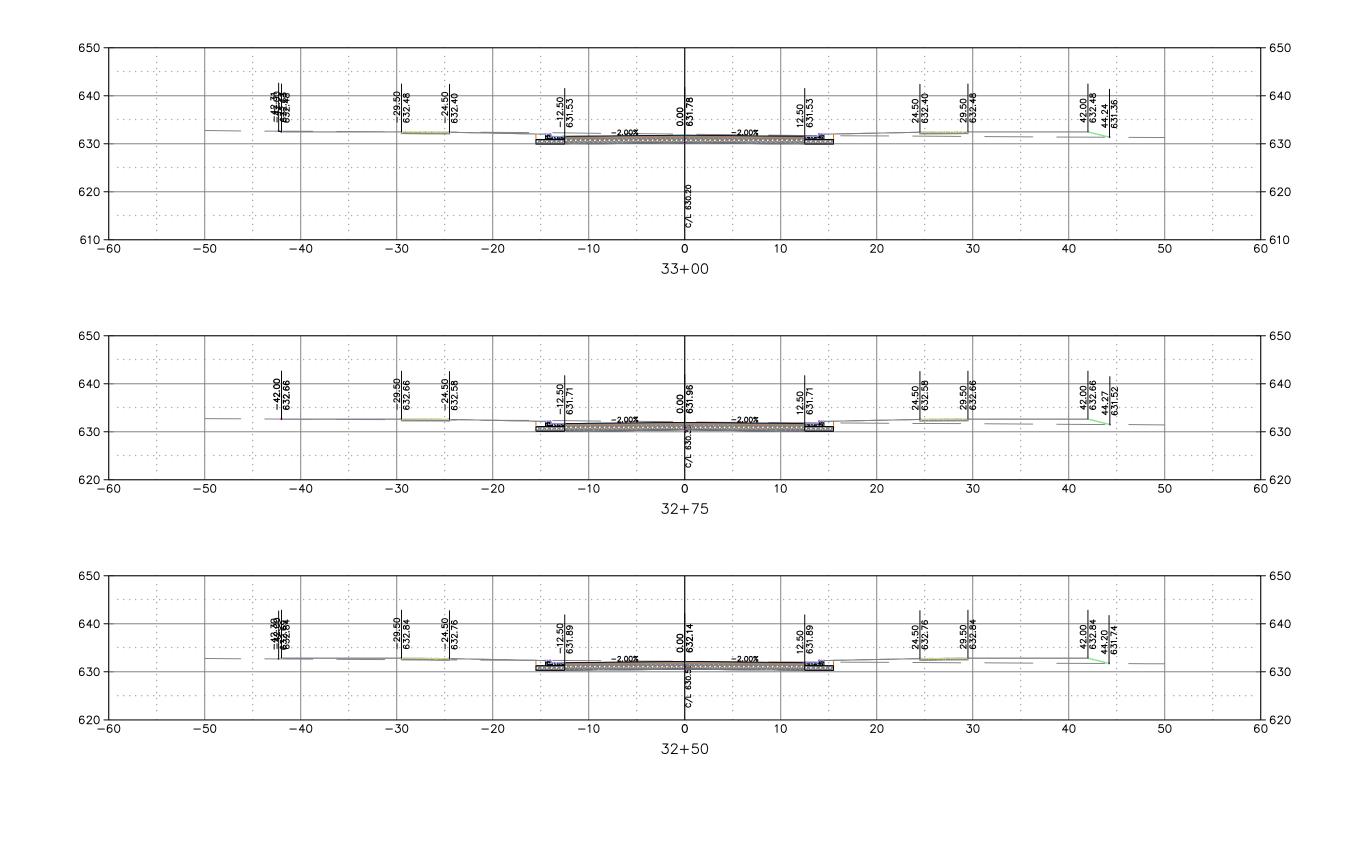




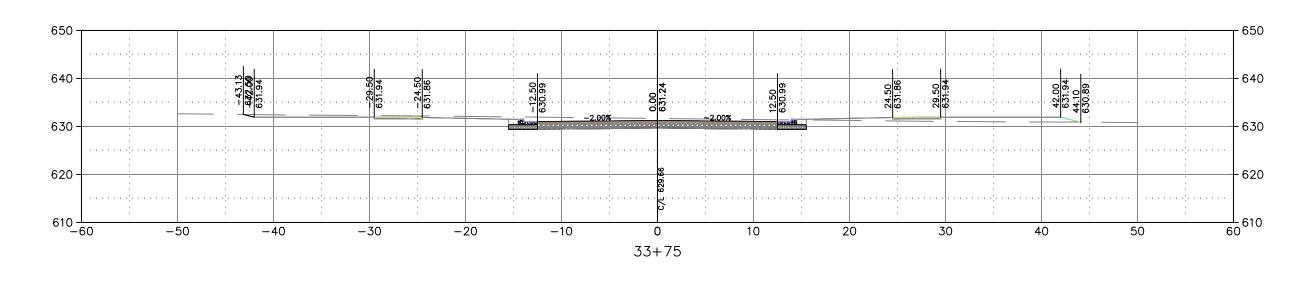
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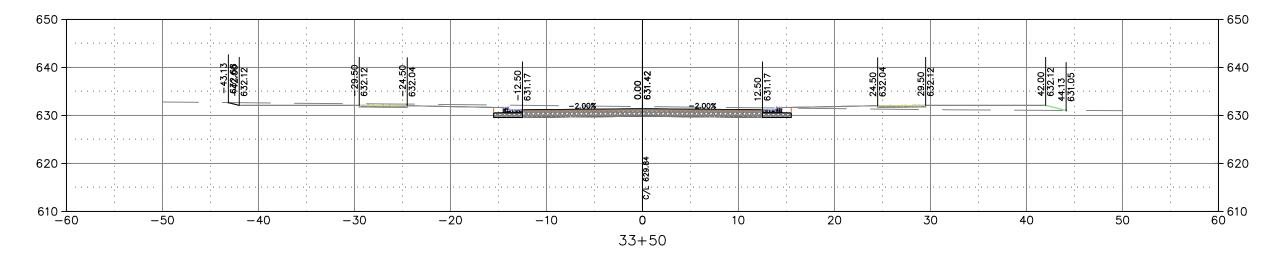


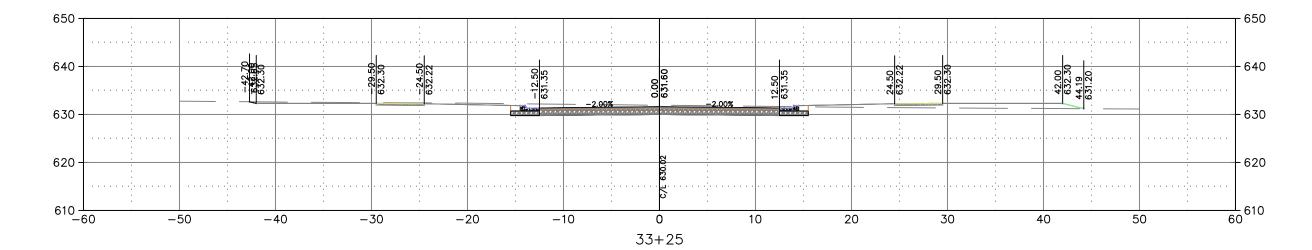
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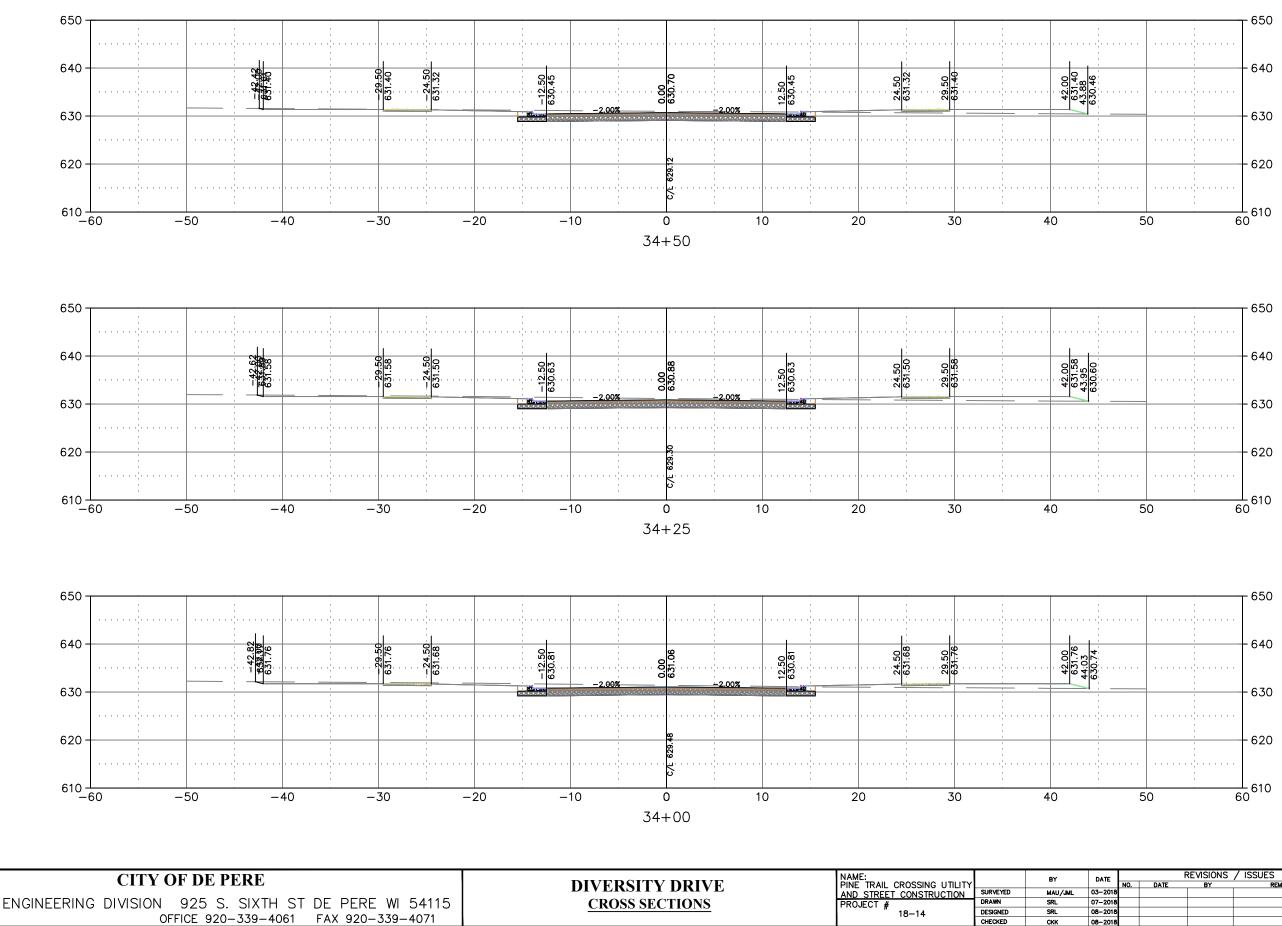




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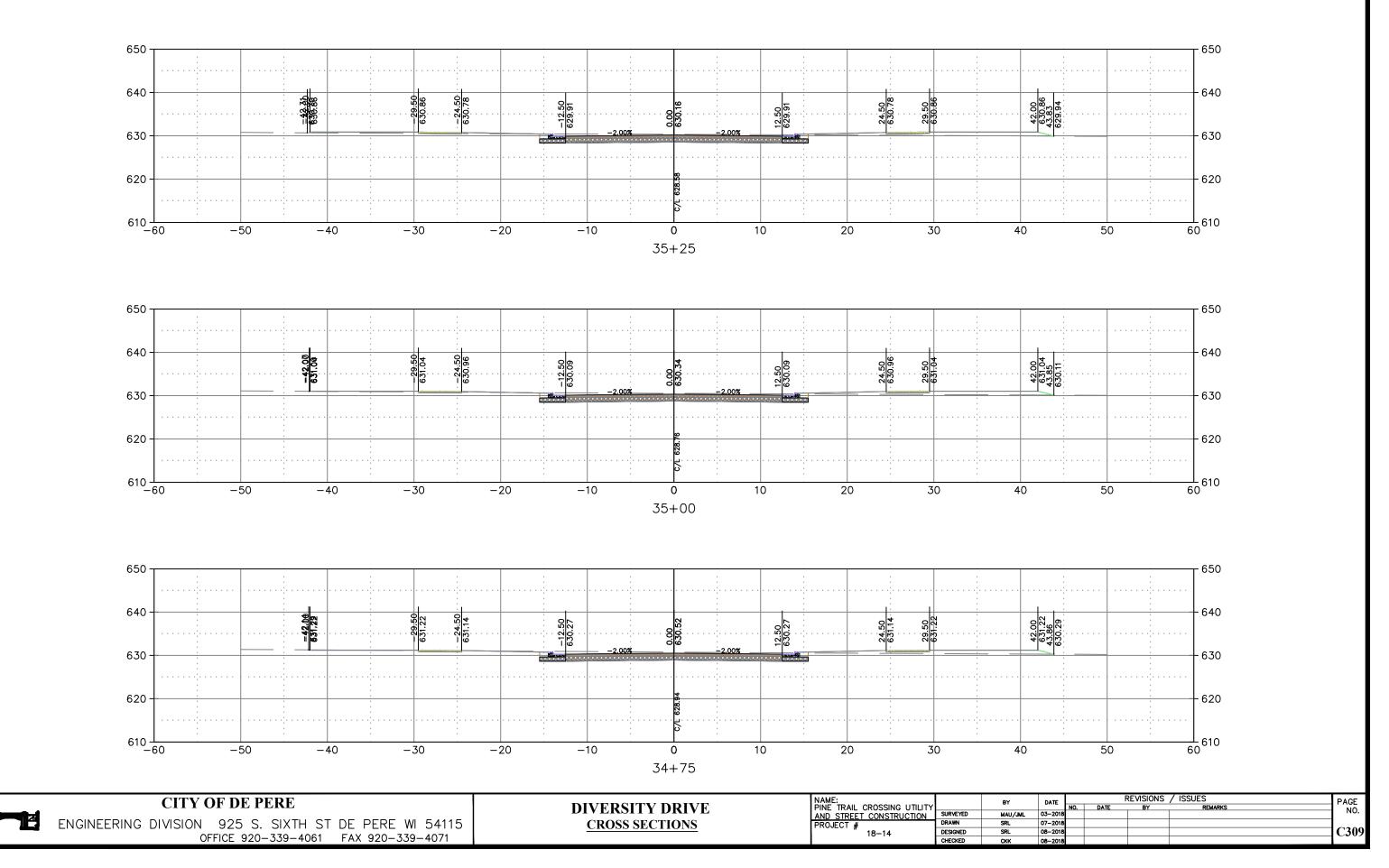
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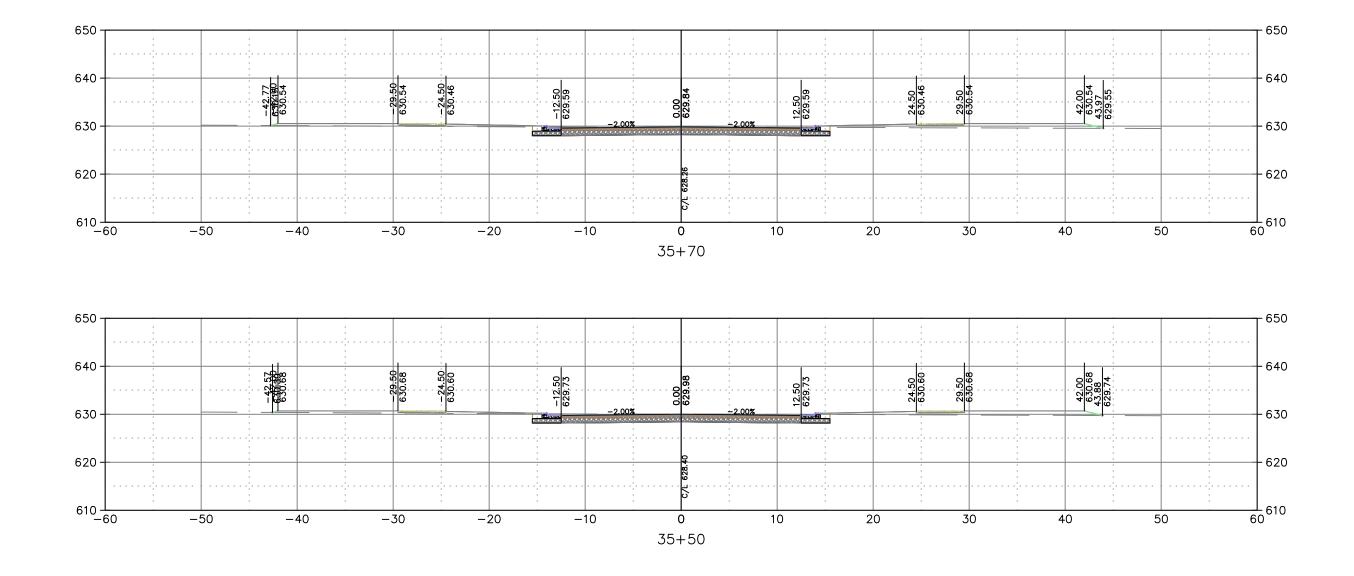


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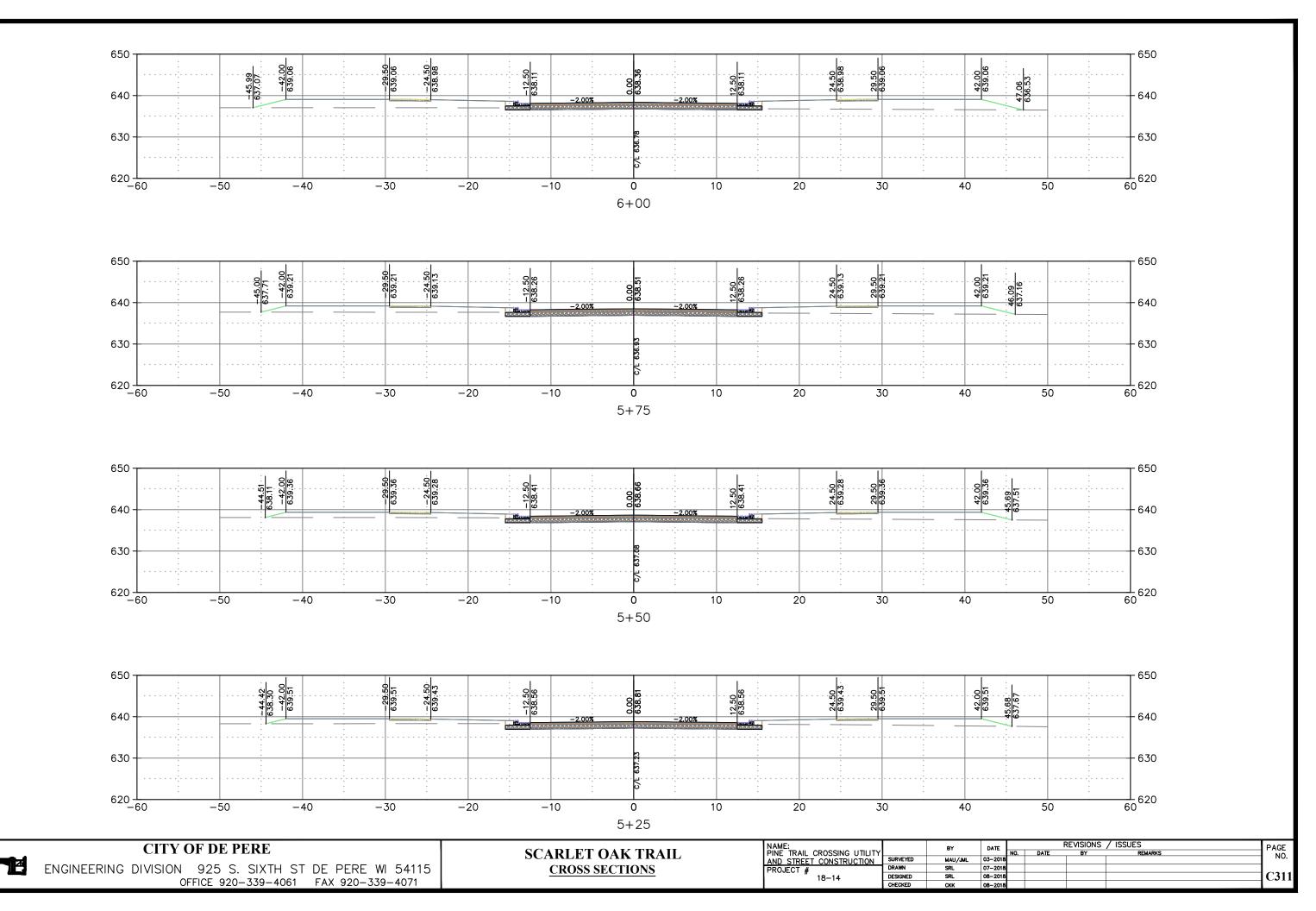


