REQUEST FOR BIDS

Natural Treatment System Maintenance, Phase 2

REQUEST NUMBER: 2625

DUE DATE: November 10, 2026

DUE TIME: 2:00 PM

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INTRODUCTION

The Gerald R. Ford International Airport Authority (GFIAA) is requesting bids for Natural Treatment System Maintenance, Phase 2 project. The project consists of the removal of existing treatment bed media and piping from four treatment cells, disposal of bed material on airport property, construction of new bed media, piping and outlet controls, and installation of a stormwater treatment.

The Gerald R. Ford International Airport is the second busiest airport in Michigan, serving business and leisure travelers with nonstop and connecting flights on six airlines. The Ford Airport is managed and operated by the Gerald R. Ford International Airport Authority.

This solicitation will be publicly opened at the Gerald R Ford International Airport Authority, located on the second floor of the Gerald R Ford International Airport Terminal Building at 5500 44th St SE, Grand Rapids, MI, 49512. All submissions will be sealed until the date and time specified, at which time they will be opened and read aloud.

SOLICITATION AND PROJECT SCHEDULE

ACTIVITY	DATE
BID Issue Date	October 13, 2026
Question Deadline	November 3, 2026
Submission Due Date	November 10, 2026
Contract Start Date	June 1, 2027

GFIAA reserves the right to modify the deadline set forth in the above table in its sole discretion. Any such modifications will be stated in an addendum.

VOLUNTARY ON-SITE CONFERENCE

CONFERENCE DETAILS	
Conference Date	October 27, 2026
Conference Time (local)	2:00 pm
Conference Location	International Room B of the airport terminal building, 5500 44th St. SE, Grand Rapids, MI 49512
Virtual Attendee Option	**Join the meeting now** Meeting ID: 260 425 600 105 900 Passcode: o5d2HF3h

A voluntary pre-submission conference is scheduled for this request. Equal opportunity will be provided for all Bidders to ask questions.

Attendees should arrive a minimum of five (5) minutes before the scheduled date and time.

Attendees requiring special services are asked to provide their requirements to the GFIAA at least

forty-eight (48) hours in advance to allow for accommodations.

An optional site visit will be available following the on-site conference.

SITE INSPECTION

Bidders may request an on-site inspection by appointment only. Discussions between the Bidder and airport staff during the on-site inspection do not override any written specification or correspondence provided in this solicitation.

CONTACT FOR AN APPOINTMENT	
Contact Name	Michelle Baker
Contact Phone Number	(616) 233-6022

Bidders shall not communicate with the above contact for any reason other than for on-site inspection purpose. Any Bidder requesting a modification to the written specification should contact the Purchasing Department as instructed within this request.

WORK SCOPE

The project consists of furnishing all material and constructing the following:

Removal of existing treatment bed media and piping from four treatment cells, disposal of bed material on airport property, construction of new bed media, piping and outlet controls, and installation of a stormwater treatment.

See Attached Technical Specifications and Contract Drawings.

EXAMINATION OF SPECIFICATIONS

Contract documents may be viewed online at https://www.grr.org/business-opportunities.

DEPOSIT FOR DRAWINGS AND SPECIFICATIONS

Hardcopy drawings and specifications are available at the 3355 Evergreen Drive NE, Grand Rapids, MI 49525 office of Prein&Newhof. Hardcopy drawings and specifications are available for the fee of $300.00 dollars. Prein&Newhof Plan Room members who want to purchase the hard copy of the drawings only, may do so for $78.00 dollars. A $15 dollar charge will be added to all mailed drawings and/or specifications. Fees are payable by cash or check only and are not refunded.

FUNDING

The work to be performed under this contract will be financed and paid for by funds received from federal and local sources.

REQUESTS FOR INFORMATION

Questions regarding this solicitation are to be submitted in writing to *purchasing@grr.org* prior to 5 p.m. on November 3, 2026.

GFIAA reserves the right to publish and respond to an inquiry, respond directly to the inquirer without publishing or not respond to the inquiry at its sole discretion. Unless otherwise indicated, all questions will be complied into one document and answers will be issued as a Questions & Answers document within 4 days after the question deadline.

It is the firm's responsibility to become familiar with and fully informed regarding the terms, conditions, and specifications of this solicitation. Lack of understanding or misinterpretation of any portions of this solicitation shall not be cause for withdrawal after opening or for subsequent protest of award.

Addendums will only be published by the GFIAA Purchasing Department and available for review at www.grr.org.

CONSTRUCTION

All work is to be done in a first-class workmanlike manner. All debris (packing materials, replaced materials, etc.) are to be cleaned up and removed by the workers.

The successful Bidder is responsible for obtaining all necessary permits and licenses so the completed work complies with all applicable codes, ordinances, regulations, standards, and laws. The cost of such permits and licenses is understood to be a part of the bid price. Any fines, fees, or other costs taxed or charged to Kent County because of the successful bidder's violation(s) of any laws, standards, etc. will be paid by the successful bidder.

Dimensions furnished are for general reference only. Bidders must take their own measurements as necessary for preparing their response.

All materials are to be new, not refurbished, and free from corrosion, scratches, or other such defects which present other than a new appearance.

REQUEST FOR BID SUBMISSION

Responses may be delivered physically or electronically. To be considered, complete submissions must be received prior to the due date and time specified (local time).

- Hard copy responses can be mailed or otherwise delivered to the address below.

  Submission address:

  Attn: Marissa Norris, Senior Procurement Specialist
  Gerald R Ford International Airport Authority
  5500 44th St SE
  Grand Rapids, MI 49512
- Electronic responses can be securely uploaded as a single pdf document to:

  https://www.dropbox.com/request/kcdh2tlzfjzmgegg2lve

Electronic submissions shall be named with a form or portion of the firm's name as part of the document name.

The firm certifies the response submitted has not been made or prepared in collusion with any other Bidder and the prices, terms or conditions thereof have not been communicated by or on behalf of the Bidder to any other Bidder prior to the official opening of this request. This certification may be treated for all

purposes as if it were a sworn statement made under oath, subject to the penalties for perjury. Moreover, it is made subject to the provisions of 18 U.S.C. Section 1001, relating to the making of false statements.

Submissions may be withdrawn by written request only if the request is received on or before the opening date and time.

Submissions not meeting these criterions may be deemed non-responsive.

GFIAA is not liable for any costs incurred by any prospective firm prior to the awarding of a contract, including any costs incurred in addressing this solicitation.

BONDS

Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to 100% of the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due.

COMPLETION DATE

The project shall be completed on or before September 30, 2027.

TERMS AND CONDITIONS

GFIAA reserves the right to require that its standard terms and conditions apply to any actual order placed in response to a firm's submission. No attempt to modify GFIAA's Standard Terms and Conditions shall be binding, absent agreement on such modification in writing and signed by GFIAA.

No payment shall be made to the Bidder for any extra material or services, or of any greater amount of money than stipulated to be paid in the contract, unless changes in or additions to the contract requiring additional outlay by the Bidder shall first have been expressly authorized and ordered in writing by contract amendment or otherwise furnished by the GFIAA.

The intent of these specifications is to solicit a properly designed and all-inclusive response. Any requirements not in the specifications, but which are needed for such a response, are to be included in the submission.

The Gerald R Ford International Airport Authority, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that for any contract entered into pursuant to this advertisement, disadvantaged business enterprises and airport concession disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

The Bidder shall not discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions or privileges of employment, or a matter directly or indirectly related to employment, because of race, color, religion, national origin, age, sex, height, weight, marital status, or disability that is unrelated to the individual's ability to perform the duties of a particular job or position.

The Bidder shall observe and comply with all applicable federal, state, and local laws, ordinances, rules and regulations at all times during the completion of any contract with the GFIAA.

The terms of this request shall be interpreted, construed and enforced pursuant to the laws of the State of Michigan, and the Parties irrevocably consent to the jurisdiction of the federal and state courts presiding in

Michigan.

The GFIAA is tax-exempt and a regional airport authority organized under 2015 P.A. 95, being MCL 259.137 et. seq.

Vendor Representation and Warranty Regarding Federal Excluded Parties List: The Bidder acknowledges that the GFIAA may be receiving funds from or through the Federal Government; such funds may not be used to pay any Bidder on the Federal Excluded Parties List (EPLS). The Bidder represents and warrants to the GFIAA that it is not on the Federal EPLS. If the Bidder is in non-compliance at any time during execution or term of this agreement (including any extensions thereof), the Bidder shall be in breach and the GFIAA shall be entitled to all remedies available to it at law or equity, specifically including but not limited to recovery of all moneys paid to the Bidder, all consequential damages (including the loss of grant funding or the requirement that grant funding be returned), and attorney fees (including the costs of in-house counsel) sustained as a result of the Bidder's non- compliance with this warranty and representation.

Pursuant to the Michigan Iran Economic Sanctions Act, 2012 P.A. 517, by submitting a bid, proposal or response, Bidder certifies, under civil penalty for false certification, that it is fully eligible to do so under law and that it is not an "Iran linked business," as that term is defined in the Act.

Insurance requirements are posted on the Documents and Forms page of the GFIAA website within the Purchasing Terms and Conditions document.

Termination For Cause: Should the firm fail to perform the Work as required by and in accordance with the schedule or time requirements, or otherwise violate any of the terms set forth in the Solicitation Request, it shall constitute breach of the Contract. Other than in force majeure situations, Bidder shall have five (5) calendar days to cure a breach of the Contract (the "Cure Period") following issuance of GFIAA written notice. Failure to cure a breach of the Contract within said Cure Period shall allow the GFIAA to, without further notice to the Bidder, declare the Contract terminated and proceed with the replacement of the Bidder and the GFIAA shall be entitled to all remedies available to it at law or in equity including a claim against any required payment/performance bonds.

Termination Without Cause: Notwithstanding any other provision, at any time and without cause, GFIAA shall have the right, in its sole discretion, to terminate the contract by giving sixty (60) days written notice.

Although it is the intent to contract with one provider, the GFIAA reserves the right to contract with alternate sources if the Bidder is unable or unwilling to service its obligation, or it is deemed by GFIAA to be in its best interest to use alternate sources.

Assignment: Neither party shall assign or delegate any of its rights or obligations under this Agreement without the prior written consent of the other party.

Bidder warrants that they are an authorized provider of products or services of his/her submission.

CONTRACT DOCUMENTS

The contract documents consist of material outlined in Article 7 of the Agreement. Each Bidder shall carefully examine his copy of the contract documents for completeness. No claim will be allowed on the basis that the contract documents are not complete.

INTERPRETATION OF THE CONTRACT DOCUMENTS

It is the intent of these contract documents to be clear, complete and consistent. If Bidder is of the opinion that any portion of the contract documents is ambiguous, inconsistent or contains errors or omissions Bidder shall,

prior to submitting its bid, in writing request Engineer to clarify that portion of the contract documents as an addendum. This interpretation or correction will be made a part of the contract documents as an addendum. Any such addendum shall be mailed, faxed, e-mailed or delivered only to each person recorded as having received/downloaded a copy of the contract documents directly from Prein&Newhof.

The last day an addendum will be issued is three (3) business days prior to the bid.

Only written addenda issued by the Engineer shall be binding. Oral interpretations, information or instructions by any office or employee of the Authority or Engineer are not authorized and therefore are not binding.

Any conclusions or information obtained or derived from Contract Documents will be at the user's sole risk. Prein&Newhof will maintain the Master Copy (hard copy), from which all electronic copies are based in its Grand Rapids Office. In the case of any contract discrepancy, the Master Copy (hard copy) shall be considered the controlling document.

BIDDERS INVESTIGATION

The Bidder will be responsible for inspecting the site of the proposed work to determine for himself all conditions under which he will be obligated to work. It is also expected that he will investigate and make his own determination concerning the available facilities for receiving, transporting, handling and storing construction equipment and materials, and concerning other local conditions that may affect his work.

BID PROPOSAL PREPARATION

A. Name, Address and Legal Status of Bidder

The name and legal status of the Bidder, Corporation, Partnership or an Individual, shall be stated in the Proposal. A corporation Bidder shall name the state in which its Articles of Incorporation are held, and must give the title of the official having authority, under the by-laws, to sign contracts. A partnership Bidder shall give the full names and addresses of all partners. An L.L.C. Bidder shall provide the full names and addresses of all members.

Anyone signing a proposal as an agent of another must submit, with his proposal, legal evidence of his authority to act as an authorized agent of the party.

The place of residence of each Bidder, or the office address in the case of a firm or company, with county and state, must be given after a signature.

B. Proposal Form

The Bidder is to complete the Bid Proposal Documents that are included in the Project Specification book (online or hard copy), referring to the table of contents to identify the exact order of these documents. Regardless of how the bid documents are received, a hard copy (paper copy) of the Bid Proposal Documents must be submitted for bidding purposes. The Bid Proposal Documents include: Bid Proposal Checklist, Bid Proposal, and Bid Proposal – Unit Prices.

The Bidder must provide the signed Bid Proposal Documents in either type written or hand written (in ink) form and clearly and completely set forth all required lump sum amounts, unit prices or other costs in a legible and understandable manner. Illegibility of any work or figure in the proposal may be sufficient cause for rejection of the proposal by the Authority.

C. Proposal Data

Proposals shall be carefully prepared in strict accordance with contract requirements and these instructions and shall include all pertinent information required by the proposal form. Failure of the bidder to comply in any respect shall be grounds for rejection of the bidder's proposal.

The proposal for work is on a unit basis.

The bids will be based on the comparison of totals of the extensions of the stated unit prices. In case of an error in preparation of the bid form, the unit prices will be used. No partial bids will be considered.

D. Experience and Qualifications

It is the intention of the Authority to award this contract to a Bidder that will perform and complete all work in compliance with the Contract Documents and in a workmanlike and professional manner. Bids are therefore only solicited from responsible Bidders known to be skilled, experienced and regularly engaged in work of similar character and magnitude to that covered by these contract documents.

After the opening of bids, when so requested by the Authority or Engineer, the Bidder will be required to provide documentation of the extent and nature of his experience in work of this kind and to furnish references as to his experience on projects of similar types and concerning contractor's ability to timely and within budget perform work of the type involved in this project. The successful Bidder shall submit a statement of his experience and financial status, a list of all jobs he now has underway, with the volume and percent completed. If the successful Bidder is an LLC, bidder shall provide, if requested, personal guarantees of its members.

In addition to the above, when so requested, the Bidder shall meet with the Authority's representatives and give further information in relation to his proposed construction plan, methodology, and schedule of operations, in order to determine the Bidder's qualifications, ability to perform the Work, and timely complete the Work in accordance with the contract requirements.

WITHDRAWAL OF BIDS

Any Bidder who has submitted a proposal to the Authority may withdraw his bid at any time prior to the scheduled time for opening bids. No Bidder may withdraw his bid after the opening for a period of Sixty (60) days thereafter.

MICHIGAN FREEDOM OF INFORMATION ACT

Information submitted in this solicitation is subject to the Michigan Freedom of Information Act and may not be held in confidence after the Bidder's submission is opened. A submission will be available for review after the project has been awarded.

GFIAA cannot assure that all of the information submitted as part of or peripheral to the Bidder's submission will be kept confidential. Any Bidder submission language designated as confidential is considered automatically invalid and void. GFIAA is subject to the Michigan Freedom of Information Act, which prohibits it from concealing information on or associated with responses, successful or unsuccessful, once they are opened.

EVALUATION, STATUS UPDATES, AWARD & CONTRACT EXECUTION

The Authority reserves the right to request additional information it may deem necessary after the submissions are received.

The Authority reserves the right at its discretion to waive irregularities of this solicitation process.

In the event of extension errors, the unit price shall prevail and the Bidder's total offer will be corrected accordingly. In the event of addition errors, the extended totals will prevail and the Bidder's total will be corrected accordingly. Bidder must check their submission where applicable. Failure to do so will be at the Bidder's risk. Submissions having erasures or corrections must be initialed in ink by the Bidder. Bidders are cautioned to recheck their submissions for possible errors.

The Bidder shall not be allowed to take advantage of error, omissions or discrepancies in the specifications.

The Authority, at its sole discretion, reserves the right to award to the Bidder whose response is deemed most advantageous to the Authority. The Authority, at its sole discretion, shall select the most responsive and responsible Bidder and evaluate all responses based on the requirements and criterion set forth in this solicitation while reserving the right to weigh specifications and other factors in the award. The Authority reserves the right to reject any and all submissions as a result of this solicitation.

The Authority reserves the right to award by line item when applicable and to accept or reject any or all parts of a submission.

Accelerated discounts should be so stated at the time of submission. If quick-pay discounts are offered, The Authority reserves the right to include that discount as part of the award criterion. Prices must, however, be based upon payment in thirty (30) days after receipt, inspection, and acceptance. In all cases, quick-pay discounts will be calculated from the date of the invoice or the date of acceptance, whichever is later

Award notifications are posted on the Authority website. It is the Bidder's responsibility to monitor the website for status updates.

Low bid shall be determined based on the lowest responsive and responsible bid. The Authority may elect to award only specific portions of work based on the availability of funding.

The Bidder to whom the contract shall have been awarded will be required to execute an Agreement in the form included in the Contract Documents and to furnish sureties, insurance policies and certificates all as required within fifteen (15) days after the award. In case of his refusal or failure to do so, he will be considered to have abandoned all his rights and interest in the award, and his bid deposit may be declared forfeited to the Authority and the work may be awarded to another Bidder.

BID PROPOSAL CHECKLIST

This checklist is for the bidder's convenience and the Engineer's use. It should be reviewed thoroughly before submitting a bid.

- ☐ Bid submitted on time.
- ☐ Addenda, if applicable, has been acknowledged and any revisions to the proposal completed.
- ☐ Bid proposal legally signed in ink or certified electronically.
- ☐ All unit prices are completed in ink or certified electronically.

EXHIBITS

Exhibit A – Bid Form

The undersigned, being familiar with the site, plans, specifications, and related documents, proposes to furnish all required labor, materials, tools and equipment to construct the project in accordance with the [unit prices/lump sum] on the following sheets.

Date Prepared: _____

Receipt of Addenda _____ through _____ is herby acknowledged.

Summary of Bids

Total Bid $ _____

The Owner reserves the right to accept or reject any or reject any or all bids and to waive any irregularities in the bidding. No partial bids will be accepted.

Contractors Signature

Contractor's Name	Email Address	Telephone Number
Business Address	City	Zip Code
Printed Name	Title	Date

_____

Signature

Seal (if bidder is a corporation)

Item No.	Description	Quantity	Unit	Unit Price	Total Amount
1	Mobilization, Max 10%	1	Lsum		
2	Safety and Security	1	Lsum		
3	Permits	2,500	DLR	$1.00	$2,500.00
4	Curb and Gutter, Rem	20	Ft		
5	Erosion Control, Inlet Protection, Fabric Drop	8	Ea		
6	Erosion Control, Silt Fence	500	Ft		
7	Excavation, Earth, As Specified	675	Cyd		
8	Aggregate Base, Conditioning	500	Syd		
9	Aggregate Base Cse, 8 inch	370	Syd		
10	Dr Structure, TSS Removal	1	Ea		
11	Conc, Grade 3500	75	Cyd		
12	Driveway, Nonreinf, 8 Inch	80	Syd		
13	Curb and Gutter, Conc, Det F4	20	Ft		
14	Riprap, Plain	75	Syd		
15	Fertilizer, Chemical Nutrient, Cl B	150	Lb		
16	Mulch	2,000	Syd		
17	Mulch Anchoring	2,000	Syd		
18	Mulch Blanket, High Velocity	3,500	Syd		

Item No.	Description	Quantity	Unit	Unit Price	Total Amount
15	Seeding, Mixture, as specified	250	Lb		
16	Topsoil Surface, Salv, 4 Inch	5,500	Syd		
17	Treatment Media	4,400	Cyd		
18	Insulation Media (Wood Chips)	1,350	Cyd		
19	Course Media	300	Cyd		
20	Geotextile Fabric	112,000	Sft		
21	Gabion Basket	550	Lf		
22	Gabion 3" to 6" Rock	150	Cyd		
23	Splash Pad	16	Ea		
24	Piping	500	Lf		
25	Pipe Coupling	4	Ea		
26	R-Tanks Mini	1,450	Ea		
27	R-Tanks HD Single	1,450	Ea		
28	Media Removal	12,000	Cyd		
29	Piping Removal	6,350	Lf		
30	Infiltrator Removal	1,200	Ea		
31	Smart Drain	5	Ea		
				Total Bid:	

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between Gerald R. Ford International Airport Authority ("Owner") and [Contractor Name & Address] ("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: Natural Treatment System Maintenance, Phase 2 including removal of existing treatment bed media and piping from four cells, disposal of bed material on airport property, construction of new bed media, piping and outlet controls.

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: *Natural Treatment System Maintenance, Phase 2*

ARTICLE 3—ENGINEER

3.01 The Owner has retained Prein&Newhof, 3355 Evergreen Drive NE, Grand Rapids, MI 49525("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by Prein&Newhof.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Dates*

A. The Work will be substantially complete on or before **August 31, 2027**, and completed and ready for final payment ~~in accordance with Paragraph 15.06 of the General Conditions~~ on or before **September 30, 2027**.

4.03 *Contract Times: Days*

A. ~~The Work will be substantially complete within **[number]** days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within **[number]** days after the date when the Contract Times commence to run~~.

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4.04 *Milestones*

A. ~~Parts of the Work must be substantially completed on or before the following Milestone(s):~~

~~1. Milestone 1 **[event & date/days]**~~

~~2. Milestone 2 **[event & date/days]**~~

~~3. Milestone 3 **[event & date/days]**~~

4.05 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner $**2,500.00** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $**5,000.00** for each day that expires after such time until the Work is completed and ready for final payment.

3. ~~*Milestones:* Contractor shall pay Owner $**[number*]** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved, or until the time specified for Substantial Completion is reached, at which time the rate indicated in Paragraph 4.05.A.1 will apply, rather than the Milestone rate~~.

4. Liquidated damages for failing to timely attain Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

C. ~~*Bonus:* Contractor and Owner further recognize the Owner will realize financial and other benefits if the Work is completed prior to the time specified for Substantial Completion. Accordingly, Owner and Contractor agree that as a bonus for early completion, Owner shall pay Contractor $**[number]** for each day prior to the time specified above for Substantial Completion (as duly adjusted pursuant to the Contract) that the Work is substantially complete. The maximum value of the bonus will be limited to $**[number]**~~.

DRAFT

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4.06 *Special Damages*

A. Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.

B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

C. The special damages imposed in this paragraph are supplemental to any liquidated damages for delayed completion established in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. ~~For all Work other than Unit Price Work, a lump sum of $**[number]**.~~

~~All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.~~

B. ~~For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item).~~

~~**Unit Price Work**~~					
~~**Item No.**~~	~~**Description**~~	~~**Unit**~~	~~**Estimated Quantity**~~	~~**Unit Price**~~	~~**Extended Price**~~
				~~$~~	~~$~~
				~~$~~	~~$~~
				~~$~~	~~$~~
				~~$~~	~~$~~
				~~$~~	~~$~~
~~Total of all Extended Prices for Unit Price Work (subject to final adjustment based on actual quantities)~~					~~$~~

~~The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General~~

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~~Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer~~.

C. ~~Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment) $**[number]**~~.

D. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Section 90 of the General Contract Provisions ~~Article 15 of the General Conditions~~. Applications for Payment will be processed by Engineer as provided in the General Contract Provisions ~~General Conditions~~.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the Thirtieth (30th) day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. **90** percent of the value of the Work completed (with the balance being retainage).

1) If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

b. **0** percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **100** percent of the Work completed, less such amounts set off by Owner pursuant to Section 90 of the General Contract Provisions ~~Paragraph 15.01.E of the General Conditions~~, and less **100** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

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6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Section 90 of the General Contract Provisions ~~Paragraph 15.06 of the General Conditions~~.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 *Interest*

A. All amounts not paid when due will bear interest at the rate of **0** percent per annum.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
   a. Performance bond (together with power of attorney).
   b. Payment bond (together with power of attorney).
3. General Contract Provisions.
4. ~~Supplementary Conditions~~.
5. Specifications as listed in the table of contents of the project manual.
6. Drawings (not attached but incorporated by reference) consisting of twenty-one (21) sheets with each sheet bearing the following general title: C-449 Natural Treatment System Maintenance, Phase 2.
7. Addenda (numbers **[number]** to **[number]**, inclusive).
8. Exhibits to this Agreement (enumerated as follows):
   a. **Contractor's Bid (pages _ to __, inclusive)**
   b. Insurance Specifications (pages 1 to 13, inclusive).
   c. The 2020 Standard Specifications for Construction adopted by the Michigan Department of Transportation are hereby incorporated into these contract documents.
   d. [List other required attachments (if any), such as documents required by funding or lending agencies]
9. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
   a. Notice to Proceed.
   b. Work Change Directives.
   c. Change Orders.

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d. Field Orders.

e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.

2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

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8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

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IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

Owner:	Contractor:
Gerald R. Ford International Airport Authority *(typed or printed name of organization)*	_____ *(typed or printed name of organization)*
By: _____ *(individual's signature)*	By: _____ *(individual's signature)*
Date: _____ *(date signed)*	Date: _____ *(date signed)*
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)* *(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*
Attest: _____ *(individual's signature)*	Attest: _____ *(individual's signature)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address for giving notices: 5500 44th Street SE Grand Rapids, MI 49512	Address for giving notices: _____
Designated Representative: Name: _____ *(typed or printed)* Title: _____ *(typed or printed)*	Designated Representative: Name: _____ *(typed or printed)* Title: _____ *(typed or printed)*
Address: 5500 44th Street SE Grand Rapids, MI 49512	Address: _____
Phone: _____ Email: _____ *(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*	Phone: _____ Email: _____ License No.: _____ *(where applicable)* State: _____

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PERFORMANCE BOND

Contractor	**Surety**
Name: Address *(principal place of business)*:	Name: Address *(principal place of business)*:
Owner	**Contract**
Name: Gerald R. Ford Int'l Airport Authority Mailing address *(principal place of business)*: 5500 44th Street SE Grand Rapids, MI 49512	Description *(name and location)*: Natural Treatment System Maintenance, Phase 2 Contract Price: Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:

    3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

    3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

    3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

    5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

    5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

    5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

    5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

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5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

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13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: **[Describe modification or enter "None"]**

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PAYMENT BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: Gerald R. Ford Int'l Airport Authority	Description *(name and location)*:
Mailing address *(principal place of business)*:	Natural Treatment System Maintenance, Phase 2
5500 44th Street SE	
Grand Rapids, MI 49512	Contract Price:
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____	_____
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature)(Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond will arise after the following:

    5.1. Claimants who do not have a direct contract with the Contractor

        5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2. Pay or arrange for payment of any undisputed amounts.

    7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's

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fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

    16.1. *Claim*—A written statement by the Claimant including at a minimum:

        16.1.1. The name of the Claimant;

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16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

16.1.4. A brief description of the labor, materials, or equipment furnished;

16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: **[Describe modification or enter "None"]**

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Part 1 – General Contract Provisions

Section 10 Definition of Terms

When the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be defined as follows:

Paragraph Number	Term	Definition
10-01	**AASHTO**	The American Association of State Highway and Transportation Officials.
10-02	**Access Road**	The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public roadway.
10-03	**Advertisement**	A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.
10-04	**Airport**	Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of way; airport buildings and facilities located in any of these areas, and a heliport.
10-05	**Airport Improvement Program (AIP)**	A grant-in-aid program, administered by the Federal Aviation Administration (FAA).
10-06	**Air Operations Area (AOA)**	The term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.
10-07	**Apron**	Area where aircraft are parked, unloaded or loaded, fueled and/or serviced.
10-08	**ASTM International (ASTM)**	Formerly known as the American Society for Testing and Materials (ASTM).

Paragraph Number	Term	Definition
10-09	**Award**	The Owner's notice to the successful bidder of the acceptance of the submitted bid.
10-10	**Bidder**	Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.
10-11	**Building Area**	An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.
10-12	**Calendar Day**	Every day shown on the calendar.
10-13	**Certificate of Analysis (COA)**	The COA is the manufacturer's Certificate of Compliance (COC) including all applicable test results required by the specifications.
10-14	**Certificate of Compliance (COC)**	The manufacturer's certification stating that materials or assemblies furnished fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer's authorized representative.
10-15	**Change Order**	A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for work within the scope of the contract and necessary to complete the project.
10-16	**Contract**	A written agreement between the Owner and the Contractor that establishes the obligations of the parties including but not limited to performance of work, furnishing of labor, equipment and materials and the basis of payment. The awarded contract includes but may not be limited to: Advertisement, Contract form, Proposal, Performance bond, payment bond, General provisions, certifications and representations, Technical Specifications, Plans, Supplemental Provisions, standards incorporated by reference and issued addenda.
10-17	**Contract Item (Pay Item)**	A specific unit of work for which a price is provided in the contract.
10-18	**Contract Time**	The number of calendar days or working days, stated in the proposal, allowed for completion of the contract, including authorized time extensions. If a calendar date of completion is stated in the proposal, in lieu of a number of

Paragraph Number	Term	Definition
		calendar or working days, the contract shall be completed by that date.
10-19	**Contractor**	The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work.
10-20	**Contractors Quality Control (QC) Facilities**	The Contractor's QC facilities in accordance with the Contractor Quality Control Program (CQCP).
10-21	**Contractor Quality Control Program (CQCP)**	Details the methods and procedures that will be taken to assure that all materials and completed construction required by the contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors.
10-22	**Control Strip**	A demonstration by the Contractor that the materials, equipment, and construction processes results in a product meeting the requirements of the specification.
10-23	**Construction Safety and Phasing Plan (CSPP)**	The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.
10-24	**Drainage System**	The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.
10-25	**Engineer**	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering, inspection, and/or observation of the contract work and acting directly or through an authorized representative.
10-26	**Equipment**	All machinery, together with the necessary supplies for upkeep and maintenance; and all tools and apparatus necessary for the proper construction and acceptable completion of the work.
10-27	**Extra Work**	An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which is found by the Owner's Engineer or Resident Project Representative (RPR) to be necessary to

Paragraph Number	Term	Definition
		complete the work within the intended scope of the contract as previously modified.
10-28	**FAA**	The Federal Aviation Administration. When used to designate a person, FAA shall mean the Administrator or their duly authorized representative.
10-29	**Federal Specifications**	The federal specifications and standards, commercial item descriptions, and supplements, amendments, and indices prepared and issued by the General Services Administration.
10-30	**Force Account**	**a.** Contract Force Account - A method of payment that addresses extra work performed by the Contractor on a time and material basis. **b.** Owner Force Account - Work performed for the project by the Owner's employees.
10-31	**Intention of Terms**	Whenever, in these specifications or on the plans, the words “directed,” “required,” “permitted,” “ordered,” “designated,” “prescribed,” or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer and/or Resident Project Representative (RPR) is intended; and similarly, the words “approved,” “acceptable,” “satisfactory,” or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer and/or RPR, subject in each case to the final determination of the Owner. Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.
10-32	**Lighting**	A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.
10-33	**Major and Minor Contract Items**	A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 20% of the total amount of the award contract. All other items shall be considered minor contract items.

Paragraph Number	Term	Definition
10-34	**Materials**	Any substance specified for use in the construction of the contract work.
10-35	**Modification of Standards (MOS)**	Any deviation from standard specifications applicable to material and construction methods in accordance with FAA Order 5300.1.
10-36	**Notice to Proceed (NTP)**	A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.
10-37	**Owner**	The term "Owner" shall mean the party of the first part or the contracting agency signatory to the contract. Where the term "Owner" is capitalized in this document, it shall mean airport Sponsor only. The Owner for this project is **the Gerald R. Ford International Airport**.
10-38	Passenger Facility Charge (PFC)	Per 14 Code of Federal Regulations (CFR) Part 158 and 49 United States Code (USC) § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls.
10-39	**Pavement Structure**	The combined surface course, base course(s), and subbase course(s), if any, considered as a single unit.
10-40	**Payment bond**	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will pay in full all bills and accounts for materials and labor used in the construction of the work.
10-41	**Performance bond**	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.
10-42	**Plans**	The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications. Plans may also be referred to as 'contract drawings.'
10-43	**Project**	The agreed scope of work for accomplishing specific airport development with respect to a particular airport.
10-44	**Proposal**	The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work

Paragraph Number	Term	Definition
		and furnish the necessary materials in accordance with the provisions of the plans and specifications.
10-45	**Proposal guaranty**	The security furnished with a proposal to guarantee that the bidder will enter into a contract if their own proposal is accepted by the Owner.
10-46	**Quality Assurance (QA)**	Owner's responsibility to assure that construction work completed complies with specifications for payment.
10-47	**Quality Control (QC)**	Contractor's responsibility to control material(s) and construction processes to complete construction in accordance with project specifications.
10-48	**Quality Assurance (QA) Inspector**	An authorized representative of the Engineer and/or Resident Project Representative (RPR) assigned to make all necessary inspections, observations, tests, and/or observation of tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.
10-49	**Quality Assurance (QA) Laboratory**	The official quality assurance testing laboratories of the Owner or such other laboratories as may be designated by the Engineer or RPR. May also be referred to as Engineer's, Owner's, or QA Laboratory.
10-50	**Resident Project Representative (RPR)**	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for all necessary inspections, observations, tests, and/or observations of tests of the contract work performed or being performed, or of the materials furnished or being furnished by the Contractor, and acting directly or through an authorized representative.
10-51	**Runway**	The area on the airport prepared for the landing and takeoff of aircraft.
10-52	**Runway Safety Area (RSA)**	A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft. See the construction safety and phasing plan (CSPP) for limits of the RSA.
10-53	**Safety Plan Compliance Document (SPCD)**	Details how the Contractor will comply with the CSPP.
10-54	**Specifications**	A part of the contract containing the written directions and requirements for completing the contract work. Standards for specifying materials or testing which are cited in the

Paragraph Number	Term	Definition
		contract specifications by reference shall have the same force and effect as if included in the contract physically.
10-55	**Sponsor**	A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.
10-56	**Structures**	Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.
10-57	**Subgrade**	The soil that forms the pavement foundation.
10-58	**Superintendent**	The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the RPR, and who shall supervise and direct the construction.
10-59	**Supplemental Agreement**	A written agreement between the Contractor and the Owner that establishes the basis of payment and contract time adjustment, if any, for the work affected by the supplemental agreement. A supplemental agreement is required if: (1) in scope work would increase or decrease the total amount of the awarded contract by more than 25%: (2) in scope work would increase or decrease the total of any major contract item by more than 25%; (3) work that is not within the scope of the originally awarded contract; or (4) adding or deleting of a major contract item.
10-60	**Surety**	The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.
10-61	**Taxilane**	A taxiway designed for low speed movement of aircraft between aircraft parking areas and terminal areas.
10-62	**Taxiway**	The portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways, aircraft parking areas, and terminal areas.
10-63	**Taxiway/Taxilane Safety Area (TSA)**	A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft. See

Paragraph Number	Term	Definition
		the construction safety and phasing plan (CSPP) for limits of the TSA.
10-64	**Work**	The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the contract, plans, and specifications.
10-65	**Working day**	A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor's control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work will be considered as working days.
10-66	**Owner Defined terms**	**None**

END OF SECTION 10

Section 20 Proposal Requirements and Conditions

20-01 Advertisement (Notice to Bidders). Refer to Advertisement, Pages 1 through 2 of 2, inclusive, included with the Contract Documents.

20-02 Qualification of bidders. Each bidder shall submit evidence of competency and evidence of financial responsibility to perform the work to the Owner at the time of bid opening.

Evidence of competency, unless otherwise specified, shall consist of statements covering the bidder's past experience on similar work, and a list of equipment and a list of key personnel that would be available for the work.

Each bidder shall furnish the Owner satisfactory evidence of their financial responsibility. Evidence of financial responsibility, unless otherwise specified, shall consist of a confidential statement or report of the bidder's financial resources and liabilities as of the last calendar year or the bidder's last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the bidder shall further certify whether their financial responsibility is approximately the same as stated or reported by the public accountant. If the bidder's financial responsibility has changed, the bidder shall qualify the public accountant's statement or report to reflect the bidder's true financial condition at the time such qualified statement or report is submitted to the Owner.

Unless otherwise specified, a bidder may submit evidence that they are prequalified with the State Highway Division and are on the current "bidder's list" of the state in which the proposed work is located. Evidence of State Highway Division prequalification may be submitted as evidence of financial responsibility in lieu of the certified statements or reports specified above.

20-03 Contents of proposal forms. The Owner's proposal forms state the location and description of the proposed construction; the place, date, and time of opening of the proposals; and the estimated quantities of the various items of work to be performed and materials to be furnished for which unit bid prices are asked. The proposal form states the time in which the work must be completed, and the amount of the proposal guaranty that must accompany the proposal. The Owner will accept only those Proposals properly executed on physical forms or electronic forms provided by the Owner. Bidder actions that may cause the Owner to deem a proposal irregular are given in paragraph 20-09 *Irregular proposals*.

Mobilization is limited to 10 percent of the total project cost.

20-04 Issuance of proposal forms. The Owner reserves the right to refuse to issue a proposal form to a prospective bidder if the bidder is in default for any of the following reasons:

a. Failure to comply with any prequalification regulations of the Owner, if such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.

b. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force with the Owner at the time the Owner issues the proposal to a prospective bidder.

c. Documented record of Contractor default under previous contracts with the Owner.

d. Documented record of unsatisfactory work on previous contracts with the Owner.

20-05 Interpretation of estimated proposal quantities. An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the proposal. It is the result of careful calculations and is believed to be correct. It is given only as a basis for comparison of proposals and the

award of the contract. The Owner does not expressly, or by implication, agree that the actual quantities involved will correspond exactly therewith; nor shall the bidder plead misunderstanding or deception because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased as provided in the Section 40, paragraph 40-02, Alteration of Work and Quantities, without in any way invalidating the unit bid prices.

20-06 Examination of plans, specifications, and site. The bidder is expected to carefully examine the site of the proposed work, the proposal, plans, specifications, and contract forms. Bidders shall satisfy themselves to the character, quality, and quantities of work to be performed, materials to be furnished, and to the requirements of the proposed contract. The submission of a proposal shall be prima facie evidence that the bidder has made such examination and is satisfied to the conditions to be encountered in performing the work and the requirements of the proposed contract, plans, and specifications.

20-07 Preparation of proposal. The bidder shall submit their proposal on the forms furnished by the Owner. All blank spaces in the proposal forms, unless explicitly stated otherwise, must be correctly filled in where indicated for each and every item for which a quantity is given. The bidder shall state the price (written in ink or typed) both in words and numerals which they propose for each pay item furnished in the proposal. In case of conflict between words and numerals, the words, unless obviously incorrect, shall govern.

The bidder shall correctly sign the proposal in ink. If the proposal is made by an individual, their name and post office address must be shown. If made by a partnership, the name and post office address of each member of the partnership must be shown. If made by a corporation, the person signing the proposal shall give the name of the state where the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer. Anyone signing a proposal as an agent shall file evidence of their authority to do so and that the signature is binding upon the firm or corporation.

20-08 Responsive and responsible bidder. A responsive bid conforms to all significant terms and conditions contained in the Owner's invitation for bid. It is the Owner's responsibility to decide if the exceptions taken by a bidder to the solicitation are material or not and the extent of deviation it is willing to accept.

A responsible bidder has the ability to perform successfully under the terms and conditions of a proposed procurement, as defined in 2 CFR § 200.318(h). This includes such matters as Contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

20-09 Irregular proposals. Proposals shall be considered irregular for the following reasons:

a. If the proposal is on a form other than that furnished by the Owner, or if the Owner's form is altered, or if any part of the proposal form is detached.

b. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind that make the proposal incomplete, indefinite, or otherwise ambiguous.

c. If the proposal does not contain a unit price for each pay item listed in the proposal, except in the case of authorized alternate pay items, for which the bidder is not required to furnish a unit price.

d. If the proposal contains unit prices that are obviously unbalanced.

e. If the proposal is not accompanied by the proposal guaranty specified by the Owner.

f. If the applicable Disadvantaged Business Enterprise information is incomplete.

The Owner reserves the right to reject any irregular proposal and the right to waive technicalities if such waiver is in the best interest of the Owner and conforms to local laws and ordinances pertaining to the letting of construction contracts.

20-10 Bid guarantee. Each separate proposal shall be accompanied by a bid bond, certified check, or other specified acceptable collateral, in the amount specified in the proposal form. Such bond, check, or collateral, shall be made payable to the Owner.

20-11 Delivery of proposal. Each proposal submitted shall be placed in a sealed envelope plainly marked with the project number, location of airport, and name and business address of the bidder on the outside. When sent by mail, preferably registered, the sealed proposal, marked as indicated above, should be enclosed in an additional envelope. No proposal will be considered unless received at the place specified in the advertisement or as modified by Addendum before the time specified for opening all bids. Proposals received after the bid opening time shall be returned to the bidder unopened.

20-12 Withdrawal or revision of proposals. A bidder may withdraw or revise (by withdrawal of one proposal and submission of another) a proposal provided that the bidder's request for withdrawal is received by the Owner **in writing** before the time specified for opening bids. Revised proposals must be received at the place specified in the advertisement before the time specified for opening all bids.

20-13 Public opening of proposals. Proposals shall be opened, and read, publicly at the time and place specified in the advertisement. Bidders, their authorized agents, and other interested persons are invited to attend. Proposals that have been withdrawn (by written or telegraphic request) or received after the time specified for opening bids shall be returned to the bidder unopened.

20-14 Disqualification of bidders. A bidder shall be considered disqualified for any of the following reasons:

a. Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.

b. Evidence of collusion among bidders. Bidders participating in such collusion shall be disqualified as bidders for any future work of the Owner until any such participating bidder has been reinstated by the Owner as a qualified bidder.

c. If the bidder is considered to be in "default" for any reason specified in paragraph 20-04, *Issuance of Proposal Forms,* of this section.

20-15 Discrepancies and Omissions. A Bidder who discovers discrepancies or omissions with the project bid documents shall immediately notify the Owner's Engineer of the matter. A bidder that has doubt as to the true meaning of a project requirement may submit to the Owner's Engineer a written request for interpretation no later than **seven (7)** days prior to bid opening.

Any interpretation of the project bid documents by the Owner's Engineer will be by written addendum issued by the Owner. The Owner will not consider any instructions, clarifications or interpretations of the bidding documents in any manner other than written addendum.

END OF SECTION 20

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Section 30 Award and Execution of Contract

30-01 Consideration of proposals. After the proposals are publicly opened and read, they will be compared on the basis of the summation of the products obtained by multiplying the estimated quantities shown in the proposal by the unit bid prices. If a bidder's proposal contains a discrepancy between unit bid prices written in words and unit bid prices written in numbers, the unit bid price written in words shall govern.

Until the award of a contract is made, the Owner reserves the right to reject a bidder's proposal for any of the following reasons:

a. If the proposal is irregular as specified in Section 20, paragraph 20-09, *Irregular Proposals*.

b. If the bidder is disqualified for any of the reasons specified Section 20, paragraph 20-14, *Disqualification of Bidders*.

In addition, until the award of a contract is made, the Owner reserves the right to reject any or all proposals, waive technicalities, if such waiver is in the best interest of the Owner and is in conformance with applicable state and local laws or regulations pertaining to the letting of construction contracts; advertise for new proposals; or proceed with the work otherwise. All such actions shall promote the Owner's best interests.

30-02 Award of contract. The award of a contract, if it is to be awarded, shall be made within **one hundred eighty (180)** calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

If the Owner elects to proceed with an award of contract, the Owner will make award to the responsible bidder whose bid, conforming with all the material terms and conditions of the bid documents, is the lowest in price.

30-03 Cancellation of award. The Owner reserves the right to cancel the award without liability to the bidder, except return of proposal guaranty, at any time before a contract has been fully executed by all parties and is approved by the Owner in accordance with paragraph 30-07 *Approval of Contract*.

30-04 Return of proposal guaranty. All proposal guaranties, except those of the two lowest bidders, will be returned immediately after the Owner has made a comparison of bids as specified in the paragraph 30-01, *Consideration of Proposals.* Proposal guaranties of the two lowest bidders will be retained by the Owner until such time as an award is made, at which time, the unsuccessful bidder's proposal guaranty will be returned. The successful bidder's proposal guaranty will be returned as soon as the Owner receives the contract bonds as specified in paragraph 30-05, *Requirements of Contract Bonds.*

30-05 Requirements of contract bonds. At the time of the execution of the contract, the successful bidder shall furnish the Owner a surety bond or bonds that have been fully executed by the bidder and the surety guaranteeing the performance of the work and the payment of all legal debts that may be incurred by reason of the Contractor's performance of the work. The surety and the form of the bond or bonds shall be acceptable to the Owner. Unless otherwise specified in this subsection, the surety bond or bonds shall be in a sum equal to the full amount of the contract.

30-06 Execution of contract. The successful bidder shall sign (execute) the necessary agreements for entering into the contract and return the signed contract to the Owner, along with the fully executed surety bond or bonds specified in paragraph 30-05, *Requirements of Contract Bonds,* of this section, within **15** calendar days from the date mailed or otherwise delivered to the successful bidder.

30-07 Approval of contract. Upon receipt of the contract and contract bond or bonds that have been executed by the successful bidder, the Owner shall complete the execution of the contract in accordance with local laws or ordinances, and return the fully executed contract to the Contractor. Delivery of the fully executed contract to the Contractor shall constitute the Owner's approval to be bound by the successful bidder's proposal and the terms of the contract.

30-08 Failure to execute contract. Failure of the successful bidder to execute the contract and furnish an acceptable surety bond or bonds within the period specified in paragraph 30-06, *Execution of Contract,* of this section shall be just cause for cancellation of the award and forfeiture of the proposal guaranty, not as a penalty, but as liquidated damages to the Owner.

END OF SECTION 30

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Section 40 Scope of Work

40-01 Intent of contract. The intent of the contract is to provide for construction and completion, in every detail, of the work described. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

40-02 Alteration of work and quantities. The Owner reserves the right to make such changes in quantities and work as may be necessary or desirable to complete, in a satisfactory manner, the original intended work. Unless otherwise specified in the Contract, the Owner's Engineer or RPR shall be and is hereby authorized to make, in writing, such in-scope alterations in the work and variation of quantities as may be necessary to complete the work, provided such action does not represent a significant change in the character of the work.

For purpose of this section, a significant change in character of work means: any change that is outside the current contract scope of work; any change (increase or decrease) in the total contract cost by more than 25%; or any change in the total cost of a major contract item by more than 25%.

Work alterations and quantity variances that do not meet the definition of significant change in character of work shall not invalidate the contract nor release the surety. Contractor agrees to accept payment for such work alterations and quantity variances in accordance with Section 90, paragraph 90-03, *Compensation for Altered Quantities*.

Should the value of altered work or quantity variance meet the criteria for significant change in character of work, such altered work and quantity variance shall be covered by a supplemental agreement. Supplemental agreements shall also require consent of the Contractor's surety and separate performance and payment bonds. If the Owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the Owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

40-03 Omitted items. The Owner, the Owner's Engineer or the RPR may provide written notice to the Contractor to omit from the work any contract item that does not meet the definition of major contract item. Major contract items may be omitted by a supplemental agreement. Such omission of contract items shall not invalidate any other contract provision or requirement.

Should a contract item be omitted or otherwise ordered to be non-performed, the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to omit such item. Payment for work performed shall be in accordance with Section 90, paragraph 90-04, *Payment for Omitted Items*.

40-04 Extra work. Should acceptable completion of the contract require the Contractor to perform an item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, Owner may issue a Change Order to cover the necessary extra work. Change orders for extra work shall contain agreed unit prices for performing the change order work in accordance with the requirements specified in the order, and shall contain any adjustment to the contract time that, in the RPR's opinion, is necessary for completion of the extra work.

When determined by the RPR to be in the Owner's best interest, the RPR may order the Contractor to proceed with extra work as provided in Section 90, paragraph 90-05, *Payment for Extra Work*. Extra work that is necessary for acceptable completion of the project, but is not within the general scope of the work

covered by the original contract shall be covered by a supplemental agreement as defined in Section 10, paragraph 10-59, *Supplemental Agreement*.

If extra work is essential to maintaining the project critical path, RPR may order the Contractor to commence the extra work under a Time and Material contract method. Once sufficient detail is available to establish the level of effort necessary for the extra work, the Owner shall initiate a change order or supplemental agreement to cover the extra work.

Any claim for payment of extra work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the Owner.

40-05 Maintenance of traffic. It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration. The Contractor shall maintain traffic in the manner detailed in the Construction Safety and Phasing Plan (CSPP).

a. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas (AOAs) of the airport with respect to their own operations and the operations of all subcontractors as specified in Section 80, paragraph 80-04, *Limitation of Operations*. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in Section 70, paragraph 70-15, *Contractor's Responsibility for Utility Service and Facilities of Others*.

b. With respect to their own operations and the operations of all subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport in accordance with the construction safety and phasing plan (CSPP) and the safety plan compliance document (SPCD).

c. When the contract requires the maintenance of an existing road, street, or highway during the Contractor's performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep the road, street, or highway open to all traffic and shall provide maintenance as may be required to accommodate traffic. The Contractor, at their expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (http://mutcd.fhwa.dot.gov/), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways. **Unless otherwise specified herein, the Contractor will not be required to furnish snow removal for such existing road, street, or highway.**

40-06 Removal of existing structures. All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the various contract items.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Resident Project Representative (RPR) shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the RPR in accordance with the provisions of the contract.

Except as provided in Section 40, paragraph 40-07, *Rights in and Use of Materials Found in the Work*, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or

grading sections established for completion of the work) shall be used in the work as otherwise provided for in the contract and shall remain the property of the Owner when so used in the work.

40-07 Rights in and use of materials found in the work. Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines, grades, or grading sections, the use of which is intended by the terms of the contract to be embankment, the Contractor may at their own option either:

a. Use such material in another contract item, providing such use is approved by the RPR and is in conformance with the contract specifications applicable to such use; or,

b. Remove such material from the site, upon written approval of the RPR; or

c. Use such material for the Contractor's own temporary construction on site; or,

d. Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option a., b., or c., the Contractor shall request the RPR's approval in advance of such use.

Should the RPR approve the Contractor's request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at their expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.

Should the RPR approve the Contractor's exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.

It is understood and agreed that the Contractor shall make no claim for delays by reason of their own exercise of option a., b., or c.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the lines, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

40-08 Final cleanup. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. The Contractor shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of the property Owner.

END OF SECTION 40

Section 50 Control of Work

50-01 Authority of the Resident Project Representative (RPR). The RPR has final authority regarding the interpretation of project specification requirements. The RPR shall determine acceptability of the quality of materials furnished, method of performance of work performed, and the manner and rate of performance of the work. The RPR does not have the authority to accept work that does not conform to specification requirements.

50-02 Conformity with plans and specifications. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross-sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans, or specifications.

If the RPR finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications, but that the portion of the work affected will, in their opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the RPR will advise the Owner of their determination that the affected work be accepted and remain in place. The RPR will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. Changes in the contract price must be covered by contract change order or supplemental agreement as applicable.

If the RPR finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the RPR's written orders.

The term "reasonably close conformity" shall not be construed as waiving the Contractor's responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the RPR's responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor's execution of the work, when, in the RPR's opinion, such compliance is essential to provide an acceptable finished portion of the work.

The term "reasonably close conformity" is also intended to provide the RPR with the authority, after consultation with the Sponsor and FAA, to use sound engineering judgment in their determinations to accept work that is not in strict conformity, but will provide a finished product equal to or better than that required by the requirements of the contract, plans and specifications.

The RPR will not be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

50-03 Coordination of contract, plans, and specifications. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. If electronic files are provided and used on the project and there is a conflict between the electronic files and hard copy plans, the hard copy plans shall govern. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited advisory circulars (ACs); contract general provisions shall govern over plans, cited standards for materials or testing, and cited ACs; plans shall govern over cited standards for materials or testing and cited ACs. If

any paragraphs contained in the Special Provisions conflict with General Provisions or Technical Specifications, the Special Provisions shall govern.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the RPR for an interpretation and decision, and such decision shall be final.

The Contractor shall not take advantage of any apparent error or omission on the plans or specifications. In the event the Contractor discovers any apparent error or discrepancy, Contractor shall immediately notify the Owner or the designated representative in writing requesting their written interpretation and decision.

50-04 List of Special Provisions. Refer to the Table of Contents included with the Contract Documents.

50-05 Cooperation of Contractor. The Contractor shall be supplied with **one (1)** hard copies or an electronic PDF of the plans and specifications. The Contractor shall have available on the construction site at all times one hardcopy each of the plans and specifications. Additional hard copies of plans and specifications may be obtained by the Contractor for the cost of reproduction.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the RPR and their inspectors and with other Contractors in every way possible. The Contractor shall have a competent superintendent on the work at all times who is fully authorized as their agent on the work. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the RPR or their authorized representative.

50-06 Cooperation between Contractors. The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with their own contract and shall protect and hold harmless the Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange their work and shall place and dispose of the materials being used to not interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join their work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

50-07 Construction layout and stakes. The Engineer/RPR shall establish necessary horizontal and vertical control. The establishment of Survey Control and/or reestablishment of survey control shall be by a State Licensed Land Surveyor. Contractor is responsible for preserving integrity of horizontal and vertical controls established by Engineer/RPR. In case of negligence on the part of the Contractor or their employees, resulting in the destruction of any horizontal and vertical control, the resulting costs will be deducted as a liquidated damage against the Contractor.

Prior to the start of construction, the Contractor will check all control points for horizontal and vertical accuracy and certify in writing to the RPR that the Contractor concurs with survey control established for the project. All lines, grades and measurements from control points necessary for the proper execution and control of the work on this project will be provided to the RPR. The Contractor is responsible to establish all layout required for the construction of the project.

Copies of survey notes will be provided to the RPR for each area of construction and for each placement of material as specified to allow the RPR to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. Surveys will be provided to the RPR prior to commencing work items that cover or disturb the survey staking. Survey(s) and notes shall be provided in the following format(s): **AutoCAD (dwg), data/text (csv) or portable document file (pdf)**.

Laser, GPS, String line, or other automatic control shall be checked with temporary control as necessary. In the case of error, on the part of the Contractor, their surveyor, employees or subcontractors, resulting in established grades, alignment or grade tolerances that do not concur with those specified or shown on the plans, the Contractor is solely responsible for correction, removal, replacement and all associated costs at no additional cost to the Owner.

No direct payment will be made, unless otherwise specified in contract documents, for this labor, materials, or other expenses. The cost shall be included in the price of the bid for the various items of the Contract.

50-08 Authority and duties of Quality Assurance (QA) inspectors. QA inspectors shall be authorized to inspect all work done and all material furnished. Such QA inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. QA inspectors are not authorized to revoke, alter, or waive any provision of the contract. QA inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

QA Inspectors are authorized to notify the Contractor or their representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the RPR for a decision.

50-09 Inspection of the work. All materials and each part or detail of the work shall be subject to inspection. The RPR shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the RPR requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be at the Contractor’s expense.

Provide advance written notice to the RPR of work the Contractor plans to perform each week and each day. Any work done or materials used without written notice and allowing opportunity for inspection by the RPR may be ordered removed and replaced at the Contractor’s expense.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) Owner, authorized representatives of the Owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

50-10 Removal of unacceptable and unauthorized work. All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the RPR as provided in paragraph 50-02, *Conformity with Plans and Specifications*.

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed

immediately and replaced in an acceptable manner in accordance with the provisions of Section 70, paragraph 70-14, *Contractor's Responsibility for Work*.

No removal work made under provision of this paragraph shall be done without lines and grades having been established by the RPR. Work done contrary to the instructions of the RPR, work done beyond the lines shown on the plans or as established by the RPR, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor's expense.

Upon failure on the part of the Contractor to comply with any order of the RPR made under the provisions of this subsection, the RPR will have authority to cause unacceptable work to be remedied or removed and replaced; and unauthorized work to be removed and recover the resulting costs as a liquidated damage against the Contractor.

50-11 Load restrictions. The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor, at their own expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel.

50-12 Maintenance during construction. The Contractor shall maintain the work during construction and until the work is accepted. Maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

50-13 Failure to maintain the work. Should the Contractor at any time fail to maintain the work as provided in paragraph 50-12, *Maintenance during Construction*, the RPR shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the RPR's notification, the Owner may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the Owner, shall be recovered as a liquidated damage against the Contractor.

50-14 Partial acceptance. If at any time during the execution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the Owner, the Contractor may request the RPR to make final inspection of that unit. If the RPR finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, the RPR may accept it as being complete, and the Contractor may be relieved of further responsibility for that unit. Such partial acceptance and beneficial occupancy by the Owner shall not void or alter any provision of the contract.

50-15 Final acceptance. Upon due notice from the Contractor of presumptive completion of the entire project, the RPR and Owner will make an inspection. If all construction provided for and contemplated by

the contract is found to be complete in accordance with the contract, plans, and specifications, such inspection shall constitute the final inspection. The RPR shall notify the Contractor in writing of final acceptance as of the date of the final inspection.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the RPR will notify the Contractor and the Contractor shall correct the unsatisfactory work. Upon correction of the work, another inspection will be made which shall constitute the final inspection, provided the work has been satisfactorily completed. In such event, the RPR will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

50-16 Claims for adjustment and disputes. If for any reason the Contractor deems that additional compensation is due for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, the Contractor shall notify the RPR in writing of their intention to claim such additional compensation before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the RPR is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the RPR has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the RPR who will present it to the Owner for consideration in accordance with local laws or ordinances.

Nothing in this subsection shall be construed as a waiver of the Contractor’s right to dispute final payment based on differences in measurements or computations.

END OF SECTION 50

Section 60 Control of Materials

60-01 Source of supply and quality requirements. The materials used in the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish documentation to the RPR as to the origin, composition, and manufacture of all materials to be used in the work. Documentation shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the RPR's option, materials may be approved at the source of supply before delivery. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

The Contractor shall furnish airport lighting equipment that meets the requirements of the specifications; and is listed in AC 150/5345-53, *Airport Lighting Equipment Certification Program* and *Addendum*, that is in effect on the date of advertisement.

60-02 Samples, tests, and cited specifications. All materials used in the work shall be inspected, tested, and approved by the RPR before incorporation in the work unless otherwise designated. Any work in which untested materials are used without approval or written permission of the RPR shall be performed at the Contractor's risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the RPR, shall be removed at the Contractor's expense.

Unless otherwise designated, quality assurance tests will be made by and at the expense of the Owner in accordance with the cited standard methods of ASTM, American Association of State Highway and Transportation Officials (AASHTO), federal specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids.

The testing organizations performing on-site quality assurance field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the RPR. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor's representative at their request after review and approval of the RPR.

A copy of all Contractor QC test data shall be provided to the RPR daily, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the RPR showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

60-03 Certification of compliance/analysis (COC/COA). The RPR may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer's COC stating that such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the work must be accompanied by a certificate of compliance in which the lot is clearly identified. The COA is the manufacturer's COC and includes all applicable test results.

Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not.

The form and distribution of certificates of compliance shall be as approved by the RPR.

When a material or assembly is specified by "brand name or equal" and the Contractor elects to furnish the specified "or equal," the Contractor shall be required to furnish the manufacturer's certificate of compliance for each lot of such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

a. Conformance to the specified performance, testing, quality or dimensional requirements; and,

b. Suitability of the material or assembly for the use intended in the contract work.

The RPR shall be the sole judge as to whether the proposed "or equal" is suitable for use in the work.

The RPR reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

60-04 Plant inspection. The RPR or their authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for acceptance of the material or assembly.

Should the RPR conduct plant inspections, the following conditions shall exist:

a. The RPR shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.

b. The RPR shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.

c. If required by the RPR, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Place office or working space in a convenient location with respect to the plant.

It is understood and agreed that the Owner shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The RPR shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

60-05 Engineer/ Resident Project Representative (RPR) field office. **An Engineer/RPR field office is not required.**

60-06 Storage of materials. Materials shall be stored to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the RPR. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans and/or CSPP, the storage of materials and the location of the Contractor's plant and parked equipment or vehicles shall be as directed by the RPR. Private property shall not be used for storage purposes without written permission of the Owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. Upon request, the Contractor shall furnish the RPR a copy of the property Owner's permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at their expense, except as otherwise agreed to (in writing) by the Owner or lessee of the property.

60-07 Unacceptable materials. Any material or assembly that does not conform to the requirements of the contract, plans, or specifications shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the site of the work, unless otherwise instructed by the RPR.

Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the RPR has approved its use in the work.

60-08 Owner furnished materials. The Contractor shall furnish all materials required to complete the work, except those specified, if any, to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified.

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor's handling, storage, or use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor's handling, storage, or use of Owner-furnished materials.

END OF SECTION 60

Section 70 Legal Regulations and Responsibility to Public

70-01 Laws to be observed. The Contractor shall keep fully informed of all federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Owner and all their officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor's employees.

70-02 Permits, licenses, and taxes. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful execution of the work.

70-03 Patented devices, materials, and processes. If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the Patentee or Owner. The Contractor and the surety shall indemnify and hold harmless the Owner, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the execution or after the completion of the work.

70-04 Restoration of surfaces disturbed by others. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the Owner, such authorized work (by others) must be shown on the plans and is indicated as follows: **No construction, reconstruction or maintenance has been coordinated with the Owner at the time of advertisement**.

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the RPR.

Should the Owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such Owners by arranging and performing the work in this contract to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the RPR, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

70-05 Federal Participation. The United States Government has agreed to reimburse the Owner for some portion of the contract costs. The contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator. No requirement of this contract shall be construed

as making the United States a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

70-06 Sanitary, health, and safety provisions. The Contractor's worksite and facilities shall comply with applicable federal, state, and local requirements for health, safety and sanitary provisions.

70-07 Public convenience and safety. The Contractor shall control their operations and those of their subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to their own operations and those of their own subcontractors and all suppliers in accordance with Section 40, paragraph 40-05, *Maintenance of Traffic,* and shall limit such operations for the convenience and safety of the traveling public as specified in Section 80, paragraph 80-04, *Limitation of Operations*.

The Contractor shall remove or control debris and rubbish resulting from its work operations at frequent intervals, and upon the order of the RPR. If the RPR determines the existence of Contractor debris in the work site represents a hazard to airport operations and the Contractor is unable to respond in a prompt and reasonable manner, the RPR reserves the right to assign the task of debris removal to a third party and recover the resulting costs as a liquidated damage against the Contractor.

70-08 Construction Safety and Phasing Plan (CSPP). The Contractor shall complete the work in accordance with the approved Construction Safety and Phasing Plan (CSPP) developed in accordance with AC 150/5370-2, Operational Safety on Airports During Construction. The CSPP is on sheet(s) **3 and 4** of the project plans.

70-09 Use of explosives. The use of explosives is not permitted on this project.

70-10 Protection and restoration of property and landscape. The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer/RPR has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the execution of the work, resulting from any act, omission, neglect, or misconduct in manner or method of executing the work, or at any time due to defective work or materials, and said responsibility shall not be released until the project has been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof by the Contractor, the Contractor shall restore, at their expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner.

70-11 Responsibility for damage claims. The Contractor shall indemnify and hold harmless the Engineer/RPR and the Owner and their officers, agents, and employees from all suits, actions, or claims, of any character, brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the "Workmen's Compensation Act," or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of their own contract considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, their own surety may be held until such suits, actions, or claims for injuries or damages shall have

been settled and suitable evidence to that effect furnished to the Owner, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

70-12 Third party beneficiary clause. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create for the public or any member thereof, a third-party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

70-13 Opening sections of the work to traffic. If it is necessary for the Contractor to complete portions of the contract work for the beneficial occupancy of the Owner prior to completion of the entire contract, such "phasing" of the work must be specified below and indicated on the approved Construction Safety and Phasing Plan (CSPP) and the project plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified.

Upon completion of any portion of work listed above, such portion shall be accepted by the Owner in accordance with Section 50, paragraph 50-14, *Partial Acceptance*.

No portion of the work may be opened by the Contractor until directed by the Owner in writing. Should it become necessary to open a portion of the work to traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the RPR, such portion of the work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provision of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the Owner shall be repaired by the Contractor at their expense.

The Contractor shall make their own estimate of the inherent difficulties involved in completing the work under the conditions herein described and shall not claim any added compensation by reason of delay or increased cost due to opening a portion of the contract work.

The Contractor must conform to safety standards contained AC 150/5370-2 and the approved CSPP.

Contractor shall refer to the plans, specifications, and the approved CSPP to identify barricade requirements, temporary and/or permanent markings, airfield lighting, guidance signs and other safety requirements prior to opening up sections of work to traffic.

70-14 Contractor's responsibility for work. Until the RPR's final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with Section 50, paragraph 50-14, *Partial Acceptance*, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities.

If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at their own expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seeding, and sodding furnished under the contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

70-15 Contractor's responsibility for utility service and facilities of others. As provided in paragraph 70-04, *Restoration of Surfaces Disturbed by Others*, the Contractor shall cooperate with the owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the Owner to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control their operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and/or in the contract documents.

Refer to Sheet G-000 of the construction drawings.

It is understood and agreed that the Owner does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of the responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the Owners of all utility services or other facilities of their plan of operations. Such notification shall be in writing addressed to "The Person to Contact" as provided in this paragraph and paragraph 70-04, *Restoration of Surfaces Disturbed By Others*. A copy of each notification shall be given to the RPR.

In addition to the general written notification provided, it shall be the responsibility of the Contractor to keep such individual Owners advised of changes in their plan of operations that would affect such Owners.

Prior to beginning the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such Owner of their plan of operation. If, in the Contractor's opinion, the Owner's assistance is needed to locate the utility service or facility or the presence of a representative of the Owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner's "Person to Contact" no later than two normal business days prior to the Contractor's commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the RPR.

The Contractor's failure to give the two days' notice shall be cause for the Owner to suspend the Contractor's operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use hand excavation methods within 3 feet (1 m) of such outside limits at such points as may be required to ensure protection from damage due to the Contractor's operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, the Contractor shall immediately notify the proper authority and the RPR and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the RPR continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to their operations whether due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or their own surety.

70-16 Furnishing rights-of-way. The Owner will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor's operations.

70-17 Personal liability of public officials. In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the Engineer, RPR, their authorized representatives, or any officials of the Owner either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

70-18 No waiver of legal rights. Upon completion of the work, the Owner will expeditiously make final inspection and notify the Contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or stopped from recovering from the Contractor or their surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill their obligations under the contract. A waiver on the part of the Owner of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor, without prejudice to the terms of the contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner's rights under any warranty or guaranty.

70-19 Environmental protection. The Contractor shall comply with all federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, asphalts, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

70-20 Archaeological and historical findings. Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during their operations, any building, part of a building, structure, or object that is incongruous with its surroundings, the Contractor shall immediately cease operations in that location and notify the RPR. The RPR will immediately investigate the Contractor's finding and the Owner will direct the Contractor to either resume operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor's operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in Section 40, paragraph 40-04, *Extra Work,* and Section 90, paragraph 90-05, *Payment for Extra Work*. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with Section 80, paragraph 80-07, *Determination and Extension of Contract Time*.

70-21 Insurance Requirements. Refer to Insurance Specifications, pages 1 through 11 of 11, inclusive, included with the Contract Documents.

END OF SECTION 70

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Section 80 Execution and Progress

80-01 Subletting of contract. The Owner will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the Resident Project Representative (RPR).

The Contractor shall perform, with his organization, an amount of work equal to at least **40** percent of the total contract cost.

Should the Contractor elect to assign their contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the Owner, and shall be consummated only on the written approval of the Owner.

The Contractor shall provide copies of all subcontracts to the RPR 30 days prior to being utilized on the project. As a minimum, the information shall include the following:

- Subcontractor's legal company name.
- Subcontractor's legal company address, including County name.
- Principal contact person's name, telephone and fax number.
- Complete narrative description, and dollar value of the work to be performed by the subcontractor.
- Copies of required insurance certificates in accordance with the specifications.
- Minority/ non-minority status.

80-02 Notice to proceed (NTP). The Owners notice to proceed will state the date on which contract time commences. The Contractor is expected to commence project operations within **ten (10)** days of the NTP date. The Contractor shall notify the RPR at least **72 hours** in advance of the time contract operations begins. The Contractor shall not commence any actual operations prior to the date on which the notice to proceed is issued by the Owner.

80-03 Execution and progress. Unless otherwise specified, the Contractor shall submit their coordinated construction schedule showing all work activities for the RPR's review and acceptance at least **ten (10) days** prior to the start of work. The Contractor's progress schedule, once accepted by the RPR, will represent the Contractor's baseline plan to accomplish the project in accordance with the terms and conditions of the Contract. The RPR will compare actual Contractor progress against the baseline schedule to determine that status of the Contractor's performance. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

If the Contractor falls significantly behind the submitted schedule, the Contractor shall, upon the RPR's request, submit a revised schedule for completion of the work within the contract time and modify their operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the execution of the work be discontinued for any reason, the Contractor shall notify the RPR at least **72 hours** in advance of resuming operations.

The Contractor shall not commence any actual construction prior to the date on which the NTP is issued by the Owner.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a **bi-weekly** basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

80-04 Limitation of operations. The Contractor shall control their operations and the operations of their subcontractors and all suppliers to provide for the free and unobstructed movement of aircraft in the air operations areas (AOA) of the airport.

When the work requires the Contractor to conduct their operations within an AOA of the airport, the work shall be coordinated with airport operations (through the RPR) at least **72 hours** prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the RPR and until the necessary temporary marking, signage and associated lighting is in place as provided in Section 70, paragraph 70-08, *Construction Safety and Phasing Plan (CSPP)*.

When the contract work requires the Contractor to work within an AOA of the airport on an intermittent basis (intermittent opening and closing of the AOA), the Contractor shall maintain constant communications as specified; immediately obey all instructions to vacate the AOA; and immediately obey all instructions to resume work in such AOA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor's operations in the AOA until satisfactory conditions are provided. The areas of the AOA identified in the Construction Safety Phasing Plan (CSPP) and as listed below, cannot be closed to operating aircraft to permit the Contractor's operations on a continuous basis and will therefore be closed to aircraft operations intermittently as follows:

No closures of the AOA are anticipated with this project.

The Contractor shall be required to conform to safety standards contained in AC 150/5370-2, Operational Safety on Airports During Construction and the approved CSPP.

80-04.1 Operational safety on airport during construction. All Contractors' operations shall be conducted in accordance with the approved project Construction Safety and Phasing Plan (CSPP) and the Safety Plan Compliance Document (SPCD) and the provisions set forth within the current version of AC 150/5370-2, Operational Safety on Airports During Construction. The CSPP included within the contract documents conveys minimum requirements for operational safety on the airport during construction activities. The Contractor shall prepare and submit a SPCD that details how it proposes to comply with the requirements presented within the CSPP.

The Contractor shall implement all necessary safety plan measures prior to commencement of any work activity. The Contractor shall conduct routine checks to assure compliance with the safety plan measures.

The Contractor is responsible to the Owner for the conduct of all subcontractors it employs on the project. The Contractor shall assure that all subcontractors are made aware of the requirements of the CSPP and SPCD and that they implement and maintain all necessary measures.

No deviation or modifications may be made to the approved CSPP and SPCD unless approved in writing by the Owner. The necessary coordination actions to review Contractor proposed modifications to an approved CSPP or approved SPCD can require a significant amount of time.

80-05 Character of workers, methods, and equipment. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations or operational safety requirements and, in the opinion of the RPR, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the RPR, be removed immediately by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the RPR.