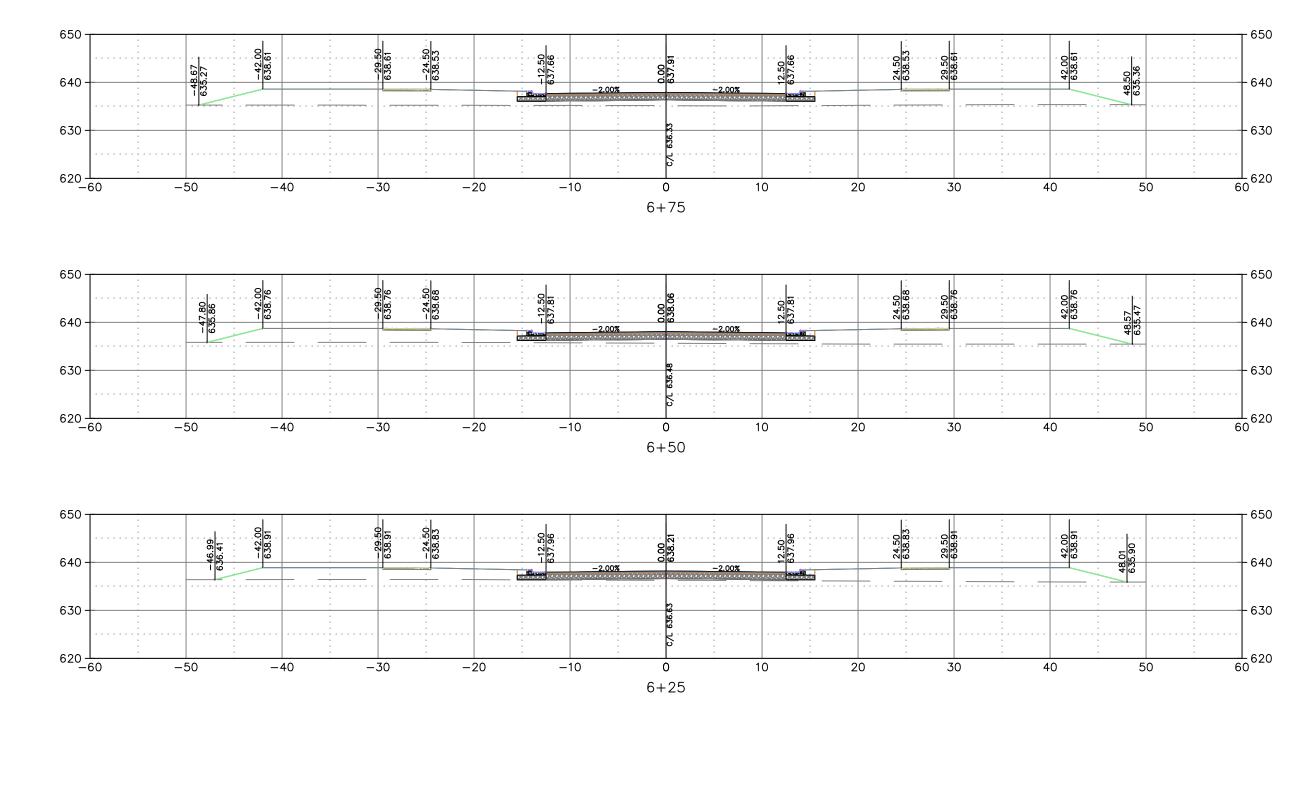




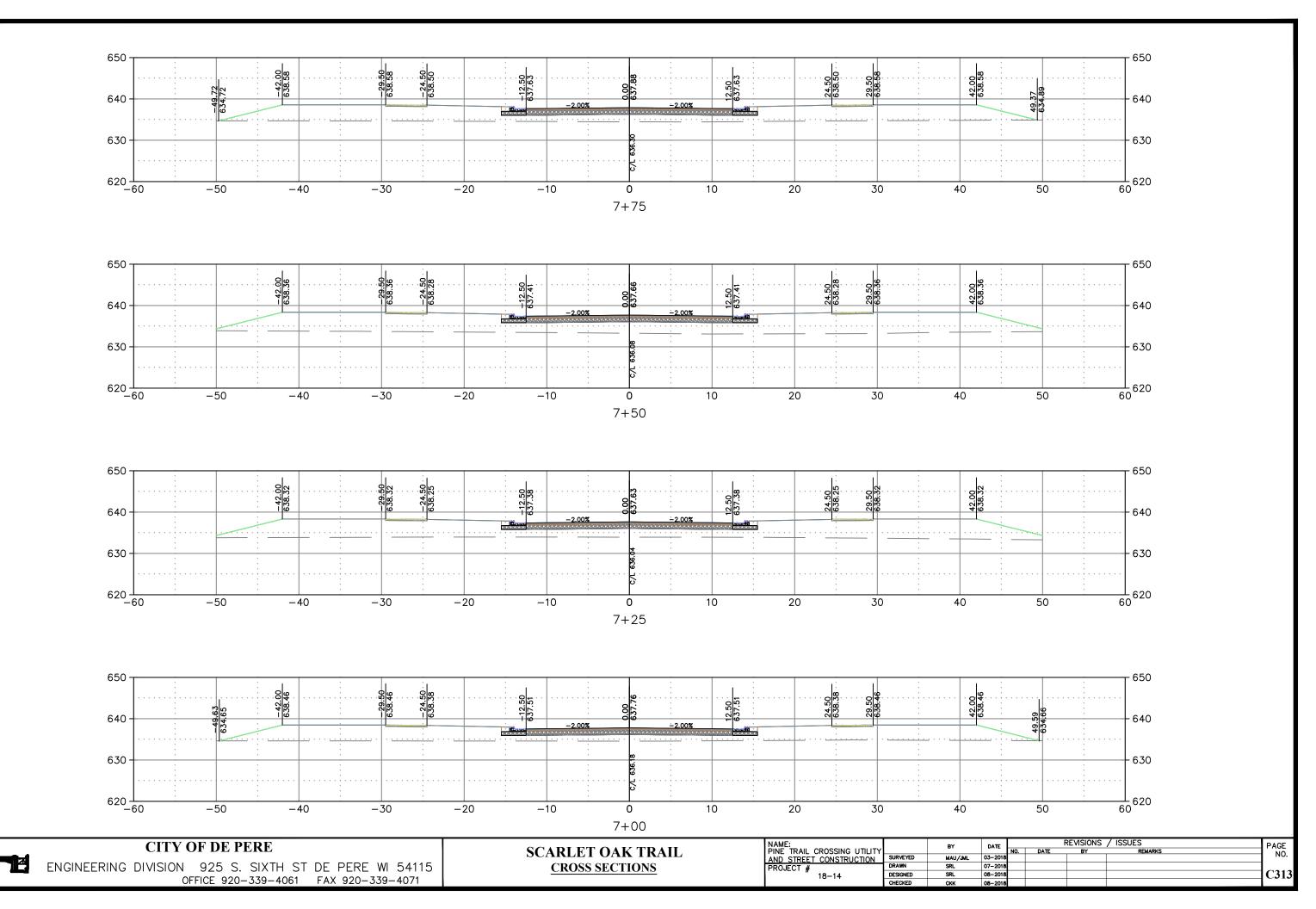


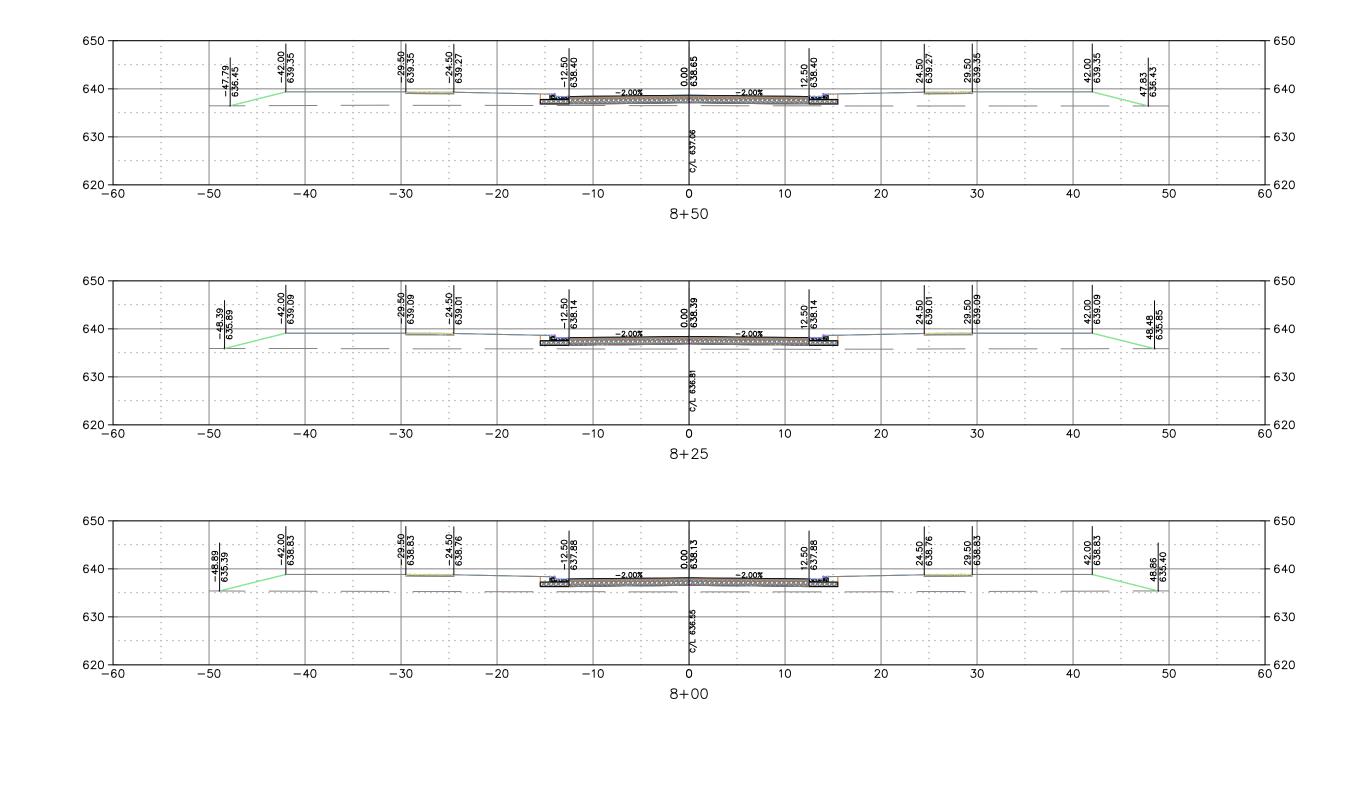
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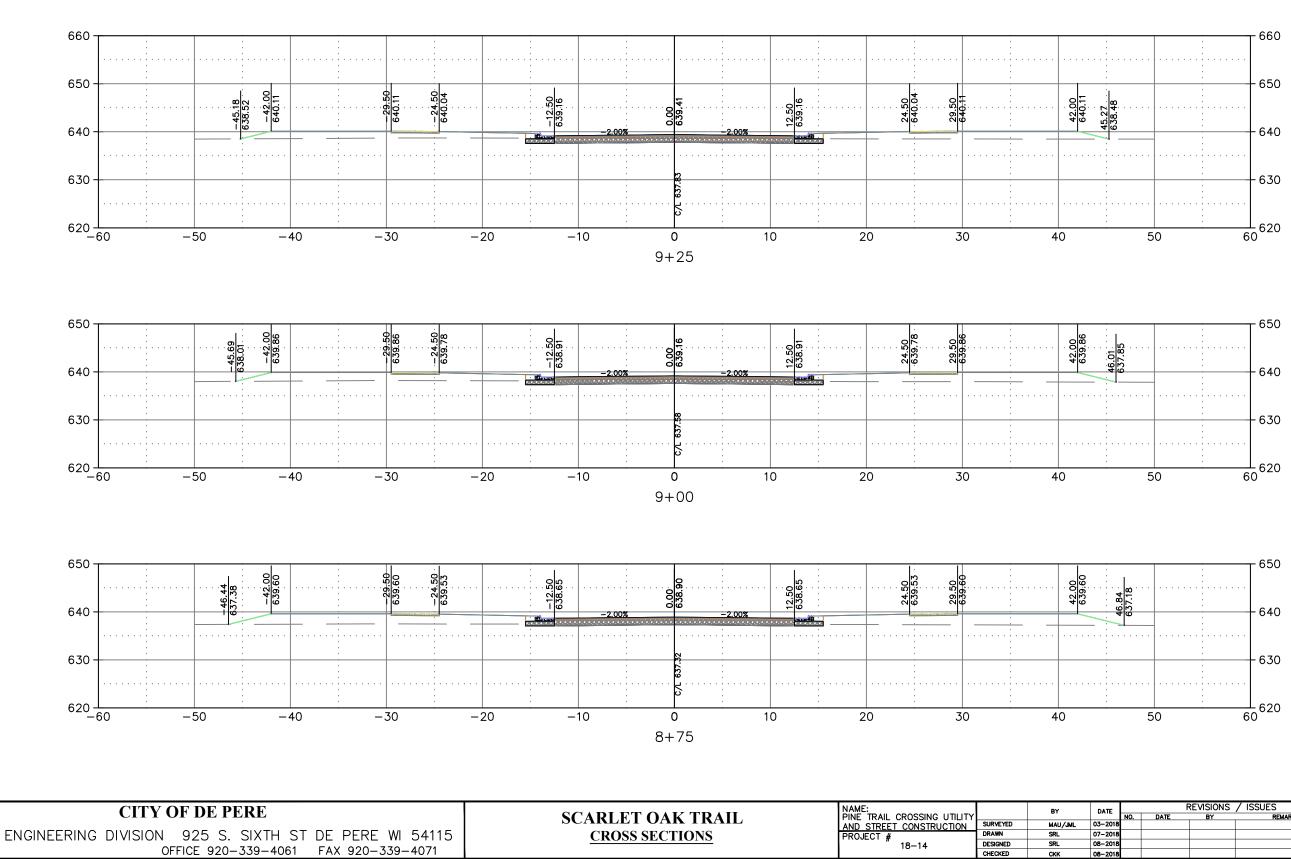


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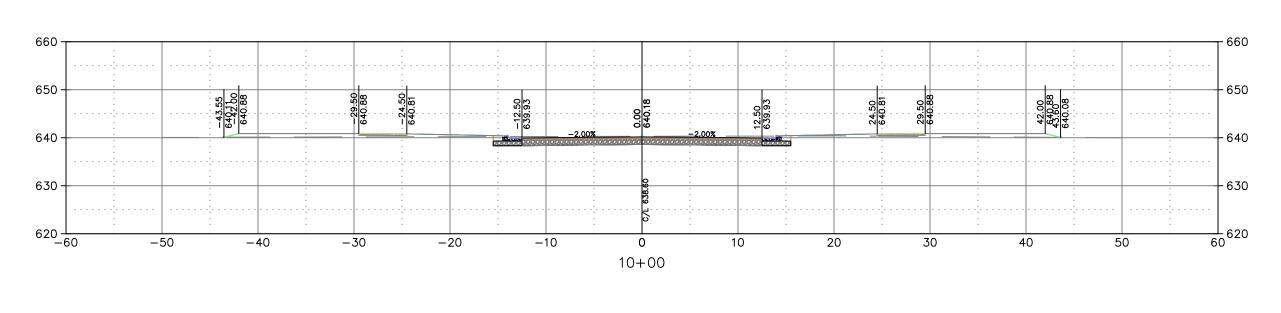


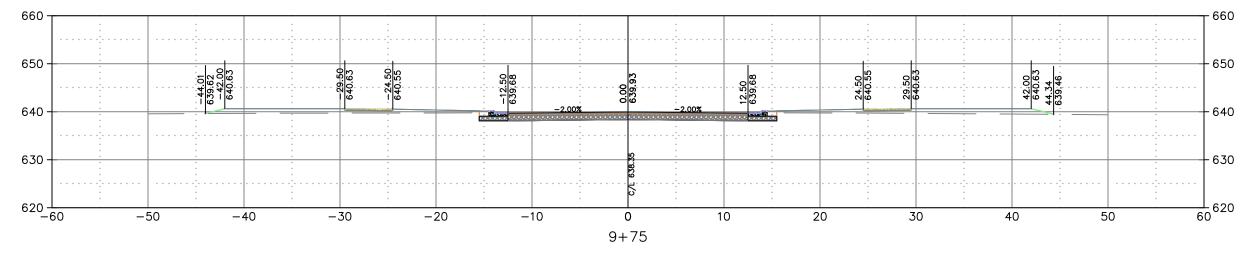


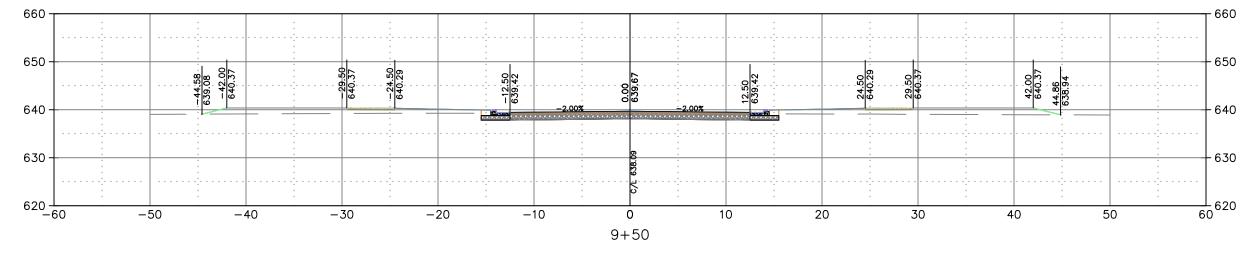
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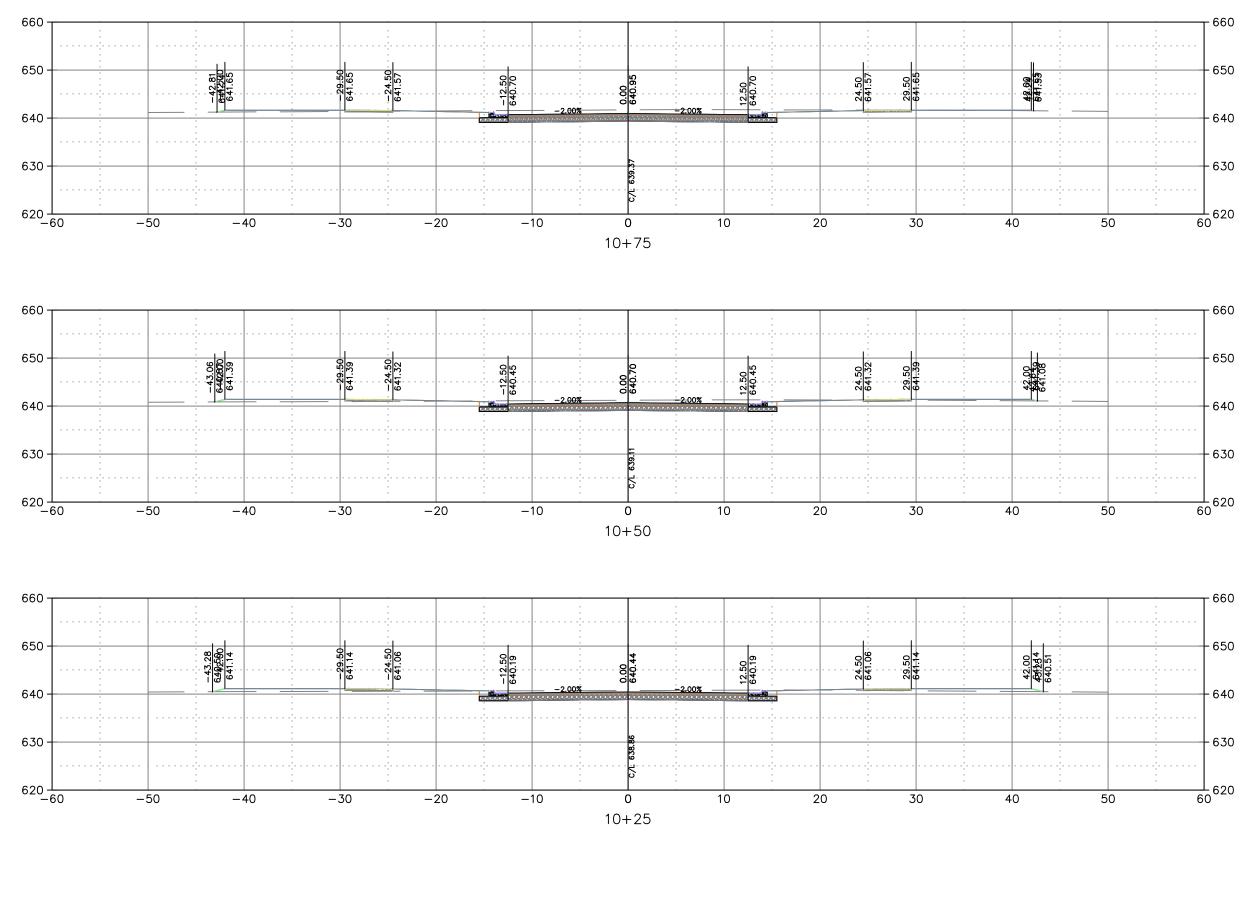




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SCARLET OAK TRAIL <u>CROSS SECTIONS</u>

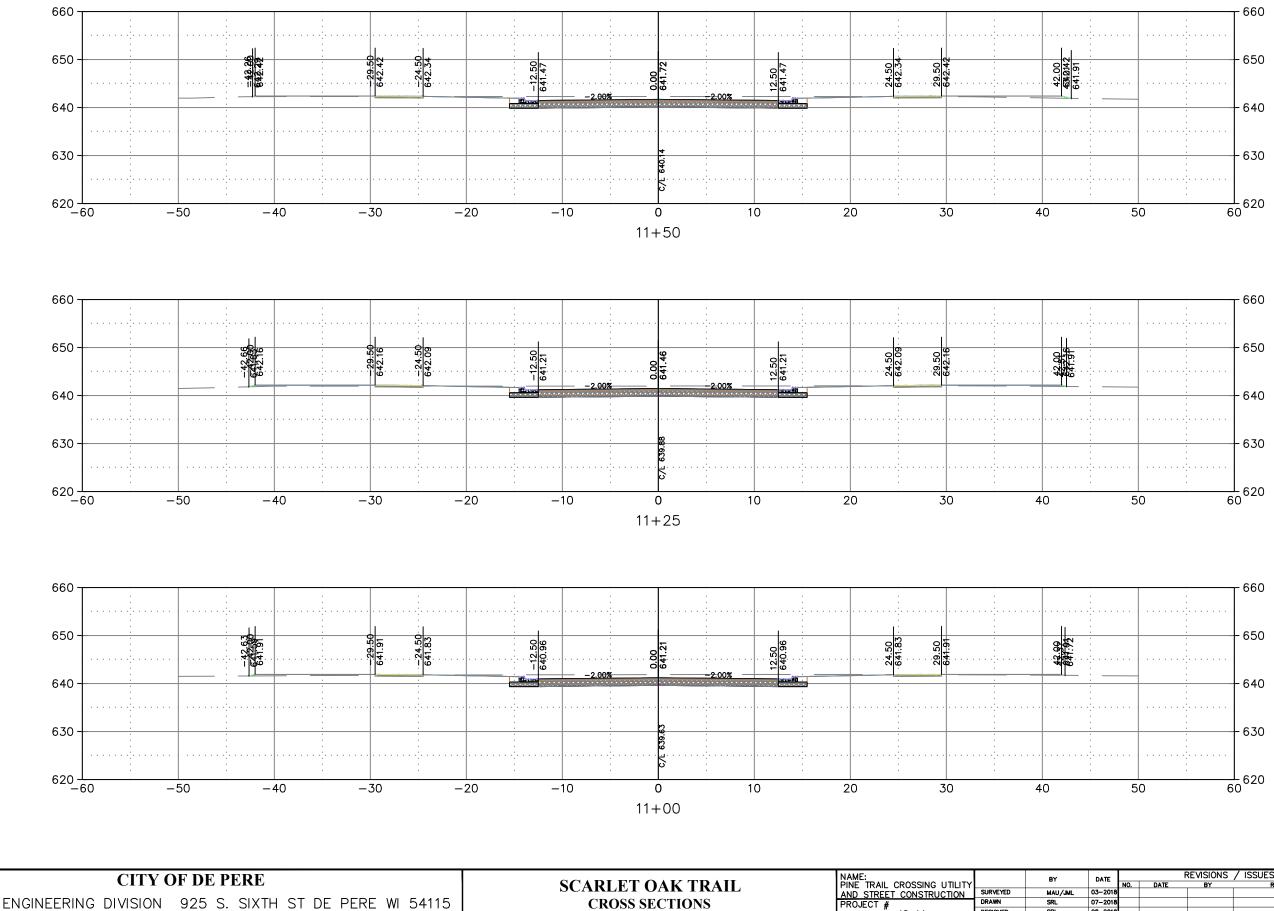
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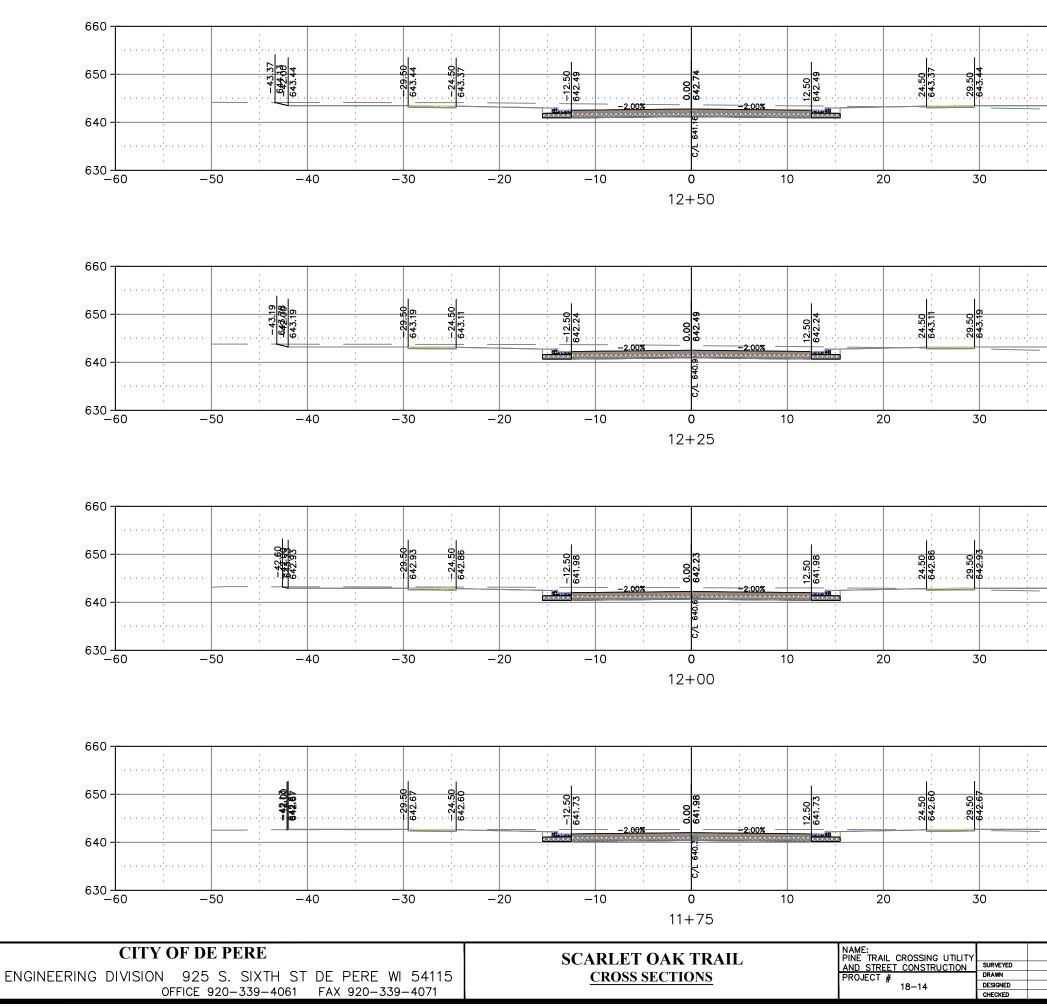


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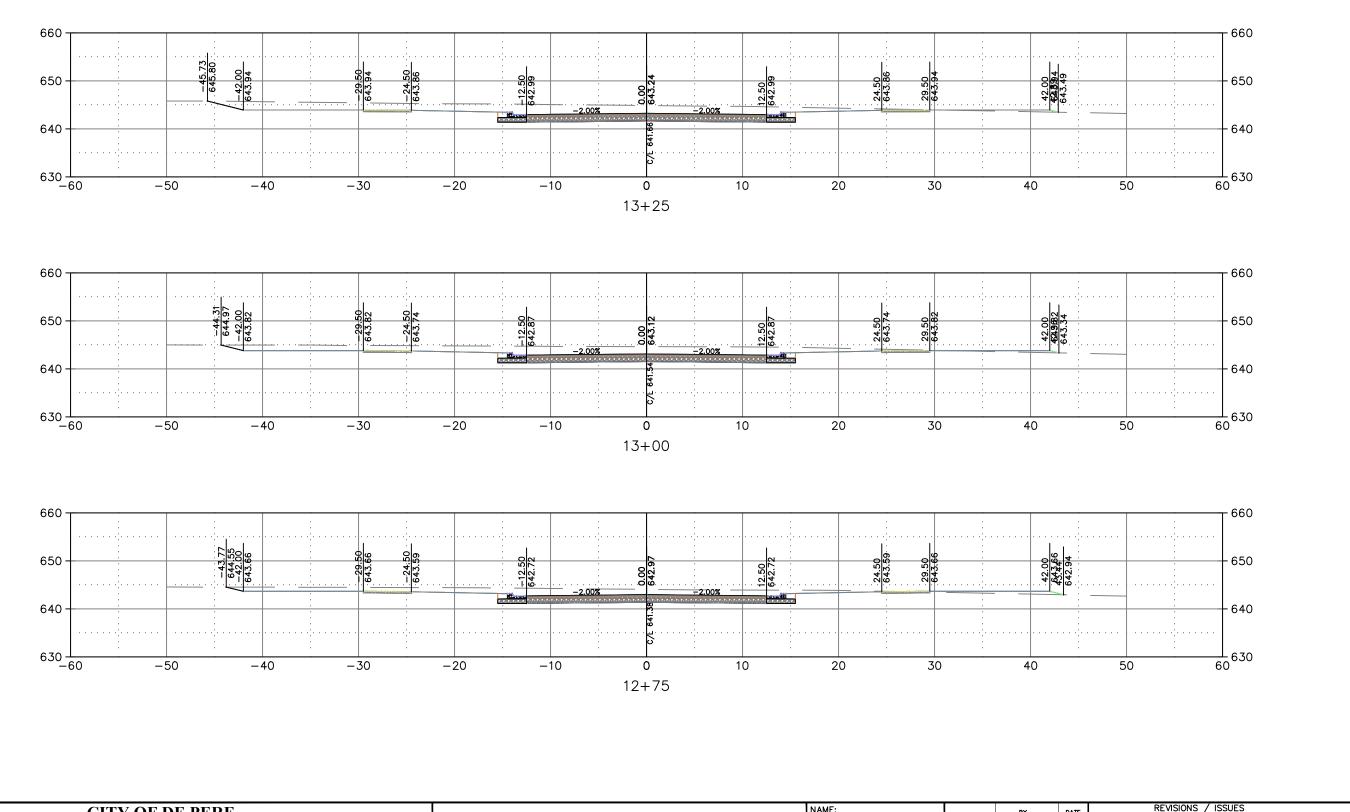


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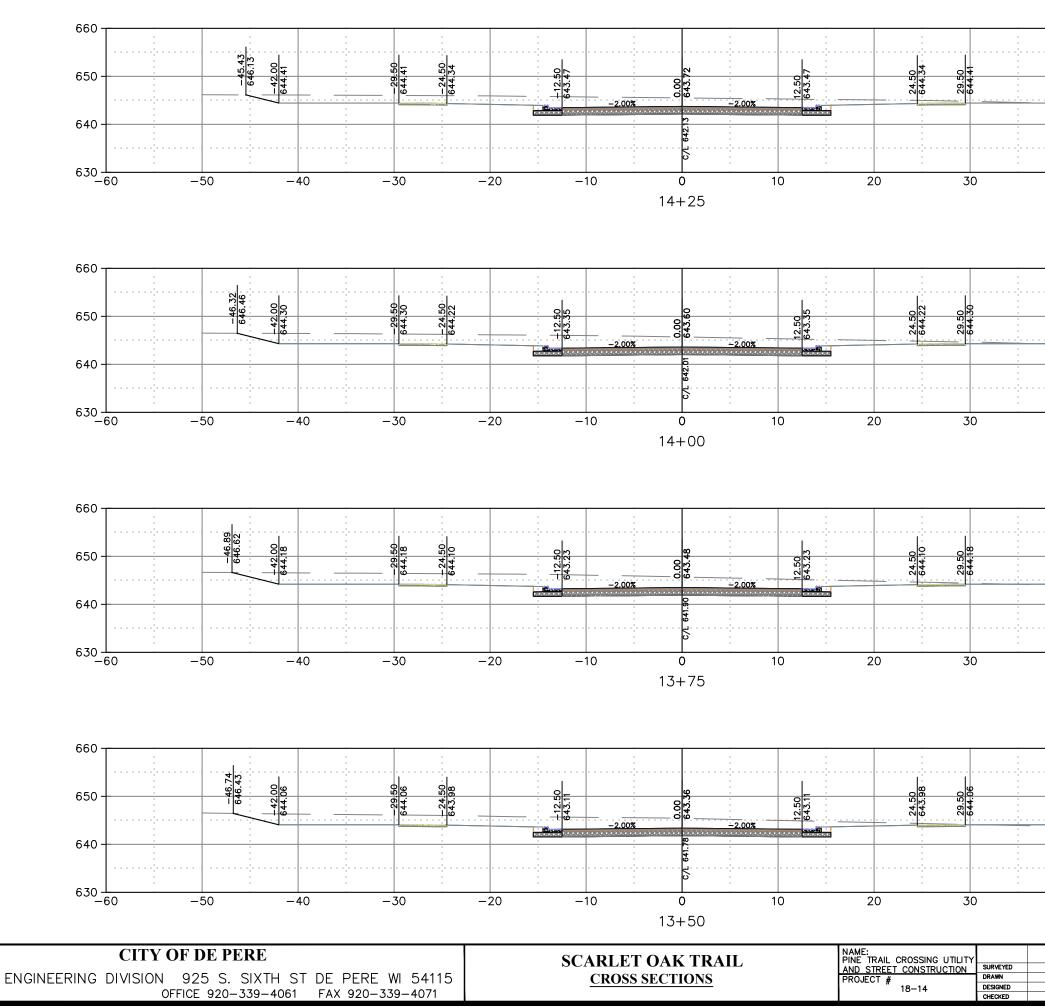


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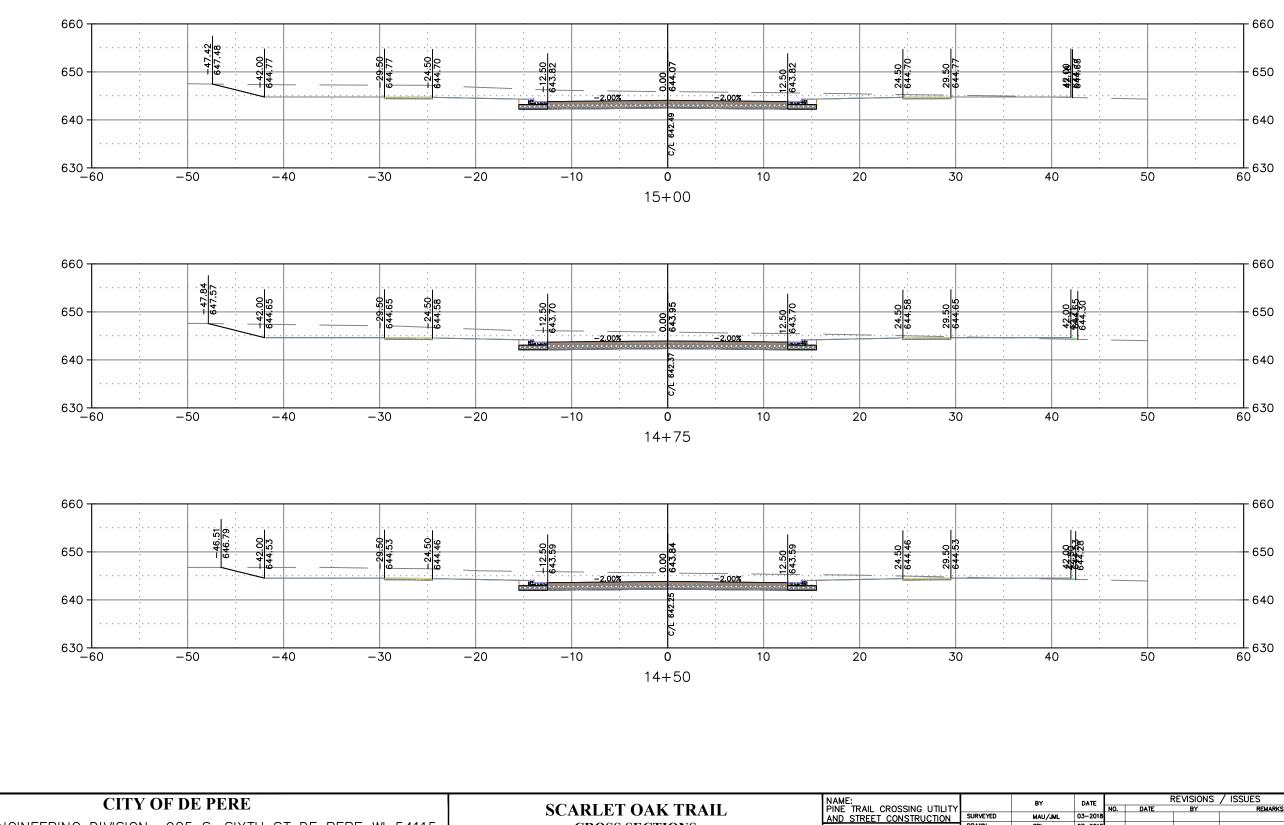
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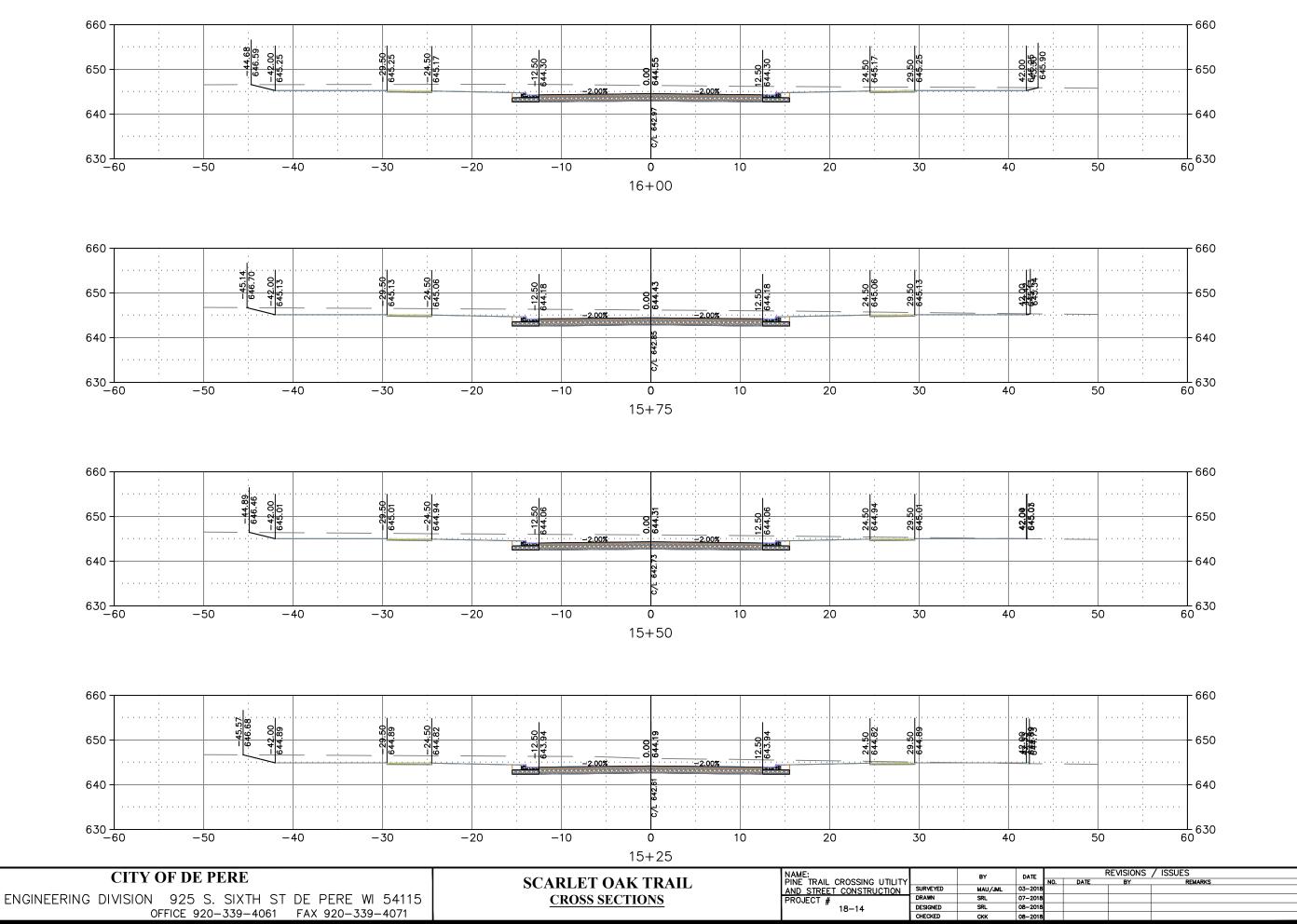


ENGINEERING DIVISION 925 S. SIXTH ST DE PERE WI 54115 OFFICE 920-339-4061 FAX 920-339-4071

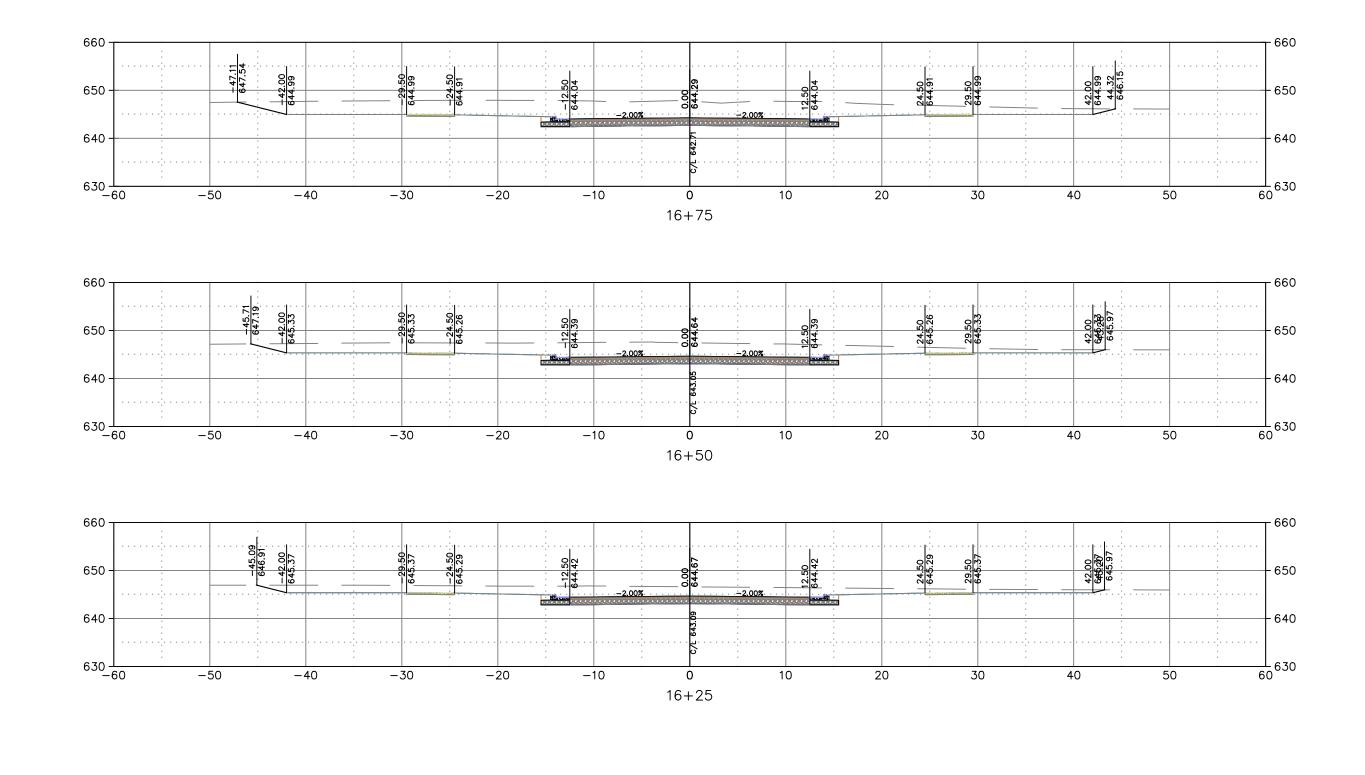
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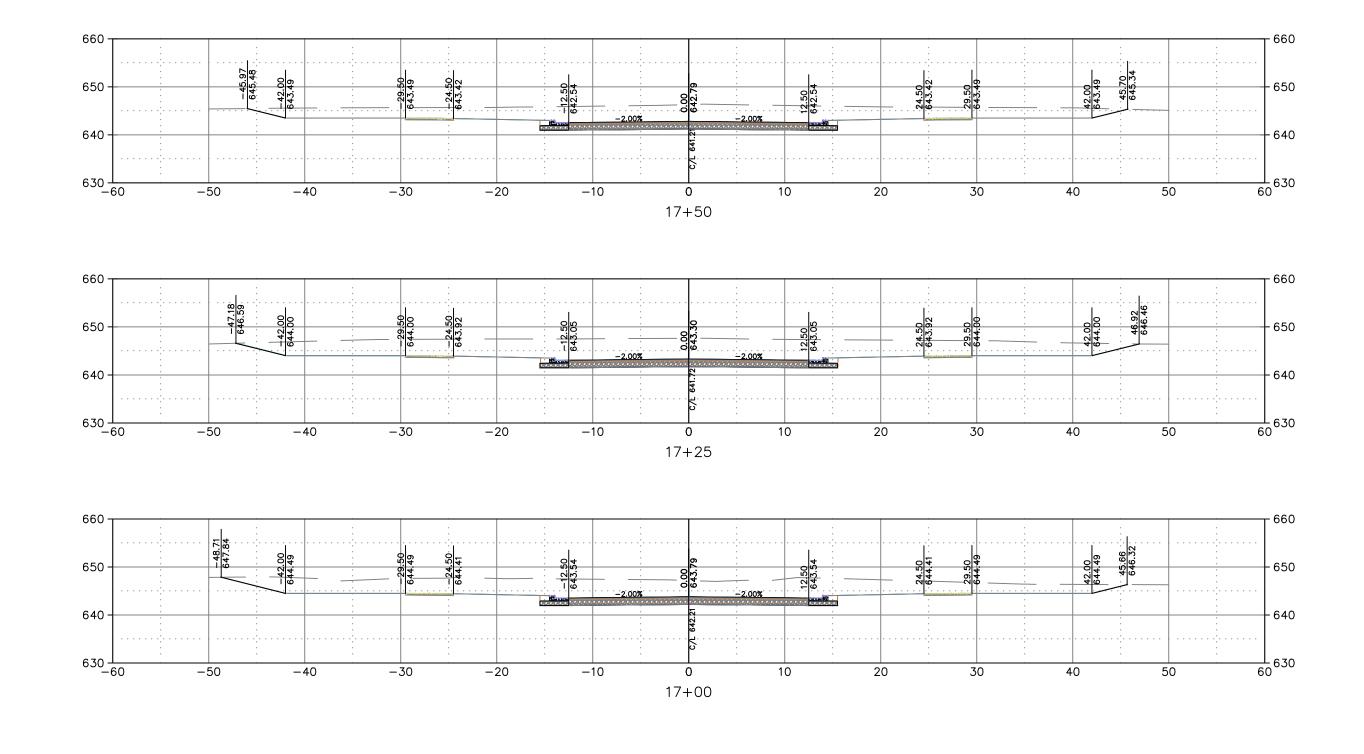
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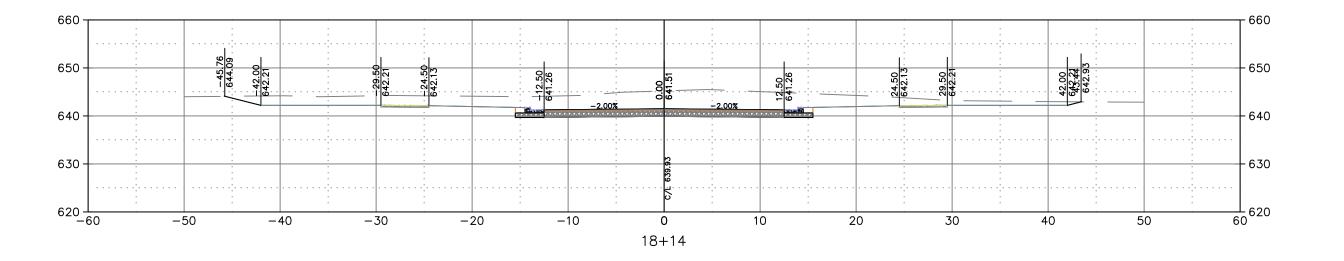
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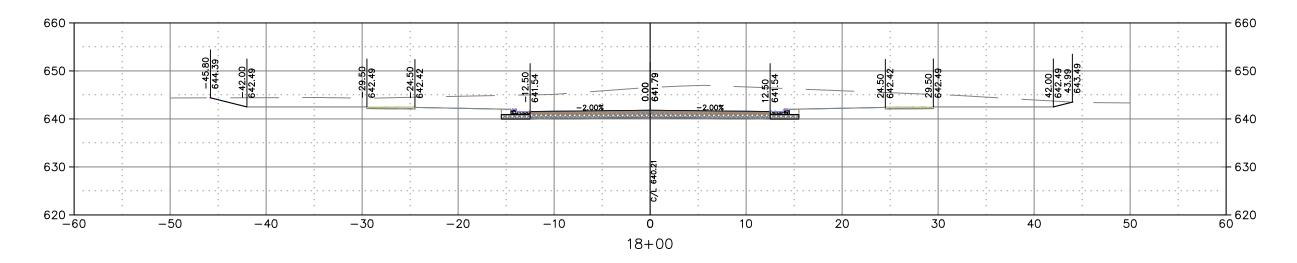


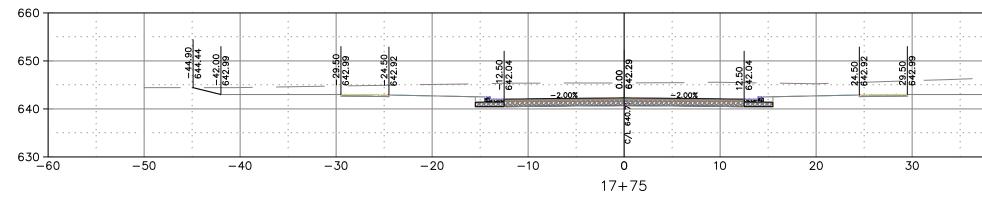
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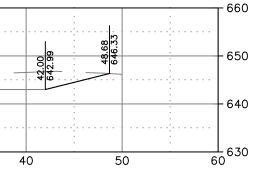
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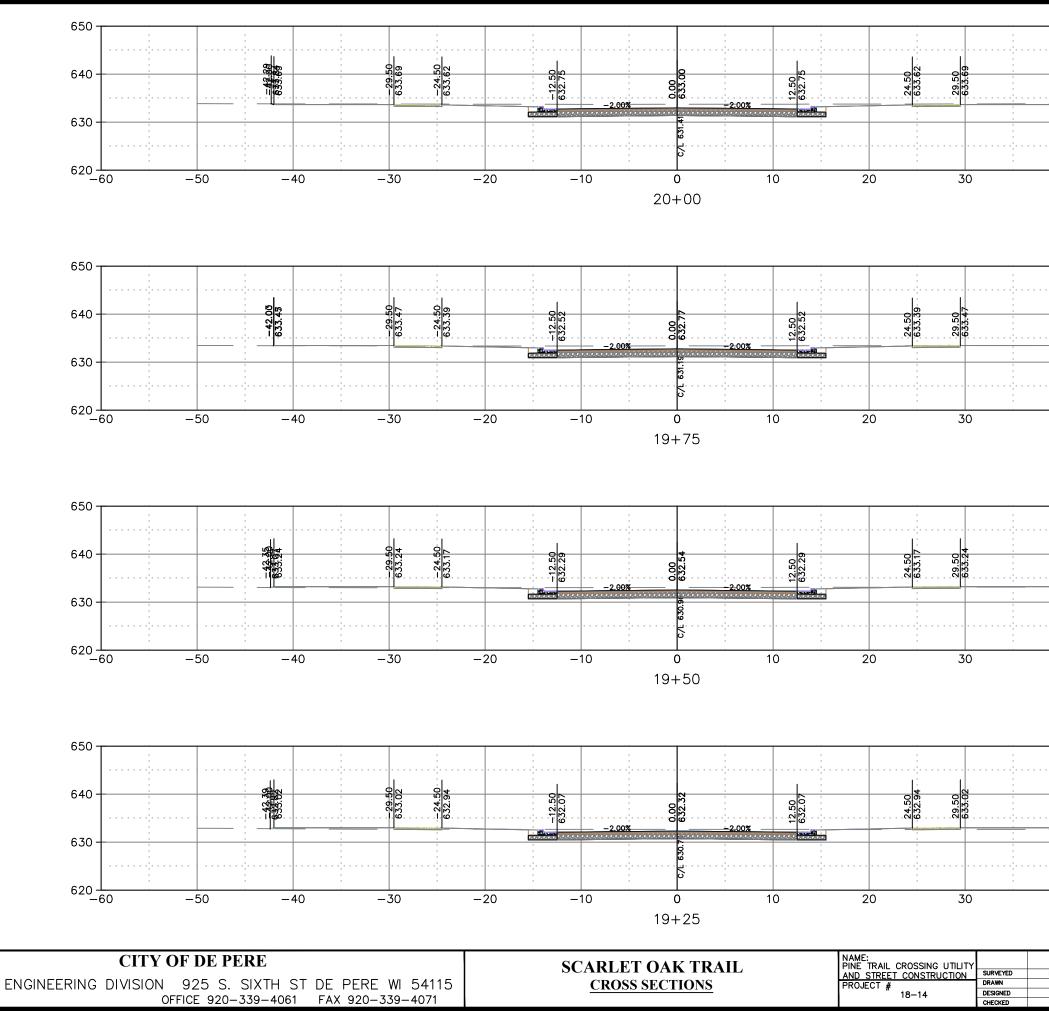






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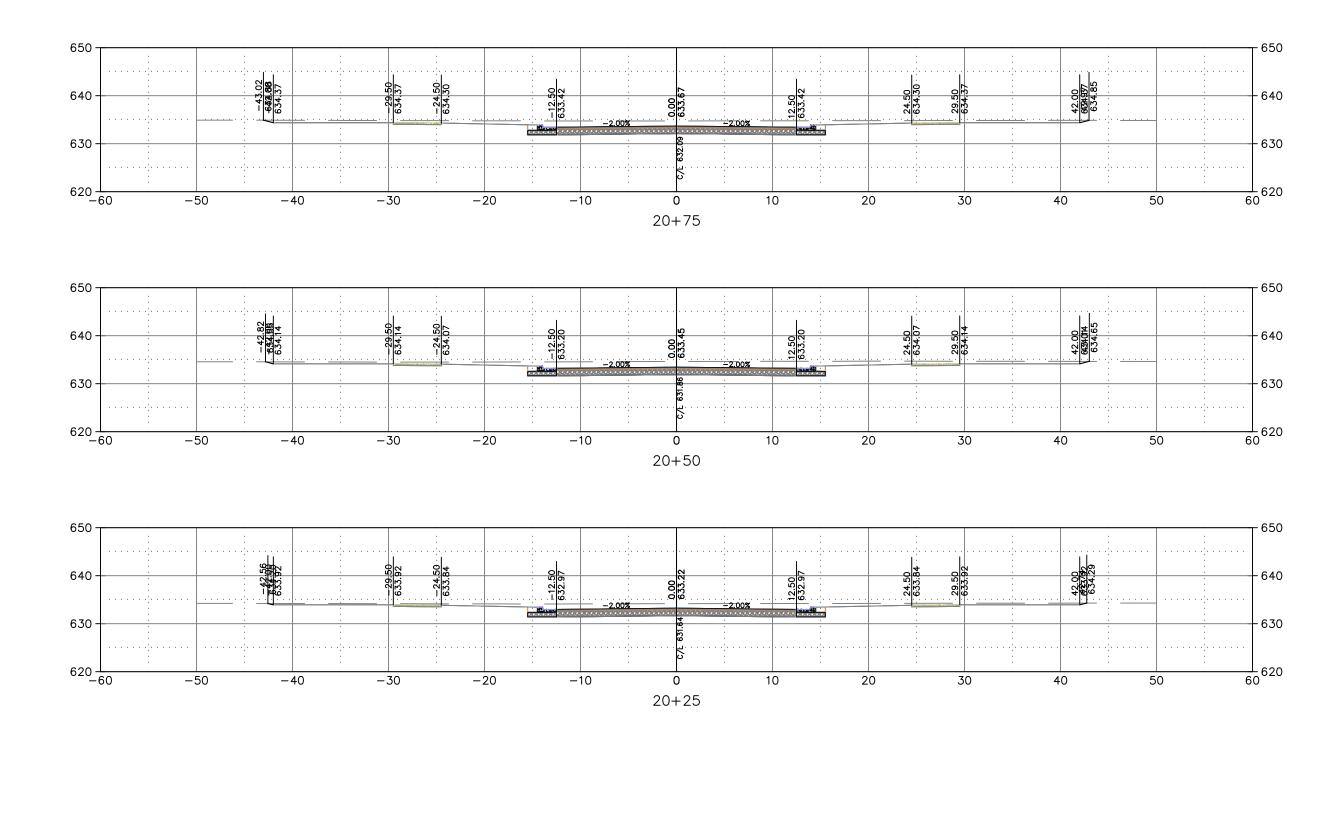