Should the Contractor fail to remove such person or persons, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the RPR may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall not cause injury to previously completed work, adjacent property, or existing airport facilities due to its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless otherwise authorized by the RPR. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the RPR to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the RPR determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the RPR may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this paragraph.

80-06 Temporary suspension of the work. The Owner shall have the authority to suspend the work wholly, or in part, for such period or periods the Owner may deem necessary, due to unsuitable weather, or other conditions considered unfavorable for the execution of the work, or for such time necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Owner, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the written order to suspend work to the effective date of the written order to resume the work. Claims for such compensation shall be filed with the RPR within the time period stated in the RPR's order to resume work. The Contractor shall submit with their own claim information substantiating the amount shown on the claim. The RPR will forward the Contractor's claim to the Owner for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather or for any other delay provided for in the contract, plans, or specifications.

If it becomes necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

80-07 Determination and extension of contract time. The **number of calendar days** shall be stated in the proposal and contract and shall be known as the Contract Time.

If the contract time requires extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

80-07.1 Contract time based on calendar days. Contract Time based on calendar days shall consist of the number of calendar days stated in the contract counting from the effective date of the Notice to Proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the Owner's orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

At the time of final payment, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in the contract time shall not consider either cost of work or the extension of contract time that has been covered by a change order or supplemental agreement. Charges against the contract time will cease as of the date of final acceptance.

80-08 Failure to complete on time. For each calendar day or working day, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in paragraph 80-07, *Determination and Extension of Contract Time*) the sum specified in the contract and proposal as liquidated damages (LD) will be deducted from any money due or to become due the Contractor or their own surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages including but not limited to additional engineering services that will be incurred by the Owner should the Contractor fail to complete the work in the time provided in their contract.

Refer to Section 4.05 of the Agreement Between Owner And Contractor For Construction Contract (Stipulated Price).

The maximum construction time allowed for Schedules will be the sum of the time allowed for individual schedules but not more than **the specified number of calendar** days. Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a wavier on the part of the Owner of any of its rights under the contract.

80-09 Default and termination of contract. The Contractor shall be considered in default of their contract and such default will be considered as cause for the Owner to terminate the contract for any of the following reasons, if the Contractor:

a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or

b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or

c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or

d. Discontinues the execution of the work, or

e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or

f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or

g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or

h. Makes an assignment for the benefit of creditors, or

i. For any other cause whatsoever, fails to carry on the work in an acceptable manner.

Should the Owner consider the Contractor in default of the contract for any reason above, the Owner shall immediately give written notice to the Contractor and the Contractor's surety as to the reasons for considering the Contractor in default and the Owner's intentions to terminate the contract.

If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the RPR of the facts of such delay, neglect, or default and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the execution of the work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the work and are acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the RPR will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

80-10 Termination for national emergencies. The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the execution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the RPR.

Termination of the contract or a portion thereof shall neither relieve the Contractor of their responsibilities for the completed work nor shall it relieve their surety of its obligation for and concerning any just claim arising out of the work performed.

80-11 Work area, storage area and sequence of operations. The Contractor shall obtain approval from the RPR prior to beginning any work in all areas of the airport. No operating runway, taxiway, or air operations area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate work in accordance with the approved CSPP and SPCD.

END OF SECTION 80

Section 90 Measurement and Payment

90-01 Measurement of quantities. All work completed under the contract will be measured by the RPR, or their authorized representatives, using **United States Customary Units of Measurement**.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet (0.8 square meters) or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the RPR.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

The term "lump sum" when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure or structural unit (in effect, "lump sum" work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

When requested by the Contractor and approved by the RPR in writing, material specified to be measured by the cubic yard (cubic meter) may be weighed, and such weights will be converted to cubic yards (cubic meters) for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the RPR and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

Measurement and Payment Terms

Term	Description
Excavation and Embankment Volume	In computing volumes of excavation, the average end area method will be used unless otherwise specified.
Measurement and Proportion by Weight	The term "ton" will mean the short ton consisting of 2,000 pounds (907 km) avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, independently certified scales by competent, qualified personnel at locations designated by the RPR. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the RPR directs, and each truck shall bear a plainly legible identification mark.
Measurement by Volume	Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this

Term	Description
	purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.
Asphalt Material	Asphalt materials will be measured by the gallon (liter) or ton (kg). When measured by volume, such volumes will be measured at 60°F (16°C) or will be corrected to the volume at 60°F (16°C) using ASTM D1250 for asphalts. Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when asphalt material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When asphalt materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, will be used for computing quantities.
Cement	Cement will be measured by the ton (kg) or hundredweight (km).
Structure	Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.
Timber	Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.
Plates and Sheets	The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.
Miscellaneous Items	When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.
Scales	Scales must be tested for accuracy and serviced before use. Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end. Scales shall be accurate within 0.5% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the RPR before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed 0.1% of the nominal rated capacity of the scale, but not less than one pound (454 grams). The use of spring balances will not be permitted.

Term	Description
	In the event inspection reveals the scales have been "overweighing" (indicating more than correct weight) they will be immediately adjusted. All materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of 0.5%. In the event inspection reveals the scales have been under-weighing (indicating less than correct weight), they shall be immediately adjusted. No additional payment to the Contractor will be allowed for materials previously weighed and recorded. Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the RPR can safely and conveniently view them. Scale installations shall have available ten standard 50-pound (2.3 km) weights for testing the weighing equipment or suitable weights and devices for other approved equipment. All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.
Rental Equipment	Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered in connection with extra work will be measured as agreed in the change order or supplemental agreement authorizing such work as provided in paragraph 90-05 *Payment for Extra Work*.
Pay Quantities	When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the RPR. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

90-02 Scope of payment. The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of Section 70, paragraph 70-18, *No Waiver of Legal Rights*.

When the "basis of payment" subsection of a technical specification requires that the contract price (price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

90-03 Compensation for altered quantities. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in Section 40, paragraph 40-02, *Alteration of Work*

and Quantities, will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from their own unbalanced allocation of overhead and profit among the contract items, or from any other cause.

90-04 Payment for omitted items. As specified in Section 40, paragraph 40-03, *Omitted Items,* the RPR shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

Should the RPR omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the RPR's order to omit or non-perform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the RPR's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the RPR's order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

90-05 Payment for extra work. Extra work, performed in accordance with Section 40, paragraph 40-04, *Extra Work*, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work.

90-06 Partial payments. Partial payments will be made to the Contractor at least once each month as the work progresses. Said payments will be based upon estimates, prepared by the RPR, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with paragraph 90-07, *Payment for Materials on Hand*. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars.

a. No retainage will be held by the Owner from progress payments due the prime.

b. The Contractor is required to pay all subcontractors for satisfactory performance of their contracts no later than 30 days after the Contractor has received a partial payment. Contractor must provide the Owner evidence of prompt and full payment of retainage held by the prime Contractor to the subcontractor within 30 days after the subcontractor's work is satisfactorily completed. A subcontractor's work is satisfactorily completed when all the tasks called for in the subcontract have been accomplished and documented as required by the Owner. When the Owner has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

c. When at least 95% of the project work has been completed to the satisfaction of the RPR, the RPR shall, at the Owner's discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based on quantities of work in excess of those provided in the proposal or covered by approved change orders or supplemental agreements, except when such excess quantities have been determined by the RPR to be a part of the final quantity for the item of work in question.

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in paragraph 90-09, *Acceptance and Final Payment*.

The Contractor shall deliver to the Owner a complete release of all claims for labor and material arising out of this contract before the final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the Owner may be compelled to pay in discharging any such lien or claim.

90-07 Payment for materials on hand. Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

a. The material has been stored or stockpiled in a manner acceptable to the RPR at or on an approved site.

b. The Contractor has furnished the RPR with acceptable evidence of the quantity and quality of such stored or stockpiled materials.

c. The Contractor has furnished the RPR with satisfactory evidence that the material and transportation costs have been paid.

d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material stored or stockpiled.

e. The Contractor has furnished the Owner evidence that the material stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.

It is understood and agreed that the transfer of title and the Owner's payment for such stored or stockpiled materials shall in no way relieve the Contractor of their responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this paragraph.

90-08 Payment of withheld funds. At the Contractor's option, if an Owner withholds retainage in accordance with the methods described in paragraph 90-06 *Partial Payments*, the Contractor may request that the Owner deposit the retainage into an escrow account. The Owner's deposit of retainage into an escrow account is subject to the following conditions:

a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.

b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the retainage that would otherwise be withheld from partial payment.

c. The Contractor shall enter into an escrow agreement satisfactory to the Owner.

d. The Contractor shall obtain the written consent of the surety to such agreement.

90-09 Acceptance and final payment. When the contract work has been accepted in accordance with the requirements of Section 50, paragraph 50-15, *Final Acceptance*, the RPR will prepare the final estimate of the items of work actually performed. The Contractor shall approve the RPR's final estimate or advise the RPR of the Contractor's objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement. The Contractor and the RPR shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor's receipt of the RPR's final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the RPR's estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with Section 50, paragraph 50-16, *Claims for Adjustment and Disputes*.

After the Contractor has approved, or approved under protest, the RPR's final estimate, and after the RPR's receipt of the project closeout documentation required in paragraph 90-11, *Contractor Final Project Documentation*, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of Section 50, paragraph 50-16, *Claims for Adjustments and Disputes,* or under the provisions of this paragraph, such claims will be considered by the Owner in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

90-10 Construction warranty.

a. In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of one year from the date of final acceptance of the work, except as noted. If the Owner takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date the Owner takes possession.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Owner real or personal property, when that damage is the result of the Contractor's failure to conform to contract requirements; or any defect of equipment, material, workmanship, or design furnished by the Contractor.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for one year from the date of repair or replacement.

e. The Owner will notify the Contractor, in writing, within **seven (7)** days after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within **fourteen (14)** days after receipt of notice, the Owner shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall: (1) Obtain all warranties that would be given in normal commercial practice; (2) Require all warranties to be executed,

in writing, for the benefit of the Owner, as directed by the Owner, and (3) Enforce all warranties for the benefit of the Owner.

h. This warranty shall not limit the Owner's rights with respect to latent defects, gross mistakes, or fraud.

90-11 Contractor Final Project Documentation. Approval of final payment to the Contractor is contingent upon completion and submittal of the items listed below. The final payment will not be approved until the RPR approves the Contractor's final submittal. The Contractor shall:

a. Provide two (2) copies of all manufacturers warranties specified for materials, equipment, and installations.

b. Provide weekly payroll records (not previously received) from the general Contractor and all subcontractors.

c. Complete final cleanup in accordance with Section 40, paragraph 40-08, *Final Cleanup*.

d. Complete all punch list items identified during the Final Inspection.

e. Provide complete release of all claims for labor and material arising out of the Contract.

f. Provide a certified statement signed by the subcontractors, indicating actual amounts paid to the Disadvantaged Business Enterprise (DBE) subcontractors and/or suppliers associated with the project.

g. When applicable per state requirements, return copies of sales tax completion forms.

h. Manufacturer's certifications for all items incorporated in the work.

i. All required record drawings, as-built drawings or as-constructed drawings.

j. Project Operation and Maintenance (O&M) Manual(s).

k. Security for Construction Warranty.

l. Equipment commissioning documentation submitted, if required.

END OF SECTION 90

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

SOIL NOMENCLATURE AND TERMINOLOGY

DRILLING & SAMPLING DESIGNATIONS:

SS : Split Spoon Sample (per ASTM D 1586)
LS : Split Spoon Sample with 3" Liner Insert
ST : Shelby Tube Sample - 3" O.D., unless otherwise noted
AS : Auger Sample
BS : Bulk Sample

HSA : Hollow Stem Auger
SSA : Solid Stem Auger
RB : Rock Bit (NX; BX; AX)
PP : Pocket Penetrometer Value
VS : Vane Shear Value
PM : Pressuremeter test - in situ

STANDARD PENETRATION TEST (ASTM D-1586): A 2-inch OD, 1⅜-inch ID split barrel sampler is driven into undisturbed soil by means of repeating blows from a 140-pound hammer falling 30 inches. The sampler is driven three successive 6-inch increments; the total number of blows required for the final 12 inches of penetration is termed the Standard Penetration Resistance (N).

GRADATION DESCRIPTION & TERMINOLOGY:

Granular Soils (coarse-grained) have more than 50% of their dry weight retained on a #200 sieve; they are described as: *Boulders*, *Cobbles*, *Gravel* or *Sand*. Fine-Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: *Clays* or *Clayey Silts* if they are cohesive, and *Silts* if they are non-cohesive. In addition to gradation, granular soils are defined based on their *in-situ density*; fine grained soils are further defined based on their strength or *consistency*, and on their *plasticity*.

Major Soil Component		Gradation Range
Boulders		Over 12 inches (305mm)
Cobbles		12 inches to 3 inches (305mm to 76mm)
Gravel	Coarse	3 inches to ¾ inches (76mm to 19mm)
	Fine	¾ inches to #4 sieve (19mm to 4.75mm)
Sand	Coarse	#4 sieve to #10 sieve (4.75mm to 2.00mm)
	Medium	#10 sieve to #40 sieve (2.00mm to 0.425mm)
	Fine	#40 sieve to #200 sieve (0.425mm to 0.074mm)
Silt		Passing #200 sieve (0.074mm) to 0.005mm
Clay		Smaller than 0.005mm

Descriptive Term(s) (Of Minor Soil Constituents)	Percent of Dry Weight
Trace	1 - 10
Little	10 - 20
Some	20 - 35
And	35 - 50

CONSISTENCY OF COHESIVE SOILS:

Unconfined Comp Strength, Qu (tsf)	Consistency
<0.25	Very Soft
0.25 – 0.50	Soft
0.50 – 1.00	Medium (firm)
1.00 – 2.00	Stiff
2.00 – 4.00	Very Stiff
4.00 – 8.00	Hard
>8.00	Very Hard

IN-SITU DENSITY OF GRANULAR SOILS:

N - Blows/ft.	In-Situ Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
50 +	Very Dense

WATER LEVEL MEASUREMENT:

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. It should be noted that groundwater levels observed during drilling in predominantly cohesive soils are not necessarily indicative of the static groundwater level. This is due to the relatively low permeability of clay soils and the tendency of drilling operations to temporarily seal off natural paths of groundwater migration into the borehole. Additionally, fluctuations in groundwater levels should be anticipated with seasonal variations and following periods of heavy or prolonged precipitation.

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FAA Airports

Contract Provision Guidelines for Obligated Sponsors and Airport Improvement Program Projects (Issued on March 17, 2026)

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APPENDIX A – CONTRACT PROVISIONS

A1 ACCESS TO RECORDS AND REPORTS

ACCESS TO RECORDS AND REPORTS

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the Owner, the Federal Aviation Administration and the Comptroller General of the United States or any of their duly authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

A2 BREACH OF CONTRACT TERMS

BREACH OF CONTRACT TERMS

Any violation or breach of terms of this contract on the part of the [*Contractor | Limno Tech Inc.*] or its subcontractors may result in the suspension or termination of this contract or such other action that may be necessary to enforce the rights of the parties of this agreement.

Owner will provide [*Contractor | Limno Tech Inc.*] written notice that describes the nature of the breach and corrective actions the [*Contractor | Limno Tech Inc.*] must undertake in order to avoid termination of the contract. Owner reserves the right to withhold payments to Contractor until such time the Contractor corrects the breach or the Owner elects to terminate the contract. The Owner's notice will identify a specific date by which the [*Contractor | Limno Tech Inc.*] must correct the breach. Owner may proceed with termination of the contract if the [*Contractor | Limno Tech Inc.*] fails to correct the breach by the deadline indicated in the Owner's notice.

The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder are in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law.

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables

Goals for minority participation for each trade:	0%
Goals for female participation in each trade:	0%

These goals are applicable to all of the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a) and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs (OFCCP) within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this notice and in the contract resulting from this solicitation, the "covered area" is Kent County, MI.

A3.1.1 Certification of Compliance with FAA Buy American Preference – Construction Projects

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with its proposal. The bidder or offeror must indicate how it intends to comply with 49 U.S.C. § 50101, BABA and other related Made in America Laws, U.S. statutes, guidance, and FAA policies, by selecting one of the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (i.e., not both) by inserting a checkmark (ü) or the letter "X".

☐ Bidder or offeror hereby certifies that it will comply with 49 U.S.C. § 50101, BABA and other related U.S. statutes, guidance, and policies of the FAA by:

a) Only installing iron, steel and manufactured products produced in the United States;

b) Only installing construction materials defined as: an article, material, or supply – other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives that are or consist primarily of non-ferrous metals; plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); glass (including optic glass); lumber or drywall that have been manufactured in the United States.

c) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or

d) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

a) To provide to the Airport Sponsor or the FAA evidence that documents the source and origin of the iron, steel, and/or manufactured product.
b) To faithfully comply with providing U.S. domestic products.
c) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.
d) Certify that all construction materials used in the project are manufactured in the U.S.

☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 U.S.C. § 50101(a) but may qualify for a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:

a) To the submit to the Airport Sponsor or FAA within 15 calendar days of being selected as the responsive bidder, a formal waiver request and required documentation that supports the type of waiver being requested.

b) That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination that may result in rejection of the proposal.
c) To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
d) To furnish U.S. domestic product for any waiver request that the FAA rejects.
e) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 2 Waiver (Nonavailability) - The iron, steel, manufactured goods or construction materials or manufactured goods are not available in sufficient quantity or quality in the United States. The required documentation for the Nonavailability waiver is

a) Completed Content Percentage Worksheet and Final Assembly Questionnaire
b) Record of thorough market research, consideration where appropriate of qualifying alternate items, products, or materials including;
c) A description of the market research activities and methods used to identify domestically manufactured items capable of satisfying the requirement, including the timing of the research and conclusions reached on the availability of sources.

Type 3 Waiver – The cost of components and subcomponents produced in the United States is more than 60 percent of the cost of all components and subcomponents of the "facility/project." The required documentation for a Type 3 waiver is:

a) Completed Content Percentage Worksheet and Final Assembly Questionnaire including;
b) Listing of all manufactured products that are not comprised of 100 percent U.S. domestic content (excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).
c) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly and installation at project location.
d) Percentage of non-domestic component and subcomponent cost as compared to total "facility" component and subcomponent costs, excluding labor costs associated with final assembly and installation at project location.

Type 4 Waiver (Unreasonable Costs) - Applying this provision for iron, steel, manufactured goods or construction materials would increase the cost of the overall project by more than 25 percent. The required documentation for this waiver is:

a) A completed Content Percentage Worksheet and Final Assembly Questionnaire from
b) At minimum two comparable equal bids and/or offers;
c) Receipt or record that demonstrates that supplier scouting called for in Executive Order 14005, indicates that no domestic source exists for the project and/or component;
d) Completed waiver applications for each comparable bid and/or offer.

False Statements: Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

Date	Signature
Company Name	Title

A3.1.2 Certification of Compliance with FAA Buy American Preference – Equipment/Building Projects

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with their proposal. The bidder or offeror must indicate how they intend to comply with 49 U.S.C. § 50101, and other Made in America Laws, U.S. statutes, guidance, and FAA policies by selecting one on the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (not both) by inserting a checkmark (ü) or the letter "X".

☐ Bidder or offeror hereby certifies that it will comply with 49 U.S.C. § 50101, BABA and other related U.S. statutes, guidance, and policies of the FAA by:

a) Only installing steel and manufactured products produced in the United States;
b) Only installing construction materials defined as: an article, material, or supply – other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives that are or consist primarily of non-ferrous metals; plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); glass (including optic glass); lumber or drywall that have been manufactured in the United States.
c) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
d) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

a) To provide to the Airport Sponsor or FAA evidence that documents the source and origin of the steel and manufactured product.
b) To faithfully comply with providing U.S. domestic product.
c) To furnish U.S. domestic product for any waiver request that the FAA rejects.
d) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 U.S.C. § 50101(a) but may qualify for a Type 3 waiver under 49 U.S.C. § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:

a) To submit to the Airport Sponsor or FAA within 15 calendar days of being selected as the responsive bidder, a formal waiver request and required documentation that supports the type of waiver being requested.
b) That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination that may result in rejection of the proposal.

c) To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
d) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 2 Waiver (**Nonavailability)** - The iron, steel, manufactured goods or construction materials are not available in sufficient quantity or quality in the United States. The required documentation for the Nonavailability waiver is:

a) Completed Content Percentage Worksheet and Final Assembly Questionnaire
b) Record of thorough market research, consideration where appropriate of qualifying alternate items, products, or materials including;
c) A description of the market research activities and methods used to identify domestically manufactured items capable of satisfying the requirement, including the timing of the research and conclusions reached on the availability of sources.

Type 3 Waiver – The cost of the item components and subcomponents produced in the United States is more that 60 percent of the cost of all components and subcomponents of the "item". The required documentation for a Type 3 waiver is:

a) Completed Content Percentage Worksheet and Final Assembly Questionnaire including;
b) Listing of all product components and subcomponents that are not comprised of 100 percent U.S. domestic content (Excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108 (products of unknown origin must be considered as non-domestic products in their entirety).
c) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly at place of manufacture.
d) Percentage of non-domestic component and subcomponent cost as compared to total "item" component and subcomponent costs, excluding labor costs associated with final assembly at place of manufacture.

Type 4 Waiver (Unreasonable Costs) - Applying this provision for iron, steel, manufactured goods or construction materials, would increase the cost of the overall project by more than 25 percent. The required documentation for this waiver is:

a) Completed Content Percentage Worksheet and Final Assembly Questionnaire from
b) At minimum two comparable equal bidders and/or offerors;
c) Receipt or record that demonstrates that supplier scouting called for in Executive Order 14005, indicates that no domestic source exists for the project and/or component;
d) Completed waiver applications for each comparable bid and/or offer.

False Statements: Per 49 U.S.C. § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

Date	Signature
Company Name	Title

A4 CIVIL RIGHTS - GENERAL

GENERAL CIVIL RIGHTS PROVISIONS

In all its activities within the scope of its airport program, the Contractor agrees to comply with pertinent statutes, Executive Orders, and such rules as identified in Title VI List of Pertinent Nondiscrimination Acts and Authorities to ensure that no person shall, on the grounds of race, color, national origin, creed, sex, age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance.

This provision is in addition to that required by Title VI of the Civil Rights Act of 1964.

A4.1.1 Specific Clause that is used for General Contract Agreements

The above provision binds the Contractor and subcontractors from the bid solicitation period through the completion of the contract.

A4.1.2 Specific Clause that is used for Lease Agreements or Transfer Agreements

If the Contractor transfers its obligation to another, the transferee is obligated in the same manner as the Contractor.

The above provision obligates the Contractor for the period during which the property is owned, used or possessed by the Contractor and the airport remains obligated to the Federal Aviation Administration.

A5 CIVIL RIGHTS – TITLE VI ASSURANCE

Title VI Solicitation Notice:

The **Gerald R. Ford International Airport Authority**, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4), 28 CFR § 50.3, and 49 CFR Part 21, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, all contractors will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of the owner's race, color, national origin, sex, creed, age, or disability in consideration for an award.

Title VI List of Pertinent Nondiscrimination Acts and Authorities

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "Contractor") agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq*., 78 stat. 252) (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR Part 21 (Non-discrimination in Federally-Assisted programs of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act of 1964) including amendments thereto;
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601) (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. § 794 *et seq*.), as amended (prohibits discrimination on the basis of disability); and 49 CFR part 27 (Nondiscrimination on the Basis of Disability in Programs or Activities Receiving Federal Financial Assistance);
- The Age Discrimination Act of 1975, as amended (42 .U.S.C. § 6101 *et seq*.) (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982 (49 U.S.C. § 47123), as amended (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987 (P.L. 100-259) (broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, the Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act of 1990 (42 U.S.C. § 12101, et seq) (prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities) as implemented by U.S. Department of Transportation regulations at 49 CFR Parts 37 and 38;
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. § 1681, et seq).

Compliance with Nondiscrimination Requirements:

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "Contractor"), agrees as follows:

1. **Compliance with Regulations:** The Contractor (hereinafter includes consultants) will comply with the Title VI List of Pertinent Nondiscrimination Acts and Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.
2. **Nondiscrimination:** The Contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, national origin), creed, sex, age, or disability in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21 including amendments thereto.
3. **Solicitations for Subcontracts, including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the Contractor of the contractor's obligations under this contract and the Nondiscrimination Acts and Authorities on the grounds of race, color, or national origin.
4. **Information and Reports:** The Contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Nondiscrimination Acts and Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the Contractor will so certify to the Sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.
5. **Sanctions for Noncompliance: In** the event of a Contractor's noncompliance with the non-discrimination provisions of this contract, the Sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:
    a. Withholding payments to the Contractor under the contract until the Contractor complies; and/or
    b. Cancelling, terminating, or suspending a contract, in whole or in part.
6. **Incorporation of Provisions:** The Contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations, and directives issued pursuant thereto. The Contractor will take action with respect to any subcontract or procurement as the Sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the Contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such

direction, the Contractor may request the Sponsor to enter into any litigation to protect the interests of the Sponsor. In addition, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(HABENDUM CLAUSE)

TO HAVE AND TO HOLD said lands and interests therein unto (***Title of Sponsor***) and its successors forever, subject, however, to the covenants, conditions, restrictions and reservations herein contained as follows, which will remain in effect for the period during which the real property or structures are used for a purpose for which Federal financial assistance is extended or for another purpose involving the provision of similar services or benefits and will be binding on the (***Title of Sponsor***), its successors and assigns.

The (***Title of Sponsor***), in consideration of the conveyance of said lands and interests in lands, does hereby covenant and agree as a covenant running with the land for itself, its successors and assigns, that (1) no person will on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination with regard to any facility located wholly or in part on, over, or under such lands hereby conveyed [,] [and]* (2) that the (***Title of Sponsor***) will use the lands and interests in lands and interests in lands so conveyed, in compliance with all requirements imposed by or pursuant to Title 49, Code of Federal Regulations, U.S. Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Effectuation of Title VI of the Civil Rights Act of 1964, and as said Regulations and Acts may be amended[, and (3) that in the event of breach of any of the above-mentioned nondiscrimination conditions, the Department will have a right to enter or re-enter said lands and facilities on said land, and that above described land and facilities will thereon revert to and vest in and become the absolute property of the Federal Aviation Administration and its assigns as such interest existed prior to this instruction].*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary in order to make clear the purpose of Title VI.)

A6 CLEAN AIR AND WATER POLLUTION CONTROL

CLEAN AIR AND WATER POLLUTION CONTROL

Contractor agrees to comply with all applicable standards, orders, and regulations issued pursuant to the Clean Air Act (42 U.S.C. §§ 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. §§ 1251-1387). The Contractor agrees to report any violation to the Owner immediately upon discovery. The Owner assumes responsibility for notifying the Environmental Protection Agency (EPA) and the Federal Aviation Administration.

Contractor must include this requirement in all subcontracts that exceed $150,000.

A7 CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS

CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS

1. Overtime Requirements.

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, including watchmen and guards, in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; Liability for Unpaid Wages; Liquidated Damages.

In the event of any violation of the clause set forth in paragraph (1) of this clause, the Contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this clause, in the sum of $33 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this clause.

3. Withholding for Unpaid Wages and Liquidated Damages.

The Federal Aviation Administration (FAA) or the Owner shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this clause.

4. Subcontractors.

The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (1) through (4) and also a clause requiring the subcontractor to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this clause.

A8 COPELAND "ANTI-KICKBACK" ACT

COPELAND "ANTI-KICKBACK" ACT

Contractor must comply with the requirements of the Copeland "Anti-Kickback" Act (18 USC 874 and 40 USC 3145), as supplemented by Department of Labor regulation 29 CFR part 3. Contractor and subcontractors are prohibited from inducing, by any means, any person employed on the project to give up any part of the compensation to which the employee is entitled. The Contractor and each Subcontractor must submit to the Owner, a weekly statement on the wages paid to each employee performing on covered work during the prior week. Owner must report any violations of the Act to the Federal Aviation Administration.

A9 DAVIS-BACON REQUIREMENTS

DAVIS-BACON REQUIREMENTS

1. Minimum Wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Secretary of Labor under regulations implementing the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalent thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can easily be seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination;

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including

the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the Contractor, the laborers, or mechanics to be employed in the classification, or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii) (B) or (C) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding. The Federal Aviation Administration or the Sponsor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Federal Aviation Administration may, after written notice to the Contractor, Sponsor, Applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and Basic Records.

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 1(b)(2)(B) of the Davis-Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records that show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual costs incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant, Sponsor, or Owner, as the case may be, for transmission to the Federal Aviation Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR § 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead, the payrolls shall only need to include an individually identifying number for each employee (*e.g.,* the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at *https://www.dol.gov/agencies/whd/government-contracts/construction/payroll-certification* or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker and shall provide them upon request to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit them to the applicant, Sponsor, or Owner, as the case may be, for transmission to the Federal Aviation Administration, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, Sponsor, or Owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR § 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR § 5.5 (a)(3)(i), and that such information is correct and complete;

(2) That each laborer and mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The Contractor or subcontractor shall make the records required under paragraph (3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Sponsor, the Federal Aviation Administration, or the Department of Labor and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the Contractor, Sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR § 5.12.

4. Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the

job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR § 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at no less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination that provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate that is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

5. Compliance with Copeland Act Requirements.

The Contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

6. Subcontracts.

The Contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR §§ 5.5(a)(1) through (10) and such other clauses as the Federal Aviation Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR § 5.5.

7. Contract Termination: Debarment.

A breach of the contract clauses in paragraph 1 through 10 of this section may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR § 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes Concerning Labor Standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of Eligibility.

(i) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR § 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR § 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 USC § 1001.

A10 DEBARMENT AND SUSPENSION

CERTIFICATION OF OFFEROR/BIDDER REGARDING DEBARMENT

By submitting a bid/proposal under this solicitation, the bidder or offeror certifies that neither it nor its principals are presently debarred or suspended by any Federal department or agency from participation in this transaction.

CERTIFICATION OF LOWER TIER CONTRACTORS REGARDING DEBARMENT

The successful bidder, by administering each lower tier subcontract that exceeds $25,000 as a "covered transaction", must confirm each lower tier participant of a "covered transaction" under the project is not presently debarred or otherwise disqualified from participation in this federally-assisted project. The successful bidder will accomplish this by:

1. Checking the System for Award Management at website: http://www.sam.gov.
2. Collecting a certification statement similar to the Certification of Offeror /Bidder Regarding Debarment, above.
3. Inserting a clause or condition in the covered transaction with the lower tier contract.

If the Federal Aviation Administration later determines that a lower tier participant failed to disclose to a higher tier participant that it was excluded or disqualified at the time it entered the covered transaction, the FAA may pursue any available remedies, including suspension and debarment of the non-compliant participant.

A11 DISADVANTAGED BUSINESS ENTERPRISE

Contract Assurance (49 CFR § 26.13)

The Contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26, including any amendments thereto, in the award and administration of DOT-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

1) Withholding monthly progress payments;
2) Assessing sanctions;
3) Liquidated damages; and/or
4) Disqualifying the Contractor from future bidding as non-responsible.

Prompt Payment (49 CFR § 26.29; acceptable/sample text provided) –
The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than **30** days from the receipt of each payment the prime contractor receives from **the Gerald R. Ford International Airport Authority (GFIAA)**. The prime contractor agrees further to return retainage payments to each subcontractor within **30** days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the GFIAA. This clause applies to both DBE and non-DBE subcontractors.

Termination of DBE Subcontracts (49 CFR § 26.53(f)

The prime contractor must not terminate a DBE subcontractor listed in response to [include Solicitation paragraph number where paragraph A11.3.1, Solicitation Language appears] (or an approved substitute DBE firm) without prior written consent of GFIAA. This includes, but is not limited to, instances in which the prime contractor seeks to perform work originally designated for a DBE subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm.

The prime contractor shall utilize the specific DBEs listed to perform the work and supply the materials for which each is listed unless the contractor obtains written consent GFIAA. Unless GFIAA consent is provided, the prime contractor shall not be entitled to any payment for work or material unless it is performed or supplied by the listed DBE.

GFIAA may provide such written consent only if GFIAA agrees, for reasons stated in the concurrence document, that the prime contractor has good cause to terminate the DBE firm. For purposes of this paragraph, good cause includes the circumstances listed in 49 CFR § 26.53.

Before transmitting to GFIAA its request to terminate and/or substitute a DBE subcontractor, the prime contractor must give notice in writing to the DBE subcontractor, with a copy to GFIAA, of its intent to request to terminate and/or substitute, and the reason for the request.

The prime contractor must give the DBE five days to respond to the prime contractor's notice and advise GFIAA and the contractor of the reasons, if any, why it objects to the proposed termination of its subcontract and why GFIAA should not approve the prime contractor's action. If required in a particular case as a matter of public necessity (e.g., safety), GFIAA may provide a response period shorter than five days.

In addition to post-award terminations, the provisions of this section apply to pre-award deletions of or substitutions for DBE firms put forward by offerors in negotiated procurements.

A12 DISTRACTED DRIVING

TEXTING WHEN DRIVING

In accordance with Executive Order 13513, "Federal Leadership on Reducing Text Messaging While Driving", (10/1/2009) and DOT Order 3902.10, "Text Messaging While Driving", (12/30/2009), the Federal Aviation Administration encourages recipients of Federal grant funds to adopt and enforce safety policies that decrease crashes by distracted drivers, including policies to ban text messaging while driving when performing work related to a grant or subgrant.

In support of this initiative, the Owner encourages the Contractor to promote policies and initiatives for its employees and other work personnel that decrease crashes by distracted drivers, including policies that ban text messaging while driving motor vehicles while performing work activities associated with the project. The Contractor must include the substance of this clause in all sub-tier contracts exceeding $15,000 that involve driving a motor vehicle in performance of work activities associated with the project.

A13 PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT

PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT

Contractor and Subcontractor agree to comply with mandatory standards and policies relating to use and procurement of certain telecommunications and video surveillance services or equipment in compliance with the National Defense Authorization Act P.L. 115-232, § 889(f)(1)).

A14 DRUG FREE WORKPLACE REQUIREMENTS

CONTRACT CLAUSE

None.

A15 FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR Part 201, et seq, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part-time workers.

The [*Contractor | Limno Tech Inc.*] has full responsibility to monitor compliance to the referenced statute or regulation. The [*Contractor | Limno Tech Inc.*] must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

A16 LOBBYING AND INFLUENCING FEDERAL EMPLOYEES

CERTIFICATION REGARDING LOBBYING

The Bidder or Offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Bidder or Offeror, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. § 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

A17 OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text. The employer must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The employer retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (29 CFR Part 1910). The employer must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

A18 PROCUREMENT OF RECOVERED MATERIALS

PROCUREMENT OF RECOVERED MATERIALS

Contractor and subcontractor agree to comply with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, and the regulatory provisions of 40 CFR Part 247. In the performance of this contract and to the extent practicable, the Contractor and subcontractors are to use products containing the highest percentage of recovered materials for items designated by the Environmental Protection Agency (EPA) under 40 CFR Part 247 whenever:

1) The contract requires procurement of $10,000 or more of a designated item during the fiscal year; or
2) The contractor has procured $10,000 or more of a designated item using Federal funding during the previous fiscal year.

The list of EPA-designated items is available at www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products.

Section 6002(c) establishes exceptions to the preference for recovery of EPA-designated products if the contractor can demonstrate the item is:

a) Not reasonably available within a timeframe providing for compliance with the contract performance schedule;
b) Fails to meet reasonable contract performance requirements; or
c) Is only available at an unreasonable price.

A19 RIGHT TO INVENTIONS

RIGHTS TO INVENTIONS

Contracts or agreements that include the performance of experimental, developmental, or research work must provide for the rights of the Federal Government and the Owner in any resulting invention as established by 37 CFR part 401, Rights to Inventions Made by Non-profit Organizations and Small Business Firms under Government Grants, Contracts, and Cooperative Agreements. This contract incorporates by reference the patent and inventions rights as specified within 37 CFR § 401.14. Contractor must include this requirement in all sub-tier contracts involving experimental, developmental, or research work.

A20 SEISMIC SAFETY

SEISMIC SAFETY

The Contractor agrees to ensure that all work performed under this contract, including work performed by subcontractors, conforms to a building code standard that provides a level of seismic safety substantially equivalent to standards established by the National Earthquake Hazards Reduction Program (NEHRP). Local building codes that model their code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety.

A21 TAX DELINQUENCY AND FELONY CONVICTIONS

CERTIFICATION OF OFFEROR/BIDDER REGARDING TAX DELINQUENCY AND FELONY CONVICTIONS

The applicant must complete the following two certification statements. The applicant must indicate its current status as it relates to tax delinquency and felony conviction by inserting a checkmark (ü) in the space following the applicable response. The applicant agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification in all lower tier subcontracts.

Certifications

1) The applicant represents that it is ( ) is not ( ) a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

2) The applicant represents that it is ( ) is not ( ) a corporation that was convicted of a criminal violation under any Federal law within the preceding 24 months.

Note

If an applicant responds in the affirmative to either of the above representations, the applicant is ineligible to receive an award unless the Sponsor has received notification from the agency suspension and debarment official (SDO) that the SDO has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The applicant therefore must provide information to the owner about its tax liability or conviction to the Owner, who will then notify the FAA Airports District Office, which will then notify the agency's SDO to facilitate completion of the required considerations before award decisions are made.

Term Definitions

Felony conviction: Felony conviction means a conviction within the preceding twenty four (24) months of a felony criminal violation under any Federal law and includes conviction of an offense defined in a section of the U.S. Code that specifically classifies the offense as a felony and conviction of an offense that is classified as a felony under 18 USC § 3559.

Tax Delinquency: A tax delinquency is any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

A22 TERMINATION OF CONTRACT

TERMINATION FOR CONVENIENCE (CONSTRUCTION & EQUIPMENT CONTRACTS)

The Owner may terminate this contract in whole or in part at any time by providing written notice to the Contractor. Such action may be without cause and without prejudice to any other right or remedy of Owner. Upon receipt of a written notice of termination, except as explicitly directed by the Owner, the Contractor shall immediately proceed with the following obligations regardless of any delay in determining or adjusting amounts due under this clause:

1. Contractor must immediately discontinue work as specified in the written notice.
2. Terminate all subcontracts to the extent they relate to the work terminated under the notice.
3. Discontinue orders for materials and services except as directed by the written notice.
4. Deliver to the Owner all fabricated and partially fabricated parts, completed and partially completed work, supplies, equipment and materials acquired prior to termination of the work, and as directed in the written notice.
5. Complete performance of the work not terminated by the notice.
6. Take action as directed by the Owner to protect and preserve property and work related to this contract that Owner will take possession.

Owner agrees to pay Contractor for:

1. Completed and acceptable work executed in accordance with the contract documents prior to the effective date of termination;
2. Documented expenses sustained prior to the effective date of termination in performing work and furnishing labor, materials, or equipment as required by the contract documents in connection with uncompleted work;
3. Reasonable and substantiated claims, costs, and damages incurred in settlement of terminated contracts with Subcontractors and Suppliers; and
4. Reasonable and substantiated expenses to the Contractor directly attributable to Owner's termination action.

Owner will not pay Contractor for loss of anticipated profits or revenue or other economic loss arising out of or resulting from the Owner's termination action.

The rights and remedies this clause provides are in addition to any other rights and remedies provided by law or under this contract.

TERMINATION FOR CAUSE (CONSTRUCTION)

Section 80-09 of FAA Advisory Circular 150/5370-10 establishes standard language for conditions, rights, and remedies associated with Owner termination of this contract for cause due to default of the Contractor.

A23 TRADE RESTRICTION CERTIFICATION

TRADE RESTRICTION CERTIFICATION

By submission of an offer, the Offeror certifies that with respect to this solicitation and any resultant contract, the Offeror –

1) is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms as published by the Office of the United States Trade Representative (USTR);

2) has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country included on the list of countries that discriminate against U.S. firms as published by the USTR; and

3) has not entered into any subcontract for any product to be used on the Federal project that is produced in a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR.

This certification concerns a matter within the jurisdiction of an agency of the United States of America and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18 USC § 1001.

The Offeror/Contractor must provide immediate written notice to the Owner if the Offeror/Contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The Contractor must require subcontractors provide immediate written notice to the Contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR § 30.17, no contract shall be awarded to an Offeror or subcontractor:

1) who is owned or controlled by one or more citizens or nationals of a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR; or
2) whose subcontractors are owned or controlled by one or more citizens or nationals of a foreign country on such USTR list; or
3) who incorporates in the public works project any product of a foreign country on such USTR list.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

The Offeror agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in all lower tier subcontracts. The Contractor may rely on the certification of a prospective subcontractor that it is not a firm from a foreign country included on the list of countries that discriminate against U.S. firms as published by USTR, unless the Offeror has knowledge that the certification is erroneous.

This certification is a material representation of fact upon which reliance was placed when making an award. If it is later determined that the Contractor or subcontractor knowingly rendered an erroneous certification, the Federal Aviation Administration (FAA) may direct through the Owner cancellation of the contract or subcontract for default at no cost to the Owner or the FAA.

A24 VETERAN'S PREFERENCE

VETERAN'S PREFERENCE

In the employment of labor (excluding executive, administrative, and supervisory positions), the Contractor and all sub-tier contractors must give preference to covered veterans as defined within 49 U.S.C. § 47112. Covered veterans include Vietnam-era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns (as defined by 15 U.S.C. § 632) owned and controlled by disabled veterans. This preference only applies when there are covered veterans readily available and qualified to perform the work to which the employment relates.

A25 DOMESTIC PREFERENCES FOR PROCUREMENTS

CERTIFICATION REGARDING DOMESTIC PREFERENCES FOR PROCUREMENTS

The Bidder or Offeror certifies by signing and submitting this bid or proposal that, to the greatest extent practicable, the Bidder or Offeror has provided a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including, but not limited to, iron, aluminum, steel, cement, and other manufactured products) in compliance with 2 CFR § 200.322.

A26 PROHIBITION OF COVERED UNMANNED AIRCRAFT SYSTEMS (UAS)

The Bidder or Offeror certifies that they are aware of and comply with relevant Federal statutes and regulations, including those from the Federal Aviation Administration (FAA), for operating unmanned aircraft systems (UAS) in accordance, and in compliance with all related requirements in the FAA Reauthorization Act of 2024 (Public Law 118-63), section 936 (49 U.S.C. § 44801 note).

Contractor warrants that all UAS operations will be conducted in full compliance with all applicable Federal Aviation Administration (FAA) regulations, including but not limited to 14 CFR Part 107, and any other applicable local, state, or Federal laws and regulations.

Sponsors and subgrant recipients cannot use AIP grant funds to enter into, extend, or renew a contract related to covered unmanned aircraft systems (UAS). This includes both procurement and operational contracts, as well as contracts with entities that operate such systems.

SPECIAL PROVISIONS
FOR
TAXES

1 OF 1

04/01/94
01/23/97
03/25/04

The Contractor shall include, and will be deemed to have included, in its bid and contract price all applicable Michigan Sales and Use taxes which have been enacted into law as of the date the bid is submitted. To the extent of any conflict, this Special provision controls over Section 70-01 of the General Provisions for Construction of Airports.

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SPECIAL NOTICE

W-9

In order for payments to be issued through the Michigan Department of Transportation the designated low bidder prior to award of the contract, shall file with the contracting office a 'Request for Taxpayer Identification Number and Certification'. This must be US Department of Treasury, Internal Revenue Service Form W-9. Following on the next page is the form W-9 which must be completed and returned to the contracting office prior to the award of this contract.

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Form **W-9**
(Rev. January 2003)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

Give form to the requester. Do not send to the IRS.

Print or type See **Specific Instructions** on page 2.

Name

Business name, if different from above

Check appropriate box: ☐ Individual/ Sole proprietor ☐ Corporation ☐ Partnership ☐ Other ► ---------- ☐ Exempt from backup withholding

Address (number, street, and apt. or suite no.)

Requester's name and address (optional)

City, state, and ZIP code

List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. For individuals, this is your social security number (SSN). **However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3.** For other entities, it is your employer identification number (EIN). If you do not have a number, see **How to get a TIN** on page 3.

Note: *If the account is in more than one name, see the chart on page 4 for guidelines on whose number to enter.*

Social security number
| | | – | | – | | | | |

or

Employer identification number
| | | – | | | | | | |

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), **and**
2. I am not subject to backup withholding because: **(a)** I am exempt from backup withholding, or **(b)** I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or **(c)** the IRS has notified me that I am no longer subject to backup withholding, **and**
3. I am a U.S. person (including a U.S. resident alien).

Certification instructions. You must cross out item **2** above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item **2** does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the Certification, but you must provide your correct TIN. (See the instructions on page 4.)

Sign Here **Signature of U.S. person ►** **Date ►**

Purpose of Form

A person who is required to file an information return with the IRS, must obtain your correct taxpayer identification number (TIN) to report, for example, income paid to you, real estate transactions, mortgage interest you paid, acquisition or abandonment of secured property, cancellation of debt, or contributions you made to an IRA.

U.S. person. Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN to the person requesting it (the requester) and, when applicable, to:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),

2. Certify that you are not subject to backup withholding, or

3. Claim exemption from backup withholding if you are a U.S. exempt payee.

Note: *If a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.*

Foreign person. If you are a foreign person, use the appropriate Form W-8 (see **Pub. 515,** Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the recipient has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement that specifies the following five items:

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.

2. The treaty article addressing the income.

3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.

4. The type and amount of income that qualifies for the exemption from tax.

5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a **nonresident alien or a foreign entity** not subject to backup withholding, give the requester the appropriate completed Form W-8.

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS 30% of such payments (29% **after** December 31, 2003; 28% **after** December 31, 2005). This is called "backup withholding." Payments that may be subject to backup withholding include interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will **not** be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester, or

2. You do not certify your TIN when required (see the Part II instructions on page 4 for details), or

3. The IRS tells the requester that you furnished an incorrect TIN, or

4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or

5. You do not certify to the requester that you are not subject to backup withholding under **4** above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See the instructions below and the separate **Instructions for the Requester of Form W-9.**

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of $50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a $500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of Federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Name

If you are an individual, you must generally enter the name shown on your social security card. However, if you have changed your last name, for instance, due to marriage without informing the Social Security Administration of the name change, enter your first name, the last name shown on your social security card, and your new last name.

If the account is in joint names, list first, and then circle, the name of the person or entity whose number you entered in Part I of the form.

Sole proprietor. Enter your **individual** name as shown on your social security card on the "Name" line. You may enter your business, trade, or "doing business as (DBA)" name on the "Business name" line.

Limited liability company (LLC). If you are a single-member LLC (including a foreign LLC with a domestic owner) that is disregarded as an entity separate from its owner under Treasury regulations section 301.7701-3, **enter the owner's name on the "Name" line.** Enter the LLC's name on the "Business name" line.

Other entities. Enter your business name as shown on required Federal tax documents on the "Name" line. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on the "Business name" line.

Note: *You are requested to check the appropriate box for your status (individual/sole proprietor, corporation, etc.).*

Exempt From Backup Withholding

If you are exempt, enter your name as described above and check the appropriate box for your status, then check the "Exempt from backup withholding" box in the line following the business name, sign and date the form.

Generally, individuals (including sole proprietors) are not exempt from backup withholding. Corporations are exempt from backup withholding for certain payments, such as interest and dividends.

Note: *If you are exempt from backup withholding, you should still complete this form to avoid possible erroneous backup withholding.*

Exempt payees. Backup withholding is **not required** on any payments made to the following payees:

1. An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2);

2. The United States or any of its agencies or instrumentalities;

3. A state, the District of Columbia, a possession of the United States, or any of their political subdivisions or instrumentalities;

4. A foreign government or any of its political subdivisions, agencies, or instrumentalities; or

5. An international organization or any of its agencies or instrumentalities.

Other payees that **may be exempt** from backup withholding include:

6. A corporation;

7. A foreign central bank of issue;

8. A dealer in securities or commodities required to register in the United States, the District of Columbia, or a possession of the United States;

9. A futures commission merchant registered with the Commodity Futures Trading Commission;

10. A real estate investment trust;

11. An entity registered at all times during the tax year under the Investment Company Act of 1940;

12. A common trust fund operated by a bank under section 584(a);

13. A financial institution;

14. A middleman known in the investment community as a nominee or custodian; or

15. A trust exempt from tax under section 664 or described in section 4947.

The chart below shows types of payments that may be exempt from backup withholding. The chart applies to the exempt recipients listed above, **1** through **15.**

If the payment is for . . .	THEN the payment is exempt for . . .
Interest and dividend payments	All exempt recipients except for **9**
Broker transactions	Exempt recipients **1** through **13.** Also, a person registered under the Investment Advisers Act of 1940 who regularly acts as a broker
Barter exchange transactions and patronage dividends	Exempt recipients **1** through **5**
Payments over $600 required to be reported and direct sales over $5,000 [1]	Generally, exempt recipients **1** through **7** [2]

[1] See **Form 1099-MISC**, Miscellaneous Income, and its instructions.

[2] However, the following payments made to a corporation (including gross proceeds paid to an attorney under section 6045(f), even if the attorney is a corporation) and reportable on Form 1099-MISC are **not exempt** from backup withholding: medical and health care payments, attorneys' fees; and payments for services paid by a Federal executive agency.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a **resident alien** and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see **How to get a TIN** below.

If you are a **sole proprietor** and you have an EIN, you may enter either your SSN or EIN. However, the IRS prefers that you use your SSN.

If you are a single-owner **LLC** that is disregarded as an entity separate from its owner (see **Limited liability company (LLC)** on page 2), enter your SSN (or EIN, if you have one). If the LLC is a corporation, partnership, etc., enter the entity's EIN.

Note: *See the chart on page 4 for further clarification of name and TIN combinations.*

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get **Form SS-5,** Application for a Social Security Card, from your local Social Security Administration office or get this form on-line at **www.ssa.gov/online/ss5.html**. You may also get this form by calling 1-800-772-1213. Use **Form W-7,** Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or **Form SS-4,** Application for Employer Identification Number, to apply for an EIN. You can get Forms W-7 and SS-4 from the IRS by calling 1-800-TAX-FORM (1-800-829-3676) or from the IRS Web Site at **www.irs.gov**.

If you are asked to complete Form W-9 but do not have a TIN, write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note: *Writing "Applied For" means that you have already applied for a TIN* ***or*** *that you intend to apply for one soon.*

Caution: *A disregarded domestic entity that has a foreign owner must use the appropriate Form W-8.*

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if items 1, 3, and 5 below indicate otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). Exempt recipients, see **Exempt from backup withholding** on page 2.

Signature requirements. Complete the certification as indicated in **1** through **5** below.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983. You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983. You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item **2** in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item **2** of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), IRA or Archer MSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account)	The actual owner of the account or, if combined funds, the first individual on the account [1]
3. Custodian account of a minor (Uniform Gift to Minors Act)	The minor [2]
4. a. The usual revocable savings trust (grantor is also trustee)	The grantor-trustee [1]
b. So-called trust account that is not a legal or valid trust under state law	The actual owner [1]
5. Sole proprietorship or single-owner LLC	The owner [3]
For this type of account:	**Give name and EIN of:**
6. Sole proprietorship or single-owner LLC	The owner [3]
7. A valid trust, estate, or pension trust	Legal entity [4]
8. Corporate or LLC electing corporate status on Form 8832	The corporation
9. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
10. Partnership or multi-member LLC	The partnership
11. A broker or registered nominee	The broker or nominee
12. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity

[1] List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

[2] Circle the minor's name and furnish the minor's SSN.

[3] **You must show your individual name,** but you may also enter your business or "DBA" name. You may use either your SSN or EIN (if you have one).

[4] List first and circle the name of the legal trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.)

Note: *If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.*

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons who must file information returns with the IRS to report interest, dividends, and certain other income paid to you, mortgage interest you paid, the acquisition or abandonment of secured property, cancellation of debt, or contributions you made to an IRA or Archer MSA. The IRS uses the numbers for identification purposes and to help verify the accuracy of your tax return. The IRS may also provide this information to the Department of Justice for civil and criminal litigation, and to cities, states, and the District of Columbia to carry out their tax laws. We may also disclose this information to other countries under a tax treaty, or to Federal and state agencies to enforce Federal nontax criminal laws and to combat terrorism.

You must provide your TIN whether or not you are required to file a tax return. Payers must generally withhold 30% of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to a payer. Certain penalties may also apply.

INSURANCE SPECIFICATIONS

Insurance Required to be Purchased and Maintained by the Contractor

Contractor shall comply with all requirements of this Insurance Specification. Contractor shall purchase and maintain (i.e. keep in force) insurance which conforms to the requirements of this Insurance Specification.

1.1 Insurance—General Provisions

1.1.1 Contractor shall obtain and maintain insurance as required in this Insurance Specification.

1.1.2 All insurance required by the Contract to be purchased and maintained by Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

1.1.3 Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Insurance Specification, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

1.1.4 Failure of Owner to demand such certificates or other evidence of the Contractor's full compliance with these insurance requirements, or failure of Owner to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the Contractor's obligation to obtain and maintain such insurance.

1.1.5 If Contractor does not purchase or maintain all of the insurance required of Contractor by the Contract, Contractor shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

1.1.6 If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16 of the General Conditions of the Contract.

1.1.7 Without prejudice to any other right or remedy, if Contractor has failed to obtain required insurance, Owner may elect to obtain equivalent insurance to protect Owner's interests at the expense of the Contractor, and the Contract Price shall be adjusted accordingly.

1.1.8 Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

1.1.9 The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

1.2 Contractor's Insurance - Liability

1.2.1 Owner's & Contractor's Protective Liability: Contractor shall purchase and maintain an Owner's & Contractor's Protective Liability Policy ("OCP" Policy). The OCP policy shall name the Owner, the Engineer, their consultants, agents, and employees, as the insureds (hereinafter collectively called the "named insureds"). The OCP policy will protect the named insureds for any actual or alleged liability arising out of the work performed by the Contractor, the Subcontractor(s), or Suppliers, on this Project. The OCP policy will provide primary, non-contributing coverage.

1.2.2 Workers' Compensation and Employer's Liability: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

1.2.2.1 Claims under workers' compensation, disability benefits, and other similar employee benefit acts.

1.2.2.2 United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

1.2.2.3 Claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

1.2.2.4 Foreign voluntary worker compensation (if applicable).

1.2.3 Commercial General Liability—Claims Covered: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

1.2.3.1 Claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.

1.2.3.2 Claims for damages insured by reasonably available personal injury liability coverage.

1.2.3.3 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

1.2.4 **Commercial General Liability—Form and Content**: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1.2.4.1 Products and completed operations coverage: Such insurance shall be maintained for three years after final payment.

1.2.4.2 Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

1.2.4.3 Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

1.2.4.4 Premises/operations liability.

1.2.4.5 Personal and advertising injury.

1.2.4.6 Broad form property damage coverage.

1.2.4.7 Severability of interest (the CGL policy shall apply to each named insured as if that named insured was the only named insured and the policy shall apply separately to each insured against whom claim is made or suit is brought).

1.2.4.8 Underground, explosion, and collapse coverage.

1.2.4.9 Personal injury coverage, including employees (with no exclusions pertaining to employment).

1.2.4.10 Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

1.2.4.11 For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

1.2.5 **Automobile liability**: Contractor shall purchase and maintain comprehensive automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle, including owned, non-owned, and hired motor vehicles. In light of standard policy provisions concerning (a) loading and unloading, and (b) definitions pertaining to motor vehicles licensed for road use versus unlicensed or self-propelled construction equipment, it is recommended that the comprehensive automobile liability insurance policy and the commercial

general liability policy be written by the same insurance carrier, though not necessarily in one the policy. The comprehensive automobile liability policy shall be written on an occurrence basis.

1.2.6 Umbrella or excess liability: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, aviation liability and automobile liability insurance described in the paragraphs above and in Section 1.2.10 below. The coverage afforded shall be at least as set for in Section 1.5.6. But if no box is checked in Section 1.5.6, then the umbrella/excess liability coverage limits will be $2,000,000 per occurrence and $2,000,000 general aggregate. The umbrella or excess liability insurance policy(ies) shall be an occurrence policy(ies)

1.2.7 Contractor's pollution liability insurance: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

1.2.8 Railroad Protective Liability: Contractor shall purchase and maintain a Railroad Protective Liability policy, where such an exposure exists, to provide coverage in the name of each railroad company having jurisdiction over rights-of-way across which Work under the Contract Documents is to be performed. The form of the policy and the limits of liability shall be determined by the railroad company(ies) involved.

1.2.9 Contractor's professional liability insurance: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall purchase and maintain applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

1.2.10 Aviation Liability Insurance: If required on this project as indicated by a check mark in Section 1.5.10, Contractor shall procure and maintain for the duration of the Contract insurance against claims for injuries to persons or damage to property which may arise from or in connection with the ownership, maintenance or use of Manned or Unmanned Aerial Vehicles, including but not limited to drone(s).

1.2.10.1 Minimum Scope and Limit of Insurance: Aviation Liability Insurance on an "occurrence" basis, including products and

completed operations, property damage, bodily injury with limits no less than $1,000,000 per occurrence, and $2,000,000 in the aggregate. This coverage may also be provided by endorsement to the Contractor's Commercial General Liability policy.

1.3 The policies of insurance required to be purchased and maintained by the Contractor shall:

1.3.1 Additional insureds: The Contractor's commercial general liability, automobile liability, umbrella or excess, pollution liability policies and aviation liability insurance, shall include and list as additional insureds the Owner and Engineer, and the following individuals and entities:

Name

Limno-Tech Inc, 501 Avis Drive, Ann Arbor, MI 48108

Prein&Newhof, 3355 Evergreen Dr. NE, Grand Rapids, MI 49525

Jacobs Engineering Group, Inc., Promenade Tower, 1230 Peachtree Street, NE, Suite 2800, Atlanta, GA, 30309.

The additional insured coverage shall include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and every additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements. Each additional insured endorsement shall state that each additional insured is entitled to the same rights as the named insured in the event of cancellation, including but not limited to prior notice of cancellation.

1.3.2 Deductible Liability: Any and all deductibles in the polices described in this Insurance Specification shall be assumed by, for the account of, and be the sole responsibility of Contractor. The amount of any deductible is subject to approval by the Owner.

1.3.3 Insurance will be primary: The insurance required to be purchased and maintained by the Contractor under this Insurance Specification shall be primary (i.e. pay first) as respects any insurance, self-insurance or self-retention maintained by the Owner, Engineer, and any other insureds. Any insurance, self-insurance or self-retention maintained by the Owner, Engineer, or any other insureds, shall be in excess of the insurance purchased and maintained by the Contractor under this Insurance Specification, and shall not contribute with it.

1.3.4 Coverages: Include at least the specific coverages provided in this Insurance Specification.

1.3.5 **Minimum Limits:** Be written for not less than the limits of liability provided in this Insurance Specification and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

1.3.6 **Notice of Cancellation:** Contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least ten (10) days prior written notice has been given to Contractor. Within three (3) days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

1.3.7 **Duration:** Remain in effect at least until final payment (and longer if expressly required in this Insurance Specification or the Supplementary Conditions) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

1.3.8 Be appropriate for the Work being performed and provide protection to Contractor, Owner, Engineer, and any other additional insured, from claims that may arise out of or result from Contractor's, Sub-contractor's or Supplier's performance of the Work, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

1.3.9 The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

1.4 Contractor's Insurance - Property

1.4.1 **Builder's Risk**: If required on this project as indicated by a check mark in Section 1.5.7, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in this Insurance Specification, or the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1.4.1.1 Include the interests of Owner, Contractor, Subcontractors, Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors, of any of them, and any other individuals or entities required by this Insurance Specification and/or the Supplementary Conditions to be insured under such builder's risk policy. Each of whom shall be listed as a named insured (the parties required to be insured shall collectively be referred to as "insureds").

1.4.1.2 Be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or

causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by this Insurance Specification and/or the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

1.4.1.3 Cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

1.4.1.4 Cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

1.4.1.5 Extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

1.4.1.6 Extend to cover damage or loss to insured property while in transit.

1.4.1.7 Allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

1.4.1.8 Allow for the waiver of the insurer's subrogation rights, as set forth below.

1.4.1.9 Provide primary coverage for all losses and damages caused by the perils or causes of loss covered.

1.4.1.10 Not include a co-insurance clause.

1.4.1.11 Include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.

1.4.1.12 Include performance/hot testing and start-up.

1.4.1.13 Be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer, with 30 days written notice to each other Insured.

1.4.2 Notice of Cancellation or Change: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this section shall contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least ten (10) days prior written notice has been given to the purchasing policyholder. Within three (3) days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

1.4.3 Deductibles: Contractor shall pay for costs not covered because of the application of a policy deductible.

1.4.4 Partial Occupancy or Use by Owner: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04 of the General Conditions of the Contract, then Owner, through Contractor, will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

1.4.5 Additional Insurance: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this section, it may do so at Contractor's expense.

1.4.6 Insurance of Other Property: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

1.4.7 Waiver of Rights: All policies purchased in accordance with this Section 1.4, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights

of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in this Insurance Specification, or the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

1.4.8 Sub-Contractors Waiver of Rights: Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in this Insurance Specification or the Supplementary Conditions, as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

1.4.9 Receipt and Application of Property Insurance Proceeds: Any insured loss under the builder's risk and other policies of insurance required by this section will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by this section shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of the Contract or applicable Laws and Regulations.

If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

1.5 Minimum limits

1.5.1 The minimum limits for the insurance required by this Insurance Specification shall provide coverage for not less than the following amounts or greater where required by Laws or Regulations:

1.5.2 Owner's & Contractor's Protective Liability Policy

1.5.2.1	Each Occurrence	$1,000,000
1.5.2.2	General – Aggregate	$2,000,000

1.5.3 Contractor's Commercial General Liability Policy

1.5.3.1	General – Aggregate	$2,000,000
1.5.3.2	Products – Completed Operations Aggregate	$2,000,000
1.5.3.3	Personal and Advertising Injury	$1,000,000
1.5.3.4	Each Occurrence	$1,000,000
1.5.3.5	Fire damage	$50,000
1.5.3.6	Medical Expense	$5,000

1.5.4 Comprehensive Automobile Liability Policy (In accordance with Michigan's No Fault Statute)

1.5.4.1	Combined Single Limit of	$1,000,000

1.5.5 Worker's Compensation and Employer's Liability Policy

1.5.5.1	Michigan		Statutory Limits
1.5.5.2	Employer's Liability		
	1.5.5.2.1	Each accident	$ 500,000
	1.5.5.2.2	Disease – each employee	$ 500,000
	1.5.5.2.3	Disease – policy limit	$ 500,000
1.5.5.3	Federal, if applicable (e.g. FELA, Longshoreman's, etc. . . .)		Statutory Limits

1.5.6 Excess or Umbrella Liability Policy

Unless increased limits are required as checked below, the limits shall be:

1.5.6.1	General Aggregate	$2,000,000
1.5.6.2	Each Occurrence	$2,000,000

Owner may select increased limits for this project as checked below; otherwise, the above limits shall apply if neither below option is checked:

	Option One	☐ Check if required	
	1.5.6.1	General Aggregate	$5,000,000
	1.5.6.2	Each Occurrence	$5,000,000
	Option Two	☐ Check if required	
	1.5.6.1	General Aggregate	$10,000,000
	1.5.6.2	Each Occurrence	$10,000,000
1.5.7	Builder's Risk "all risk" policy		Full Replacement Cost
	☐ Check if required		

Items to be covered by Builder's Risk include:

_____

_____

_____

1.5.8	Contractor's Pollution Liability Policy			$1,000,000
1.5.9	Railroad Protective Liability			
	☐ Check if required			$
1.5.10	Aviation Liability Insurance			
	☐ Check if required			
	1.5.10.1	General – Aggregate		$2,000,000
	1.5.10.2	Products – Completed Operations Aggregate		$2,000,000
	1.5.10.4	Each Occurrence		$1,000,000
1.5.11	Other insurance	☐ Check if required	(List Type)	$

OP ID: JF

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER		CONTACT NAME:	
-	Phone:	PHONE (A/C, No, Ext):	FAX (A/C, No):
-	Fax:	E-MAIL ADDRESS:	
-		PRODUCER CUSTOMER ID #: _	
-		INSURER(S) AFFORDING COVERAGE	NAIC #
INSURED Owner's Name and Address		INSURER A : INSURANCE COMPANY _ AM BEST FINANCIAL	
-		INSURER B :	
-		INSURER C :	
		INSURER D :	
		INSURER E :	
		INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
--	**GENERAL LIABILITY**						EACH OCCURRENCE	$ 1,000,000
-	[ ] COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
	[ ] CLAIMS-MADE [ ] OCCUR						MED EXP (Any one person)	$
-	[X] Owner's & Contractor's Prot						PERSONAL & ADV INJURY	$
-	[ ]						GENERAL AGGREGATE	$ 2,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$
	[ ] POLICY [ ] PRO-JECT [ ] LOC							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	[ ] ANY AUTO						BODILY INJURY (Per person)	$
	[ ] ALL OWNED AUTOS						BODILY INJURY (Per accident)	$
	[ ] SCHEDULED AUTOS						PROPERTY DAMAGE (Per accident)	$
	[ ] HIRED AUTOS							$
	[ ] NON-OWNED AUTOS							$
	[ ] **UMBRELLA LIAB** [ ] OCCUR						EACH OCCURRENCE	$
	[ ] **EXCESS LIAB** [ ] CLAIMS-MADE						AGGREGATE	$
	[ ] DEDUCTIBLE							$
	[ ] RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N						[ ] WC STATU-TORY LIMITS [ ] OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? [ ] **(Mandatory in NH)**	N / A					E.L. EACH ACCIDENT	$
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER

-

Contractor's Name and Address

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

SAMPLE

© 1988-2009 ACORD CORPORATION. All rights reserved.

OP ID: JF

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:
- Phone:	PHONE (A/C, No, Ext): / FAX (A/C, No):
- Fax:	E-MAIL ADDRESS:
-	PRODUCER CUSTOMER ID #:
-	

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
Contractor's Name and Address	INSURER A : INSURANCE COMPANY AM BEST FINANCIAL	
-	INSURER B :	
-	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
-	**GENERAL LIABILITY**						EACH OCCURRENCE	$ 1,000,000
	X COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 100,000
	CLAIMS-MADE X OCCUR						MED EXP (Any one person)	$ 5,000
							PERSONAL & ADV INJURY	$ 1,000,000
							GENERAL AGGREGATE	$ 2,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$ 2,000,000
	POLICY X PRO-JECT LOC							$
-	**AUTOMOBILE LIABILITY**						COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
	X ANY AUTO						BODILY INJURY (Per person)	$
	X ALL OWNED AUTOS						BODILY INJURY (Per accident)	$
	X SCHEDULED AUTOS						PROPERTY DAMAGE (Per accident)	$
	X HIRED AUTOS							$
	X NON-OWNED AUTOS							$
-	X **UMBRELLA LIAB** X OCCUR						EACH OCCURRENCE	$ 2,000,000
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$ 2,000,000
	DEDUCTIBLE							$
	RETENTION $							$
-	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** Y / N	N / A					X WC STATU-TORY LIMITS OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? **(Mandatory in NH)**						E.L. EACH ACCIDENT	$ 500,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$ 500,000
							E.L. DISEASE - POLICY LIMIT	$ 500,000
-	**Builder's Risk "ALL RISK" PROPERTY**						**CONTENTS**	**Full Replacement Cost**
	POLLUTION LIABILITY							**$1,000,000**

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

Name of Additional Insured

CERTIFICATE HOLDER

-

Owner's Name and Address

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

SAMPLE

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Sample Safety Plan Compliance Document (SPCD)
Gerald R. Ford International Airport
C-449 Natural Treatment System Maintenance, Phase 2
2026-AGL-xxxx-NRA thru 2026-AGL-xxxx-NRA

I, ___, the General Contractor for the above noted project, have read the Construction Safety Phasing Plan for the above referenced project, and will abide by it as written and with the following additions, as noted:

1) **Coordination**
   A. The General contractor will have regularly scheduled meetings with the Airport Manager and with subcontractors to discuss safety and airport operations, during the entire project duration.
   B. Contractor shall provide updated construction schedule with each application for payment.
   C. No FAA ATO coordination is anticipated.

2) **Phasing**
   A. This project consists of essentially one phase, which consists of obstruction removal.
   B. Construction will take place daily, 6am-8pm, depending on project progress and weather conditions.
   C. Runway and Taxiway operations will not be affected by this project

3) **Affected Areas**
   A. Per CSPP

4) **NAVAID Protection**
   A. None needed. All construction activity takes place away from NAVAID installations.

5) **Contractor Access**
   A. All contractor access will come from using existing public and private roadways and private airport perimeter roads.
   B. Gate access will be maintained secure. Contractor be vigilant of all non-normal activity and report same to Airport Manager, as soon as possible.

6) **Wildlife Management**
   A. Contractor shall report all wildlife sightings inside the airport perimeter to the Airport Management.

7) **Foreign Object Debris Management-**
   A. All food products and trash will be disposed of properly. Trash receptacles will be sealed and secured daily, to remove attraction of animals.

8) **Dust Control**
   A. Contractor shall utilize an approved dust control plan.

9) **Hazardous Material Management**

A. No hazardous materials will be used in this construction project. If any situation were to develop, OSHA requirements for the items or situation will be followed.

10) Contractor-Construction Contacts

A. ___
B. ___
C. Contractor shall follow emergency procedures outlined in their Safety Plan.
D. ARFF coordination will be performed.
E. FAA coordination will be through the Gerald R. Ford International Airport.
F. All equipment to be used that is taller than the height requirements provided in the CSPP shall receive an approved airspace clearance prior to utilizing the equipment.
G. No batch plants or associated airspacing are anticipated for this project.

11) Inspection Requirements

A. General Contractor shall have a representative on site during all construction.
B. Airport's consultant shall perform progress inspections.
C. Airport's consultant, MDOT Aero, and Airport Management shall perform final inspection with Contractor per the schedule developed.

12) Underground Utilities

A. Underground utilities shall be marked by the Miss Dig System.
B. The Contractor is responsible for performing all necessary investigations and protection of existing underground utilities. Existing utilities were taken from plans of record. They have been shown to the extent known and are offered in good faith solely for informational purposes. They may not reflect actual locations and may not be all inclusive.
C. Standard OSHA precautions shall be observed and practiced by all contractors.

13) Penalties

A. Per CSPP

14) Special Conditions

A. None Noted

15) Runway and Taxiway Visual Aids-

A. This project does not involve lighting or signage.
B. This project does not involve permanent or temporary markings.
C. This project does not involve NAVAIDS.

16) Access Routes

A. Construction route marking and signage will be provided as required. Contractor may provide marking or signage upon written approval from the Airport's consultant.

17) Hazard Marking and Lighting

A. Construction site will be marked using conventional construction marking devices as required by local authorities.

18) Protection of runway and taxiway safety areas

A. Runway safety areas are not impacted by this project.
B. Runway object free areas are not impacted by this project.
C. Taxiway safety areas are not impacted by this project.
D. Taxiway object free areas are not impacted by this project.
E. Obstacle free zones are not impacted by this project.
F. Runway approach surfaces are not impacted by this project.
G. No activity near taxiways will take place as part of this project.

Respectfully Submitted by _____

<Authorized Representative>
<Title>
<Contractor Name>

Special Provision – Waste Disposal

Owner:	Gerald R. Ford International Airport Authority
Project Title:	Natural Treatment System Maintenance, Phase 2
Project #:	C-449 (2250383)

1 SPECIAL PROVISION – WASTE DISPOSAL

1.01 Reports and Drawings

The following reports regarding Waste Disposal from a previous project adjacent to this site were utilized by the Engineer in the preparation of Contract Documents:

Analytical Results for Volatile Organics, TCLP and Metals, TCLP dated September 2, 2026.