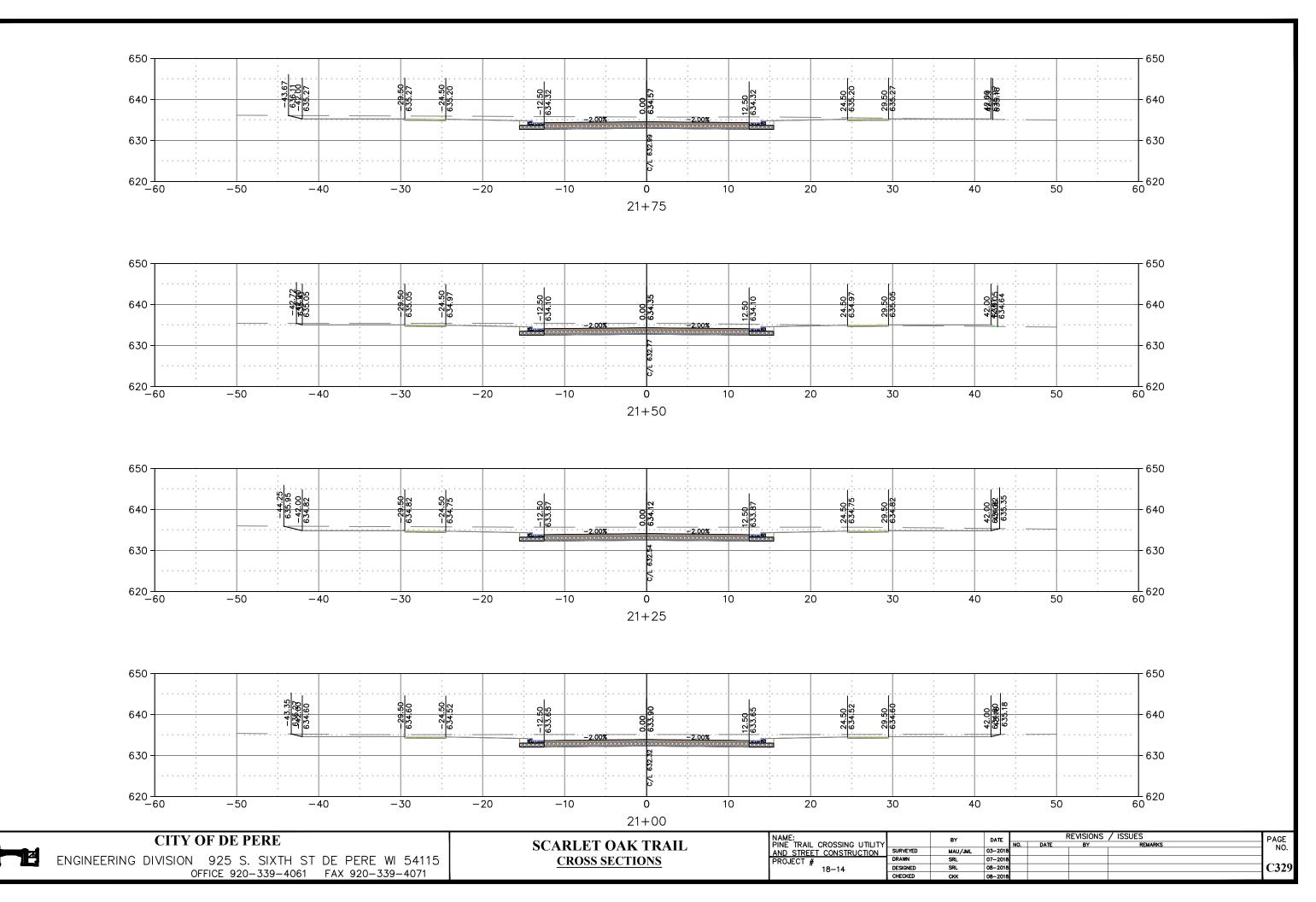
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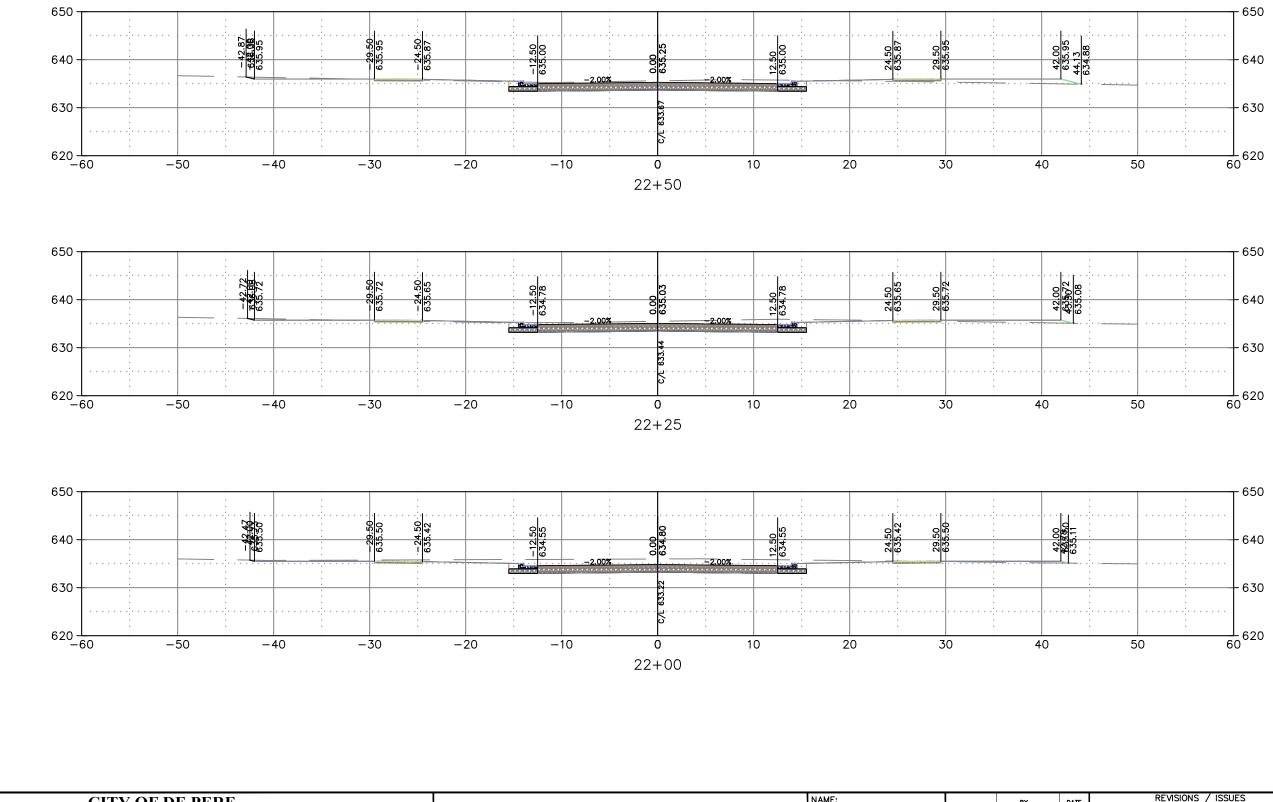
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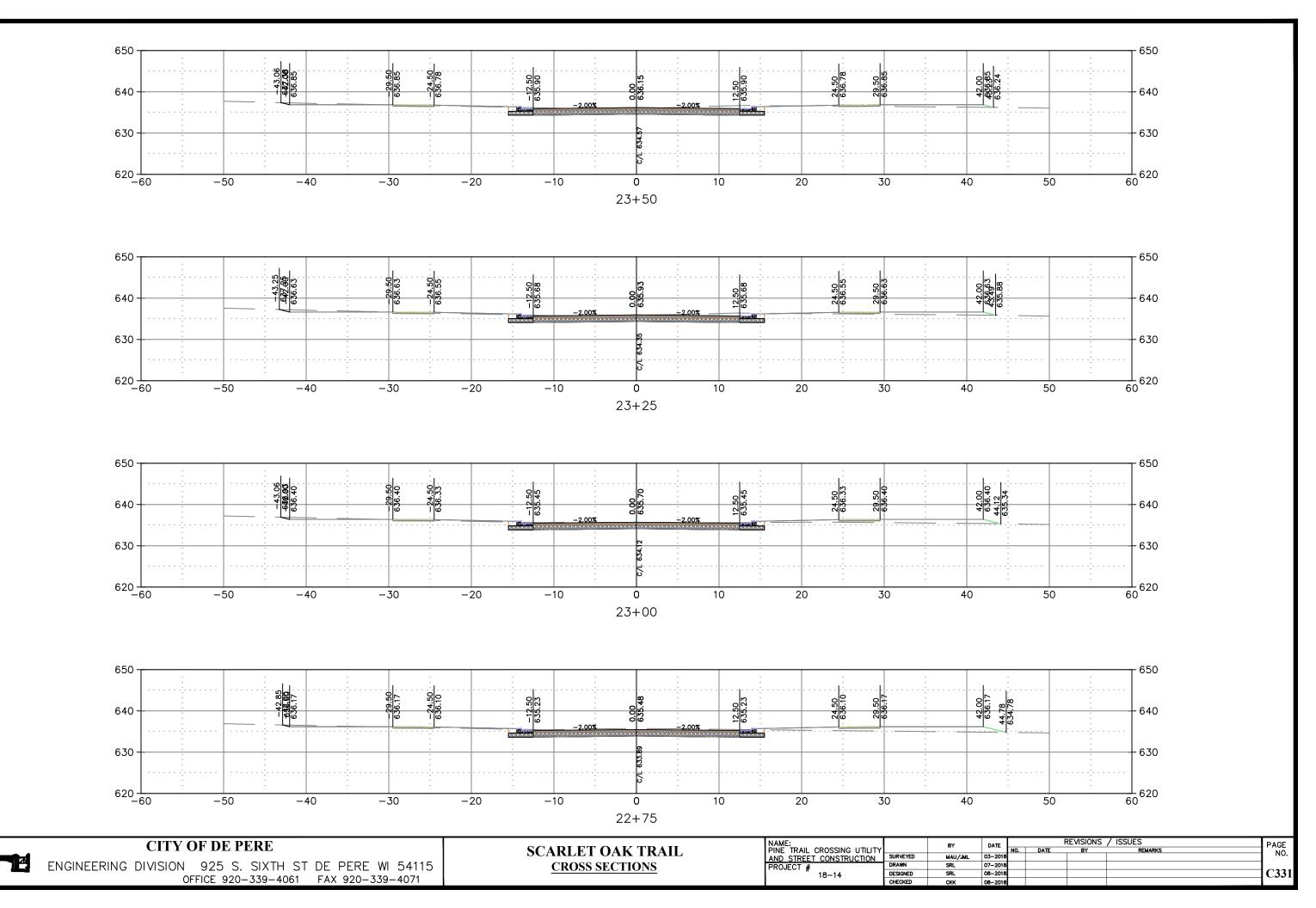


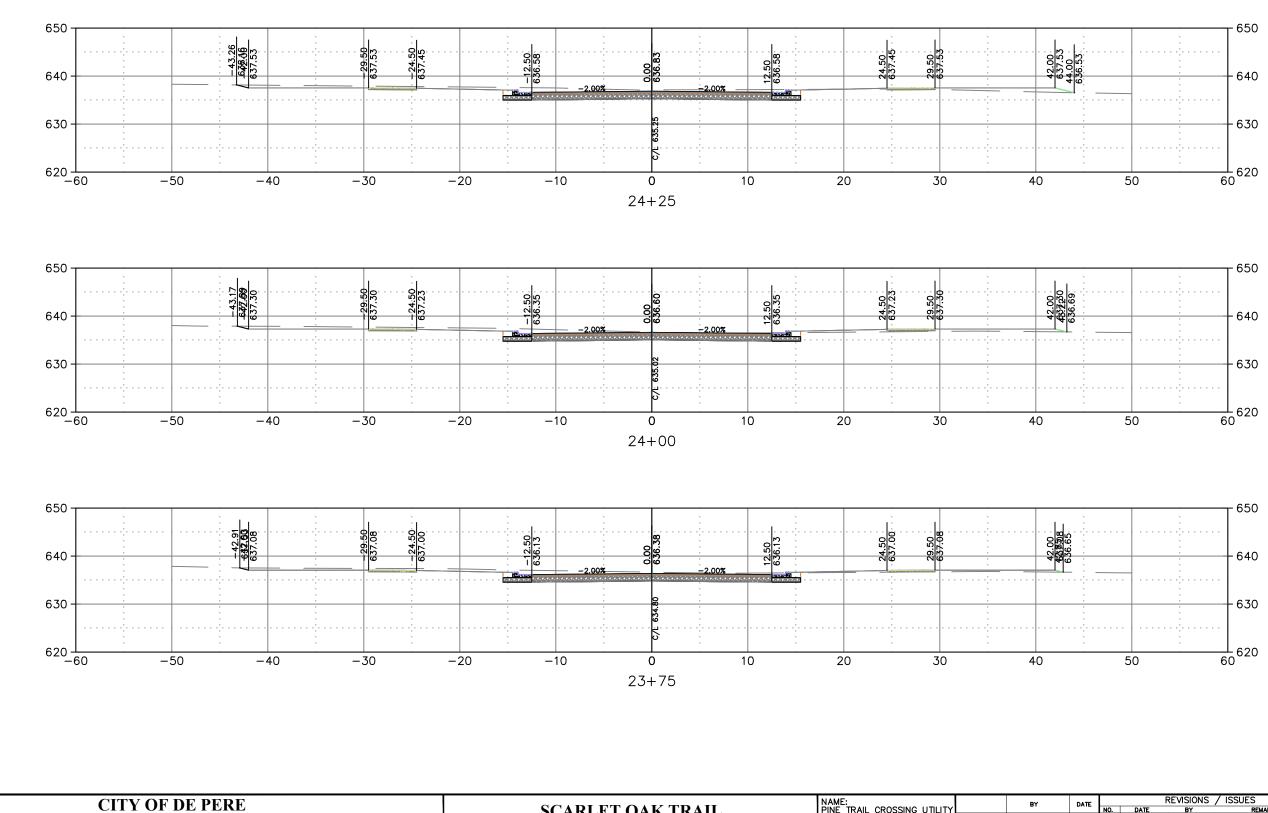
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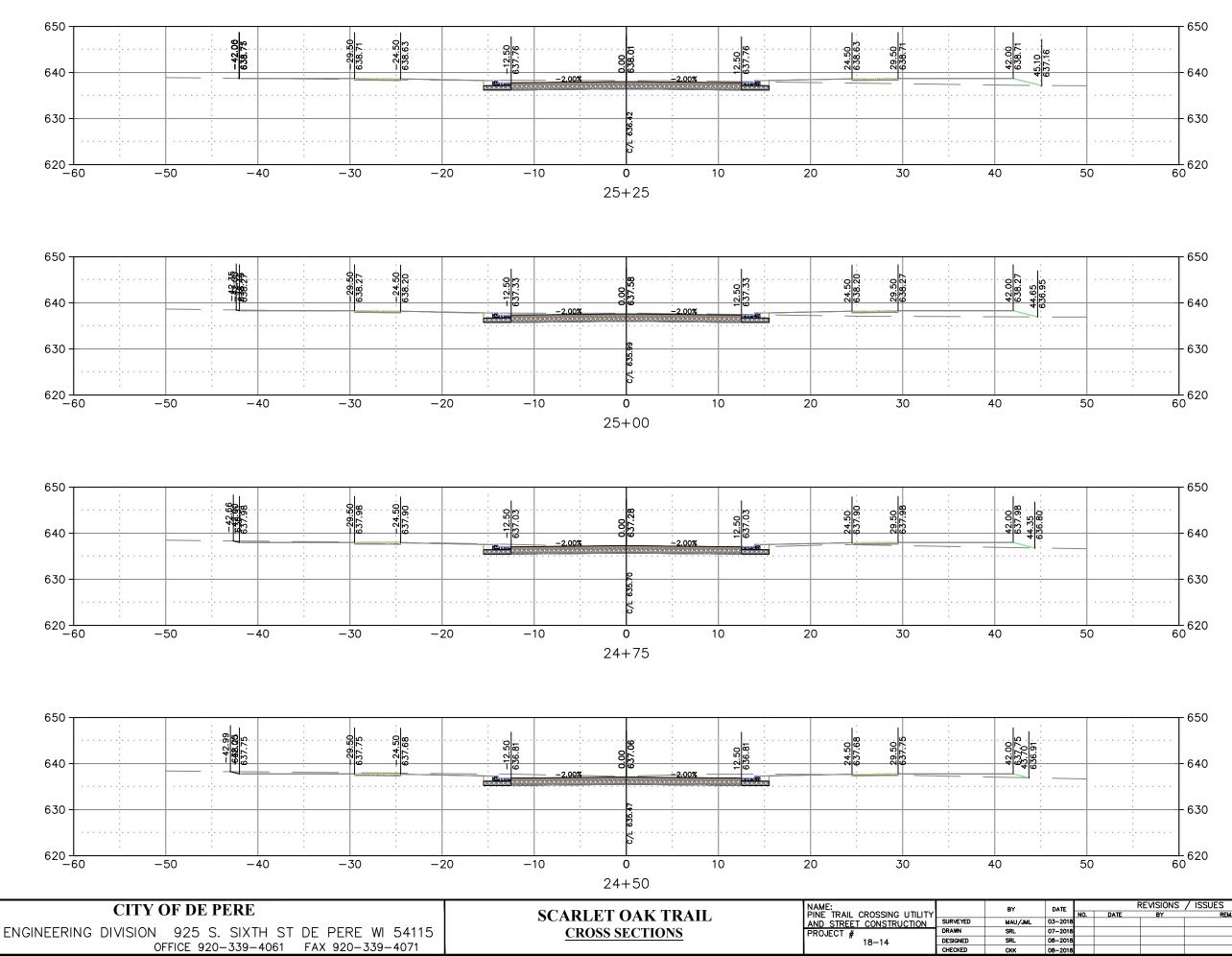
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SCARLET OAK TRAIL **CROSS SECTIONS** 

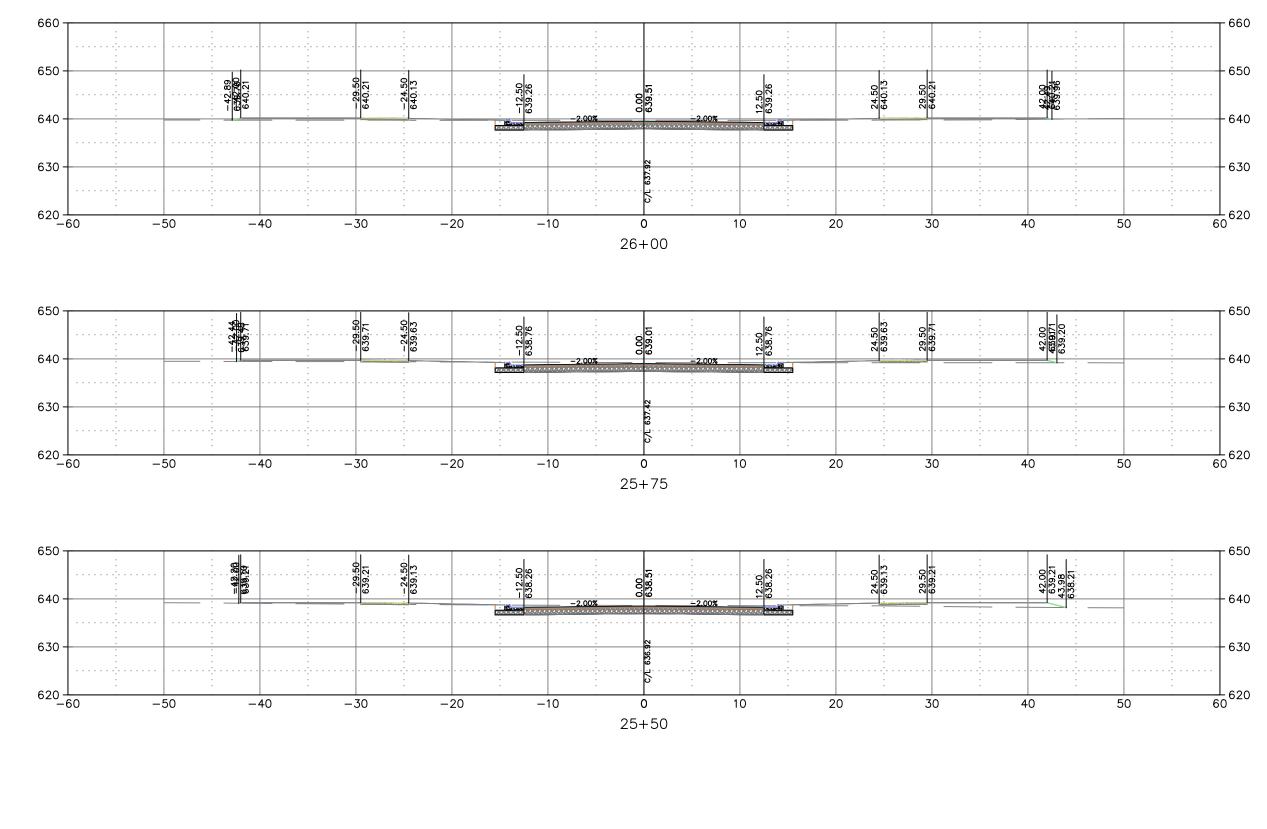
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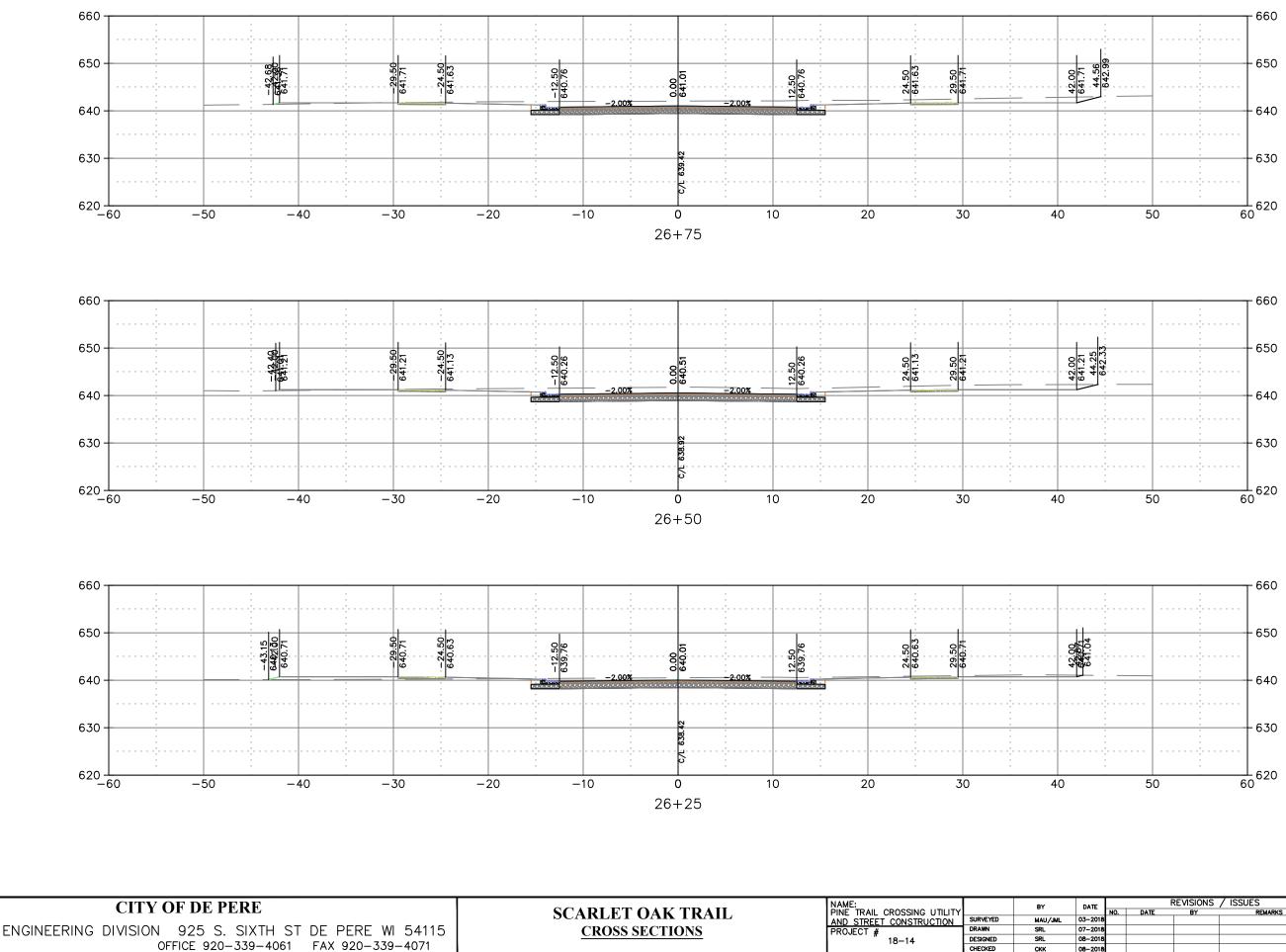


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SCARLET OAK TRAIL <u>CROSS SECTIONS</u>

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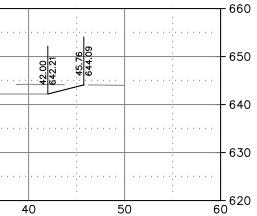
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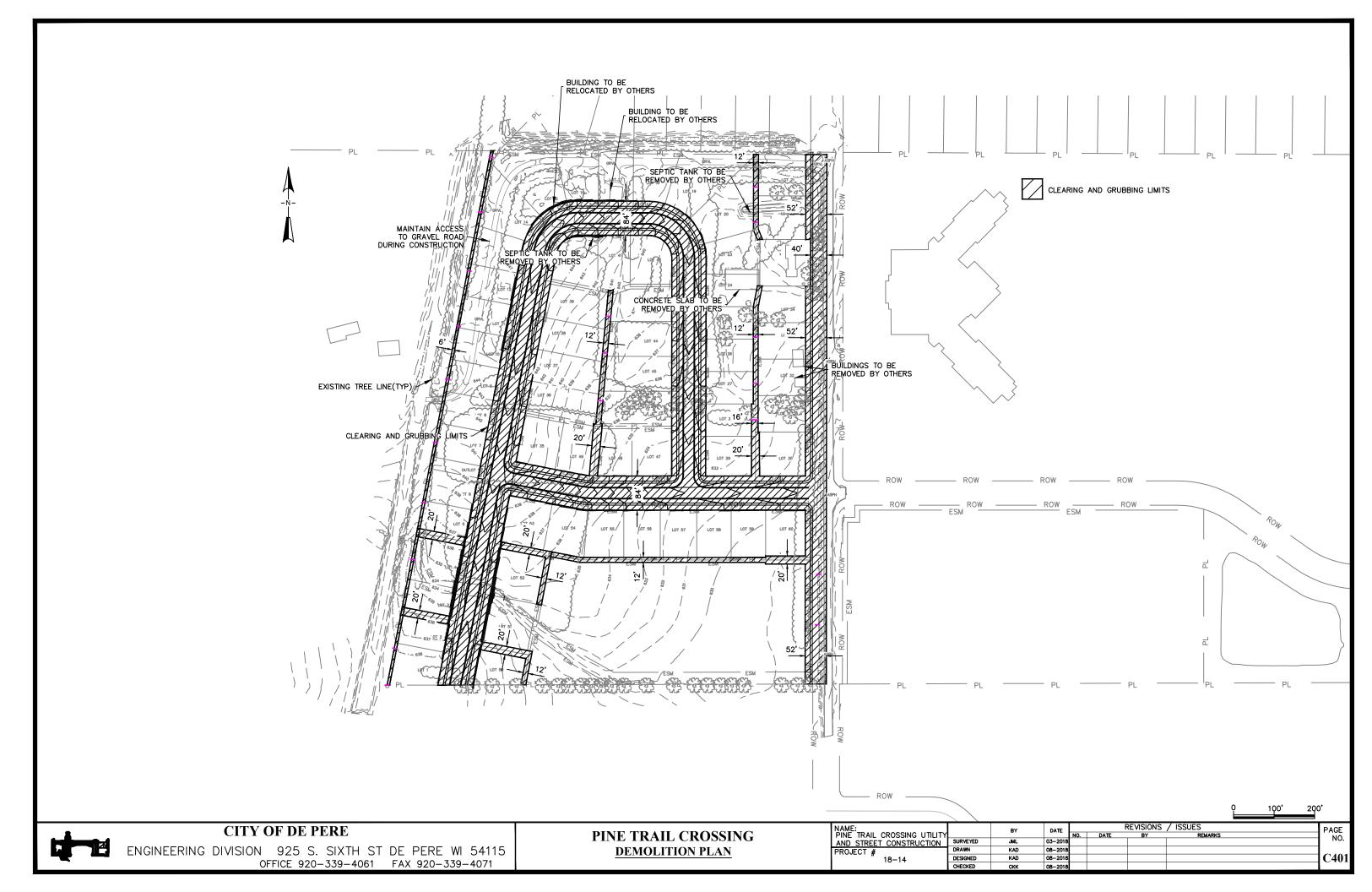