Technical Report for Limno Tech, GRR Airport dated September 3, 2026.

The following drawings regarding Waste Disposal from a previous project adjacent to this site were utilized by the Engineer in the preparation of Contract Documents:

None.

Technical Data contained in such Reports and Drawings are included with this Special Provision.

1.02 Reliance by Contractor Not Authorized

Contractor may not make any Claim against Owner, Engineer or the Consultants of either with respect to:

The completeness of such reports, drawings and/or Technical Data, 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, the cost of Work and safety precautions and programs incident thereto; or

The accuracy of any Technical Data, or any other data, interpretations, opinions, and information contained in such reports or shown on such drawings; or

Any Contractor interpretation of or conclusion drawn from any such report, drawing or Technical Data.

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

September 02, 2026

LimnoTech
501 Avis Dr
Suite 1
Ann Arbor, MI 48108

RE: GRR NTS - GRR26

Order No.: 2608L94

Dear Mr. Chris Cieciek:

Guide to Reading Lab Result

Prein&Newhof Laboratory received 4 sample(s) on 8/25/2026 on your behalf. Your test results are provided in your Prein&Newhof Laboratory analytical report. Please carefully review your analytical report, noting the following.

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

Any analyte that exceeds the client provided permit level are noted on the report with an "*" in the Qual field. Quality control data is within laboratory defined or method specified acceptance limits except if noted.

When testing for PFNA, FOSA, MeFOSA, EtFOSA, MeFOSE, EtFOSE, PFHxS, PFOA, PFOS, MeFOSAA, and EtFOSAA results include both branched
and linear isotopes. We extract a Method Blank and analyze it with the preparation batch. Method Blank analytes are within the Reporting Limit (RL).

To learn more about interpreting your Lab Report, follow the link above to view our "Guide to Reading Lab Results". If you have any concerns about your test results or need additional help, please call: 616-364-7600 or email me: sbylsma@preinnewhof.com.

We use EPA Approved Methods for all regulated parameters. EPA Lab #: MI000014

Thank you for trusting Prein&Newhof with your testing needs.

Sincerely,

Steve Bylsma
Laboratory Manager

CC:
Mr. Chris Behnke
Mr. Scott Bell

Original

3350 Evergreen Drive, NE Grand Rapids, MI 49525 t.616-364-7600 www.preinnewhof.com

Analytical Report

(TCLP)

WO#: **2608L94**

Date Reported: **9/2/2026**

CLIENT:	LimnoTech	**Collection Date:**	8/25/2026 11:30:00 AM
Project:	GRR NTS - GRR26	**Received Date:**	8/25/2026 2:55:00 PM
Lab ID:	2608L94-01	**Matrix:**	SOLID
Client Sample ID:	NTS-PIPE-01	**Sampled By:**	C. Behnke
Location:			

Analyses	Result	RL	Qual	Units	Hazardous Level	Date Analyzed
VOLATILE ORGANICS, TCLP				**SW 8260B**		Analyst: **JS**
Benzene	< 0.00100	0.00100		mg/L	0.500	8/29/2026 1:29:00 AM
Ethylbenzene	< 0.00100	0.00100		mg/L		8/29/2026 1:29:00 AM
Toluene	< 0.00100	0.00100		mg/L		8/29/2026 1:29:00 AM
m,p-Xylene	< 0.00100	0.00100		mg/L		8/29/2026 1:29:00 AM
o-Xylene	< 0.00100	0.00100		mg/L		8/29/2026 1:29:00 AM
Xylenes, Total	< 0.00100	0.00100		mg/L		8/29/2026 1:29:00 AM
METALS, TCLP				**SW 6020B**		Analyst: **AS**
Cadmium	0.00449	0.00200	D	mg/L	1.00	9/2/2026 9:01:58 AM
Chromium	< 0.0100	0.0100	D	mg/L	5.00	9/2/2026 9:01:58 AM
Lead	< 0.0100	0.0100	D	mg/L	5.00	9/2/2026 9:01:58 AM

Qualifiers:

<	Not Detected at the Reporting Limit	D	Dilution was required.
H	Holding times for preparation or analysis exceeded	MCL	Maximum Contaminant Level
PL	Permit Limit	RL	Reporting Limit

Original

3350 Evergreen Drive, NE Grand Rapids, MI 49525 t.616-364-7600 www.preinnewhof.com

Analytical Report

(TCLP)

WO#: **2608L94**

Date Reported: **9/2/2026**

CLIENT:	LimnoTech	**Collection Date:**	8/25/2026 12:00:00 PM
Project:	GRR NTS - GRR26	**Received Date:**	8/25/2026 2:55:00 PM
Lab ID:	2608L94-02	**Matrix:**	SOLID
Client Sample ID:	NTS-PIPE-02	**Sampled By:**	C. Behnke
Location:			

Analyses	Result	RL	Qual	Units	Hazardous Level	Date Analyzed
VOLATILE ORGANICS, TCLP				**SW 8260B**		Analyst: **JS**
Benzene	< 0.00100	0.00100		mg/L	0.500	8/29/2026 1:56:00 AM
Ethylbenzene	< 0.00100	0.00100		mg/L		8/29/2026 1:56:00 AM
Toluene	< 0.00100	0.00100		mg/L		8/29/2026 1:56:00 AM
m,p-Xylene	< 0.00100	0.00100		mg/L		8/29/2026 1:56:00 AM
o-Xylene	< 0.00100	0.00100		mg/L		8/29/2026 1:56:00 AM
Xylenes, Total	< 0.00100	0.00100		mg/L		8/29/2026 1:56:00 AM
METALS, TCLP				**SW 6020B**		Analyst: **AS**
Cadmium	< 0.00200	0.00200	D	mg/L	1.00	9/2/2026 9:07:28 AM
Chromium	< 0.0100	0.0100	D	mg/L	5.00	9/2/2026 9:07:28 AM
Lead	< 0.0100	0.0100	D	mg/L	5.00	9/2/2026 9:07:28 AM

Qualifiers:

<	Not Detected at the Reporting Limit	D	Dilution was required.
H	Holding times for preparation or analysis exceeded	MCL	Maximum Contaminant Level
PL	Permit Limit	RL	Reporting Limit

Original

3350 Evergreen Drive, NE Grand Rapids, MI 49525 t.616-364-7600 www.preinnewhof.com

Analytical Report

(TCLP)

WO#: **2608L94**

Date Reported: **9/2/2026**

CLIENT:	LimnoTech	**Collection Date:**	8/25/2026 12:30:00 PM
Project:	GRR NTS - GRR26	**Received Date:**	8/25/2026 2:55:00 PM
Lab ID:	2608L94-03	**Matrix:**	SOLID
Client Sample ID:	Diffuser	**Sampled By:**	C. Behnke
Location:			

Analyses	Result	RL	Qual	Units	Hazardous Level	Date Analyzed
VOLATILE ORGANICS, TCLP				**SW 8260B**		Analyst: **JS**
Benzene	< 0.00100	0.00100		mg/L	0.500	8/31/2026 3:05:00 PM
Ethylbenzene	< 0.00100	0.00100		mg/L		8/31/2026 3:05:00 PM
Toluene	< 0.00100	0.00100		mg/L		8/31/2026 3:05:00 PM
m,p-Xylene	< 0.00100	0.00100		mg/L		8/31/2026 3:05:00 PM
o-Xylene	< 0.00100	0.00100		mg/L		8/31/2026 3:05:00 PM
Xylenes, Total	< 0.00100	0.00100		mg/L		8/31/2026 3:05:00 PM
METALS, TCLP				**SW 6020B**		Analyst: **AS**
Cadmium	< 0.00200	0.00200	D	mg/L	1.00	9/2/2026 9:12:58 AM
Chromium	< 0.0100	0.0100	D	mg/L	5.00	9/2/2026 9:12:58 AM
Lead	< 0.0100	0.0100	D	mg/L	5.00	9/2/2026 9:12:58 AM

Qualifiers:

<	Not Detected at the Reporting Limit	D	Dilution was required.
H	Holding times for preparation or analysis exceeded	MCL	Maximum Contaminant Level
PL	Permit Limit	RL	Reporting Limit

Original

3350 Evergreen Drive, NE Grand Rapids, MI 49525 t.616-364-7600 www.preinnewhof.com

Analytical Report

(TCLP)

WO#: **2608L94**

Date Reported: **9/2/2026**

CLIENT:	LimnoTech	**Collection Date:**	8/25/2026 12:50:00 PM
Project:	GRR NTS - GRR26	**Received Date:**	8/25/2026 2:55:00 PM
Lab ID:	2608L94-04	**Matrix:**	SOLID
Client Sample ID:	NTS-PIPE-03	**Sampled By:**	C. Behnke
Location:			

Analyses	Result	RL	Qual	Units	Hazardous Level	Date Analyzed
VOLATILE ORGANICS, TCLP				**SW 8260B**		Analyst: **JS**
Benzene	< 0.00100	0.00100		mg/L	0.500	8/31/2026 3:32:00 PM
Ethylbenzene	< 0.00100	0.00100		mg/L		8/31/2026 3:32:00 PM
Toluene	< 0.00100	0.00100		mg/L		8/31/2026 3:32:00 PM
m,p-Xylene	< 0.00100	0.00100		mg/L		8/31/2026 3:32:00 PM
o-Xylene	< 0.00100	0.00100		mg/L		8/31/2026 3:32:00 PM
Xylenes, Total	< 0.00100	0.00100		mg/L		8/31/2026 3:32:00 PM
METALS, TCLP				**SW 6020B**		Analyst: **AS**
Cadmium	< 0.00200	0.00200	D	mg/L	1.00	9/2/2026 9:18:29 AM
Chromium	< 0.0100	0.0100	D	mg/L	5.00	9/2/2026 9:18:29 AM
Lead	< 0.0100	0.0100	D	mg/L	5.00	9/2/2026 9:18:29 AM

Qualifiers:

<	Not Detected at the Reporting Limit	D	Dilution was required.
H	Holding times for preparation or analysis exceeded	MCL	Maximum Contaminant Level
PL	Permit Limit	RL	Reporting Limit

Original

3350 Evergreen Drive, NE Grand Rapids, MI 49525 t.616-364-7600 www.preinnewhof.com

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

3350 Evergreen Drive, NE
Grand Rapids, MI 49525
t. 616-364-7600
f. 616-364-6955

Client Name: LimnoTech / Prein & Newhoff
Billing Address: 501 Avis Drive, Ann Arbor, MI
Phone Number: 734 332 1200
Email Report to: cciecick@limno.com
Email Invoice to: jwerner@limno.com
Project Name: GRR NTS
Project Number: GRR26
Sampling Personnel: C. Behnke

CHAIN OF CUSTODY

No. 64108

Wastewater	W
Drinking Water	D
Groundwater	G
Soil	S
Sludge	L
Other	X

LAB USE	Sample Information				Preservative						Analysis Requested															
Lab Sample ID #	Date Collected	Time Collected	Sample Description and Location (e.g. MW-1)	MATRIX	None	H2SO4	HNO3	HCL	NaOH	Other	TCLP BTEX	TCLP Cadmium	TCLP Chromium	TCLP Lead												
8L94-1	8/25/26	1130	NTS-PIPE-01	X	X						X	X	X	X												
2		1200	NTS-PIPE-02	X	X						X	X	X	X												
3		1230	Diffuser	X	X						X	X	X	X												
4		1250	NTS-PIPE-03	X	X						X	X	X	X												
		1300	Equipment Blank	A			X	X			X	X	X	X												
		—	Trip Blank	A				X			X															

Comments: A : lab provided water

10 °C

Relinquished By: (Signature)	Date	Time	Received By: (Signature)	Date	Time
Sam	8/25/26	~~1:30 PM~~			
Relinquished By: (Signature)	Date	Time	Received for Laboratory By: (Signature)	Date	Time
		3:00 PM	OVP	8-25-26	1455

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

LimnoTech

GRR Airport

SGS Job Number: FC36273

Sampling Date: 08/25/26



Report to:

LimnoTech
501 Avis Drive
Ann Arbor, MI 48108
ccieciek@limno.com

ATTN: Christopher Cieciek

Total number of pages in report: 63

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable unless noted in the narrative, comments or footnotes.

Norm Farmer
Technical Director

Client Service contact: Andrea Colby 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), NC(573), NJ(FL002), NY(12022), SC(96038001) DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177), AL, AK, AR, CT, IA, KY, MA, MI. MS, ND, NH, NV, OK, OR, IL, UT, VT, WA, WI, WV

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Test results relate only to samples analyzed.

How did we do today?

Your feedback helps us improve our service and takes less than a minute to complete.

START SURVEY

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1 2 3 4 5 6

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Sample Summary

LimnoTech

GRR Airport

Job No: FC36273

Sample Number	Collected Date	Time	By	Received	Matrix Code	Matrix Type	Client Sample ID
This report contains results reported as ND = Not detected. The following applies: Organics ND = Not detected above the MDL							
FC36273-1	08/25/26	11:30	LI	08/28/26	SO	Soil	NTS-PIPE-01
FC36273-2	08/25/26	12:00	LI	08/28/26	SO	Soil	NTS-PIPE-02
FC36273-3	08/25/26	12:30	LI	08/28/26	SO	Soil	DIFFUSER
FC36273-4	08/25/26	12:50	LI	08/28/26	SO	Soil	NTS-PIPE-03
FC36273-5	08/25/26	13:00	LI	08/28/26	AQ	Equipment Blank	EQUIPMENT BLANK

Soil samples reported on a dry weight basis unless otherwise indicated on result page.

SAMPLE DELIVERY GROUP CASE NARRATIVE

Client: LimnoTech **Job No:** FC36273

Site: GRR Airport **Report Date** 9/3/2026 2:18:47 PM

On 08/28/2026, 4 Sample(s), 0 Trip Blank(s), 1 Equip. Blank(s) and 0 Field Blank(s) were received at SGS North America Inc. - Orlando, at a maximum corrected temperature of 0.8 C. Samples were intact and chemically preserved, unless noted below. A SGS North America Inc. - Orlando Job Number of FC36273 was assigned to the project.

Laboratory sample ID, client sample ID and dates of sample collection are detailed in the report's Results Summary Section. Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

MS Semi-volatiles By Method EPA 1633A

Matrix: AQ **Batch ID:** OP17280

Sample(s) DA85599-1DUP, FC36274-1MS were used as the QC samples indicated.

RPD(s) for Duplicate for 6:2-FTS, Perfluorooctanesulfonic acid are outside control limits for sample OP17280-DUP. Probable cause is due to sample non-homogeneity.

Matrix: SO **Batch ID:** OP17284

Sample(s) FC35520-4MS, FC35520-4MSD were used as the QC samples indicated.

Matrix Spike Recovery(s) for Perfluorohexanesulfonic acid, Perfluorooctanoic acid, Perfluorooctanesulfonic acid are outside control limits. Outside control limits due to high level in sample relative to spike amount or possible matrix interference. Matrix Spike Duplicate Recovery(s) for Perfluorooctanesulfonic acid are outside control limits. Outside control limits due to high level in sample relative to spike amount or possible matrix interference.

SGS North America Inc. - Orlando certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting the Quality System precision, accuracy and completeness objectives except as noted. Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria. SGS North America Inc.- Orlando is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety.

Narrative prepared by:

_____

Kim Benham, Report Generation *(signature on file)*

Summary of Hits

Job Number: FC36273
Account: LimnoTech
Project: GRR Airport
Collected: 08/25/26

Lab Sample ID / Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FC36273-1	**NTS-PIPE-01**					
No hits reported in this sample.						
FC36273-2	**NTS-PIPE-02**					
No hits reported in this sample.						
FC36273-3	**DIFFUSER**					
Perfluorooctanoic acid		0.059 J	0.16	0.048	ug/kg	EPA 1633A
FC36273-4	**NTS-PIPE-03**					
No hits reported in this sample.						
FC36273-5	**EQUIPMENT BLANK**					
No hits reported in this sample.						

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID:	NTS-PIPE-01		
Lab Sample ID:	FC36273-1	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	6Q49150.D	1	09/02/26 19:45	MV	08/31/26 20:35	OP17284	S6Q759
Run #2							

	Initial Weight	Final Volume
Run #1	5.04 g	4.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROALKYL CARBOXYLIC ACIDS						
375-22-4	Perfluorobutanoic acid	ND	0.32	0.13	ug/kg	
2706-90-3	Perfluoropentanoic acid	ND	0.32	0.12	ug/kg	
307-24-4	Perfluorohexanoic acid	ND	0.16	0.061	ug/kg	
375-85-9	Perfluoroheptanoic acid	ND	0.16	0.075	ug/kg	
335-67-1	Perfluorooctanoic acid	ND	0.16	0.048	ug/kg	
375-95-1	Perfluorononanoic acid	ND	0.16	0.087	ug/kg	
335-76-2	Perfluorodecanoic acid	ND	0.16	0.048	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	0.16	0.071	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	0.16	0.061	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	0.16	0.087	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	0.16	0.090	ug/kg	
PERFLUOROALKYL SULFONIC ACIDS						
375-73-5	Perfluorobutanesulfonic acid	ND	0.16	0.083	ug/kg	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.16	0.097	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	ND	0.16	0.090	ug/kg	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.16	0.12	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.16	0.10	ug/kg	
68259-12-1	Perfluorononanesulfonic acid	ND	0.16	0.10	ug/kg	
335-77-3	Perfluorodecanesulfonic acid	ND	0.16	0.079	ug/kg	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.16	0.085	ug/kg	
FLUOROTELOMER SULFONIC ACIDS						
757124-72-4	4:2-FTS	ND	0.32	0.15	ug/kg	
27619-97-2	6:2-FTS	ND	0.32	0.21	ug/kg	
39108-34-4	8:2-FTS	ND	0.32	0.20	ug/kg	
PERFLUOROOCTANE SULFONAMIDES						
754-91-6	PFOSA	ND	0.16	0.086	ug/kg	
31506-32-8	MeFOSA	ND	0.32	0.11	ug/kg	
4151-50-2	EtFOSA	ND	0.32	0.084	ug/kg	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: NTS-PIPE-01
Lab Sample ID: FC36273-1
Matrix: SO - Soil
Method: EPA 1633A EPA 1633A
Project: GRR Airport

Date Sampled: 08/25/26
Date Received: 08/28/26
Percent Solids: n/a [a]

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROOCTANE SULFONAMIDOACETIC ACIDS						
2355-31-9	MeFOSAA	ND	0.32	0.12	ug/kg	
2991-50-6	EtFOSAA	ND	0.32	0.10	ug/kg	
PERFLUOROOCTANE SULFONAMIDO ETHANOLS						
24448-09-7	MeFOSE	ND	0.32	0.079	ug/kg	
1691-99-2	EtFOSE	ND	0.32	0.092	ug/kg	
PER and POLYFLUOROETHER CARBOXYLIC ACIDS						
13252-13-6	HFPO-DA (GenX)	ND	0.32	0.077	ug/kg	
919005-14-4	ADONA	ND	0.32	0.074	ug/kg	
377-73-1	PFMPA	ND	0.32	0.079	ug/kg	
863090-89-5	PFMBA	ND	0.32	0.079	ug/kg	
151772-58-6	NFDHA	ND	0.32	0.11	ug/kg	
PER and POLYFLUOROETHER SULFONIC ACIDS						
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.32	0.11	ug/kg	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.32	0.098	ug/kg	
113507-82-7	PFEESA	ND	0.32	0.087	ug/kg	
FLUOROTELOMER CARBOXYLIC ACIDS						
356-02-5	3:3-FTCA	ND	0.32	0.13	ug/kg	
914637-49-3	5:3-FTCA	ND	0.32	0.14	ug/kg	
812-70-4	7:3-FTCA	ND	0.32	0.15	ug/kg	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C4-PFBA	73%		10-130%
	13C5-PFPeA	73%		35-130%
	13C5-PFHxA	78%		40-130%
	13C4-PFHpA	70%		40-130%
	13C8-PFOA	79%		40-130%
	13C9-PFNA	73%		40-130%
	13C6-PFDA	67%		40-130%
	13C7-PFUnDA	67%		40-130%
	13C2-PFDoDA	71%		40-130%
	13C2-PFTeDA	75%		20-130%
	13C3-PFBS	73%		40-135%
	13C3-PFHxS	76%		40-130%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	NTS-PIPE-01		
Lab Sample ID:	FC36273-1	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOS	80%		40-130%
	13C8-FOSA	73%		40-130%
	d3-MeFOSA	53%		10-130%
	d5-EtFOSA	61%		10-130%
	d3-MeFOSAA	90%		40-135%
	d5-EtFOSAA	88%		40-150%
	d7-MeFOSE	52%		20-130%
	d9-EtFOSE	67%		15-130%
	13C2-4:2FTS	76%		40-165%
	13C2-6:2FTS	70%		40-215%
	13C2-8:2FTS	81%		40-275%
	13C3-HFPO-DA	71%		40-130%

(a) All results reported on a wet weight basis.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	NTS-PIPE-02		
Lab Sample ID:	FC36273-2	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	6Q49151.D	1	09/02/26 20:02	MV	08/31/26 20:35	OP17284	S6Q759
Run #2							

	Initial Weight	Final Volume
Run #1	4.96 g	4.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROALKYL CARBOXYLIC ACIDS						
375-22-4	Perfluorobutanoic acid	ND	0.32	0.13	ug/kg	
2706-90-3	Perfluoropentanoic acid	ND	0.32	0.12	ug/kg	
307-24-4	Perfluorohexanoic acid	ND	0.16	0.062	ug/kg	
375-85-9	Perfluoroheptanoic acid	ND	0.16	0.076	ug/kg	
335-67-1	Perfluorooctanoic acid	ND	0.16	0.048	ug/kg	
375-95-1	Perfluorononanoic acid	ND	0.16	0.088	ug/kg	
335-76-2	Perfluorodecanoic acid	ND	0.16	0.048	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	0.16	0.073	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	0.16	0.062	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	0.16	0.088	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	0.16	0.091	ug/kg	
PERFLUOROALKYL SULFONIC ACIDS						
375-73-5	Perfluorobutanesulfonic acid	ND	0.16	0.084	ug/kg	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.16	0.098	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	ND	0.16	0.092	ug/kg	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.16	0.13	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.16	0.10	ug/kg	
68259-12-1	Perfluorononanesulfonic acid	ND	0.16	0.10	ug/kg	
335-77-3	Perfluorodecanesulfonic acid	ND	0.16	0.081	ug/kg	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.16	0.086	ug/kg	
FLUOROTELOMER SULFONIC ACIDS						
757124-72-4	4:2-FTS	ND	0.32	0.15	ug/kg	
27619-97-2	6:2-FTS	ND	0.32	0.22	ug/kg	
39108-34-4	8:2-FTS	ND	0.32	0.21	ug/kg	
PERFLUOROOCTANE SULFONAMIDES						
754-91-6	PFOSA	ND	0.16	0.087	ug/kg	
31506-32-8	MeFOSA	ND	0.32	0.11	ug/kg	
4151-50-2	EtFOSA	ND	0.32	0.085	ug/kg	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	NTS-PIPE-02		
Lab Sample ID:	FC36273-2	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROOCTANE SULFONAMIDOACETIC ACIDS						
2355-31-9	MeFOSAA	ND	0.32	0.12	ug/kg	
2991-50-6	EtFOSAA	ND	0.32	0.10	ug/kg	
PERFLUOROOCTANE SULFONAMIDO ETHANOLS						
24448-09-7	MeFOSE	ND	0.32	0.081	ug/kg	
1691-99-2	EtFOSE	ND	0.32	0.094	ug/kg	
PER and POLYFLUOROETHER CARBOXYLIC ACIDS						
13252-13-6	HFPO-DA (GenX)	ND	0.32	0.078	ug/kg	
919005-14-4	ADONA	ND	0.32	0.075	ug/kg	
377-73-1	PFMPA	ND	0.32	0.081	ug/kg	
863090-89-5	PFMBA	ND	0.32	0.081	ug/kg	
151772-58-6	NFDHA	ND	0.32	0.11	ug/kg	
PER and POLYFLUOROETHER SULFONIC ACIDS						
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.32	0.11	ug/kg	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.32	0.10	ug/kg	
113507-82-7	PFEESA	ND	0.32	0.089	ug/kg	
FLUOROTELOMER CARBOXYLIC ACIDS						
356-02-5	3:3-FTCA	ND	0.32	0.13	ug/kg	
914637-49-3	5:3-FTCA	ND	0.32	0.14	ug/kg	
812-70-4	7:3-FTCA	ND	0.32	0.15	ug/kg	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C4-PFBA	70%		10-130%
	13C5-PFPeA	63%		35-130%
	13C5-PFHxA	68%		40-130%
	13C4-PFHpA	65%		40-130%
	13C8-PFOA	70%		40-130%
	13C9-PFNA	63%		40-130%
	13C6-PFDA	63%		40-130%
	13C7-PFUnDA	66%		40-130%
	13C2-PFDoDA	61%		40-130%
	13C2-PFTeDA	65%		20-130%
	13C3-PFBS	70%		40-135%
	13C3-PFHxS	64%		40-130%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	NTS-PIPE-02		
Lab Sample ID:	FC36273-2	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOS	71%		40-130%
	13C8-FOSA	79%		40-130%
	d3-MeFOSA	67%		10-130%
	d5-EtFOSA	72%		10-130%
	d3-MeFOSAA	75%		40-135%
	d5-EtFOSAA	66%		40-150%
	d7-MeFOSE	72%		20-130%
	d9-EtFOSE	70%		15-130%
	13C2-4:2FTS	69%		40-165%
	13C2-6:2FTS	76%		40-215%
	13C2-8:2FTS	66%		40-275%
	13C3-HFPO-DA	60%		40-130%

(a) All results reported on a wet weight basis.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DIFFUSER		
Lab Sample ID:	FC36273-3	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	6Q49152.D	1	09/02/26 20:19	MV	08/31/26 20:35	OP17284	S6Q759
Run #2							

	Initial Weight	Final Volume
Run #1	5.03 g	4.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROALKYL CARBOXYLIC ACIDS						
375-22-4	Perfluorobutanoic acid	ND	0.32	0.13	ug/kg	
2706-90-3	Perfluoropentanoic acid	ND	0.32	0.12	ug/kg	
307-24-4	Perfluorohexanoic acid	ND	0.16	0.061	ug/kg	
375-85-9	Perfluoroheptanoic acid	ND	0.16	0.075	ug/kg	
335-67-1	Perfluorooctanoic acid	0.059	0.16	0.048	ug/kg	J
375-95-1	Perfluorononanoic acid	ND	0.16	0.087	ug/kg	
335-76-2	Perfluorodecanoic acid	ND	0.16	0.048	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	0.16	0.072	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	0.16	0.061	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	0.16	0.087	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	0.16	0.090	ug/kg	
PERFLUOROALKYL SULFONIC ACIDS						
375-73-5	Perfluorobutanesulfonic acid	ND	0.16	0.083	ug/kg	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.16	0.097	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	ND	0.16	0.091	ug/kg	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.16	0.12	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.16	0.10	ug/kg	
68259-12-1	Perfluorononanesulfonic acid	ND	0.16	0.10	ug/kg	
335-77-3	Perfluorodecanesulfonic acid	ND	0.16	0.080	ug/kg	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.16	0.085	ug/kg	
FLUOROTELOMER SULFONIC ACIDS						
757124-72-4	4:2-FTS	ND	0.32	0.15	ug/kg	
27619-97-2	6:2-FTS	ND	0.32	0.21	ug/kg	
39108-34-4	8:2-FTS	ND	0.32	0.21	ug/kg	
PERFLUOROOCTANE SULFONAMIDES						
754-91-6	PFOSA	ND	0.16	0.086	ug/kg	
31506-32-8	MeFOSA	ND	0.32	0.11	ug/kg	
4151-50-2	EtFOSA	ND	0.32	0.084	ug/kg	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DIFFUSER		
Lab Sample ID:	FC36273-3	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROOCTANE SULFONAMIDOACETIC ACIDS						
2355-31-9	MeFOSAA	ND	0.32	0.12	ug/kg	
2991-50-6	EtFOSAA	ND	0.32	0.10	ug/kg	
PERFLUOROOCTANE SULFONAMIDO ETHANOLS						
24448-09-7	MeFOSE	ND	0.32	0.080	ug/kg	
1691-99-2	EtFOSE	ND	0.32	0.092	ug/kg	
PER and POLYFLUOROETHER CARBOXYLIC ACIDS						
13252-13-6	HFPO-DA (GenX)	ND	0.32	0.077	ug/kg	
919005-14-4	ADONA	ND	0.32	0.074	ug/kg	
377-73-1	PFMPA	ND	0.32	0.080	ug/kg	
863090-89-5	PFMBA	ND	0.32	0.080	ug/kg	
151772-58-6	NFDHA	ND	0.32	0.11	ug/kg	
PER and POLYFLUOROETHER SULFONIC ACIDS						
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.32	0.11	ug/kg	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.32	0.099	ug/kg	
113507-82-7	PFEESA	ND	0.32	0.087	ug/kg	
FLUOROTELOMER CARBOXYLIC ACIDS						
356-02-5	3:3-FTCA	ND	0.32	0.13	ug/kg	
914637-49-3	5:3-FTCA	ND	0.32	0.14	ug/kg	
812-70-4	7:3-FTCA	ND	0.32	0.15	ug/kg	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C4-PFBA	72%		10-130%
	13C5-PFPeA	73%		35-130%
	13C5-PFHxA	75%		40-130%
	13C4-PFHpA	77%		40-130%
	13C8-PFOA	76%		40-130%
	13C9-PFNA	78%		40-130%
	13C6-PFDA	77%		40-130%
	13C7-PFUnDA	79%		40-130%
	13C2-PFDoDA	78%		40-130%
	13C2-PFTeDA	74%		20-130%
	13C3-PFBS	77%		40-135%
	13C3-PFHxS	78%		40-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	DIFFUSER		
Lab Sample ID:	FC36273-3	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOS	88%		40-130%
	13C8-FOSA	85%		40-130%
	d3-MeFOSA	69%		10-130%
	d5-EtFOSA	78%		10-130%
	d3-MeFOSAA	98%		40-135%
	d5-EtFOSAA	89%		40-150%
	d7-MeFOSE	78%		20-130%
	d9-EtFOSE	78%		15-130%
	13C2-4:2FTS	86%		40-165%
	13C2-6:2FTS	85%		40-215%
	13C2-8:2FTS	80%		40-275%
	13C3-HFPO-DA	75%		40-130%

(a) All results reported on a wet weight basis.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	NTS-PIPE-03		
Lab Sample ID:	FC36273-4	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	6Q49153.D	1	09/02/26 20:37	MV	08/31/26 20:35	OP17284	S6Q759
Run #2							

	Initial Weight	Final Volume
Run #1	5.01 g	4.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROALKYL CARBOXYLIC ACIDS						
375-22-4	Perfluorobutanoic acid	ND	0.32	0.13	ug/kg	
2706-90-3	Perfluoropentanoic acid	ND	0.32	0.12	ug/kg	
307-24-4	Perfluorohexanoic acid	ND	0.16	0.061	ug/kg	
375-85-9	Perfluoroheptanoic acid	ND	0.16	0.075	ug/kg	
335-67-1	Perfluorooctanoic acid	ND	0.16	0.048	ug/kg	
375-95-1	Perfluorononanoic acid	ND	0.16	0.087	ug/kg	
335-76-2	Perfluorodecanoic acid	ND	0.16	0.048	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	0.16	0.072	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	0.16	0.061	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	0.16	0.087	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	0.16	0.090	ug/kg	
PERFLUOROALKYL SULFONIC ACIDS						
375-73-5	Perfluorobutanesulfonic acid	ND	0.16	0.083	ug/kg	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.16	0.097	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	ND	0.16	0.091	ug/kg	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.16	0.13	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.16	0.10	ug/kg	
68259-12-1	Perfluorononanesulfonic acid	ND	0.16	0.10	ug/kg	
335-77-3	Perfluorodecanesulfonic acid	ND	0.16	0.080	ug/kg	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.16	0.085	ug/kg	
FLUOROTELOMER SULFONIC ACIDS						
757124-72-4	4:2-FTS	ND	0.32	0.15	ug/kg	
27619-97-2	6:2-FTS	ND	0.32	0.21	ug/kg	
39108-34-4	8:2-FTS	ND	0.32	0.21	ug/kg	
PERFLUOROOCTANE SULFONAMIDES						
754-91-6	PFOSA	ND	0.16	0.086	ug/kg	
31506-32-8	MeFOSA	ND	0.32	0.11	ug/kg	
4151-50-2	EtFOSA	ND	0.32	0.085	ug/kg	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	NTS-PIPE-03		
Lab Sample ID:	FC36273-4	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROOCTANE SULFONAMIDOACETIC ACIDS						
2355-31-9	MeFOSAA	ND	0.32	0.12	ug/kg	
2991-50-6	EtFOSAA	ND	0.32	0.10	ug/kg	
PERFLUOROOCTANE SULFONAMIDO ETHANOLS						
24448-09-7	MeFOSE	ND	0.32	0.080	ug/kg	
1691-99-2	EtFOSE	ND	0.32	0.093	ug/kg	
PER and POLYFLUOROETHER CARBOXYLIC ACIDS						
13252-13-6	HFPO-DA (GenX)	ND	0.32	0.077	ug/kg	
919005-14-4	ADONA	ND	0.32	0.074	ug/kg	
377-73-1	PFMPA	ND	0.32	0.080	ug/kg	
863090-89-5	PFMBA	ND	0.32	0.080	ug/kg	
151772-58-6	NFDHA	ND	0.32	0.11	ug/kg	
PER and POLYFLUOROETHER SULFONIC ACIDS						
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.32	0.11	ug/kg	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.32	0.099	ug/kg	
113507-82-7	PFEESA	ND	0.32	0.088	ug/kg	
FLUOROTELOMER CARBOXYLIC ACIDS						
356-02-5	3:3-FTCA	ND	0.32	0.13	ug/kg	
914637-49-3	5:3-FTCA	ND	0.32	0.14	ug/kg	
812-70-4	7:3-FTCA	ND	0.32	0.15	ug/kg	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C4-PFBA	71%		10-130%
	13C5-PFPeA	70%		35-130%
	13C5-PFHxA	70%		40-130%
	13C4-PFHpA	70%		40-130%
	13C8-PFOA	74%		40-130%
	13C9-PFNA	75%		40-130%
	13C6-PFDA	76%		40-130%
	13C7-PFUnDA	77%		40-130%
	13C2-PFDoDA	80%		40-130%
	13C2-PFTeDA	74%		20-130%
	13C3-PFBS	78%		40-135%
	13C3-PFHxS	78%		40-130%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	NTS-PIPE-03		
Lab Sample ID:	FC36273-4	**Date Sampled:**	08/25/26
Matrix:	SO - Soil	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a [a]
Project:	GRR Airport		

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOS	69%		40-130%
	13C8-FOSA	78%		40-130%
	d3-MeFOSA	64%		10-130%
	d5-EtFOSA	67%		10-130%
	d3-MeFOSAA	80%		40-135%
	d5-EtFOSAA	74%		40-150%
	d7-MeFOSE	70%		20-130%
	d9-EtFOSE	68%		15-130%
	13C2-4:2FTS	82%		40-165%
	13C2-6:2FTS	82%		40-215%
	13C2-8:2FTS	79%		40-275%
	13C3-HFPO-DA	70%		40-130%

(a) All results reported on a wet weight basis.

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: EQUIPMENT BLANK
Lab Sample ID: FC36273-5
Matrix: AQ - Equipment Blank
Method: EPA 1633A EPA 1633A
Project: GRR Airport

Date Sampled: 08/25/26
Date Received: 08/28/26
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	9Q28945.D	1	09/01/26 23:58	MB	08/31/26 08:00	OP17280	S9Q527
Run #2							

	Initial Volume	Final Volume
Run #1	450 ml	4.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROALKYL CARBOXYLIC ACIDS						
375-22-4	Perfluorobutanoic acid	ND	3.6	1.8	ng/l	
2706-90-3	Perfluoropentanoic acid	ND	3.6	1.8	ng/l	
307-24-4	Perfluorohexanoic acid	ND	1.8	0.56	ng/l	
375-85-9	Perfluoroheptanoic acid	ND	1.8	0.84	ng/l	
335-67-1	Perfluorooctanoic acid	ND	1.8	0.80	ng/l	
375-95-1	Perfluorononanoic acid	ND	1.8	0.75	ng/l	
335-76-2	Perfluorodecanoic acid	ND	1.8	0.53	ng/l	
2058-94-8	Perfluoroundecanoic acid	ND	1.8	1.0	ng/l	
307-55-1	Perfluorododecanoic acid	ND	1.8	0.65	ng/l	
72629-94-8	Perfluorotridecanoic acid	ND	1.8	0.61	ng/l	
376-06-7	Perfluorotetradecanoic acid	ND	1.8	0.66	ng/l	
PERFLUOROALKYL SULFONIC ACIDS						
375-73-5	Perfluorobutanesulfonic acid	ND	1.8	0.75	ng/l	
2706-91-4	Perfluoropentanesulfonic acid	ND	1.8	0.99	ng/l	
355-46-4	Perfluorohexanesulfonic acid	ND	1.8	0.91	ng/l	
375-92-8	Perfluoroheptanesulfonic acid	ND	1.8	0.87	ng/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	1.8	0.88	ng/l	
68259-12-1	Perfluorononanesulfonic acid	ND	1.8	0.98	ng/l	
335-77-3	Perfluorodecanesulfonic acid	ND	1.8	1.0	ng/l	
79780-39-5	Perfluorododecanesulfonic aci	ND	1.8	0.89	ng/l	
FLUOROTELOMER SULFONIC ACIDS						
757124-72-4	4:2-FTS	ND	3.6	2.0	ng/l	
27619-97-2	6:2-FTS	ND	3.6	1.8	ng/l	
39108-34-4	8:2-FTS	ND	3.6	1.7	ng/l	
PERFLUOROOCTANE SULFONAMIDES						
754-91-6	PFOSA	ND	1.8	0.89	ng/l	
31506-32-8	MeFOSA	ND	3.6	0.96	ng/l	
4151-50-2	EtFOSA	ND	3.6	0.90	ng/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EQUIPMENT BLANK		
Lab Sample ID:	FC36273-5	**Date Sampled:**	08/25/26
Matrix:	AQ - Equipment Blank	**Date Received:**	08/28/26
Method:	EPA 1633A EPA 1633A	**Percent Solids:**	n/a
Project:	GRR Airport		

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROOCTANE SULFONAMIDOACETIC ACIDS						
2355-31-9	MeFOSAA	ND	3.6	0.98	ng/l	
2991-50-6	EtFOSAA	ND	3.6	0.89	ng/l	
PERFLUOROOCTANE SULFONAMIDO ETHANOLS						
24448-09-7	MeFOSE	ND	3.6	1.8	ng/l	
1691-99-2	EtFOSE	ND	3.6	1.8	ng/l	
PER and POLYFLUOROETHER CARBOXYLIC ACIDS						
13252-13-6	HFPO-DA (GenX)	ND	1.8	1.1	ng/l	
919005-14-4	ADONA	ND	3.6	0.84	ng/l	
377-73-1	PFMPA	ND	3.6	0.89	ng/l	
863090-89-5	PFMBA	ND	3.6	0.89	ng/l	
151772-58-6	NFDHA	ND	3.6	1.8	ng/l	
PER and POLYFLUOROETHER SULFONIC ACIDS						
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	3.6	0.89	ng/l	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	3.6	0.89	ng/l	
113507-82-7	PFEESA	ND	3.6	0.64	ng/l	
FLUOROTELOMER CARBOXYLIC ACIDS						
356-02-5	3:3-FTCA	ND	3.6	1.2	ng/l	
914637-49-3	5:3-FTCA	ND	3.6	0.95	ng/l	
812-70-4	7:3-FTCA	ND	3.6	1.6	ng/l	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C4-PFBA	101%		10-130%
	13C5-PFPeA	98%		40-130%
	13C5-PFHxA	101%		40-130%
	13C4-PFHpA	100%		40-130%
	13C8-PFOA	105%		40-130%
	13C9-PFNA	102%		40-130%
	13C6-PFDA	99%		40-130%
	13C7-PFUnDA	89%		30-130%
	13C2-PFDoDA	69%		10-130%
	13C2-PFTeDA	52%		10-130%
	13C3-PFBS	83%		40-135%
	13C3-PFHxS	83%		40-130%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: EQUIPMENT BLANK
Lab Sample ID: FC36273-5
Matrix: AQ - Equipment Blank
Method: EPA 1633A EPA 1633A
Project: GRR Airport

Date Sampled: 08/25/26
Date Received: 08/28/26
Percent Solids: n/a

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOS	74%		40-130%
	13C8-FOSA	76%		40-130%
	d3-MeFOSA	62%		10-130%
	d5-EtFOSA	60%		10-130%
	d3-MeFOSAA	99%		40-170%
	d5-EtFOSAA	88%		25-135%
	d7-MeFOSE	52%		10-130%
	d9-EtFOSE	65%		10-130%
	13C2-4:2FTS	118%		40-200%
	13C2-6:2FTS	115%		40-200%
	13C2-8:2FTS	113%		40-300%
	13C3-HFPO-DA	85%		40-130%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

SGS North America Inc - Orlando

Chain of Custody

4405 Vineland Road, Suite C-15 Orlando, Fl 32811
TEL 407-425-6700 FAX 407-425-0707
www.sgs.com

SGS - ORLANDO JOB # : FC36273 PAGE 1 OF 1

SGS - ORLANDO Quote # SKIFF #

Client / Reporting Information		Project Information	
Company Name:	Limno Tech	Project Name:	
Address:	501 Avis Drive	Street	
City:	Ann Arbor State: MI Zip: 48108	City State	
Project Contact:	Chris Ciecierk Email: cciecierk@limno.com	Project #	GRR26
Phone #:	734-332-1200	Fax #	
Sampler(s) Name(s) (Printed) Sampler 1:	Behnke Sampler 2:	Client Purchase Order #	

Analytical Information: PFAS (method 1633)

Matrix Codes: DW - Drinking Water; GW - Ground Water; WW - Water; SW - Surface Water; SO - Soil; SL- Sludge; OI - Oil; LIQ - Other Liquid; AIR - Air; SOL - Other Solid

SGS Orlando Sample #	Field ID / Point of Collection	COLLECTION DATE	TIME	SAMPLED BY	MATRIX	CONTAINER INFORMATION TOTAL # OF BOTTLES	OTHER	NONE	HCl	NaOH	HNO3	H2SO4	NaOH+ZnAc	DI WATER	MeOH	PFAS (method 1633)	LAB USE ONLY
1	NTS-Pipe-01	8/25/26	1130	LTI	SOL	1		X								X	
2	NTS-Pipe-02	8/25/26	1200	LTI	SOL	1		X								X	
3	Diffuser	8/25/26	1230	LTI	SOL	1		X								X	
4	NTS-Pipe-03	8/25/26	1250	LTI	SOL	1		X								X	
5	Equipment Blank	8/25/26	1300	LTI	WW	3		X								X	

Turnaround Time (Business days)

- 10 Day (Business) — Approved By: / Date:
- 7 Day
- 5 Day
- 3 Day *RUSH*
- 2 Day *RUSH*
- 1 Day *RUSH*
- Other

Rush T/A Data Available VIA Email or Lablink

Data Deliverable Information

- ☐ COMMERCIAL "A" (RESULTS ONLY)
- ☐ COMMERCIAL "B" (RESULTS PLUS QC)
- ☐ REDT1 (EPA LEVEL 3)
- ☐ FULLT1 (EPA LEVEL 4)
- ☐ EDD'S

Comments / Remarks

INITIAL ASSESSMENT

LABEL VERIFICATION ZB

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished By Sampler/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
1 LIMNOTECH	8/27/26 1600	2	3		4 8/28/26 900
Relinquished by/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
5		6	7		8

Lab Use Only : Cooler Temperature (s) Celsius (corrected): 1.0 IR#1

http://www.sgs.com/en/terms-and-conditions

ORLD-SMT-0001-03-FORM-COC (4).xls Rev 031318

FC36273: Chain of Custody
Page 1 of 2

SGS - Orlando Sample Receipt Summary

Job Number: fc36273 **Client:** LIMNOTECH **Project:** GRR26

Date / Time Received: 8/28/2026 9:00:00 AM **Delivery Method:** FEDEX **Airbill #'s:** 876396734796

Cooler Temps (Raw Measured) °C: Cooler 1: (1.0);

Cooler Temps (Corrected) °C: Cooler 1: (0.8);

Cooler Informatio	Y	or	N
1. Custody Seals Present:	☑		☐
2. Custody Seals Intact:	☑		☐
3. Temp criteria achieved:	☑		☐
4. Cooler temp verification:	IR Gun		
5. Cooler media:	Ice (Bag)		

Trip Blank Information	Y	or	N	N/A
1. Trip Blank present / cooler:	☐		☐	☑
2. Trip Blank listed on COC:	☐		☐	☑

	W	or	S	N/A
3. Type of TB Received	☐		☐	☑

Sample Information	Y	or	N	N/A
1. Sample labels present on bottles:	☑		☐	
2. Samples preserved properly	☑		☐	
3. Sufficient volume/containers recv'd for analysis	☑		☐	
4. Condition of sample:	Intact			
5. Sample recv'd within HT	☑		☐	
6. Dates/Times/IDs on COC match sample label	☑		☐	
7. VOCs headspace free:	☐		☐	☑
8. Bottles received for unspecified tests	☐		☑	
9. Compositing instructions clear	☐		☐	☑
10. Voa Soil Kits/Jars received past 48hrs?	☐		☐	☑
11. % Solids Jar Received?	☐		☐	☑
12. Residual Chlorine Present?	☐		☐	☑

Misc Information

Number of Encores: 25 Gram 5 Gram

Test Strip Lot #s: pH 0-3: 216524

Residual Chlorine Test Strip Lot

Number of Lab Filtered Metals

pH 10-12:

Other: (Specify) 0-14 210224

Comments

Sample Receipt Summary 012726 KE Technician: ZANEB Date: 8/28/2026 2:22:09 PM Reviewer: Date:

FC36273: Chain of Custody

Page 2 of 2

MS Semi-volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17280-MB	9Q28923.D	1	09/01/26	MB	08/31/26	OP17280	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.0032	0.0016	ug/l	
2706-90-3	Perfluoropentanoic acid	ND	0.0032	0.0016	ug/l	
307-24-4	Perfluorohexanoic acid	ND	0.0016	0.00050	ug/l	
375-85-9	Perfluoroheptanoic acid	ND	0.0016	0.00076	ug/l	
335-67-1	Perfluorooctanoic acid	ND	0.0016	0.00072	ug/l	
375-95-1	Perfluorononanoic acid	ND	0.0016	0.00067	ug/l	
335-76-2	Perfluorodecanoic acid	ND	0.0016	0.00048	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0016	0.00091	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0016	0.00058	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0016	0.00055	ug/l	
376-06-7	Perfluorotetradecanoic acid	ND	0.0016	0.00059	ug/l	
375-73-5	Perfluorobutanesulfonic acid	ND	0.0016	0.00067	ug/l	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.0016	0.00089	ug/l	
355-46-4	Perfluorohexanesulfonic acid	ND	0.0016	0.00082	ug/l	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.0016	0.00078	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.0016	0.00079	ug/l	
68259-12-1	Perfluorononanesulfonic acid	ND	0.0016	0.00088	ug/l	
335-77-3	Perfluorodecanesulfonic acid	ND	0.0016	0.00093	ug/l	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.0016	0.00080	ug/l	
757124-72-4	4:2-FTS	ND	0.0032	0.0018	ug/l	
27619-97-2	6:2-FTS	ND	0.0032	0.0016	ug/l	
39108-34-4	8:2-FTS	ND	0.0032	0.0015	ug/l	
754-91-6	PFOSA	ND	0.0016	0.00080	ug/l	
31506-32-8	MeFOSA	ND	0.0032	0.00086	ug/l	
4151-50-2	EtFOSA	ND	0.0032	0.00081	ug/l	
2355-31-9	MeFOSAA	ND	0.0032	0.00088	ug/l	
2991-50-6	EtFOSAA	ND	0.0032	0.00080	ug/l	
24448-09-7	MeFOSE	ND	0.0032	0.0016	ug/l	
1691-99-2	EtFOSE	ND	0.0032	0.0016	ug/l	
13252-13-6	HFPO-DA (GenX)	ND	0.0016	0.00095	ug/l	
919005-14-4	ADONA	ND	0.0032	0.00076	ug/l	
377-73-1	PFMPA	ND	0.0032	0.00080	ug/l	
863090-89-5	PFMBA	ND	0.0032	0.00080	ug/l	
151772-58-6	NFDHA	ND	0.0032	0.0016	ug/l	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.0032	0.00080	ug/l	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.0032	0.00080	ug/l	

Method Blank Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17280-MB	9Q28923.D	1	09/01/26	MB	08/31/26	OP17280	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.0032	0.00058	ug/l	
356-02-5	3:3-FTCA	ND	0.0032	0.0011	ug/l	
914637-49-3	5:3-FTCA	ND	0.0032	0.00086	ug/l	
812-70-4	7:3-FTCA	ND	0.0032	0.0015	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	103%	10-130%
	13C5-PFPeA	102%	40-130%
	13C5-PFHxA	105%	40-130%
	13C4-PFHpA	104%	40-130%
	13C8-PFOA	105%	40-130%
	13C9-PFNA	101%	40-130%
	13C6-PFDA	102%	40-130%
	13C7-PFUnDA	105%	30-130%
	13C2-PFDoDA	92%	10-130%
	13C2-PFTeDA	68%	10-130%
	13C3-PFBS	102%	40-135%
	13C3-PFHxS	104%	40-130%
	13C8-PFOS	90%	40-130%
	13C8-FOSA	69%	40-130%
	d3-MeFOSA	51%	10-130%
	d5-EtFOSA	51%	10-130%
	d3-MeFOSAA	97%	40-170%
	d5-EtFOSAA	88%	25-135%
	d7-MeFOSE	44%	10-130%
	d9-EtFOSE	58%	10-130%
	13C2-4:2FTS	135%	40-200%
	13C2-6:2FTS	128%	40-200%
	13C2-8:2FTS	132%	40-300%
	13C3-HFPO-DA	98%	40-130%

Method Blank Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17284-MB	6Q49138.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.32	0.13	ug/kg	
2706-90-3	Perfluoropentanoic acid	ND	0.32	0.12	ug/kg	
307-24-4	Perfluorohexanoic acid	ND	0.16	0.062	ug/kg	
375-85-9	Perfluoroheptanoic acid	ND	0.16	0.075	ug/kg	
335-67-1	Perfluorooctanoic acid	ND	0.16	0.048	ug/kg	
375-95-1	Perfluorononanoic acid	ND	0.16	0.087	ug/kg	
335-76-2	Perfluorodecanoic acid	ND	0.16	0.048	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	0.16	0.072	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	0.16	0.062	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	0.16	0.087	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	0.16	0.090	ug/kg	
375-73-5	Perfluorobutanesulfonic acid	ND	0.16	0.083	ug/kg	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.16	0.098	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	ND	0.16	0.091	ug/kg	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.16	0.13	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.16	0.10	ug/kg	
68259-12-1	Perfluorononanesulfonic acid	ND	0.16	0.10	ug/kg	
335-77-3	Perfluorodecanesulfonic acid	ND	0.16	0.080	ug/kg	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.16	0.086	ug/kg	
757124-72-4	4:2-FTS	ND	0.32	0.15	ug/kg	
27619-97-2	6:2-FTS	ND	0.32	0.22	ug/kg	
39108-34-4	8:2-FTS	ND	0.32	0.21	ug/kg	
754-91-6	PFOSA	ND	0.16	0.086	ug/kg	
31506-32-8	MeFOSA	ND	0.32	0.11	ug/kg	
4151-50-2	EtFOSA	ND	0.32	0.085	ug/kg	
2355-31-9	MeFOSAA	ND	0.32	0.12	ug/kg	
2991-50-6	EtFOSAA	ND	0.32	0.10	ug/kg	
24448-09-7	MeFOSE	ND	0.32	0.080	ug/kg	
1691-99-2	EtFOSE	ND	0.32	0.093	ug/kg	
13252-13-6	HFPO-DA (GenX)	ND	0.32	0.078	ug/kg	
919005-14-4	ADONA	ND	0.32	0.074	ug/kg	
377-73-1	PFMPA	ND	0.32	0.080	ug/kg	
863090-89-5	PFMBA	ND	0.32	0.080	ug/kg	
151772-58-6	NFDHA	ND	0.32	0.11	ug/kg	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.32	0.11	ug/kg	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.32	0.099	ug/kg	

Method Blank Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17284-MB	6Q49138.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.32	0.088	ug/kg	
356-02-5	3:3-FTCA	ND	0.32	0.13	ug/kg	
914637-49-3	5:3-FTCA	ND	0.32	0.14	ug/kg	
812-70-4	7:3-FTCA	ND	0.32	0.15	ug/kg	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	80%	10-130%
	13C5-PFPeA	88%	35-130%
	13C5-PFHxA	92%	40-130%
	13C4-PFHpA	94%	40-130%
	13C8-PFOA	88%	40-130%
	13C9-PFNA	81%	40-130%
	13C6-PFDA	82%	40-130%
	13C7-PFUnDA	81%	40-130%
	13C2-PFDoDA	82%	40-130%
	13C2-PFTeDA	87%	20-130%
	13C3-PFBS	86%	40-135%
	13C3-PFHxS	82%	40-130%
	13C8-PFOS	85%	40-130%
	13C8-FOSA	97%	40-130%
	d3-MeFOSA	88%	10-130%
	d5-EtFOSA	90%	10-130%
	d3-MeFOSAA	94%	40-135%
	d5-EtFOSAA	86%	40-150%
	d7-MeFOSE	90%	20-130%
	d9-EtFOSE	92%	15-130%
	13C2-4:2FTS	89%	40-165%
	13C2-6:2FTS	90%	40-215%
	13C2-8:2FTS	86%	40-275%
	13C3-HFPO-DA	89%	40-130%

Instrument Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q524-IBLK	9Q28791.D	1	08/30/26	MB	n/a	n/a	S9Q524

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.0080	0.0016	ug/l	
2706-90-3	Perfluoropentanoic acid	ND	0.0080	0.0016	ug/l	
307-24-4	Perfluorohexanoic acid	ND	0.0032	0.00050	ug/l	
375-85-9	Perfluoroheptanoic acid	ND	0.0032	0.00076	ug/l	
335-67-1	Perfluorooctanoic acid	ND	0.0032	0.00072	ug/l	
375-95-1	Perfluorononanoic acid	ND	0.0032	0.00067	ug/l	
335-76-2	Perfluorodecanoic acid	ND	0.0032	0.00065	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0032	0.00091	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0032	0.00058	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0032	0.00055	ug/l	
376-06-7	Perfluorotetradecanoic acid	0.00064	0.0032	0.00059	ug/l	J
375-73-5	Perfluorobutanesulfonic acid	ND	0.0032	0.00067	ug/l	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.0032	0.00089	ug/l	
355-46-4	Perfluorohexanesulfonic acid	ND	0.0032	0.00082	ug/l	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.0032	0.00078	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.0032	0.00079	ug/l	
68259-12-1	Perfluorononanesulfonic acid	ND	0.0032	0.00088	ug/l	
335-77-3	Perfluorodecanesulfonic acid	ND	0.0032	0.00093	ug/l	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.0032	0.00080	ug/l	
757124-72-4	4:2-FTS	ND	0.0080	0.0018	ug/l	
27619-97-2	6:2-FTS	ND	0.0080	0.0016	ug/l	
39108-34-4	8:2-FTS	ND	0.0080	0.0015	ug/l	
754-91-6	PFOSA	ND	0.0032	0.00080	ug/l	
31506-32-8	MeFOSA	ND	0.0080	0.00086	ug/l	
4151-50-2	EtFOSA	ND	0.0080	0.00081	ug/l	
2355-31-9	MeFOSAA	ND	0.0032	0.00088	ug/l	
2991-50-6	EtFOSAA	ND	0.0032	0.00080	ug/l	
24448-09-7	MeFOSE	ND	0.0080	0.0016	ug/l	
1691-99-2	EtFOSE	ND	0.0080	0.0016	ug/l	
13252-13-6	HFPO-DA (GenX)	ND	0.0016	0.00095	ug/l	
919005-14-4	ADONA	ND	0.0032	0.00076	ug/l	
377-73-1	PFMPA	ND	0.0032	0.00080	ug/l	
863090-89-5	PFMBA	ND	0.0032	0.00080	ug/l	
151772-58-6	NFDHA	ND	0.0032	0.0016	ug/l	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.0032	0.00080	ug/l	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.0032	0.00080	ug/l	

Instrument Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q524-IBLK	9Q28791.D	1	08/30/26	MB	n/a	n/a	S9Q524

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.0032	0.00058	ug/l	
356-02-5	3:3-FTCA	ND	0.0080	0.0011	ug/l	
914637-49-3	5:3-FTCA	ND	0.0080	0.00086	ug/l	
812-70-4	7:3-FTCA	ND	0.0080	0.0015	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	100%	10-130%
	13C5-PFPeA	98%	40-130%
	13C5-PFHxA	103%	40-130%
	13C4-PFHpA	100%	40-130%
	13C8-PFOA	101%	40-130%
	13C9-PFNA	99%	40-130%
	13C6-PFDA	104%	40-130%
	13C7-PFUnDA	104%	30-130%
	13C2-PFDoDA	104%	10-130%
	13C2-PFTeDA	99%	10-130%
	13C3-PFBS	105%	40-135%
	13C3-PFHxS	106%	40-130%
	13C8-PFOS	99%	40-130%
	13C8-FOSA	102%	40-130%
	d3-MeFOSA	93%	10-130%
	d5-EtFOSA	97%	10-130%
	d3-MeFOSAA	104%	40-170%
	d5-EtFOSAA	104%	25-135%
	d7-MeFOSE	103%	10-130%
	d9-EtFOSE	95%	10-130%
	13C2-4:2FTS	124%	40-200%
	13C2-6:2FTS	125%	40-200%
	13C2-8:2FTS	118%	40-300%
	13C3-HFPO-DA	98%	40-130%

Instrument Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-IBLK	9Q28903.D	1	09/01/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.0080	0.0016	ug/l	
2706-90-3	Perfluoropentanoic acid	ND	0.0080	0.0016	ug/l	
307-24-4	Perfluorohexanoic acid	ND	0.0032	0.00050	ug/l	
375-85-9	Perfluoroheptanoic acid	ND	0.0032	0.00076	ug/l	
335-67-1	Perfluorooctanoic acid	ND	0.0032	0.00072	ug/l	
375-95-1	Perfluorononanoic acid	ND	0.0032	0.00067	ug/l	
335-76-2	Perfluorodecanoic acid	ND	0.0032	0.00048	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0032	0.00091	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0032	0.00058	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0032	0.00055	ug/l	
376-06-7	Perfluorotetradecanoic acid	0.00059	0.0032	0.00059	ug/l	J
375-73-5	Perfluorobutanesulfonic acid	ND	0.0032	0.00067	ug/l	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.0032	0.00089	ug/l	
355-46-4	Perfluorohexanesulfonic acid	ND	0.0032	0.00082	ug/l	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.0032	0.00078	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.0032	0.00079	ug/l	
68259-12-1	Perfluorononanesulfonic acid	ND	0.0032	0.00088	ug/l	
335-77-3	Perfluorodecanesulfonic acid	ND	0.0032	0.00093	ug/l	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.0032	0.00080	ug/l	
757124-72-4	4:2-FTS	ND	0.0080	0.0018	ug/l	
27619-97-2	6:2-FTS	ND	0.0080	0.0016	ug/l	
39108-34-4	8:2-FTS	ND	0.0080	0.0015	ug/l	
754-91-6	PFOSA	ND	0.0032	0.00080	ug/l	
31506-32-8	MeFOSA	ND	0.0080	0.00086	ug/l	
4151-50-2	EtFOSA	ND	0.0080	0.00081	ug/l	
2355-31-9	MeFOSAA	ND	0.0032	0.00088	ug/l	
2991-50-6	EtFOSAA	ND	0.0032	0.00080	ug/l	
24448-09-7	MeFOSE	ND	0.0080	0.0016	ug/l	
1691-99-2	EtFOSE	ND	0.0080	0.0016	ug/l	
13252-13-6	HFPO-DA (GenX)	ND	0.0016	0.00095	ug/l	
919005-14-4	ADONA	ND	0.0032	0.00076	ug/l	
377-73-1	PFMPA	ND	0.0032	0.00080	ug/l	
863090-89-5	PFMBA	ND	0.0032	0.00080	ug/l	
151772-58-6	NFDHA	ND	0.0032	0.0016	ug/l	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.0032	0.00080	ug/l	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.0032	0.00080	ug/l	

Instrument Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-IBLK	9Q28903.D	1	09/01/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.0032	0.00058	ug/l	
356-02-5	3:3-FTCA	ND	0.0080	0.0011	ug/l	
914637-49-3	5:3-FTCA	ND	0.0080	0.00086	ug/l	
812-70-4	7:3-FTCA	ND	0.0080	0.0015	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	98%	10-130%
	13C5-PFPeA	97%	40-130%
	13C5-PFHxA	99%	40-130%
	13C4-PFHpA	98%	40-130%
	13C8-PFOA	101%	40-130%
	13C9-PFNA	94%	40-130%
	13C6-PFDA	103%	40-130%
	13C7-PFUnDA	105%	30-130%
	13C2-PFDoDA	101%	10-130%
	13C2-PFTeDA	91%	10-130%
	13C3-PFBS	100%	40-135%
	13C3-PFHxS	99%	40-130%
	13C8-PFOS	93%	40-130%
	13C8-FOSA	97%	40-130%
	d3-MeFOSA	94%	10-130%
	d5-EtFOSA	93%	10-130%
	d3-MeFOSAA	100%	40-170%
	d5-EtFOSAA	98%	25-135%
	d7-MeFOSE	103%	10-130%
	d9-EtFOSE	91%	10-130%
	13C2-4:2FTS	116%	40-200%
	13C2-6:2FTS	109%	40-200%
	13C2-8:2FTS	115%	40-300%
	13C3-HFPO-DA	94%	40-130%

Instrument Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-IBLK	9Q28918.D	1	09/01/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.0080	0.0016	ug/l	
2706-90-3	Perfluoropentanoic acid	ND	0.0080	0.0016	ug/l	
307-24-4	Perfluorohexanoic acid	ND	0.0032	0.00050	ug/l	
375-85-9	Perfluoroheptanoic acid	ND	0.0032	0.00076	ug/l	
335-67-1	Perfluorooctanoic acid	ND	0.0032	0.00072	ug/l	
375-95-1	Perfluorononanoic acid	ND	0.0032	0.00067	ug/l	
335-76-2	Perfluorodecanoic acid	ND	0.0032	0.00048	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0032	0.00091	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0032	0.00058	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0032	0.00055	ug/l	
376-06-7	Perfluorotetradecanoic acid	ND	0.0032	0.00059	ug/l	
375-73-5	Perfluorobutanesulfonic acid	ND	0.0032	0.00067	ug/l	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.0032	0.00089	ug/l	
355-46-4	Perfluorohexanesulfonic acid	ND	0.0032	0.00082	ug/l	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.0032	0.00078	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.0032	0.00079	ug/l	
68259-12-1	Perfluorononanesulfonic acid	ND	0.0032	0.00088	ug/l	
335-77-3	Perfluorodecanesulfonic acid	ND	0.0032	0.00093	ug/l	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.0032	0.00080	ug/l	
757124-72-4	4:2-FTS	ND	0.0080	0.0018	ug/l	
27619-97-2	6:2-FTS	ND	0.0080	0.0016	ug/l	
39108-34-4	8:2-FTS	ND	0.0080	0.0015	ug/l	
754-91-6	PFOSA	ND	0.0032	0.00080	ug/l	
31506-32-8	MeFOSA	ND	0.0080	0.00086	ug/l	
4151-50-2	EtFOSA	ND	0.0080	0.00081	ug/l	
2355-31-9	MeFOSAA	ND	0.0032	0.00088	ug/l	
2991-50-6	EtFOSAA	ND	0.0032	0.00080	ug/l	
24448-09-7	MeFOSE	ND	0.0080	0.0016	ug/l	
1691-99-2	EtFOSE	ND	0.0080	0.0016	ug/l	
13252-13-6	HFPO-DA (GenX)	ND	0.0016	0.00095	ug/l	
919005-14-4	ADONA	ND	0.0032	0.00076	ug/l	
377-73-1	PFMPA	ND	0.0032	0.00080	ug/l	
863090-89-5	PFMBA	ND	0.0032	0.00080	ug/l	
151772-58-6	NFDHA	ND	0.0032	0.0016	ug/l	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.0032	0.00080	ug/l	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.0032	0.00080	ug/l	

Instrument Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-IBLK	9Q28918.D	1	09/01/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.0032	0.00058	ug/l	
356-02-5	3:3-FTCA	ND	0.0080	0.0011	ug/l	
914637-49-3	5:3-FTCA	ND	0.0080	0.00086	ug/l	
812-70-4	7:3-FTCA	ND	0.0080	0.0015	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	99%	10-130%
	13C5-PFPeA	98%	40-130%
	13C5-PFHxA	101%	40-130%
	13C4-PFHpA	97%	40-130%
	13C8-PFOA	101%	40-130%
	13C9-PFNA	91%	40-130%
	13C6-PFDA	98%	40-130%
	13C7-PFUnDA	108%	30-130%
	13C2-PFDoDA	100%	10-130%
	13C2-PFTeDA	91%	10-130%
	13C3-PFBS	100%	40-135%
	13C3-PFHxS	97%	40-130%
	13C8-PFOS	96%	40-130%
	13C8-FOSA	96%	40-130%
	d3-MeFOSA	93%	10-130%
	d5-EtFOSA	92%	10-130%
	d3-MeFOSAA	95%	40-170%
	d5-EtFOSAA	93%	25-135%
	d7-MeFOSE	103%	10-130%
	d9-EtFOSE	94%	10-130%
	13C2-4:2FTS	125%	40-200%
	13C2-6:2FTS	120%	40-200%
	13C2-8:2FTS	116%	40-300%
	13C3-HFPO-DA	95%	40-130%

Instrument Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S6Q759-IBLK	6Q49132.D	1	09/02/26	MV	n/a	n/a	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.80	0.13	ug/kg	
2706-90-3	Perfluoropentanoic acid	ND	0.80	0.12	ug/kg	
307-24-4	Perfluorohexanoic acid	ND	0.32	0.062	ug/kg	
375-85-9	Perfluoroheptanoic acid	ND	0.32	0.075	ug/kg	
335-67-1	Perfluorooctanoic acid	ND	0.32	0.048	ug/kg	
375-95-1	Perfluorononanoic acid	ND	0.32	0.087	ug/kg	
335-76-2	Perfluorodecanoic acid	ND	0.32	0.048	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	0.32	0.072	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	0.32	0.062	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	0.32	0.087	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	0.32	0.090	ug/kg	
375-73-5	Perfluorobutanesulfonic acid	ND	0.32	0.083	ug/kg	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.32	0.098	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	ND	0.32	0.091	ug/kg	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.32	0.13	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.32	0.10	ug/kg	
68259-12-1	Perfluorononanesulfonic acid	ND	0.32	0.10	ug/kg	
335-77-3	Perfluorodecanesulfonic acid	ND	0.32	0.080	ug/kg	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.32	0.086	ug/kg	
757124-72-4	4:2-FTS	ND	0.80	0.15	ug/kg	
27619-97-2	6:2-FTS	ND	0.80	0.22	ug/kg	
39108-34-4	8:2-FTS	ND	0.80	0.21	ug/kg	
754-91-6	PFOSA	ND	0.32	0.086	ug/kg	
31506-32-8	MeFOSA	ND	0.80	0.11	ug/kg	
4151-50-2	EtFOSA	ND	0.80	0.085	ug/kg	
2355-31-9	MeFOSAA	ND	0.32	0.12	ug/kg	
2991-50-6	EtFOSAA	ND	0.32	0.10	ug/kg	
24448-09-7	MeFOSE	ND	0.80	0.080	ug/kg	
1691-99-2	EtFOSE	ND	0.80	0.093	ug/kg	
13252-13-6	HFPO-DA (GenX)	ND	0.32	0.078	ug/kg	
919005-14-4	ADONA	ND	0.80	0.074	ug/kg	
377-73-1	PFMPA	ND	0.80	0.080	ug/kg	
863090-89-5	PFMBA	ND	0.80	0.080	ug/kg	
151772-58-6	NFDHA	ND	0.80	0.11	ug/kg	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.80	0.11	ug/kg	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.80	0.099	ug/kg	

Instrument Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S6Q759-IBLK	6Q49132.D	1	09/02/26	MV	n/a	n/a	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.80	0.088	ug/kg	
356-02-5	3:3-FTCA	ND	0.80	0.13	ug/kg	
914637-49-3	5:3-FTCA	ND	0.80	0.14	ug/kg	
812-70-4	7:3-FTCA	ND	0.80	0.15	ug/kg	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	98%	10-130%
	13C5-PFPeA	97%	35-130%
	13C5-PFHxA	101%	40-130%
	13C4-PFHpA	103%	40-130%
	13C8-PFOA	106%	40-130%
	13C9-PFNA	93%	40-130%
	13C6-PFDA	101%	40-130%
	13C7-PFUnDA	101%	40-130%
	13C2-PFDoDA	102%	40-130%
	13C2-PFTeDA	99%	20-130%
	13C3-PFBS	96%	40-135%
	13C3-PFHxS	88%	40-130%
	13C8-PFOS	96%	40-130%
	13C8-FOSA	107%	40-130%
	d3-MeFOSA	90%	10-130%
	d5-EtFOSA	96%	10-130%
	d3-MeFOSAA	105%	40-135%
	d5-EtFOSAA	103%	40-150%
	d7-MeFOSE	95%	20-130%
	d9-EtFOSE	93%	15-130%
	13C2-4:2FTS	104%	40-165%
	13C2-6:2FTS	107%	40-215%
	13C2-8:2FTS	101%	40-275%
	13C3-HFPO-DA	98%	40-130%

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-ICCB	9Q28941.D	1	09/01/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.0080	0.0016	ug/l	
2706-90-3	Perfluoropentanoic acid	ND	0.0080	0.0016	ug/l	
307-24-4	Perfluorohexanoic acid	ND	0.0032	0.00050	ug/l	
375-85-9	Perfluoroheptanoic acid	ND	0.0032	0.00076	ug/l	
335-67-1	Perfluorooctanoic acid	ND	0.0032	0.00072	ug/l	
375-95-1	Perfluorononanoic acid	ND	0.0032	0.00067	ug/l	
335-76-2	Perfluorodecanoic acid	ND	0.0032	0.00048	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0032	0.00091	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0032	0.00058	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0032	0.00055	ug/l	
376-06-7	Perfluorotetradecanoic acid	ND	0.0032	0.00059	ug/l	
375-73-5	Perfluorobutanesulfonic acid	ND	0.0032	0.00067	ug/l	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.0032	0.00089	ug/l	
355-46-4	Perfluorohexanesulfonic acid	ND	0.0032	0.00082	ug/l	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.0032	0.00078	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.0032	0.00079	ug/l	
68259-12-1	Perfluorononanesulfonic acid	ND	0.0032	0.00088	ug/l	
335-77-3	Perfluorodecanesulfonic acid	ND	0.0032	0.00093	ug/l	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.0032	0.00080	ug/l	
757124-72-4	4:2-FTS	ND	0.0080	0.0018	ug/l	
27619-97-2	6:2-FTS	ND	0.0080	0.0016	ug/l	
39108-34-4	8:2-FTS	ND	0.0080	0.0015	ug/l	
754-91-6	PFOSA	ND	0.0032	0.00080	ug/l	
31506-32-8	MeFOSA	ND	0.0080	0.00086	ug/l	
4151-50-2	EtFOSA	ND	0.0080	0.00081	ug/l	
2355-31-9	MeFOSAA	ND	0.0032	0.00088	ug/l	
2991-50-6	EtFOSAA	ND	0.0032	0.00080	ug/l	
24448-09-7	MeFOSE	ND	0.0080	0.0016	ug/l	
1691-99-2	EtFOSE	ND	0.0080	0.0016	ug/l	
13252-13-6	HFPO-DA (GenX)	ND	0.0016	0.00095	ug/l	
919005-14-4	ADONA	ND	0.0032	0.00076	ug/l	
377-73-1	PFMPA	ND	0.0032	0.00080	ug/l	
863090-89-5	PFMBA	ND	0.0032	0.00080	ug/l	
151772-58-6	NFDHA	ND	0.0032	0.0016	ug/l	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.0032	0.00080	ug/l	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.0032	0.00080	ug/l	

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-ICCB	9Q28941.D	1	09/01/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.0032	0.00058	ug/l	
356-02-5	3:3-FTCA	ND	0.0080	0.0011	ug/l	
914637-49-3	5:3-FTCA	ND	0.0080	0.00086	ug/l	
812-70-4	7:3-FTCA	ND	0.0080	0.0015	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	98%	10-130%
	13C5-PFPeA	94%	40-130%
	13C5-PFHxA	99%	40-130%
	13C4-PFHpA	99%	40-130%
	13C8-PFOA	101%	40-130%
	13C9-PFNA	98%	40-130%
	13C6-PFDA	102%	40-130%
	13C7-PFUnDA	107%	30-130%
	13C2-PFDoDA	96%	10-130%
	13C2-PFTeDA	94%	10-130%
	13C3-PFBS	98%	40-135%
	13C3-PFHxS	98%	40-130%
	13C8-PFOS	98%	40-130%
	13C8-FOSA	99%	40-130%
	d3-MeFOSA	98%	10-130%
	d5-EtFOSA	95%	10-130%
	d3-MeFOSAA	100%	40-170%
	d5-EtFOSAA	97%	25-135%
	d7-MeFOSE	106%	10-130%
	d9-EtFOSE	97%	10-130%
	13C2-4:2FTS	119%	40-200%
	13C2-6:2FTS	116%	40-200%
	13C2-8:2FTS	114%	40-300%
	13C3-HFPO-DA	89%	40-130%

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-ICCB	9Q28949.D	1	09/02/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.0080	0.0016	ug/l	
2706-90-3	Perfluoropentanoic acid	ND	0.0080	0.0016	ug/l	
307-24-4	Perfluorohexanoic acid	ND	0.0032	0.00050	ug/l	
375-85-9	Perfluoroheptanoic acid	ND	0.0032	0.00076	ug/l	
335-67-1	Perfluorooctanoic acid	ND	0.0032	0.00072	ug/l	
375-95-1	Perfluorononanoic acid	ND	0.0032	0.00067	ug/l	
335-76-2	Perfluorodecanoic acid	ND	0.0032	0.00048	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0032	0.00091	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0032	0.00058	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0032	0.00055	ug/l	
376-06-7	Perfluorotetradecanoic acid	ND	0.0032	0.00059	ug/l	
375-73-5	Perfluorobutanesulfonic acid	ND	0.0032	0.00067	ug/l	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.0032	0.00089	ug/l	
355-46-4	Perfluorohexanesulfonic acid	ND	0.0032	0.00082	ug/l	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.0032	0.00078	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.0032	0.00079	ug/l	
68259-12-1	Perfluorononanesulfonic acid	ND	0.0032	0.00088	ug/l	
335-77-3	Perfluorodecanesulfonic acid	ND	0.0032	0.00093	ug/l	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.0032	0.00080	ug/l	
757124-72-4	4:2-FTS	ND	0.0080	0.0018	ug/l	
27619-97-2	6:2-FTS	ND	0.0080	0.0016	ug/l	
39108-34-4	8:2-FTS	ND	0.0080	0.0015	ug/l	
754-91-6	PFOSA	ND	0.0032	0.00080	ug/l	
31506-32-8	MeFOSA	ND	0.0080	0.00086	ug/l	
4151-50-2	EtFOSA	ND	0.0080	0.00081	ug/l	
2355-31-9	MeFOSAA	ND	0.0032	0.00088	ug/l	
2991-50-6	EtFOSAA	ND	0.0032	0.00080	ug/l	
24448-09-7	MeFOSE	ND	0.0080	0.0016	ug/l	
1691-99-2	EtFOSE	ND	0.0080	0.0016	ug/l	
13252-13-6	HFPO-DA (GenX)	ND	0.0016	0.00095	ug/l	
919005-14-4	ADONA	ND	0.0032	0.00076	ug/l	
377-73-1	PFMPA	ND	0.0032	0.00080	ug/l	
863090-89-5	PFMBA	ND	0.0032	0.00080	ug/l	
151772-58-6	NFDHA	ND	0.0032	0.0016	ug/l	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.0032	0.00080	ug/l	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.0032	0.00080	ug/l	

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-ICCB	9Q28949.D	1	09/02/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.0032	0.00058	ug/l	
356-02-5	3:3-FTCA	ND	0.0080	0.0011	ug/l	
914637-49-3	5:3-FTCA	ND	0.0080	0.00086	ug/l	
812-70-4	7:3-FTCA	ND	0.0080	0.0015	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	97%	10-130%
	13C5-PFPeA	94%	40-130%
	13C5-PFHxA	99%	40-130%
	13C4-PFHpA	102%	40-130%
	13C8-PFOA	100%	40-130%
	13C9-PFNA	97%	40-130%
	13C6-PFDA	101%	40-130%
	13C7-PFUnDA	106%	30-130%
	13C2-PFDoDA	97%	10-130%
	13C2-PFTeDA	94%	10-130%
	13C3-PFBS	97%	40-135%
	13C3-PFHxS	100%	40-130%
	13C8-PFOS	101%	40-130%
	13C8-FOSA	105%	40-130%
	d3-MeFOSA	102%	10-130%
	d5-EtFOSA	102%	10-130%
	d3-MeFOSAA	107%	40-170%
	d5-EtFOSAA	103%	25-135%
	d7-MeFOSE	111%	10-130%
	d9-EtFOSE	100%	10-130%
	13C2-4:2FTS	119%	40-200%
	13C2-6:2FTS	114%	40-200%
	13C2-8:2FTS	116%	40-300%
	13C3-HFPO-DA	90%	40-130%

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S6Q759-ICCB	6Q49147.D	1	09/02/26	MV	n/a	n/a	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.80	0.13	ug/kg	
2706-90-3	Perfluoropentanoic acid	ND	0.80	0.12	ug/kg	
307-24-4	Perfluorohexanoic acid	ND	0.32	0.062	ug/kg	
375-85-9	Perfluoroheptanoic acid	ND	0.32	0.075	ug/kg	
335-67-1	Perfluorooctanoic acid	ND	0.32	0.048	ug/kg	
375-95-1	Perfluorononanoic acid	ND	0.32	0.087	ug/kg	
335-76-2	Perfluorodecanoic acid	ND	0.32	0.048	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	0.32	0.072	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	0.32	0.062	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	0.32	0.087	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	0.32	0.090	ug/kg	
375-73-5	Perfluorobutanesulfonic acid	ND	0.32	0.083	ug/kg	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.32	0.098	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	ND	0.32	0.091	ug/kg	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.32	0.13	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.32	0.10	ug/kg	
68259-12-1	Perfluorononanesulfonic acid	ND	0.32	0.10	ug/kg	
335-77-3	Perfluorodecanesulfonic acid	ND	0.32	0.080	ug/kg	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.32	0.086	ug/kg	
757124-72-4	4:2-FTS	ND	0.80	0.15	ug/kg	
27619-97-2	6:2-FTS	ND	0.80	0.22	ug/kg	
39108-34-4	8:2-FTS	ND	0.80	0.21	ug/kg	
754-91-6	PFOSA	ND	0.32	0.086	ug/kg	
31506-32-8	MeFOSA	ND	0.80	0.11	ug/kg	
4151-50-2	EtFOSA	ND	0.80	0.085	ug/kg	
2355-31-9	MeFOSAA	ND	0.32	0.12	ug/kg	
2991-50-6	EtFOSAA	ND	0.32	0.10	ug/kg	
24448-09-7	MeFOSE	ND	0.80	0.080	ug/kg	
1691-99-2	EtFOSE	ND	0.80	0.093	ug/kg	
13252-13-6	HFPO-DA (GenX)	ND	0.32	0.078	ug/kg	
919005-14-4	ADONA	ND	0.80	0.074	ug/kg	
377-73-1	PFMPA	ND	0.80	0.080	ug/kg	
863090-89-5	PFMBA	ND	0.80	0.080	ug/kg	
151772-58-6	NFDHA	ND	0.80	0.11	ug/kg	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.80	0.11	ug/kg	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.80	0.099	ug/kg	

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S6Q759-ICCB	6Q49147.D	1	09/02/26	MV	n/a	n/a	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.80	0.088	ug/kg	
356-02-5	3:3-FTCA	ND	0.80	0.13	ug/kg	
914637-49-3	5:3-FTCA	ND	0.80	0.14	ug/kg	
812-70-4	7:3-FTCA	ND	0.80	0.15	ug/kg	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	99%	10-130%
	13C5-PFPeA	100%	35-130%
	13C5-PFHxA	105%	40-130%
	13C4-PFHpA	103%	40-130%
	13C8-PFOA	98%	40-130%
	13C9-PFNA	102%	40-130%
	13C6-PFDA	93%	40-130%
	13C7-PFUnDA	101%	40-130%
	13C2-PFDoDA	96%	40-130%
	13C2-PFTeDA	95%	20-130%
	13C3-PFBS	101%	40-135%
	13C3-PFHxS	100%	40-130%
	13C8-PFOS	100%	40-130%
	13C8-FOSA	111%	40-130%
	d3-MeFOSA	101%	10-130%
	d5-EtFOSA	109%	10-130%
	d3-MeFOSAA	115%	40-135%
	d5-EtFOSAA	109%	40-150%
	d7-MeFOSE	101%	20-130%
	d9-EtFOSE	98%	15-130%
	13C2-4:2FTS	117%	40-165%
	13C2-6:2FTS	108%	40-215%
	13C2-8:2FTS	108%	40-275%
	13C3-HFPO-DA	98%	40-130%

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S6Q759-ICCB	6Q49155.D	1	09/02/26	MV	n/a	n/a	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.80	0.13	ug/kg	
2706-90-3	Perfluoropentanoic acid	ND	0.80	0.12	ug/kg	
307-24-4	Perfluorohexanoic acid	ND	0.32	0.062	ug/kg	
375-85-9	Perfluoroheptanoic acid	ND	0.32	0.075	ug/kg	
335-67-1	Perfluorooctanoic acid	ND	0.32	0.048	ug/kg	
375-95-1	Perfluorononanoic acid	ND	0.32	0.087	ug/kg	
335-76-2	Perfluorodecanoic acid	ND	0.32	0.048	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	0.32	0.072	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	0.32	0.062	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	0.32	0.087	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	0.32	0.090	ug/kg	
375-73-5	Perfluorobutanesulfonic acid	ND	0.32	0.083	ug/kg	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.32	0.098	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	ND	0.32	0.091	ug/kg	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.32	0.13	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.32	0.10	ug/kg	
68259-12-1	Perfluorononanesulfonic acid	ND	0.32	0.10	ug/kg	
335-77-3	Perfluorodecanesulfonic acid	ND	0.32	0.080	ug/kg	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.32	0.086	ug/kg	
757124-72-4	4:2-FTS	ND	0.80	0.15	ug/kg	
27619-97-2	6:2-FTS	ND	0.80	0.22	ug/kg	
39108-34-4	8:2-FTS	ND	0.80	0.21	ug/kg	
754-91-6	PFOSA	ND	0.32	0.086	ug/kg	
31506-32-8	MeFOSA	ND	0.80	0.11	ug/kg	
4151-50-2	EtFOSA	ND	0.80	0.085	ug/kg	
2355-31-9	MeFOSAA	ND	0.32	0.12	ug/kg	
2991-50-6	EtFOSAA	ND	0.32	0.10	ug/kg	
24448-09-7	MeFOSE	ND	0.80	0.080	ug/kg	
1691-99-2	EtFOSE	ND	0.80	0.093	ug/kg	
13252-13-6	HFPO-DA (GenX)	ND	0.32	0.078	ug/kg	
919005-14-4	ADONA	ND	0.80	0.074	ug/kg	
377-73-1	PFMPA	ND	0.80	0.080	ug/kg	
863090-89-5	PFMBA	ND	0.80	0.080	ug/kg	
151772-58-6	NFDHA	ND	0.80	0.11	ug/kg	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.80	0.11	ug/kg	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.80	0.099	ug/kg	

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S6Q759-ICCB	6Q49155.D	1	09/02/26	MV	n/a	n/a	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.80	0.088	ug/kg	
356-02-5	3:3-FTCA	ND	0.80	0.13	ug/kg	
914637-49-3	5:3-FTCA	ND	0.80	0.14	ug/kg	
812-70-4	7:3-FTCA	ND	0.80	0.15	ug/kg	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	104%	10-130%
	13C5-PFPeA	99%	35-130%
	13C5-PFHxA	103%	40-130%
	13C4-PFHpA	94%	40-130%
	13C8-PFOA	96%	40-130%
	13C9-PFNA	101%	40-130%
	13C6-PFDA	112%	40-130%
	13C7-PFUnDA	116%	40-130%
	13C2-PFDoDA	108%	40-130%
	13C2-PFTeDA	103%	20-130%
	13C3-PFBS	107%	40-135%
	13C3-PFHxS	104%	40-130%
	13C8-PFOS	106%	40-130%
	13C8-FOSA	112%	40-130%
	d3-MeFOSA	105%	10-130%
	d5-EtFOSA	108%	10-130%
	d3-MeFOSAA	123%	40-135%
	d5-EtFOSAA	108%	40-150%
	d7-MeFOSE	106%	20-130%
	d9-EtFOSE	104%	15-130%
	13C2-4:2FTS	114%	40-165%
	13C2-6:2FTS	112%	40-215%
	13C2-8:2FTS	109%	40-275%
	13C3-HFPO-DA	94%	40-130%

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-ICCB	9Q28914.D	1	09/01/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

S9Q527-IBLK, S9Q527-RT

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.0080	0.0016	ug/l	
2706-90-3	Perfluoropentanoic acid	ND	0.0080	0.0016	ug/l	
307-24-4	Perfluorohexanoic acid	ND	0.0032	0.00050	ug/l	
375-85-9	Perfluoroheptanoic acid	ND	0.0032	0.00076	ug/l	
335-67-1	Perfluorooctanoic acid	ND	0.0032	0.00072	ug/l	
375-95-1	Perfluorononanoic acid	ND	0.0032	0.00067	ug/l	
335-76-2	Perfluorodecanoic acid	ND	0.0032	0.00048	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0032	0.00091	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0032	0.00058	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0032	0.00055	ug/l	
376-06-7	Perfluorotetradecanoic acid	ND	0.0032	0.00059	ug/l	
375-73-5	Perfluorobutanesulfonic acid	ND	0.0032	0.00067	ug/l	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.0032	0.00089	ug/l	
355-46-4	Perfluorohexanesulfonic acid	ND	0.0032	0.00082	ug/l	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.0032	0.00078	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.0032	0.00079	ug/l	
68259-12-1	Perfluorononanesulfonic acid	ND	0.0032	0.00088	ug/l	
335-77-3	Perfluorodecanesulfonic acid	ND	0.0032	0.00093	ug/l	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.0032	0.00080	ug/l	
757124-72-4	4:2-FTS	ND	0.0080	0.0018	ug/l	
27619-97-2	6:2-FTS	ND	0.0080	0.0016	ug/l	
39108-34-4	8:2-FTS	ND	0.0080	0.0015	ug/l	
754-91-6	PFOSA	ND	0.0032	0.00080	ug/l	
31506-32-8	MeFOSA	ND	0.0080	0.00086	ug/l	
4151-50-2	EtFOSA	ND	0.0080	0.00081	ug/l	
2355-31-9	MeFOSAA	ND	0.0032	0.00088	ug/l	
2991-50-6	EtFOSAA	ND	0.0032	0.00080	ug/l	
24448-09-7	MeFOSE	ND	0.0080	0.0016	ug/l	
1691-99-2	EtFOSE	ND	0.0080	0.0016	ug/l	
13252-13-6	HFPO-DA (GenX)	ND	0.0016	0.00095	ug/l	
919005-14-4	ADONA	ND	0.0032	0.00076	ug/l	
377-73-1	PFMPA	ND	0.0032	0.00080	ug/l	
863090-89-5	PFMBA	ND	0.0032	0.00080	ug/l	
151772-58-6	NFDHA	ND	0.0032	0.0016	ug/l	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.0032	0.00080	ug/l	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.0032	0.00080	ug/l	

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-ICCB	9Q28914.D	1	09/01/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

S9Q527-IBLK, S9Q527-RT

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.0032	0.00058	ug/l	
356-02-5	3:3-FTCA	ND	0.0080	0.0011	ug/l	
914637-49-3	5:3-FTCA	ND	0.0080	0.00086	ug/l	
812-70-4	7:3-FTCA	ND	0.0080	0.0015	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	100%	10-130%
	13C5-PFPeA	97%	40-130%
	13C5-PFHxA	98%	40-130%
	13C4-PFHpA	99%	40-130%
	13C8-PFOA	103%	40-130%
	13C9-PFNA	95%	40-130%
	13C6-PFDA	105%	40-130%
	13C7-PFUnDA	109%	30-130%
	13C2-PFDoDA	107%	10-130%
	13C2-PFTeDA	97%	10-130%
	13C3-PFBS	100%	40-135%
	13C3-PFHxS	103%	40-130%
	13C8-PFOS	96%	40-130%
	13C8-FOSA	101%	40-130%
	d3-MeFOSA	94%	10-130%
	d5-EtFOSA	95%	10-130%
	d3-MeFOSAA	98%	40-170%
	d5-EtFOSAA	95%	25-135%
	d7-MeFOSE	108%	10-130%
	d9-EtFOSE	97%	10-130%
	13C2-4:2FTS	125%	40-200%
	13C2-6:2FTS	116%	40-200%
	13C2-8:2FTS	115%	40-300%
	13C3-HFPO-DA	85%	40-130%

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-ICCB	9Q28929.D	1	09/01/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

OP17280-DUP

CAS No.	Compound	Result	RL	MDL	Units	Q
375-22-4	Perfluorobutanoic acid	ND	0.0080	0.0016	ug/l	
2706-90-3	Perfluoropentanoic acid	ND	0.0080	0.0016	ug/l	
307-24-4	Perfluorohexanoic acid	ND	0.0032	0.00050	ug/l	
375-85-9	Perfluoroheptanoic acid	ND	0.0032	0.00076	ug/l	
335-67-1	Perfluorooctanoic acid	ND	0.0032	0.00072	ug/l	
375-95-1	Perfluorononanoic acid	ND	0.0032	0.00067	ug/l	
335-76-2	Perfluorodecanoic acid	ND	0.0032	0.00048	ug/l	
2058-94-8	Perfluoroundecanoic acid	ND	0.0032	0.00091	ug/l	
307-55-1	Perfluorododecanoic acid	ND	0.0032	0.00058	ug/l	
72629-94-8	Perfluorotridecanoic acid	ND	0.0032	0.00055	ug/l	
376-06-7	Perfluorotetradecanoic acid	ND	0.0032	0.00059	ug/l	
375-73-5	Perfluorobutanesulfonic acid	ND	0.0032	0.00067	ug/l	
2706-91-4	Perfluoropentanesulfonic acid	ND	0.0032	0.00089	ug/l	
355-46-4	Perfluorohexanesulfonic acid	ND	0.0032	0.00082	ug/l	
375-92-8	Perfluoroheptanesulfonic acid	ND	0.0032	0.00078	ug/l	
1763-23-1	Perfluorooctanesulfonic acid	ND	0.0032	0.00079	ug/l	
68259-12-1	Perfluorononanesulfonic acid	ND	0.0032	0.00088	ug/l	
335-77-3	Perfluorodecanesulfonic acid	ND	0.0032	0.00093	ug/l	
79780-39-5	Perfluorododecanesulfonic aci	ND	0.0032	0.00080	ug/l	
757124-72-4	4:2-FTS	ND	0.0080	0.0018	ug/l	
27619-97-2	6:2-FTS	ND	0.0080	0.0016	ug/l	
39108-34-4	8:2-FTS	ND	0.0080	0.0015	ug/l	
754-91-6	PFOSA	ND	0.0032	0.00080	ug/l	
31506-32-8	MeFOSA	ND	0.0080	0.00086	ug/l	
4151-50-2	EtFOSA	ND	0.0080	0.00081	ug/l	
2355-31-9	MeFOSAA	ND	0.0032	0.00088	ug/l	
2991-50-6	EtFOSAA	ND	0.0032	0.00080	ug/l	
24448-09-7	MeFOSE	ND	0.0080	0.0016	ug/l	
1691-99-2	EtFOSE	ND	0.0080	0.0016	ug/l	
13252-13-6	HFPO-DA (GenX)	ND	0.0016	0.00095	ug/l	
919005-14-4	ADONA	ND	0.0032	0.00076	ug/l	
377-73-1	PFMPA	ND	0.0032	0.00080	ug/l	
863090-89-5	PFMBA	ND	0.0032	0.00080	ug/l	
151772-58-6	NFDHA	ND	0.0032	0.0016	ug/l	
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND	0.0032	0.00080	ug/l	
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND	0.0032	0.00080	ug/l	

Continuing Calibration Blank

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S9Q527-ICCB	9Q28929.D	1	09/01/26	MB	n/a	n/a	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

OP17280-DUP

CAS No.	Compound	Result	RL	MDL	Units	Q
113507-82-7	PFEESA	ND	0.0032	0.00058	ug/l	
356-02-5	3:3-FTCA	ND	0.0080	0.0011	ug/l	
914637-49-3	5:3-FTCA	ND	0.0080	0.00086	ug/l	
812-70-4	7:3-FTCA	ND	0.0080	0.0015	ug/l	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	100%	10-130%
	13C5-PFPeA	97%	40-130%
	13C5-PFHxA	102%	40-130%
	13C4-PFHpA	100%	40-130%
	13C8-PFOA	100%	40-130%
	13C9-PFNA	95%	40-130%
	13C6-PFDA	102%	40-130%
	13C7-PFUnDA	109%	30-130%
	13C2-PFDoDA	107%	10-130%
	13C2-PFTeDA	100%	10-130%
	13C3-PFBS	97%	40-135%
	13C3-PFHxS	95%	40-130%
	13C8-PFOS	85%	40-130%
	13C8-FOSA	95%	40-130%
	d3-MeFOSA	95%	10-130%
	d5-EtFOSA	93%	10-130%
	d3-MeFOSAA	86%	40-170%
	d5-EtFOSAA	90%	25-135%
	d7-MeFOSE	98%	10-130%
	d9-EtFOSE	99%	10-130%
	13C2-4:2FTS	115%	40-200%
	13C2-6:2FTS	107%	40-200%
	13C2-8:2FTS	106%	40-300%
	13C3-HFPO-DA	90%	40-130%

Blank Spike Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17280-LLBS	9Q28922.D	1	09/01/26	MB	08/31/26	OP17280	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
375-22-4	Perfluorobutanoic acid	0.0032	0.0034	106	70-140
2706-90-3	Perfluoropentanoic acid	0.0032	0.0032	100	65-135
307-24-4	Perfluorohexanoic acid	0.0032	0.0032	100	70-145
375-85-9	Perfluoroheptanoic acid	0.0032	0.0031	97	70-150
335-67-1	Perfluorooctanoic acid	0.0032	0.0032	100	70-150
375-95-1	Perfluorononanoic acid	0.0032	0.0031	97	70-150
335-76-2	Perfluorodecanoic acid	0.0032	0.0032	100	70-140
2058-94-8	Perfluoroundecanoic acid	0.0032	0.0032	100	70-145
307-55-1	Perfluorododecanoic acid	0.0032	0.0033	103	70-140
72629-94-8	Perfluorotridecanoic acid	0.0032	0.0036	113	65-140
376-06-7	Perfluorotetradecanoic acid	0.0032	0.0033	103	60-140
375-73-5	Perfluorobutanesulfonic acid	0.0032	0.0031	97	60-145
2706-91-4	Perfluoropentanesulfonic acid	0.0032	0.0032	100	65-140
355-46-4	Perfluorohexanesulfonic acid	0.0032	0.0034	106	65-145
375-92-8	Perfluoroheptanesulfonic acid	0.0032	0.0031	97	70-150
1763-23-1	Perfluorooctanesulfonic acid	0.0032	0.0032	100	55-150
68259-12-1	Perfluorononanesulfonic acid	0.0032	0.0034	106	65-145
335-77-3	Perfluorodecanesulfonic acid	0.0032	0.0028	88	60-145
79780-39-5	Perfluorododecanesulfonic aci	0.0032	0.0023	72	50-145
757124-72-4	4:2-FTS	0.0032	0.0032	100	70-145
27619-97-2	6:2-FTS	0.0032	0.0029	91	65-155
39108-34-4	8:2-FTS	0.0032	0.0033	103	60-150
754-91-6	PFOSA	0.0032	0.0038	119	70-145
31506-32-8	MeFOSA	0.0032	0.0028	88	60-150
4151-50-2	EtFOSA	0.0032	0.0032	100	65-145
2355-31-9	MeFOSAA	0.0032	0.0036	113	50-140
2991-50-6	EtFOSAA	0.0032	0.0035	109	70-145
24448-09-7	MeFOSE	0.0032	0.0041	128	70-145
1691-99-2	EtFOSE	0.0032	0.0036	113	70-135
13252-13-6	HFPO-DA (GenX)	0.0032	0.0030	94	70-140
919005-14-4	ADONA	0.0032	0.0032	100	65-145
377-73-1	PFMPA	0.0032	0.0034	106	55-140
863090-89-5	PFMBA	0.0032	0.0032	100	60-150
151772-58-6	NFDHA	0.0032	0.0030	94	50-150
756426-58-1	9Cl-PF3ONS (F-53B Major)	0.0032	0.0032	100	70-155
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	0.0032	0.0028	88	55-160

* = Outside of Control Limits.

Blank Spike Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17280-LLBS	9Q28922.D	1	09/01/26	MB	08/31/26	OP17280	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
113507-82-7	PFEESA	0.0032	0.0030	94	70-140
356-02-5	3:3-FTCA	0.0032	0.0032	100	65-130
914637-49-3	5:3-FTCA	0.0032	0.0037	116	70-135
812-70-4	7:3-FTCA	0.0032	0.0030	94	50-145

CAS No.	ID Standard Recoveries	BSP	Limits
	13C4-PFBA	106%	10-130%
	13C5-PFPeA	103%	40-130%
	13C5-PFHxA	106%	40-130%
	13C4-PFHpA	105%	40-130%
	13C8-PFOA	109%	40-130%
	13C9-PFNA	101%	40-130%
	13C6-PFDA	108%	40-130%
	13C7-PFUnDA	108%	30-130%
	13C2-PFDoDA	95%	10-130%
	13C2-PFTeDA	76%	10-130%
	13C3-PFBS	108%	40-135%
	13C3-PFHxS	106%	40-130%
	13C8-PFOS	95%	40-130%
	13C8-FOSA	81%	40-130%
	d3-MeFOSA	66%	10-130%
	d5-EtFOSA	60%	10-130%
	d3-MeFOSAA	92%	40-170%
	d5-EtFOSAA	90%	25-135%
	d7-MeFOSE	54%	10-130%
	d9-EtFOSE	70%	10-130%
	13C2-4:2FTS	139%	40-200%
	13C2-6:2FTS	132%	40-200%
	13C2-8:2FTS	129%	40-300%
	13C3-HFPO-DA	100%	40-130%

* = Outside of Control Limits.

Blank Spike Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17284-LLBS	6Q49137.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
375-22-4	Perfluorobutanoic acid	0.32	0.30	94	70-140
2706-90-3	Perfluoropentanoic acid	0.32	0.31	97	60-150
307-24-4	Perfluorohexanoic acid	0.32	0.30	94	65-140
375-85-9	Perfluoroheptanoic acid	0.32	0.34	106	65-145
335-67-1	Perfluorooctanoic acid	0.32	0.29	91	70-150
375-95-1	Perfluorononanoic acid	0.32	0.28	88	70-155
335-76-2	Perfluorodecanoic acid	0.32	0.34	106	70-155
2058-94-8	Perfluoroundecanoic acid	0.32	0.30	94	70-155
307-55-1	Perfluorododecanoic acid	0.32	0.34	106	70-150
72629-94-8	Perfluorotridecanoic acid	0.32	0.28	88	65-150
376-06-7	Perfluorotetradecanoic acid	0.32	0.36	113	65-150
375-73-5	Perfluorobutanesulfonic acid	0.32	0.31	97	65-145
2706-91-4	Perfluoropentanesulfonic acid	0.32	0.31	97	55-160
355-46-4	Perfluorohexanesulfonic acid	0.32	0.33	103	60-150
375-92-8	Perfluoroheptanesulfonic acid	0.32	0.31	97	65-155
1763-23-1	Perfluorooctanesulfonic acid	0.32	0.28	88	65-160
68259-12-1	Perfluorononanesulfonic acid	0.32	0.29	91	55-140
335-77-3	Perfluorodecanesulfonic acid	0.32	0.32	100	40-155
79780-39-5	Perfluorododecanesulfonic aci	0.32	0.34	106	25-160
757124-72-4	4:2-FTS	0.32	0.30	94	60-150
27619-97-2	6:2-FTS	0.32	0.35	109	55-200
39108-34-4	8:2-FTS	0.32	0.30	94	70-150
754-91-6	PFOSA	0.32	0.31	97	70-140
31506-32-8	MeFOSA	0.32	0.36	113	70-155
4151-50-2	EtFOSA	0.32	0.31	97	70-140
2355-31-9	MeFOSAA	0.32	0.37	116	65-155
2991-50-6	EtFOSAA	0.32	0.35	109	65-165
24448-09-7	MeFOSE	0.32	0.31	97	70-140
1691-99-2	EtFOSE	0.32	0.30	94	70-135
13252-13-6	HFPO-DA (GenX)	0.32	0.30	94	70-145
919005-14-4	ADONA	0.32	0.31	97	70-160
377-73-1	PFMPA	0.32	0.31	97	30-140
863090-89-5	PFMBA	0.32	0.31	97	60-150
151772-58-6	NFDHA	0.32	0.30	94	60-155
756426-58-1	9Cl-PF3ONS (F-53B Major)	0.32	0.27	84	70-150
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	0.32	0.31	97	45-160

* = Outside of Control Limits.

Blank Spike Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17284-LLBS	6Q49137.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
113507-82-7	PFEESA	0.32	0.31	97	70-140
356-02-5	3:3-FTCA	0.32	0.31	97	45-130
914637-49-3	5:3-FTCA	0.32	0.32	100	60-130
812-70-4	7:3-FTCA	0.32	0.29	91	60-150

CAS No.	ID Standard Recoveries	BSP	Limits
	13C4-PFBA	81%	10-130%
	13C5-PFPeA	78%	35-130%
	13C5-PFHxA	81%	40-130%
	13C4-PFHpA	76%	40-130%
	13C8-PFOA	82%	40-130%
	13C9-PFNA	83%	40-130%
	13C6-PFDA	75%	40-130%
	13C7-PFUnDA	77%	40-130%
	13C2-PFDoDA	74%	40-130%
	13C2-PFTeDA	80%	20-130%
	13C3-PFBS	86%	40-135%
	13C3-PFHxS	77%	40-130%
	13C8-PFOS	80%	40-130%
	13C8-FOSA	83%	40-130%
	d3-MeFOSA	70%	10-130%
	d5-EtFOSA	83%	10-130%
	d3-MeFOSAA	86%	40-135%
	d5-EtFOSAA	83%	40-150%
	d7-MeFOSE	80%	20-130%
	d9-EtFOSE	82%	15-130%
	13C2-4:2FTS	84%	40-165%
	13C2-6:2FTS	83%	40-215%
	13C2-8:2FTS	93%	40-275%
	13C3-HFPO-DA	77%	40-130%

* = Outside of Control Limits.

Blank Spike Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17280-BS	9Q28921.D	1	09/01/26	MB	08/31/26	OP17280	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
375-22-4	Perfluorobutanoic acid	0.04	0.0402	101	70-140
2706-90-3	Perfluoropentanoic acid	0.04	0.0392	98	65-135
307-24-4	Perfluorohexanoic acid	0.04	0.0383	96	70-145
375-85-9	Perfluoroheptanoic acid	0.04	0.0390	98	70-150
335-67-1	Perfluorooctanoic acid	0.04	0.0384	96	70-150
375-95-1	Perfluorononanoic acid	0.04	0.0375	94	70-150
335-76-2	Perfluorodecanoic acid	0.04	0.0410	103	70-140
2058-94-8	Perfluoroundecanoic acid	0.04	0.0399	100	70-145
307-55-1	Perfluorododecanoic acid	0.04	0.0390	98	70-140
72629-94-8	Perfluorotridecanoic acid	0.04	0.0400	100	65-140
376-06-7	Perfluorotetradecanoic acid	0.04	0.0395	99	60-140
375-73-5	Perfluorobutanesulfonic acid	0.04	0.0373	93	60-145
2706-91-4	Perfluoropentanesulfonic acid	0.04	0.0367	92	65-140
355-46-4	Perfluorohexanesulfonic acid	0.04	0.0398	100	65-145
375-92-8	Perfluoroheptanesulfonic acid	0.04	0.0391	98	70-150
1763-23-1	Perfluorooctanesulfonic acid	0.04	0.0389	97	55-150
68259-12-1	Perfluorononanesulfonic acid	0.04	0.0394	99	65-145
335-77-3	Perfluorodecanesulfonic acid	0.04	0.0346	87	60-145
79780-39-5	Perfluorododecanesulfonic aci	0.04	0.0287	72	50-145
757124-72-4	4:2-FTS	0.04	0.0408	102	70-145
27619-97-2	6:2-FTS	0.04	0.0387	97	65-155
39108-34-4	8:2-FTS	0.04	0.0368	92	60-150
754-91-6	PFOSA	0.04	0.0412	103	70-145
31506-32-8	MeFOSA	0.04	0.0387	97	60-150
4151-50-2	EtFOSA	0.04	0.0407	102	65-145
2355-31-9	MeFOSAA	0.04	0.0403	101	50-140
2991-50-6	EtFOSAA	0.04	0.0381	95	70-145
24448-09-7	MeFOSE	0.04	0.0418	105	70-145
1691-99-2	EtFOSE	0.04	0.0368	92	70-135
13252-13-6	HFPO-DA (GenX)	0.04	0.0392	98	70-140
919005-14-4	ADONA	0.04	0.0392	98	65-145
377-73-1	PFMPA	0.04	0.0410	103	55-140
863090-89-5	PFMBA	0.04	0.0394	99	60-150
151772-58-6	NFDHA	0.04	0.0352	88	50-150
756426-58-1	9Cl-PF3ONS (F-53B Major)	0.04	0.0405	101	70-155
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	0.04	0.0320	80	55-160

* = Outside of Control Limits.

Blank Spike Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17280-BS	9Q28921.D	1	09/01/26	MB	08/31/26	OP17280	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
113507-82-7	PFEESA	0.04	0.0369	92	70-140
356-02-5	3:3-FTCA	0.04	0.0372	93	65-130
914637-49-3	5:3-FTCA	0.04	0.0416	104	70-135
812-70-4	7:3-FTCA	0.04	0.0362	91	50-145

CAS No.	ID Standard Recoveries	BSP	Limits
	13C4-PFBA	102%	10-130%
	13C5-PFPeA	100%	40-130%
	13C5-PFHxA	102%	40-130%
	13C4-PFHpA	101%	40-130%
	13C8-PFOA	105%	40-130%
	13C9-PFNA	98%	40-130%
	13C6-PFDA	105%	40-130%
	13C7-PFUnDA	102%	30-130%
	13C2-PFDoDA	90%	10-130%
	13C2-PFTeDA	69%	10-130%
	13C3-PFBS	102%	40-135%
	13C3-PFHxS	104%	40-130%
	13C8-PFOS	95%	40-130%
	13C8-FOSA	81%	40-130%
	d3-MeFOSA	67%	10-130%
	d5-EtFOSA	63%	10-130%
	d3-MeFOSAA	93%	40-170%
	d5-EtFOSAA	88%	25-135%
	d7-MeFOSE	53%	10-130%
	d9-EtFOSE	68%	10-130%
	13C2-4:2FTS	135%	40-200%
	13C2-6:2FTS	124%	40-200%
	13C2-8:2FTS	126%	40-300%
	13C3-HFPO-DA	98%	40-130%

* = Outside of Control Limits.

Blank Spike Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17284-BS	6Q49136.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
375-22-4	Perfluorobutanoic acid	4	3.7	93	70-140
2706-90-3	Perfluoropentanoic acid	4	3.7	93	60-150
307-24-4	Perfluorohexanoic acid	4	4.0	100	65-140
375-85-9	Perfluoroheptanoic acid	4	3.6	90	65-145
335-67-1	Perfluorooctanoic acid	4	4.0	100	70-150
375-95-1	Perfluorononanoic acid	4	3.6	90	70-155
335-76-2	Perfluorodecanoic acid	4	3.8	95	70-155
2058-94-8	Perfluoroundecanoic acid	4	3.9	98	70-155
307-55-1	Perfluorododecanoic acid	4	4.0	100	70-150
72629-94-8	Perfluorotridecanoic acid	4	3.7	93	65-150
376-06-7	Perfluorotetradecanoic acid	4	3.8	95	65-150
375-73-5	Perfluorobutanesulfonic acid	4	3.7	93	65-145
2706-91-4	Perfluoropentanesulfonic acid	4	3.9	98	55-160
355-46-4	Perfluorohexanesulfonic acid	4	3.8	95	60-150
375-92-8	Perfluoroheptanesulfonic acid	4	3.9	98	65-155
1763-23-1	Perfluorooctanesulfonic acid	4	3.5	88	65-160
68259-12-1	Perfluorononanesulfonic acid	4	3.7	93	55-140
335-77-3	Perfluorodecanesulfonic acid	4	3.9	98	40-155
79780-39-5	Perfluorododecanesulfonic aci	4	3.5	88	25-160
757124-72-4	4:2-FTS	4	4.0	100	60-150
27619-97-2	6:2-FTS	4	3.9	98	55-200
39108-34-4	8:2-FTS	4	3.4	85	70-150
754-91-6	PFOSA	4	3.7	93	70-140
31506-32-8	MeFOSA	4	3.8	95	70-155
4151-50-2	EtFOSA	4	3.7	93	70-140
2355-31-9	MeFOSAA	4	3.5	88	65-155
2991-50-6	EtFOSAA	4	3.9	98	65-165
24448-09-7	MeFOSE	4	4.1	103	70-140
1691-99-2	EtFOSE	4	3.6	90	70-135
13252-13-6	HFPO-DA (GenX)	4	3.5	88	70-145
919005-14-4	ADONA	4	3.4	85	70-160
377-73-1	PFMPA	4	3.7	93	30-140
863090-89-5	PFMBA	4	3.8	95	60-150
151772-58-6	NFDHA	4	3.7	93	60-155
756426-58-1	9Cl-PF3ONS (F-53B Major)	4	3.6	90	70-150
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	4	3.6	90	45-160

* = Outside of Control Limits.

Blank Spike Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17284-BS	6Q49136.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
113507-82-7	PFEESA	4	3.5	88	70-140
356-02-5	3:3-FTCA	4	3.7	93	45-130
914637-49-3	5:3-FTCA	4	3.6	90	60-130
812-70-4	7:3-FTCA	4	3.6	90	60-150

CAS No.	ID Standard Recoveries	BSP	Limits
	13C4-PFBA	88%	10-130%
	13C5-PFPeA	93%	35-130%
	13C5-PFHxA	92%	40-130%
	13C4-PFHpA	95%	40-130%
	13C8-PFOA	84%	40-130%
	13C9-PFNA	96%	40-130%
	13C6-PFDA	95%	40-130%
	13C7-PFUnDA	89%	40-130%
	13C2-PFDoDA	95%	40-130%
	13C2-PFTeDA	97%	20-130%
	13C3-PFBS	93%	40-135%
	13C3-PFHxS	87%	40-130%
	13C8-PFOS	93%	40-130%
	13C8-FOSA	96%	40-130%
	d3-MeFOSA	85%	10-130%
	d5-EtFOSA	93%	10-130%
	d3-MeFOSAA	87%	40-135%
	d5-EtFOSAA	88%	40-150%
	d7-MeFOSE	84%	20-130%
	d9-EtFOSE	95%	15-130%
	13C2-4:2FTS	90%	40-165%
	13C2-6:2FTS	93%	40-215%
	13C2-8:2FTS	107%	40-275%
	13C3-HFPO-DA	97%	40-130%

* = Outside of Control Limits.

Matrix Spike Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17280-MS	9Q28947.D	1	09/02/26	MB	08/31/26	OP17280	S9Q527
FC36274-1	9Q28946.D	1	09/02/26	MB	08/31/26	OP17280	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	FC36274-1 ug/l	Q	Spike ug/l	MS ug/l	MS %	Limits
375-22-4	Perfluorobutanoic acid	0.0162		0.0494	0.0695	108	70-140
2706-90-3	Perfluoropentanoic acid	0.0596		0.0494	0.113	108	65-135
307-24-4	Perfluorohexanoic acid	0.0408		0.0494	0.0936	107	70-145
375-85-9	Perfluoroheptanoic acid	0.0089		0.0494	0.0589	101	70-150
335-67-1	Perfluorooctanoic acid	0.0110		0.0494	0.0607	101	70-150
375-95-1	Perfluorononanoic acid	0.0590		0.0494	0.112	107	70-150
335-76-2	Perfluorodecanoic acid	ND		0.0494	0.0490	99	70-140
2058-94-8	Perfluoroundecanoic acid	ND		0.0494	0.0489	99	70-145
307-55-1	Perfluorododecanoic acid	ND		0.0494	0.0508	103	70-140
72629-94-8	Perfluorotridecanoic acid	ND		0.0494	0.0481	97	65-140
376-06-7	Perfluorotetradecanoic acid	ND		0.0494	0.0503	102	60-140
375-73-5	Perfluorobutanesulfonic acid	0.0079		0.0494	0.0528	91	60-145
2706-91-4	Perfluoropentanesulfonic acid	0.0093		0.0494	0.0567	96	65-140
355-46-4	Perfluorohexanesulfonic acid	0.170		0.0494	0.217	95	65-145
375-92-8	Perfluoroheptanesulfonic acid	0.0048		0.0494	0.0576	107	70-150
1763-23-1	Perfluorooctanesulfonic acid	0.0989		0.0494	0.146	95	55-150
68259-12-1	Perfluorononanesulfonic acid	ND		0.0494	0.0419	85	65-145
335-77-3	Perfluorodecanesulfonic acid	ND		0.0494	0.0345	70	60-145
79780-39-5	Perfluorododecanesulfonic aci	ND		0.0494	0.0258	52	50-145
757124-72-4	4:2-FTS	ND		0.0494	0.0499	101	70-145
27619-97-2	6:2-FTS	0.108		0.0494	0.166	117	65-155
39108-34-4	8:2-FTS	ND		0.0494	0.0485	98	60-150
754-91-6	PFOSA	ND		0.0494	0.0495	100	70-145
31506-32-8	MeFOSA	ND		0.0494	0.0479	97	60-150
4151-50-2	EtFOSA	ND		0.0494	0.0530	107	65-145
2355-31-9	MeFOSAA	ND		0.0494	0.0475	96	50-140
2991-50-6	EtFOSAA	ND		0.0494	0.0524	106	70-145
24448-09-7	MeFOSE	ND		0.0494	0.0576	117	70-145
1691-99-2	EtFOSE	ND		0.0494	0.0481	97	70-135
13252-13-6	HFPO-DA (GenX)	ND		0.0494	0.0538	109	70-140
919005-14-4	ADONA	ND		0.0494	0.0494	100	65-145
377-73-1	PFMPA	ND		0.0494	0.0526	107	55-140
863090-89-5	PFMBA	ND		0.0494	0.0496	100	60-150
151772-58-6	NFDHA	ND		0.0494	0.0466	94	50-150
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND		0.0494	0.0418	85	70-155
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND		0.0494	0.0293	59	55-160

* = Outside of Control Limits.

Matrix Spike Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17280-MS	9Q28947.D	1	09/02/26	MB	08/31/26	OP17280	S9Q527
FC36274-1	9Q28946.D	1	09/02/26	MB	08/31/26	OP17280	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	FC36274-1 ug/l	Q	Spike ug/l	MS ug/l	MS %	Limits
113507-82-7	PFEESA	ND		0.0494	0.0444	90	70-140
356-02-5	3:3-FTCA	ND		0.0494	0.0493	100	65-130
914637-49-3	5:3-FTCA	ND		0.0494	0.0591	120	70-135
812-70-4	7:3-FTCA	ND		0.0494	0.0516	104	50-145

CAS No.	ID Standard Recoveries	MS	FC36274-1	Limits
	13C4-PFBA	95%	96%	10-130%
	13C5-PFPeA	97%	94%	40-130%
	13C5-PFHxA	100%	99%	40-130%
	13C4-PFHpA	99%	99%	40-130%
	13C8-PFOA	98%	101%	40-130%
	13C9-PFNA	94%	95%	40-130%
	13C6-PFDA	93%	89%	40-130%
	13C7-PFUnDA	83%	74%	30-130%
	13C2-PFDoDA	64%	58%	10-130%
	13C2-PFTeDA	46%	44%	10-130%
	13C3-PFBS	98%	102%	40-135%
	13C3-PFHxS	96%	97%	40-130%
	13C8-PFOS	84%	87%	40-130%
	13C8-FOSA	95%	93%	40-130%
	d3-MeFOSA	64%	60%	10-130%
	d5-EtFOSA	56%	53%	10-130%
	d3-MeFOSAA	84%	81%	40-170%
	d5-EtFOSAA	76%	68%	25-135%
	d7-MeFOSE	43%	42%	10-130%
	d9-EtFOSE	56%	54%	10-130%
	13C2-4:2FTS	116%	121%	40-200%
	13C2-6:2FTS	104%	107%	40-200%
	13C2-8:2FTS	100%	94%	40-300%
	13C3-HFPO-DA	93%	99%	40-130%

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17284-MS	6Q49140.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759
OP17284-MSD	6Q49141.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759
FC35520-4	6Q49139.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	FC35520-4 ug/kg	Q	Spike ug/kg	MS ug/kg	MS %	Spike ug/kg	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
375-22-4	Perfluorobutanoic acid	ND		4.44	3.9	88	4.39	3.8	87	3	70-140/17
2706-90-3	Perfluoropentanoic acid	ND		4.44	3.9	88	4.39	4.0	91	3	60-150/26
307-24-4	Perfluorohexanoic acid	0.34		4.44	4.3	89	4.39	4.0	83	7	65-140/23
375-85-9	Perfluoroheptanoic acid	ND		4.44	4.0	90	4.39	3.7	84	8	65-145/21
335-67-1	Perfluorooctanoic acid	3.0		4.44	5.7	61*	4.39	6.3	75	10	70-150/23
375-95-1	Perfluorononanoic acid	ND		4.44	4.1	92	4.39	3.9	89	5	70-155/24
335-76-2	Perfluorodecanoic acid	ND		4.44	4.1	92	4.39	3.9	89	5	70-155/26
2058-94-8	Perfluoroundecanoic acid	ND		4.44	4.1	92	4.39	4.2	96	2	70-155/26
307-55-1	Perfluorododecanoic acid	ND		4.44	3.9	88	4.39	4.2	96	7	70-150/25
72629-94-8	Perfluorotridecanoic acid	ND		4.44	3.8	86	4.39	4.0	91	5	65-150/26
376-06-7	Perfluorotetradecanoic acid	ND		4.44	4.4	99	4.39	4.5	103	2	65-150/24
375-73-5	Perfluorobutanesulfonic acid	0.13	J	4.44	4.3	94	4.39	4.4	97	2	65-145/25
2706-91-4	Perfluoropentanesulfonic acid	0.25		4.44	4.2	89	4.39	4.3	92	2	55-160/29
355-46-4	Perfluorohexanesulfonic acid	3.9		4.44	5.9	45*	4.39	6.8	66	14	60-150/28
375-92-8	Perfluoroheptanesulfonic acid	0.86		4.44	5.0	93	4.39	4.7	87	6	65-155/27
1763-23-1	Perfluorooctanesulfonic acid	12.2		4.44	11.6	-14* [a]	4.39	11.4	-18* [a]	2	65-160/27
68259-12-1	Perfluorononanesulfonic acid	ND		4.44	4.1	92	4.39	4.5	103	9	55-140/27
335-77-3	Perfluorodecanesulfonic acid	ND		4.44	4.1	92	4.39	4.2	96	2	40-155/31
79780-39-5	Perfluorododecanesulfonic aci	ND		4.44	4.2	95	4.39	4.4	100	5	25-160/40
757124-72-4	4:2-FTS	ND		4.44	3.8	86	4.39	3.8	87	0	60-150/27
27619-97-2	6:2-FTS	ND		4.44	4.3	97	4.39	4.5	103	5	55-200/50
39108-34-4	8:2-FTS	ND		4.44	4.1	92	4.39	4.5	103	9	70-150/27
754-91-6	PFOSA	ND		4.44	3.9	88	4.39	4.1	93	5	70-140/19
31506-32-8	MeFOSA	ND		4.44	4.2	95	4.39	4.2	96	0	70-155/26
4151-50-2	EtFOSA	ND		4.44	4.1	92	4.39	4.1	93	0	70-140/19
2355-31-9	MeFOSAA	ND		4.44	3.6	81	4.39	3.7	84	3	65-155/31
2991-50-6	EtFOSAA	ND		4.44	4.0	90	4.39	4.2	96	5	65-165/31
24448-09-7	MeFOSE	ND		4.44	4.0	90	4.39	4.0	91	0	70-140/19
1691-99-2	EtFOSE	ND		4.44	4.1	92	4.39	3.8	87	8	70-135/17
13252-13-6	HFPO-DA (GenX)	ND		4.44	3.8	86	4.39	4.2	96	10	70-145/25
919005-14-4	ADONA	ND		4.44	3.6	81	4.39	4.4	100	20	70-160/26
377-73-1	PFMPA	ND		4.44	4.0	90	4.39	3.9	89	3	30-140/25
863090-89-5	PFMBA	ND		4.44	4.0	90	4.39	4.1	93	2	60-150/33
151772-58-6	NFDHA	ND		4.44	3.7	83	4.39	3.7	84	0	60-155/27
756426-58-1	9Cl-PF3ONS (F-53B Major)	ND		4.44	3.9	88	4.39	4.3	98	10	70-150/23
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	ND		4.44	3.8	86	4.39	4.6	105	19	45-160/31

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17284-MS	6Q49140.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759
OP17284-MSD	6Q49141.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759
FC35520-4	6Q49139.D	1	09/02/26	MV	08/31/26	OP17284	S6Q759

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-1, FC36273-2, FC36273-3, FC36273-4

CAS No.	Compound	FC35520-4 ug/kg	Q	Spike ug/kg	MS ug/kg	MS %	Spike ug/kg	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
113507-82-7	PFEESA	ND		4.44	3.7	83	4.39	3.8	87	3	70-140/20
356-02-5	3:3-FTCA	ND		4.44	3.6	81	4.39	3.8	87	5	45-130/32
914637-49-3	5:3-FTCA	ND		4.44	3.7	83	4.39	3.6	82	3	60-130/28
812-70-4	7:3-FTCA	ND		4.44	3.6	81	4.39	3.7	84	3	60-150/39

CAS No.	ID Standard Recoveries	MS	MSD	FC35520-4	Limits
	13C4-PFBA	86%	82%	86%	10-130%
	13C5-PFPeA	87%	83%	82%	35-130%
	13C5-PFHxA	89%	90%	83%	40-130%
	13C4-PFHpA	87%	87%	85%	40-130%
	13C8-PFOA	83%	77%	80%	40-130%
	13C9-PFNA	86%	81%	82%	40-130%
	13C6-PFDA	96%	95%	96%	40-130%
	13C7-PFUnDA	94%	88%	99%	40-130%
	13C2-PFDoDA	93%	86%	93%	40-130%
	13C2-PFTeDA	87%	85%	98%	20-130%
	13C3-PFBS	96%	80%	85%	40-135%
	13C3-PFHxS	94%	73%	82%	40-130%
	13C8-PFOS	89%	80%	87%	40-130%
	13C8-FOSA	95%	85%	91%	40-130%
	d3-MeFOSA	80%	74%	75%	10-130%
	d5-EtFOSA	82%	76%	84%	10-130%
	d3-MeFOSAA	91%	88%	91%	40-135%
	d5-EtFOSAA	94%	86%	93%	40-150%
	d7-MeFOSE	86%	76%	81%	20-130%
	d9-EtFOSE	87%	81%	88%	15-130%
	13C2-4:2FTS	105%	89%	90%	40-165%
	13C2-6:2FTS	99%	81%	85%	40-215%
	13C2-8:2FTS	101%	87%	92%	40-275%
	13C3-HFPO-DA	90%	78%	83%	40-130%

(a) Outside control limits due to high level in sample relative to spike amount.

* = Outside of Control Limits.

Duplicate Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17280-DUP	9Q28932.D	1	09/01/26	MB	08/31/26	OP17280	S9Q527
DA85599-1	9Q28930.D	1	09/01/26	MB	08/31/26	OP17280	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	DA85599-1 ug/l	Q	DUP ug/l	Q	RPD	Limits
375-22-4	Perfluorobutanoic acid	0.013	U	ND		nc	21
2706-90-3	Perfluoropentanoic acid	0.013	U	ND		nc	23
307-24-4	Perfluorohexanoic acid	0.0064	U	ND		nc	24
375-85-9	Perfluoroheptanoic acid	0.0064	U	ND		nc	28
335-67-1	Perfluorooctanoic acid	0.0064	U	ND		nc	27
375-95-1	Perfluorononanoic acid	0.0064	U	ND		nc	28
335-76-2	Perfluorodecanoic acid	0.0064	U	ND		nc	26
2058-94-8	Perfluoroundecanoic acid	0.0064	U	ND		nc	29
307-55-1	Perfluorododecanoic acid	0.0064	U	ND		nc	21
72629-94-8	Perfluorotridecanoic acid	0.0064	U	ND		nc	29
376-06-7	Perfluorotetradecanoic acid	0.0064	U	ND		nc	27
375-73-5	Perfluorobutanesulfonic acid	0.0064	U	ND		nc	23
2706-91-4	Perfluoropentanesulfonic acid	0.0064	U	ND		nc	25
355-46-4	Perfluorohexanesulfonic acid	0.0064	U	ND		nc	27
375-92-8	Perfluoroheptanesulfonic acid	0.0064	U	ND		nc	30
1763-23-1	Perfluorooctanesulfonic acid	0.0229		ND		200*	29
68259-12-1	Perfluorononanesulfonic acid	0.0064	U	ND		nc	29
335-77-3	Perfluorodecanesulfonic acid	0.0064	U	ND		nc	30
79780-39-5	Perfluorododecanesulfonic aci	0.0064	U	ND		nc	35
757124-72-4	4:2-FTS	0.013	U	ND		nc	27
27619-97-2	6:2-FTS	0.113		0.0764		39*	32
39108-34-4	8:2-FTS	0.013	U	ND		nc	33
754-91-6	PFOSA	0.0064	U	ND		nc	22
31506-32-8	MeFOSA	0.013	U	ND		nc	30
4151-50-2	EtFOSA	0.013	U	ND		nc	26
2355-31-9	MeFOSAA	0.013	U	ND		nc	32
2991-50-6	EtFOSAA	0.013	U	ND		nc	28
24448-09-7	MeFOSE	0.013	U	ND		nc	29
1691-99-2	EtFOSE	0.013	U	ND		nc	21
13252-13-6	HFPO-DA (GenX)	0.0064	U	ND		nc	23
919005-14-4	ADONA	0.013	U	ND		nc	23
377-73-1	PFMPA	0.013	U	ND		nc	23
863090-89-5	PFMBA	0.013	U	ND		nc	27
151772-58-6	NFDHA	0.013	U	ND		nc	37
756426-58-1	9Cl-PF3ONS (F-53B Major)	0.013	U	ND		nc	30
763051-92-9	11Cl-PF3OUdS (F-53B Minor)	0.013	U	ND		nc	35

* = Outside of Control Limits.

Duplicate Summary

Job Number: FC36273
Account: LIMNMIAA LimnoTech
Project: GRR Airport

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP17280-DUP	9Q28932.D	1	09/01/26	MB	08/31/26	OP17280	S9Q527
DA85599-1	9Q28930.D	1	09/01/26	MB	08/31/26	OP17280	S9Q527

The QC reported here applies to the following samples: **Method:** EPA 1633A

FC36273-5

CAS No.	Compound	DA85599-1 ug/l	Q	DUP ug/l	Q	RPD	Limits
113507-82-7	PFEESA	0.013	U	ND		nc	25
356-02-5	3:3-FTCA	0.013	U	ND		nc	23
914637-49-3	5:3-FTCA	0.013	U	ND		nc	24
812-70-4	7:3-FTCA	0.013	U	ND		nc	34

CAS No.	ID Standard Recoveries	DUP	DA85599-1	Limits
	13C4-PFBA	99%	102%	10-130%
	13C5-PFPeA	100%	100%	40-130%
	13C5-PFHxA	102%	103%	40-130%
	13C4-PFHpA	100%	103%	40-130%
	13C8-PFOA	99%	103%	40-130%
	13C9-PFNA	89%	88%	40-130%
	13C6-PFDA	86%	88%	40-130%
	13C7-PFUnDA	76%	80%	30-130%
	13C2-PFDoDA	63%	68%	10-130%
	13C2-PFTeDA	55%	67%	10-130%
	13C3-PFBS	101%	101%	40-135%
	13C3-PFHxS	97%	94%	40-130%
	13C8-PFOS	73%	78%	40-130%
	13C8-FOSA	80%	82%	40-130%
	d3-MeFOSA	58%	60%	10-130%
	d5-EtFOSA	53%	58%	10-130%
	d3-MeFOSAA	75%	70%	40-170%
	d5-EtFOSAA	66%	67%	25-135%
	d7-MeFOSE	48%	48%	10-130%
	d9-EtFOSE	63%	66%	10-130%
	13C2-4:2FTS	111%	111%	40-200%
	13C2-6:2FTS	107%	101%	40-200%
	13C2-8:2FTS	92%	89%	40-300%
	13C3-HFPO-DA	94%	91%	40-130%

* = Outside of Control Limits.

Project Specifications

Owner:	Gerald R. Ford International Airport Authority
Project Title:	Natural Treatment System Maintenance, Phase 2
Project #:	C-449 (2250383)

1 TECHNICAL SPECIFICATIONS

SECTION 01 22 00

UNIT PRICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 02, Division 32 and Division 40 Specification Sections, apply to this Section.

1.02 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by Change Order, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.03 PROCEDURES

A. Unit prices include all costs for material, labor, equipment, delivery, installation, insurance, and all other items necessary to complete the item as specified and shown on the drawings.

B. Measurement and Payment: Upon completion of work involving unit prices, submit documentation to establish actual quantity of work provided. A Change Order will be issued in an amount equal to the actual quantity multiplied by the unit price.

C. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

D. Cost for any work not specifically identified on Drawings C-100, C-101, C-103, C-202, C-203, C-204, C-210 and C-501 or Division 02, Division 32 and Division 40 Specification Sections shall be included into the unit price items identified in this section.

E. Loss of material due to handling, stockpiling, washing, transfer or any other cause will not be paid. Cost for lost materials shall be included in the unit prices for each respective item of work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price: Treatment Media (Bid Item #17)

1. Description: Construction of proposed treatment system media. Refer to Sections 02 10 00 - Natural Treatment System and 02 94 10 – Treatment Media.
2. Unit of Measurement: Cubic yard of Treatment Media, compacted (as specified) in place.

B. Unit Price: Insulation Media, Wood Chips (Bid Item #18)

1. Description: Installation of the top layer of expanded lightweight aggregate to as insulation for the Natural Treatment System. Refer to Sections 02 10 00 – Natural Treatment System and 02 90 10 – Treatment Media.
2. Unit of Measurement: Cubic yard of Insulation Media (Wood Chips), compacted (as specified) in place.

C. Unit Price: Course Media (Bid Item #19)

1. Description: Rock or cobble between 3-inches and 6-inches installed between the R-Tanks and excavation limits and other locations as shown on the drawings. Refer to Section 02 10 00, Natural Treatment System.
2. Unit of Measurement: Cubic yard of Course Media, compacted (as specified) in place.

D. Unit Price: Geotextile Fabric (Bid Item #20)

1. Description: Woven geotextile fabric installed as shown on the drawings. Refer to the drawings.
2. Unit of Measurement: Square feet of Geotextile Fabric, along the ground, in place.

E. Unit Price: Gabion Basket (Bid Item #21)

1. Description: Stainless Steel mesh basket to hold “Gabion 3” to 6” Rock”. Refer to Section 02 94 10, Treatment Media.
2. Unit of Measurement: Lineal feet, regardless of width, of Gabion Basket, in place.

F. Unit Price: Gabion 3" to 6" Rock (Bid Item #22)

1. Description: Rock or cobble between 3-inches and 6-inches installed inside gabion baskets as shown on the drawings. Refer to Section 02 94 10, Treatment Media.
2. Unit of Measurement: Cubic yard of Gabion 3" to 6" Rock, compacted (as specified) in place.

G. Unit Price: Splash Pad (Bid Item #23)

1. Description: Construction of 5-foot by 5-foot concrete, 6-inches thick, splash pads at the outlet of each of the distribution pipes as shown on the drawings.

Refer to Sections 02 10 00 – Natural Treatment System and 40 27 00 – Process Piping and Specialties.

2. Unit of Measurement: Each Splash Pad, constructed in place.

H. Unit Price: Piping (Bid Item #24)

1. Description: Piping within Cells 1A, 1B, 1C and 1D of the Natural Treatment System regardless of diameter or material. Refer to Sections 40 27 00 - Process Piping and Specialties, Section 40 27 02 – Process Valves and Operators, and Section 40 80 01 – Process Piping and Leakage Testing.

2. Unit of Measurement: Lineal feet of Piping, along the centerline of the pipe, from center of structure to center of structure, in place.

I. Unit Price: Pipe Coupling (Bid Item #25)

1. Description: The connection between piping described in Item H above and the existing dosing chamber discharge pipe. Refer to Sections 40 27 00 - Process Piping and Specialties, Section 40 27 02 – Process Valves and Operators, and Section 40 80 01 – Process Piping and Leakage Testing.

2. Unit of Measurement: Each Pipe Coupling, constructed in place.

J. Unit Price: R-Tanks Mini (Bid Item #26)

1. Description: Fabricated water storage units with dimensions approximately 28.15-inches wide by 15.75-inches long by 9.45-inch height as shown in the drawings. Refer to Section 02 10 00, Natural Treatment System.

2. Unit of Measurement: Each R-Tank Mini, constructed in place.

K. Unit Price: R-Tanks HD Single (Bid Item #27)

1. Description: Fabricated water storage units with dimensions approximately 28.15-inches wide by 15.75-inches long by 17.32-inch height as shown in the drawings. All R-Tanks will be paid as “Single”. References to other combinations will be interpreted to be multiple “Single” units. Refer to Section 02 10 00, Natural Treatment System.

2. Unit of Measurement: Each R-Tank Single, constructed in place.

L. Unit Price: Media Removal (Bid Item #28)

1. Description: Excavation of existing treatment system soils, transporation to on-airport soil disposal area, placing and compacting soil in disposal area, separation of other pay items from the soil media and preparation of existing soils for placement of other materials. Refer to Sections 02 10 00 - Natural Treatment System and 02 41 00 – Demolition.

2. Unit of Measurement: Cubic yard of Media Removal, as measured from the existing surface to the bottom of the excavation.

M. Unit Price: Piping Removal (Bid Item #29)

1. Description: Removal and disposal, off-airport property, of existing infiltrator. Refer to Section 02 41 00, Demolition.
2. Unit of Measurement: Lineal feet of Piping Removal, along the centerline of the pipe, from end (or removal limits) to end, in place.

N. Unit Price: Infiltrator Removal (Bid Item #30)

1. Description: Removal and disposal, off-airport property, of existing 52” x 34” (approximate) infiltrator sections. Refer to Section 02 41 00, Demolition.
2. Unit of Measurement: Each Infiltrator removed.

O. Unit Price: Smart Drain (Bid Item #31)

1. Description: Fabricated Water Level Control System. Refer to Section 02 10 00, Natural Treatment System.
2. Unit of Measurement: Each Smart Drain, constructed in place.

END OF SECTION

SECTION 02 10 00
NATURAL TREATMENT SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. This item shall consist of the construction and startup of the four natural treatment systems (NTS) beds (inline water level control structures, R-Tank stormwater modules, Treatment Media, and spare parts) in accordance with these specifications and as shown on the Drawings.

1.02 SUBMITTALS

A. Fabricated Water Level Control Structures:

1. Shop Drawings:
   a. Make, model, weight, and dimensions of each unit.
   b. Manufacturer’s catalog information, descriptive literature, specifications, and identification of materials of construction.
   c. Detailed Structural and Mechanical Drawings showing the unit fabrications, including stoplogs and weir. Include dimensions, size, elevations and locations of connections to piping.
2. Quality Control Submittals:
   a. Manufacturer’s Certificate of Compliance.
   b. Special shipping, storage and protection, and handling instructions.
   c. Manufacturer’s written/printed installation instructions.
   d. Operation and maintenance manual.

B. R-Tank Stormwater Modules:

1. Shop Drawings:
   a. Make, model, weight, and dimensions of each unit.
   b. Manufacturer’s catalog information, descriptive literature, specifications, and identification of materials of construction.
2. Quality Control Submittals:
   a. Manufacturer’s Certificate of Compliance.
   b. Special shipping, storage and protection, and handling instructions.
   c. Manufacturer’s written/printed installation instructions.
   d. Operation and maintenance manual.

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C. Measurement and Payment

1. The measurement for natural treatment system shall be unit cost.
2. Payment will be made at the Contract unit cost price for all components of the NTS system and related structures. This price shall fully compensate the Contractor for furnishing all materials and for all preparation, excavation, and installation of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

1.03 MATERIAL REQUIREMENTS

A. American Association of State Highway and Transportation Officials (AASHTO): M 252, High Density Polyethylene Drainage Tubing (all types).

B. ASTM International (ASTM):

1. A240, Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. A276, Stainless Steel Bars and Shapes.
3. B209, Aluminum and Aluminum-Alloy Sheet and Plate.
4. B308, Aluminum-Alloy 6061-T6 Standard Structural Profiles.

1.04 SPARE AND MISCELLANEOUS PARTS

A. Fabricated Water Level Control Structure:

1. Spare parts shall be procured by the Contractor and delivered to the Owner at the completion of the project.
2. Spare Parts include, but are not limited to:
   a. One Complete Unit:
      1) Enclosure.
      2) Solar panel.
      3) CPU.
      4) Modem.
      5) Slide Gate.
      6) Power Actuator.
   b. One additional power actuator.

B. Mechanical Stroke Counter:

1. Mechanical Stroke Counter shall be procured by the Contractor and delivered to the Owner.
2. Mechanical Stroke Counter shall be Durant, Eaton Corporation, Model 5-H-1-2-R with a 5-digit mechanical totalizer display. The counter shall have a key-operated reset.

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PART 2 PRODUCTS

2.01 GENERAL

A. Materials shall meet the requirements shown on the Drawings and specified below.

2.02 FABRICATED WATER LEVEL CONTROL STRUCTURE

A. Materials:

1. Aluminum Plate and Shapes: ASTM B209 and B308, Alloy 6061-T6.
2. Stainless Steel:
   a. Plate, Sheet, and Strip: ASTM A240, Type 316L.
   b. Bars and Shapes: ASTM A276, Type 316L.

B. Water level control structures: The level control structure shall be Smart Drain™ unit constructed by Agri-Drain. The water level control structure is a retrofit using the structure of the existing onsite Agri Drain box with new mechanical equipment. All stop logs shall be removed from the current level control structure, but provided to the Owner.

C. Multi-Level Automated Remote-Control Valve:

1. Agri-Drain system shall include a power and control unit system that is comprised of a solar panel, battery, controller, and weather-proof enclosure to operate the power actuator.
2. Smart Drainage System shall include one power actuator to open and close the slide gate valve in a two-level structure. The structure will have a two-level valve installed with the slide gate valve detailed in the Drawings covered by manual stoplogs.
3. Power actuator:
   a. Material: all aluminum frame and extension tube.
   b. Input voltage: 12V dc, 24V dc.
   c. Dynamic load range: 34 lbs to 225 lbs.
   d. Maximum static load: 562 lbs.
   e. Standard present limit switches at both ends of stroke.
   f. Accessories:
      1) Mounting brackets.
      2) Direction reversing switches.
      3) Wired and wireless controllers.
      4) Direction reversing relays.

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D. Smart Drain System Operating Protocols:

1. Primary operating protocol is based on a set water level elevation that triggers the actuated valve to open for a set period of time. The water level elevation trigger and the period of time for the valve to open shall be changeable from offsite remote Web site program during startup and normal operations of the system.
2. Secondary operating protocol is based on a set time from last valve opening instead of an elevation based action. Programming of the controller will trigger secondary operating protocol if the water level does not trigger the primary operating protocol regularly. The Contractor to coordinate programming with the manufacturer to include the following on the screen of the onsite controller:
    a. Visualization of the parameter showing amount of time between openings.
    b. Option to change the amount of time between openings in hours.

2.03 R-TANK STORMWATER MODULE

A. Materials:

1. Heavy-Duty (HD) Single Module:
    a. Height: 17.32 inches.
    b. Length: 28.15 inches.
    c. Width: 15.75 inches.
    d. Void Area: Internal 95 percent and surface area of 90 percent.
    e. Vertical compressive strength: 33.4 psi.
    f. Recycled Content: 100 percent recycled polypropylene.
2. Heavy-Duty Mini (HD-Mini) Module:
    a. Height: 9.45 inches.
    b. Length: 28.15 inches.
    c. Width: 15.75 inches.
    d. Void Area: Internal 95 percent and surface area of 90 percent.
    e. Vertical compressive strength: 33.4 psi.
    f. Recycled Content: 100 percent recycled polypropylene.

B. Stormwater Modules: The stormwater modules shall be constructed of recycled polypropylene designed with 90 percent surface area void available for infiltration and 95 percent void area for treated water collection and transfer.

C. The Contractor is responsible for properly securing the R-Tank modules in place per the manufacturer’s recommendations.