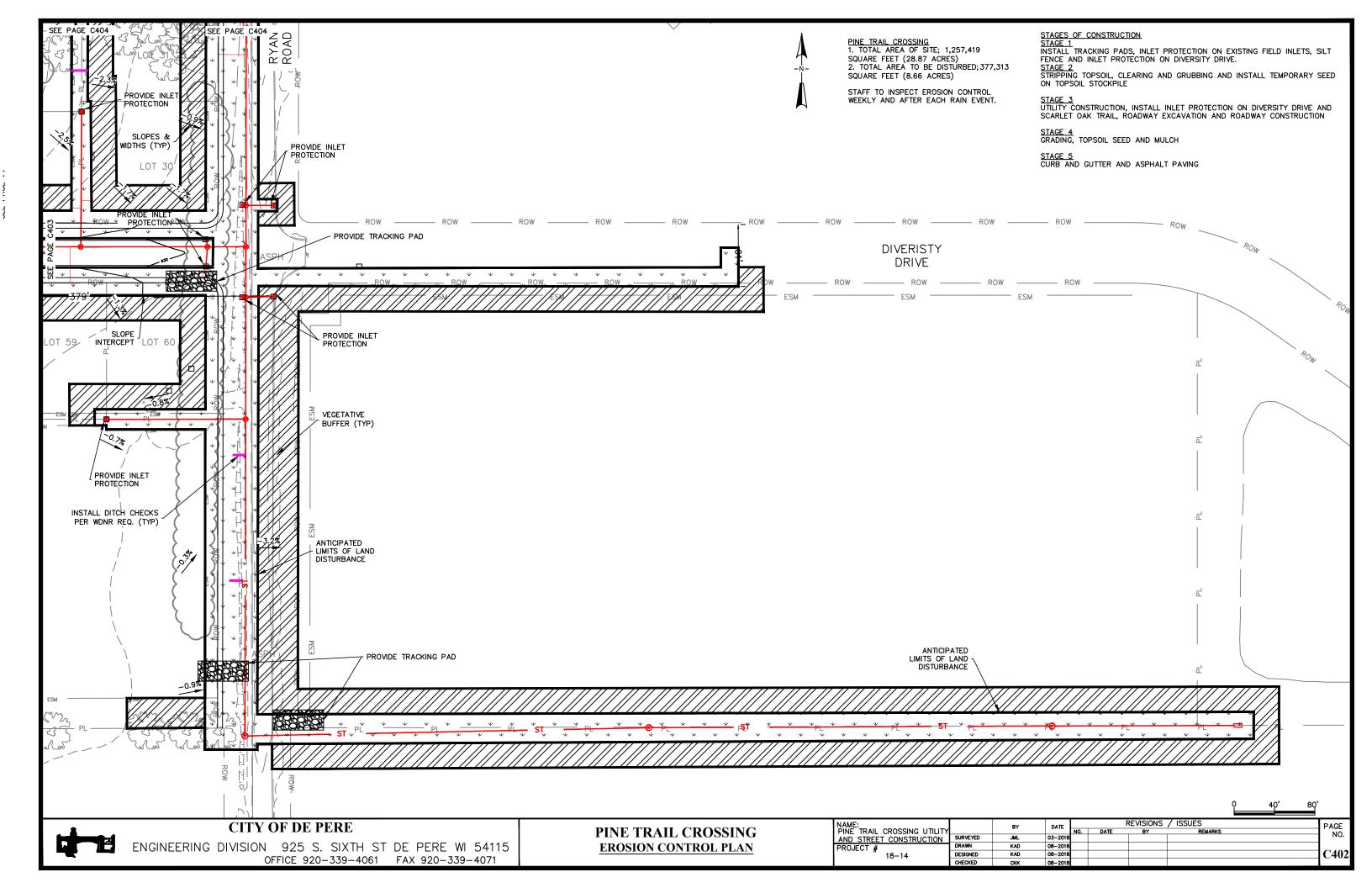
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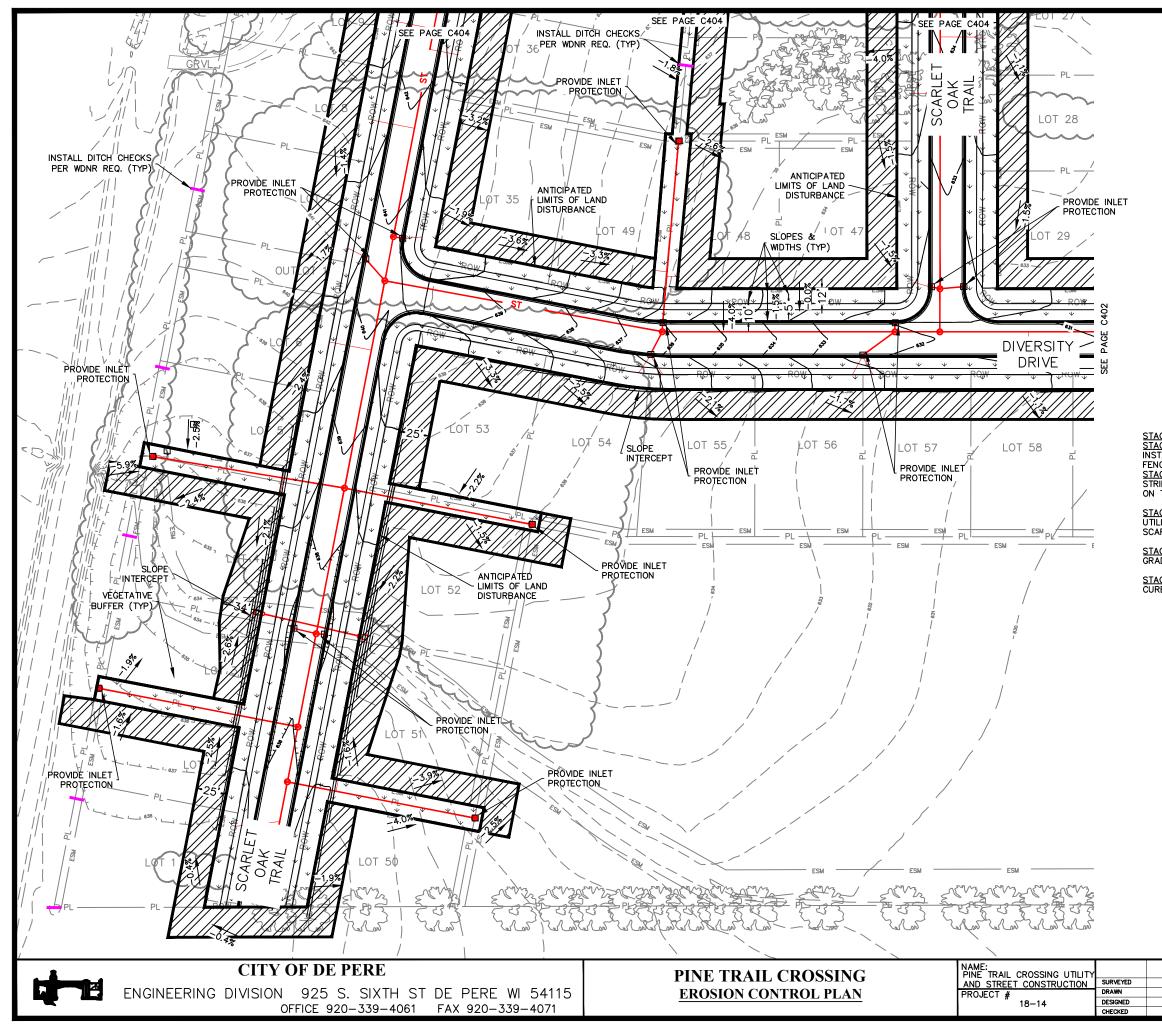
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STAGES OF CONSTRUCTION STAGE 1 INSTALL TRACKING PADS, INLET PROTECTION ON EXISTING FIELD INLETS, SILT FENCE AND INLET PROTECTION ON DIVERSITY DRIVE.

STAGE 2 STRIPPING TOPSOIL, CLEARING AND GRUBBING AND INSTALL TEMPORARY SEED ON TOPSOIL STOCKPILE

STAGE 3 UTILITY CONSTRUCTION, INSTALL INLET PROTECTION ON DIVERSITY DRIVE AND SCARLET OAK TRAIL, ROADWAY EXCAVATION AND ROADWAY CONSTRUCTION

STAGE 4 GRADING, TOPSOIL SEED AND MULCH

STAGE 5 CURB AND GUTTER AND ASPHALT PAVING

PINE TRAIL CROSSING 1. TOTAL AREA OF SITE; 1,257,419 SQUARE FEET (28.87 ACRES) 2. TOTAL AREA TO BE DISTURBED; 377,313 SQUARE FEET (8.66 ACRES)

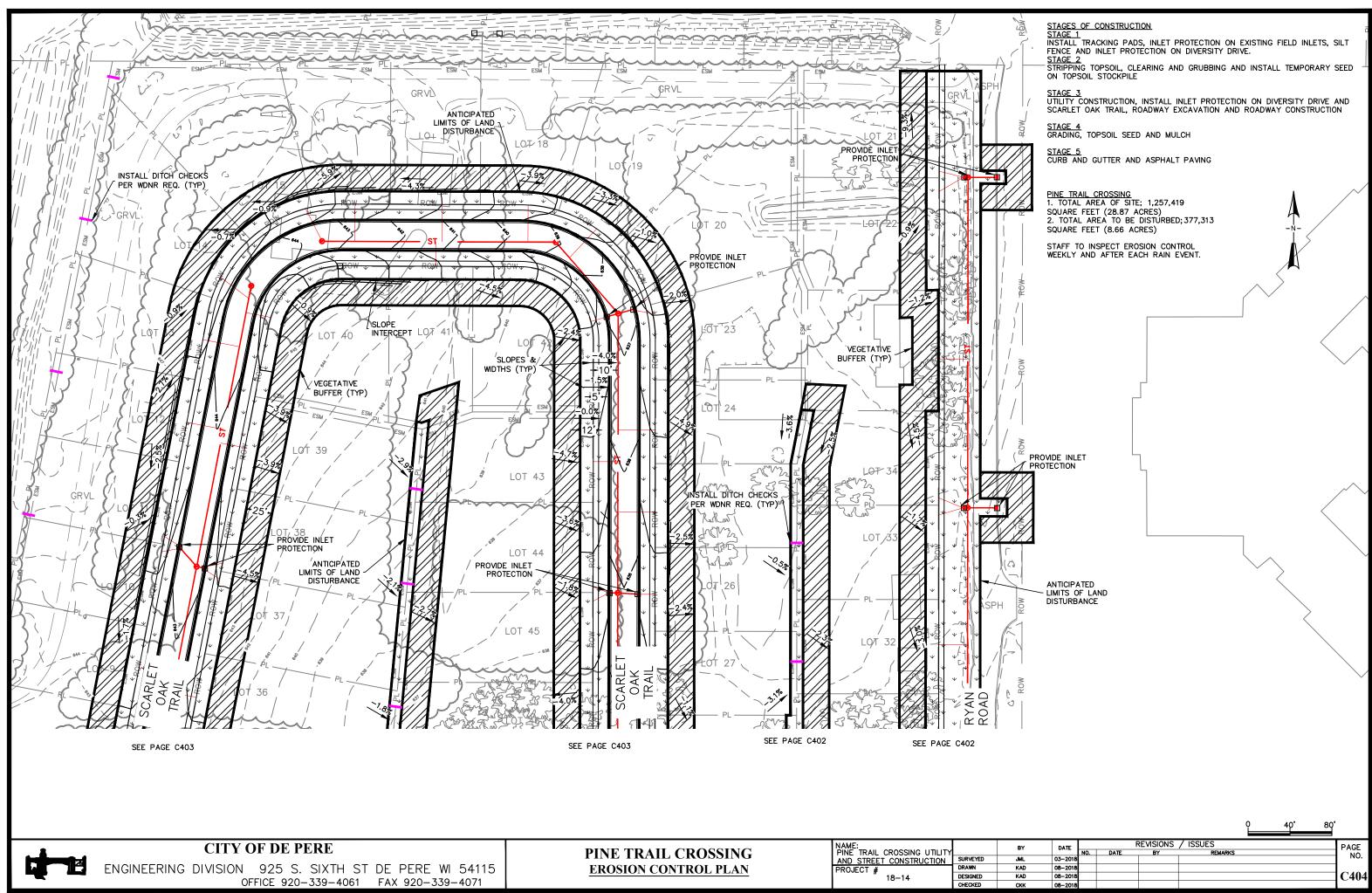
STAFF TO INSPECT EROSION CONTROL WEEKLY AND AFTER EACH RAIN EVENT.

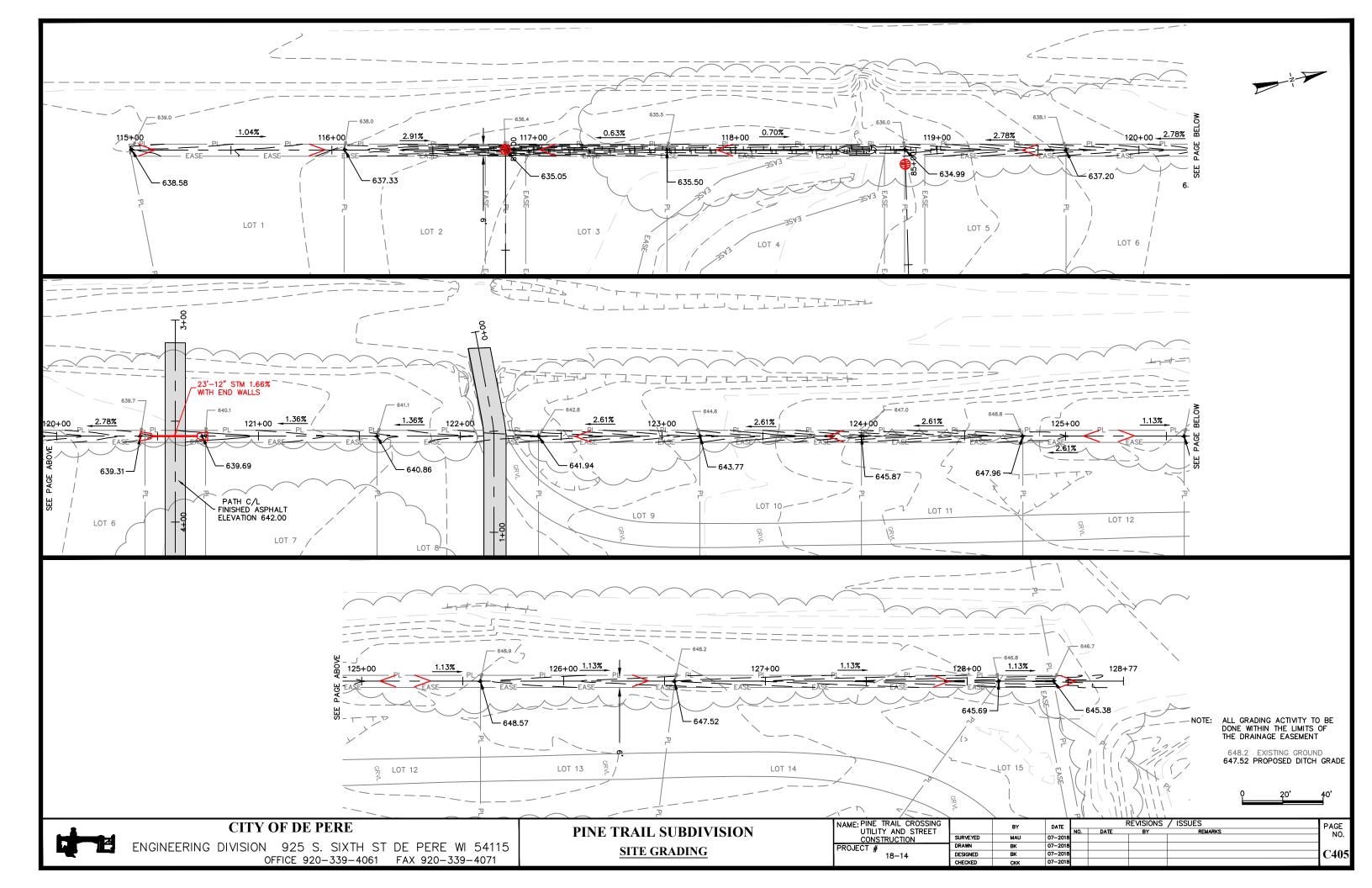
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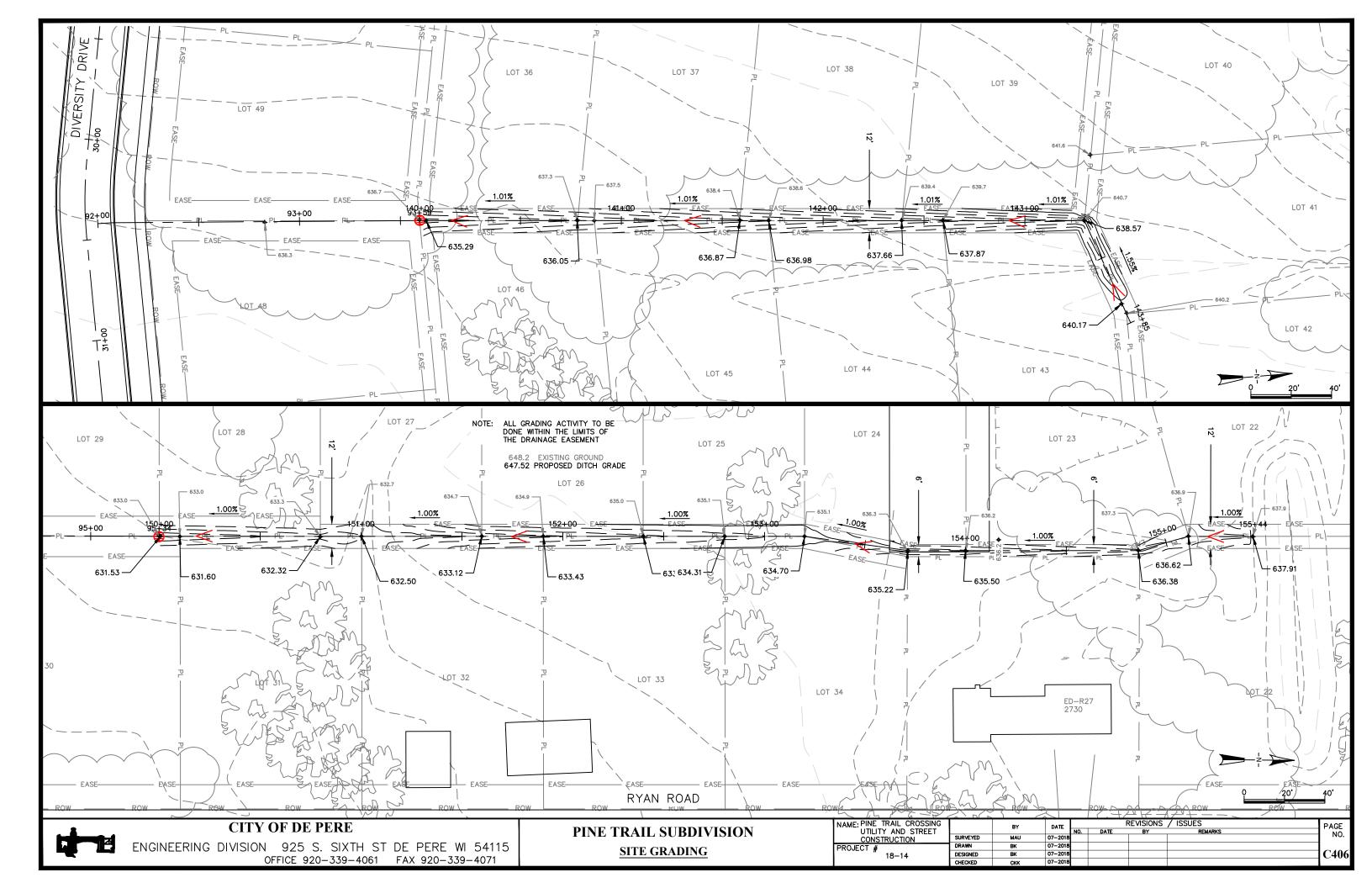
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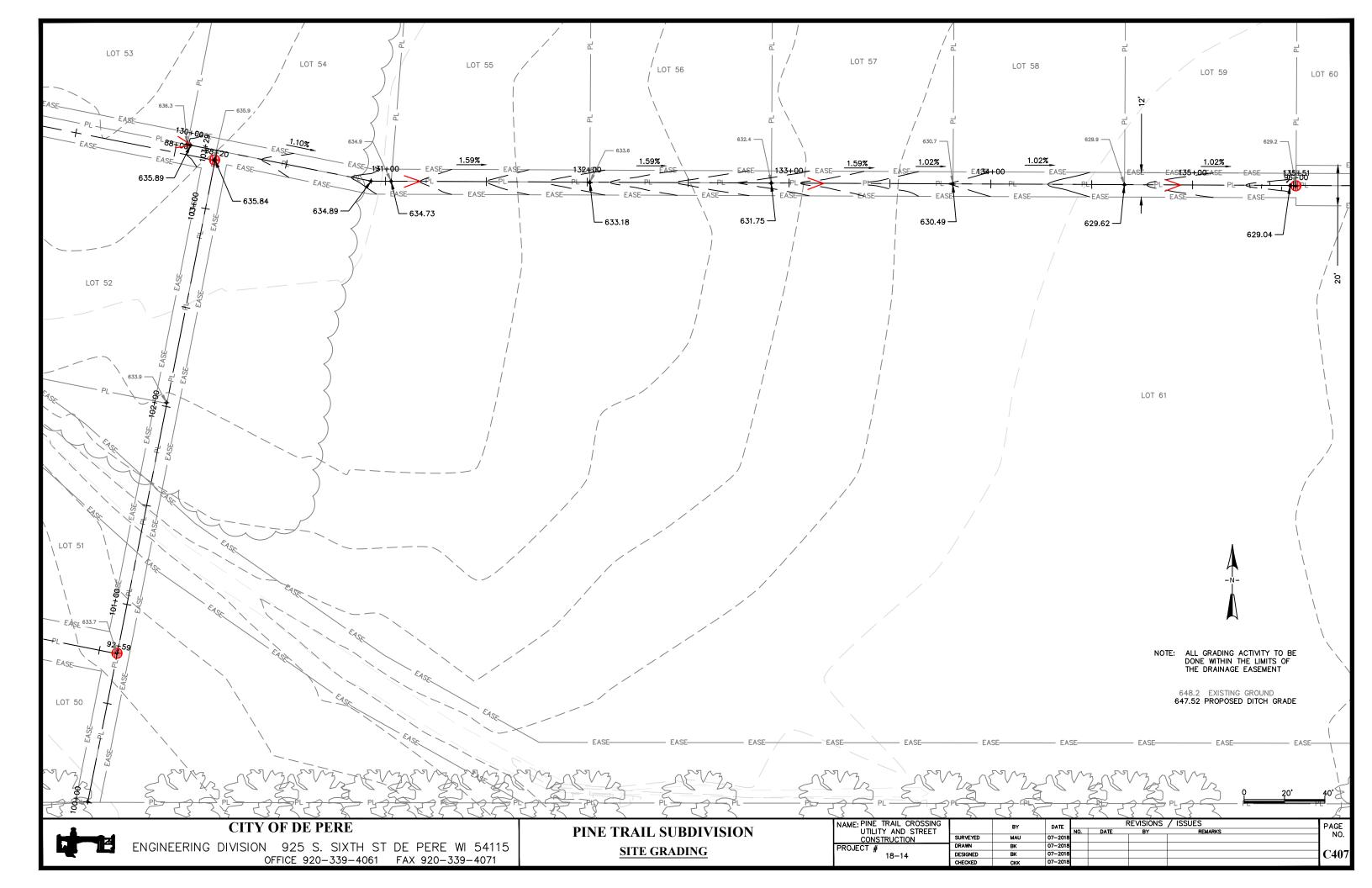
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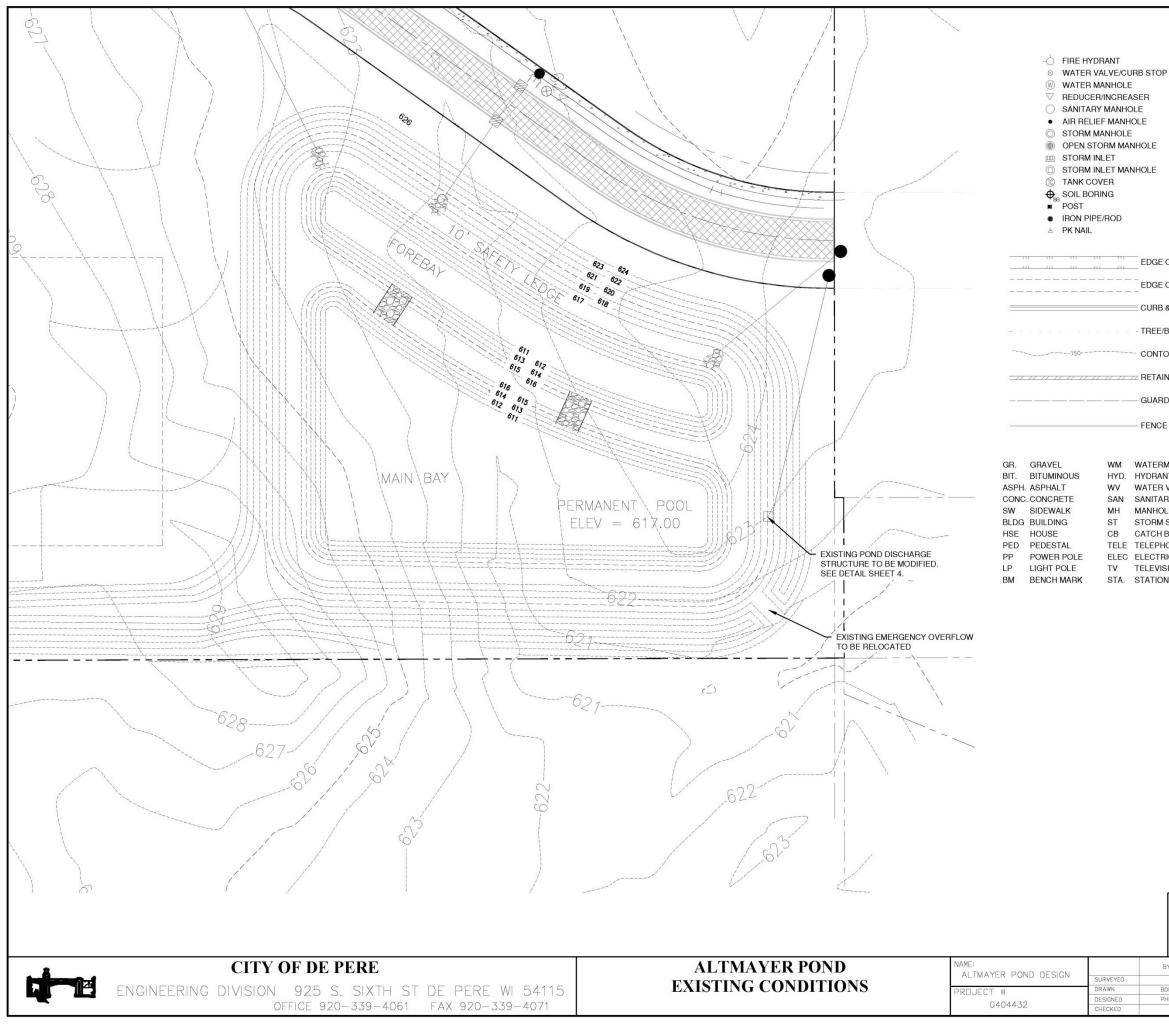
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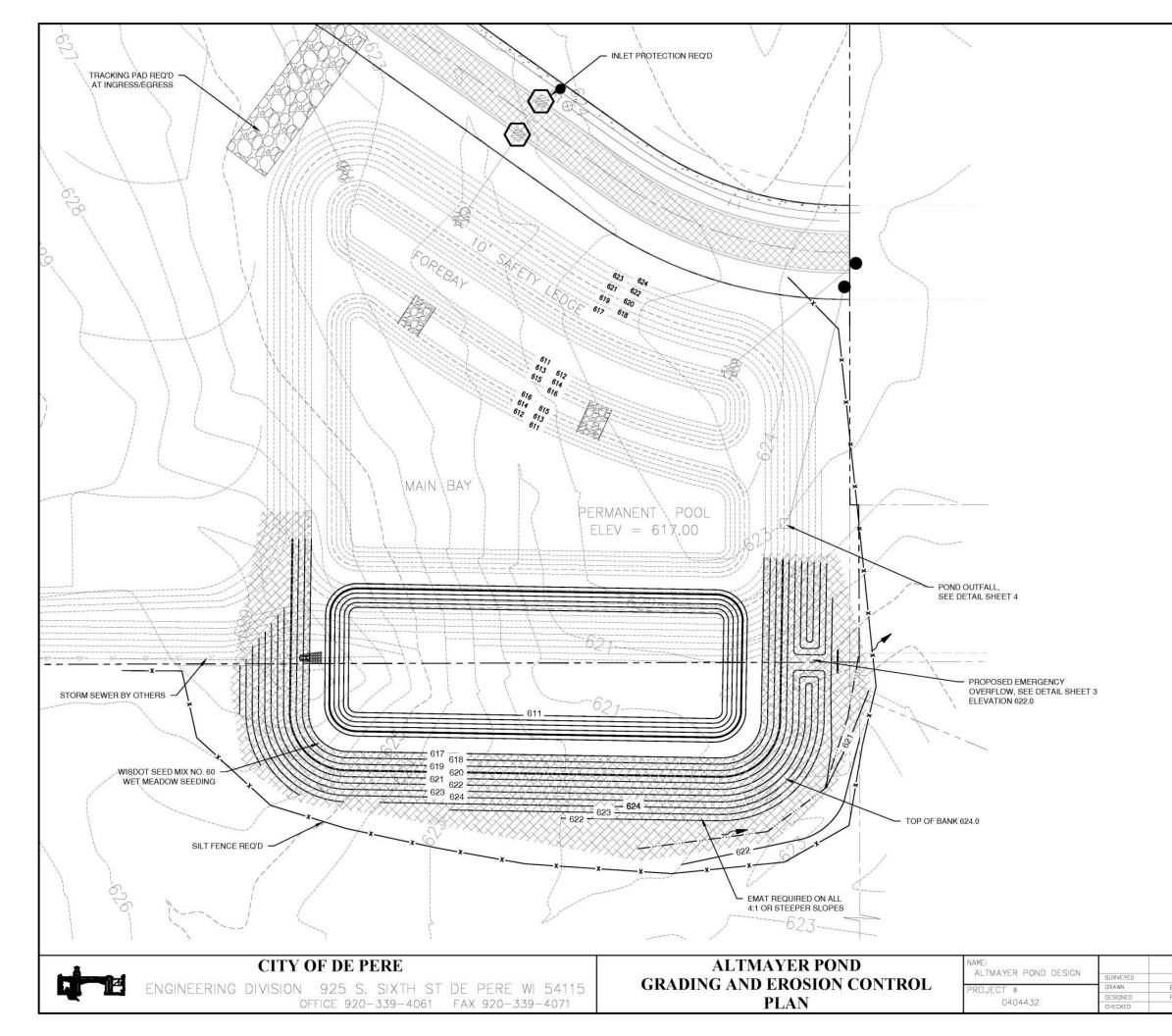