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D. Geotextile: An 8-ounce geotextile will be installed below and above the stormwater modules to prevent material from entering into the void area. Geotextile will be installed as shown on the Drawings. No geotextile will be installed on either side of the stormwater modules. Any geotextile found to be on the side of the stormwater media will require removal by the Contractor. Geotextile shall also be installed over the gabions to prevent surface media from falling into the void area of the gabions. No geotextile shall be placed on top of treatment media.

2.04 TREATMENT MEDIA

A. Refer to Specification 02 94 10, Treatment Media for the specifications on the treatment media installed around and above the R-Tank systems

PART 3 EXECUTION

3.01 GENERAL

A. The construction of the NTS beds requires that the Contractor comply with the methods and sequence of construction, as specified below and in the Drawings. Alternative methods, materials, and sequences must be approved by the Engineer.

3.02 FABRICATED WATER LEVEL CONTROL STRUCTURE (AGRI-DRAIN)

A. Installation: The Smart Drain™ unit shall be installed in the existing Agri Drain structure onsite according to the manufacturer’s installation requirements and as shown on the Drawings.

3.03 R-TANK STORMWATER MODULE

A. Site Preparation: The geomembrane will be installed below the stormwater modules before installation begins.

B. Installation:

1. R-tank stormwater modules shall be assembled prior to installation in the treatment system per manufacturer’s guidelines and recommendations.
2. R-Tank stormwater modules shall be installed per the manufacturer’s recommended installation guide. Occasional minor gaps or variation in the heigh of between units (less than 1/2-inches) are acceptable, but reasonable efforts should be made to minimize these variations. If gaps or height variations persist through three or more adjacent units, remove the modules and repair the base.

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3. A single HD unit and a single HD-Mini unit will be stacked to achieve the desired treatment system height and void area necessary to drain the system effectively. Stacking and location of the R-tanks shall be installed as shown on the Drawings and per direction of the manufacturer. Stormwater modules shall be installed only at the base of the treatment system and not up the berm slopes.
4. Coarse media, as described in Section 02 94 10, Treatment Media, shall be installed on the side of the stormwater modules between the stormwater modules and the berms.
5. Place the geotextile, as shown on the Drawings, at the top of the R-Tank stormwater modules to prevent media from falling into the stormwater modules. Do not install geotextile on the sides of the R-Tank stormwater modules.

3.04 TREATMENT MEDIA

A. Contractor to install the treatment media as specified in Section 02 94 10, Treatment Media.

B. Contractor shall prevent treatment media from entering the R-Tanks and gabion baskets during installation.

3.05 CONSTRUCTION SEQUENCING PLAN

A. Before starting construction, the Contractor shall submit a construction schedule showing the proposed order of work and indicate the anticipated completion time of the work items. The schedule shall be a definitive account of the work that is to be accomplished within the time indicated and shall be updated weekly to reflect actual work progress. In the event that the proposed schedule does not meet the schedule criteria set forth by the Engineer, the Contractor shall resubmit a revised schedule for approval. The construction schedule shall be utilized as a sequencing reference for the progress of construction operations and may, at the sole discretion of the Engineer, be employed by the Engineer in determining delays and time extensions but does not become a part of the Contract.

B. The Contractor shall make no change in the construction schedule at any time, without prior approval of the Engineer. Notify the Engineer immediately of conflicts requiring schedule review.

C. The Engineer’s review of schedule shall not imply changes in Contract for services. The Contractor is responsible to notify the Engineer of Contract Implications or changes that arise from alterations of construction schedule.

END SECTION

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SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI): A10.6, Safety Requirements for Demolition Operations.
2. Occupational Safety and Health Administration (OSHA), U.S. Code of Federal Regulations (CFR) Title 29 Part 1926—Occupational Safety and Health Regulations for Construction.
3. Environmental Protection Agency (EPA), U.S. Code of Federal Regulations (CFR), Title 40:
    a. Part 61—National Emission Standards for Hazardous Air Pollutants.
    b. Part 82—Protection of Stratospheric Ozone.
    c. Part 273—Standards for Universal Waste Management.

1.02 DEFINITIONS

A. Demolition: Includes removal of pipes, manholes tanks, conduit, and other underground facilities, whether as a separate activity or in conjunction with construction of new facilities.

B. Modify: Provide all necessary material and labor to modify an existing item to the condition indicated or specified.

C. Relocate: Remove, protect, clean and reinstall equipment, including electrical, instrumentation, and all ancillary components required to make the equipment fully functional, to the new location identified on the Drawings.

D. Salvage/Salvageable: Remove and deliver, to the specified location(s), the equipment, materials, or other items so identified to be saved from destruction, damage, or waste; such property to remain that of the Owner. Unless otherwise specified, title to items identified for demolition shall revert to the Contractor.

1.03 SUBMITTALS

A. Informational Submittals:

1. Submit proposed demolition, in accordance with requirements specified herein, for approval before such Work is started.

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2. Submit copies of any notifications, authorizations and permits required to perform the Work.

1.04 REGULATORY AND SAFETY REQUIREMENTS

A. When applicable, demolition Work shall be accomplished in strict accordance with 29 CFR 1926-Subpart T.

B. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the General Conditions, Contractor's safety requirements shall conform to ANSI A10.6.

C. Furnish timely notification of this demolition project to applicable federal, state, regional, and local authorities in accordance with 40 CFR 61-Subpart M.

D. Removed pipe requires regulatory testing prior to disposal. Owner will perform the required testing. Contractor shall designate and maintain area onsite for staging and storage of removed pipe following demolition. Contractor shall store the pipe in the designated area and shall not dispose of the pipe until the Owner has completed testing and authorized disposal.

1.05 SEQUENCING AND SCHEDULING

A. Include the Work of this specification in the progress schedule.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXISTING FACILITIES TO BE DEMOLISHED OR RENOVATED

A. Utilities and Related Equipment:

1. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Engineer.
2. When utility lines are encountered that are not indicated on the Drawings, notify the Owner prior to further work in that area.

B. Paving and Slabs: Remove concrete and asphaltic concrete paving and slabs as indicated. Provide neat sawcuts at limits of pavement removal as indicated.

3.02 PROTECTION

A. Dust and Debris Control: Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to vehicular traffic.

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B. Traffic Control Signs: Where pedestrian and driver safety is endangered in the area of removal Work, use traffic barricades with flashing lights.

C. Existing Work:

1. Survey the Site and examine the Drawings and specifications to determine the extent of the Work before beginning any demolition or renovation.
2. Take necessary precautions to avoid damage to existing items scheduled to remain in place, to be reused, or to remain the property of the Owner; any Contractor-damaged items shall be repaired or replaced as directed by the Engineer.
3. Ensure that structural elements are not overloaded as a result of or during performance of the Work. Responsibility for additional structural elements or increasing the strength of existing structural elements as may be required as a result of any Work performed under this Contract shall be that of the Contractor. Repairs, reinforcement, or structural replacement must have the Engineer approval.
4. Do not overload pavements to remain.

D. Trees: Protect trees within the Site that might be damaged during demolition and are indicated to be left in place, by a 6-foot-high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the Work shall be replaced in kind, as approved by the Engineer.

E. Facilities:

1. Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.
2. Protect all facility elements not scheduled for demolition.

F. Protection of Personnel:

1. During demolition, continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site.
2. Provide temporary barricades and other forms of protection to protect the Owner’s personnel and the general public from injury due to demolition Work.

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3.03 BURNING

A. The use of burning at the Site for the disposal of refuse and debris will not be permitted.

3.04 RELOCATIONS

A. Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Clean all items to be relocated prior to reinstallation, to the satisfaction of the Engineer. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the Engineer.

3.05 BACKFILL

A. Do not use demolition debris as backfill material.

3.06 TITLE TO MATERIALS

A. All salvaged equipment and materials will remain the property of the Owner.

3.07 DISPOSITION OF MATERIAL

A. Salvage equipment and material to the maximum extent possible.

B. Remove materials and equipment that are indicated to be removed by the Contractor and deliver to a storage site as directed.

C. Pipe Material: Contractor shall stage and store removed pipe in the designated onsite storage area pending testing by Owner. Do not remove or dispose of pipe from the Project Site until Owner has completed testing and authorized disposal.

D. Remove salvaged items in a manner to prevent damage, and pack or crate to protect the items from damage while in storage or during shipment. Properly identify containers as to contents.

E. Repair or replace, at the discretion of the Engineer, items damaged during removal or storage.

F. Remove salvaged items designated as the property of the Owner in a manner to prevent damage, and pack or crate to protect the items from damage while in storage or during shipment. Properly identify containers as to contents.

G. Repair or replace, at the discretion of the Engineer, items damaged during removal or storage.

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H. Deliver salvaged items that are designated as the property of the Owner to a storage site as directed on the Site.

I. The Owner will not be responsible for the condition or loss of, or damage to, property scheduled to become the Contractor's property after the Engineer's authorization to begin demolition. Materials and equipment shall not be viewed by prospective purchasers or sold on the Site.

J. The Owner will not be responsible for the condition or loss of, or damage to, such property after the Engineer's authorization to begin demolition.

K. Store salvaged items as approved by the Engineer and remove them from the Owner's property before completion of the Contract. Materials and equipment shall not be either viewed by prospective purchasers or sold on the Site.

3.08 REUSE OF MATERIALS AND EQUIPMENT

A. Properly store and maintain equipment and materials in same condition as when removed.

B. Store equipment and material designated to be reused in a location designated by the Owner.

C. Equipment and material designated to be reused shall be cleaned, serviced and checked for proper operability before being put back into service.

D. The Engineer will determine condition of equipment and materials prior to removal.

3.09 SPECIALIZED SALVAGE

A. Historical Items: Remove in a manner to prevent damage.

3.10 UNSALVAGEABLE MATERIAL

A. Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of in the following manner and location.

1. Designated by the Owner.

B. Combustible material shall be disposed of off the Site.

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3.11 CLEANUP

A. Debris and rubbish shall be removed from excavations. Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

END OF SECTION

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SECTION 02 94 10
TREATMENT MEDIA

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Work shall consist of procuring materials, material blending, testing, and placement of the aggregate media into the rehabilitated treatment cells intended to provide water quality treatment of surface water runoff and deicing fluid from the Gerald R. Ford International Airport (GFIA) as shown on the Drawings. The Work included in this section consists of the following:

1. Aggregate media material acquisition.
2. Testing and analysis for specification conformance.
3. Preparation of treatment media mix and testing for conformance.
4. Installation and placement of aggregate media.
5. Final in-place testing of aggregate media.
6. Clean-up.

B. Definitions:

1. Woodchips: Coarse sawmill woodchips free of fines used to insulate the treatment system.
2. Treatment Media: A homogeneous washed aggregate media free of fines used for the treatment of stormwater and deicing fluid.
3. Coarse Media: Washed aggregate media free of fines used to fill the area between R-tanks and cell berms, and between the ends of the gabion course and berms.

C. Qualifications and Quality Assurance:

1. Analysis and Testing of Materials Qualifications: For each type of packaged material required for the Work of this section, provide manufacturer’s certified analysis. For all other materials, provide complete analysis by a recognized laboratory made in strict compliance with the standards and procedures of the following:
   a. American Society of Testing Materials (ASTM).
   b. American Association of State Highway and Transportation Officials (AASHTO).
   c. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

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2. Quality Assurance Qualifications: Work and materials shall meet the standards of the following references:
    a. American Society for Testing Materials (ASTM).
    b. American Association of State Highway and Transportation Officials (AASHTO).
    c. Environmental Protection Agency (EPA).
    d. Code of Federal Regulations (CFR) – 40 CFR Part 261 Subpart C.
    e. Michigan Department of Transportation (MDOT).
    f. Michigan Department of Environment, Great Lakes, and Energy (EGLE).
3. Installer Qualifications: A qualified installer whose work has resulted in successful installation of filter media systems.
    a. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project Site who has at least 5 years' experience with projects of similar scale and complexity.
    b. The Contractor shall have experience in the proper and safe transportation and installation of filter media material.
    c. The Contractor shall have adequate supervision, staff, equipment and experience needed to complete a project of this magnitude.
    d. The Contractor shall prepare and present to the Engineer required media material submittals, and their associated specified test results a minimum of 2 weeks prior to the scheduled Treatment Media, Woodchip Media and Coarse Media installation.
    e. The Contractor shall have at least 3 to 5 years' experience in installing media.
4. Media Mixing Contractor Qualifications:
    a. Shall be able to provide aggregate media mixes that meet the specifications within tolerances assigned. Treatment Media and all ingredients should be both stored in a way that prevents foreign material from entering the washed media.
    b. Shall be able to produce enough consistently uniform Treatment Media material for the Project to meet the scheduled demands.
    c. The Treatment Media blending vendor/contractor shall have at least 3 to 5 years of aggregate media blending experience.
5. Testing Laboratory Qualifications: An independent, state-operated, or university-operated laboratory; experienced in aggregate media testing; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
    a. Employ a qualified independent testing and inspection laboratory acceptable to the Engineer and Owner to perform tests and certifications indicated. Alternative agencies must be submitted to the Engineer for approval prior to use.
    b. It is the responsibility of the Contractor in conjunction with the Treatment Media, Woodchip, and Coarse Media Supplier to submit materials for the tests.

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c. Tests shall be made in strict compliance with the standards of the Association of Official Analytical Chemists and follow standards from ASTM, ASHTO, EPA, and/or Methods of Soil Analysis.

D. Pre-installation Meetings:

1. Pre-installation conference: Conduct conference virtually or onsite prior to commencement of construction activities with the Engineer and the Owner.
2. All submittals, testing, and materials shall be completed and approved by the Engineer prior to the pre-installation conference.

E. Submittals and Testing:

1. Sampling, Testing and Acceptance:
   a. General: Perform tests on the media samples according to requirements in this article. Only media conforming to specifications stated herein shall be permitted to be used by the Contractor.
   b. Sampling: Samples will be taken of any stockpiled media per requirements of the *Procedures for Aggregate Inspection* manual produced by MDOT, latest version available.
   c. Testing: All composite samples shall have a sieve analysis performed in accordance with ASTM C136 to determine d10, UC, percent fines, and gradation of the specified media. Sieve analyses shall be performed by an independent materials testing laboratory acceptable to the Engineer. This should not constrain the Contractor from performing additional sieve analyses at the production site to ensure good quality control. The Contractor shall pay for testing composite samples specified herein. Retesting of material that had been previously rejected or additional QA/QC testing performed by the Supplier shall also be paid for by the Contractor. The first composite sample shall also be analyzed for specific gravity in accordance with ASTM C127. These analyses shall be performed by an independent materials testing laboratory acceptable to the Engineer. In lieu of an independent testing laboratory, the Engineer may allow testing to be completed by the Supplier’s laboratory. The Contractor shall pay for these tests. Retesting of material that had previously been rejected shall also be paid for by the Contractor.
   d. The submittal package shall include color photographs of the proposed woodchips and clean aggregate materials. Photographs shall clearly depict the material type, quality, gradation, and stockpile conditions. Additional supporting documentation, including product data sheets and material specifications, shall be provided to demonstrate compliance with project requirements.

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e. Acceptance and Rejection: Materials that have been prequalified and passed each and every part of the applicable requirements of this section, as verified by the Engineer, will be allowed to be hauled to the Construction Site for placement in preparation for construction of the media beds. No material shall be hauled to the Site that have not been verified as having passed all testing criteria. Should a run of material fail to meet all applicable requirements, the Contractor may, upon approval from the Engineer, reprocess the material in question to meet the specifications. Retesting of such material shall be the sole responsibility of the Contractor.

f. Materials that have been improperly handled or stockpiled, as per the specifications, will be rejected and not paid for by the Owner.

2. At least 10 working days prior to blending of each media, the Contractor shall submit to the Engineer the following data. These data are required even if using pre-approved material. The dates of the tests shall be within 45 days of blending and be taken from the same stockpile, batch or source as will be used in the blending. All testing shall be by a certified laboratory.

   a. Treatment Media Product Data and Testing:
      1) Source certificate or manufacturer cut sheet showing the source for and description of the material.
      2) Grain Size Analysis and Coefficient of Uniformity (Cu) results performed by an independent certified laboratory in accordance with ASTM D422, Standard Test Method for Particle-Size Analysis of Soils for at least the sieves shown in descriptions in Section II B.1.
      3) Material density in lbs./CF or lbs./CY.
      4) The Grain Size Analysis and Coefficient of Uniformity (Cu) testing shall be performed on the washed Treatment Media at least once for every 50 CY of media produced.

   b. Woodchip Product Data and Testing:
      1) Include recommendations for application and use.
      2) Include test data substantiating that products comply with requirements.

   c. Coarse Media Product Data and Testing:
      1) Include recommendations for application and use.
      2) Include test data substantiating that products comply with requirements.
      3) Include sieve analyses for media materials.
      4) Include test data substantiating insulating rating to comply with requirements.

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d. Material Certificates: For each type of imported media before delivery to the Site, according to the following:
    1) Manufacturer's qualified testing agency's certified analysis of standard products.
    2) Analysis of nonstandard materials, by a qualified testing agency.

3. Information Submittals:
    a. The Contractor must submit a “Media Blending, Delivery, Protection, and Placement Plan”. The submittal must be approved by the Engineer prior to any blending of the Treatment Media.
        1) Media Blending, Delivery, Protection, and Placement Plan shall include, but not limited to, (1) the location of media storage onsite, (2) equipment used to place the media including load ground pressure information, and (3) sequencing of media placement
    b. Qualification Data: For each testing agency.
    c. Laboratory Information: Include the following information for the laboratories used for the material testing:
        1) Name of Lab.
        2) Address.
        3) Phone Number.
        4) Contact person with email.
        5) Date of current certification by ASTM, AASHTO, MDOT, or EGLE.
    d. Field quality-control reports.

F. Delivery, Storage and Handling:

1. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws, if applicable.
2. Bulk Materials:
    a. Do not dump or store bulk materials near structures, utilities, walkways and pavement, or on existing turf areas or plants outside of the designated stockpile area.
    b. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
    c. Do not move or handle materials when they are wet or frozen.
3. Hauling Materials:
    a. Do not haul over surfacing in process of construction.
    b. Loads: Of uniform capacity.
    c. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.

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d. Hauling of accepted media from the point of production to the construction site shall be in trucks with cleaned beds free of any other material that are being used for no other purpose than to transport Treatment Media, Woodchips, or Coarse Media. Trucks that have been hauling other rock or sand materials shall be thoroughly washed prior to loading with media.
e. Under no circumstances shall loaders and trucks that have been used to haul dirt, sludge, debris, stumps, vegetative, or other organic-based materials be allowed to haul Treatment Media, Woodchips, or Coarse Media, unless approved by the Engineer. The Engineer may elect to allow loaders/trucks which have hauled such material to be used, provided that the truckbed is thoroughly washed and cleaned to the Engineer's satisfaction.
f. Should a load of material be delivered to the Site by the Supplier in a truckbed that does not meet the above criteria, the entire load will be rejected and shall be removed immediately. The Contractor shall bear all costs associated with removal. Any and all rejected material shall not be used even after reprocessing/washing.
g. Trucks hauling specified media to the Construction Site shall follow specific traffic routes to help preclude excessive pickup of foreign materials that may contaminate the specified media. The traffic routes will be established by the Contractor and may be reviewed by the Owner or Engineer.
h. Temporary stockpiling of Treatment Media, Woodchips, or Coarse Media will be allowed only if material is covered and kept clean from other site debris. The stockpile areas shall be well drained and sloped and bermed as necessary to preclude contact with storm runoff and drainage from other material stockpiles and equipment areas. To the maximum extent practicable, stockpiles shall be placed so as to avoid contamination from vehicles, stationary equipment, and excessive dust or other airborne contaminants.
i. The Contractor shall clearly delineate and identify all specified media stockpiling areas onsite.

4. Handling and Spreading Materials:
   a. Distribute material to provide required density, depth, grade, and dimensions with allowance for subsequent lifts.
   b. Produce even distribution of material upon roadway or prepared surface without segregation.
   c. Use low ground pressure spreading equipment with a maximum ground pressure of 5 psi.

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PART 2 PRODUCTS

A. Treatment Media

1. Treatment Media shall be mineral aggregate and meet the gradation requirements below and be thoroughly cleaned and free of dirt, clay, silt, asphalt, organic material, or other foreign matter and all aggregate passing the No. 4 sieve size. Treatment Media is described as MDOT 17A aggregate with a final screening over a 3/8-inch screen. The following treatment media description meets MDOT 17A for all categories except No. 4 where standard gradation allows up to 8 percent passing.

US Sieve Size	Sieve Size (mm)	Percent Passing by Weight
1-inch	25.0	100
3/4-inch	19.0	90-100
1/2-inch	12.5	50-75
3/8-inch	9.5	20-50
1/4-inch	6.3	0.5-20
No. 4	4.75	<1*

*Note: No. 4 gradation is stricter percent passing than MDOT 17A.

2. Treatment Media shall be thoroughly washed and free of dirt, clay, silt, asphalt, organic material, or other foreign matter. Loss by washing shall be less than 1 percent.

B. Woodchips:

1. Woodchips shall consist of knife-produced, screened, coarse sawmill woodchips manufactured from clean virgin wood. Chips shall be predominantly blocky in shape and conform to ISO 17225-4 Class P45S or P63S featuring sizes ranging from 1 centimeter to 5 centimeters in size.
2. Shredded wood, mulch, hog fuel, tub-ground material, arborist chips, brush chips, and materials containing leaves, needles, or other non-woody vegetative matter are not acceptable.
3. Woodchips shall be thoroughly screened and free of dirt, clay, silt, asphalt, organic material, or other foreign matter.

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C. Coarse Media: Coarse Media shall be rock or cobble and be between 3 and 6 inches according to AASHTO No. 1 standards and be thoroughly cleaned and free of dirt, clay, silt, asphalt, organic material, or other foreign matter and all aggregate passing the No. 4 sieve size.

PART 3 EXECUTION

A. General:

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, asphalt/concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, solid waste, or acid has been deposited in the Treatment Media, Woodchips or Coarse Media.
2. Proceed with placement only after unsatisfactory conditions have been corrected and approved by the Engineer.
3. Finish Grading: Grade Woodchips, Treatment Media, and Coarse Media to a loose, uniform surface plane as smooth as media size will allow. Do not compact media. Roll and rake, remove ridges, and fill depressions to meet finish grades.

B. Equipment:

1. Non-compacting Equipment: Contractor shall use equipment that prevents compaction of the media and, if required to travel over the media, shall not exceed 5 psi loading ground pressure.

C. Construction Courses:

1. Media (all sizes):
    a. Maximum Completed Lift Thickness: 6 inches for treatment media and surface media, 12 inches for coarse media.
    b. Completed Course Total Thickness: As shown on the Drawings.
    c. Spread lift on preceding course to required cross-section.
    d. Blade or broom surface to maintain true line, grade, and cross-section.
    e. Contractor shall use means of course construction that do not exceed 5 psi loading ground pressure.

D. Protection:

1. Protect areas of in-place media from compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
    a. Storage of construction materials, debris, or excavated material.
    b. Parking vehicles or equipment.

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c. Vehicle traffic.
d. Foot traffic.
e. Impoundment of water.
f. Excavation or other digging unless otherwise indicated.
g. Divert stormwater runoff from in-place media until vegetation is established or other adequate stabilization is in place. Engineer approval required.

2. If either media is compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the media and contamination; restore the subgrade as directed by Engineer and replace contaminated Treatment Media, Woodchips, or Coarse Media with new media.

E. Cleaning:

1. Protect areas adjacent to media preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
2. Remove surplus media and waste material including excess media, unsuitable materials, trash, and debris and legally dispose of them off the Owner's property unless otherwise indicated.
   a. Dispose of excess subsoil, media, and unsuitable materials onsite where directed by the Owner.

END OF SECTION

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SECTION 40 27 00
PROCESS PIPING AND SPECIALTIES

PART 1 GENERAL

1.01 REFERENCES

A. American Society of Testing and Materials International (ASTM).

1.02 DEFINITIONS

A. Submerged or Wetted:

1. Zone below elevation of: Detention Basin Emergency Spillway (EL 749).

1.03 DESIGN REQUIREMENTS

A. Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

1. Buried Piping: H20-S16 traffic load with 1.5 impact factor, AASHTO HB-17, as applicable.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Fabricated Piping: Layout drawing showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.
2. Pipe Wall Thickness: Identify wall thickness and rational method or standard applied to determine wall thickness for each size of each different service including exposed, submerged, buried, and concrete-encased installations for Contractor-designed piping.

B. Informational Submittals:

1. Manufacturer’s Certification of Compliance:
   a. Pipe and fittings.
2. Nondestructive inspection and testing procedures.
3. Laboratory Testing Equipment: Certified calibrations, manufacturer’s product data, and test procedures.

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1.05 DELIVERY, STORAGE, AND HANDLING

A. Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.

B. Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps.

C. Linings and Coatings: Prevent excessive drying.

D. Cold Weather Storage: Locate products to prevent coating from freezing to ground.

E. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

PART 2 PRODUCTS

2.01 PIPING

A. As specified on Piping Data Sheet(s) and Piping Schedule located at the end of this section as Supplement.

B. Diameters Shown:

1. Standardized Products: Nominal size.

2.02 JOINTS

A. Mechanical connections of high-density polyethylene pipe to auxiliary equipment such as valves, and other piping systems shall be through flanged connections consisting of the following:

1. A polyethylene stub end thermally butt-fused to end of pipe.
2. Steel backing flange, 125-pound, ASME B16.1 standard.
3. Bolts and nuts of sufficient length to show a minimum of three complete threads when joint is made and tightened to manufacturer’s standard. Retorque nuts after 4 hours.
4. Gaskets as required.

2.03 GASKET LUBRICANT

A. Lubricant shall be supplied by pipe manufacturer and no substitute or “Or-equal” will be allowed.

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2.04 RESTRAINT COUPLING

A. Restraint coupling shall be a wide range restraint coupling with the following specifications:

1. Romac Industries, Inc. Alpha Wide Range Restraint Coupling, “Or-equal.”
2. Sized to meet specifications of the inflow pipe from the siphon box and the distribution piping, as shown in the Drawings.
3. Material: Type 304 or Type 316 Stainless Steel

2.05 VENT AND DRAIN VALVES

A. Pipeline 2-Inch Diameter and Smaller: 1/2-inch vent, 1-inch drain, unless shown otherwise.

B. Pipelines 2-1/2-Inch Diameter and Larger: 3/4-inch vent, 1-inch drain, unless shown otherwise.

2.06 FABRICATION

A. Mark each pipe length on outside with the following:

1. Size or diameter and class.
2. Manufacturer’s identification and pipe serial number.
3. Location number on laying drawing.
4. Date of manufacture.

B. Code markings according to approved Shop Drawings.

2.07 FINISHES

A. Factory prepare, prime, and finish coat in accordance with Pipe Data Sheet(s) and Piping Schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.

B. Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings.

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3.02 PREPARATION

A. Notify the Engineer at least 2 weeks prior to field fabrication of pipe or fittings.

B. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

C. Damaged Coatings and Linings: Repair using original coating and lining materials in accordance with manufacturer's instructions.

3.03 INSTALLATION—GENERAL

A. Join pipe and fittings in accordance with manufacturer's instructions, unless otherwise shown or specified.

B. Remove foreign objects prior to assembly and installation.

C. Flanged Joints:

1. Install perpendicular to pipe centerline.
2. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
3. Use torque-limiting wrenches to ensure uniform bearing and proper bolt tightness.
4. Plastic Flanges: Install annular ring filler gasket at joints of raised-face flange.
5. Grooved Joint Flange Adapters: Include stainless steel washer plates as required for mating to serrated faces and lined valves and equipment.
6. Raised-Face Flanges: Use flat-face flange when joining with flat-faced ductile or cast iron flange.
7. Verify compatibility of mating flange to adapter flange gasket prior to selecting grooved adapter flanging.
8. Flange fillers are to be avoided, but if necessary, may be used to make up for small angles up to 6 degrees and for filling gaps up to 2 inches between flanges. Stacked flange fillers shall not be used.
9. Threaded flanged joints shall be shop fabricated and delivered to Site with flanges in-place and properly faced.
10. Manufacturer: Same as pipe manufacturer.

D. Threaded and Coupled Joints:

1. Conform to ASME B1.20.1.
2. Produce sufficient thread length to ensure full engagement when screwed home in fittings.

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3. Countersink pipe ends, ream and clean chips and burrs after threading.
4. Make connections with not more than three threads exposed.
5. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.

E. Grooved-End Joints:

1. Piping shall be grooved in accordance with the manufacturer's latest published instructions and shall be accurately cut with tools conforming to coupling manufacturer's standards and to AWWA C606.
2. Install grooved joint couplings and gaskets in accordance with manufacturer's latest published installation instructions.

F. High-Density Polyethylene Piping:

1. Join pipes, fittings, and flange connections by means of thermal butt-fusion.
2. Perform butt-fusion in accordance with pipe manufacturer's recommendations as to equipment and technique.
3. Special Precautions at Flanges: Polyethylene pipe connected to heavy fittings, manholes, and rigid structures shall be supported in such a manner that no subsequent relative movement between polyethylene pipe at flanged joint and rigid structures is possible.

G. Restraint Coupling:

1. Confirm outer diameters of pipes to be joined by restraint coupling are within coupling range of applicability
2. Join pipes according to the manufacturer's recommendations as to technique

3.04 INSTALLATION—EXPOSED PIPING

A. Piping Runs: Parallel and perpendicular to floor of structures, unless shown otherwise.

B. Group piping wherever practical at common elevations.

C. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection; install to allow for contraction and expansion without stressing pipe, joints, or connected equipment.

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D. Piping clearance, unless otherwise shown:

1. From Adjacent Work: Minimum 1 inch from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

3.05 INSTALLATION—BURIED PIPE

A. Joints:

1. Dissimilar Buried Pipes: Provide concrete closure collar for gravity and low pressure (maximum 10 psi) piping or as shown.
2. Concrete Encased or Embedded Pipe: Do not encase joints in concrete, unless specifically shown.

B. Placement:

1. Keep trench dry until pipe laying and joining are completed.
2. Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.
3. Measure for grade at pipe invert, not at top of pipe.
4. Excavate trench bottom and sides of ample dimensions to permit visual inspection and testing of entire flange, valve, or connection.
5. Prevent foreign material from entering pipe during placement.
6. Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's work.
7. Lay pipe upgrade with bell ends pointing in direction of laying.
8. Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, provide:
   a. Shorter pipe lengths.
   b. Special mitered joints.
   c. Standard or special fabricated bends.
9. After joint has been made, check pipe alignment and grade.
10. Place sufficient pipe zone material to secure pipe from movement before next joint is installed.
11. Prevent uplift and floating of pipe prior to backfilling.

C. HDPE Pipe Placement:

1. Lay pipe snaking from one side of trench to other.
2. Offset: As recommended by manufacturer for maximum temperature variation between time of fusion welding and during operation.
3. Do not lay pipe when temperature is below 40 degrees F, or above 90 degrees F when exposed to direct sunlight.

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4. Shield ends to be joined from direct sunlight prior to and during the laying operation.

D. Tolerances:

1. Deflection from Horizontal Line, HDPE: Maximum 2 inches.
2. Deflection From Vertical Grade: Maximum 1/4 inch.
3. Joint Deflection: Maximum of 75 percent of manufacturer's recommendation.
4. Horizontal position of pipe centerline on alignment around curves maximum variation of 1.75 feet from position shown.
5. Pipe Cover: Minimum 3 feet, unless otherwise shown.

3.06 BRANCH CONNECTIONS

A. Do not install branch connections smaller than 1/2-inch nominal pipe size, unless shown otherwise.

B. When line of lower pressure connects to a line of higher pressure, requirements of Piping Data Sheet for higher pressure rating prevails, unless otherwise shown.

C. Threaded Pipe Tap Connections:

1. Limitations: Threaded taps in pipe barrel are unacceptable.

3.07 VENTS AND DRAINS

A. Vents and drains at high and low points in piping required for completed system may or may not be shown. Install vents on high points and drains (3/8-inch holes at 15-feet spacing) on low points of pipelines at all low and high point locations.

3.08 FIELD FINISHING

A. Notify Engineer at least 3 days prior to start of any surface preparation or coating application work.

B. Any piping damaged during installation shall be replaced and reinstalled according to the drawings.

3.09 FIELD QUALITY CONTROL

A. Pressure Leakage Testing: As specified in Section 40 80 01, Process Piping Leakage Testing.

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3.10 CLEANING

A. Following assembly and testing, and prior to final acceptance, flush pipelines (except as stated below) with water at 2.5 fps minimum flushing velocity until foreign matter is removed.

B. If impractical to flush large diameter pipe at 2.5 fps or blow at 4,000 fpm velocity, clean in-place from inside by brushing and sweeping, then flush or blow line at lower velocity.

C. Remove accumulated debris through drains 2 inches and larger or by removing spools and valves from piping.

3.11 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are part of this specification:

1. Piping Schedule Legend.
2. Piping Schedule.

END OF SECTION

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PIPING SCHEDULE LEGEND

SERVICE

SD	Storm Drain
SB	Splitter Box
DSC	Dosing Siphon Chamber
NTS	Natural Treatment System

EXPOSURE

BUR	Buried
EXP	Exposed
SUB	Submerged

MATERIAL

HDPE	High-Density Polyethylene

JOINT TYPE

FL	Flanged
GR	Grooved
HU	Hub and spigot
PRJ	Proprietary Restrained
RM	Restrained Mechanical
S	Screwed
W	Welded (including solvent and fusion)

PRESSURE TEST

G	Gravity Service: Test pressure is not shown on gravity services. Test to highest liquid level that pipe can be subject to.
H	Hydrostatic
I	In Service

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Piping Schedule								
Service	**Legend**	**Size (in)[1]**	**Exposure**	**Piping Material**	**Specification Section**	**Joint Type**	**Test Pressure (psig)**	**Test Specification Section**
Splitter Box Inflow	SB	24	BUR	HDPE		Electrofuse	5	40 80 01
Dosing Chamber Inflow	DSC	8-12	BUR	HDPE		Electrofuse	5	40 80 01
NTS Distribution	NTS	4-12	BUR/EXP	HDPE		Electrofuse	5	40 80 01*
NTS Collection	NTS	4-12	BUR/SUB	HDPE		Electrofuse	5	40 80 01*

NOTES:

*Pressure testing of pipes located within and over NTS 1 and NTS 2. The Contractor will flow water thru piping to verify minimal leakage and that all pipe joints are properly connected, flow test shall be witnessed by the Engineer, prior to covering.

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SECTION 40 27 02
PROCESS VALVES AND OPERATORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):
   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   b. B16.44, Manually Operated Metallic Gas Valves for Use in Above Ground Piping Systems up to 5 psi.
2. American Water Works Association (AWWA):
   a. C500, Metal-Seated Gate Valves for Water Supply Service.
   b. C508, Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.
   c. C509, Resilient-Seated Gate Valves for Water Supply Service.
   d. A276, Standard Specification for Stainless Steel Bars and Shapes.
   e. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
   f. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   g. A564/A564M, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
3. Manufacturers Standardization Society (MSS):
   a. SP-80, Bronze Gate, Globe, Angle, and Check Valves.
   b. SP-81, Stainless Steel, Bonnetless, Flanged Knife Gate Valves.
   c. SP-85, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.
4. NSF International (NSF): 61, Drinking Water System Components—Health Effects.
5. UL.
6. USC Foundation for Cross-Connection Control and Hydraulic Research.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Product data sheets for each make and model. Indicate valve Type Number, applicable Tag Number, and facility name/number or service where used.

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b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
c. Sizing calculations for open-close/throttle and modulating valves.

B. Informational Submittals:

1. Manufacturer's Certificate of Compliance.
2. Tests and inspection data.
3. Operation and Maintenance Data.
4. Manufacturer's Certificate of Proper Installation.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves to include operator, actuator, chain wheel, extension stem, floor stand, operating nut, chain, wrench, and accessories to allow a complete operation from the intended operating level.

B. Valve to be suitable for intended service. Renewable parts not to be of a lower quality than specified.

C. Valve same size as adjoining pipe, unless otherwise called out on the Drawings or in Supplements.

D. Valve ends to suit adjacent piping.

E. Resilient seated valves shall have no leakage (drip-tight) in either direction at valve rated design pressure. All other valves shall have no leakage (drip-tight) in either direction at valve rated design pressure, unless otherwise allowed for in this section or in stated valve standard.

F. Size operators and actuators to operate valve for full range of pressures and velocities.

G. Valve to open by turning counterclockwise, unless otherwise specified.

H. Factory mount operator, actuator, and accessories.

2.02 SCHEDULE

A. Additional requirements relative to this section located at the end of this section.

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2.03 MATERIALS

A. Bronze and brass valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.

1. Approved alloys are of the following ASTM designations: B61, B62, B98/B98M (Alloy UNS No. C65100, C65500, or C66100), B139/B139M (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.
2. Stainless steel Alloy 18-8 may be substituted for bronze.

B. Valve materials in contact with or intended for drinking water service to meet the following requirements:

1. Materials to comply with requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements.
2. Coatings materials to be formulated from materials deemed acceptable to NSF 61.

2.04 FACTORY FINISHING

A. General:

1. Interior coatings for valves and hydrants shall be in accordance with AWWA C550, unless otherwise specified.
2. Material in contact with potable water shall conform to NSF 61.
3. Exposed safety isolation valves and lockout valves with handles, or chain wheels shall be “safety yellow.”

B. Where epoxy lining and coating are specified, factory finishing shall be as follows:

1. In accordance with AWWA C550.
2. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as “fusion” or “fusion bonded” epoxy.
3. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

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2.05 VALVES

A. Gate Valves:

1. General:
   a. AWWA gate valves to be in full compliance with stated AWWA standard and the following requirements:
      1) Provide 2-inch operating nut for AWWA gate valves 12 inches and smaller.
      2) Provide totally enclosed spur or bevel gear operator with indicator for AWWA gate valves 14 inches and larger.
      3) Provide Affidavit of Compliance per the applicable AWWA standard for AWWA gate valves.
      4) Mark AWWA gate valves with manufacturer's name or mark, year of valve casting, valve size, and working water pressure.
      5) Repaired AWWA gate valves shall not be submitted or supplied.
      6) Supply AWWA gate valves with stainless steel bolting.
      7) AWWA C509 and AWWA C515 valves may be substituted for each other.
2. Type V107 Gate Valve 2 Inches and Smaller:
   a. All-bronze, screwed bonnet, packed gland, NPT threaded ends, single solid wedge gate, rising stem, stainless steel seat rings, Class 300 rated 300 psi SWP/1,000 psi CWP, complies with MSS SP-80 Type 2.
   b. Manufacturers and Products:
      1) Crane; Figure 634E.
      2) Stockham; Figure B-145.
3. Type V137 Resilient Seated Gate Valve 4 Inches to 12 Inches:
   a. UL Listed and FM Approved for fire protection, iron body, resilient seat, bronze mounted, ASME B16.1 Class 125 flanged ends, nonrising stem, 2-inch operating nut, in accordance with AWWA C509, design working water pressure 200 psig, full port, fusion-epoxy coated inside and outside per AWWA C550, NSF 61 certified, indicator post flange and indicator post assembly with lockable handle.
   b. Manufacturers and Products:
      1) Kennedy Valve; Ken-Seal II.
      2) M&H Valve; Style 4067.
      3) Mueller; P-2360.

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2.06 OPERATORS

A. Manual Operators:

1. General:
   a. For AWWA valves, operator force not to exceed requirements of applicable valve standard. Provide gear reduction operator when force exceeds requirements.
   b. For non-AWWA valves, operator force not to exceed applicable industry standard or 80 pounds, whichever is less, under operating condition, including initial breakaway. Provide gear reduction operator when force exceeds requirements.
   c. Operator self-locking type or equipped with self-locking device.
   d. Position indicator on quarter-turn valves.
   e. Worm and gear operators one-piece design, worm-gears of gear bronze material. Worm of hardened alloy steel with thread ground and polished. Traveling nut type operator's threaded steel reach rod with internally threaded bronze or ductile iron nut.
2. Exposed Operator:
   a. Cranks on gear type operator.
   b. Chain wheel operator with tieback, extension stem, floor stand, and other accessories to permit operation from normal operation level.
   c. Valve handles to take a padlock, and wheels a chain and padlock.
3. Buried Operator:
   a. Buried service operators on valves larger than 2-1/2 inches shall have a 2-inch AWWA operating nut. Buried operators on valves 2 inches and smaller shall have cross handle for operation by forked key. Enclose moving parts of valve and operator in housing to prevent contact with the soil.
   b. Buried service operators to be grease packed and gasketed to withstand submersion in water to 20 feet minimum.
   c. Buried valves shall have extension stems, bonnets, and valve

2.07 ACCESSORIES

A. Tagging: 1-1/2-inch diameter heavy brass or stainless steel tag attached with No. 16 solid brass or stainless steel jack chain for each valve operator, bearing valve tag number shown on Manual Valve Schedule.

B. T-Handled Operating Wrench:

1. One each galvanized operating wrenches, 4 feet long.
2. Manufacturers and Products:
   a. Mueller; No. A-24610.
   b. Clow No.; F-2520.
3. One each galvanized operating keys for cross handled valves.

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C. Extension Bonnet for Valve Operator: Complete with enclosed stem, extension, support brackets, and accessories for valve and operator.

1. Manufacturers and Products:
   a. Pratt.
   b. DeZurik.

D. Floor Stand:

1. Nonrising, heavy pattern, indicating type.
2. Complete with solid extension stem, coupling, stem guide brackets, and yoke attachment. Stem length as required to connect valve operating nut and floor stand.
3. Stem Guide: Space such that stem L/R ratio does not exceed 200.
4. Anchor Bolts: Type 304 stainless steel.
5. Manufacturers and Products:
   a. Clow; Figure F-5515.
   b. Mueller, Figure A-26426.

E. Floor Box:

1. Plain type, for support of nonrising type stem.
2. Complete with solid extension stem, operating nut, and stem guide brackets. Stem length as required to extend valve operating nut to within 3 inches of finish floor.
3. Stem Guide: Space such that stem L/R ratio does not exceed 200.
4. Anchor Bolts: Type 304 stainless steel.
5. Manufacturers and Products:
   a. Neenah Foundry; R 7506.
   b. Clow; No. F5690.

F. Chain Wheel and Guide:

1. Complete with chain.
2. Galvanized or cadmium-plated.
3. Manufacturers and Products:
   a. Clow Corp.; Figure F-5680.
   b. Walworth Co.; Figure 804.
   c. DeZurik Corp.; Series W or LWG.

G. Cast-Iron Valve Box: Designed for traffic loads, sliding type, with minimum of 5-1/4-inch ID shaft.

1. Box: Cast iron with minimum depth of 9 inches.
2. Lid: Cast iron, minimum depth 3 inches, non-locking type marked STORMWATER.

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3. Extensions: Cast iron.
4. Two-piece box and lid for valves 4 inches through 12 inches, three-piece box and lid for valves larger than 12 inches with base sized for valve.
5. Valve extension stem for valves with operating nuts 3 feet or greater below finish grade.
6. Manufacturers and Products:
    a. East Jordan Iron Works; Cast-Iron Valve Boxes.
    b. Bingham & Taylor; Cast-Iron Valve Boxes.

H. Indicator Post Assembly:

1. Cast or ductile iron post head, bell, and wrench with cast or ductile iron or steel barrel.
2. Plexiglas or equal protected window to indicate OPEN and CLOSED position.
3. Padlockable eye bolt for wrench.
4. Adjustable bury depth. Bury depth as required for valve installation.
5. UL Listed and FM Approved.
6. Manufacturers and Products:
    a. Clow; Style 2945.
    b. Mueller; A-20806.

PART 3 EXECUTION

3.01 INSTALLATION

A. Flange Ends:

1. Flanged valve bolt holes shall straddle vertical centerline of pipe.
2. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.

B. Valve Installation and Orientation:

1. General:
    a. Install valves so handles operate from fully open to fully closed without encountering obstructions.
    b. Install valves in location for easy access for routine operation and maintenance.
    c. Install valves per manufacturer’s recommendations.
2. Gate, Globe, and Ball Valves:
    a. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor, unless otherwise shown.

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b. Install operating stem horizontal in horizontal runs of pipe having centerline elevations greater than 4 feet 6 inches above finish floor, unless otherwise shown.

C. Locate valve to provide accessibility for control and maintenance. Install access doors in finished walls and plaster ceilings for valve access.

D. Extension Stem for Operator: Where depth of valve operating nut is 3 feet or greater below finish grade, furnish operating extension stem with 2-inch operating nut to bring operating nut to a point within 6 inches of finish grade.

E. Torque Tube: Where operator for quarter-turn valve is located on floor stand, furnish extension stem torque tube of a type properly sized for maximum torque capacity of valve.

F. Floor Box and Stem: Steel extension stem length shall locate operating nut in floor box.

G. Chain Wheel and Guide: Install chain wheel and guide assemblies or chain lever assemblies on manually operated valves over 6 feet 9 inches above finish floor. Install chain to within 3 feet of finish floor. Where chains hang in normally traveled areas, use appropriate “L” type tie-back anchors. Install chains to within operator horizontal reach of 2 feet 6 inches maximum, measured from normal operator standing location or station.

3.02 TESTS AND INSPECTION

A. Valve may be either tested while testing pipelines, or as a separate step.

B. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.

C. Inspect air and vacuum valves as pipe is being filled to verify venting and seating is fully functional.

D. Count and record number of turns to open and close valve; account for discrepancies with manufacturer’s data.

E. Set, verify, and record set pressures for relief and regulating valves.

F. Automatic valves to be tested in conjunction with control system testing. Set opening and closing speeds, limit switches, as required or recommended by the Engineer.

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G. Test hydrostatic relief valve seating; record leakage. Adjust and retest to maximum leakage of 0.1 gpm per foot of seat periphery.

3.03 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: Present at Site for minimum person-days listed below, travel time excluded:

1. 1 person-day for installation assistance and inspection.
2. 1 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.

3.04 SUPPLEMENTS

A. The supplement listed below, following "End of Section," is part of this specification.

1. Manual Valve Schedule.

END OF SECTION

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Manual Valve Schedule						
Tag No.	**Valve Type No.**	**Size (inches)**	**Maximum Pressure (psig)**	**Average Flow (gpm)**	**Maximum Flow (gpm)**	**Fluid**
1A	V137	8	10	450	750	stormwater
1B	V137	8	10	450	750	stormwater
1C	V137	8	10	450	750	stormwater
1D	V137	8	10	450	750	stormwater
1E	V137	8	10	450	750	stormwater
1F	V137	8	10	450	750	stormwater
NA*	V107	2	10	450	750	stormwater
NOTES: * 12 service valves needed at each siphon box.						

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SECTION 40 80 01
PROCESS PIPING LEAKAGE TESTING

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Testing Plan: Submit prior to testing and include at least the information that follows.
   a. Testing dates.
   b. Piping systems and section(s) to be tested.
   c. Test type.
   d. Method of isolation.
   e. Calculation of maximum allowable leakage for piping section(s) to be tested.
2. Certifications of Calibration: Testing equipment.
3. Certified Test Report.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION

A. Notify the Engineer in writing 5 days in advance of testing. Perform testing in presence of the Engineer.

B. Gravity Piping:

1. Perform testing after service connections, manholes, and backfilling have been completed between stations to be tested.
2. Determine groundwater level at time of testing by exploratory holes or other method acceptable to the Engineer.

3.02 HYDROSTATIC TEST FOR PRESSURE PIPING

A. Fluid: Clean water of such quality to prevent corrosion of materials in piping system.

B. Exposed Piping:

1. Perform testing on installed piping prior to application of insulation.
2. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.

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3. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
4. Maintain hydrostatic test pressure continuously for 30 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
5. Examine joints and connections for leakage.
6. Correct visible leakage and retest as specified.
7. Empty pipe of water prior to final cleaning.

C. Buried Piping:

1. Test after backfilling has been completed.
2. Expel air from piping system during filling.
3. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
4. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.
5. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
6. Maximum Allowable Leakage:

$$L = \frac{SD(P)^{1/2}}{133{,}200}$$

where:

L = Allowable leakage, in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of pipe, in inches.
P = Test pressure during leakage test, in pounds per square inch.

7. Correct leakage greater than allowable, and retest as specified.

3.03 HYDROSTATIC TEST FOR GRAVITY PIPING

A. Testing Equipment Accuracy: Plus or minus 1/2-gallon water leakage under specified conditions.

B. Maximum Allowable Leakage: 0.16 gallons per hour per inch diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.

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C. Exfiltration Test:

1. Hydrostatic Head:
   a. At least 6 feet above maximum estimated groundwater level in section being tested.
   b. No less than 6 feet above inside top of highest section of pipe in test section, including service connections.
2. Length of Pipe Tested: Limit length such that pressure on invert of lower end of section does not exceed 30 feet of water column.

D. Infiltration Test:

1. Groundwater Level: At least 6 feet above inside top of highest section of pipe in test section, including service connections.

E. Piping with groundwater infiltration rate greater than allowable leakage rate for exfiltration will be considered defective even if pipe previously passed a pressure test.

F. Defective Piping Sections: Replace or test and seal individual joints, and retest as specified.

3.04 PNEUMATIC TEST FOR GRAVITY PIPING

A. Equipment:

1. Calibrate gauges with standardized test gauge at start of each testing day. Engineer will witness calibration.
2. Install gauges, air piping manifolds, and valves at ground surface.
3. Provide pressure release device, such as rupture disc or pressure relief valve, to relieve pressure at 6 psi or less.
4. Restrain plugs used to close sewer lines to prevent blowoff.

B. Procedure:

1. Require that no person enter manhole where pipe is under pressure.
2. Slowly introduce air into pipe section until internal air pressure reaches 4 psi greater than average back pressure of groundwater submerging pipe.
3. Allow 2 minutes minimum for air temperature to stabilize.

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C. Allowable Leakage: Test section will be considered defective when time required for pressure to decrease from 3.5 to 2.5 psi greater than average back pressure of groundwater submerging pipe is less than that computed utilizing values from following table:

TABLE 1*

A Pipe Diameter (Inches)	B Time per Foot up to Length in Col C (Seconds)	C Test Length (Feet)	D Test Time for any Length Between Col C & E (Min:Sec)	E Length at Which Time in Col F Applies (Feet)	F Time per Foot for Total Length (Seconds)
4	0.18	636	1:54	1,114	0.10
6	0.40	424	2:50	743	0.23
8	0.71	318	3:47	557	0.41
10	1.11	255	4:43	446	0.63
12	1.60	212	5:40	371	0.91
15	2.50	170	7:05	297	1.42
18	3.62	141	8:30	248	2.06
21	4.92	121	9:55	212	2.81
24	6.42	106	11:20	187	3.67

EXAMPLE: 15-inch diameter pipe:
For 150 feet, T = 2.50 sec (Col B) x 150 ft = 375 sec = 6:15
For 250 feet, T = 7:05 (Col D)
For 500 feet, T = 1.42 sec (Col F) x 500 ft = 710 sec = 11:50

*Based on 0.003 cfm per square foot with a minimum significant loss of 2 cfm and a maximum loss of 3.5 cfm.

D. Piping with groundwater infiltration rate greater than allowable leakage rate for exfiltration will be considered defective even if pipe previously passed a pressure test.

E. Defective Piping Sections: Replace or test and seal individual joints, and retest as specified.

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3.05 FIELD QUALITY CONTROL

A. Test Report Documentation:

1. Test date.
2. Description and identification of piping tested.
3. Test fluid.
4. Test pressure.
5. Remarks, including:
   a. Leaks (type, location).
   b. Repair/replacement performed to remedy excessive leakage.
6. Signed by the Contractor and Engineer to represent that test has been satisfactorily completed.

END OF SECTION

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2 2020 MDOT STANDARD SPECIFICATIONS

Section 101. Terms, Format, and Definitions

101.01. General

The titles and headings of the sections, subsections, and subparts are intended for reference and are not considered as bearing on their interpretation.

References in the contract to publications refer to the most recent edition, including interim publications that are current as of the advertisement date, unless otherwise specified by the contract.

References in the contract to the Department's procedures for inspection, sampling, testing, and certification of materials refer to the edition of the relevant manuals, Michigan Test Methods (MTMs), MDOT Standard Plans, and *MDOT Standard Specifications for Construction (Standard Specifications)* that is current as of the advertisement date unless otherwise specified by the contract.

101.02. Abbreviations

When the following abbreviations are used in the *Standard Specifications* and in the contract, they have the meanings listed below.

°C	degrees Celsius
°F	degrees Fahrenheit
AAN	American Association of Nurserymen
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ABR	Certified Bridge Fabricator – Advanced (AISC Certification)
ABS	acrylonitrile butadiene styrene
AC	alternating current
ACA	ammoniacal copper arsenate
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
ACQ	ammoniacal copper quaternary
ACZA	ammoniacal copper zinc arsenate
ADA	Americans with Disabilities Act
ADT	average daily traffic
AGC	Associated General Contractors of America
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMS	Aerospace Material Specification

ANSI	American National Standards Institute
APA	Authorized Public Agency
API	American Petroleum Institute
ARA	American Railway Association
AREMA	American Railway Engineering and Maintenance-of-Way Association
ARTBA	American Road & Transportation Builders Association
ASC	Accredited Standards Committee
ASCE	American Society of Civil Engineers
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASR	alkali-silica reactivity
ASTM	ASTM International
ATSSA	American Traffic Safety Services Association
AWG	American Wire Gauge
AWI	Aggregate Wear Index
AWPA	American Wood Protection Association
AWS	American Welding Society
AWWA	American Water Works Association
Blue Book	Equipment Watch's *Rental Rate Blue Book for Construction Equipment*
BPN	British Pendulum Number
BTU	British thermal unit
CA	copper azole
$CaCl_2$	calcium chloride
CCA	chromated copper arsenate
centistoke	unit of measurement of kinematic viscosity
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CIA	Construction Influence Area
CIE	International Commission on Illumination
CIP	compacted-in-place
CIP	cast-in-place
CJP	complete joint penetration
CMD	cross-machine direction
CNC	computer numerically controlled
Commission	Michigan State Transportation Commission
CPE	corrugated polyethylene
cPs	centipoise, a measurement of viscosity
CPT	Bridge Component Quality Management System Certification (AISC Certification)

CPV	corrugated polyvinyl chloride
Crg	contraction joint
CRSI	Concrete Reinforcing Steel Institute
CSP	concrete surface profile
CSQC	Contractor Staking Quality Control
CW	Civil Works
CWI	Certified Welding Inspector
dB	decibel
DBE	Disadvantaged Business Enterprise
DBI	dowel bar inserter
DC	direct current
DFT	dry film thickness
DI	ductile iron (pipe)
EGLE	Michigan Department of Environment, Great Lakes, and Energy
ESAL	equivalent single-axle load
Esc	expansion joint
FAA	Federal Aviation Administration
FC	Fracture Critical Endorsement (AISC Certification)
FCAW	flux-cored arc welding
FCC	Federal Communications Commission
FCM	fracture critical members
FHWA	(U.S. Department of Transportation) Federal Highway Administration
Forest Service	USDA Forest Service
FSS	Federal Specifications and Standards
fy	yield point
G*/sin θ	high temperature stiffness
G*sin θ	intermediate temperature stiffness
g/ft²	gram per square foot
G_{mm}	maximum specific gravity of mixture
G_{sb}	bulk specific gravity of aggregate
G_{se}	effective specific gravity
GMAW	gas metal arc welding
GPS	Global Positioning System
HDPE	high-density polyethylene
HMA	hot mix asphalt
HP	high performance
HRWR	high-range water reducer
IBR	Certified Bridge Fabricator – Intermediate (AISC Certification)
ICEA	Insulated Cable Engineers Association

IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IMSA	International Municipal Signal Association
IP	internet protocol
ISA	International Society of Arboriculture
ISO	International Organization for Standardization
ISSA	International Slurry Surfacing Association
ITCP	Internal Traffic Control Plan
ITE	Institute of Traffic Engineers
ITS	Intelligent Transportation Systems
JMF	job mix formula
k	thermal conductivity
kip	1,000 pounds-force
kPa	kilopascal
ksi	kilo-pound per square inch
LA	Los Angeles
LAST	lowest anticipated service temperature
lb/cyd	pounds per cubic yard
lb/ft³	pound per cubic foot
LBW	loss by washing
LCD	liquid crystal display
LED	light-emitting diode
LL	lane length
LM	loose measure
LMC	latex modified concrete
LRFD	Load and Resistance Factor Design
LRFR	load and resistance factor rating
MASH	Manual for Assessing Safety Hardware
MC	medium curing
MCA	Michigan Concrete Association
mcd/lux/sq m	millicandela per lux per square meter
MCL	Michigan Compiled Laws
MCS	Michigan Coordinate System
MD	machine direction
MDARD	Michigan Department of Agriculture & Rural Development
MDLARA	Michigan Department of Licensing and Regulatory Affairs
MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
mil	thousandth of an inch
MIOSHA	Michigan Occupational Safety and Health Administration
mm	millimeter

MMUTCD	Michigan Manual of Uniform Traffic Control Devices
MPa	megapascal
mph	miles per hour
MQAP Manual	MDOT's *Materials Quality Assurance Procedures (MQAP) Manual*
MSA	Mine Safety Administration
MSA	Michigan Statutes Annotated
MT	magnetic particle testing
MTD	material transfer device
MTM	Michigan Test Method
MTR	Mill Test Report
N/A	not applicable
NaCl	sodium chloride
NBI	National Bridge Inventory
NCHRP	National Cooperative Highway Research Program
NCR	nonconformance report
N_d	design number of gyrations
NDT	nondestructive testing
NEC	National Electrical Code
NELMA	Northeastern Lumber Manufacturers Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NHPMA	Northern Hardwood and Pine 'Manufacturers Association
N_i	initial number of gyrations
NIST	National Institute of Standards and Technology
N_m	maximum number of gyrations
N_m	Newton meter
NPCA	National Precast Concrete Association
NPDES	National Pollutant Discharge Elimination System
NPT	National Pipe Thread Tapered
NREPA	Natural Resources and Environmental Protection Act
NRMCA	National Ready Mixed Concrete Association
NTCIP	National Transportation Communications for ITS [Intelligent Transportation Systems] Protocol
OD	outside diameter
OD	oven dry
OGDC	open-graded drainage course
ohm	unit of electrical resistance
OJT	on-the-job training
Pa•s	pascal-second
PAV	Pressure Aging Vessel

P_b ..... percent asphalt binder content
PCC ..... Portland cement concrete
pcf ..... pounds per cubic foot
PCI ..... Precast/Prestressed Concrete Institute
PCMS ..... portable changeable message sign
PDF ..... portable document format
PE ..... polyethylene
PG ..... performance-graded
PJP ..... partial joint penetration
PLSS ..... Public Land Survey System
PPSS ..... paver-placed surface seal
psf ..... pounds per square foot
psi ..... pounds per square inch
psig ..... pounds per square in gauge
PT ..... penetrant testing
PTCSI ..... Pedestrian Traffic Control Signal Indications
PTS ..... portable traffic signal
PVC ..... polyvinyl chloride
QA ..... Quality Assurance
QAI ..... Quality Assurance Inspector
QC ..... Quality Control
rad/s ..... radian per second
RAP ..... reclaimed asphalt pavement
RC ..... rapid curing
RCRA ..... Resource Conservation and Recovery Act
RHW ..... rubber insulation, heat resistance of 75°C, water resistance
rms ..... root mean square
RPM ..... reflective pavement marker
RPM ..... raised pavement marker
RT ..... radiographic testing
SAE ..... Society of Automotive Engineers
SAW ..... submerged arc welding
SBR ..... Certified Bridge Fabricator – Simple (AISC Certification)
SCM ..... supplementary cementitious material
SDR ..... standard dimension ratio
SESC ..... soil erosion and sedimentation control
SFMC ..... silica fume modified concrete
SGC ..... Superpave gyratory compactor
SMAW ..... shielded metal arc welding
SPE ..... Sophisticated Paint Endorsement (AISC Certification)
SPIB ..... Southern Pine Inspection Bureau

SQRT ..... square root
SSPC ..... The Society for Protective Coatings
Superpave ..... Superior Performing Asphalt Pavements
TIG ..... tungsten inert gas
TON ..... turn-of-nut
Trg ..... tied joint
TRM ..... turf reinforcement mat
TRPM ..... temporary raised pavement marker
TS ..... total solids
TS ..... traffic signal
TSR ..... tensile strength ratio
UL ..... Underwriters Laboratories
USC ..... U.S. Code
USDA ..... United States Department of Agriculture
USDOT ..... U.S. Department of Transportation
USE ..... underground service entrance
UT ..... ultrasonic testing
UV ..... ultraviolet
VAC ..... volts alternating current
VDC ..... volts direct current
VFA ..... voids filled with asphalt
VMA ..... voids in mineral aggregate
VT ..... visual test
VTCSH ..... Vehicle Traffic Control Signal Heads
WCLIB ..... West Coast Lumber Inspection Bureau
w/cm ratio ..... water-cementitious material ratio
WPS ..... weld procedure specification
WR ..... wet reflective
WWPA ..... Western Wood Products Association

101.03. Definitions

Absolute Refusal. The nominal pile driving resistance value of 150% of the nominal pile driving resistance shown on the plans. Also see “Practical Refusal.”

Addendum. Revisions to the plans and/or proposal issued by the Department after the advertisement date but before the submission of the bid.

Adjustment. Monetary revision that applies to a contract unit price or to the entire contract.

Advertisement. Public announcement of a project inviting Contractors to submit bids for work to be performed and materials to be furnished.

Authorization. The Department's written approval of a contract modification.

Average Daily Traffic (ADT). The total volume of traffic during a time period that is greater than 1 day and less than 1 year and divided by the number of days in the time period.

Award. The Department's formal execution of the contract.

Base Course. Layer or layers of specified material placed on a subbase or subgrade to support a surface course.

Bid. A completed schedule of items submitted as an offer to perform work at quoted prices.

Bid Appeal Committee. Michigan Department of Transportation (MDOT) committee that performs the administrative review of appeals of low bid rejections.

Bid Document. An electronic document prepared using current Department software that includes the schedule of items, designated and specialty items, if applicable, and warranty obligations, if applicable.

Bid Guaranty. Amount the Bidder agrees, at the time of bid submission, to pay MDOT if the Bidder fails to execute the contract form and file satisfactory bonds and other required documents necessary for the award of the contract within the 21-day period provided or within Department-approved extensions.

Bid Review Committee. MDOT committee that reviews irregular bids for adherence to standard bid procedures. See subsection 102.06 for a definition of irregular bid.

Bidder

A. Individual or legal entity submitting a bid.

B. An affiliated Bidder is a Bidder having a relationship in which one business concern or individual directly or indirectly controls or can control the others.

Bridge. Structure, including supports, built over a depression, watercourse, highway, railroad, or other obstruction with a clear span of at least 20 feet measured along the center of roadway.

Calendar Day. Every day shown on the calendar, beginning and ending at midnight. Unless otherwise specified in the contract, the word "day" means calendar day.

Calendar Date Contract. Contract in which the project is required to be physically complete or open to traffic on or before a designated date on the calendar.

Calendar Day Contract. Contract in which the time required to physically complete the project or open it to traffic is designated by the number of calendar days.

Certification of Disadvantaged Business Enterprise (DBE) Contractor. Process in which the Department establishes that a Contractor meets the federal requirements of a DBE. Also see "Disadvantaged Business Enterprise."

Change. Addition to or deletion from a pay item or condition.

Commission. Michigan State Transportation Commission.

Construction Influence Area (CIA). The project and the area surrounding the project, as shown in the contract, that define the limits of responsibility for traffic control.

Contract. Written agreement between the Department and the Contractor setting forth the obligations of the parties for the performance of and payment for the prescribed work. The contract includes the advertisement for bids, bid document, contract form, contract bonds, Standard Specifications, special details, MDOT Standard Plans, plans, proposal, addenda, notice of award, local agency agreements (when applicable), DBE commitment forms (when applicable), and warranty forms and bonds (when applicable).

Contract Modification. Regulation form prepared as a recommendation for changes in, adjustments to, or extras to the contract. The contract modification becomes an authorization (an approved modification) when it is signed by the duly authorized MDOT representative. Also see "Authorization."

Contract Time. Time specified in the contract to perform and complete all the work, including authorized extensions of time.

Contract Unit Price. Unit price of a pay item.

Contractor. Individual or legal entity contracting with the Department to perform prescribed construction work and supply materials.

Controlling Operation. An operation that, if the Contractor's expected rate of performance is not met or the scheduled start date is delayed, would delay the opening to traffic or completion of the entire project. A controlling operation may be on or off the job site. The size of the operation is not a factor in determining whether an operation is a controlling operation. Any operation on the critical path is a controlling operation (see "Critical Path").

Coordination Clause. Clause in the contract that requires the Contractor to coordinate construction activities with agencies, utilities, or other Contractors.

Critical Path. Longest continuous path of activities through the contractual completion milestones in the schedule that establishes the scheduled completion date. The critical path is typically the path of activities with the least total float. The critical path may follow different paths of activities at different times during the performance of the work due to the progress of the work or revisions made to the schedule. Any operation on the critical path is a controlling operation.

Culvert. Structure, including supports, built over a depression, watercourse, highway, railroad, or other obstruction, with a clear span of less than 20 feet measured along the center of roadway.

Department

A. Michigan Department of Transportation when the State is the awarding authority;

B. Board of County Road Commissioners or Wayne County when a County is the awarding authority; or

C. City or Village or authorized representative when the City or Village is the awarding authority.

Design Pile Length. Pile length shown on the plans.

Design Pile Tip Elevation. Pile tip elevation if the design pile length is shown on the plans.

Designated Classifications. Work classifications that the Department lists in the proposal as the major work classifications required to construct the project and requiring appropriate prequalification to perform the specified work.

Determined Low Bidder. The Bidder determined to have the lowest total bid for a project and to meet all project requirements.

Director. The person, as provided by law, to serve as the principal executive officer of the Department and to be responsible for executing the policies of the Commission.

Disadvantaged Business Enterprise (DBE). The definition as provided in 49 CFR 26.5.

Dynamic Formula. Empirical formula used to estimate nominal pile driving resistance during pile driving. The Federal Highway Administration (FHWA) Gates formula is specified.

Dynamic Testing. High strain dynamic testing conducted during pile driving to estimate the nominal pile driving resistance using instrumentation and signal-matching computer software.

Earth Grade. Elevation of the completely graded roadway before the pavement structure is placed.

Engineer

A. The Director of the Department or the Engineer designated by the Director, acting directly or through authorized representatives, who is responsible for engineering supervision of the construction when the State of Michigan is the awarding authority;

B. The Engineer representing the county when a county is the awarding authority; or

C. The Engineer representing the city or village when a city or village is the awarding authority.

Estimate

A. **Final Estimate**. Compilation of quantities showing work performed upon which final payment is made.

B. **Progress Estimate**. Estimate made as the work progresses showing estimated work performed and materials furnished upon which periodic payments are made.

Estimated Pile Length. Length shown on the plans used as a guide for estimating the work and ordering test piles if the nominal pile driving resistance is shown on the plans.

Estimated Pile Tip Elevation. Elevation shown on the plans, estimated for piles to develop the nominal pile driving resistance.

Extension of Time. Additional contract time authorized by the Department.

Extra Work. Work determined to be essential to the satisfactory completion of the contract but that does not appear in the proposal as a specific pay item and is not included in the price bid for other items in the contract.

Falsework. Any temporary facility/device used to support a permanent structure until the structure is self-supporting. Falsework includes, but is not limited to, steel or timber beams, girders, columns, piles and foundations, and any propriety equipment including modular shoring frames, post shores, and adjustable horizontal shoring.

Float. The total available time to complete a non-controlling operation or sequence of non-controlling operations, as designated by the Contractor in the progress schedule, minus the total planned duration associated with the non-controlling operation or sequence of non-controlling operations. Float within the schedule is not for the exclusive use or benefit of the Department or the Contractor but is a resource available to both parties as needed until it expires.

Forms. Facility, device, or mold used to retain plastic or fluid concrete in its designated shape until it hardens.

Geohazard. Harmful event caused by a geological process (e.g., earthquake, landslide, tsunami, volcano).

Grade Separation. Structure that provides for highway traffic, pedestrian traffic, or utilities to pass over or under another highway or the tracks of a railway.

Highway. General term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

Holidays. Recognized state holidays are New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the day after Thanksgiving Day, Christmas Eve, Christmas Day, and New Year's Eve.

Inspector. Representative of the Engineer assigned to test materials, perform inspections of contract performance, or both.

Laboratory. Testing laboratory operated by or designated by the Department.

Labor Dispute. Controversy between the Contractor and the Contractor's employees, union, bargaining agents, suppliers, or suppliers' bargaining agents or between unions that results in a work stoppage.

Lien Bond. The security furnished by the Contractor and the Contractor's surety to guarantee payment of the debts covered by the bond.

Limits of Earth Disturbance. Area extending 10 feet outside the slope stake line except adjacent to wetlands where the limits of earth disturbance are at the slope stake line.

Liquidated Damages. Monetary damages paid at a specified rate by the Contractor to the Department for work not completed by the completion dates or within specified time frames.

Local Traffic. Traffic that has origin or destination within the CIA.

Major and Minor Pay Items. Pay items with an original item value that meets any of the criteria listed below are considered major pay items. All other original pay items are considered minor. The original item value is the product of the plan quantity of the pay item and the contract unit price.

A. The original contract amount is less than or equal to $5,000,000 and the original item value is equal to or greater than 5% of the original contract amount.

B. The original contract amount is greater than $5,000,000 but less than or equal to $20,000,000 and the original item value is equal to or greater than 4% of the original contract amount but not less than $250,000.

C. The original contract amount is greater than $20,000,000 but less than or equal to $30,000,000 and the original item value is equal to or

greater than 3% of the original contract amount but not less than $800,000.

D. The original contract amount is greater than $30,000,000 and the original item value is equal to or greater than 2% of the original contract amount but not less than $900,000.

E. If no major pay items are identified using the criteria in A through D above, then the major pay item or items are all of the original pay items, in sequence from the greatest original item value to the next lower item value and so on, until the total original value of the items adds up to 60% of the original contract amount.

Materially Unbalanced Bid. Bid that generates a reasonable doubt that award to the Bidder submitting a mathematically unbalanced bid will not result in the lowest ultimate cost to the Department.

Mathematically Unbalanced Bid. Bid containing lump sum or unit price bid items that do not reflect reasonable actual costs of labor, equipment, and materials, plus a reasonable proportionate share of the Bidder's anticipated profit, overhead costs, and other indirect costs.

Maximum Unit Weight or Maximum Density. Maximum value of the weight per unit volume established for a material.

MDOT Standard Plans. Drawings approved for repetitive use, showing details to be used where appropriate. The MDOT Standard Plans that apply to the project will be designated in the contract.

Median. The portion of a divided highway separating the traveled ways.

Michigan Registered Service Agency. Definition in MCL 290.602.

Minimum Pile Length. Length between pile cutoff elevation and the minimum pile penetration elevation shown on the plans.

Minimum Pile Penetration Elevation. Elevation shown on the plans that the bottom of piles must be driven to or below.

Net Prequalification. Current balance of the Bidder's established prequalification rating. The current balance is obtained by subtracting the uncompleted work on hand from the established rating.

Nominal Pile Driving Resistance. Nominal pile driving resistance measured during pile driving using the dynamic formula or dynamic testing methods in kips, as shown on the plans. Also see "Dynamic Formula" and "Dynamic Testing."

Non-Controlling Operation. An operation that, if the Contractor's expected rate of performance is not met or the scheduled start date is delayed, would not delay the opening to traffic or completion of the entire project. A non-controlling operation may be on or off the project site. The size of the

operation is not a factor in determining whether an operation is a non-controlling operation. Also see “Controlling Operation.”

Notice of Award. Written notice to the Contractor that the contract has been awarded.

On-the-Job Training (OJT) Program. MDOT’s OJT program meets the requirements of the Federal-Aid Highway Act of 1970 and 23 CFR Part 230, Subpart A. The objective is to develop skill improvement programs to provide opportunities for unskilled workers, particularly minorities, women, and disadvantaged persons, to acquire training in the skilled construction trades.

Ordered Pile Length. For timber piles, the Engineer will determine the ordered pile length. For cast-in-place concrete piles and steel piles, the Contractor will determine the ordered pile length.

Pay Item. Item of work in the contract. Also see “Major and Minor Pay Items.”

Pavement Structure. All combinations of subbase, base course, and surface course, including shoulders, placed on a subgrade.

Performance Bond. The security furnished by the Contractor and the Contractor’s surety to guarantee performance of the work in accordance with the contract.

Plan Grade. Vertical control grade shown on the plans.

Plan Quantity. Original contract quantity of a pay item.

Plans. Contract drawings that show the location, character, and dimensions of the prescribed work. Contract drawings also include the MDOT Standard Plans.

Practical Refusal. The nominal pile driving resistance value of 110% of the nominal pile driving resistance shown on the plans. Also see “Absolute Refusal.”

Prebore Elevation. Elevation designated for stopping preboring, as shown on the plans.

Prequalification of Contractors. Process used by the Department to determine the work classifications that a Contractor is eligible to perform and the maximum contract amount that the Contractor’s resources enables it to manage. The process is according to the MDOT *Administrative Rules Governing the Prequalification of Bidders for Highway and Transportation Construction Work*.

Production Piles. Piles other than test piles.

Progress Clause. The part of the proposal with the starting date, all intermediate and completion dates or the number of work days or both, and other restrictions or conditions.

Progress Schedule. Sequential listing of all of the controlling operations and the estimated time the operations will be controlling. The progress schedule is submitted by the Contractor after award and prior to starting work. It is reviewed and approved by the Engineer.

Project. The section of a highway or property on which the construction operation is to be performed as described in the contract.

Project Limits. The physical limits in the contract showing the points of beginning and ending of the work included in the project.

Proposal. Document with information on the project that is being advertised for bid. The information includes the location and description of work, schedule of items, progress clause, bid guaranty amount, date and time for electronic submission and downloading of bids, Special Provisions, Supplemental Specifications, or other requirements that may vary from or that are not contained in the Standard Specifications or plans, and the applicable wage rates to be paid by the Bidder.

Qualified Products List. List of materials that have been prequalified for use on projects.

Redrive. Pile driving beyond 3 inches or beyond the first 20 blows, whichever occurs first, after the end of drive.

Restrike. Pile driving to move the pile an additional 3 inches or the first 20 blows, whichever occurs first, after the end of drive.

Right-of-Way (ROW). General term denoting land, property, or interest therein acquired for or devoted to a highway, as shown on the plans.

Roadbed. Portion of the roadway between the outside edges of finished shoulders or the outside edges of berm immediately back of curbs or gutters, when constructed.

Roadside. Portion of the right-of-way outside the roadway.

Roadway. Portion of the right-of-way required for construction, limited by the outside edges of slopes and including ditches, channels, and all structures pertaining to the work.

Seasonal Limitation. Time during which construction of work items will be suspended unless otherwise specified in the contract.

Seasonal Suspension. Period from November 15 through April 15 unless specified otherwise in the contract.

Segregation. Areas of non-uniform distribution of material components that are visually identifiable or can be determined by other methods.

Shoulder. Portion of the roadway adjacent to the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Sidewalk. Portion of the roadway constructed primarily for pedestrian use.

Specialty Classifications. Work classifications that the Department considers to require specialized equipment or crafts to an extent warranting being listed separately from the designated classification in the proposal.

Specifications. General term applied to all written directions, provisions, and requirements concerning the performance of the work.

A. *MDOT Standard Specifications for Construction (Standard Specifications)*. All requirements and provisions contained in this book.

B. Supplemental Specifications. Detailed specifications that modify and supersede the Standard Specifications.

C. Special Provisions. Detailed specifications that modify and supersede the *Standard Specifications* and Supplemental Specifications, applicable to an individual project.

Spuds. Short, strong, driven members removed to make holes for inserting piles.

State

A. The State of Michigan or the Michigan Department of Transportation Department, or both, when the State is the awarding authority;

B. The County when a County is the awarding authority; or

C. The Municipality when a City or Village is the awarding authority.

Station. When used as a definition or term of measurement, a station is 100 feet.

Subbase. Layer of specified material placed on the subgrade as part of the pavement structure.

Subcontractor. Individual or legal entity that performs part of the work through a contract agreement with the Contractor.

Subcontract. Written agreement between the Contractor and any individual or legal entity to perform a part of the contract work.

Subgrade. Portion of the earth grade upon which the pavement structure is placed.

Substructure. All of the structure below the bearings of simple and continuous spans, the skewbacks of arches, and the tops of footings of rigid frames, including backwalls, wingwalls, and wing protection railings; except backwalls designed integrally with the superstructure.

Superstructure. All of a structure not classified as substructure.

Surety. Legal entity or individual other than the Contractor executing a bond(s) furnished by the Contractor.

Surface Course. Top layer of a pavement structure.

Temporary Road. Roadway and appurtenances constructed to help the movement of highway and pedestrian traffic around a construction operation.

Temporary Route. Existing road over which the traffic is temporarily detoured around a construction operation.

Temporary Structure. Bridge, culvert, or grade separation constructed to maintain traffic during the construction or reconstruction of a bridge, grade separation, or culvert.

Test Pile. Pile driven at a location shown on the plans to determine pile driving characteristics. The Engineer will certify nominal pile resistance of a test pile using a static load test, dynamic formula, or dynamic testing methods.

Ton. Unit of weight equal to 2,000 pounds.

Traffic Control Devices. Signs, signals, lighting devices, barricades, delineators, pavement markings, traffic regulators, and all other equipment for protecting and regulating traffic in accordance with the *Michigan Manual of Uniform Traffic Control Devices* (MMUTCD), unless otherwise specified in the contract.

Traffic Lane. Portion of the traveled way used for the movement of a single line of vehicles.

Traffic Regulator. Person assigned to direct traffic, dressed and equipped as specified in the MMUTCD.

Traveled Way. Portion of the roadway designated for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

Utility(ies). Properties of railway, telegraph, telephone, water, sewer, electric, gas, petroleum, cable television, and similar companies.

Waters of the State. “Groundwaters, lakes, impoundments, open drains, rivers, wetlands, streams and all other watercourses and waters, including the Great Lakes and their connecting waters, within the jurisdiction of this state [Michigan]” (MCL 324.3101(aa)).

Work. The furnishing of all labor, materials, equipment, and other items necessary to complete the project according to the contract. Work includes all alterations, amendments or extensions thereto, made by work order or other written orders of the Engineer.

Work Day (Working Day). All days when, as determined by the Engineer, it is possible for the Contractor to effectively carry out work on the controlling operation.

Work Day Contract. A contract in which the time required to physically complete the project or open it to traffic is designated by the number of work days.

Working Drawings. Supplemental design sheets or similar data that the Contractor may be required to submit to the Engineer. Examples include, but are not limited to, design calculations, stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, and bending diagrams for reinforcing steel.

Work Order. Written order by the Engineer requiring performance by the Contractor.

Section 109. Measurement and Payment

109.01. Measurement of Quantities

The Engineer will determine quantities of materials furnished and of work performed under the contract by methods of measurement and computations that are generally recognized as conforming to good engineering practice. The Engineer will measure quantities of work completed under the contract according to United States standard measures.

Unless otherwise required by the contract, manufacturing tolerances established by the industries involved will be accepted.

When required by the Engineer, the Contractor must provide copies of paid freight bills, trucking slips, bills of lading, and paid invoices for any material used in the work. The Contractor and the Engineer will routinely review quantities during the life of the contract.

A. **Payments Based on Plan Quantities.** If the contract requires payment of an item or part of an item on a plan quantity basis, the payments will be those quantities shown on the plans.

   For earthwork, the basis for changes in quantities will include any demonstrated errors discovered in plan quantities.

   If a Contractor believes that a plan quantity basis is inaccurate, the Contractor may request, in writing, that the Department check the identified quantity. The request must be accompanied by the Contractor's calculations, drawings, or other evidence indicating why the plan quantity is believed to be in error. If the plan quantity is in error, the Department will pay according to the corrected plan quantity, except as otherwise provided in subsection 103.02.

   If the Department believes that a plan quantity is inaccurate, the Department will check the identified quantity. If the plan quantity is in error, the Department will pay according to the corrected plan quantity. If during construction, the Department finds that conditions have changed from those anticipated in design to the extent that actual measurement of a plan quantity item is warranted, the Department will measure the quantity and will base payment on the measured quantity.

B. **Payments Based on Actual Quantities.** Unless specified otherwise, the basis of payment for a pay item will be the actual quantity. The Engineer will measure and calculate the actual quantity of work performed, using quantities from measurements taken from the completed in-place work in accordance with the "Measurement and Payment" subsection for the relevant pay item and the following:

1. **Linear and Area Measurements.** When the method of measurement specifies measurements in stations, miles, or acres, the measurements will be horizontal measurements, unless specified otherwise.

   When the method of measurement for a particular item specifies that it will be measured in place, linear or area measurements will be taken at the surface of the completed item, parallel to the base.

2. **Volume and Weight Measurements.** All pay items specified to be measured as compacted-in-place will be measured in the field according to the subsection that applies to that material.

   For all materials specified to be measured by the cubic yard, loose measure (LM) will be measured in the hauling vehicle at the point of delivery, unless specified otherwise. The Engineer's approval is required for all vehicles used for this purpose. The shape of the hauling unit must be such that the volume of the unit may be readily and accurately determined.

   a. **Aggregates.** The Engineer will make moisture determinations on aggregates on the dry basis using Formula 109-1.

      $$Z = \frac{(X-Y)}{Y} \times 100$$ Formula 109-1

      Where:

      X = Wet weight;
      Y = Dry weight; and
      Z = Percent moisture.

      Measurement of pay quantities of aggregates on a ton basis when a maximum specified amount of moisture is allowed will be calculated as follows:

      i. When the actual moisture, including liquid admixtures, present at time of weighing does not exceed the maximum moisture content permitted, the actual scale weights will be used as pay quantities.

      ii. When the actual moisture present at time of weighing is more than the maximum moisture content permitted, the pay quantities will be calculated using Formula 109-2.

         $$A = B\frac{100+C}{100+D}$$ Formula 109-2

         Where:

         A = Pay quantity of aggregate (tons);
         B = Weight of wet aggregate (tons);

C = Allowable moisture (percent); and
D = Actual moisture (percent).

3. **Measuring Wire and Steel Sheets and Plates.** The size of wire for electrical conductors will be measured according to ASTM B258.

   When the term “gauge” refers to the measurement of steel wire, it means the wire gauge specified in ASTM A510/A510M.

   The term “gauge,” when used concerning the measurement of steel sheets and light plates, means the gauge referenced in ASTM A568/A568M for uncoated sheet and in ASTM A653/A653M for a galvanized sheet.

4. **Measuring Depth of Reinforcement and Thickness of Concrete Pavement and Concrete Base Course.** The Engineer will core concrete pavements and concrete base courses before final acceptance to determine thickness of concrete pavement and, if required, the depth of reinforcement below the pavement surface in accordance with subsection 602.04.

5. **Measuring Thickness of Miscellaneous Concrete Construction.** The Engineer may core concrete construction when evidence shows nonconformance with the contract. The Engineer may core concrete construction on any portion or all of the work involved. Acceptance will be according to subsection 104.04.

6. **Measuring Weight on Scales.** Platform, belt conveyor, surge bin, and weigh batch scales, and associated weights, must conform to the requirements of the Weights and Measures Act (MCL 290.601 et seq.), and the requirements of the NIST Handbook 44, *Specifications, Tolerances and Other Technical Requirements for Weighing and Measuring Devices*.

   Unless specified otherwise, enlist the services of a Michigan Registered Service Agency to certify the calibration and working order of the weighing system annually and whenever maintenance or repairs require restoring calibration.

   A computer-generated printout system is required on platform, surge bin, and weigh batch scales. For concrete plant weigh batch scale systems, the ticketing system must conform to subsection 1001.03.A.4. For platform and surge bin scale systems, the ticketing system must print and identify all of the following information on a triplicate ticket for each truckload:

a. Project number;

b. Contractor's name;

c. Type of material being weighed;

d. Time;

e. Date;

f. Sequential, non-duplicate, ticket number (may be preprinted on a ticket);

g. Gross weight;

h. Tare weight;

i. Net weight; and

j. Net accumulated jobs daily total.

The information must be labeled so each ticket can be readily understood. The system must be interlocked to allow printing only when the scale has come to a complete rest.

109.02. Scope of Payment

The Department will pay the Contractor for accepted quantities of contract pay items at the contract unit prices, as required by the contract, except as otherwise specified in subsection 103.02.

The Contractor must agree to accept this compensation as full payment for the following:

A. Performing the work; and

B. Compensation for loss or damage arising from the nature of the work or from the action of the elements (except as specified in subsection 107.11) or from any unforeseen difficulties that may be encountered during the prosecution of the work.

109.03. Payments for Increased or Decreased Quantities

Whenever the quantity of any item of work as given in the contract is increased or decreased, payment for the item of work will be based on the quantity completed. The payment will be authorized at the unit price for the item named in the contract, except as otherwise provided in subsection 103.02.

109.04. Progress and Partial Payments

The Engineer will make progress payments for units of work completed and partial payments for delivered and stockpile materials. Payments will be made in a timely manner; however, no claim will be considered for delayed payment.

Progress payments do not constitute partial or full acceptance of the work. Acceptance of the work is specified in section 109.07.

A. **Completed Work.** The Engineer will make progress payments based upon estimates prepared by the Engineer of the work completed. The estimates are subject to final payment in accordance with section 109.07. Progress payments will be made every 2 weeks if all of the following occur:

1. The work is progressing according to the progress or critical path method schedule; and
2. The written directives of the Engineer and contract requirements are being fulfilled.

The final payment will be made according to the requirements specified under subsection 109.07.D.

B. **Delivered and Stockpiled Materials.** The Engineer may pay the cost of nonperishable materials that meet the contract requirements and that are produced, fabricated, or purchased for incorporation into the contract, including freight charges, when all of the following conditions are met:

1. The value of the delivered material to be used in one item of work exceeds $3,000 and is not scheduled to be incorporated into the work within 30 days after delivery;
2. The Contractor presents a copy of proof of payment authenticated by the supplier or a copy of the supplier invoice related to the stockpiled material to the Engineer. If a copy of the supplier invoice is provided, the Contractor must furnish the paid invoice within 10 days after receiving payment from the Engineer. However, if the prime Contractor is the supplier, producer, or fabricator, the Engineer will base the payment on proven production cost; and
3. The Contractor stores or stockpiles the materials, in accordance with contract requirements or manufacturer’s recommendations, on the project, at locations near the project or at the fabrication facility, as approved by the Engineer.

For materials stockpiled at locations not on the project or at locations near the project, the materials must have been approved by the Department for

shipment or for use. Fabricated materials required to be accepted by the Department based on “Fabrication Inspection” will still be accepted based on the two-part acceptance process shown in the *MQAP Manual*. Stockpiled material payment for fabricated items will be made in accordance with the Department’s procedures.

The Engineer will base the payment for delivered or stockpiled materials on amounts paid to or invoiced by the supplier for the materials. However, the Engineer will withhold a portion of the contract unit price to cover completion of the work related to the pay item. The Engineer will not make payment for materials in excess of contract quantities. When the Engineer makes partial payment for materials, the Contractor must reserve the materials for use on the project. The Contractor is responsible for any loss or damage to the materials until the materials are incorporated in the work and the work is accepted.

The Contractor assumes the cost of any additional testing required by partial payment for stockpiling.

The Engineer’s approval of partial payment for delivered or stockpiled materials will not constitute final acceptance of such materials for use in completing items of work.

When the Contractor provides receipted bills, paid invoices, or other satisfactory evidence of payment by the fabricator for structural steel raw material that is to be part of the completed structure and that has been produced by the steel mill and delivered to the fabricator, the Engineer will include the value of the steel in the progress estimate. Detailed descriptions of the delivered material, including weights, dimensions, heat and unit numbers, and chemical and physical test reports, must be shown on the invoice or supplied to the Engineer. The fabricator must store the material separately and use the material only for fabricating the structural steel for the contract.

The Contractor must present evidence that the producer, fabricator, or supplier of the material is fully aware of all details of the transaction.

The Contractor must immediately pay the fabricator for those materials upon receipt of payment by the Department.

If the fabricator notifies the Department that payment for materials paid for by the Department has not been received, and the fabricator’s claim remains unsatisfied for more than 10 days following the Department’s payment to the Contractor, the amount provided for payment to the fabricator will be deducted from the next progress estimate.

109.05. Payment for Contract Revisions

A. **General.** The Department will pay for contract revisions, excluding those resulting from increased or decreased quantities of pay items covered by subsection 109.03, using the sequence specified in subsection 109.05.B through subsection 109.05.F. This payment covers all costs for performing the revised work, delay costs, and all other associated costs the Engineer deems reasonable and not expressly precluded in subsection 109.05.G. The Department may direct the Contractor, at any time, to perform the revised work under force account.

If a contract revision includes an extension of time for compensable delays under subsections 108.09.B.1 through 108.09.B.4, the Department will pay for delay costs in accordance with subsection 109.05.E

If a contract revision includes direction to the Contractor to accelerate the work in accordance with subsection 104.01.C, the Department will pay for the directed acceleration in accordance with subsection 109.05.F.

B. **Contract Unit Prices.** The Engineer will attempt to price revised work using contract unit prices.

C. **Negotiated Prices.** The Engineer and the Contractor will negotiate the price of a contract revision if the Engineer and the Contractor cannot agree on a price using contract unit prices.

The Contractor must provide an estimate of the proposed unit prices or lump sum price for the contract revision that includes the cost of performing the revised work, delay costs, and all other associated costs, plus a reasonable allowance for profit and applicable overhead. The Engineer may request that the Contractor justify the estimate by providing one or more of the following used in deriving the estimate:

1. Contractor’s labor requirements, by trade, in hours for each task;
2. Contractor’s equipment costs and time requirements;
3. Material costs; and
4. Any specialty subcontractor costs.

The Contractor must provide the justification within 5 calendar days after the Department’s request. The Department will respond to the estimate within 5 calendar days after receipt of the Contractor’s justification. The Department and the Contractor can mutually agree to extend these 5-day requirements.

D. **Force Account.**

1. **General.** If the parties are unable to reach agreement using contract unit prices or negotiated prices, the Engineer may direct the Contractor to perform the revised work, including any required offsite work, under force account.

   The Department will pay the Contractor for the directed work as specified in this subsection. The Contractor must accept the compensation provided in this subsection as full payment for the directed work.

   At the end of each work day, the Contractor's representative and the Engineer will compare records of the work done under force account.

   At any point during the execution of a force account, both parties may mutually agree to return to payment for the revised work in accordance with subsection 109.05.B or subsection 109.05.C.

2. **Work Plan.** Before starting the force account work, the Contractor must submit a written proposal for the directed work, including the planned equipment, materials, labor, and schedule. The work plan must include, to the extent possible, a progress schedule of controlling items and their duration, equipment to be used (Contractor-owned and rented), labor to be used (number of people and crafts), and a list of material. The Engineer will review and approve the plan. From the work plan, the Engineer will prepare a budget recommendation for the force account work. If the conditions relative to the force account change or if the progress of the work becomes inconsistent with the original work plan, the Contractor and the Engineer will jointly revise the work plan.

3. **Labor.** The Engineer will pay the Contractor an amount equal to the sum of the following labor costs, plus 55% of the sum (for road work) or 60% of the sum (for bridge work), to cover the costs of home office overhead, bond premium, insurance, and payroll taxes and to provide for a reasonable profit.

   For foreman and laborers, the Contractor will receive the rate of wage (or scale) that was agreed to in writing before beginning work. This rate will be paid for the time the foreman and laborers are engaged in the work. This will include hours required by a collective bargaining agreement or other employment contract applicable to the class of labor employed on the work, exclusive of time included in the "estimated operating costs."

   The Contractor will receive the amount paid to, or on behalf of, workers for vacation benefits, health and welfare benefits, pension

fund benefits, or other benefits when the amounts are required by a collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the work.

For the superintendent, the amount the Contractor will receive will be limited to the work hours in which the superintendent is engaged in the performance of the work done under force account.

4. **Materials.** For materials used and accepted by the Engineer, the Contractor will receive the cost of materials delivered, including tax and transportation charges, plus 15%.

   If a change in the amount or a change in the type of force account work results in a surplus of the material ordered and delivered to the project site, the Department will reimburse the Contractor for the costs, including restocking charges, incurred in returning the surplus material to the supplier.

   Discount for prompt payment or penalty for late payment will not be considered in determining the cost of materials charged to the force account work.

5. **Equipment and Plant.** The Contractor will be paid according to the following for any equipment or special equipment, other than small hand or power tools, the use of which is approved by the Engineer. Exclusive of costs for the operator, the Department calculates the base hourly rate for a piece of equipment by adding two distinct components: a rental rate and an operating rate. The Department defines rental rate, operating rate, and base hourly rate as follows:

   Rental Rate. Includes depreciation, taxes, major overhaul and repairs, overhead, interest, regional adjustment, equipment age adjustment, insurance, and storage.

   Operating Rate. Includes fuel, lubricants, labor service and maintenance, field repairs, tires, and other expendable items needed for continuous and efficient operation.

   Base Hourly Rate. The sum of a piece of equipment's rental and operating rates.

   The cost of supplies, attachments not listed separately in the Equipment Watch's *Rental Rate Blue Book*, field and home office overhead, profit and incidentals, insurance covering the usual insurable risks, including fire and theft, are incidental to the base hourly rate. The Department will not be liable for losses that can be covered by insurance.

Upon request, the Contractor must furnish to the Engineer either original bills and invoices or certification documenting the equipment's original invoice price plus improvements. Payment for equipment will not exceed the equipment's original invoice cost plus any documented improvements. Cumulative payment for multiple force accounts for any piece of equipment on a single contract will not exceed the equipment's original invoice cost plus any documented improvements.

Time elapsed while equipment is broken down and being repaired will not be considered for payment. Time elapsed after the Engineer has advised the Contractor in writing that the equipment is no longer needed to complete the force account work will not be considered for payment except for transportation costs.

a. **Contractor-Owned Equipment.** This subsection applies to the equipment and plant owned directly by the Contractor or by entities that are divisions, affiliates, subsidiaries, or in any other way related to the Contractor or parent company.

   i. **Equipment Listed in Blue Book.** The published monthly rental rate for each piece of Contractor-owned equipment used, including appurtenances and attachments to equipment, will be determined by using the Blue Book. The edition that is current at the time the force account work is started will apply. The rental rate will be equal to the published monthly rental rate divided by 176, modified by the rate adjustment factor and the applicable map adjustment factor. The operating rate will be equal to the published estimated operating costs per hour.

   ii. **Equipment Not Listed in Blue Book.** The monthly rental rate will be determined by using the published monthly rental rate listed for a similar piece of equipment giving proper consideration to the capacity, size, horsepower, and age of the equipment. The rental rate will then be determined by dividing the published monthly rental rate by 176, modified by the rate adjustment factor and the applicable map adjustment factor. The operating rate will be equal to the published estimated operating costs per hour. Rates must be agreed upon in writing before the equipment is used.

   For equipment for which there is no comparable in the Blue Book, the Contractor will provide the monthly rental rate and operating rate and furnish cost data to support these rates. The monthly rental rate must be reasonable but not more than 5% of the invoiced cost of the equipment. The rental rate will

be determined by dividing the monthly rental rate by 176. Rates must be agreed upon in writing before the equipment is used.

iii. **Small Tools.** No payment will be allowed for small hand and power tools that are not listed in the Blue Book. Small hand and power tools listed in the Blue Book at a rate of less than $1.00 per hour will not be paid for separately.

iv. **Foreman's Transportation.** The rate for the foreman's transportation unit will be $25.00 per hour.

v. **Minimum Equipment Time.** The minimum time per day for equipment used productively in force account work will be 2 hours.

vi. **Equipment Transportation.** Travel time to the location of the force account work will be included when the equipment is moved under its own power. When equipment is moved from one site to another by means other than its own power, the actual operating time during periods of loading and unloading equipment will be paid for at the established base hourly rate, and transportation costs will be allowed.

Transportation charges for each piece of equipment to and from the work site will be paid provided:

(a) Equipment is obtained from the nearest available source;

(b) Return charges do not exceed the delivery charges; and

(c) Charges are restricted to the units of equipment not already available and not on or near the project.

b. **Non-Contractor-Owned Equipment.** If the Contractor is required to rent a specific type of equipment, the Contractor must inform the Engineer of the need to rent the equipment and provide a written estimate from the rental agency for that equipment before using it on the work site. The Contractor will be paid the actual rental cost plus the operating rate for the time the equipment is used to accomplish the work, plus the cost of moving the equipment onto and away from the job. The Contractor must provide a copy of invoices for all rental expenses incurred.

c. **Standby Rate and Allowable Hours.** For Contractor-owned equipment, the standby rate will be one-half the rental rate established in subsection 109.05.D.5.a. The standby rate will only be allowed if the Engineer explicitly requires the equipment to remain on the site for later use on the force account work.

The Engineer will provide written notice when the equipment is no longer needed to complete the force account work and will not be considered for payment, except for transportation costs.

Payments for standby time will not be made on any day the equipment operates for 8 or more hours. For equipment accumulating less than 8 hours operating time on any normal work day, standby payment will be limited to only that number of hours that, when added to the operating time for that day, equals 8 hours.

6. **Subcontracting or Hiring Services by Others.** For administration costs in connection with subcontracting work or hiring services by others to perform specialized work that the Contractor is not qualified to do, the Contractor will receive an amount equal to 5% of the total cost of the work, computed as set forth above. Prior approval by the Engineer is required.

7. **Miscellaneous.** No additional allowance will be made for general superintendence or other costs for which no specific allowance is provided.

8. **Coordination of Records.** The Contractor's representative and the Engineer will compare records for work completed on a force account basis and bring these records into agreement at least once a week.

9. **Statements.** The Contractor will furnish the Engineer an itemized statement of the cost for the work performed on a force account basis including the percentage(s) added to labor, materials, and subcontracts. The Contractor must use a standard MDOT form or approved equal that includes the following details for reporting all force account costs.

    a. **For Each Employee.** Name, classification, dates worked, time worked each day, total time worked on the force account activity, hourly rate of pay, total wages and fringe benefits, and total earnings to date.

    b. **For Each Unit of Equipment Used.** Description, dates used, number of hours operated each day, standby hours, total hours, rental and operating rates, and total cost.

    c. **For Materials Used.** Total quantities of materials used and material costs, including transportation. Statements must be supported by invoices for all materials used and transportation charges.

If materials used on the force account work are not purchased for specifically the work but are taken from the Contractor's stock, the Contractor must give the Engineer an affidavit certifying the following:

i. The materials were taken from stock;

ii. The quantity claimed was used; and

iii. The costs including transportation represent the actual Contractor's cost.

E. **Delay Costs**

1. **General.** If the Contractor incurs a delay attributable to the Department, the Department will pay for the costs specified in this section as allowed by subsection 108.09.B, unless these costs have been previously paid as allowed in subsection 109.05.D. Such payment constitutes full compensation for the delay costs.

   The Department will make no payment for delays occurring during seasonal suspension unless the Contractor's approved progress schedule depicts work on the controlling operation during this period or the Engineer directs the Contractor to work during seasonal suspension.

   The Department will not pay for delay costs until the Contractor submits an itemized statement of those costs. Provide the content specified in subsection 109.05.D.9 for the applicable items in this statement and as follows:

   a. Proof of cost of project staff salaries, wages, payroll taxes, and insurance;

   b. Proof of cost of field office overhead;

   c. Proof of escalated cost for labor, equipment, and material; and

   d. Proof of material storage costs.

2. **Allowable Delay Costs.** Increases in cost for labor, equipment, and materials will be calculated as follows:

   a. **Idle Labor.** Labor costs during delays must be calculated as specified in subsection 109.05.D.3 for all non-salaried personnel remaining on the project as required under collective bargaining agreements or for other Engineer-approved reasons.

   b. **Escalated Labor.** Payments authorized for increases in labor costs will be based on the difference between old and new labor rates established by a state or federal agency or an agreement

between the employee and Contractor's bargaining agency that is accepted by the Department. Payment will be based on certified payrolls. Payment will also include the increases in fringe benefit rates and increases in payroll taxes that the Contractor is required to pay.

c. **Idle Equipment.** Payment may be allowed on a rental basis for the idled equipment if any one of the following criteria is met:

   i. The equipment is on the project site at the time of the delay, is required for the controlling operation, and cannot be used at other locations on the project.

   ii. The equipment is specialized and directly related to the controlling operation, whether on or off the project site. Both must be certified by the Contractor and verified by the Engineer.

   The rental rate for idled leased or rented equipment will be the leased or rented rate. However, the Engineer may direct the Contractor to return equipment and take it off rental.

   The rental rate for idled Contractor-owned equipment will be one-half the rate established in subsection 109.05.D.5.a. No payment will be allowed for operating costs.

   Payment will be limited to the difference between the hours used and 8 hours in any one day and to the difference between the hours used and 40 hours in any one week. No additional compensation for overhead will be allowed.

   Equipment demobilization and remobilization, if directed by the Engineer, will be paid in accordance with subsection 109.05.

d. **Material Escalation or Material Storage.** Payment for increased cost of materials will be based on differences in the invoice costs before and after the delay period. When requesting an increase in cost of materials, the Contractor must document the increased costs due to the delay. The cost of materials storage during the delay will be the invoiced storage cost.

e. **Field Office Overhead.** Payment for field office overhead costs includes field office rent, office utilities, land rent, and office supplies. Compute these costs on a calendar day basis using actual costs incurred due to the delay.

F. **Directed Acceleration.** If the Engineer orders the Contractor to accelerate the work in accordance with subsection 104.01.C, prior to

accelerating the work, the Engineer and the Contractor will negotiate compensation to the Contractor for the costs to accelerate the work.

G. **Unrecoverable Costs.** The Contractor is not entitled to compensation for costs not specifically allowed or provided for in this subsection including, but not limited to, the following:

1. Loss of anticipated profit.
2. Consequential damages, including loss of bonding capacity, loss of bidding opportunities, insolvency, and the effects of force account work on other contracts, or business interruption.
3. Indirect costs.
4. Attorney's fees, claim preparation expenses, and the costs of litigation.
5. Unabsorbed or extended field or home office overhead or any damages using an Eichleay or similar equation, except as otherwise provided in the mark-ups specified in subsections 109.05.D.1 through 109.05.D.7.

109.06. Source of Supply and Carrier Rates on Materials

The following do not constitute cause for claim for extra compensation:

A. The inability to secure satisfactory materials, for reasons beyond the Contractor's control, from the source upon which the bid was based, unless contract-specific single-source suppliers are specified by the Department; or

B. Changes in carrier rates or the alteration of transportation facilities for these materials during the life of the contract.

109.07. Final Inspection, Acceptance, and Final Payment

A. **Partial Acceptance.** Upon completion of a portion of the work, the Contractor may request, in writing, partial acceptance of that portion of the work. Within 7 days of the Contractor's written request, the Engineer will conduct an inspection to determine whether the Contractor has satisfactorily completed that portion of the work in accordance with the contract. Within 7 days of the inspection, the Engineer will provide written notice of either partial acceptance for that portion of the work and the effective date or an explanation for rejecting the Contractor's request for partial acceptance.

Partial acceptance will relieve the Contractor of maintenance responsibility and third-party damage liability for the designated portion of the work. By relieving the Contractor of maintenance and third-party

damage claims, the Department does not relieve the Contractor of responsibility for defective work or damages caused by the Contractor's operations. The Contractor must not construe partial acceptance to be final inspection, final acceptance of any part of the work, or waiver of any legal rights specified under section 107.

B. **Delayed Acceptance.** Upon completion of contract work items designated for delayed acceptance, the Contractor must notify the Engineer, in writing, of the completion of the designated work. Within 7 days of the Contractor's written request, the Engineer will conduct an inspection to determine whether the Contractor has satisfactorily completed the designated portion of the work in accordance with the contract. Within 7 days of the inspection, the Engineer will notify the Contractor, in writing, of the date the delayed acceptance period begins.

   Delayed acceptance will relieve the Contractor of maintenance responsibility and third-party damage liability for the designated portion of the work. By relieving the Contractor of maintenance and third-party damage claims, the Department does not relieve the Contractor of responsibility for defective work or damages caused by the Contractor's operations. The Contractor must not construe delayed acceptance to be final inspection, final acceptance of any part of the work, or waiver of any legal rights specified under section 107.

C. **Final Inspection and Final Acceptance**

   1. **Final Inspection.** The Engineer will conduct the final inspection within 7 days of receiving the Contractor's written notification that the work is completed. The Contractor must attend the final inspection.

      Within 7 days of the final inspection, the Engineer will provide written notice to the Contractor of a satisfactory final inspection or will provide a list of specific defects to be remedied in order to achieve a satisfactory final inspection.

      After achieving satisfactory final inspection, the Contractor is relieved of the duty of maintaining and protecting the project. In addition, the Contractor is relieved of its responsibility for third-party damage claims and for damage to the work that may occur after satisfactory final inspection.

   2. **Final Acceptance.** Within 7 days of satisfactory final inspection and submission of all required contract documentation by the Contractor, the Engineer will give the Contractor written notification of final acceptance effective on the date the Department executes MDOT Form 1120 *Final Inspection/Acceptance*.

The Contractor, without prejudice to the terms of the contract, is liable to the Department at any time, both before and after final acceptance, for latent defects, fraud, such gross mistakes as may amount to fraud, or actions affecting the Department's rights under any warranty or guarantee.

D. **Final Payment.** Within 30 calendar days after final acceptance, the Engineer will prepare a final estimate of work performed. The Contractor will have 30 calendar days of issuance of the final estimate to file a claim or objections to the quantities within the final estimate. If no claim or objections are filed within 30 calendar days, the Department will process the final estimate for approval and final payment. At that time, the Contractor will be furnished a copy of the approved final estimate.

1. The final payment will be made when the Contractor has provided the following:

   a. All reports or documents required by the Department and FHWA;

   b. The consent of the surety for payment of the final estimate; and

   c. Satisfactory evidence by affidavit, or other means, that all the indebtedness due to the contract has been fully paid or satisfactorily secured. If the evidence is not furnished, the Department may retain out of any amount due the Contractor sufficient sums to cover all lienable claims unpaid.

2. The Department can recover from the Contractor in the final estimate all overpayments. However, no recovery for overpayment will be made if both of the following conditions exist:

   a. The final estimate is issued more than 6 months after the acceptance of the project; and

   b. The overpayment was paid to a subcontractor not in existence at the time of the final estimate.

Section 203. Removing Drainage Structures, Culverts, and Sewers

203.01. Description

This work consists of removing or abandoning, in whole or in part, drainage structures, culverts, and sewers; salvaging, storing, and disposing of removed materials; and backfilling and compacting the excavated sites.

203.02. Materials

Provide materials in accordance with the following sections:

Sound Earth 205
Granular Material Class III 902

203.03. Construction

A. **Drainage Structures.** When removing or abandoning a drainage structure, rebuild and reconnect live sewers through the removal area. Maintain service of live sewers during construction operations.

If the plans show abandoning a drainage structure, remove the cover and break down the masonry in accordance with subsection 204.03. Dispose of materials in accordance with subsection 205.03.P and backfill in accordance with subsection 204.03.C.

B. **Culvert Pipe.** Completely remove pipe culverts as required, including end treatments.

Dispose of materials in accordance with subsection 205.03.P and backfill in accordance with subsection 204.03.C.

Remove only the portions of the existing culvert pipe necessary to allow connection to the new work when extending an existing culvert or replacing the existing end treatment. Do not damage the remaining culvert pipe.

Bulkhead abandoned culvert pipes in accordance with subsection 402.03.E or use other Department-approved methods. If the Engineer determines that the culvert is not in suitable condition for abandonment, the Engineer will specify alternate treatment.

For culvert pipes with a top elevation within 5 feet of the top of pavement and that require abandonment, review the abandonment treatment with the Engineer.

C. **Sewer Pipe.** Remove sewers (storm, sanitary, or combined) or parts of sewers that require removal or that interfere with the new construction.

Dispose of materials in accordance with subsection 205.03.P and backfill in accordance with subsection 204.03.C.

Remove only the part of the existing sewer necessary to allow the required connection to the new work when extending existing sewers or incorporating existing sewers into the new work. Trim the connecting sewer pipe edges to meet the required lines and grades without weakening or damaging those parts of the remaining sewer.

Bulkhead abandoned sewers in accordance with subsection 402.03.E or use other Department-approved methods. If the Engineer determines that the sewer pipe is not in suitable condition for abandonment, the Engineer will specify alternate treatment.

For sewer pipes with a top elevation within 5 feet of the top of pavement and that require abandonment, review the abandonment treatment with the Engineer.

203.04. Measurement and Payment

Pay Item	Pay Unit
Dr Structure, Rem	Each
Dr Structure, Abandon	Each
Culv, Rem, Less than 24 inch	Each
Culv, Rem, 24 inch to 48 inch	Each
Culv, Rem, Over 48 inch	Each
Culv, End, Rem, Less than 24 inch	Each
Culv, End, Rem, 24 inch to 48 inch	Each
Culv, End, Rem, Over 48 inch	Each
Sewer, Rem, Less than 24 inch	Foot
Sewer, Rem, 24 inch to 48 inch	Foot
Sewer, Rem, Over 48 inch	Foot

A. **General.** Unless otherwise required, the Engineer will measure structures or materials in the original positions.

The unit prices for the removal pay items include the cost of breaking down structures and material; sawing, removal, and disposal; providing, placing, and compacting backfill; and providing and placing replacement soil or base material.

The Department will pay for piling or timber cribs encountered during structure removal, but not shown on the plans, as extra work.

B. **Drainage Structure, Removal and Drainage Structure, Abandon**. The unit prices for **Dr Structure, Rem, and Dr Structure, Abandon** include the cost of maintaining and reconnecting live sewers and of removing attached parts and connections.

C. **Culvert, Removal and Culvert End, Removal**. The Engineer will measure elliptical or pipe arch culverts across the greatest dimension. The cost of removing existing end treatments, regardless of type, is included in the unit prices for the related culvert removal or culvert end removal pay items.

D. **Removal of Pipes (Culverts, Sewers, Underdrains, etc.) with Diameters Less than 12 inches**. The cost of removing pipes, including culverts, sewers, and underdrains, with diameters less than 12 inches is included in the unit price for constructing the new structure, culvert, or sewer if portions of the existing pipe are within the excavation limits of a new structure, culvert, or sewer.

E. **Abandoning Pipe Culverts and Abandoning Sewers.** The Department will not pay separately for abandoning pipe culverts and abandoning sewers.

   Unless included in the unit price for abandoning drainage structures, the Department will pay for bulkheads greater than 12 inches that are required in abandoning pipe culverts and abandoning sewers as **Sewer Bulkhead** of the type required, in accordance with subsection 402.04.D.

F. **Removal of End Treatments**. The Department will pay for removing end treatments on existing sewers as **Culv End, Rem**.

Section 204. Removing Miscellaneous Structures and Materials

204.01. Description

This work consists of removing miscellaneous structures and materials to clear the right-of-way, salvaging or disposing of removed materials and backfilling the resulting excavated sites.

204.02. Materials

Provide materials in accordance with the following:

Sound Earth 205
Granular Material Class III 902

204.03. Construction

A. **Breaking Down and Removing**. Remove structures or portions of structures entirely or to the limits required, including attached parts and connections. Do not damage the remaining portion of an existing structure.

1. **Partial Removal**. Break down portions of existing miscellaneous structures, not interfering with the new construction, to 3 feet below the pavement surface within the limits of the roadbed and to 1 foot below the finished grade outside the limits of the roadbed.

2. **Pavement, Curb, and Sidewalk.** Remove pavement, curb, gutter, curb and gutter, sidewalk, downspout headers, and similar structures to an existing joint or to a sawed joint. Saw concrete full depth unless otherwise approved by the Engineer. Provide for proper grades and connections to new work.

   All anticipated pavement removal operations conducted over utilities and other critical areas identified on the plans must be saw cut and the pavement removed full depth in such a manner as to not disrupt or damage these utilities or critical areas. Impact- or vibratory-type equipment is not permitted.

   Replace adjacent soils or base materials removed with concrete removal operations with similar material approved by the Engineer.

3. **Masonry and Concrete Structures**. Remove entirely or break down walls, foundations, and similar structures, excluding bridges, culverts, and retaining walls, in accordance with subsection 204.03.A.1.

4. **Basement Cleanout**. Remove existing backfill material from basements, break-up floors, plug drains, and backfill.

5. **Structures and Retaining Walls.** During the removal operations, protect the remaining portions of existing structures and new work under construction from damage.

   If the contract requires salvaging part of a steel structure, before dismantling, match-mark with paint the members designated for re-erection. Match-mark pins, nuts, loose plates, and parts to show proper locations. Treat pins, pin holes, and machined surfaces to prevent corrosion. Wire loose parts to adjacent members or pack in match-marked containers.

   If the contract requires incorporating portions of an existing concrete structure into the new construction, use a concrete saw to make the concrete cuts that will be exposed in the final work. Do not overcut corners; drill and chip to provide square corners. Avoid cutting reinforcing steel wherever possible. Do not cut off steel reinforcement projecting from the existing concrete structure. Protect projecting steel reinforcement from damage and embed it in the new concrete.

   Do not use explosives unless the Engineer provides written permission in accordance with subsection 107.17. The Engineer's written permission does not relieve the Contractor of liability or responsibility for damages resulting from the use of explosives.

6. **Culvert Structures.** Remove culvert structures or parts of culvert structures required for removal or that interfere with the new construction.

   For contracts requiring extension or incorporation of existing culvert structures into the new work, remove only enough of the existing structure to allow a connection to the new work. Trim the connecting edges of the existing culvert structure to the lines and grades as required without weakening or damaging that part of the structure.

7. **Railway Track Work**. Remove rails, paving, timber, rubber or concrete crossing panels, ties, track encasement, concrete header foundations, and other related items. Leave crushed stone or gravel ballast in place as directed by the Engineer.

8. **Guardrail**. Remove posts, beam elements, and anchorages, including concrete blocks and steel sleeves, or both; hardware; and other items.

9. **Utility Pole**. Remove poles, parts, and connections attached to utility poles.

10. **Fence**. Remove fence fabric, wire, posts, and foundations.

11. **Concrete Barrier and Glare Screen.** Remove concrete barrier, glare screen, and footings of an existing joint or sawed joint. Backfill as

required. Remove barrier footings and post footings entirely. Saw cut concrete full depth unless otherwise approved by the Engineer. Repair damage to existing manholes, catch basins, bridge piers, and remaining concrete barrier, glare screen, and footings that results from removal operations.

For contracts requiring extension or incorporation of existing barrier footings and/or post footings into the new work, remove only enough of the existing footing to allow a connection to the new work.

B. **Disposal of Materials.** Assume ownership of removed materials. Without causing damage, remove materials salvaged for use by the Department, local agency, or others and store outside the construction limits in a location and manner approved by the Engineer. Dispose of materials not incorporated into the new work in accordance with subsection 205.03.P before the Department accepts the project.

The Contractor may salvage materials that meet specification requirements and use them in the new work.

Dispose of broken concrete, matted together by steel reinforcement, outside the right-of-way. Provide the Engineer with written permission from the property owner of the disposal site.

C. **Backfilling.** Backfill excavated sites or holes resulting from removals within the influence of the subgrade surface limit with granular material Class III. Place and compact the granular material in accordance with the controlled density method in subsection 205.03.H.4.a.

For excavated sites outside the influence of the subgrade surface, backfill with sound earth in accordance with subsection 205.03.H.4.a.

204.04. Measurement and Payment

Pay Item	Pay Unit
Pavt, Rem	Square Yard
Curb, Rem	Foot
Gutter, Rem	Foot
Curb and Gutter, Rem	Foot
Sidewalk, Rem	Square Yard
Basement Cleanout	Cubic Yard
Track, Rem	Foot
Utility Pole, Rem	Each
Structures, Rem (Structure Identification)	Lump Sum
Structures, Rem Portions (Structure Identification)	Lump Sum
Culv, Other than Pipe, Rem	Each
Masonry and Conc Structure, Rem	Cubic Yard

Guardrail, Rem ..... Foot
Fence, Rem ..... Foot
Conc Barrier, Rem ..... Foot
Glare Screen, Rem ..... Foot

A. **General.** Unless otherwise required by the contract, the Engineer will measure the structure or material quantities in their original position.

The cost of breaking down and removing, sawing, disposing of materials, and providing, placing, and compacting backfill is included in the unit price for the related pay items. The cost of providing and placing replacement soils or base materials is included in the related pay items.

The Department will pay for piling or timber cribs encountered during the removal of structures, but not shown on the plans, as extra work.

B. **Pavement, Removal.** The limits of **Pavt, Rem**, as shown on the plans, will be established at the discretion of the Engineer. The Engineer may decide to leave areas in place or remove additional sections to attain the required cross section and base. The Engineer will measure **Pavt, Rem** in accordance with the following criteria:

1. **HMA Pavements and HMA Driveways**. The Department will pay separately for the removal of curb, curb and gutter, or gutter in conjunction with removing hot mix asphalt (HMA) pavements or HMA driveways.

   a. **HMA No Greater Than 12 Inches Thick**. The Engineer will measure the removal of HMA surface no greater than 12 inches thick overlying a material designated for removal or that is required to remain in place, as **HMA Surface, Rem** in accordance with subsection 501.04.H. The Engineer will measure the removal of the underlying material separately.

   b. **HMA Greater Than 12 Inches Thick**. The Engineer will measure the removal of HMA surface, greater than 12 inches thick, overlying a material designated for removal or that is required to remain in place, as **Pavt, Rem**. The Engineer will measure the removal of the underlying material separately.

2. **Concrete and Masonry Pavements and Concrete Driveways.** The Engineer will measure the removal of concrete and masonry pavements and concrete driveways as **Pavt, Rem**.

   If concrete or masonry pavements are encountered under the pavement being removed, the Engineer will measure each type of additionally encountered pavement at the unit price for **Pavt, Rem**.

The Department will consider a concrete overlay a separate pavement.

The Engineer will measure the removal of curb, curb and gutter, or gutter in conjunction with removing concrete or masonry pavement or concrete driveways, as **Pavt, Rem**.

C. **Curb, Removal; Gutter, Removal; or Curb and Gutter, Removal.** The Engineer will measure **Curb, Rem; Gutter, Rem**; and **Curb and Gutter, Rem** if included as separate pay items and not removed in conjunction with pavement or driveway removal along the base of the curb face or along the flowline of the gutter.

The unit prices for **Curb, Rem; Gutter, Rem**; and **Curb and Gutter, Rem** include the cost of removing downspout headers.

D. **Sidewalk, Removal.** The unit price for **Sidewalk, Rem** includes the cost of removing and disposing of sidewalk 6 inches thick or less. The Engineer will measure sidewalk greater than 6 inches thick as **Pavt, Rem** in accordance with subsection 204.04.B.

E. **Basement Cleanout.** The Engineer will calculate the volume of **Basement Cleanout** on the elevation of the existing backfill, the elevation of the floor, and the inside dimensions of the foundation. The Engineer will measure **Basement Cleanout** outside the pay limits for **Excavation, Earth** in accordance with subsection 205.04.

F. **Track Removal.** The Engineer will measure **Track, Rem** by the length of a single line track. The unit price for **Track, Rem** includes the cost of removing rails, ties, track encasement, stone or ballast as directed, concrete header foundations, and other related items.

The Engineer will measure the removal of pavement from between the rails and on either side of the track as **Pavt, Rem** in accordance with subsection 204.04.B.

G. **Utility Pole Removal.** The unit price for **Utility Pole, Rem** includes the cost of removing and disposing of the pole, attached parts, and connections.

H. **Structures, Removal and Structures, Removal, Portions.** The unit prices for **Structures, Rem** and **Structures, Rem Portions** include the cost of removing and disposing of miscellaneous structures or portions of structures.

I. **Payment for Culvert, Other than Pipe, Removal.** The unit price for **Culv, Other than Pipe, Rem** includes the cost of breaking down, removing, sawing, and disposing of materials and of providing, placing, and compacting backfill.

J. **Payment for Masonry and Concrete Structures, Removal.** The Department will pay only for **Masonry and Conc Structure, Rem** if the smallest dimension of the masonry or concrete structures, or parts of masonry or concrete structures, is at least 12 inches, and the smallest dimension of reinforced concrete structures is at least 8 inches. The Department will pay for the removal of other masonry and concrete structures as **Excavation, Earth** in accordance with subsection 205.04.

K. **Guardrail, Removal.** The Engineer will measure **Guardrail, Rem** along the face of the existing guardrail installation. The unit price for **Guardrail, Rem** includes the cost of the removal and disposal of multiple beam elements, posts, anchorages, including concrete blocks and sleeves, hardware, and other items.

L. **Fence, Removal.** The unit price for **Fence, Rem** includes the cost of removing and disposing of fence fabric, wire, posts, and foundations.

M. **Concrete Barrier, Removal.** The Engineer will measure **Conc Barrier, Rem** along the centerline of the barrier. The Engineer will measure the removal of split concrete barrier along the centerline of the barrier or glare screen on each side, without deductions for bridge piers. The unit price for **Conc Barrier, Rem** includes the cost of breaking down and removing, sawing, and disposing of materials; providing, placing, and compacting backfill; and repairing damage to existing items that are damaged during removal operations.

   If the pay item **Glare Screen, Rem** is not included in the contract, the cost of removing glare screen in conjunction with concrete barrier removal is included in the unit price for **Conc Barrier, Rem**.

N. **Glare Screen, Removal.** The Engineer will measure **Glare Screen, Rem** along the centerline of the screen. The unit price for **Glare Screen, Rem** includes the cost of breaking down and removing, sawing, disposing of materials and repairing existing concrete barrier damaged during removal operations.

O. **Bulkheads.** The cost of bulkheading abandoned pipes, conduits, or service connections with a diameter no greater than 12 inches and encountered in excavation is included in other related pay items. The Engineer will measure bulkheading abandoned pipes, conduits, or service connections with a diameter greater than 12 inches as **Sewer Bulkhead** in accordance with subsection 402.03.E.

Section 205. Roadway Earthwork

205.01. Description

This work consists of the following:

A. Constructing earth grades by excavating soil or rock and placing embankments or fills;

B. Salvaging and stockpiling selected materials;

C. Providing, placing, and compacting embankment materials;

D. Trimming the earth grade;

E. Disposing of surplus or unsuitable material; and

F. Maintaining the work in a finished condition until accepted by the Engineer.

Earth excavation consists of the work to excavate materials not otherwise addressed in the contract as separate work items. Rock excavation and subgrade undercutting are separate work items.

Investigate local conditions before bidding in accordance with subsection 102.04. Boring logs shown on the plans are for information only. Refer to MDOT's *Geotechnical Manual* for detailed data on soils.

G. **Definitions**

CIP. When used with an embankment item, CIP denotes compacted-in-place.

Frost heave textured material. Material with more than 50% silt particles by weight and a plasticity index of less than 10.

Loose measure (LM). Refer to section 109.01.B.2.

Silt. Material with a particle size from 0.002 mm to 0.075 mm.

Sound earth. Natural homogeneous material composed of soil or aggregate that can be compacted to the required density, contains no visible organic material, and has a maximum unit weight of at least 95 pounds per cubic foot.

205.02. Materials

Provide materials in accordance with the following sections:

Granular Material Class II, III 902
Open-Graded Aggregate..... 902
Geosynthetics 910

Do not use foundry sand from metal casting for roadway earthwork.

Refer to MDOT's *Density Testing and Inspection Manual* for maximum unit weight and in-place density test methods.

205.03. Construction

Before beginning earth-disturbing activities, install soil erosion and sedimentation control measures in accordance with section 208.

The Department considers buried rubbish and trash not identified in the contract a differing site condition in accordance with subsection 103.02.C. All buried rubbish and trash that are found must be disposed of properly.

A. **Preparing Roadway Foundation.** Remove material from the roadway foundation and salvage or dispose of. Compact the roadway foundation to the depth and density required.

Perform removal, salvage, and disposal operations in accordance with the following:

1. **Removing and Salvaging Topsoil.** Before removing topsoil, reduce vegetation to a height of 6 inches. Remove and dispose of cut vegetation, brush, rocks, and other unsuitable material.

   Remove topsoil to the required depth from designated areas before excavating or placing embankment. Use equipment and methods that avoid lifting subsoil. Suspend topsoil removal if the Engineer determines that soil or weather conditions are unsuitable.

   Submit a request to the Engineer in accordance with subsection 104.12 to temporarily stockpile topsoil inside the right-of-way.

   Prior to temporarily stockpiling topsoil outside the right-of-way, obtain written permission from the owner of the property that has been designated for material placement and obtain required permits in accordance with subsection 208.03.A. Provide documentation to the Engineer before stockpiling topsoil. Do not stockpile temporarily or permanently in wetlands or floodplains.

   Remove topsoil as follows:

   a. In peat and muck areas, do not remove topsoil;

   b. In borrow and clear vision areas, remove topsoil to the depth and width required;

   c. At inlet, outlet, and berm ditch areas, remove topsoil within the construction limits; and

   d. At roadway cut and embankment areas, remove topsoil within the limits of earth disturbance.

2. **Salvaging Materials.** Remove existing gravel, crushed stone, or selected excavated materials. The Contractor may salvage these materials. The Engineer may approve the use of salvaged materials to construct earth shoulders, approaches, or temporary roadway surfacing or to use in other work the Engineer determines appropriate. Do not salvage foreign or undesirable material. Temporarily stockpile salvaged material outside the limits of Contractor's earth disturbance and within the right-of-way limits, as approved by the Engineer.

   Surplus salvaged material is the property of the Contractor. Dispose of surplus salvaged materials in accordance with subsection 205.03.P before project completion.

3. **Disposing of Stones, Broken Rock, and Boulders**. For materials that cannot be incorporated in the work, dispose of the materials in accordance with subsection 205.03.P.

B. **Rock Excavation.** Excavate boulders with a volume of at least ½ cubic yard. Excavate rock or cemented soils that do not soften when wet or that cannot be removed without continuous drilling, blasting, or continuous use of a ripper or other special equipment.

   Expose the surface of the rock to allow the Engineer to measure before starting rock excavation. Remove rock encountered in the excavation to the required cross section and in accordance with all of the following:

   1. Excavate so no rock extends more than 6 inches above the lines of the required cross section;

   2. Excavate backslopes to the neat line slopes shown on the plans with no rock extending more than 12 inches from the true slope;

   3. Excavate the rock surface to provide drainage. Do not leave undrained pockets in the rock surface; and

   4. Remove rock or boulders loosened in the excavation and overhanging ledges on or outside the required cross section.

C. **Peat Excavation.** Remove peat, muck, marl, and very soft underlying clay. Coordinate removal with swamp backfill operations.

D. **Swamp Backfill.** Construct embankments across peat marshes as shown on the plans. Widen the embankment at culvert locations to provide a stable foundation for the length of the culvert, including headwalls and end sections. Provide granular material Class III for swamp backfill.

   If total excavation of peat results in a reasonably dry trench as determined by the Engineer, the Engineer may allow backfilling as a separate operation. Backfill the reasonably dry trench immediately after completing

the excavation in accordance with the controlled density method in subsection 205.03.H.4.a. Perform excavation and backfill as separate operations in shallow peat areas only with the Engineer's prior approval.

Coordinate the rate of advancement of the embankment and surcharge in deep swamps with the rate of excavation of the upheaved peat. If a trench of the required depth is not maintained full width ahead of the surcharge, use additional peat-excavating equipment or stop construction of embankment and surcharge until the two operations are in balance.

Dispose of peat as shown on the plans or in accordance with subsection 205.03.P.

The Department will bore swamp backfill to determine whether unsuitable material has been completely excavated or displaced. If the borings show the presence of unsuitable material under the swamp backfill, the Department will determine the corrective action. The Department will complete borings and notify the Contractor of corrective actions within 60 days after completion of the swamp backfill.

Corrective action may consist of excavating, placing a surcharge, excavating relief trenches, or a combination of these actions.

If a surcharge is placed over the swamp backfill, the Engineer will determine the width and elevation. Leave the surcharge in place until the Engineer determines that the swamp backfill is stable or the required settlement has taken place. The Engineer may require that the surcharge remain in place for up to 90 days.

Material from the surcharge is the property of the Contractor.

Obtain the Engineer's approval for swamp backfill and complete peat excavation and spreading before placing the pavement structure.

E. **Subgrade Undercutting.** Undercut the subgrade and backfill to replace material susceptible to frost heaving or differential frost action and to remedy unstable soil conditions.

Topsoil removal and peat excavation are not included in subgrade undercutting. Subgrade undercutting includes excavation below subgrade in cut sections, excavation at the transition from cut-to-fill sections, and excavation, other than peat excavation, as required below the topsoil in fill sections.

Excavated material from subgrade undercutting is the property of the Contractor.

1. **Limits of Subgrade Undercutting.** Excavate the subgrade to the approximate grade. The Engineer will promptly inspect the grade to

decide whether undercutting is necessary and to determine the limits of undercutting.

In shallow fill areas, the Engineer will inspect the fill area and determine the limits of the subgrade undercutting before the Contractor begins embankment placement.

Remove deposits of frost heave textured material within the subgrade surface limit. For areas north of the north boundary of Township 12 North, remove the frost heave textured material to a depth of 4 feet to 5 feet below the plan grade. For areas south of the north boundary of Township 12 North, remove the frost heave textured material to a depth of 3½ feet to 4 feet below the plan grade.

2. **Backfill of Subgrade Undercut.** Backfill subgrade undercutting Type I with selected clay or other Engineer-approved material.

   Backfill subgrade undercutting Type II with granular material Class II.

   Backfill subgrade undercutting Type III with the material excavated from subgrade undercut areas after mixing the excavated material to break up the undesirable strata of soils or with other Engineer-approved backfill material.

   Backfill subgrade undercutting Type IV with 21AA dense-graded aggregate or 4G open-graded aggregate. Encapsulate 4G aggregate with geotextile separator.

   Compact subgrade undercutting backfill to at least 95% of its maximum unit weight.

F. **Subgrade Manipulation.** Scarify, mix, and blend the roadbed subgrade to a depth of 12 inches below the top of subgrade. Compact to at least 95% of its maximum unit weight.

G. **Earth Excavation.** Excavated material is the property of the Contractor.

Compact the subgrade to at least 95% of its maximum unit weight and to a depth of at least 10 inches. If the subgrade cannot be compacted to 95% of its maximum unit weight using conventional construction methods, the Engineer may authorize the use of other methods to attain compaction.

In cut sections where the existing material appears to meet the requirements of subsection 301.02, excavate the grade to top of subbase rather than to the bottom of subbase. The Engineer will then determine whether the existing material meets subbase requirements. Shape material meeting subbase requirements to the top of subbase grade and compact to at least 95% of its maximum unit weight and to a depth of at

least 12 inches. The Engineer will adjust earthwork quantities accordingly. Excavate material not meeting subbase requirements to the bottom of subbase. The Department will not consider claims for damage caused by the Contractor's halting of grading operations so the Engineer can make subbase determinations.

Maintain the roadbed and ditches and provide drainage at all times. Install and remove temporary drainage facilities at no additional cost to the Department.

Perform grading to avoid removing or loosening material outside the required slopes. Replace and compact material removed or loosened outside the slopes to the required density and cross section.

Dispose of surplus or waste material resulting from ditch construction in accordance with subsection 205.03.P. Remove roots, stumps, or other materials that are unacceptable to the Engineer in the slopes and bottom of the ditch and backfill the holes with suitable material. Maintain ditches until the Engineer's final acceptance.

H. **Roadway Embankment**

1. **Stepping Side Slope**. Step embankments constructed on existing side slopes of 1:6 or steeper before placing embankment. Form steps with a horizontal dimension of at least 3 feet according to the *MDOT Standard Plan R-105* series.

2. **Borrow.** Borrow is defined in subsection 105.03. Excavate, transport, and place borrow material in accordance with subsection 105.03 and the following:

   After removal of borrow, leave borrow areas free formed without rigid geometric shapes. Make side slopes as flat as practical but ensure that slopes are no steeper than 1:4. Round the tops and bottoms of slopes with vertical curves to blend into adjacent terrain. Grade overburden left in the borrow area, except topsoil, to eliminate unsightly mounds, as determined by the Engineer.

   Where practical, shape borrow areas to drain, leaving usable land after completion. In granular soil, leave the area at least 12 inches above the high ground water level. In cohesive soil, leave the area at least 12 inches above the high-water elevation of the drainage outlet.

   If the borrow area cannot be drained, create a pond or a wetland. Create ponds by excavating to a depth of at least 8 feet below normal ground water level in granular soil or to 8 feet below the lowest drainage outlet in cohesive soil. Create wetlands by excavation to the elevation directed by the Engineer.

Restore borrow areas as shown on the plans or in a manner that will leave the land in a useful condition and with a natural appearance. Restore borrow areas within the right-of-way as required by the contract. Fence ponded borrow areas unless otherwise directed by the Engineer.

Restore borrow areas outside the right-of-way in accordance with permit requirements covered by Part 91, Soil Erosion and Sedimentation Control, of the Natural Resources and Environmental Protection Act (MCL 324.9101 et seq.) and any land use agreements with the property owner.

The Engineer may allow boulders to remain in borrow areas if placement creates a natural appearance.

The Engineer may waive restoration requirements if the Contractor takes borrow from the working area of an existing commercial source or the property owner holds a permit from a county or municipal enforcing agency designated under Part 91, Soil Erosion and Sedimentation Control, of the Natural Resources and Environmental Protection Act (MCL 324.9101 et seq.) Provide the Engineer with a copy of the property owner's permit.

3. **Winter Grading.** The Engineer will determine the winter grading limits. Remove ice and snow from the ground surface before placing embankment.

   Remove frozen material if the original ground contains more than 4 inches of frost within the limits of 1:1 slopes extending away from the finished shoulders to points of intersection with the original ground.

   Remove frozen material on a partially complete fill before placing more fill on the embankment. Stockpile frozen material in areas approved by the Engineer and outside the limits of earth disturbance until thawed. Use the thawed material in the embankment if it meets moisture requirements at the time of use.

4. **Placing and Compacting Embankment.** After preparing the ground area, construct embankments with sound earth and stones, broken rock, concrete, or masonry, except within the top 3 feet of embankment, or as allowed in the disposal of peat excavation material in accordance with subsection 205.03.D and subsection 205.03.P. Do not place frost heave textured materials in the top 3 feet of embankment below subgrade surface. Use a uniformly textured material to construct the top 3 feet of embankment to a uniformly

stable condition. Provide at least 50 feet of longitudinal transition between two types of textured materials.

Deposit embankment materials and compact in accordance with the controlled density method. The Engineer may direct or approve the 12-inch layer method, rock embankment method, or methods for the treatment of peat marshes.

Construct embankments using methods that do not create an unstable slope condition. Do not block the drainage of granular material by placing impervious material on the outside of embankments or by placing a combination of pervious and impervious material in the embankment, creating potential pockets of saturated material. Do not place peat excavation material in upland areas between the 1:1 slope that extends down from the subgrade surface/front slope intercept point and the final plan fill slope in fills greater than 14 feet high.

The Engineer may allow the placement of uncovered stones within construction limits, broken concrete, and broken rock from rock cuts in embankments. Use stones, broken concrete, and broken rock with the largest dimension no greater than 12 inches. Place in layers. Fill voids with sound earth and compact to at least 95% maximum unit weight. Do not place stones, broken concrete, or broken rock layers within 3 feet of the subgrade surface.

When placing embankment in layers of the required thickness is not feasible (e.g., filling in water, constructing on poorly drained soil), the Engineer may allow construction of the embankment in one layer of granular material Class III and will determine the minimum elevation for equipment operation. Thoroughly compact the fill material. Above the granular material Class III elevation, construct the embankment in accordance with the controlled density method.

Backfill and compact embankment adjacent to structures in accordance with subsections 205.03.I and 206.03.B. Construct other embankment and backfill as follows:

a. **Controlled Density Method.** Deposit cohesive material for embankments and spread in layers no greater than 9 inches deep, loose measure, and extending the full width of the fill area.

   For granular material, attain the required density by depositing, spreading, and compacting in layers no greater than 15 inches deep.

   Provide cohesive material with a moisture content no greater than 3% above optimum at the time of compaction. Provide granular material with a moisture content below saturation in accordance

with the one-point cone chart in MDOT's *Density Testing and Inspection Manual*.

Provide cohesive material in the top 3 feet of embankment with a moisture content not exceeding optimum at time of compaction. For material containing excess moisture, dry to the required moisture content before compacting. Ensure that each layer of material meets moisture requirements, and compact each layer to at least 95% of the maximum unit weight before placing the succeeding layer.

If the required percentage of maximum unit weight and the required moisture content are attained but the compacted material does not provide support for the subbase, the Engineer may direct the Contractor to dry the material by aeration and recompact. Aerate by disking or by manipulating the material using other methods approved by the Engineer.

b. **Twelve-Inch Layer Method**. Deposit the material and spread in layers no greater than 12 inches deep, loose measure, parallel to the finished grade, and extending to the full width of the embankment. Deposit the material by operating the hauling equipment over the layer being placed. Compact each layer to at least 95% of its maximum unit weight in accordance with the 12-inch layer method test in MDOT's *Density Testing and Inspection Manual.*

c. **Rock Embankment.** Use shattered rock from blasting or ripping with the largest dimension no greater than 12 inches to construct rock embankment. Deposit rock on the constructed fill and push over the leading edge to extend the fill. Do not deposit the shattered rock from the hauling equipment directly over the end of the fill. Place the rock embankment in layers no greater than 3 feet thick. Fill the surface of the rock embankment with rock fragments and rock fines to prevent infiltration of the earth embankment. Use granular material Class III to supplement insufficient rock fines to fill the surface of the rock embankment.

Do not use the aforementioned method in fills less than 4 feet deep. Do not place the stones and broken rock layers within 3 feet of the subgrade surface. For structures under rock embankment, provide at least 24 inches of granular material Class III along the sides and the top of structures before placing the rock embankment.

I. **Structure Embankment**

1. **Compaction of Original Ground**. In fill areas on which a structure is required, remove the topsoil from the area within the toes of slope in accordance with subsection 205.03.A.1. Compact the area to at least 95% of the maximum unit weight and at least 9 inches deep.

2. **Placing Structure Embankment**. Place and compact structure embankment to the limits shown on the plans before casting overlying footings. Protect structure embankments from freezing until placement of overlying footings.

   a. **Under Structure Footings Supported by Piling**. Construct structure embankment with granular material Class III within the limits shown on the plans. The Engineer may allow the use of sound earth as an alternate material when placed between April 1 and November 15. Use sound earth as defined in subsection 205.01 except that for rocks, the greatest dimension must be less than 3 inches. Deposit and compact structure embankment in accordance with the controlled density method.

   b. **Under Structure Footings for Which Piling is Not Specified**. Construct structure embankment with granular material Class III within the limits shown on the plans and deposit and compact in accordance with the controlled density method. Compact structure embankment to 100% of the maximum unit weight within the limits of 1:1 slopes, extending outward and downward from the bottom edges of the structure footings.

3. **Winter Grading for Structure Embankment.** Construct embankment during winter weather in accordance with subsection 205.03.H.3 except that before placing embankment to support a structure, remove ground containing frost within the limits of 1:1 slopes spreading outward in every direction from the bottom edges of structure footings. Stockpile frozen material until thawed outside the limits of earth disturbance in areas that are approved by the Engineer.

J. **Machine Grading.** Machine grading consists of light grading, 12 inches deep, to develop the cross section shown on the plans and includes the following:

1. Scarifying;
2. Plowing;
3. Disking;
4. Moving;

5. Compacting; and
6. Shaping the earth.

Loading or hauling material is not required for machine grading.

Grade ditches to drain runoff water. Grade intersections, approaches, entrances, and driveways as shown on the plans or as directed by the Engineer. Obtain the Engineer's approval before using excavation from ditches and roadbeds for shaping shoulders and adjacent fills.

K. **Ditch Cleanout.** Perform ditch cleanout to a depth of no greater than 2 feet based on a typical cross section shown on the plans. Include the following work:

1. Remove cattails, brush, and miscellaneous debris;
2. Remove trees with a diameter of less than 6 inches;
3. Blend ditch profiles to match the existing ditch; and
4. Remove soils/spoils from the project site.

L. **Temporary Railroad Crossing.** Construct temporary railroad crossings in accordance with subsection 107.20.

M. **Granular Blanket.** Excavate unstable soil in the slopes and backfill within the limits and to the depths shown on the plans or as directed by the Engineer. Dispose of excavated material in accordance with subsection 205.03.P.

For granular blanket, Type 1, backfill with granular material Class II.

For granular blanket, Type 2, dress the excavated area with a nominal 3-inch layer of granular material Class II before placing the drainage layer. Construct the drainage layer using one of the following:

1. A 2-inch layer of open-graded aggregate with geotextile blanket above and below;
2. A three-dimensional mesh with geotextile blanket above and below; or
3. Other geocomposite section approved by the Engineer.

Place at least a 12-inch layer of granular material Class II on the drainage layer to bring the slope and ditch section to the required elevation and cross section.

Construct underdrains adjacent to or as a part of the slope protection in accordance with section 404.

N. **Trimming and Finishing Earth Grade.** Construct the earth grade to the required grade. Remove exposed stones and rocks with a diameter greater than 3 inches.

Trim the subgrade to the grade shown on the plans. If a subbase is required, trim the subgrade to within 1 inch of the required grade. If a subbase is not required, trim the subgrade to within ¾ inch of the required grade.

Trim and shape the earth grade outside the subgrade to the required lines, grades, and cross sections. Finish slopes to Class B tolerance unless Class A tolerance is required.

Finish Class A slopes to within 1 inch of the average slopes shown on the plans. Make measurements at right angles to the slope.

Finish Class B backslopes to within 6 inches of the average slopes shown on the plans. Make measurement at right angles to the slope. Do not leave abrupt variations in the finished surface. Remove debris and unsuitable material.

Finish Class B fill slopes to within 2½ inches of the required grade and cross section from the outside shoulder line for 3 feet down the slope. Measure at right angles to the slope. Finish the remainder of the fill slope the same as a Class B backslope.

If trees or other obstacles do not interfere, round the tops of backslopes, bottoms of fill slopes, and other angles in the lines of the cross section to form vertical curves as shown on the plans or as directed by the Engineer. Make vertical curve transitions gradual such that they present a uniform and attractive appearance. The Contractor may omit vertical curves if constructing ditches in peat.

O. **Channel Excavation.** Trim, straighten, widen, deepen, or relocate the channel of a stream or watercourse. Remove and dispose of excavated material. Remove masonry and concrete structures in accordance with section 204. Complete work in the new channel before diverting the stream flow to the new channel. Maintain channels and keep free from debris until final acceptance of the channel.

P. **Disposing of Surplus and Unsuitable Material.** The Department assumes no legal obligation to ensure that the Contractor responsibly disposes of surplus and unsuitable material in accordance with this section. Permits must be obtained as necessary in accordance with subsection 107.02.