## LEGEND

		Lt	GEN	D						
		POWEF				凝	DECIDU	OUS TREE		
-		POWEF		W/GUY WIRE		2+2	CONIFE	ROUS TREE		
	-	TRAFFI		IAL POLE NHOLE		$\odot$	BUSH			
[	E	ELECT	RIC ME				RIP RAP			
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		MAILBO	X			Ŀ	HANDIC	AP PARKING		
6	9	BOLLA	RD							
E OF ASPHAL	Т							ARY SEWER (SIZE NOTED) MAIN (SIZE NOTED)		
				10''ST				EMAIN (SIZE NOTED) M SEWER (SIZE NOTED)		
E OF GRAVEL				6"W		— 6"W	- WATER	RMAIN (SIZE NOTED)		
B & GUTTER								NE IEAD TELEPHONE LINE		
				T		- T		GROUND TELEPHONE LINE		
E/BRUSH LINE	Е			OE		- OE	OVERHEAD ELECTRIC LINE			
				——————————————————————————————————————		- E	— UNDERGROUND ELECTRIC LINE			
TOUR LINE				OTV		- OTV	- OVERH	HEAD CABLE TV LINE		
				TV		- TV	CABLE	TV LINE		
AINING WALL						- FO		OPTIC LINE		
RD RAIL							- R/W LI	NE		
HU HAIL								ERTYLINE		
								1ENT LINE		
CE					_			NG SETBACK LINE		
							- SECTIO	ON LINE		
RMAIN		VPC	VEBT	ICAL POINT OF	CUB		B-B	BACK TO BACK (OF CURB)		
ANT		VPI		ICAL POINT OF			F-F	FACE TO FACE (OF CURB)		
R VALVE		VPT		ICAL POINT OF			B/W	RIGHT OF WAY		
ARY SEWER		PC		T OF CURVATU			T/C	TOP OF CURB		
OLE		PI		T OF INTERSEC			F/L	FLOW LINE		
M SEWER		PT		T OF TANGENC			C/L	CENTERLINE		
HBASIN		R	RADI				B/L	REFERENCE LINE		
PHONE		EX	EXIST				INV.	INVERT		
TRIC		PR		POSED			CMP	COBRUGATED METAL PIPE		
/ISION		FOR		OF RADIUS			BCP	REINFORCED CONCRETE PIPE		
ON		BOC		OF CURB				CULVERT		

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## LEGEND

TOP OF CURB ELEVATION
FLOW LINE ELEVATION
TOP OF SIDEWALK ELEVATION
EDGE OF PAVEMENT ELEVATION
TOP OF RETAINING WALL ELEVATION
GROUND ELEVATION
DRAINAGE SWALE
DRAINAGE DIVIDE
SILT FENCE
BALE DITCH CHECK
FLOW ARROW
TRACKING PAD
EROSION MAT
INLET PROTECTION

### EROSION CONTROL

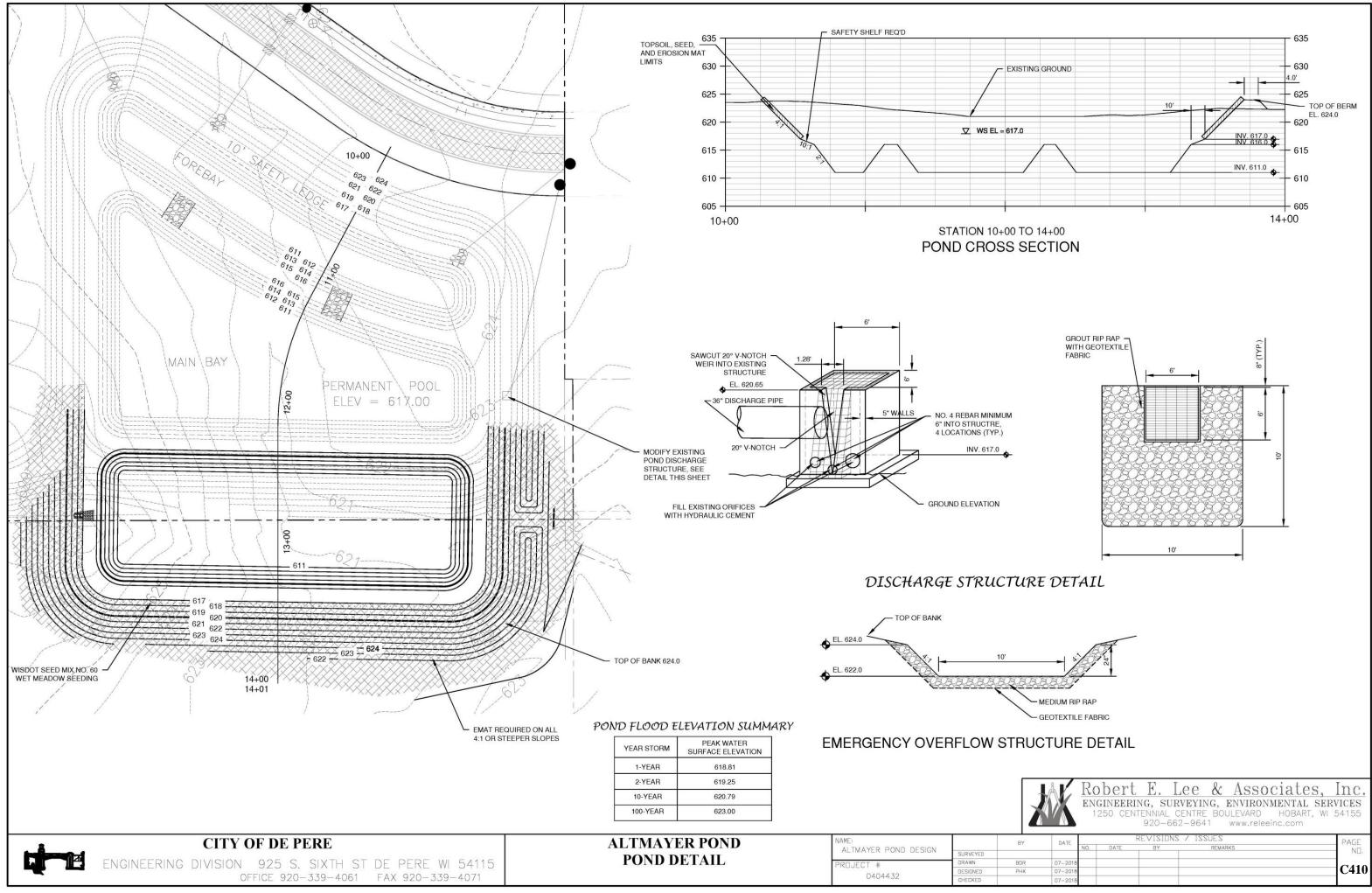
ALL EROSION CONTROL PRACTICES INDICATED ON THIS PLAN ARE APPROXIMATE LOCATIONS ONLY. THE ACTUAL SITE MAY REQUIRE MORE OR LESS EROSION CONTROL DEPENDING ON THE CURRENT CONDITION OF THE SITE.

- 1. SILT FENCE IS REQUIRED DOWNSLOPE OF ANY DISTURBED LAND THAT MAY CARRY SEDIMENTS OFF SITE.
- 2. A TRACKING PAD IS REQUIRED AT ANY INGRESS/EGRESS LOCATION, WHERE SEDIMENT MAY BE TRACKED OFF-SITE.
- 3. PROPER INLET PROTECTION SHALL BE USED DEPENDING ON THE INLET TYPE.
- 4. ALL NECESSARY SITE DEWATERING SHALL BE PERFORMED IN ACCORDANCE WITH WDNR TECHNICAL STANDARD 1061.

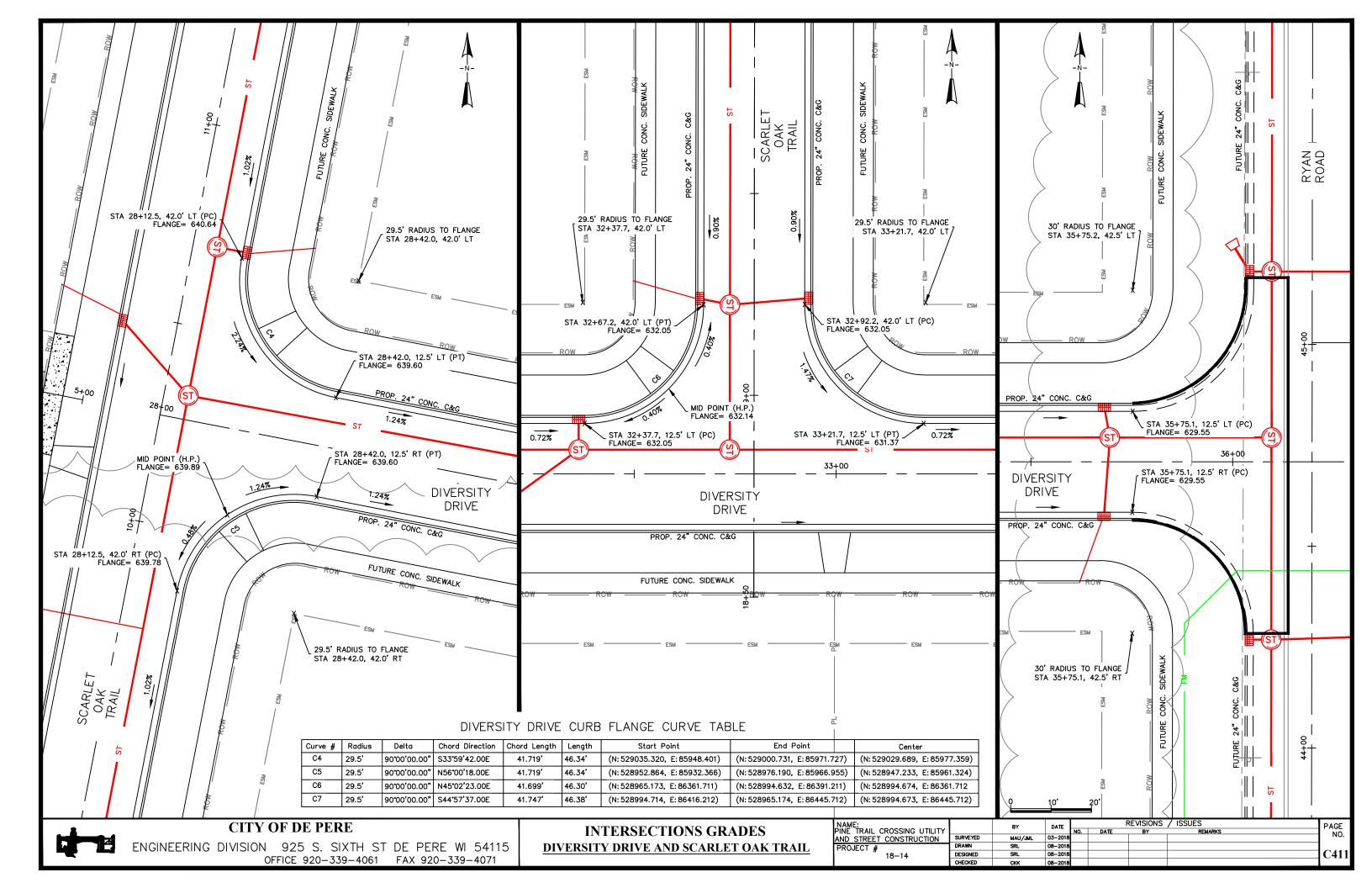
## POND CONSTRUCTION NOTE

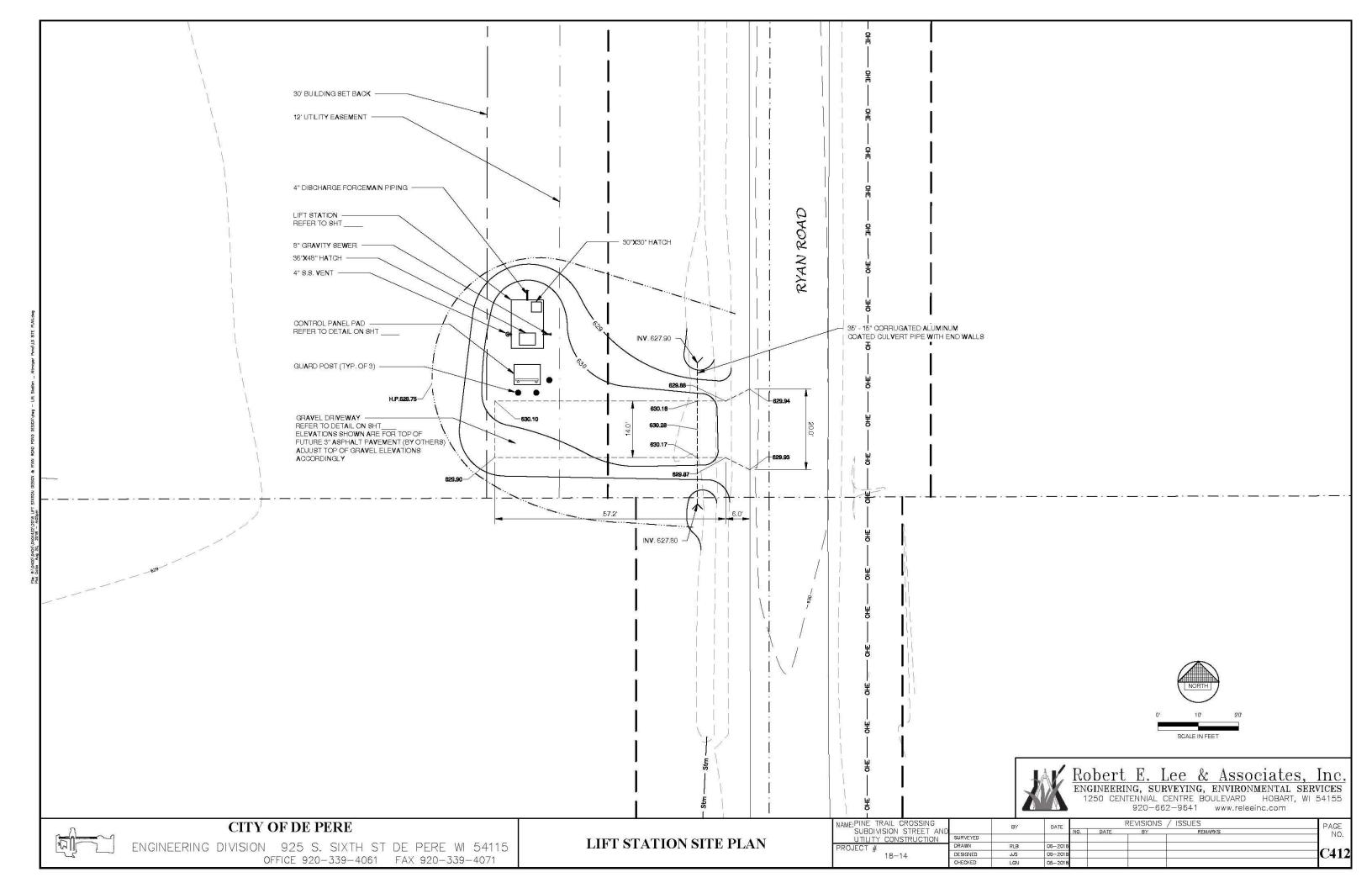
IF SAND OR BEDROCK IS ENCOUNTERED WITHIN TWO FEET OF THE EXCAVATION LIMITS OF THE POND, MODIFICATIONS TO THE DESIGN MAY BE REQUIRED. **CONTACT ENGINEER** FOR FURTHER DIRECTION PRIOR TO COMPLETION OF POND CONSTRUCTION.

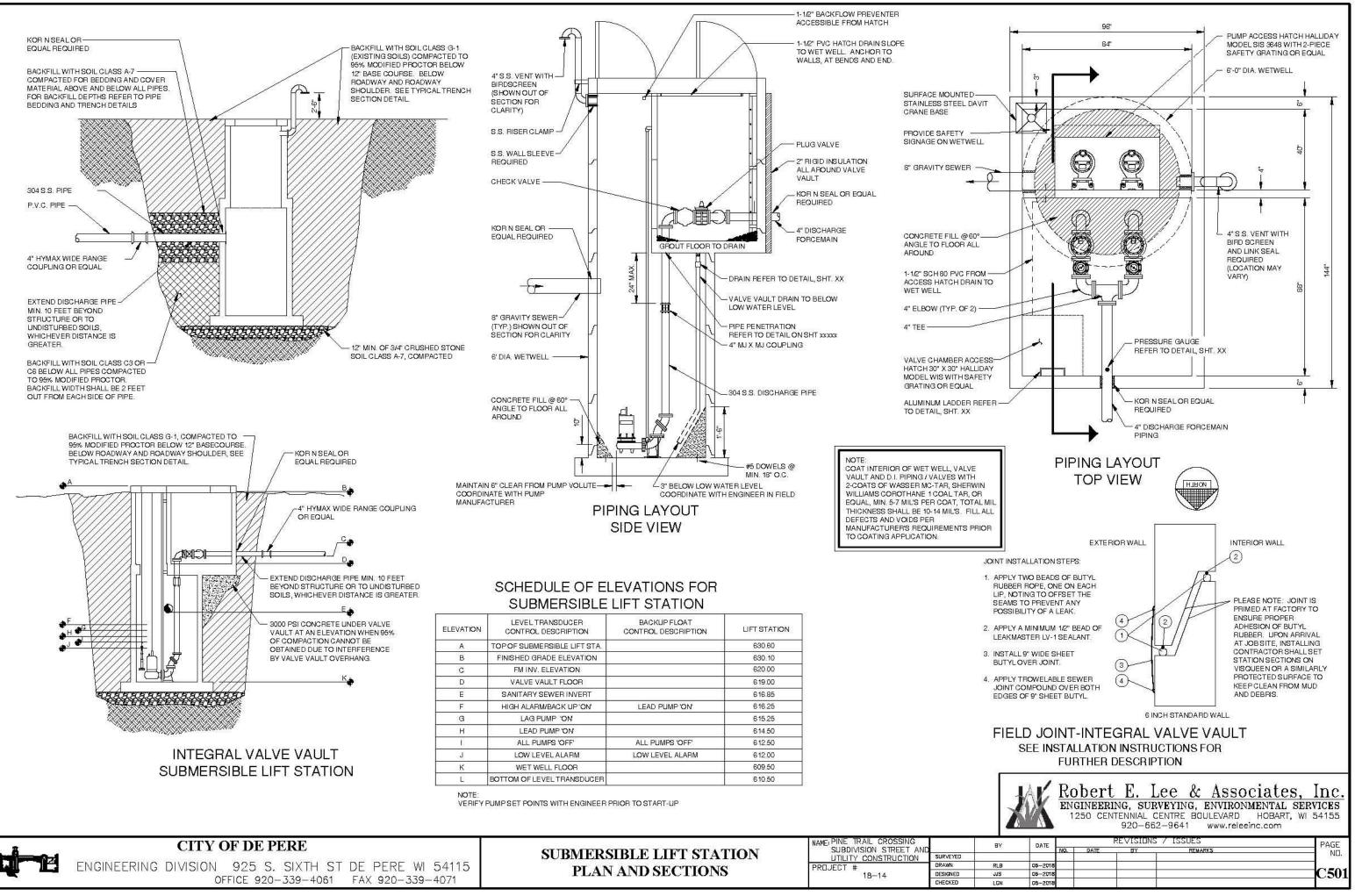
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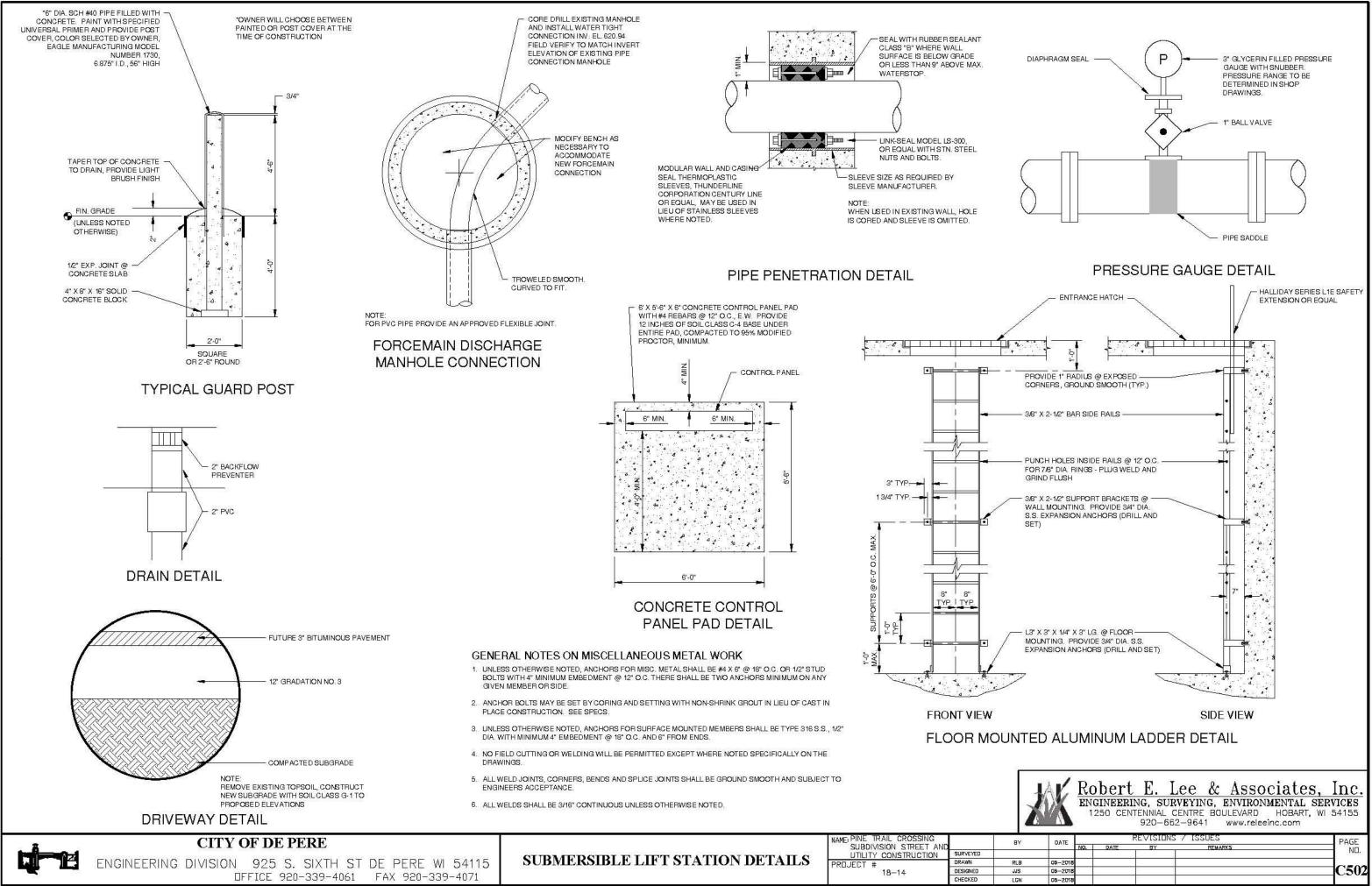


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## GENERAL

- G1 SCOPE THE NOTES AND DETAILS ON THIS SHEET ARE GENERAL AND APPLY TO THE ENTIRE PROJECT EXCEPT WHERE THERE ARE SPECIFIC INDICATIONS TO THE CONTRARY. G2 APPLICABLE SPECIFICATIONS AND CODES CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE WISCONSIN ADMINISTRATIVE CODE. THE ABOVE SHALL GOVERN EXCEPT WHERE OTHER APPLICABLE CODES OR THE FOLLOWING NOTES ARE MORE RESTRICTIVE.
- G3 ALTERNATIVE DESIGNS

THE STRUCTURAL SYSTEMS AND DETAILS ON THESE PLANS ARE THE PRIORITY DESIGN. ALTERNATIVE SYSTEMS AND DETAILS MAY BE USED IF THE CONTRACTOR SUBMITS PLANS WITH SUBSTANTIATING CALCULATIONS AND TEST DATA, AND IF THE ALTERNATIVE PLANS ARE ACCEPTED BY THE ENGINEER

G4 DIMENSIONS

STRUCTURAL DIMENSIONS CONTROLLED BY OR RELATED TO MECHANICAL OR ELECTRICAL EQUIPMENT SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

G5 PROVISIONS FOR EQUIPMENT

MECHANICAL AND ELECTRICAL EQUIPMENT SUPPORTS ANCHORAGES OPENINGS BECESSES. AND REVEALS NOT SHOWN ON THE STRUCTURAL DRAWINGS BUT REQUIRED BY OTHER CONTRACT DRAWINGS SHALL BE PROVIDED PRIOR TO CASTING CONCRETE.