1. **Disposal Within the Right-of-Way**. Do not dispose of material, temporarily or permanently, beyond the normal plan fill slope across

regulated or unregulated wetlands or floodplains. The Engineer may allow disposal of material, including associated restoration material, within the right-of-way to fill low areas or flatten slopes at no additional cost to the Department.

2. **Disposal Outside the Right-of-Way.** Do not dispose of material, temporarily or permanently, in regulated or unregulated wetlands or floodplains. Prior to excavation, obtain written permission from the owner of the property including restoration requirements to be used for disposal outside the right-of-way and file the written permission with the Department. Dispose of material and restore areas in accordance with subsection 205.03.H.2 at no additional cost to the Department.

3. **Contractor Responsibility.** The Contractor is directly and solely responsible for disposal of surplus and unsuitable material.

   Contact the appropriate regulatory agencies to determine whether an area is a regulated or unregulated wetland or floodplain before disposing of surplus or unsuitable material in areas outside the right-of-way and not shown on the plans as disposal sites.

   Immediately move to an upland site any surplus or unsuitable material that was disposed of in portions of regulated or unregulated wetlands or floodplains not shown on the plans as disposal sites, at no additional cost to the Department. Restore the vacated area as directed by the applicable regulatory agencies at no additional cost to the Department.

   The Engineer will not consider requests for extensions of contract time without an assessment of liquidated damages for delays associated with moving surplus or unsuitable material to an upland site.

4. **Notification to Regulatory Agencies**. The Department will notify the applicable regulatory agencies if the Department becomes aware that the Contractor disposed of surplus or unsuitable material in portions of a regulated or unregulated wetland or floodplain not shown on the plans.

Q. **Berm Grading.** Remove existing earthen berms along shoulders of the roadway including under existing guardrail to facilitate drainage. Remove all berms from the paved shoulder to the hinge point of the fill slope and grade the slope to provide positive drainage or to the dimensions shown on the plans. Removed berm material, if approved for reuse, must be in accordance with subsection 107.15. Dispose of surplus or unsuitable material in accordance with subsection 205.03.P.

205.04. Measurement and Payment

Pay Item	Pay Unit
Excavation, Earth	Cubic Yard
Granular Material, Cl __	Cubic Yard
Excavation, Rock	Cubic Yard
Excavation, Peat	Cubic Yard
Backfill, Swamp	Cubic Yard
Subgrade Undercutting, Type __	Cubic Yard
Subgrade Manipulation	Square Yard
Embankment, LM	Cubic Yard
Embankment, CIP	Cubic Yard
Embankment, Structure, CIP	Cubic Yard
Machine Grading	Station
Ditch Cleanout	Station
Granular Blanket, Type __	Cubic Yard
Excavation, Channel	Cubic Yard
Berm Grading	Station

A. **Roadway Earthwork Volumes.** Prior to the start of the work, the Engineer and Contractor may agree to accept plan quantity, or the Engineer will calculate roadway earthwork volumes using the average end areas, the staked-section method, or an agreed-to alternative method.

The Engineer will determine the average end areas using the cross sections determined from the original and final elevation measurements. An alternative method such as a comparison of digital terrain models may be used if agreed to by the Contractor and the Engineer prior to the start of work.

For the staked-section method, the Engineer will calculate earthwork quantities by comparing the original cross sections taken before construction to the cross sections taken during and after construction.

The Engineer will take measurements during construction to verify conformance to the required grade and cross sections. The Engineer will adjust quantities for the following:

1. Changes in design;
2. Engineer-authorized deviation from the established grade and cross section;
3. Changes in original ground topography after the original survey was made; or

4. Any changes required by the Engineer during construction such as changing of cut or fill slopes and for excavation of peat, muck, marl, and very soft underlying clay.

B. **General.** The cost to build, maintain, remove, and restore borrow haul routes is included in the unit prices for other pay items.

The Engineer will measure removed topsoil and other selected excavated materials from embankment areas as **Excavation, Earth**.

If the progress clause in the contract requires the Contractor to construct embankments during the seasonal suspension, the Department will pay for the frozen material that is removed and the embankment that is required to replace it at the unit price for **Excavation, Earth** and **Embankment** of the type required. The Engineer will direct the grading limits during the seasonal suspension.

The Department will not pay for removing topsoil and frozen material to facilitate the Contractor's operations.

The unit prices for other pay items include the cost of compacting existing material in embankment and cut sections after removing topsoil.

The Department will pay for the removal of masonry and concrete structures in accordance with section 204.

The Engineer will measure **Granular Material, Cl II** and **Granular Material, Cl III** in place. The Engineer will measure **Granular Material, Cl III** required for constructing fills in water or constructing fills on poorly drained soil as **Backfill, Swamp**.

The Engineer will measure **Underdrains, Bank** in accordance with subsection 404.04.

The cost of trimming the subgrade and slopes to the required tolerances is included in the unit prices for other pay items.

The cost of restoring borrow and disposal areas is included in the unit prices for other pay items.

C. **Excavation, Rock.** The Engineer will measure **Excavation, Rock** using the staked-section method with no allowance for overbreak. The Department considers overbreak the material removed outside the area shown on the plans or the Engineer-approved cross section for rock excavation.

The Engineer will not make deductions for rock projecting inside the lines of the cross section within the limits required.

The Engineer will measure boulders greater than ½ cubic yard individually and will calculate the volume from average dimensions taken in three directions. The Department will pay for boulders greater than ½ cubic yard as **Excavation, Rock**.

The Engineer will measure the removal of overburden as **Excavation, Earth**.

D. **Peat Excavation and Swamp Backfill.** The Engineer will measure total **Excavation, Peat** in its original position.

For the measurement of partial **Excavation, Peat** and displacement, the Engineer will include the volume of the peat that is excavated to form the trench and the excavation of the upheaved peat in the trench. The Engineer will estimate the volume of upheaved peat required for removal from the trench at 100% of the actual peat displaced. The Department will not include peat displaced outside the pay limits shown on the plans in the pay quantity. The Engineer will take borings to determine the depth of displacement for calculating pay quantities.

The Department will pay for excavating peat, muck, marl, and very soft underlying clay as **Excavation, Peat**.

The unit price for **Excavation Peat** includes the cost of rehandling waste material to facilitate displacement.

In the treatment of peat marshes, the Department will not allow claims for delays lasting less than 60 days caused by Department testing and determination of corrective methods. Perform corrective work in areas requiring the total excavation method at no additional cost to the Department.

The Department and the Contractor will share equally the costs for corrective work in areas where the partial peat excavation and displacement method is required or directed by the Engineer. Payment for the corrective work includes excavation and relief trenches. If the Engineer recommends placement of a temporary surcharge, the Department will pay for half the swamp backfill quantity required for the surcharge. The Department will pay for half the quantity of swamp backfill removed as **Excavation, Earth** after the backfill stabilizes or the required settlement occurs.

If shown on the plans, the Department will pay for placement of temporary surcharge at the unit price for **Embankment, CIP** or **Backfill, Swamp**. The Department will pay for the removal of temporary surcharge at the unit price for **Excavation, Earth**.

The cost of maintaining a temporary surcharge, moved forward as the fill progresses, is included in the unit prices for other relevant pay items.

The Engineer will measure **Backfill, Swamp** in its original position. To facilitate measurement, isolate an area in the borrow pit or roadway cut as the exclusive source of material for **Backfill, Swamp**. If the Engineer requires more than initial and final cross sections to measure and calculate the volume of material removed, the Contractor must pay the Department for additional cross sections and calculations.

If not practical to calculate the volume of **Backfill, Swamp** in its original position, the Engineer will calculate the volume within the limits shown on the plans, or from fill borings, and increase the volume by 15%. The Engineer will not increase the **Backfill, Swamp** volume by 15% if the peat excavation results in a dry hole.

The Engineer will not increase the volume of **Backfill, Swamp** by 15% if the material is used to construct sand core fills regardless of whether sand core fills are shown on the plans or directed by the Engineer.

E. **Subgrade Undercutting and Subgrade Manipulation**

1. **Subgrade Undercutting.** The Engineer will measure **Subgrade Undercutting** in its original position. The Department will not make deductions to subgrade undercut quantities in areas where underdrain is installed.

   The Department will not adjust the unit price for changes to the quantity of the type of **Subgrade Undercutting** required.

   The unit price for **Subgrade Undercutting** of the type required includes the cost of removal and disposal of unsuitable material and replacement with required material.

   Payment for geotextile separator required for 4G backfill will be paid for according to subsection 308.04.

2. **Subgrade Manipulation.** The Engineer will measure **Subgrade Manipulation** only in designated areas shown on the plans or directed by the Engineer.

F. **Earth Excavation and Embankment.** The cost of stepping side slopes is included in the unit prices for the related roadway embankment pay items.

1. **Embankment, LM**. The Engineer will measure **Embankment, LM** by volume, loose measure. The unit price for **Embankment, LM** includes the cost of providing, hauling, placing, and compacting material at the required locations.

2. **Excavation, Earth and Embankment, CIP.** Payment for **Excavation, Earth** and **Embankment, CIP** will be based on subsection 205.04.A.

   If material is removed in embankment areas to a greater depth than required, the Department will pay only for the quantities of **Excavation, Earth**; **Embankment, CIP**; and **Embankment, Structure, CIP** as shown on the plans or as directed by the Engineer.

3. **Embankment, Structure, CIP.** The Engineer will measure **Embankment, Structure, CIP** based on the grade and cross section shown on the plans using the staked-section method. The Engineer will not make allowance for increases in quantities of fill material required due to normal consolidation of the natural ground under the embankment.

   The Engineer will measure sound earth if used as structure embankment under pile-supported footings as **Embankment, CIP**.

G. **Machine Grading.** The Engineer will measure **Machine Grading** along the surface edge. The Engineer will measure each side of the road where work is performed, separately.

H. **Ditch Cleanout.** The Engineer will measure **Ditch Cleanout** along the center line of the ditch. Restoration will be paid for separately in accordance with section 816.

I. **Granular Blanket**

1. **Granular Blanket, Type 1**. The Engineer will measure **Granular Blanket, Type 1**, including the volume of granular material Class II, within the limits and to the depth shown on the plans or as approved by the Engineer.

2. **Granular Blanket, Type 2**. The Engineer will measure **Granular Blanket, Type 2** in place and include the volumes of the drainage layer and granular material Class II within the limits and to the depth shown on the plans or as approved by the Engineer.

J. **Channel Excavation.** The Engineer will measure **Excavation, Channel** by volume in its original position.

K. **Berm Grading.** The Engineer will measure **Berm Grading** along the shoulder edge. The Engineer will measure each side of the road where work is performed, separately. The cost for berm grading under guardrail is included in this item. Grading under new or reconstructed guardrail is included in the unit price for the guardrail according to subsection 807.04.A.

Section 206. Excavation and Backfill for Structures

206.01. Description

This work consists of clearing, removing old structures or parts of structures, removing materials required for constructing structures, disposing of surplus or unsuitable material in accordance with subsection 205.03.P, and backfilling completed structures.

206.02. Materials

Provide materials in accordance with the following sections:

Sound Earth 205
Granular Material Class II 902
Aggregate, 6A, 46G 902
Geosynthetics 910

A. **Bridges, Pump Stations, Retaining Walls, and Culverts (Other Than Pipe)**. Provide granular material Class II.

B. **Miscellaneous Structures.** Unless otherwise required, provide sound earth. Miscellaneous structures are structures other than bridges, pump stations, retaining walls, and culverts other than pipe.

206.03. Construction

A. **Foundation Excavation and Rock Foundation Excavation.** Excavate to allow for foundation unit construction. If shown on the plans or approved by the Engineer, trim the footing excavation to the exact size of the footing and omit the footing forms. For concrete placed on or against an excavated surface other than rock, do not disturb the bottom and side surfaces of the excavation before placing concrete. Excavate to the required grade immediately before concrete placement.

   Before placing concrete, check the excavation depth and secure the Engineer's approval of the foundation support material. Place concrete in the absence of free-standing water. Change the elevations for the bottom of footings as directed by the Engineer to ensure a stable foundation.

   If directed by the Engineer, remove and replace unsound material under proposed structures and replace with Department-approved material. Remove loose fragments and clean and cut rock surface or other hard material before placing concrete on required surface. Level, step, or serrate the surface as directed by the Engineer.

   1. **Foundation Excavation**. Excavate materials, including portions of the existing structures, within the foundation excavation limits, except rock foundation excavation.

2. **Rock Foundation Excavation**. Excavate in accordance with subsection 205.03.B.

B. **Backfill Placement and Compaction.** Place and compact backfill around completed structures.

1. **Placing Backfill.** Provide material appropriate for the type of structure requiring backfill in accordance with subsection 206.02.

   If soil that is excavated from the site meets material requirements, the Contractor may use it to backfill around completed structures.

   Place backfill against the concrete structure after completion of the required curing, surface finishing, and waterproofing. Cover the inlet of each weep hole with geotextile blanket prior to placing backfill. Place backfill evenly around the structure to equalize horizontal loadings.

2. **Compacting Backfill**

   a. **Bridges, Pump Stations, Retaining Walls, and Culverts (Other Than Pipe).** Place backfill material in 6-inch layers. Compact each layer to 100% of the maximum unit weight in the load-bearing area. The load-bearing area is the area within the 1:1 slope, down and away from the outer limits of the bottom of the footing to the bottom of the excavation.

   Place backfill behind and around substructure units, between the outer limits of the bottom of the footing and the surface elevation, in layers no greater than 12 inches deep. Compact backfill to at least 95% of the maximum unit weight.

   Place backfill between the bottom of footing elevation and the bottom of slope paving subbase in layers no greater than 12 inches deep. Compact to at least 95% of the maximum unit weight.

   b. **Miscellaneous Structures.** For miscellaneous structures, place backfill in 12-inch layers and compact to at least 95% of the maximum unit weight. The Engineer may approve an increase in the thickness of layers if the Contractor obtains the required compaction results.

206.04. Measurement and Payment

Pay Item	Pay Unit
Excavation, Fdn	Cubic Yard
Excavation, Rock Fdn	Cubic Yard
Backfill, Structure, CIP	Cubic Yard
Backfill, Structure, LM	Cubic Yard

Aggregate ..... Cubic Yard

A. **Excavation.** The Department does not consider excavation to include removal of ice, water, or liquids. Unless otherwise required, the cost of sheeting, shoring, and dewatering is included in the unit prices for related structure excavation pay items.

1. **Excavation, Foundation.** The Engineer will base payment for **Excavation, Fdn** on plan quantity in accordance with subsection 109.01.A. Unless otherwise shown on the plans, the Engineer will determine the plan quantities using the space bounded by the existing ground surface or exposed portions of the existing substructure, the elevation of the bottom of the foundation, and the 1:1 slopes extending outward and upward from points 18 inches outside the bottom of the footing.

   The Department will pay for, as extra work, the removal of piling below the bottom of footing elevations that is not shown on the plans and encountered during structure excavation.

2. **Excavation, Rock Foundation.** The Engineer will measure **Excavation, Rock Fdn** in its original position for the amount of rock excavated within vertical planes through the footing neat lines. The Engineer will make allowance for overbreak if the Engineer determines that it is impractical to excavate to the neat lines of the footing. The Engineer will measure the amount of overbreak by actual cross sections of the footing excavation. Overbreak allowance is limited to vertical planes 6 inches outside and parallel to the neat lines of the footing and to a depth of 3 inches below the elevation of the bottom of the footing, as shown on the plans.

   Excavation, Rock Fdn does not include removal of portions of existing structures.

B. **Backfill**

1. **Backfill, Structure, CIP.** The Engineer will base payment for **Backfill, Structure, CIP** on plan quantity in accordance with subsection 109.01.A regardless of the foundation excavation slope. The Engineer will not measure material placed outside the maximum pay limits shown on the plans.

   The Department will pay for granular material Class II used to backfill bridges, pump stations, retaining walls, and culverts other than pipe as **Backfill, Structure, CIP.**

2. **Sound Earth**. The cost of sound earth used as backfill material for miscellaneous structures is included in the unit prices for related pay items.

3. **Aggregate**. The Engineer will measure **Aggregate** by volume, loose measure. The unit price for **Aggregate** includes the cost of providing, hauling, and placing 6A or 46G material at locations as directed by the Engineer.

Section 208. Soil Erosion and Sedimentation Control

208.01. Description

This work consists of installing and maintaining erosion and sedimentation controls to minimize soil erosion and control sediment from leaving the right-of-way and affecting water resources of the State of Michigan and adjacent properties. Complete this work in accordance with this section and MDOT's *SESC Manual*. The Department considers the terms "stabilization" and "erosion control measures" as defined in the *SESC Manual*.

Failure to install and maintain soil erosion controls may result in project shutdown, fines from the EGLE, or both. The Contractor is responsible for obtaining applicable federal, state, and local permits when disturbing areas outside a Department right-of-way or outside Department-acquired easement areas.

208.02. Materials

Provide materials in accordance with the following sections:

Coarse Aggregate, 6A 902
Granular Material Class II 902
Dense-Graded Aggregate, 21AA, 22A 902
Open-Graded Aggregate, 34R, 46G 902
Fencing Materials 907
Culvert Pipe 909
Geosynthetics 910
Cobblestone 916
Coarse Aggregate, 3×1 916
Riprap 916
Heavy Riprap 916
Sand and Stone Bags 916
Temporary Plastic Sheet 916
Turbidity Curtain 916

208.03. Construction

A. **Area Limitations.** Conduct work to minimize soil erosion.

Limit the area of earth disturbance to 50 stations of dual roadways or 100 stations of single roadway during clearing and grading. The Engineer may change the limits of exposed surface area based on the Contractor's ability to minimize erosion and prevent offsite sedimentation.

Do not disturb lands and waters outside the limits of earth disturbance within the right-of-way without prior approval from the Engineer. Restore

Contractor-disturbed areas beyond the plan or Engineer-approved limits at no additional cost to the Department.

Obtain and give the Engineer copies of local, state, or federally required permits before disturbing sites outside the right-of-way, such as borrow, waste or disposal areas, haul roads, or storage sites. Provide temporary and permanent erosion and sedimentation controls in accordance with the permits.

B. **Time Limitations.** Bring grading sections to the final earth grade as soon as possible. Completion of the final earth grade does not include topsoil or other permanent restoration measures. The Engineer will consider the earth grade final and ready for placement of topsoil and permanent soil erosion control measures when the Contractor constructs a slope, channel, ditch, or other disturbed area in accordance with subsection 205.03.N.

Complete topsoil placement and stabilize slopes, channels, ditches, and other disturbed areas within 5 calendar days after final earth grade with permanent soil erosion control measures. Permanently restore and place topsoil on slopes and ditches within 150 feet of lakes, streams, or wetlands within 24 hours of achieving final earth grade using permanent soil erosion control measures.

Do not prolong trimming, finishing final earth grade, or both, to permanently stabilize the project at one time.

C. **Construction and Maintenance of Erosion and Sedimentation Controls.** Construct temporary or permanent erosion and sedimentation controls in accordance with the *SESC Manual*, details shown on the plans, or as directed by the Engineer.

Maintain temporary erosion and sedimentation controls as necessary to ensure their effectiveness until permanent stabilization of the disturbed area has occurred. Dispose of sediment and debris removed from temporary sedimentation control devices in accordance with subsection 205.03.P.

Maintain permanent erosion controls as necessary to ensure their effectiveness until project completion and acceptance. Repair damaged areas, replace lost devices, and remove sediment as required. Dispose of sediment and debris removed from permanent sedimentation control devices in accordance with subsection 205.03.P.

1. **Check Dams**. Install, maintain, and remove check dams across ditches.

2. **Sediment Traps and Basins.** Excavate 5 cubic yards or less for sediment traps and greater than 5 cubic yards for sediment basins. Construct, maintain, and fill sediment traps and basins.

   Prevent the excavated material from eroding into lakes, watercourses, or wetlands. Install required check dams downstream from a trap or basin before excavating the trap or basin.

3. **Filter Bag.** Provide, place, and remove at least 225-square-foot filter bags constructed of geotextile blanket. Pump water from the construction area into the filter bag to filter the water before it enters a watercourse. Install gravel filter berms on the downslope side of the filter bag for additional protection in sensitive areas or where the Engineer determines that the filter bag is not effectively removing the sediment. Place the filter bag in an upland vegetated area, on level ground, above, and as far as possible from watercourse banks. Use one pump discharge hose per filter bag. Hose must be of appropriate size for the filter bag. Use multiple filter bags as necessary to ensure effective filtration. The Engineer must approve the location of the filter bag before pumping begins.

   Replace or dispose of the filter bag and its contents when no longer effective or required. Dispose of filter bag and contents in accordance with subsection 205.03.P.

   The Contractor may discharge silt-free, sediment-free water directly to a watercourse.

4. **Sand and Stone Bags**. Provide, place, maintain, remove, and dispose of sand or stone bags. Use non-contaminated sediment-free materials. The stone from stone bags may remain in place after the required period if the bags are cut open and the stone spread evenly, as directed by the Engineer.

5. **Silt Fence**. Provide, install, maintain, remove, and dispose of silt fence consisting of woven geotextile fabric stapled to and supported by posts. Place material removed from trenching in the silt fence on the upslope side of the silt fence. In areas where water ponds behind the silt fence, provide a stone filter to channel away the water and prevent failure. Silt fence may remain in place after the required period if directed by the Engineer.

6. **Gravel Filter Berm**. Provide, place, maintain, remove, and dispose of gravel filter berms consisting of coarse aggregate 6A or open-graded aggregate 34R or 46G. Do not use a gravel filter berm instead of a check dam in a ditch.

7. **Inlet Protection, Fabric Drop**. Provide, place, maintain, and remove fabric drop inlet protection devices as directed by the Engineer. Remove and dispose of accumulated sediment as necessary.

8. **Inlet Protection, Geotextile and Stone.** Provide, place, maintain, remove, and dispose of geotextile blanket, coarse aggregate 6A or open-graded aggregate 34R or 46G, or both, for inlet protection. Remove and dispose of accumulated sediment as necessary.

9. **Inlet Protection, Sediment Trap**. Excavate, provide, maintain, remove, and dispose of sediment traps consisting of geotextile blanket and coarse aggregate 6A or open-graded aggregate 34R or 46G. Remove and dispose of accumulated sediment as necessary.

10. **Temporary Plastic Sheets or Geotextile Cover**. Provide, place, maintain, remove, and dispose of plastic sheets or geotextile cover. Secure temporary plastic sheets or geotextile cover as directed by the Engineer.

11. **Sand Fence.** Provide, maintain, remove, and dispose of fence to prevent sand from migrating onto roads.

12. **Aggregate Cover**. Provide, place, maintain, remove, and dispose of geotextile separator and dense-graded aggregate 21AA, coarse aggregate 3×1, coarse aggregate 6A, or other Engineer-approved material.

13. **Gravel Access Approach**. Provide, place, maintain, remove, and dispose of geotextile separator and coarse aggregate 3×1 or other Engineer-approved material.

14. **Turbidity Curtain**. Provide, install, maintain, remove, and dispose of shallow or deep turbidity curtain.

    Use shallow turbidity curtain when the water is no greater than 2 feet deep. Use deep turbidity curtain when the water is greater than 2 feet deep.

    Provide a floating or staked turbidity curtain. During removal, minimize sediment loss.

15. **Intercepting Ditch**. Construct and maintain intercepting ditches. Remove ditches when no longer needed or as directed by the Engineer.

D. **Removal of Erosion and Sedimentation Control Facilities.** Remove or obliterate temporary erosion and sedimentation controls when the permanent controls are complete and approved unless otherwise directed by the Engineer. Do not remove temporary controls next to lakes,

watercourses, or wetlands until the establishment of turf on the adjacent slopes. Before placing topsoil, permanent seed, and fertilizer, remove or incorporate mulch placed for temporary erosion control into the slope. Minimize erosion and sedimentation into watercourses during removal of erosion controls. Repair damage caused during the removal of erosion controls at no additional cost to the Department.

208.04. Measurement and Payment

Pay Item	Pay Unit
Erosion Control, Check Dam, Stone	Foot
Erosion Control, Sediment Trap	Each
Erosion Control, Sediment Basin	Cubic Yard
Erosion Control, Filter Bag	Each
Erosion Control, Sand Bag	Each
Erosion Control, Stone Bag	Each
Erosion Control, Silt Fence	Foot
Erosion Control, Gravel Filter Berm	Foot
Erosion Control, Inlet Protection, Fabric Drop	Each
Erosion Control, Inlet Protection, Geotextile and Stone	Each
Erosion Control, Inlet Protection, Sediment Trap	Each
Erosion Control, Temp Plastic Sheet/Geotextile Cover	Square Yard
Erosion Control, Sand Fence	Foot
Erosion Control, Aggregate Cover	Square Yard
Erosion Control, Gravel Access Approach	Each
Erosion Control, Maintenance, Sediment Rem	Cubic Yard
Erosion Control, Turbidity Curtain, Shallow	Foot
Erosion Control, Turbidity Curtain, Deep	Foot
Ditch, Intercepting	Station

The Department will not pay for repairing or replacing temporary or permanent SESC measures damaged by the Contractor's negligence. The Department will pay for repairing or replacing temporary or permanent SESC measures damaged by causes other than the Contractor's negligence at the contract unit price for the relevant pay items.

A. **Erosion Control, Check Dam, Stone.** The Engineer will measure **Erosion Control, Check Dam, Stone** in place. The unit price for **Erosion Control, Check Dam, Stone** includes the cost of providing, placing, maintaining, and removing the stone check dam.

B. **Erosion Control, Sediment Trap or Basin**

1. Erosion Control, Sediment Trap. The unit price for **Erosion Control, Sediment Trap** includes the cost of excavating, constructing, maintaining, and removing sediment traps.

The Department will pay separately for removing and disposing of accumulated sediment or debris from a sediment trap as **Erosion Control, Maintenance, Sediment Rem**.

2. **Erosion Control, Sediment Basin.** The Engineer will measure **Erosion Control, Sediment Basin** by volume, loose measure. The unit price for **Erosion Control, Sediment Basin** includes the cost of excavating, constructing, maintaining, and removing the sediment basin.

   The Department will pay separately for removing and disposing of accumulated sediment or debris from a sediment basin as **Erosion Control, Maintenance, Sediment Rem**.

C. **Erosion Control, Filter Bag.** The unit price for **Erosion Control, Filter Bag** includes the cost of providing, placing, maintaining, and disposing of the filter bag and its contents and restoring the filter bag site.

   The Department will pay separately for gravel filter berm used in conjunction with a filter bag as **Erosion Control, Gravel Filter Berm**.

D. **Erosion Control, Sand Bag and Erosion Control, Stone Bag**. The Engineer will measure **Erosion Control, Sand Bag** and **Erosion Control, Stone Bag** in place. The unit prices for **Erosion Control, Sand Bag** and **Erosion Control, Stone Bag** include the cost of providing, placing, maintaining, removing, and disposing of the sand or stone bags.

E. **Erosion Control, Silt Fence.** The Engineer will measure **Erosion Control, Silt Fence** in place excluding overlaps. The unit price for **Erosion Control, Silt Fence** includes the cost of providing, installing, maintaining, removing, and disposing of the fence and posts.

   The Department will pay separately for removing and disposing of accumulated sediment or debris from behind silt fence as **Erosion Control, Maintenance, Sediment Rem**.

F. **Erosion Control, Gravel Filter Berm.** The Engineer will measure **Erosion Control, Gravel Filter Berm** in place. The unit price for **Erosion Control, Gravel Filter Berm** includes the cost of providing, placing, maintaining, removing, and disposing of the gravel filter berm.

G. **Erosion Control, Inlet Protection**

   1. **Erosion Control, Inlet Protection, Fabric Drop**. The unit price for **Erosion Control, Inlet Protection, Fabric Drop** includes the cost of constructing, maintaining, and removing inlet protection fabric drops.

   2. **Erosion Control, Inlet Protection, Geotextile and Stone**. The unit price for **Erosion Control, Inlet Protection, Geotextile and Stone**

includes the cost of constructing, maintaining, and removing geotextile and stone inlet protection.

3. **Erosion Control, Inlet Protection, Sediment Trap**. The unit price for **Erosion Control, Inlet Protection, Sediment Trap** includes the cost of excavating, constructing, maintaining, and removing sediment traps for inlet protection.

The Department will pay separately for removing and disposing of accumulated sediment or debris from a sediment trap inlet protection device as **Erosion Control, Maintenance, Sediment Rem**.

H. **Erosion Control, Temporary Plastic Sheet/Geotextile Cover.** The unit price for **Erosion Control, Temporary Plastic Sheet/Geotextile Cover** includes the cost of constructing, maintaining, and removing temporary plastic sheets and geotextile covers.

I. **Erosion Control, Sand Fence.** The Engineer will measure **Erosion Control, Sand Fence** in place. The unit price for **Erosion Control, Sand Fence** includes the cost of constructing, maintaining, and removing sand fence.

J. **Erosion Control, Aggregate Cover.** The unit price for **Erosion Control, Aggregate Cover** includes the cost of constructing, maintaining, and removing aggregate cover.

K. **Erosion Control, Gravel Access Approach.** The unit price for **Erosion Control, Gravel Access Approach** includes the cost of temporary culverts and ditching required to maintain existing drainage courses through or around gravel access approaches and providing, constructing, maintaining, and removing gravel access approaches.

L. **Erosion Control, Maintenance, Sediment Rem**. The Engineer will measure **Erosion Control, Maintenance, Sediment Rem** by volume, loose measure. The unit price for **Erosion Control, Maintenance, Sediment Rem** includes the cost of removing sediment and debris from erosion and sedimentation control devices as required by the *SESC Manual* and as necessary to ensure their effectiveness.

M. **Erosion Control, Turbidity Curtain.** The Engineer will measure **Erosion Control, Turbidity Curtain, Shallow** and **Erosion Control, Turbidity Curtain, Deep** in place. The unit prices for **Erosion Control, Turbidity Curtain, Shallow** and **Erosion Control Turbidity Curtain, Deep** include the cost of providing, installing, maintaining, and removing turbidity curtains.

The unit price for **Erosion Control, Maintenance, Sediment Rem** includes the cost of removing and disposing of accumulated sediment or debris retained by the turbidity curtain.

N. **Intercepting Ditch.** The Engineer will measure **Ditch, Intercepting** in place along the ditch centerline. The unit price for **Ditch, Intercepting** includes the cost of constructing, maintaining, and removing the intercepting ditch.

Section 302. Aggregate Base Course

302.01. Description

This work consists of constructing an aggregate base course on a surface approved by the Engineer.

302.02. Materials

Provide materials in accordance with the following section:

Dense-Graded Aggregate 21AA, 21A, 22A..... 902

Provide aggregate meeting the aggregate series shown on the plans.

302.03. Construction

A. **Placing and Compacting.** Provide a ticket with each load stating the following information:

1. Project number;
2. Aggregate source;
3. Aggregate series;
4. Date;
5. Time;
6. Truck identifier number;
7. Supplier name; and
8. Type of aggregate approval.

If the contract requires payment by weight, ensure the ticket includes the gross weight, tare weight, and net weight to the nearest 100 pounds. Determine the truck tare weight at least once daily.

If the contract does not require payment by weight, the Engineer may accept written documentation instead of tickets. Written documentation must identify the pay item of the material and include all of the information listed above except time and truck identifier number.

Provide and place aggregate with a uniform gradation, free of contamination and segregation. Do not place aggregate base on frozen, soft, unstable or rutted subgrade, subbase, or aggregate base. Do not rut or distort the subbase material or aggregate base during spreading.

The Contractor may use additives to facilitate compaction, shaping, and maintenance of the aggregate surface.

Compact the aggregate layers to a uniform thickness, no less than 3 inches and no greater than 8 inches. If placing aggregate base in a layer less than 3 inches, blend the new aggregate base material with the layer below to ensure a total of 6 inches. Blending must be performed to ensure that the new aggregate base material is uniformly mixed with the layer below.

Compact each layer of aggregate base to at least 98% of the maximum unit weight at a moisture content no greater than optimum for aggregate base under hot mix asphalt (HMA) pavement. Compact each layer of aggregate base to at least 95% of the maximum unit weight at a moisture content no greater than optimum for aggregate base under concrete pavement. Within the limits of bridge approaches, from the abutment wall to the typical roadway cross section, compact each layer of the aggregate base to at least 98% of the maximum unit weight. Shape the finished surface and the layer thickness to within ±½ inch of the crown and grade shown on the plans.

Remove, dispose of, and replace aggregate base material that mixes with subbase or subgrade material at no additional cost to the Department.

B. **Conditioning Aggregate Base.** Shape the finished surface of the existing aggregate base course to within ±½ inch of the grade and cross section shown on the plans. Provide additional aggregate to address irregularities and obtain the required grade or cross section.

If placing aggregate base in a layer less than 3 inches, blend the new material with the layer below to ensure a total of 6 inches. Blending must be performed to ensure that the new material is uniformly mixed with the layer below and compacted as specified in subsection 302.03.A.

C. **Maintenance During Construction.** Maintain the aggregate base course layer at the required line, grade, and cross section until placement of the next layer. Ensure the exposed aggregate base course layer remains smooth, compacted, and uncontaminated.

If the subgrade, subbase, or aggregate base is damaged due to the Contractor’s operations or construction traffic, restore to the required condition at no additional cost to the Department.

D. **Surplus Existing Aggregate Base Material.** Surplus existing aggregate base material meeting the material requirements described in this section may be used instead of providing new aggregate base material. Remove and dispose of surplus aggregate base material not being used elsewhere on the project and any unsuitable material in accordance with subsection 205.03.P.

302.04. Measurement and Payment

Pay Item	Pay Unit
Aggregate Base	Ton
Aggregate Base, LM	Cubic Yard
Aggregate Base, __ inch	Square Yard
Aggregate Base, Conditioning	Station, Square Yard
Aggregate Base, Conditioning, Surplus and Unsuitable, Rem, LM	Cubic Yard
Salv Aggregate Base, Conditioning, LM	Cubic Yard

A. **Aggregate Base.** The Engineer will determine the moisture content and pay weights in accordance with section 109.

The Engineer will measure **Aggregate Base** by the scale weight of the material, including admixtures, and moisture content no greater than 8%.

The Engineer will perform moisture tests at the start of weighing operations and if construction operations, weather conditions, or other causes may change the moisture content of the material. If tests indicate a moisture content greater than 8%, the Engineer will deduct the weight of the excess moisture from the scale weight of the aggregate until moisture tests indicate the moisture content is no greater than 8%.

B. **Aggregate Base, LM.** The Engineer will measure **Aggregate Base, LM** based on hauling unit dimensions and load count before placement and compaction. The unit price for **Aggregate Base, LM** includes the cost of providing, hauling, placing, compacting, and grading the material and providing water for compaction.

C. **Aggregate Base, __ inch.** The Engineer will measure **Aggregate Base, __ inch** by width and length for the specified depth as shown on the plans.

D. **Aggregate Base, Conditioning.** If the contract requires payment for **Aggregate Base, Conditioning** in station pay units, the Engineer will measure along the alignment of the roadway.

If the contract requires payment for **Aggregate Base, Conditioning** in area pay units, the Engineer will measure by the width and length shown on the plans.

If the contract does not include the pay item **Aggregate Base, Conditioning**, the Department will consider the cost of conditioning aggregate base and of providing additives and water for compaction and maintenance to be included in other aggregate base pay items.

E. **Aggregate Base, Conditioning, Surplus and Unsuitable, Rem, LM.** The Department will pay for **Aggregate Base, Conditioning, Surplus**

and Unsuitable, Rem, LM only if the Contractor removes material from the project site and disposes of it in accordance with subsection 205.03.P.

F. **Salv Aggregate Base, Conditioning, LM.** The Department will pay for **Salv Aggregate Base, Conditioning, LM** for use in other areas of the project only if existing aggregate base material requires loading and hauling. The Engineer will measure and the Department will pay for as **Salv Aggregate Base, Conditioning, LM** surplus material that is loaded and hauled from locations on the project to other locations in order to attain the plan grade or cross section. The Engineer will measure the material in its final location.

Section 402. Storm Sewers

402.01. Description

This work consists of constructing storm sewers of the size and class required, including excavation, bedding, and backfill.

The following terms apply to this section:

Type HE. An elliptical pipe placed with the major axis in the horizontal direction.

Type VE. An elliptical pipe placed with the major axis in the vertical direction.

402.02. Materials

Provide materials in accordance with the following sections:

Granular Material Class II, III, IIIA 902
Aggregate 6A, 17A, 34R, 46G 902
Sewer Pipe 909
Sealers for Sewer Joints 909
Steel Pipe (for jacking in place) 909
Geosynthetics 910
Concrete, Grade 3000 1004
Mortar, Type R-2 1005

Select pipe with watertight joint systems from the Qualified Products List.

Storm sewers are divided into five classes, as specified in Table 402-1. If the contract specifies only the size and class of sewer, select and provide an alternative storm sewer pipe allowed in Table 402-1.

For types of sewer material that are required but are not included in Table 402-1, the contract will specify the type and size of sewer material.

A higher strength or greater thickness of sewer may be substituted for the minimum required sewer strength or minimum required thickness.

Table 402-1: Pipe Alternatives for Storm Sewer Classes

Type of Pipe	Storm Sewer Class (depth of cover, feet[a])				
	Class A Sewer (1–10)[b][c]	Class B Sewer (>10–16)	Class C Sewer (>16–23)	Class D Sewer (>23–33)[c]	Class E Sewer (1–3)[c][d]
Reinforced concrete[e]	II	III	IV	V	IV
Nonreinforced concrete[f]	1	3	No	No	No
Corrugated and spiral ribbed al-alloy[g]	Yes	Yes	Yes	Yes	No
Corrugated and spiral ribbed steel[h]	Yes	Yes	Yes	Yes	No
Dual-wall polymer-precoated galvanized steel	Yes	Yes	Yes	Yes	No
Smooth-lined corrugated plastic (CPE)[i]	Yes[j][k]	Yes[k][l]	No	No	No
Corrugated polyvinyl chloride (CPV)[m]	Yes[j][k]	Yes[k][l]	No	No	No

(a) Cover, including the pavement structure is defined as the height of fill above the top of the pipe measured to final grade.

(b) Class A sewer applies when the sewer is outside the influence of proposed pavement or is beneath the influence of proposed pavement and the depth of cover is >3 feet but ≤10 feet.

(c) Special design is required for depths of cover <1 foot and >33 feet.

(d) Class E Sewer applies when the sewer is beneath the influence of proposed pavement and the depth of cover is ≤3 feet.

(e) Roman numerals refer to class of reinforced concrete pipe in accordance with AASHTO M170.

(f) Arabic numerals refer to the class of nonreinforced concrete pipe in accordance with AASHTO M86.

(g) Allowed for 12- to 66-inch spiral ribbed and 12- to 18-inch helically corrugated 2⅔ by ½ inch aluminum alloy pipe only.

(h) Allowed for 12- to 84-inch spiral ribbed and 12- to 18-inch helically corrugated 2⅔ by ½ inch steel pipe only.

(i) Provide CPE in accordance with AASHTO M294, Type S polyethylene pipe.

(j) Allowed only for 36-inch-diameter pipe and under for CPE and CPV pipes. At least 3 feet of cover.

(k) Refer to the Class A, B and F Bury Plastic Pipe Qualified Products List for approved manufacturers and products.

(l) Allowed only for 12- to 24-inch diameter CPE and CPV pipes.

(m) CPV must conform to AASHTO M304.

402.03. Construction

A. **Excavation, Trench Construction, and Sewer Bedding.** Perform trench construction using methods that meet the health and safety requirements specified in subsection 104.07.

Excavate the trench as shown on the plans or as determined by the Engineer. Construct the trench width to at least the minimum width shown in the *MDOT Standard Plan R-83* series and wide enough to provide free working space and allow compaction of the backfill around the pipe. Shape the bottom of the trench to support the pipe uniformly. Place bedding using uncompacted granular material Class IIIA to the required elevation.

Where unstable soil conditions or obstructions other than rock require excavation of the trench below the elevation detailed on the plans, undercut, backfill, and compact the trench as directed by the Engineer. Use 6A, 17A, 34R, or 46G aggregate as backfill material for undercutting due to unstable soil conditions. Use 34R aggregate for bedding material instead of granular material Class IIIA. Place the backfill up to 4 inches below the proposed bottom of the pipe. The completed work will be paid for as Trench Undercut and Backfill according to subsection 402.04.E.

During sewer construction, maintain and protect existing live utilities. Minimize service interruptions and coordinate with the local municipality or utility company. Immediately repair or replace utilities interrupted during sewer construction as directed by the Engineer.

B. **Repair of Damaged Coated Surfaces.** Repair coated pipe surfaces damaged during pipe transportation, handling, or installation, at no additional cost to the Department. Complete repair of galvanized pipe surfaces in accordance with subsection 716.03.E or as approved by the Engineer. Repair other coated sewer pipe surfaces as directed by the Engineer.

C. **Laying and Jointing Pipe.** Lay storm sewers as shown on the plans with bells or grooves upgrade and ends fully and closely jointed. Provide a full, firm bearing along the length of each pipe section. Wrap all pipe joints with geotextile blanket. Use geotextile at least 36 inches wide and center it on the joint. Overlap the ends of the geotextile blanket at least 12 inches.

Remove and replace pipe damaged by Contractor operations. After trench backfill and compaction is complete, mandrel test replaced CPE and CPV pipe. Remove and re-lay sewer sections showing signs of settlement or poor horizontal or vertical alignment as determined by the Engineer at no additional cost to the Department.

1. **Corrugated Plastic Pipe (CPE and CPV).** Provide homing marks on CPE and CPV pipe sections and joint material to show the correct alignment of the pipe sections and joint material during field installation.

   After trench backfill and compaction is complete, the Engineer will select at least 50% of the installed length of each size of CPE and CPV pipe for deformation testing. Provide the labor and equipment that are required to complete the testing.

   Unless otherwise approved by the Engineer, perform the mandrel test within 10 work days prior to pavement surfacing or completion of final grade.

   Use a nine-point mandrel with a diameter equal to 95% of the nominal pipe diameter. Provide the Engineer with a proving-ring to verify the mandrel size. Pull the mandrel through the pipe by hand using non-mechanical means and without damaging the pipe. The Contractor may use laser profile technology to measure deflection as an approved alternative to mandrel testing.

   Remove and reinstall or replace pipe with a nominal diameter reduced by at least 5% at no additional cost to the Department. Reinstall only undamaged pipe. Do not reinstall pipe without the Engineer's approval.

   The Contractor is responsible for all expenses and delays caused by reinstallation or replacement of pipe.

2. **Concrete Pipe.** Install reinforced concrete elliptical pipe with the longer axis placed horizontally unless otherwise required.

   Install Type HE elliptical pipe with the longer axis within 5 degrees of horizontal.

   Install Type VE elliptical pipe with the longer axis within 5 degrees of vertical.

   Install circular concrete pipe with elliptical reinforcement so the lift holes or manufacturer's marks are on the top of the pipe. Place pipe so the lift holes or manufacturer's marks designating the top and bottom of the pipe are no more than 5 degrees from the vertical plane through the longitudinal axis of the pipe. After installing the pipe, seal the lift holes with concrete plugs and waterproof.

3. **Metal Pipe.** Provide metal pipe with helical corrugations with a continuous lock seam in accordance with subsection 909.05.

Use of dissimilar types of base metal (steel or aluminum alloy) or dissimilar types of coatings on steel (zinc or aluminum) in a single line of pipe is prohibited. Construction between dissimilar metal type pipes is not allowed unless a drainage structure is used to transition between the two dissimilar type metals. Changing materials at the drainage structure is allowed if the roughness coefficients have been adjusted accordingly. Use coupling bands of the same base metal and coating metal as the pipe.

D. **Sewer Taps.** Make connections to storm sewers owned by counties, municipalities, or drain commissions in accordance with the regulations of the owner and as required by the contract. If a conflict exists between the owner's regulations and these specifications, the owner's regulations will take precedence.

For existing storm sewers with plugs or bulkheads, remove plugs or bulkheads without damaging the existing sewer and make watertight joint connections. Remove material in accordance with subsection 204.03.B.

If tapping an existing pipe, cut an opening in the receiving pipe at least 6 inches larger than the outside diameter of the inlet pipe. Insert the inlet pipe and cut flush with the inner wall of the receiving pipe. Pack a layer of mortar at least 3 inches thick around the inlet pipe and strike smooth with the inner wall of the receiving pipe. Encase the inlet pipe on the outside of the connection with concrete to provide bearing under the pipe. Repair or replace existing pipe damaged by Contractor tapping operations at no additional cost to the Department.

Do not direct tap sewer inlet pipes with outside diameters greater than half the inside diameter of the trunk sewer. Construct a manhole structure for these taps in accordance with section 403. Obtain the Engineer's approval before using other methods of tapping existing sewers.

E. **Sewer Bulkheads.** Construct sewer bulkheads using Grade 3000 concrete or brick or block masonry. Extend the bulkhead at least 1 foot into the pipe from the inner wall of the drainage structure. Construct masonry bulkheads in accordance with subsection 403.03.A.

F. **Backfilling.** Backfill in accordance with subsection 401.03.D.

G. **Sewer Jacked in Place.** Jack sewers in place in accordance with subsection 401.03.G.

H. **Disposal of Surplus Material.** Take possession and dispose of surplus material in accordance with subsection 205.03.P.

I. **Cleanout.** Maintain storm sewers installed on the project. Verify that installed sewers are free of silt, debris, and other deleterious material at the time of final acceptance and in accordance with section 209.

J. **Video Inspection of Sewer Pipe.** Use closed circuit television to inspect required storm sewers. Dewater or divert flow in sewers for inspection. Video inspection is not required for extensions of existing catch basin leads less than 20 feet.

After backfilling and compacting the trench, and within 10 working days prior to pavement surfacing or completion of final grade, conduct the inspection of sewers under pavement unless otherwise approved by the Engineer.

For sewers not under pavement, after backfilling and compacting the trench, conduct the inspection as close to project completion as possible but allow time for corrective action as determined by the video inspection and directed by the Engineer.

1. **Traffic Control.** Obtain the Engineer's approval of traffic control measures at least 5 days before beginning work. Propose a traffic control plan in accordance with the *Michigan Manual of Uniform Traffic Control Devices* (MMUTCD) and the maintaining traffic plans in the contract.

   Unless otherwise approved by the Engineer, keep traffic lanes open. For necessary lane or shoulder closures, use traffic control measures in accordance with the traffic control plan.

2. **Equipment.** Use a camera designed and constructed for inspecting sewers and equipped with the following features:

   a. A pan and tilt head external to the main body of the camera to allow inspection of the sewer joints and cracks or other defects;

   b. Lighting to allow a clear picture of the perimeter of the pipe; and

   c. Underwater operation capable of producing a picture quality that is satisfactory to the Engineer.

   d. Show or document camera magnification at all times in the video.

   If the Engineer determines the video quality is not satisfactory, re-inspect the pipes to obtain acceptable results at no additional cost to the Department.

   Use continuous running video capable of recording audio and video information. Include the date (month, day, and year) and camera location. Provide a continuous record of the sewer section from manhole to manhole or from end to end. Use high quality, color, digital

format at a standard play speed. Obtain the Engineer's approval before using other recording media.

3. **Sewer Flow Control.** For video inspection, provide flow control to bring the depth of flow in the sewer pipe to within the range specified in subsection 402.03.J.6.a. Before starting work, submit the proposed method of sewer flow control to the Engineer for approval.

    a. **Depth of Flow.** Lower the depth of flow in the sewer during the videotaping operation to less than 2 inches. Reduce flow by plugging or blocking the flow or by pumping the flow and bypassing the pipe section during inspection, as approved by the Engineer.

    b. **Plugging or Blocking.** Insert a sewer line plug into the line upstream of the section undergoing inspection. Use a plug designed to allow the release of portions of the flow. During video inspection, reduce the flow depth to 2 inches. Restore normal flow after completing the work. Meter flow discharge to prevent erosion.

    c. **Pumping and Bypassing.** For pumping and bypassing, supply the pumps, conduits, and other equipment to divert the flow around the sewer section undergoing inspection. Provide a bypass system with a capacity to handle existing flow plus additional flow that may occur during a rain event. Provide the labor and supervision required to set up and operate the pumping and bypassing system.

    d. **Flow Control Precautions.** If the flow in a sewer line is plugged, blocked, or bypassed, protect the sewer lines from damage that may result from sewer surcharging. Do not cause flooding or damage to public or private property while controlling sewer flow.

4. **Procedure.** Move the camera through the line at a rate no greater than 0.5 feet per second, stopping as required to document the joint and pipe conditions. Use winches, cable, powered rewinds, or other devices that do not obstruct the camera view or interfere with proper documentation of the pipe conditions.

    Adjust the camera to travel above the level of the flow in the pipe. If the camera encounters a dip in the pipe such that the water rises above the springline of the pipe or if the camera lens becomes submerged, withdraw the camera and re-insert it from the other end as far as possible. Do not back the camera into a pipe undergoing inspection.

    Measure the distance to the location of defects above ground using a meter device. Marking defect locations on the cable to measure the

distance to defects is not allowed. Provide a distance meter with an accuracy within 1 foot and check using a walking meter, roll-a-tape, or other device.

5. **Documentation.** Provide the inspection to the Engineer in a digital format. Include a written log of damages or installation defects, including pipe deformation, cracking, joint separation, corrosion, perforation, and other features identified in the video. Provide a digital copy of the log to the Engineer. Locate the damage or defect by meter marking of the video in the inspection log. Label the videos to describe the reaches of sewer or culverts contained in the videos, including street location and manhole numbers. If manhole numbers are not provided, assign a numbering system to allow identification in the inspection report and video.

402.04. Measurement and Payment

Pay Item	Pay Unit
Sewer, Cl __, __ inch, Tr Det __	Foot
Sewer, Reinf Conc Ellip, (shape) Cl __, (rise) by (span) inch, Tr Det __	Foot
Sewer, Cl __, __ inch, Jacked in Place	Foot
Sewer Tap, __ inch	Each
Sewer Bulkhead, __ inch	Each
Trench Undercut and Backfill	Cubic Yard
Dewatering System, Trench	Foot
Video Taping Sewer and Culv Pipe	Foot

A. **Sewer and Sewer, Reinforced Concrete Elliptical.** The Engineer will measure **Sewer** and **Sewer, Reinf Conc, Ellip** of the size, class, and trench detail required, in place from center to center of manholes, catch basins, or inlets. The unit price for **Sewer** and **Sewer, Reinf Conc, Ellip** includes the cost of excavation, backfill, and geotextile blanket.

B. **Sewer, Jacked in Place.** The Engineer will measure **Sewer, Jacked in Place** of the size and class required, by length, as determined by multiplying the number of units jacked by the commercial laying length. The unit price for **Sewer, Jacked in Place** includes the cost of excavating the pit; providing and installing sheeting, bracing, and other safety devices; providing jacking equipment; drainage and dewatering; and other items associated with the operation.

C. **Sewer Tap.** The Engineer will measure **Sewer Tap** based on the inlet pipe size required, by each tap into an existing system. If tapping an existing sewer line using a drainage structure, the Department will pay for one sewer tap in addition to the drainage structure.

D. **Sewer Bulkhead.** The Engineer will measure only sewer bulkheads for storm sewers with a diameter larger than 12 inches. The cost of constructing sewer bulkheads for pipes with a diameter less than or equal to 12 inches or constructed as part of abandoning or removing drainage structures as shown on the plans is included in the unit prices for related pay items.

   The Department will pay separately for bulkheading pipes greater than 12 inches.

E. **Trench Undercut and Backfill.** The Engineer will measure **Trench Undercut and Backfill** by calculating the volume from the length, depth, and width of undercut authorized by the Engineer and shown on the plans. The Engineer will not make allowance for sloping the sides of the trench. The unit price for **Trench Undercut and Backfill** includes the cost of excavation and disposal of material and providing, placing, and compacting 6A, 17A, 34R, or 46G aggregate to the bottom of trench elevation shown on the plans.

F. **Rock Excavation.** The Engineer will measure and the Department will pay separately for rock excavation in accordance with subsection 205.04.

G. **Dewatering System, Trench.** If the contract does not include a pay item for **Dewatering System, Trench** and the Contractor uses a dewatering system, the Department will not pay separately for the system but will consider the cost to be included in the unit price for related pay items.

H. **Trenchless.** The Engineer may authorize trenchless methods, in place of open-cut construction methods. The Department will delete or proportionally reduce pay item quantities required for corresponding open-cut construction from the contract if the Engineer authorizes trenchless methods. The Department will not make an adjustment in the pay items of **Minor Traf Devices** or **Traf Regulator Control.**

   Payment for the work performed by trenchless methods will not exceed the unit price bid for the open-cut method.

   If the Engineer authorizes trenchless installation, **Obstructions** will be removed in accordance with subsection 718.03.F.2. Additional payment or delays for removal of obstructions will not be considered.

I. **Video Taping Sewer and Culvert Pipe.** The unit price for **Video Taping Sewer and Culv Pipe** includes the cost of dewatering, flow control, video inspection, and documentation.

   The Department will pay separately for traffic maintenance and control in accordance with subsection 812.04.

J. **Obstructions.** Engineer will measure, and the Department will pay for the removal of obstructions, which require the use of special procedures at the unit price for **Obstruction Removal** in accordance with subsection 718.04.D.

Section 403. Drainage Structures

403.01. Description

This work consists of adjusting, constructing, or temporarily lowering drainage structures and cleaning existing drainage structures and leads as directed by the Engineer.

Drainage structures include manholes, catch basins, leaching basins, inlets, and drop inlets.

Drainage Structure. Includes concrete footing or precast sump. Used for access to new or existing sewers with a diameter no greater than 48 inches.

Manhole Base, Type 1 or Type 2, and Manhole Riser. Used for access to new or existing sewers with a diameter of at least 48 inches. Manhole Base Type 1 may be substituted for Precast Manhole Tees. **Precast Manhole Tee and Manhole Riser.** Used for access to new sewers with diameters of at least 42 inches.

Manhole Base, Type 1 or Type 2, and Manhole Riser. Used for access to new or existing sewers with a diameter of at least 48 inches. Manhole Base Type 1 may be substituted for **Precast Manhole Tees**.

403.02. Materials

Provide materials in accordance with the following sections:

Granular Material Class II, III 902
Steel Reinforcement 905
Miscellaneous Metal Products 908
Castings 908
Culvert, Sewer Pipe, and Box Sections 909
Geosynthetics 910
Masonry Units 913
Concrete, Grade 3000 1004
Mortar Type R-2 1005

Provide cast-in-place or precast concrete construction for sanitary sewer manholes.

Provide structural steel plate, at least ½ inch thick, for temporary lowering of drainage structures that span 72 inches or less. Verify that plates cover the entire drainage structure with a bearing surface of at least 12 inches. For plates that span greater than 72 inches, submit structural calculations prepared by a Professional Engineer licensed in the State of Michigan to the Engineer.

Provide leveling course hot mix asphalt (HMA) for patching during the temporary lowering operations or other HMA mixture as approved by the Engineer.

403.03. Construction

A. **Constructing, Adjusting, and Temporary Lowering of Drainage Structures, Precast Manhole Tees, Manhole Bases, and Manhole Risers**

1. **Excavation.** Excavate for constructing, adjusting, and temporarily lowering drainage structures, precast manhole tees, manhole bases, and manhole risers in accordance with subsection 206.03.A.

2. **Concrete Construction.** Construct concrete portions of drainage structures in accordance with subsection 706.03. Do not cast drainage structures if the concrete temperature is above 90°F.

3. **Placing Brick and Block Masonry.** Do not place masonry with mortar when the ambient air temperature is 36°F or less unless approved by the Engineer. Remove and replace work damaged by frost. Apply a ½-inch-thick plaster coat of mortar to the outer surface of structures and to the inner surface below the outlet flow line on catch basins with traps or sumps. Place the first set of bricks or blocks on a full bed of mortar. Lay brick or block in courses with uniform mortar joints ½ inch thick within ⅛ inch of depth. Stagger joints by half the length of the brick or block on adjoining courses. Place courses level unless otherwise required. Strike and point joints so the exposed surface is smooth. Rake joints and wet brick or block before placing the plaster coat. Allow the brick or block surface to dry to provide for proper bonding of the plaster coat.

   Wet the brick. Allow the brick surface to dry to allow the brick and mortar to bond. Use of broken or chipped brick on the faces of the structure is prohibited. Provide a course made of headers at least every seventh course. Make closures with brick lengths no less than the width of a whole brick.

4. **Precast Reinforced Concrete Units.** Use poured-in-place concrete in accordance with subsection 403.03.A.2 or precast concrete footings. Construct precast reinforced concrete units in accordance with the contract. Seal the joints with mortar in accordance with subsection 403.03.A.3, or use butyl rubber sealant that conforms to ASTM C990. Support precast concrete footings on a 6-inch subbase of compacted granular material Class II.

5. **Steel Reinforcement.** Install steel reinforcement in accordance with subsection 706.03.

6. **Inlet and Outlet Pipes.** Place and compact backfill around the manhole base or sump to provide bedding for inlet and outlet pipes.

   Extend inlet and outlet pipes through the outside wall surface of the manhole a sufficient length to allow for pipe connections. Construct masonry around pipes and seal with mortar or other product approved by the Engineer to prevent leakage.

7. **Backfilling.** Backfill in accordance with subsection 401.03.D.

   Stage backfilling to coordinate with the construction sequencing of the structure as necessary.

8. **Temporary Lowering of Drainage Structures.** Lower drainage structures before milling the pavement.

   Record the location of the structure so each cover can be reinstalled at its original location. Remove the existing frames and covers and match mark them for later identification and placement. Salvage and safely store frames and covers. Repair the existing structure to allow uniform contact of the steel plate to the top of the structure. Place and compact the HMA for patching in accordance with section 501.

9. **Protection during Construction.** Install inlet protection devices in accordance with section 208 and as approved by the Engineer when working around the drainage structure.

B. **Drainage Structure Covers.** Provide and install new covers, including frames and grates, on new or existing structures as required. Place castings on a full mortar bed.

C. **Adjusting Drainage Structure Covers.** Adjusting drainage structure covers applies when the new elevation of the cover requires a vertical change of no greater than 6 inches. Before placing the HMA top course or overlay, make final adjustments to drainage structure covers within the HMA pavement section if only applying one course. Adjust the cover to the required elevation by supporting it on one of the following:

   1. Metal ring adjustor;

   2. Precast concrete adjusting ring;

   3. Masonry in a full mortar bed; or

   4. Alternate adjustor selected from the Qualified Products List.

Hold adjusted covers in place. Remove and replace the adjacent pavement, curb, or curb and gutter to match the existing grades or the required new elevations.

D. **Additional Depth of Adjusting Drainage Structures.** Additional depth of adjusting drainage structure covers applies when a drainage structure cover is adjusted more than 6 inches from the existing cover elevation due to a change in elevation of the roadway or when alterations to the drainage structure exceed 6 inches regardless of the change in cover elevation. Remove damaged or unsound portions of the structure as directed by the Engineer and adjust as required.

E. **Drainage Structure Taps.** Make connections to existing drainage structures owned by counties, municipalities, or drain commissions in accordance with the owner's regulations and the contract. If a conflict exists between the owner's regulations and these specifications, the owner's requirements take precedence.

If tapping an existing drainage structure, cut an opening into the receiving structure at least equal to the outside diameter of the inlet pipe plus 6 inches and insert the pipe. Pack a layer of mortar at least 3 inches thick around the inlet pipe and strike smooth with the inner wall of the receiving structure. Repair or replace existing drainage structure damaged by Contractor operations during tapping at no additional cost to the Department.

Tap directly to a sewer or culvert in accordance with subsection 402.03.D.

F. **Cleanout.** Maintain catch basins, manholes, leaching basins, and inlets installed on the project. Ensure that installed catch basins, manholes, leaching basins, and inlets are free of silt, debris, and other deleterious material at the time of final acceptance.

G. **Cleaning Existing Drainage Structures and Leads.** Before the Contractor starts work, the Engineer will determine the condition and identify the areas on the project that require cleaning of existing drainage structures and leads.

First, clean the downstream drainage structure nearest the trunk sewer and place a temporary bulkhead so the trunk sewer remains clear. Clean upstream drainage structures and leads only after cleaning and bulkheading the downstream drainage structure.

Clean the drainage structures and leads of sand, silt, and debris and prevent further contamination of the leads.

Dispose of the waste generated from the drainage structure or drainage structure lead cleanout operation using either Disposal Alternative A or Disposal Alternative B in accordance with this subsection.

If the Contractor suspects the waste generated is non-hazardous contaminated material or hazardous contaminated material, notify the Engineer. If testing shows the material is a hazardous waste as defined in Part 111, Hazardous Waste Management, of the Natural Resources and Environmental Protection Act (Michigan Compiled Laws [MCL] 324.11101 et seq.), immediately notify the Engineer.

1. **Disposal Alternative A**

   a. **Solid Waste Phase.** Solid waste disposal rules require that the waste have no releasable liquids. Dispose of the solid waste at a Type II landfill. The landfill may require testing before accepting the waste. Provide disposal documentation from the Type II landfill to the Engineer.

   b. **Liquid Waste Phase.** Dispose of the liquid waste using one of the following options:

      Option 1 – Evaporate the liquid waste by use of drying beds, decanting stations, or similar systems that contain the solids during evaporation.

      Option 2 – Place liquid waste in a sanitary sewer system with the sanitary sewer owner's approval. Provide a copy of the owner's approval to the Engineer.

      Option 3 – Pump the majority of clear liquid from the drainage structure and leads without disturbing the solids. Discharge the clear liquid to:

      i. A sanitary sewer or combined sanitary and storm system with the sewer owner's approval;

      ii. The curb and gutter such that it re-enters and is completely contained within the storm sewer system and does not directly discharge into the waters of the state; or

      iii. An area of undisturbed, well-vegetated ground at a rate that does not result in excessive ponding, runoff, or soil erosion.

      Dispose of the remaining solid and liquid phase as waste using Disposal Alternative A, either Option 1 or Option 2, or Disposal Alternative B.

2. **Disposal Alternative B.** Use a Licensed Liquid Industrial Waste Hauler to transport the waste generated and dispose of it in

accordance with Part 121, Liquid Industrial By-Products, of the Natural Resources and Environmental Protection Act (MCL 324.12101 et seq.). Provide the Engineer with a copy of the transport manifest.

403.04. Measurement and Payment

Pay Item	Pay Unit
Dr Structure, __ inch dia	Each
Dr Structure, Add Depth of __ inch dia, 8 foot to 15 foot	Foot
Dr Structure, Add Depth of __ inch dia, more than 15 foot	Foot
Drop Inlet, Type __	Each
Mh, Precast Tee, Cl __, __ inch	Each
Mh Base, __ inch, Type __	Each
Mh Riser	Foot
Dr Structure Cover, Type __	Each
Dr Structure Cover, Adj, Case __	Each
Dr Structure, Adj, Add Depth	Foot
Dr Structure, Tap, __ inch	Each
Dr Structure, Temp Lowering	Each
Dr Structure, Cleaning	Each
Dr Structure Lead, Cleaning, __ inch	Foot

A. **Drainage Structures Excluding Drop Inlets.** The Engineer will measure the depth of drainage structures, with the exception of drop inlets, from the top of the masonry to the top of the concrete footing.

The unit price for **Dr Structure** of the diameter required includes the cost of concrete footing and no greater than 8 feet of the drainage structure depth. The unit price for **Dr Structure** includes the cost of temporary or final grade adjustments of the structure.

The unit price for **Dr Structure, Add Depth, 8 foot to 15 foot** of the diameter required includes the cost of drainage structure portions greater than 8 feet deep but no greater than 15 feet deep.

The unit price for **Dr Structure, Add Depth, more than 15 foot** of the diameter required includes the cost of drainage structure portions greater than 15 feet deep.

The unit price for new structures includes the cost of cleaning new drainage structures.

B. **Drop Inlets.** The Engineer will measure drop inlets as units, of the type required, regardless of depth.

The Department will pay separately for pipe leading from the drop inlet to a sewer or catch basin. The cost of pipe from drop inlets, Type 1, is included in the unit price for related sewer pay items in accordance with

subsection 402.04. The cost of pipe from drop inlets, Type 2, as shown in the special detail, is included in the unit price for the related sewer pay item.

The Department will pay for a sewer tap or drainage structure tap in accordance with subsection 402.04 only if tapping the sewer or encased sewer into an existing drainage system is required.

C. **Manhole Base and Riser.** The Engineer will measure **Mh Riser** vertically from above the collar of the **Mh, Precast Tee** or above the **Mh Base** to the top of the riser.

The unit price for **Mh Base, Type 1** includes the cost of cutting access holes in the sewer.

If the Contractor uses **Mh Base, Type 1** in place of **Mh, Precast Tee,** and the contract does not include the pay item **Mh Base, Type 1**, the unit price for **Mh, Precast Tee** includes the cost of installing a Type 1 manhole base.

D. **Drainage Structure Covers.** When new covers are placed on existing structures, the Engineer will measure and the Department will pay for **Dr Structure Cover, Adj, Case __** in addition to the new cover.

The unit price for **Dr Structure Cover, Adj, Case 1** includes the cost of the following:

1. Sawcutting existing pavement, curb, and curb and gutter;
2. Adjusting the cover up or down no greater than 6 inches; and
3. Removing and replacing pavement adjacent to the adjusted cover in accordance with the *MDOT Standard Plan R-37* series.

The Department will pay separately for removing and replacing curb and gutter adjacent to the adjusted structure.

The Department will pay only for **Dr Structure Cover, Adj, Case 2** for structure adjustments located outside existing pavement, curb, and curb and gutter.

The unit price for **Dr Structure Cover, Adj** of the case required includes the cost of repairs for uniform contact of temporary steel plate to the top of structures.

The Engineer will measure **Dr Structure, Adj, Add Depth** of the required diameter and depth beginning 6 inches from the level of the existing structure, in the direction of adjustment, to the limit of the additional adjustment depth. If the contract includes a pay item for **Dr Structure, Adj, Add Depth,** the contract will also include a pay item for **Dr Structure**

Cover, Adj of the case required. The unit price for **Dr Structure, Adj, Add Depth** includes the cost of drainage structure taps within the limits of the adjustment.

The Department will pay for drainage structure taps outside the limits of the adjustment as **Dr Structure, Tap**. The Department will pay for taps to existing sewers as **Sewer Tap** of the size required, in accordance with subsection 402.04.

E. **Drainage Structure, Temporary Lowering.** The unit price for **Dr Structure, Temp Lowering** includes the cost of the following:

1. Match marking;
2. Removing, salvaging, and transporting castings to and from the site;
3. Storing the existing structure castings;
4. Plating the structure;
5. HMA patching; and
6. Removing the plate and HMA patching materials for final adjustment.

The Department will pay separately for the final adjustments to drainage structures. The unit price for **Dr Structure Cover, Adjust, Case 1** includes the cost of removing pavement to lower the structure.

The cost of repairs is included in the unit price for the related drainage structure adjustment pay item.

F. **Cleaning Existing Drainage Structures and Leads.** The unit price for **Dr Structure, Cleaning** includes the cost of testing for disposal, hauling, and disposing of generated waste.

The unit price for **Dr Structure Lead, Cleaning** of the size required includes temporary bulkheads and the cost of testing for disposal, hauling, and disposing of generated waste.

The cost for cleaning out existing sewers, plugged by Contractor operations, is included in related pay items.

If not included in the contract, the Department will pay for disposal of non-hazardous contaminated material and hazardous contaminated material in accordance with subsection 109.05.

Section 706. Structural Concrete Construction

706.01. Description

This work consists of constructing concrete portions of bridges, box and slab culverts, headwalls, parapets, wingwalls, retaining walls, and other structures, and providing and installing electrical grounding systems.

706.02. Materials

Provide materials in accordance with the following sections:

Curing Materials 903
Insulating Blankets 903
Polystyrene Insulation 903
Steel Reinforcement 905
Bar Chairs and Wire Ties 905
Structural Steel 906
Miscellaneous Metal Products 908
Geosynthetics 910
Water 911
Fiber Joint Filler for Concrete Construction 914
Joint Sealants for Concrete Construction 914
Conduit 918
Electrical Grounding System 918
Concrete, Grades 3500, 3500HP, 4500, 4500HP 1004
Mortar and Grout 1005

Provide Grade 3500 concrete for structure concrete placed under water. Provide slump for these tremie applications in accordance with Table 1004-1.

Provide Grade 3500 concrete for substructure and subfooting concrete.

Provide Grade 3500HP concrete for high-performance substructure concrete.

Provide Grade 4500 concrete for superstructure concrete and superstructure concrete, night casting.

Provide Grade 4500HP concrete for high-performance superstructure concrete and high-performance superstructure concrete, night casting.

Provide natural aggregate and with no greater than 2.50% absorption as specified in ASTM C127 for structure concrete. Do not use slag aggregate.

Provide expansion joint devices and end plates meeting the requirements of AASHTO M270, Grade 36, or ASTM A588/A588M. Galvanize expansion joint devices and end plates in accordance with section 716. Provide commercial-quality steel floor plate meeting the requirements of ASTM A786/A786M, galvanized in accordance with section 716, for expansion joint

cover plates. Provide ASTM F593 (Type 304) stainless steel, flathead countersunk screws with inserts.

Refer to section 1004, Table 1004-1, and the contract for required minimum flexural and compressive strengths of concrete.

Select penetrating water repellant from the Qualified Products List.

706.03. Construction

A. Equipment

1. **Placing Equipment.** Use equipment with capacity and arrangement for placing concrete in accordance with subsection 706.03.H. Make equipment available to the Engineer for inspection, testing, and approval before use.

   Use a tremie, pump, or other Engineer-approved equipment for placing concrete under water.

   If placing concrete with a tremie, provide a tremie with a capacity of at least 7 cubic feet and a watertight discharge tube at least 10 inches in diameter. Equip the lower end of the tremie with a valve or suitable device capable of closing tightly while charging and lowering the tremie into position and opening fully in the lowered position.

   If pumping concrete, provide a pump discharge, pipe, and fittings with an inside diameter of at least 4 inches. Do not use aluminum pipe for conveying or placing concrete.

2. **Bridge Deck Finishing Equipment.** Use a self-propelled, transverse finishing machine capable of finishing concrete from curb line to curb line or from curb line to bulkhead. Equip bridge deck finishing machines with rotating finishing cylinder(s), auger(s), drag float, and other structural and mechanical equipment to finish the concrete within the required tolerances.

   Use a machine or supporting frame to transversely span the cast section and travel in the direction of concrete placement. Mount the machine on wheels operated on longitudinal rails capable of carrying the loads between supports with a deflection no greater than 1⁄16 inch. Mount rails on adjustable supports that prevent deflection under the machine load. Use rail sections, straight within ⅛ inch per foot, and rail grades that differ from the required screed grade by no more than 1⁄16 inch. Install the rail at a height above the surface allowing hand floating under the rails.

   Place rail supports over beams unless approved by the Engineer. Design falsework supporting rails in accordance with subsection

706.03.C. Use portable, lightweight, or wheeled work bridges capable of transversely spanning the cast section to transversely finish machine-finished deck sections.

Use a 3-foot, lightweight metal float and a 10-foot, lightweight, rigid straightedge, each equipped with a suitable handle.

Alternative types of vibrating or oscillating screeds may be used if approved by the Engineer.