G6 CONSTRUCTION LOADS

STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ON COMPLETED STRUCTURES; DURING CONSTRUCTION, STRUCTURES SHALL BE PROTECTED BY BRACING AND BALANCING WHERE VER EXCESSIVE CONSTRUCTION LOADS MAY OCCUR. ALL TEMPORARY AND PERMANENT SURCHARGE LOADS SHALL BE CONSIDERED.

G7 DRAINAGE SURFACES

SLOPE DRAINAGE SURFACES UNIFORMLY TO DRAIN. SLOPE SHALL BE 1/4-IN. PER FOOT EXCEPT WHERE NOTED OTHERWISE ON THE PLANS.

G8 FLOOR DRAINS

SEE ARCHITECTURAL AND MECHANICAL DRAWINGS FOR LOCATIONS AND SIZES.

### STRUCTURAL

S1 DESIGN CODE

DESIGN IS IN ACCORDANCE WITH THE LATEST EDITION OF THE WISCONSIN ADMINISTRATIVE CODE EXCEPT WHERE OTHER APPLICABLE CODES OR THE FOLLOWING NOTES ARE MORE BESTRICTIVE

S2 DESIGNLIVE LOADS

WALKWAYS AND STAIRS -- 100 PSF

GROUND SNOW LOAD -- 40 PSF

WIND -- 20 PSF

S3 CONSTRUCTION JOINTS

LOCATION OF ALL CONSTRUCTION JOINTS SHALL HAVE THE APPROVAL OF THE ENGINEER MAXIMUM LENGTH OF WALL AND SLAB POURS 40'. MAXIMUM HEIGHT OF WALL POURS 16' UNLESS OTHERWISE APPROVED BY ENGINEER. IN WATERTIGHT STRUCTURES, CONTINUOUS WATERSTOPS SHALL BE PROVIDED IN THE CONSTRUCTION JOINTS. CONSTRUCTION JOINTS SHALL BE AS DETAILED ON THE DRAWINGS.

#### ALUMINUM

A1 APPLICABLE CODE

DESIGN AND CONSTRUCTION OF ALUMINUM STRUCTURES SHALL CONFORM TO SUGGESTED SPECIFICATIONS FOR STRUCTURES OF ALUMINUM ALLOYS 6061-T6 AND 6062-T6, AMERICAN SOCIETY OF CIVIL ENGINEERS PROCEEDINGS PAPER NO. 3341, DECEMBER 1962.

A2 MATERIAL

UNLESS OTHERWISE INDICATED, STRUCTURAL ALUMINUM SHALL BE ALLOY 6061-T6 AS SPECIFIED IN ASTM B-308.

A3 ALUMINUM IN CONTACT WITH CONCRETE

WHERE ALUMINUM IS IN CONTACT WITH CONCRETE OR MASONRY SURFACES OR DISSIMILAR METALS, CONTACT SURFACES SHALL BE COATED WITH HEAVY ALKALI-RESISTANT BITUMINOUS PAINT

### STEEL

ST1 APPLICABLE CODE

STEEL CONSTRUCTION SHALL CONFORM TO SPECIFICATIONS AND STANDARDS PRESENTED IN AISC STEEL CONSTRUCTION MANUAL 360-05, 13TH EDITION



## CITY OF DE PERE ENGINEERING DIVISION 925 S. SIXTH ST DE PERE WI 54115 OFFICE 920-339-4061 FAX 920-339-4071

ST2 MATERIAL

ALL STRUCTURAL SHAPES INDICATED ON THE DRAWINGS SHALL CONFORM TO ASTM A-992. ALL BARS, PLATES AND SHEETS SHALL CONFORM TO ASTM A-36. ALL PIPE SHALL CONFORM TO ASTM A-53, TYPE E, GRADE B. ALL RECTANGULAR OR SQUARE TUBES SHALL CONFORM TO ASTM A-500 GRADE B

#### ST3 WELDING

WELDING SHALL CONFORM TO AWS CODE FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION. ALL WELDERS MUST BE CERTIFIED, USE E-70XX ELECTRODES. ALL FILLET WELDS SHALL BE FULL LENGTH AND HAVE END RETURNS IN THE SAME PLANE UNLESS. NOTED OTHERWISE. ALL BUTT AND GROOVE WELDS SHALL BE FULL PENETRATION UNLESS OTHERWISE NOTED. PROVIDE CONTINUOUS SEAL WELDS AT ALL UNWELDED JOINTS.

#### ST4 ENCASED STEEL

C3

C4

STEEL ENCASED IN CONCRETE SHALL NOT BE PAINTED ON THAT SURFACE IN CONTACT WITH THE CONCRETE AND SHALL HAVE A CLEAN SURFACE FOR BONDING TO CONCRETE GALVANIZED STEEL ENCLOSED IN CONCRETE SHALL HAVE SURFACES IN CONTACT WITH THE CONCRETE PHOSPHATIZED AND CLEANED.

ST5 COATINGS STRUCTURAL STEEL SHALL BE PAINTED AS SPECIFIED IN SECTION 09800. MISCELLANEOUS METALS SHALL BE GALVANIZED AS SPECIFIED IN SECTION 05500.

### CONCRETE

C1 APPLICABLE CODE CONCRETE CONSTRUCTION SHALL CONFORM TO ACI 318-08 REINFORCING STEEL DETAILS C11 ALL DETAILING, FABRICATION, AND ERECTION OF REINFORCING BARS, UNLESS OTHERWISE NOTED, SHALL BE IN ACCORDANCE WITH MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES (ACI-315), LATEST EDITION. MATERIAL STRENGTHS CONCRETE, FC' 4,000 PSI ULTIMATE COMPRESSIVE STRESS AT 28 DAYS. ALL CONCRETE TO BE AIR ENTRAINED PER SPECIFICATIONS C12 REINFORCING STEEL SHALL BE DEFORMED AND HAVE A TENSILE YIELD STRENGTH 60.000 PS1/GRADE 60). CONCRETE COVER C13

CONCRETE COVER FOR REINFORCING BARS SHALL BE AS FOLLOWS: CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH

CONCRETE CAST TO EARTH, LIQUID, WEATHER, OR CAST AGAINST A CONCRETE WORK MAT. SLAPS AND JOISTS

BEAMS AND (	COLUMNS:	
STIRRL	JPS, SPIRALS, AND TIES	2"
PRIMAR	RY REINFORCEMENT	2-1/2"
WALLS		2"
FOOTINGS AN	ND BASE SLABS:	
FORME	DSURFACES	2"
TOP OF	FOOTINGS AND BASE SLABS	2"

MINIMUM REINFORCEMENT C5

> CONCRETE CONSTRUCTION SHALL BE REINFORCED CONCRETE EXCEPT WHERE PLAIN CONCRETE (P/C) IS CALLED OUT ON THE DRAWINGS, IN WHICH CASE NO REINFORCEMENT SHALL BE USED. CONCRETE THAT IS NOT DESIGNATED P/C AND HAS NO REINFORCEMENT INDICATED SHALL BE REINFORCED PER ACI 318-08 AND THE FOLLOWING SCHEDULES:

WALL THICKNESS	SIZE	SPACING, E.W.	POSITION
6"	#4	12"	<b>ON CENTERLINE</b>
8"	#4	12"	E.F.
12" AND GREATER	#5	12"	E.F.

MASS CONCRETE SHALL BE REINFORCED WITH #5 @ 12" E.W. MINIMUM IN ALL FACES.

C6 SHRINKAGE AND TEMPERATURE STEEL

> UNLESS OTHERWISE NOTED, SHRINKAGE AND TEMPERATURE REINFORCING STEEL SHALL BE PROVIDED FOR SLABS IN ACCORDANCE WITH THE FOLLOWING SCHEDULES:

EQUIPMENT BASE OR SLAB THICKNESS	SIZE	SPACING		
4"	#3	12"	M1	MORTAR
5"	#3	12"		
6"-7"	#3	12" T AND B		USE MORTAR
8"-12"	#4	12" T AND B		
GREATER THAN 12"	#5	12" T AND B		

3"

C7 EXTRA ACCESSORY BARS

IN ADDITION TO NORMAL ACCESSORIES USED TO HOLD REINFORCING STEEL FIRMLY IN POSITION, EXTRA ACCESSORY BARS SHALL BE USED AS FOLLOWS:

IN SLABS #5 RAISER BARS AT 36" O.C. MAXIMUM TO SUPPORT TOP REINFORCING

STEEL IN WALLS WITH TWO CURTAINS #3 "U" OR "Z" SHAPE SPACERS AT 6 O.C. E.W.

STRUCTURAL NOTES

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BAR SPLICES C8

CQ

ANCHORS

BOLT DIAL

MIN EMB GROUTED

ALLOWAE

ALL ANCHOR BOLTS IN CONCRETE SHALL CONFORM TO AISI TYPE 316 STAINLESS STEEL AND HAVE A STRAIGHT EMBEDMENT OF 12 ROD DIAMETERS AND A 90° HOOK LENGTH OF 3 ROD DIAMETERS UNLESS OTHERWISE NOTED, EMBEDDED PORTION OF ALL ANCHOR BOLTS SHALL BE CLEAN AND FREE OF OIL GREASE, AND ANY FOREIGN SUBSTANCES.

ALL EXPANSION BOLTS FASTENED TO SOLID CONCRETE OR SOLID MASONRY SHALL BE AISI TYPE 316 STAINLESS STEEL WEDGE TYPE IN ACCORDANCE WITH FEDERAL SPECIFICATION EE-S-325, GROUP 11, TYPE 5, CLASS 1. ALLOWABLE LOADS SHALL NOT EXCEED THE MANUFACTURER'S RECOMMENDATIONS.

ALL EXPANSION BOLTS FASTENED TO HOLLOW MASONRY OR HOLLOW CONCRETE SHALL BE AISI TYPE 316 STAINLESS STEEL SLEEVE TYPE IN ACCORDANCE WITH FEDERAL SPECIFICATION FF-S-325, GROUP II, TYPE 3, CLASS 3. ALLOWABLE LOADS SHALL NOT EXCEED THE MANUFACTURER'S RECOMMENDATIONS.

ALL ADHESIVE ANCHORS SHALL BE AS SPECIFIED IN SECTION 05500.

PROVIDE CLASS "B" LAP SPLICES UNLESS OTHERWISE NOTED. PROVIDE 1.3 X CLASS "B" LAP SPLICES FOR HORIZONTAL BARS WITH MORE THAN 12" OF FRESH CONCRETE CAST BELOW THE REINFORCEMENT. PROVIDE TEMPERATURE REINFORCEMENT WITH A 30 BAR DIAMETER LAP, BUT NOT LESS THAN 12".

PROVIDE THE FOLLOWING LAP LENGTHS (INCHES) FOR SPLICES IN REINFORCING STEEL:

BARSIZE	CLASS "A"	CLASS "B"
#3	12	14
#4	14	19
#5	18	23
#6	21	28
#7	25	32 39
#8	30	39
#9	38	49
#10	48	63
#11	59	77

#### RESTRICTED BAR ANCHORAGE

IN CASES WHERE REINFORCING BARS CANNOT BE EXTENDED AS FAR AS REQUIRED DUE TO THE LIMITED EXTENT OF THE ADJACENT CONCRETE STRUCTURE, THE BARS SHALL EXTEND AS FAR AS POSSIBLE AND END IN STANDARD HOOKS.

BARS WITH HOOKS SHALL CONFORM TO THE REQUIREMENTS OF ACI 318-08.

WHERE HOOKS ARE REQUIRED AT EACH END OF REINFORCING STEEL DETAIL BARS IN AT LEAST 2 PIECES WITH A LAP SPLICE AT THE CENTER EXCEPT WHERE BARS ARE NOT OF SUFFICIENT LENGTH TO ACCOMMODATE THE SPLICE.

#### GROUND SUPPORTED SLABS

CONCRETE SLABS SUPPORTED BY GROUND, UNLESS OTHERWISE NOTED, SHALL BE 6" THICK, REINFORCED WITH #4 @ 12" O.C.. PROVIDE SPECIFIED VAPOR BARRIER. PROVIDE 1/2" THICK PERFORMED JOINT FILLER TO ISOLATE THE SLAB FROM CONTACT WITH THE STRUCTURE

MONOLITHIC SLABS WITH TOPS THAT ARE SLOPED, SHALL HAVE BOTTOMS SLOPED THE SAME AMOUNT, MAINTAINING A UNIFORM SLAB THICKNESS.

EXCEPT AS OTHERWISE REQUIRED, EXPOSED CONCRETE CORNERS AND EDGES SHALL HAVE 3/4" CHAMFERS. RE-ENTRANT CORNERS SHALL NOT HAVE FILLETS.

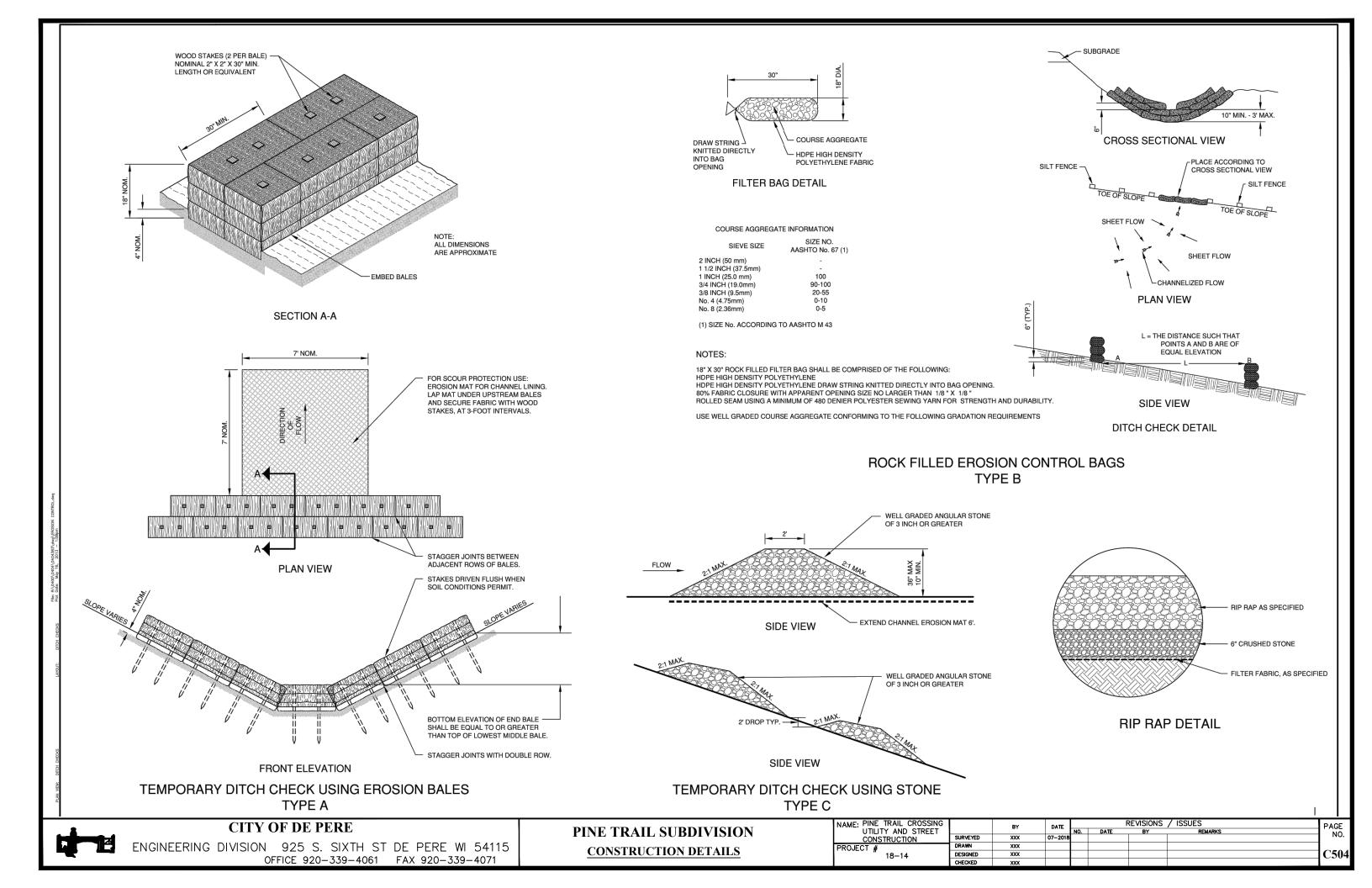
USE OF ANCHOR BOLTS OR EX PANSION BOLTS IN MASONRY SHALL CONFORM TO AISI TYPE 316 STAINLESS STEEL AND BE GOVERNED BY THE FOLLOWING TABLE:

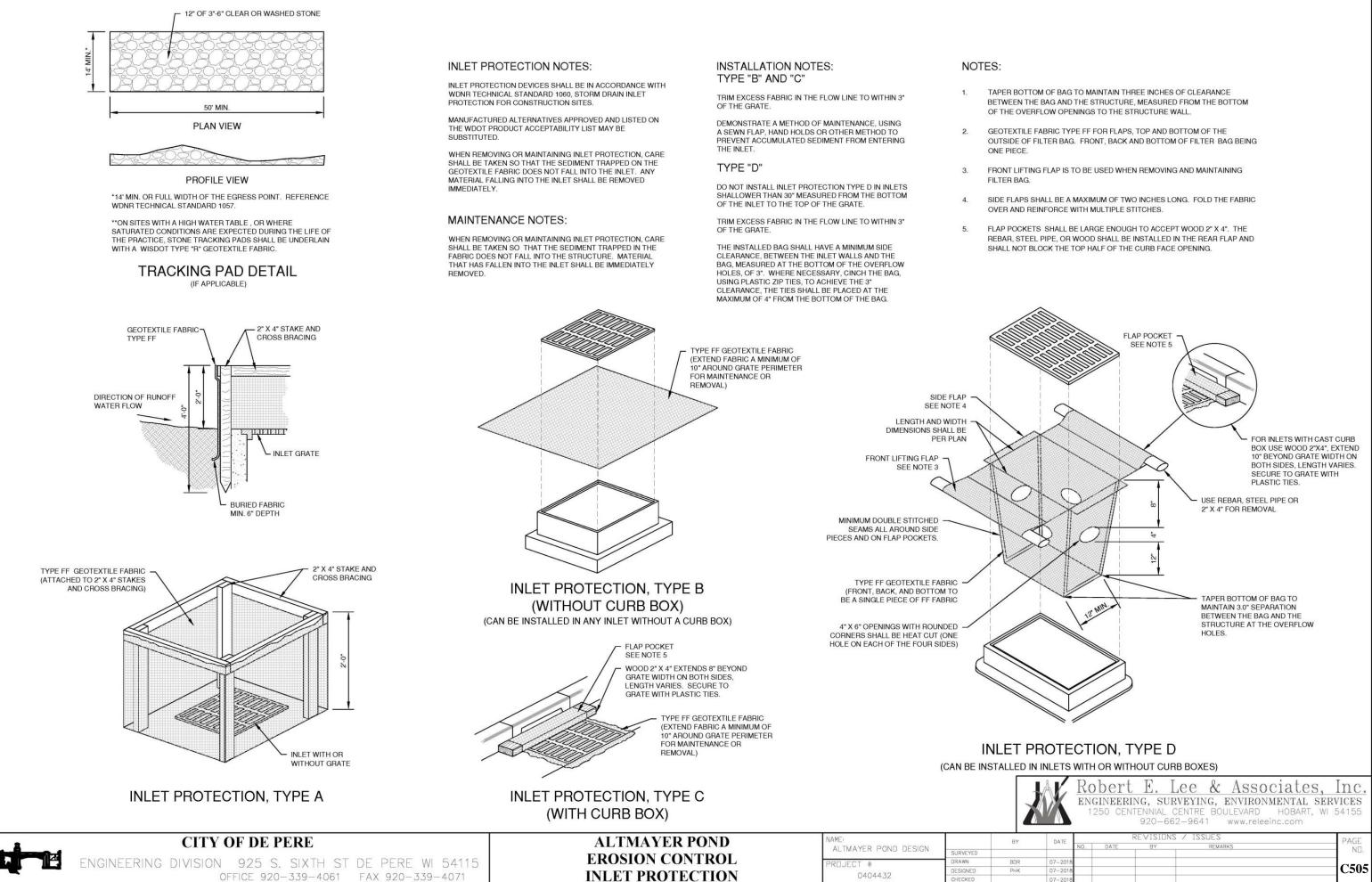
METER	1/2"	5/B"	3/4"	7/8"	1"	1 1/8"	1 1/4"
BEDMENT IN SOLIDLY D MASONRY	4"	4"	5"	6"	7"	8"	9"
BLE SHEAR	550#	750#	1 100#	1500#	1850#	2250#	2500#

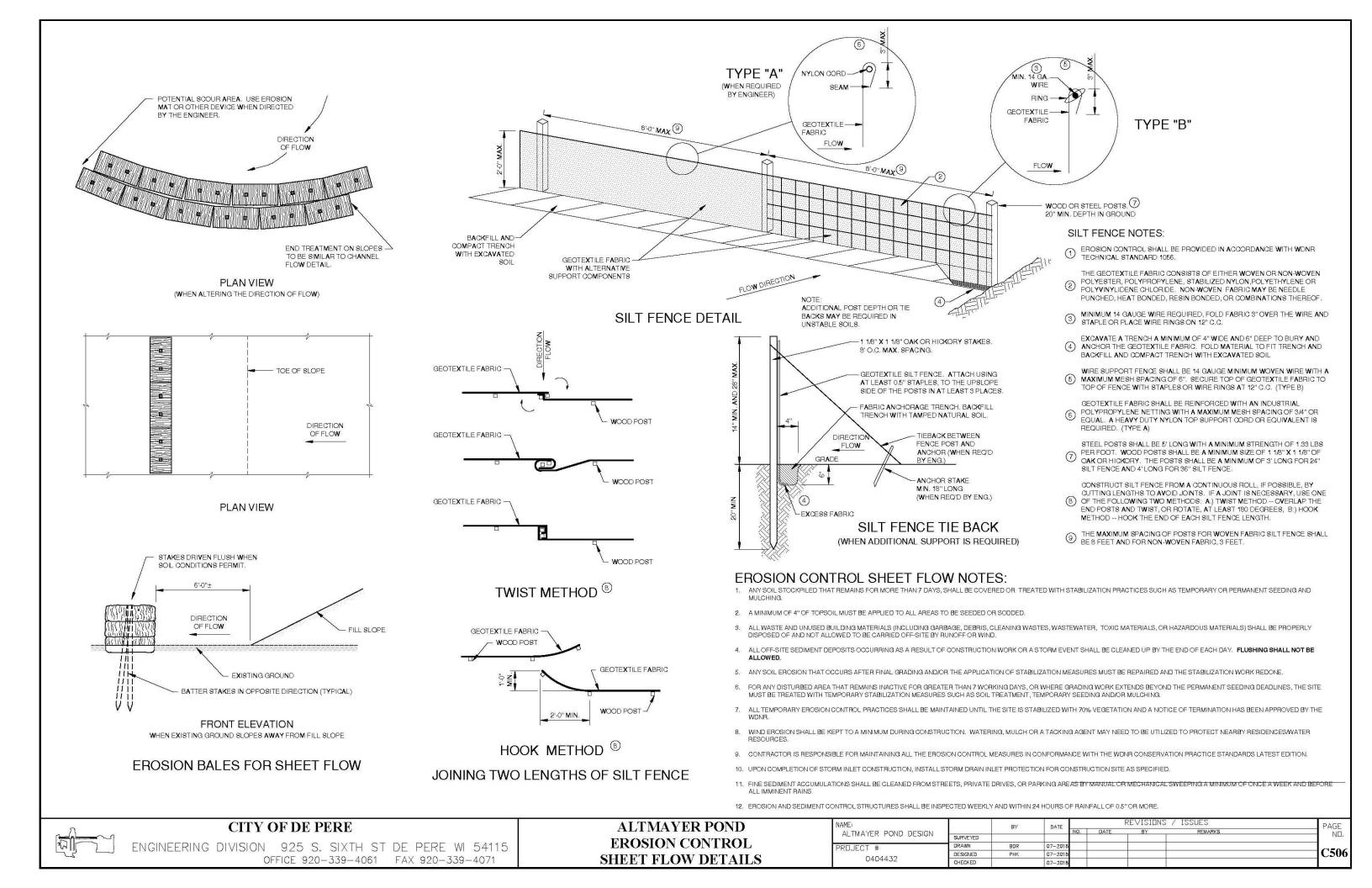
### MASONRY

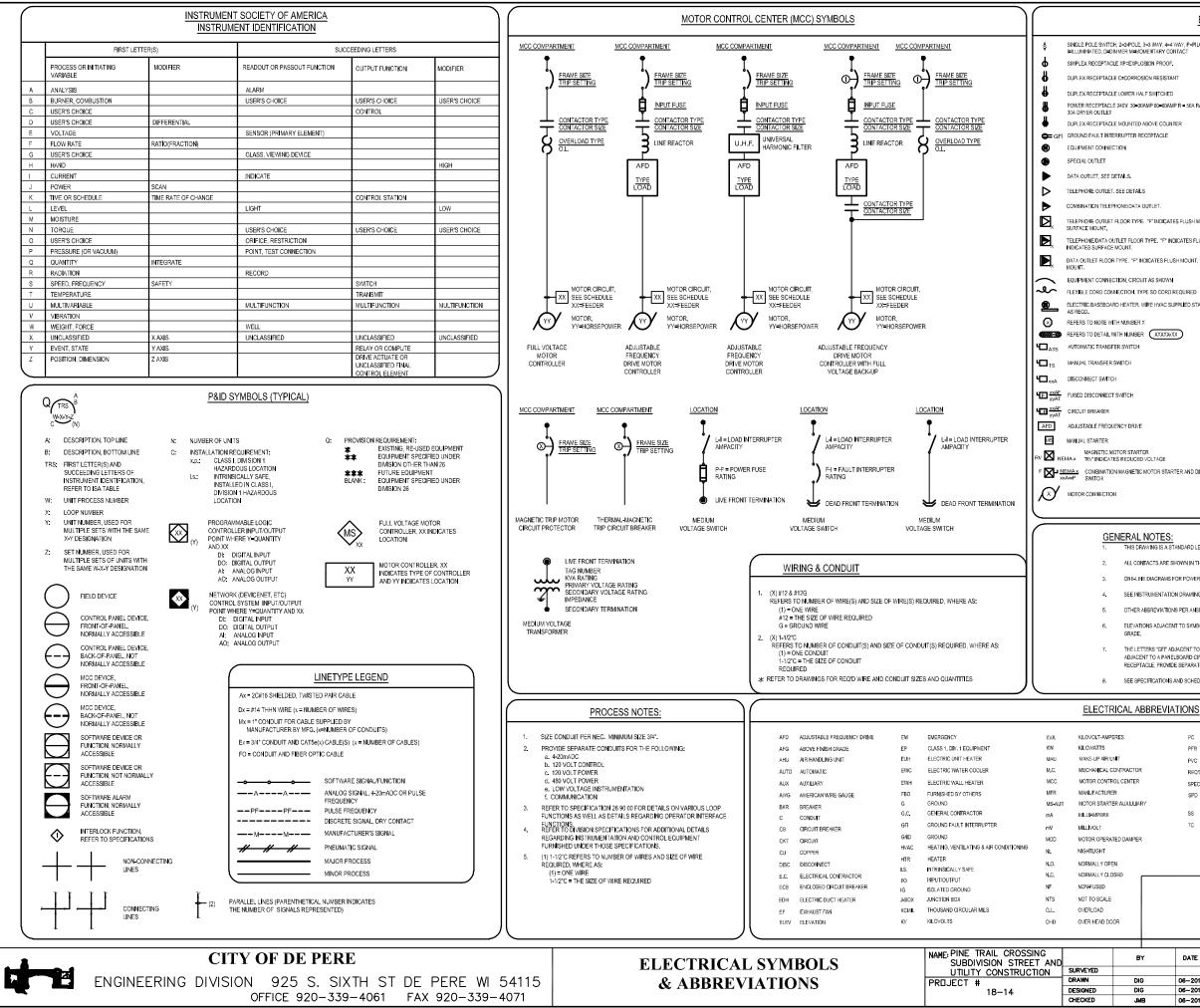
FARS SPECIFIED IN SECTION 04100.

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ELECTRICAL PLAN S	YMBOLS	
POLE, 3=3 WAY, 4=4 WAY, P=PILOT R=RELAY, K=KEYED,	-	COND. WITH BUSHING ON END.
M=MOMENTARY CONTACT EXPLOSION PROOF.		BOX AROUND OUTLET INDICATES COMBINATION OUTLET IN COMMON BOX. DEVICE MOUNTED AT RECEPTACLE HEIGHT.
ORROSION RESISTANT		SAME AS ABOVE EXCEPT DEVICE MOUNTED AT 100" TO BOTTOM.
ER HALF SWITCHED		WIREMOLD PLUG STRIP FIRE ALARM HORN/STROBE UNIT
30=30AMP 60=60AMP R = 50A RANGE OUTLET D =	l ⊠r ⊡	FIRE ALARM INDICATOR FOR SMOKE DETECTORS
NTED ABOVE COUNTER	F	FIRE ALARM STATION
FER RECEPTACLE	5	STROBE
	FACP	FIRE ALARM CONTROL PANEL
	FAAP	FIRE ALARM ANNUNCIATOR PANEL
	AR	AREA OF RESCUE STATION
S.	A84	AREA OF RESCUE STATION
ETALS	ARL	AREA OF RESCUE ILLUMINATED SIGN
DATA OUTLET.	_	HEAT DETECTOR
TYPE. "F" INDICATES FLUSH MOUNT, "S" INDICATES	0	SMOKE DETECTOR
	lõ	DUCT SMOKE DETECTOR
LOOR TYPE, "F" INDICATES FLUSH MOUNT, "S" F.	ŏ	ELEVATOR SMOKE DETECTOR
"F" INDICATES FLUSH MOUNT, "S" INDICATES SURFACE	N.	MAGNETIC DOOR HOLDER
	0	SMOKE DOOR OPERATOR/DETECTOR
CIRCUIT AS SHOWN		
DN, TYPE SO CORD REQUIRED	₽₽	PAGING SYSTEM HANDSET
TER, WIRE HVAC SUPPLIED STARTERS, PROVIDE DISC.		PAGING SYSTEM SPEAKER
/BER X	L P	SECURITY SYSTEM MOTION DETECTOR
JMBER (XXXXX-XX)	80	DOOR SWITCH, SEE DETAIL
ІТСН	DC	DOOR CONTROL
	LS	LIMIT SWITCH
4		DUAL TECHNOLOGY MOTION DETECTOR LIGHTING
	ĸ	INTRUSION ALARM KEY PAD
CH	o	WALL MOUNTED THERMOSTAT, LV=LOW VOLTAGE
	-	POLE MOUNTED LIGHT FIXTURE
	0	INC. OR HID FIXTURE FLUSH OR SURFACE MOUNTED
DRIVE	으	INC. OR HID WALL MOUNTED, FLUSH OR SURFACE
		FLUORESCENT FIXTURE
STARTER DUCED VOLTAGE		EMERGENCY LIGHT
NETIC MOTOR STARTER AND DISCONNECT	8	EXIT LIGHT
		REMOTE EMERGENCY LIGHT HEAD
		J-BOX J-BOX

### GENERAL NOTES:

THIS DRAWING IS A STANDARD LEGEND. SYMBOLS SHOWN MAY NOT ALL APPEAR ON DRAWINGS FOR THIS PROJECT.

ALL CONTACTS ARE SHOWN IN THE DE-ENERGIZED (SHELF) POSITION. BI-STABLE RELAYS ARE SHOWN IN THE RESET POSITION.

ONE-LINE DIAGRAMS FOR POWER SWITCHGEAR, USE ANSI STANDARD SYMBOLS AND ABBREVIATION

SEE INSTRUMENTATION DRAWINGS FOR INSTRUMENTATION SYMBOLS AND DETAILS.

OTHER ABBREVIATIONS PER ANSI Z32.13 AND ISA S5.

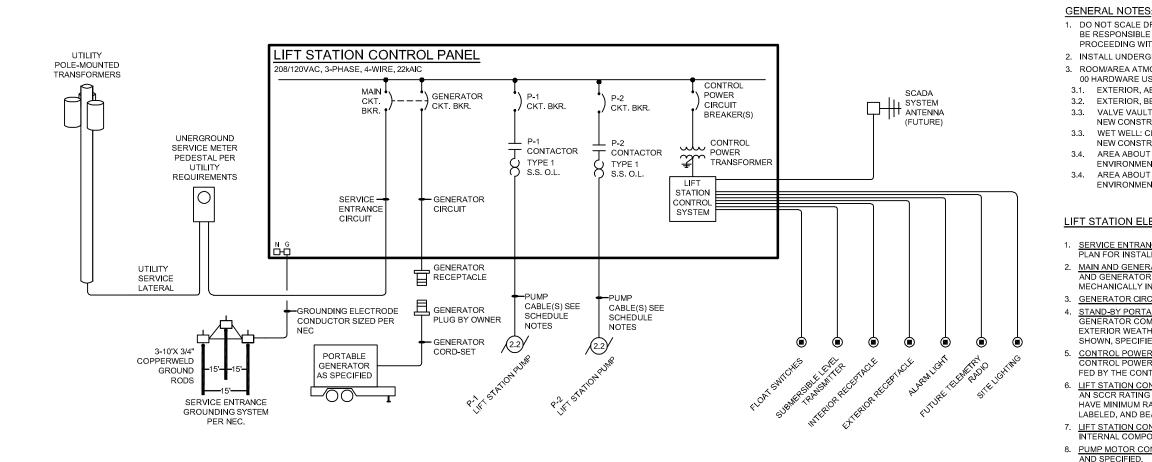
ELEVATIONS ADJACENT TO SYMBOLS ARE BASED ON STATION DATUM. HEIGHTS ADJACENT TO SYMBOLS (+4.0) ARE REFERENCED TO FINISHED FLOOR

THE LETTERS "GFI" ADJACENT TO A RECEPTACLE INDICATES A GROUND FAULT INTERRUPTER FEED-THROUGH RECEPTACLE ASSEMBLY. THE LETTERS ADJACENT TO A PANELBOARD CIRCUIT BREAKER INDICATES A GROUND FAULT CIRCUIT BREAKER. THE LETTERS "IG" INDICATE AN ISOLATED GROUND RECEPTACLE. PROVIDE SEPARATE GROUND WIRE.

SEE SPECIFICATIONS AND SCHEDULES FOR COMPONENT REQUIREMENTS FOR MOTOR CONTROLLERS AND FOR CONTACTORS.

	PC	PHOTO CONTROL	TYP	TYPICAL
	PFR	PHASE FAIL RELAY	UH	UNIT HEATER
	PVC	POLYVINYL CHLORIDE	UPS	UNINTERRUPTIBLE POWER SUPPLY
ACTOR	REQ'D	REQUIRED	W/	WITH
NTER	SPEC	SPECIFICATION	WH	WATER HEATER
	SPD	160KA/PHASE MINIMUM SURGE PROTECTIVE	WP	WEATHER PROOF
(IULIARY		DEVICE	XFMR	TRANSFORMER
	SS	STAINLESS STEEL	XLP	CROSS LINKED POLYETHYLENE
	TC	7 DAY TIMECLOCK PROVIDED BY ELECTRICAL CONTRACTOR		

					MUERM	 Solid planning, superior solutions P.O. Bor 235   178 Francis II, Kei Wissord Prane 920.894-7800	
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# LIFT STATION ONE-LINE DIAGRAM

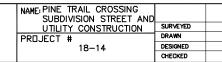
	LIFT STATION ELECTRICAL DATA												
	ELECT	RIC SERVIC	E ENTRANCE	STATION CONTROL ENTRANCE PANEL EQUIPMENT PUMP DATA		UMP DATA	STAND-BY POWER EQUIPMENT						
STATION	VOLTAGE	AMPACITY	SERVICE ENTRANCE CIRCUIT	MAIN CIRCUIT BREAKER	HP	CIRCUIT BREAKER	UNIT SIZE (KW)	GENERATOR CB SIZE	GENERATOR CIRCUIT				
DePere Lift Station	208/120V 3Ø,4W	200A	4#3/0 & #6G IN 1-2"C	150AF/100AT	2.2	150AF/20AT	30kW	100A	4#3 & #8G IN 1-1 1/4"C				
NOTES:	•			•		-							

1. STANDARD MOTOR DATA IS USED IN THE ABOVE CALCULATIONS. VERIFY ACTUAL NAMEPLATE FULL-LOAD AMP RATING WITH MANUFACTURER. 2. COORDINATE WITH PUMP MANUFACTURER AND DETERMINE NUMBER AND SIZE OF PUMP CABLES. SIGNAL CABLE FOR HIGH TEMPERATURE AND SEAL FAIL SENSOR WIRING MAY BE PROVIDED AS A SEPARATE CABLE OR INTEGRAL TO THE PUMP POWER CABLE BASED ON PUMP MANUFACTURER DESIGN. SIZE PUMP CABLE CONDUITS AS NEEDED TO SATISFY NEC REQUIREMENTS FOR CONDUIT FILL. PUMP SENSOR CABLES MAY BE ROUTED IN SAME CONDUIT AS PUMP POWER CABLES.



ENGINEERING	DIVISION 9	925 S. SIX	TH ST DE	PERE WI 54	115	0
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LIFT STATION
ONE-LINE DIAGRAM



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1. DO NOT SCALE DRAWINGS. IF DIMENSIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ENGINEER PRIOR TO PROCEEDING WITH WORK.

2. INSTALL UNDERGROUND CONDUITS PER DETAIL 2605-310.

3. ROOM/AREA ATMOSPHERE REQUIREMENTS, REFER TO SPECIFICATION SECTION 26 05 00 HARDWARE USAGE TABLE:

3.1. EXTERIOR, ABOVE GRADE: GENERAL, WET, NEW CONSTRUCTION.

3.2. EXTERIOR, BELOW GRADE: UNDERGROUND, WET, NEW CONSTRUCTION. VALVE VAULT: CLASS I, DIV 2, GROUPS C AND D HAZARDOUS ENVIRONMENT, WET, NEW CONSTRUCTION.

WET WELL: CLASS I, DIV 1, GROUPS C AND D HAZARDOUS ENVIRONMENT, WET, NEW CONSTRUCTION.

AREA ABOUT WET WELL VENT: CLASS I, DIV 1, GROUPS C AND D, HAZARDOUS ENVIRONMENT FOR A RADIUS TO THREE FEET.

AREA ABOUT WET WELL VENT: CLASS I, DIV 2, GROUPS C AND D, HAZARDOUS ENVIRONMENT FOR A RADIUS OF THREE TO FIVE FEET.

#### LIFT STATION ELECTRICAL REQUIREMENTS:

SERVICE ENTRANCE CIRCUIT: PROVIDE SERVICE ENTRANCE CIRCUIT AS SCHEDULED. SEE SITE PLAN FOR INSTALLATION REQUIREMENTS.

2. MAIN AND GENERATOR CIRCUIT BREAKERS: PROVIDE LIFT STATION MAIN CIRCUIT BREAKER AND GENERATOR CIRCUIT BREAKER IN CONTROL PANEL, AS SCHEDULED. BREAKERS SHALL BE MECHANICALLY INTERLOCKED SO ONLY ONE CIRCUIT BREAKER CAN BE CLOSED AT A TIME. 3. GENERATOR CIRCUIT: PROVIDE GENERATOR CIRCUIT AS SCHEDULED.

<u>STAND-BY PORTABLE GENERATOR:</u> PROVIDE 30KW, DIESEL-FUELED PORTABLE STAND-BY GENERATOR COMPLETE WITH SCHEDULED CIRCUIT BREAKER, FUEL SYSTEM, EXHAUST SYSTEM, EXTERIOR WEATHER-PROOF SOUND-ATTENUATING ENCLOSURE, AND OTHER ACCESSORIES AS SHOWN, SPECIFIED, AND DETAILED.

CONTROL POWER SYSTEM: CONTROL PANEL SUPPLIER SHALL BE RESPONSIBLE FOR SIZING CONTROL POWER COMPONENTS BASED ON THE CONNECTED LOAD OF THE BRANCH CIRCUITS FED BY THE CONTROL POWER SYSTEM.

6. LIFT STATION CONTROL PANEL: PANEL SHALL BE RATED FOR 208V SERVICE AND SHALL HAVE AN SCCR RATING THAT EXCEEDS THE AVAILABLE FAULT CURRENT AT THE METER. PANEL SHALL HAVE MINIMUM RATING AS INDICATED ON DRAWINGS. PANEL SHALL BE SERVICE ENTRANCE LABELED, AND BEAR A "SUITABLE FOR USE AS SERVICE DISCONNECT" LABEL.

7. LIFT STATION CONTROL PANEL COMPONENTS. PROVIDE LIFT STATION CONTROL PANEL INTERNAL COMPONENTS AS SCHEDULED AND SPECIFIED.

PUMP MOTOR CONTROLLERS: PROVIDE FVNR MOTOR CONTROL COMPONENTS AS SCHEDULED

PUMP CABLES: INSTALL PUMP CABLES AS DETAILED. PUMP CABLES SHALL BE PROVIDED BY PUMP MANUFACTURER AND SIZED FOR THE FULL LOAD OF THE PUMP MOTOR. PUMP CABLES MAY INCLUDE SENSOR (HIGH TEMPERATURE AND SEAL FAIL) WIRING OR SECOND CABLE MAY BE PROVIDED FOR THIS PURPOSE. PROVIDE CONDUITS (QUANTITY AND SIZE) AS APPROPRIATE FOR THE PUMP CABLE(S) PROVIDED UNDER THIS CONTRACT, MANUFACTURER SUPPLIED CABLES SHALL BE ROUTED TO CONTROL PANEL AND SHALL NOT BE SPLICED.

10. FLOAT SWITCHES: PROVIDE AND INSTALL THREE FLOAT SWITCHES AS DETAILED. FLOAT SWITCH CABLES SHALL BE INSTALLED IN ACCORDANCE WITH NEC REQUIREMENTS FOR INTRINSICALLY SAFE SYSTEMS. MANUFACTURER SUPPLIED CABLES SHALL BE ROUTED TO CONTROL PANEL AND SHALL NOT BE SPLICED.

11. SUBMERSIBLE LEVEL SENSOR: FURNISH AND INSTALL ONE SUBMERSIBLE LEVEL SENSOR AS DETAILED. LEVEL SENSOR CABLE SHALL BE INSTALLED IN ACCORDANCE WITH NEC REQUIREMENTS FOR INTRINSICALLY SAFE SYSTEMS. MANUFACTURER SUPPLIED CABLES SHALL BE ROUTED TO CONTROL PANEL AND SHALL NOT BE SPLICED.

12. EXTERIOR RECEPTACLE: PROVIDE AND INSTALL ONE EXTERIOR WEATHERPROOF, EXTRA-HEAVY DUTY/HOSPITAL GRADE GFCI DUPLEX RECEPTACLE ON SIDE OF CONTROL PANEL ENCLOSURE. PROVIDE WITH ALUMINUM "WHILE-IN-USE" COVER AS SPECIFIED. ROUTE 2#10 & #10G IN 3/4"C TO 20A/1P CIRCUIT BREAKER IN CONTROL PANEL.

13. FUTURE SCADA SYSTEM RADIO AND ANTENNA: PROVIDE FOR FUTURE SCADA SYSTEM RADIO AND ANTENNA. MAINTAIN A MINIMUM 18" X 18" SPACE INSIDE PANEL FOR TELEMETRY RADIO AND SURGE SUPPRESSOR. PROVIDE CONDUIT ENTRANCE ON SIDE FAILE FOR FUTURE ANTENNA CABLE. REFER TO DETAIL (2690-702) AND ACCOMMODATE FOR FUTURE MAST MOUNTING REQUIREMENTS IN PANEL CONSTRUCTION AND INSTALLATION.

14. SITE LIGHTING: PROVIDE SWITCH WITHIN CONTROL PANEL TO FOR AREA LIGHT FIXTURE ON/OFF CONTROL. WIRE FIXTURE TO BE CONTROLLED FROM LIGHT-POLE MOUNTED PHOTOCELL WHEN SWITCH IS IN THE ON POSITION, SEE SITE PLAN.



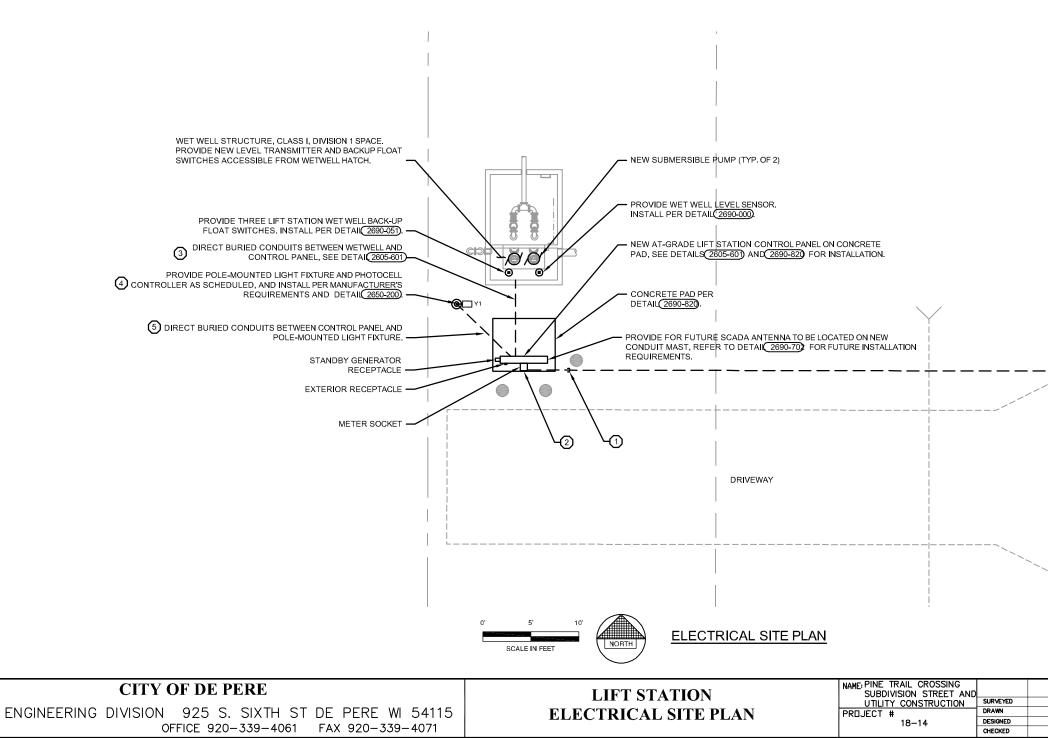
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	FIXTURE SCHEDULE							
TYPE	DESCRIPTION	WATTS	LAMP TYPE	LAMP QTY.	MANUFACTURER	CATALOG NUMBER	NOTE	
Y1	15' POLE MOUNTED FIXTURE - SINGLE HEAD	134	LED-4000K	W/FIX.	LITHONIA	CSX1-LED-60C-700-40K-T3M-MVOLT-SPAVG-BS-		
	13 FOLE MOONTED HATORE - SINGLE HEAD					DDBXD		
Y1	15 FT ALUMINUM SQ. POLE. DARK BRONZE	N/A	N/A	N/A		SSA-15-4C-DM19-DDB		
		1.07	10,1		Ennionan			
GENER	AL NOTES:							
1. ALL	FIXTURES SHALL BE UNIVERSAL VOLTAGE UNLESS OTHERWISE INDICAT	FED.						
2. ALL	2. ALL LED FIXTURES SHALL BE DESIGNLIGHTS <sub>TM</sub> CONSORTIUM QUALIFIED.							

3. FIXTURES BY MANUFACTURERS OTHER THAN THOSE SHOWN IN THE SCHEDULE SHALL BE CONSIDERED EQUAL PROVIDED THEY ARE

OF SIMILAR QUALITY OF CONSTRUCTION AND HAVE ALL FEATURES, OPTIONS AND ACCESSORIES AS THE SCHEDULED FIXTURE.



### GENERAL NOTES:

- 1. COORDINATE WITH ELECTRIC UTILITY TO PROVIDE ELECTRIC SERVICE TO THE FACILITY AS SCHEDULED.
- 2. DO NOT SCALE DRAWINGS. IF DIMENSIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ENGINEER PRIOR TO PROCEEDING WITH WORK.
- 3. INSTALL UNDERGROUND CONDUITS PER DETAI 2605-310.
- 4. UNDERGROUND CONDUIT ROUTING IS DIAGRAMMATIC IN NATURE. ACTUAL ROUTING TO BE DETERMINED IN FIELD BASED ON SITE CONDITIONS AND COORDINATED WITH ENGINEER.
- 5. ROOM/AREA ATMOSPHERE REQUIREMENTS, REFER TO SECTION 26 05 00 HARDWARE USAGE TABLE:
- 5.1. EXTERIOR, ABOVE GRADE: GENERAL, WET, NEW CONSTRUCTION.
- 5.2. EXTERIOR, BELOW GRADE: UNDERGROUND, WET, NEW CONSTRUCTION.5.3. VALVE VAULT: CLASS I, DIV 2, GROUPS C AND D HAZARDOUS ENVIRONMENT,
- WET, NEW CONSTRUCTION.
- 3.3. WET WELL: CLASS I, DIV 1, GROUPS C AND D HAZARDOUS ENVIRONMENT, WET, NEW CONSTRUCTION.
- 3.4. AREA ABOUT WET WELL VENT: CLASS I, DIV 1, GROUPS C AND D, HAZARDOUS ENVIRONMENT TO A RADIUS TO THREE FEET.
- 3.4. AREA ABOUT WET WELL VENT: CLASS I, DIV 2, GROUPS C AND D, HAZARDOUS ENVIRONMENT FOR A RADIUS OF THREE TO FIVE FEET.

### PLAN NOTES:

- 1. PROVIDE CONDUIT SWEEP 30" BFG AND EXTEND TO 30" FROM EDGE OF PAD FOR UTILITY SECONDARY, AND INSTALL PER UTILITY REQUIREMENTS. UTILITY TO PROVIDE CONDUIT AND SECONDARY TO UTILITY POLE WITH POLE-MOUNTED TRANSFORMERS. COORDINATE ROUTING AND LOCATION IN FIELD WITH ENGINEER AND UTILITY. MAINTAIN REQUIRED CONDUIT DEPTH FOR ENTIRE RUN.
- 2. MOUNT METER SOCKET ON BACK OF CONTROL PANEL. COORDINATE INFIELD WITH ENGINEER AND UTILITY.
- 3. PROVIDE SCH. 40 DIRECT BURIED PVC CONDUITS FOR WET WELL CIRCUITS AS FOLLOWS:
- 3.1. (2) 2" MINIMUM CONDUITS FOR PUMP CABLES
- 3.2. (1) 2 1/2" MINIMUM CONDUIT FOR FLOAT CABLES
- 3.3. (1) 1" MINIMUM CONDUIT FOR TRANSDUCER CABLE.
- 4. PROVIDE SCH. 40 DIRECT BURIED PVC CONDUIT FOR AREA LIGHT POWER CIRCUIT, (1) - 1" CONDUIT. PROVIDE 120V, 20A CIRCUIT, 2#12 & #12 GROUND .
- 5. PROVIDE PHOTOCELL CONTROLLER, TORK #2001 OR EQUAL, AND MOUNT ON LIGHT POLE AT A MINIMUM OF 10 FEET ABOVE FINISHED GRADE. SEE NOTES ON ONE-LINE FOR FIXTURE CONTROL.

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