3. **Concrete Saws.** Use a self-propelled saw to neatly cut hardened concrete to the line and depth required.
4. **Texturing Equipment.** Use texturing equipment to produce uniform transverse grooves of the required width, depth, and spacing.
5. **Equipment for Applying Penetrating Water-Repellent Material.** Apply penetrating water repellent material with low-pressure, 15 to 40 psi, airless-type spray equipment or with long-nap rollers.
6. **Equipment Approval.** Obtain the Engineer's approval for all equipment and tools for placing and finishing of concrete before starting work, including, but not limited to, pumping equipment, air compressors, vibrators, joint-sealing equipment, straightedges, and finishing tools.

B. **False Decking.** Construct false decking to the limits shown on the plans.

Construct false decking capable of supporting all material and debris falling from the deck. Abut false decking pieces to prevent material or debris from falling through. Use a false decking system that does not damage beams and meets the approval of the Engineer.

Install false decking after erecting structural steel or precast concrete beams or before beginning deck removal, repair, or other bridge construction activities. Do not construct false decking systems over traffic that project below beam bottom flanges. Maintain false decking to prevent hazards to vehicular, pedestrian, or waterway traffic. Remove material or debris on the flooring outside the fascia at least once a day. Leave false decking in place until completion of construction activity, as directed by the Engineer.

For bridges over waterways, barges may be used in the waterway in place of constructing a false decking system. Position the barge in the waterway after erecting the structural steel or precast concrete beams or before beginning deck removal, deck repair, or bridge construction activities. Maintain the barge to prevent hazards or impediments to waterway traffic. Provide a barge large enough to support material and debris falling from the deck. Leave the barge in place until the bridge deck

over the waterway is cast. If the Engineer determines that the barge is ineffective in preventing falling material and debris from entering the waterway, replace it with a conventional false decking system at no additional cost to the Department.

C. **Falsework.** Design, construct, place, and remove temporary supports required for constructing the permanent structure. Weld falsework supports in accordance with subsections 707.03.E.7.b, c, d, and g. Do not weld to the structural steel or use mechanical fasteners that damage the structural steel or coatings.

Submit working drawings and design calculations for falsework if required by the contract. Submit working drawings and calculations in accordance with subsection 104.02 a minimum of 14 days prior to beginning installation. The working drawings and design calculations must be sealed by a Professional Engineer licensed in the State of Michigan. Do not place concrete prior to securing the Engineer's approval of the working drawings and calculations.

Correct settlement in the falsework during loading.

D. **Forming**

1. **General.** Construct forms true to the lines shown on the plans. Construct mortar-tight forms with net sections capable of withstanding impacts during placement and supporting the weight of concrete through curing. Use falsework for forms in accordance with subsection 706.03.C.

   Deck forms or supports are not allowed to protrude above the top of haunches or above the bottom of the deck.

2. **Vertical Clearance.** The Department defines minimum vertical clearance as the minimum vertical distance from any point on the roadbed surface, including 24 inches either side of the roadbed, to the low beam.

   Over active roadbeds, maintain formwork above the bottom of beams. Obtain the Engineer's approval if form work must extend below the bottom of beams. Provide and place advance-warning signs at locations directed by the Engineer before changing the existing structure vertical clearance. Provide 14 days for the Engineer to determine locations for the advance warning signs.

3. Removable Forms

   a. **Type A Surface.** Type A surfaces are exposed surfaces of piers, abutments, wingwalls, retaining walls and the outside faces of

girders, T beams, slabs, columns, brackets, curbs, headwalls, barriers, railings, arch rings, spandrel walls, and parapets.

Use metal forms or 5-ply structural grade western fir plywood for face-forming material. If the grain of three plies of the plywood runs perpendicular to the studs, the $^{25}/_{32}$-inch thickness meets 1-inch nominal thickness.

The Engineer will allow dressed shiplap or square-edged lumber, sized four sides, at least ¾ inch thick, and covered by form lining instead of structural plywood for form lumber. Use metal, composition, or plywood form lining for shiplap or square-edged lumber. Use composition or plywood lining at least ¼ inch thick.

The Engineer will evaluate the sizing, spacing, and dimensions of metal, composition, or special plywood forms and may allow continued use based on performance.

The Engineer may modify the requirements for pattern and minimum lumber thickness for curved Type A surfaces. The inside faces of forms for Type A surfaces must be free of holes, irregularities, and unevenness.

b. **Type B Surface.** Type B surfaces are formed concrete surfaces that will not be exposed in the finished work, the bottoms of floor slabs and sidewalk, the sides of interior beams and girders, backwalls above the bridge seat, and exposed surfaces not included in Type A surfaces.

   Use metal forms or face-forming material at least ¾ inch thick for Type B surfaces.

   Material allowed for Type A surfaces may be used for Type B surfaces, except do not use square-edged lumber for forming horizontal surfaces. Form lining is not required for shiplap and square-edged lumber.

c. **Type A and B Surfaces.** Do not use forms and face-form material with defects for Type A or Type B surfaces.

   For Type A surfaces, space studs no greater than 12 inches center-to-center. For Type B surfaces, space studs no greater than 24 inches center-to-center. Provide nominal 2 by 6-inch or 4 by 4-inch sections, except that nominal 2 by 4-inch studs are allowed for pour heights not exceeding 3½ feet. Cap studs with a straight top plate at least the size of the Engineer-approved studs.

   Scab all joints in plates 4 feet each way to provide continuity.

Constructed forms must remain true to shape. Countersink bolts and rivet heads on the inside face of the forms.

Design clamps, pins, or other connecting devices to hold forms rigidly together and allow removal without damage to the concrete. Do not use metal forms that do not present a smooth surface or that do not line up properly. Maintain metal forms free of rust, grease, and other material that may discolor concrete.

Scab wales to prevent distortion during concrete placement and curing. Place a row of wales within 6 inches of the bottom of each pour, unless studs extend below the bottom of the pour secured by wales fastened to rods in the previous pour.

d. **Construction.** Brace forms to prevent movement during concrete placement. Do not use mechanical or adhesive methods to secure forms to concrete bridge decks or pavements that will be exposed in the completed work. Finish corners square without moldings. For exposed concrete faces, saw the form edges at corners square and straight and place them to form a tight fit. Form chamfered corners with dimensions measured on the sides.

   For Type A surfaces, arrange the forms to present a neat geometric pattern of form marks. Do not offset or shift patterns. Construct forms to allow removal without damaging concrete.

e. **Ties and Spreaders.** Do not use wire ties and pipe spreaders.

   After removing forms, remove the ends of metal appliances inside the forms to maintain correct alignment. Remove ends to a depth of at least 1 inch from the surface of the concrete without creating an opening greater than 1½ inches in diameter. Remove metal or wooden spreaders that are separate from form ties during concrete placement.

f. **Form Surface Treatment.** Treat the inside of forms with a release agent that will not discolor or adversely affect the concrete. Do not allow the release agent to contact steel reinforcement or existing concrete or steel surfaces.

4. **Permanent Metal Deck Forms**

   a. **Materials and Fabrication.** Provide corrugated forms and supports fabricated from steel sheet conforming to ASTM A653/A653M and galvanized to a G210 coating designation. Provide fasteners galvanized in accordance with AASHTO M232. Fabricate permanent metal deck forms, supports, and accessories in accordance with section 707.

b. **Design.** Verify beam dimensions before fabricating permanent metal deck forms.

Design forms, form supports, and attachments to carry a 50-pound-per-square-foot construction load, all dead loads, and resultant horizontal loads due to forming of cantilever overhangs. Consider the span length to be the clear span of the form plus 2 inches, measured parallel to the form flutes. Consider the full-deck slab thickness shown on the plans to be above the corrugations. Design forms for a maximum deflection of ¼ inch or $\frac{1}{180}$ of the form span length, whichever is less. Do not use form camber to compensate for deflection greater than the limits specified.

Use unit working stresses no greater than 0.725 of the specified yield strength of the steel, or 36,000 pounds per square inch, whichever is less.

Submit working drawings and calculations for permanent metal deck forms, supports, and connections in accordance with subsection 104.02 a minimum of 14 days prior to beginning installation. The working drawings and design calculations must be sealed by a Professional Engineer licensed in the State of Michigan.

c. **Construction.** Do not use metal forms below longitudinal or transverse open joints or expansion-type joints.

Do not allow form sheets to rest directly on beam flanges. Center each sheet in the bay and provide a bearing length of at least 1 inch at each end. Attach sheets promptly to avoid hazards that may result from lateral movement or sudden uplift of the forms. Provide safety stops where necessary.

Make attachments using bolts, clips, or other Department-approved methods. Attach forms to supports using sheet metal screws, or other Department-approved fasteners, from the top side where practical. Do not weld forms or accessories to structural steel. Size support straps such that welds terminate a minimum of ¼ inch from the edge of the strap. Do not flame cut metal deck forms or supports. Repair of galvanized areas at welds or unbolted edges after shearing or punching is not required.

Field drill ¼-inch-diameter weep holes at spacing no greater than 12 inches along transverse and longitudinal construction joints.

Place and secure polystyrene in corrugations to prevent displacement during concrete placement.

Do not fill corrugations with concrete.

5. **Form Liners for Aesthetic Texturing of Concrete.** Use smooth, custom formed elastomeric or multi-use, acrylonitrile butadiene styrene (ABS) plastic form liners to produce the concrete textures as required in the contract. Single-use, polystyrene, or similar plastic liners are prohibited.

   Submit shop drawings to the Engineer for approval a minimum of 14 days prior to placing form liners. The shop drawings must detail the form liner pattern and geometry, show the complete pattern layout for the entire limits of textured concrete as required in the contract, and indicate where each of the patterns begin and end. Configure the liner so the contours do not cause the concrete to be locked into the liner.

   Use form release agents that are compatible with the form liners. Provide written certification from the manufacturer that the form release agents are compatible and non-reacting and non-staining. If form liners are required by the contract, use a single form release agent for the entire project, including formed surfaces not required to be textured.

   a. **Test Sections**. Construct a test section for each unique texturing pattern and application of pattern before constructing textured portions of permanent concrete. Test sections must demonstrate the quality of the textured concrete, including the concrete mix design, quality of forming, joint control, consolidation technique, and fully textured corners. Obtain the Engineer's approval for the location of the test sections.

      If the Engineer determines that a test section is not satisfactory, adjust construction techniques and cast additional test sections until approval from the Engineer has been obtained. The cost of any necessary additional test sections will be borne by the Contractor.

      Approved test sections will be used by the Engineer as a measure of the quality and finish of the permanent textured concrete.

   b. **Placing Forms**. Do not place form-liner horizontal splices within the textured area. Carefully match vertical splices. Visible seams or conspicuous form marks are not allowed. Bevel the top and bottom edge of the form liner at a 45 degree angle to produce a ¾-inch bevel where pattern ends.

      Thoroughly clean form liners and cant strips according to the manufacturer's recommendations and to the satisfaction of the Engineer prior to each reuse.

Handle forms and form liners according to the manufacturer's recommendations for storage, fastening liners to the forms, stripping the lined forms from the concrete, and cleaning and reconditioning liners.

Damage or wear that affects the finished appearance of the concrete will be cause for rejection and replacement of the liner. All costs associated with replacement of damaged or worn liners will be borne by the Contractor.

Apply release agent according to the manufacturer's recommendations. Remove excess release agent to prevent staining of the concrete surface.

Locate form ties at high points of the texturing pattern so they will be in the recess of the concrete. Use form ties designed so that all material can be disengaged and removed without spalling or damaging the concrete. Finish form tie holes according to subsection 706.03.R.1.

c. **Repairs.** Repair or replace textured concrete at no additional cost to the Department that, in the opinion of the Engineer, does not meet the quality and finish of the test section.

E. **Steel Reinforcement**

1. **Storage and Protection.** Store steel reinforcement on platforms, skids, or other supports. Store steel reinforcement neatly and clearly marked to facilitate inspection. Locate storage sites at water crossing locations above the high water elevation shown on the plans. Store epoxy-coated bars on padded wood or steel cribbing and cover to prevent exposure to ultraviolet rays.

2. **Handling of Epoxy-Coated Reinforcement.** Use systems with padded contact areas for handling coated bars. Pad bundling bands or use other banding to prevent damage to the coating. Lift bundles of coated bars with a strongback, spreader bar, multiple supports, or platform bridges to prevent bar-to-bar abrasion. Do not drop or drag the bars or bundles.

3. **Field Bending.** Do not bend reinforcing bars in the field unless otherwise shown on the plans or to correct minor errors or omissions in shop bending. Perform field bending cold. Make field bends in accordance with subsection 905.03.A for shop bends. Repair damaged epoxy coating in accordance with subsection 706.03.E.8.

4. **Placing and Fastening.** Accurately place and firmly secure steel reinforcement prior to concrete placement. Steel reinforcement must

be free of dirt, excessive rust, loose mill scale, and other deleterious material. Bar spacing must not vary more than one-sixth of the spacing shown on the plans, except as needed to allow placing anchor bolts and position dowels. Do not exceed the bar spacing shown on the plans. Use wire ties to secure all bar intersections for the top mat. Use wire ties to secure all bar intersections for other mats where the product of the length and width of bar intersection spacing exceeds 120 square inches. If the product of the length and the width of spacing does not exceed 120 square inches, tie alternating intersections. Do not weld to steel reinforcement.

Tie bar laps within 3 inches of each end of the lap.

For all reinforcement except for deck reinforcement, provide a clear distance from the reinforcement to the concrete surface at least equal to the dimensions shown on the plans but no more than 25% greater than the dimension. For deck reinforcement, do not vary the distance from the top transverse reinforcement to the bottom of the concrete slab by more than ⅜ inch from the dimensions shown on the plans. Provide concrete clear cover over the top transverse reinforcement at least equal to the dimensions shown on the plans.

Maintain the required reinforcement distances from forms using stays, ties, hangers, bar chairs, or other Department-approved supports, except that in bridge superstructures, use bar chairs only. If bar chairs are used, they must be plastic or coated metal with a bearing area that prevents penetration into forming material. Use commercial-grade concrete brick only in footings.

For bridge decks, place bar chairs parallel to the beam, spaced with the lines of supports measured from center-to-center, at the ¼-point and ¾-point for beam spacing less than 9 feet, and at the ⅙ point, ½ point, and ⅚ point for beam spacing 9 feet or greater.

Use additional bar chairs outside the fascia beam to support reinforcing steel along and near the fascia. On concrete box beam bridges without slab ties, use bar chairs along the longitudinal centerline of each beam. Support the upper layer of reinforcement directly over the supports for the lower layer of reinforcement with rows of Department-approved continuous steel bar supports consisting of at least three longitudinal wires.

Tie the upper layer of reinforcing steel to the structural steel, stud shear developers, or other structural components at intervals no greater than 5 feet along each beam or girder. Use two loops of 16 gauge tie wire for tie-downs. Tie coated reinforcement with coated tie wire to prevent wire from damaging the coating.

Cover epoxy-coated reinforcement if the concrete for the element is not cast within 2 months from the time of placing the epoxy-coated reinforcement. Use a cover that will prevent exposure to ultraviolet rays.

5. **Splicing.** Do not splice bars unless otherwise shown on the plans.
6. **Lapping.** Lap bars at locations shown on the plans. Do not eliminate or move laps from the locations shown on the plans without approval by the Engineer.
7. **Cutting Reinforcement.** Saw or shear bars when cutting is permitted. Do not flame cut reinforcing bars.
8. **Repair of Epoxy Coating.** Repair coating damaged by bending, sawing, shearing, or damaged during shipping, unloading, storage, installation, or handling on the project.

   Patch sawed or sheared ends and visible defects in accordance with ASTM A775/A775M. Use a patching or repair material selected from the Qualified Products List. Clean areas requiring patching by removing surface contaminants and damaged coating. Roughen the area requiring patching before applying patching material. Remove rust by dry blast cleaning or power tool cleaning immediately before applying patching material.

   Immediately treat bars in accordance with the patching material manufacturer's recommendations and before oxidation occurs. Overlap patching material onto the original coating by 2 inches or as recommended by the manufacturer. Provide at least 8 mils of dry film thickness on the patched areas. Replace bars with 5% or more damaged area in a 12-inch bar length. Coat mechanical splices after splice installation in the same manner as required for sawed or sheared ends.

F. **Placing Galvanized Metal Pipe Sleeves.** Place galvanized metal pipe sleeves in the bridge to carry utility company facilities across the bridge. The utility company will provide pipe sleeves at the bridge site at no cost to the Contractor. Notify the utility company at least 7 days before the sleeves are needed. If the contract requires the utility company to install conduit or ducts in the structure, notify the utility company at least 7 days before the utility company is required to install conduit or ducts. The Department will not allow additional compensation for costs associated with delays caused by utility company operations.

G. **Placing Conduit.** Align the conduit, tightly fit the joints, and firmly secure conduit prior to concrete placement. Assemble and protect sleeve expansion joints in the superstructure to allow movement after concrete

encasement. Place concrete encasement after the Engineer approves the alignment of and connection to the conduit. Swab the conduit for the entire length immediately after casting encasement to remove concrete materials.

H. **Placing Concrete**

1. **General.** Prepare and test work progress specimens as necessary in accordance with section 1002.

   Obtain the Engineer's written approval of forms, bracing, reinforcing steel, and preparations for casting concrete before beginning concrete placement operations. Before placing concrete, clean forms, piling, and reinforcing steel and remove sawdust, chips, and other debris from the form interior. Concrete placed without the Engineer's approval may be rejected and required to be removed.

   Remove struts, stays, and braces to hold forms in the correct shape and alignment when the concrete elevation renders them unnecessary.

   Place concrete to avoid material segregation and reinforcement displacement.

   Complete each pour in a continuous operation with no interruption longer than 45 minutes, except concrete subfootings. Place and consolidate each layer before initial set of the previous layer.

   For concrete subfootings, the Contractor may place vertical construction joints within the subfooting for a substructure unit.

   Do not place additional concrete on finished reinforced substructure concrete until the substructure concrete cures for at least 3 days and attains at least 70% of its required minimum 28-day flexural or compressive design strength.

   Do not use mechanical attachments to support forms until substructure concrete attains at least 70% of its required minimum 28-day flexural or compressive strength. The Engineer may lower the concrete strength required for attaching forms after reviewing calculations performed by a Professional Engineer, licensed in the State of Michigan, showing that forces due to imposed loads will not exceed the capacity of the concrete section based on 70% of the concrete strength at the time the loads are applied.

   Do not pour deck concrete until diaphragm concrete attains a compressive strength of 70% of its required minimum 28-day flexural or compressive strength.

Regulate concrete placement so pressure caused by wet concrete does not exceed the pressure used in designing the forms.

Place the concrete in the forms in layers of suitable thickness as close to the final position as possible. In pier caps and wall sections, place layers no greater than 12 inches thick. The Engineer may modify the layer thickness requirements for wall sections depending on the steel reinforcement spacing.

Place subfooting and tremie concrete to the full depth of the section.

Place footing concrete and column concrete in layers no greater than 36 inches thick.

For concrete placed by pumping, dispose of water-cement slurry used to lubricate the discharge pipe outside the forms.

Other than subfootings and tremie seals, place and vibrate substructure concrete in the dry.

Do not allow superstructure concrete to free fall more than 12 inches to the top of reinforcing steel. Do not allow concrete to free fall more than 5 feet for other structural applications. If concrete must drop more than 5 feet, place concrete through Department-approved pipes or tremie tubes at least 6 inches in diameter and arranged to avoid concrete segregation. If reinforcing bar spacing prevents the use of a 6-inch tube, loosen the bar ties and spread the bars enough to allow the use of the tremie tube or chute. Reposition and re-tie reinforcing bars before covering with concrete.

Use mechanical, high-frequency internal vibrators approved by the Engineer and capable of visibly and effectively consolidating the concrete mixture for a radius of at least 18 inches from the tip of the vibrator. If using epoxy-coated or other coated reinforcement, use a vibrator with a rubber-coated head.

The Engineer may allow concrete consolidation using hand methods if the use of vibratory equipment is not possible.

Use vibrators to consolidate incoming concrete within 15 minutes of placement. Manipulate vibrators to work the concrete around the reinforcement and embedded fixtures into corners and angles of forms. Vibrate freshly placed concrete at the point of placement. Thoroughly consolidate the concrete, but do not cause segregation.

Move vibrators to prevent forming localized areas of grout. Uniformly space the points of vibration no greater than twice the radius of the visibly effective vibration area. Do not hold vibrators against forms or

reinforcing steel, and do not use them for flowing or spreading concrete. Do not disturb partially hardened concrete.

Do not disturb forms or projecting reinforcement after the initial set of the concrete.

Maintain forms, reinforcing steel, and placing equipment clean and free of hardened concrete.

Discharge water used to flush placing equipment away from concrete and forms.

If concreting operations extend into the night, illuminate the work to make operations clearly visible for inspection.

Do not form or cast sidewalk, brush block, or barrier pours until the deck concrete attains its required minimum 7-day flexural or compressive strength and after completion of the 7-day continuous wet cure.

Do not place heavy equipment on the deck until the deck concrete attains its required minimum 28-day flexural or compressive strength and after completion of the 7-day continuous wet cure.

2. **Hot Weather Limitations.** Place bridge deck concrete when the rate of evaporation at the site is less than 0.20 psf per hour in accordance with Figure 706-1.

   Cast concrete only when the temperature of the concrete being placed is below 90°F.

   Supply and use Engineer-approved equipment for determining the relative humidity and wind velocity on the project.

3. **Placing Concrete under Water.** Place concrete under water if shown on the plans. Place concrete under water in a compact mass in the final position using a tremie tube or by pumping. Equip the tremie tube so the bottom end closes if concrete does not encase the pipe. Do not use bottom dump buckets. Maintain still water at the point of placement, and provide tight forms. Do not disturb the concrete after placement.

   Support the tremie tube to allow free movement of the discharge end over the entire work surface and to allow rapid raising or lowering to adjust the concrete flow. Place the concrete full depth in one continuous operation, starting from one end of the cofferdam. Always keep the tremie tube in the freshly placed concrete; withdraw the tremie tube only upon completion of each pour or as required due to foundation piling or cofferdam bracing.

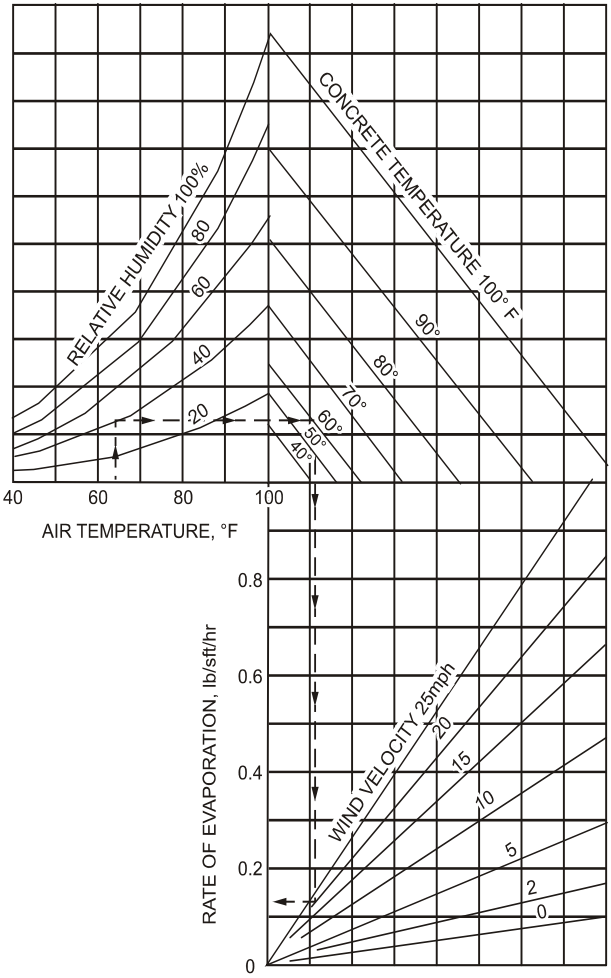


Figure 706-1: Surface Evaporation for Concrete

Estimate the evaporation rate in accordance with the following:

a. Enter the air temperature, measured from 4 to 6 feet above the evaporating surface, on the windward side and shielded from the sun;

b. Move up to the line corresponding to the relative humidity;

c. Move right to the line corresponding to the concrete temperature;

d. Move down to the line corresponding to the wind velocity, measured from 18 inches above the evaporating surface;

e. Read the evaporation rate on the scale to the left of this point.

After withdrawing the tremie tube, recharge it with concrete above water, lower it to the new position, and set the discharge end into freshly placed concrete. During placing operations, maintain the tremie tube full to the bottom of the hopper. After dumping a batch into the hopper, induce the flow of concrete by raising the discharge end of the tremie tube slightly. Do not remove the end of the tremie tube from the concrete.

Remove laitance or other deleterious material without damaging the concrete. Place concrete to at least the elevation of the top of tremie seals but no more than 6 inches above the seals. Remove excess concrete.

Dewater cofferdams after the tremie concrete has been placed and has attained at least 50% of its required minimum 28-day compressive strength or after test beams cured in water on top of the tremie concrete break with a flexural strength of at least 325 psi. These strength requirements do not relieve the Contractor of responsibility for failure of any part of the cofferdam.

I. **Nighttime Casting of Superstructure Concrete**

1. **Construction Methods.** Begin work no earlier than 1 hour after sunset or as approved by the Engineer. Complete placement of concrete no later than 1 hour prior to sunrise or as approved by the Engineer. Use the sunset and sunrise times published by the National Weather Service for the proposed date of night casting or the time determined by the Engineer. Coordinate nighttime deck pours with the Engineer to allow scheduling of inspection.

   Comply with the deck pouring sequence and curing requirements shown on the plans. If approved by the Engineer, the Contractor may consecutively pour areas shown on the plans for simultaneous pour, the same night, using retarder in the first pour to prevent initial set until completion of the second pour. Submit any changes to the pour sequence to the Engineer for approval a minimum of 7 days prior to placing concrete.

2. **Lighting Requirements.** Use light sources to achieve a minimum average intensity of 10 foot-candles over the entire work area, including the concrete testing area. Submit the deck lighting scheme to the Engineer for approval. Provide a lighting alignment that does not interfere with or impede traffic on open roadways. Refer to subsection 812.03.H for additional lighting requirements for night work.

J. **Cold Weather Precautions.** Protect concrete to prevent damage from cold weather. Remove and replace frozen concrete or concrete damaged by cold weather at no additional cost to the Department.

If the National Weather Service forecasts that air temperatures will remain below 50°F but above 40°F, apply ordinary protection requirements to protect concrete.

If the National Weather Service forecasts air temperatures below 40°F during the curing period, apply low-temperature protection requirements to protect concrete.

Cure concrete in accordance with subsection 706.03.N.1, except that only one application of curing compound is required.

1. **Ordinary Protection**. Ordinary protection consists of using tarpaulins, straw covering, or other Engineer-approved methods to protect concrete. If the prevailing temperatures will produce concrete temperature less than 45°F, raise the concrete temperature in accordance with subsection 1001.03.E.5.

   Seal keyways, anchor bolt wells, or other depressions on exposed horizontal surfaces against water intrusion.

   If approved by the Engineer, protect footings by completely submerging them under water inside the cofferdam area 2 hours after placement. After submersion, maintain water level necessary to cover the concrete and keep ice from contacting the concrete.

2. **Low-Temperature Protection.** Low-temperature protection consists of using insulated forms or heating and housing to protect concrete. Place concrete in the forms at temperatures specified in subsection 1001.03.E.5. Maintain concrete at a temperature of at least 45°F.

   a. **Insulated Forms-Substructure Concrete**. Apply blanket insulation tightly against the forms and fasten securely. Insulate corners and edges. If placing concrete against previously cast concrete, extend the blanket insulation at least 14 inches and hold in place against the previously cast concrete. Patch or cover tears and holes in the blanket.

      Cut polystyrene insulation to fit snugly between wood form studs and fasten securely. For steel forms, fit the insulation boards between the ribs and hold in place with adhesive or Department-approved fasteners.

      Provide insulating blankets or polystyrene insulation meeting the minimum thickness or the minimum R values specified in Table 706-1.

Table 706-1:
Minimum Insulation Requirements

	Unlined Steel Forms		Wood-Lined Steel or Wood Forms	
Thickness of Pour (inch)	Thickness (inch)	R Value	Thickness (inch)	R Value
<12	2	7.0	2	5.25
12–24	2	7.0	1.5	5.25
>24	1.5	5.25	1	4.0

Clean ice, snow, and frost from forms when placing concrete. Place substructure concrete when the air temperature is above 35°F, unless the form interiors, metal surfaces, and adjacent concrete surfaces are preheated to at least 35°F. Use only gas-fired burners if heating by direct flame. Place substructure concrete in insulated forms only when the air temperature is above 15°F, except that the Contractor may place subfootings, footings, and CIP concrete piles if the air temperature is above 0°F. Wrap exposed portions of CIP concrete piles with insulating blankets or protect them with straw.

Cover the top of pours with insulating blankets. Cover inaccessible areas around protruding reinforcing bars with straw. Cover the tops of insulated pours, including the insulation, with tarpaulins or other Department-approved material.

Leave insulated forms in place until the concrete attains at least 50% of the required minimum 28-day flexural or compressive strength and for at least 5 days after final concrete placement in individual units.

Unless otherwise directed by the Engineer, do not loosen forms to lower temperatures. Remove blankets or straw from the tops of footings no earlier than the third day after casting to allow forming subsequent portions of the unit. Obtain the Engineer's approval before loosening forms or removing the top covering. If the outside air temperature reaches 0°F or below, or the National Weather Service forecasts air temperatures 0°F or below for the next 24 hours, do not remove forms for 8 days after casting unless otherwise directed by the Engineer and only if the air temperature is between 0°F and 32°F and the temperature difference between the air and the concrete surface is no greater than 30°F. If possible, remove forms at midday.

b. **Insulated Forms-Superstructure Concrete**. If the National Weather Service forecasts air temperatures below 20°F during the

curing period, provide material and heating equipment on the project to protect forms and concrete. Do not begin placing superstructure concrete if the air temperature is below 35°F.

Do not place superstructure concrete if the air temperature is below 40°F unless form interiors, metal surfaces, and the adjacent concrete surfaces are preheated to at least 40°F. Use only gas-fired burners if heating by direct flame.

Insulating the bottom of deck forms is not required. If the National Weather Service forecasts air temperatures below 40°F for more than 8 consecutive hours during the curing period, protect the top of the freshly placed concrete as soon as possible to maintain a concrete temperature of at least 45°F. Use tightly joined insulating blankets or polystyrene insulation and insulate in accordance with Table 706-1.

Hang tarpaulins or other Department-approved material from the top of the curb to enclose the entire protected section. If the temperature falls below 15°F during the curing period, circulate heated air under the enclosed superstructure section. Maintain circulation for the remainder of the protection period required for concrete protected by heating and housing.

c. **Heating and Housing**. Before placing concrete in forms, provide enclosures for concrete sections being placed to maintain the specified temperatures within the enclosure.

Arrange enclosures to allow removal of forms and finishing of concrete surfaces without interrupting heating.

Provide uniform forced air or radiant heat in the enclosure. Vent the heating system to prevent exposure to carbon dioxide exhaust gases during concrete placement and curing. Before placing concrete, preheat reinforcing steel and form surfaces to temperatures from 40 to 75°F.

During and after concrete placement, operate the heating system to maintain an air temperature inside the enclosure from 40 to 75°F. Maintain the temperature inside the enclosure until the concrete attains at least 50% of its required minimum 28-day flexural or compressive strength.

At the end of the heating period, decrease the temperature to the outside air temperature at a rate no greater than 15°F per 12 hours. Allow the concrete surface to dry during the cooling period. Remove the enclosure.

In case of a heating system failure, provide emergency heaters for use within 1 hour. Place and operate heaters and provide for moisture, as directed by the Engineer.

K. **Construction and Expansion Joints.** Construct joints in concrete structures where shown on the plans. Clean laitance and other deleterious material from the contact concrete surface in place, and wet surfaces before placing new concrete. Finish face edges of joints to the line and elevation shown on the plans. Finish joint surfaces that provide expansion in the plane of the joint within ⅛ inch of a true plane. Form keys within reasonable tolerances using suitable material.

1. **Sealer.** Use poured joint sealers of the type required by the contract. Handle hot-poured joint sealer material in accordance with subsection 602.03.S.

2. **Fiber Joint Filler.** Shape premolded expansion joint filler to fit adjacent concrete. Hold premolded expansion joint filler in place to prevent formation of concrete fins under or between expansion joint filler and to prevent the joint filler from being dislodged during concrete placement.

3. **Joint Seals.** For concrete, install seals as shown on the plans.

   a. **Sawing Construction Joints.** Saw the joint groove at each transverse construction joint, as shown on the plans. Provide a joint groove symmetrical about the construction joint.

   b. **Expansion Joints.** Construct expansion joints as shown on the plans and symmetrical about the filler centerline.

   c. **Cleaning after Sawing.** Immediately after sawing, remove deleterious material from sawed joints.

   d. **Patching Transverse Joints.** Inspect and repair transverse joints in accordance with subsection 602.03.P.

   e. **Installing Seals.** Install the top of the seal ¼ inch below the surface of the deck.

4. **Expansion Joint Devices.** From the approved expansion joint devices shown in the contract, select joint devices for each location that are suitable to accommodate the total movement shown in the contract. Inform the Engineer of the selected expansion joint device.

   Submit complete working drawings of all details of fabrication of the expansion joint device in accordance with subsection 104.02. This requirement is waived for expansion joint devices for which a set of

standard installation details has been approved. Standard installation details can be obtained from the Engineer.

Fabricate the expansion joint to conform to the contour of the bridge deck accounting for raised sidewalks, brush blocks, and barriers as shown in the contract.

Install expansion joint devices in accordance with the contract and as shown on the approved working drawings. Set the top of the expansion joint device ¼ to ⅜ inch below the top of the concrete slab or pavement.

Tie deck-reinforcing steel-to-steel frame anchors to the maximum extent practicable without damaging galvanized or epoxy coatings.

Clean expansion joint device and install the gland in one continuous piece in accordance with the manufacturer's recommendations.

If splicing of the gland is required and approved by the Engineer, use a trained representative of the joint manufacturer to perform splicing.

Remove shipping bolts prior to placement of concrete.

Weld in accordance with subsections 707.03.E.7.b, d, and f.

5. **Expansion Joint Device Covers.** Install plate covers as shown in the contract. Cast curbs and sidewalks with sliding plates in place to ensure proper alignment of inserts and screws. Apply bond breaker to sliding plates before installation. Form concrete recess areas in sidewalks to receive sliding plates and grind to provide smooth surface. Tool or grind concrete edges to a ¼ inch radius.

   Apply one coat of epoxy resin adhesive to allow bent sliding plate to move freely without friction. Ensure that no adhesive contacts the expansion joint device or gland. Remove foreign particles before installing plates. Install plates to position the anchors on the high side of longitudinal sidewalk grade. Repair damage to galvanized surfaces in accordance with section 716.

L. **Placing Anchor Bolts and Position Dowels in Concrete.** Set anchor bolts and position dowels in the forms using a template prior to placing concrete. If shown on the plans, the Contractor may drill holes in hardened concrete and utilize adhesive anchors or mechanical expansion anchors in accordance with subsections 712.03.J and 712.03.K at no additional cost to the Department.

   Finish the surface around anchor bolts or position dowels in accordance with subsection 706.03.M.2.

M. **Finishing Plastic Concrete.** Do not over-vibrate or over-finish the completed surface. If approved by the Engineer, apply water to the concrete surface with a fog sprayer to aid finishing. After finishing, texture sidewalks and curbs in a transverse direction with a broom to produce uniform, narrow grooves no greater than ⅛ inch deep. Texture the final deck surface in accordance with subsection 706.03.M.3.

1. **Machine Finishing.** Use a self-propelled transverse finishing machine to strike off and finish concrete surfaces subject to vehicular traffic. To accommodate the type of finishing machine used, the Engineer may authorize elimination of longitudinal construction joints shown on the plans.

   Immediately before placing concrete, operate the finishing machine over the full length and width of the bridge segment to be placed and adjacent segments if a pour sequence is required. Perform the test run with the screed adjusted to the finishing position. While operating the finishing machine, check the screed for deflection and adjustment. Measure and record the depth of the reinforcement below the screed, the controlling dimensions of deck reinforcement, and the forms. Make necessary corrections during the test run. Upon completion and documentation of the test run, do not make adjustments to the finishing machine or rails unless approved by the Engineer.

   When finishing concrete surfaces, complete screed passes with sufficient concrete material along the leading edge to ensure filling low spots. Leave the surface at the required grade and free of water and laitance after the final pass of the screed. Remove deleterious material from the gutters where the Engineer allows final hand finishing.

   As soon as practical, place the work bridge behind the finishing machine.

   While concrete remains plastic, test the slab surface for trueness with a 10-foot straightedge or other Engineer-approved method. Finish the surface to the required grade and cross section.

   Without damaging concrete, completely remove rail supports or partially remove so no portion remains less than 3 inches below finished concrete. Fill the resulting holes with concrete, consolidate, and finish flush with the deck surface before the deck concrete hardens.

2. **Hand Floated Surface Finish.** Provide a floated surface finish on areas not requiring machine finishing, such as bridge seats, sidewalks, areas of bridge decks under sidewalks, and similar

surfaces. Finish by striking off the concrete surface with a screed set to the required cross section.

Vibrating or oscillating screeds may be used if approved by the Engineer.

Provide a movable screed on guides set to the required elevation with allowance for camber if required. After striking-off, finish the surface with a wood or magnesium float.

Broom finish the concrete surface under elastomeric bearings.

3. **Texturing.** Groove the final deck surface as soon as deck concrete can maintain a texture. Construct grooves perpendicular to the centerline. Form grooves in plastic concrete without causing edges to slump or surface tearing. End grooving 12 to 16 inches from sidewalk or barrier edges. Do not groove within 3 to 6 inches of expansion or contraction joints or the end of the slab. Space grooves on ½-inch centers, ⅛ inch wide, and ⅛ inch deep. Random spacing is permitted if the spacing between grooves remains between ¼ inch and 1 inch.

   The Engineer may require removal and replacement of deck surfaces that are not grooved as required. If the Engineer determines that grooves are too shallow but allow decks to remain in place, regroove after the concrete attains the required minimum 28-day flexural or compressive strength. Use a machine built specifically for grooving pavements, with blades 0.095 inch ±0.003 inch wide, spaced randomly from ¾ inch to 1¼ inches on centers. Orient grooves along the initial grooving at right angles to the centerline of the pavement or skewed no greater than the maximum skew of the bridge. Cut grooves uniformly ⅛ inch deep.

   Control and minimize dust from grooving operations. Remove and dispose of residue from the grooving operations to prevent debris from entering drainage systems.

4. **Surface Tolerances.** As soon as practical, check surface tolerances. If surfaces do not meet the specified tolerances, grind with a carborundum brick or other Department-approved methods. If grinding to obtain evenness results in an elevation below the limits shown on the plans, the Engineer will direct the Contractor to take corrective action at no additional cost to the Department.

   Position bridge seats within ⅛ inch of elevations shown on the plans. Finish bridge seats under bearings or masonry plates to an unevenness of no greater than 1/16 inch.

Cast the tops of concrete subfootings within ½ inch of the elevations shown on the plans and footings, wingwalls, parapets, slope walls, headers, and other surfaces within ¼ inch of the elevations shown on the plans.

For final deck surfaces, cast decks to within a tolerance of ⅛ inch over 10 feet. Before acceptance, the Engineer will check the deck with a 10 foot straightedge and mark defective areas. Remove or reduce high spots, ridges, and other defects greater than ⅛ inch by rubbing with a carborundum brick and water or grinding and re-grooving.

N. **Curing.** Protect steel reinforcement from curing compound overspray. For air temperatures below 40°F, cure concrete in accordance with subsection 706.03.J. For air temperatures of 40°F and above, cure concrete in accordance with this section. Prepare and test work progress specimens, as necessary, in accordance with section 1002.

1. **Top Surfaces Exposed in the Completed Structure**

a. **Other than Bridge Decks.** Immediately upon completion of concrete finishing operations, spray curing compound uniformly on the concrete surface. Use transparent or white curing compound. Apply white curing compound at a rate of at least 1 gallon of compound per 150 square feet. Apply transparent curing compound in two coats at a rate of at least 1 gallon of compound per 300 square feet for each coat. Apply the second coat when the first coat dries sufficiently to avoid runoff but no more than 2 hours after applying the first coat. Do not dilute the curing compound.

b. **Bridge Decks.** Use a two-phase continuous 7-day wet-cure procedure. Before beginning concrete placement operations, demonstrate to the Engineer that curing materials and equipment are on-site and that equipment is in operating condition.

Immediately after the bleed water sheen leaves the textured concrete surface, begin the first phase of the curing procedure by spraying a single coat of curing compound over the surface. Apply the curing compound at a rate of at least 1 gallon per 150 square feet of surface. Do not leave more than 10 feet of textured concrete surface exposed without curing compound.

Prepare clean, contaminant-free burlap by soaking it in clean water for at least 12 hours before beginning concrete placement. Immediately before use, drape or suspend the burlap sheeting vertically to remove excess water that may dilute or damage plastic concrete. Cover concrete surfaces with wet burlap when the curing compound has dried sufficiently to prevent adhesion,

and the concrete surface can support it without deformation, but no more than 4 hours after the concrete placement. Do not allow the burlap to dry once it is in place. Do not use burlap-polyethylene (Burlene) or other products with impervious surfaces.

Install a network of soaker hoses over the wet burlap when the concrete surface can support it without deformation. Use soaker hoses perforated throughout their lengths within the limits of curing. Use soaker hoses of lengths and capacities capable of applying cure water uniformly and continuously over the entire bridge deck surface without the need to move the hoses periodically. Prevent excessive localized water discharge that may damage concrete surfaces. Use non-perforated hose outside the limits of curing. Demonstrate to the Engineer that soaker hose systems provide uniform and thorough coverage of the deck surface.

Place a layer of transparent or white polyethylene film at least 4 mils thick over the deck surface and the soaker hose system. Overlap seams in the polyethylene at least 10 inches. Activate the wet cure system and maintain it to ensure uninterrupted wet curing of the deck surface. Control the water runoff to prevent soil erosion or hazards to traffic. Do not allow curing water runoff to discharge directly into surface waters.

Maintain the wet cure until the concrete attains the required minimum 7-day flexural or compressive strength and for at least 7 days following concrete placement. Do not remove the wet cure system based on 7-day compressive strengths attained in less than 7 days. Do not form or cast succeeding portions onto the bridge deck prior to completion of the 7-day two-phase continuous wet cure. Ensure that excess or ponding cure water is removed prior to casting of succeeding structure portions.

2. **Top Surfaces to Which Succeeding Portions of the Structure Will Be Bonded.** Maintain top surfaces on which succeeding portions of the structure will be placed including, but not limited to, medians, shoulders, sidewalks, barriers, parapets, membrane waterproofing, tops of backwalls, tops of diaphragms, and latex overlays, free of curing compound.

   Begin wet curing when the concrete hardens sufficiently to prevent marring or water damage. Cure these surfaces by keeping them continuously wet until the concrete attains the required minimum 7-day flexural or compressive strength and for at least 7 days following concrete placement. Do not form or cast succeeding portions

onto the bridge deck prior to completion of the 7-day, two-phase continuous wet cure. Forming of barriers and other appurtenances on raised sidewalks and brush blocks is permitted provided the wet cure is maintained.

3. **All Surfaces Other than Top Surfaces.** Cure surfaces, other than top surfaces, by keeping continuously wet until the concrete attains at least 70% of its required minimum 28-day flexural or compressive strength and for at least 5 days following concrete placement. Alternatively, cure concrete by leaving forms or other waterproof devices in place during the curing period or by applying transparent membrane curing compound for structures.

   Do not use membrane curing compound on surfaces requiring water curing and bonding of additional concrete or surfaces requiring application of joint waterproofing or protective coatings or penetrating sealers.

   Clean surfaces of steel dowels, anchors, waterstops, exposed reinforcing steel, and similar devices of curing compound before encasement.

   For structures, apply transparent membrane curing compound in two coats, each with at least 1 gallon of compound per 300 square feet of surface. Apply the first coat immediately after removing forms. Apply the second coat from 30 minutes to 2 hours after applying the first coat.

   Apply curing compound using a brush, roller, or spray equipment capable of producing a uniform film without causing the compound to run or sag. Obtain the Engineer's approval for spray equipment before use.

   If the method of applying the compound does not produce a uniform film, stop using the curing compound and keep the concrete surface wet for the required curing period.

O. **Removing Falsework and Temporary Supports.** Leave falsework and temporary supports for concrete structures other than railings in place until the concrete attains at least 70% of its required minimum 28-day flexural or compressive strength and for at least 5 days following concrete placement.

   Falsework for railings may be removed after 15 hours.

   Remove materials used to construct falsework outside low-water limits to at least 6 inches below the finished ground surface. Remove falsework material inside low-water limits to the stream bed.

P. **Removing Forms.** Do not remove vertical forms, including bulkheads at construction joints, until at least 15 hours after completion of the pour. Remove forms under slab spans, beams, girders, and brackets in accordance with subsection 706.03.O. If forms are braced against finished work portions subject to movement due to temperature changes, remove restraining falsework or adjust to prevent damage to the new work.

Q. **Placing Beams on Substructure Units.** Do not place beams until substructure concrete attains at least 70% of the required minimum 28-day flexural or compressive strength.

R. **Finishing Hardened Concrete**

1. **General.** Remove concrete fins and irregular projections from surfaces, except those that will not be exposed or those not requiring waterproofing. Clean honeycomb areas, broken corners or edges, cavities produced by form ties, other defects, and holes greater than ¾ inch in diameter and ⅜ inch deep. Keep surfaces saturated with water until pointed and trued with mortar. Mix the mortar using cement and fine aggregate of the proportions used in the concrete grade finished. Use a cement mixture composed of two-thirds of the brand used in the concrete and one-third white cement. Use fine aggregate from the same source as used in the concrete. Use workable mortar that has attained initial set. Restore consistency by reworking but not retempering. Cure mortar patches in accordance with subsection 706.03.N.

2. **Rubbed Surface Finish.** If the contract requires a rubbed surface finish, start rubbing as soon as possible after removing forms and completing pointing and truing required in accordance with subsection 706.03.R.1. Immediately before beginning rubbing work, keep the concrete saturated with water for at least 1 hour. Allow time before wetting concrete to allow mortar in pointing of holes and defects to set. Do not damage mortar used in pointing of holes and defects. Rub the surfaces with a medium-coarse carborundum brick. Do not paint or plaster surfaces with neat cement or mortar. Continue rubbing to obtain a uniform surface, including the removal of form marks, projections, and irregularities, and filling of voids. Leave paste in place produced by this rubbing.

   After casting all concrete above the treated surface, obtain the final finish by rubbing with a fine carborundum brick and water. Continue rubbing to produce a smooth surface, uniform in color.

   After completion of final rubbing and after the surface dries, rub with burlap to remove loose powder. Leave rubbed surfaces free of

unsound patches, paste, powder, and marks that the Engineer determines objectionable.

S. **Penetrating Water-Repellent Treatment.** Before applying the material, provide the Engineer with the product data sheets showing the manufacturer's recommended surface preparation, application procedure, and temperature range.

Unless adjacent steel surfaces require coating after concrete cleaning, protect them to prevent damage. If damage occurs, repair it according to the contract at no additional cost to the Department.

1. **Application.** Apply penetrating water repellent material in accordance with the manufacturer's recommendations and at the application rate specified in the Qualified Products List. Do not dilute or alter penetrating water repellent material.

2. **Limitations**. Cure concrete at least 28 days before treating. Allow concrete to air dry during the final 48 hours of the curing period. Apply penetrating water repellent material to surface dry concrete.

   Apply penetrating water repellent material when the concrete and the air temperature are within the range recommended by the manufacturer but no colder than 40°F.

   Do not spray the water repellent material if wind, rain, or other conditions are present that would adversely affect the application.

T. **Electrical Grounding System.** Use electricians licensed in the State of Michigan and experienced in grounding system installation to perform grounding work. Install a ground at each side of the bridge, at opposite ends.

Weld bonding jumpers across the steel structure at the expansion joints and across the steel fence posts at expansion joints. Size bonding jumpers, as approved by the Engineer, to allow for the movement of the expansion joints. Install grounding cables down the piers or abutments from the bonding jumpers, fence posts, or steel fence to the grounding rod. Make connections with exothermic welds. Use the required mold and associated equipment for each connection.

Install bonding jumpers and grounding cables to allow for at least 2 inches of expansion between connections.

Measure ground resistance using the fall-of-potential method and do not exceed 25 ohms. If a single 8-foot grounding rod does not attain 25 ohms, drive additional 8-foot grounding rods, added to the top of the first rod or driven as a second ground, and connect to the first ground.

Place grounding cables and tops of grounding rods at least 12 inches below finished ground.

U. **Name Plates.** Furnish and install name plates as shown on the plans. Before installation, submit name plates with the required data imprinted legibly in the surface to the Engineer for approval.

V. **Wall Drain.** Attach wall drain strips as recommended by the manufacturer. Peel geotextile layers from the core at the lower edge and wrap around the foundation underdrain. Provide additional geotextile sections to completely encapsulate the pipe-strip junction. Shingle lap geotextile to preclude entrance of backfill material.

Hold the top composite strip snug against the wall using mechanical means or a heavy bead of caulk, as approved by the Engineer, until the backfill is placed.

Repair damage to composite strips or replace the strip. Deliver and store composite strips in ultraviolet-resistant wrapping. Protect composite strips from prolonged exposure to sunlight in accordance with the manufacturer's instructions.

706.04. Measurement and Payment

Pay Item	Pay Unit
False Decking	Square Foot
Reinforcement, Steel	Pound
Reinforcement, Steel, Epoxy Coated	Pound
Reinforcement, Stainless Steel	Pound
Reinforcement, Steel, Culv and Headwall	Pound
Conc, Grade __	Cubic Yard
Conc, Grade 3500, Subfooting	Cubic Yard
Substructure Conc	Cubic Yard
Substructure Conc, High Performance	Cubic Yard
Superstructure Conc	Cubic Yard
Superstructure Conc, High Performance	Cubic Yard
Superstructure Conc, Night Casting	Cubic Yard
Superstructure Conc, Night Casting, High Performance	Cubic Yard
Water Repellent Treatment, Penetrating	Square Yard
Expansion Joint Device	Foot
Expansion Joint Device, Cover Plate	Foot
Pipe Sleeve, __ inch	Each
Pipe Sleeve, __ inch, Placed	Each
Conduit, __ inch	Foot
Conduit, __ inch, Placed	Foot

Superstructure Conc, Form, Finish, and Cure (Structure Identification)..... Lump Sum
Superstructure Conc, Form, Finish, and Cure, Night Casting (Structure Identification)..... Lump Sum
Bridge Ltg, Furn and Rem (Structure Identification)..... Lump Sum
Bridge Ltg, Oper and Maintain..... Cubic Yard
Conc, Low Temperature Protection..... Cubic Yard
Elec Grounding System..... Each
Wall Drain..... Square Foot
Aesthetic Texturing..... Square Yard

A. **General.** Unless otherwise specified, the Engineer will calculate pay quantities for pay items listed in this subsection based on the lines and dimensions shown on the plans. The Engineer will calculate concrete volumes without subtracting the volume of steel reinforcement or steel H-piling.

B. **False Decking.** The Engineer will measure **False Decking** for the total area protected, including beam widths. The unit price for **False Decking** includes the cost of providing, installing, maintaining, moving, and removing false decking material or barges.

C. **Steel Reinforcement.** The Engineer will calculate the weight of bars or bar mats, plain or coated, from the theoretical bar weights in accordance with Table 706-2, based on the total calculated weight for the bar sizes and lengths, mesh, or bar mats. The Engineer will not make allowance for the weight of coating.

Table 706-2:
Weights for Reinforcing Bars

Bar Size Designation	Weight (lb/ft)	Diameter, Round Sections (inch)
No. 3	0.376	0.375
No. 4	0.668	0.500
No. 5	1.043	0.625
No. 6	1.502	0.750
No. 7	2.044	0.875
No. 8	2.670	1.000
No. 9	3.400	1.128
No. 10	4.303	1.270
No. 11	5.313	1.410
No. 14	7.65	1.693
No. 18	13.60	2.257

The unit prices for **Reinforcement, Steel**; **Reinforcement, Steel, Epoxy Coated**; **Reinforcement, Stainless Steel**; and **Reinforcement, Steel, Culv and Headwall** include the cost of furnishing and installing the reinforcement.

D. **Structure Concrete.** Conduct concrete quality control as specified in section 1002 and the contract. The Engineer will conduct quality assurance as specified in section 1003 and the contract. The Department will pay for concrete required for this work based on the quality assurance results.

Provide substructure concrete and superstructure concrete for bridge structures. Provide concrete of the grade required for box and slab culverts, headwalls, parapets, wingwalls, retaining walls, tremie seals, and other structures.

The Engineer will measure superstructure concrete for decks based on batch plant tickets with deductions made for material wasted or rejected.

The unit prices for **Substructure Conc**; **Substructure Conc, High Performance**; **Conc, Grade __**; and **Conc, Grade 3500, Subfooting** include the cost of forming, finishing, and curing.

If the contract requires casting concrete against steel sheet piling, the Engineer will calculate the concrete volume based on an outline to the midpoint of the corrugations in the sheet piling section.

The Engineer will not make deductions in concrete volumes for piles embedded 12 inches or less.

If casting concrete footings on or against excavated rock, the Engineer will make an allowance in concrete volume for rock overbreak within 6 inches outside and 6 inches below the neat outline of the footing.

The Engineer will measure, and the Department will pay for, concrete placed by pumping as concrete placed by other methods. The Department will not adjust the unit price of concrete as a result of adjustments in aggregate proportions, an increase in cement to facilitate the use of pumping equipment, or for the water-cement slurry pumped through the discharge pipe at the beginning of a pour.

E. **Water Repellent Treatment, Penetrating.** The unit price for **Water Repellent Treatment, Penetrating** includes the cost of preparing concrete surfaces and providing and placing water-repellent material.

F. **Expansion Joint Device.** The Engineer will determine **Expansion Joint Device** quantities by the joint device length placed within the limits in the contract or authorized by the Engineer, including allowance for vertical heights and the terminal assemblies at the curbs, sidewalks, or barriers.

The unit price for **Expansion Joint Device** includes the cost of providing and placing attaching hardware for the device and all materials and labor required for proper installation of the expansion joint, end plates, and terminal assemblies at the curbs, sidewalks, or barriers.

G. **Expansion Joint Device, Cover Plate.** The unit price for **Expansion Joint Device, Cover Plate** includes providing the cover plate and associated hardware for proper installation of the cover plate. The Engineer will determine **Expansion Joint Device, Cover Plate** quantities by measuring the length of cover plate placed within the limits shown on the plans in the contract or authorized by the Engineer.

H. **Conduit and Pipe Sleeve.** The unit prices for **Conduit, __ inch** and **Pipe Sleeve __ inch** include the cost of providing and installing conduit or pipe sleeve.

The unit prices for **Conduit, __ inch, Placed** and **Pipe Sleeve, __ inch, Placed** include the cost of installing conduit or pipe sleeve provided by others.

The Department will not make additional payments to the Contractor for additional work of forming for conduit or ducts.

I. **Superstructure Concrete, Form, Finish, and Cure.** The Engineer will measure **Superstructure Conc, Form, Finish, and Cure** as a unit for each structure.

The unit prices for **Form, Finish, and Cure** pay items include the cost of finishing and curing concrete, designing, fabricating, providing, and erecting forms or permanent metal deck forms and providing and installing polystyrene.

J. **Bridge Lighting**

1. **Furnishing and Removing.** The Engineer will measure **Bridge Ltg, Furn and Rem** as a unit for each structure. The unit price for **Bridge Ltg, Furn and Rem** includes the cost of furnishing, placing, and removing the lighting system for nighttime lighting.

2. **Operating and Maintaining.** The Engineer will measure **Bridge Ltg, Oper and Maintain** based on cubic yards of superstructure concrete cast at night. The unit price for **Bridge Ltg, Oper and Maintain** includes the cost of operating and maintaining the lighting system.

K. **Low Temperature Protection.** If the contract does not include a separate item for **Conc, Low Temperature Protection** and the Department orders low-temperature protection work due to Department-caused delays, or the Department orders an expedited progress schedule, the Department and

the Contractor will agree on a unit price for **Conc, Low Temperature Protection** before beginning protection work.

The Department will pay for **Conc, Low Temperature Protection** based on the concrete quantity actually protected if the quantity did not increase due to the Contractor's failure to perform the work as shown on the progress schedule or due to the Contractor's performance of more work than shown on the progress schedule.

L. **Wall Drain.** The unit price for **Wall Drain** includes the cost of providing and attaching geocomposite and additional geotextile to wrap the foundation underdrain. The Engineer will measure, and the Department will pay for, foundation underdrain in accordance with subsection 404.04.

M. **Electrical Grounding System.** The unit price for **Elec Grounding System** includes the cost of providing and installing the complete system to ground the bridge on two sides.

N. **Aesthetic Texturing.** The Engineer will measure **Aesthetic Texturing** by the square yard of the area textured without allowance for the shape and depth of the texturing. The unit price for **Aesthetic Texturing** includes:

1. Providing form liners;
2. Replacing damaged form liners;
3. Installing form liners;
4. Initial test sections;
5. Subsequent test sections, if any;
6. Repairing concrete surfaces that do not meet the quality and finish of the test section;
7. Shop drawings; and
8. Release agents.

O. **Providing and Placing Interim Curing Material.** The unit prices for the relevant structural concrete pay items include the cost of providing and placing interim curing material on bridge deck top surfaces exposed in the completed structure.

P. **Name Plates.** The cost of providing, fabricating, imprinting, and installing name plates on structures is included in the unit prices for other items of work.

Q. **Unstable Foundations.** The Department will pay for special treatment for unstable foundations at the unit price or authorized unit price for the item of work.

Section 801. Concrete Driveways

801.01. Description

This work consists of constructing reinforced or non-reinforced concrete driveways as required by the contract.

801.02. Materials

Provide materials in accordance with the following sections:

Curing Compound 903
Steel Reinforcement 905
Joint Materials 914
Concrete, Grade 3500 1004

801.03. Construction

Construct driveways in accordance with subsection 803.03 and the *MDOT Standard Plan R-29* series.

801.04. Measurement and Payment

Pay Item	Pay Unit
Driveway, Reinf Conc, __ inch	Square Yard
Driveway, Nonreinf Conc, __ inch	Square Yard

A. **Acceptance.** Conduct concrete quality control (QC) as specified in section 1002. The Engineer will conduct quality assurance (QA) as specified in section 1003. The Department will apply adjustments to this work based on the QA results.

B. **Driveway, Reinf Conc and Driveway, Nonreinf Conc.** The Engineer will measure **Driveway, Reinf Conc, __ inch** and **Driveway, Nonreinf Conc, __ inch** by the width and length placed, for the specified thickness required on the plans.

Section 802. Concrete Curb, Gutter, and Dividers

802.01. Description

This work consists of constructing the following items on the prepared base, with or without reinforcement, as required by the contract:

A. Concrete curb, combination curb and gutter, and curb nose;

B. Valley gutter and shoulder gutter;

C. Downspout headers and spillways; and

D. Dividers.

802.02. Materials

Provide materials in accordance with the following sections:

Curing Compound 903
Asphaltic Materials 904
Steel Reinforcement 905
Geotextile Liner 910
Lane Ties 914
Joint Fillers 914
Concrete, Grade 3500 1004
Mortar, Type R-2 1005

802.03. Construction

A. **Preparation of Base.** Prepare the base in accordance with subsection 602.03.B. Construct a uniform base. Compact the base material to 95% of the maximum unit weight. Prepare the base and geotextile liner for concrete spillways in accordance with subsection 814.03.A.

B. **Placing Forms.** Place fixed forms in accordance with subsection 602.03.C. Use face forms, if necessary, to construct straight curbs.

If using slip-forming methods, match the dimensions of the form to the dimensions of the curb shown on the plans.

C. **Placing Steel Reinforcement.** Place steel reinforcement and lane ties in the correct position during concrete placement, as required.

Splice steel reinforcement bars by lapping them at least 10 inches. Tie bar laps with wire ties within 2 inches of each end of the lap.

D. **Placing Concrete.** Obtain the Engineer's approval of the base before placing concrete. Wet the base before placing concrete.

For concrete curbing constructed as an integral part of the concrete pavements, except at night headers, place concrete curbing within

30 minutes of placing the concrete for the pavement. At night headers, use ties and methods approved by the Engineer.

Construct transitions between concrete valley gutter and concrete curb and gutter in accordance with section 602.

Place concrete to the required depth and spade or vibrate to ensure consolidation.

Apply membrane-curing compound as soon as concrete has been placed and in areas requiring repairs after the repairs have been made.

Repair honeycombed areas or voids with Type R-2 mortar.

E. **Joints.** Construct joints perpendicular to the surfaces of the curb, gutter, or dividers in accordance with the *MDOT Standard Plan R-30* or *R-33* series. Seal joints in accordance with subsection 602.03.S.

1. **Contraction Joints and Plane-of-Weakness Joints.** Construct joints, in accordance with plans, to ensure a plane-of-weakness at least one-fourth the depth of the section.

2. **Expansion Joints.** Place expansion joint filler to the full depth of the joint. Recess the top of the joint filler ¼ to ½ inch below the finished surface of the structure.

F. **Finishing.** Round the exposed edges to a ¼-inch radius, including transverse joints. Shape the face of the curb to produce the radii shown on the plans. Fill low spots with the same concrete mixture used in the work.

Finish exposed surfaces smooth and even, and lightly brush using a broom or brush. Finish the gutter and top of curb to within 3⁄16 inch of the plan dimensions when checked with a 10-foot straightedge. Finish other exposed surfaces to within ⅜ inch of the plan dimensions.

Do not add water to the concrete surface to aid finishing.

G. **Stenciling.** Stencil survey station numbers, in accordance with subsection 602.03.L, into the exposed surface of continuous runs of concrete curb, gutter, curb and gutter, and driveway opening, or shoulder that directly adjoins the traveled way. Stenciling curb and gutter is not required if concrete barrier is present and is stenciled in accordance with subsection 602.03.L.

Place stencil numbers as follows:

1. To be read from the traveled way;

2. On one side of one-way roadways (preferably the right side);

3. On both sides of the traveled way of two-way roadways; and
4. Midway up on the face of a curb or 2 inches from the back of a gutter or driveway opening.

Do not stamp, stencil, or in any way mark concrete with a company name, logo, or other such information.

H. **Curing.** Cure concrete curb, gutter, and dividers in accordance with subsection 602.03.M.

I. **Weather and Temperature Limitations.** Protect concrete curb, gutter, and dividers in accordance with subsection 602.03.T.

J. **Backfilling.** Place and compact backfill after the concrete gains the needed strength to support placing and compacting. Grade the remaining excavated areas.

802.04. Measurement and Payment

Pay Item	Pay Unit
Curb, Conc, Det __	Foot
Curb and Gutter, Conc, Det __	Foot
Valley Gutter, Conc	Foot
Curb and Gutter, Bridge Approach, Det__	Foot
Shld Gutter, Conc, Det __	Each
Curb Nose	Each
Downspout Header, Conc	Each
Driveway Opening, Conc, Det M	Foot
Spillway, Conc	Foot
Divider, Conc, Type __	Square Foot

A. **Concrete Acceptance.** Conduct concrete QC as specified in section 1002. The Engineer will conduct QA as specified in section 1003. The Department will apply adjustments to this work based on the QA results.

B. **Curb, Concrete; Curb and Gutter, Concrete; Valley Gutter, Concrete; and Curb and Gutter, Bridge Approach, Det__.** The Engineer will measure **Curb and Gutter, Conc, Det __**, **Valley Gutter, Conc**, and **Curb and Gutter, Bridge Approach, Det__** in place along the joint of the curbing with the pavement. The Engineer will not make deductions in the pay item measured length for catch basins, inlet castings, or Detail L driveway openings. The Engineer will divide transition areas between **Valley Gutter, Conc** and **Curb and Gutter, Conc** in half and will measure each half in the units of the adjacent item.

C. **Integral Curb and Pavement Construction.** If the Contractor chooses to construct curb as an integral part of the pavement, the Engineer will

measure the curb separately. The Department will not consider payment for extras or increases in pay quantities due to the Contractor's choice to cast curbing integral with the pavement.

D. **Shoulder Gutter, Concrete.** The unit price for **Shld Gutter, Conc, Det __** includes the cost of providing and placing a geotextile liner. The plans will show the pay limits for **Shld Gutter, Conc, Det __.**

E. **Driveway Opening, Conc, Det M**. The Engineer will measure **Driveway Opening, Conc, Det M** from springline to springline.

F. **Spillway, Concrete.** The unit price for **Spillway, Conc** includes the cost of providing and placing a geotextile liner.

G. **Divider, Concrete, Type __.** The unit prices for concrete divider include the cost of steel reinforcement, if required.

H. **Excavation and Backfill.** Unless the contract includes separate pay items for excavation and backfill, the unit price for other items of work will include the cost of excavation and backfilling.

Section 803. Concrete Sidewalk, Curb Ramps, and Steps

803.01. Description

The work consists of constructing concrete sidewalks, curb ramps, and steps.

803.02. Materials

Provide materials in accordance with the following sections:

Sound Earth 205
Granular Material Class II 902
Curing Compound 903
Steel Reinforcement 905
Pipe Railing 908
Joint Fillers 914
Concrete, Grade 3000, 3500 1004
Grout 1005

A. **Steps.** Use Grade 3500 for concrete for steps. Precast steps will be allowed.

B. **Detectable Warning Surfaces.** Provide pre-fabricated detectable warning surfaces selected from the Qualified Products List that contrast visually with adjacent walking surfaces, either light-on-dark or dark-on-light. Base the selection on whether the detectable warning surface will be installed on existing concrete or on newly cast concrete. Ensure that the surface-applied products include mechanical anchors.

803.03. Construction

A. **Preparation of Base.** Excavate to the required depth and to a width that will allow forming. Remove unsuitable material below the required depth and replace with sound earth. Shape base to conform to the section shown on the plans and compact to 95%.

B. **Forms.** Use either fixed forms or slip forms. Provide straight, full-depth, unwarped forms that will resist springing during concrete placement. Firmly stake fixed forms.

C. **Placing and Finishing Concrete.** Wet the base before placing concrete. Do not place concrete on a frozen base or on a base that is unstable from excessive moisture. Place the concrete and consolidate before finishing. Place and finish concrete in a continuous operation.

   If replacing gutters in addition to curb ramps, transition the gutter cross section in advance of the curb ramp to meet the dimension and profile in

the *MDOT Standard Plan R-28* series. Use the same reinforcement pattern present in the existing gutter.

Place the railing sockets for concrete steps in the plastic concrete or drill into the hardened concrete.

Float the surface to produce a smooth surface, free from irregularities. Round the edges and joints with a finishing tool.

Texture the surface of sidewalks, curb ramps, driveways, and steps with a coarse broom transverse to the direction of travel.

Do not stamp, stencil, or in any way mark concrete with a company name, logo, or other such information.

D. **Sidewalk Joints.** Construct transverse and longitudinal expansion and plane-of-weakness joints at intervals and locations shown in the *MDOT Standard Plan R-29* series. Align transverse joints with like joints in adjacent slabs. Construct joints with faces perpendicular to the surface of the sidewalk and no greater than ¼ inch from the position shown on the plans. Construct transverse joints at right angles to the centerline of the sidewalk and longitudinal joints parallel to the centerline.

Spade or vibrate and compact the concrete to fill voids at the faces of the joints.

Place expansion joint filler the full depth of the joint. Recess the top of the joint filler ¼ to ½ inch below the finished surface.

Cut the plane-of-weakness joints into the concrete after floating. Cut plane-of-weakness joints to at least one-fourth the thickness of the sidewalk and from ⅛ to ¼ inch wide.

Do not seal the joints.

E. **Curing and Protection.** Cure and protect the concrete in accordance with subsection 602.03.M and subsection 602.03.T.

F. **Railing for Steps.** Place the railing in the sockets and fill the space between the pipe and the socket with a non-shrink mortar or grout selected from the Qualified Products List. Provide bracing as needed for the railing to remain plumb while the grout achieves the proper strength.

G. **Backfilling.** After the concrete gains the needed strength, remove fixed forms and backfill with sound earth. Compact and level the backfill 1 inch below the concrete surface.

H. **Detectable Warning Surfaces.** Install detectable warning surfaces in accordance with the manufacturer's instructions and the *MDOT Standard Plan R-28* series.

I. **Curb Ramp Opening.** Construct curb ramp openings in accordance with subsection 802.03, the *MDOT Standard Plan R-28* series, and as required to conform with the curb ramp geometry including, but not limited to, slopes, counter slopes, running slopes, cross slopes, flares, and widths.

803.04. Measurement and Payment

Pay Item	Pay Unit
Sidewalk, Conc, __ inch	Square Foot
Curb Ramp, Conc, __ inch	Square Foot
Detectable Warning Surface	Foot
Steps, Conc	Cubic Yard
Railing for Steps	Foot
Curb Ramp Opening, Conc	Foot

A. **Concrete Acceptance.** Conduct concrete QC as specified in section 1002. The Engineer will conduct QA as specified in section 1003. The Department will apply adjustments to this work based on the QA results.

B. **Sidewalk, Concrete.** The Engineer will measure **Sidewalk, Conc**, **__ inch** of the required thickness, in place.

C. **Curb Ramp.** The Engineer will measure **Curb Ramp, Conc, __ inch** by the area of ramp and landing in place. **Curb Ramp, Conc, __ inch** includes sidewalk sloped greater than the normal continuous sidewalk grades to meet the elevation of the curb opening or intermediate landing. Landing areas constructed and meeting the requirements of the *MDOT Standard Plan R-28* series will be included in the **Curb Ramp, Conc, __ inch** item.

The unit price for **Curb Ramp, Conc, __ inch** includes the cost of landings, monolithic rolled curbs or side flares along the longitudinal edges of the ramp or landing, and transitions to existing sidewalk.

The Department will pay separately for replacing sidewalks, curbs, or curb and gutter outside the area measured for **Curb Ramp, Conc, __ inch**.

The Department will pay for rolled curb adjacent to the non-traffic edge of parallel or combination ramps separately only if the required height exceeds 18 inches along a continuous run.

D. **Detectable Warning Surface.** The Engineer will measure **Detectable Warning Surface** in place by length along the center of the 24-inch-wide detectable warning surface material at required locations. The unit price

for **Detectable Warning Surface** includes the cost of surface preparation and application.

E. **Steps, Concrete.** The Engineer will measure and the Department will pay for **Steps, Conc** based on plan quantities in accordance with subsection 109.01. The unit price for **Steps, Conc** includes the cost of foundation preparation; constructing forms; providing and placing steel reinforcement; providing, placing, finishing, and curing concrete; providing and placing backfill; and cleanup.

The Engineer will measure **Railing for Steps** in place by length of top rail for each railing required. The unit price for **Railing for Steps** includes the cost of providing, fabricating, installing, and grouting the railing.

F. **Excavation and Backfill.** Unless the contract includes separate pay items for excavation and backfill, the unit price for other items of work will include the cost of excavation and backfilling.

G. **Curb Ramp Opening, Conc.** The Engineer will measure **Curb Ramp Opening, Conc** in place along the joint between the curbing with the pavement including transitions to and from adjacent standard full-height curb and gutter cross section.

Section 813. Slope Protection

813.01. Description

This work consists of constructing precast and cast-in-place (CIP) concrete slope paving, including plain, heavy, and grouted riprap and associated headers.

813.02. Materials

Provide materials in accordance with the following sections:

Cement	901
Granular Material Class II	902
Curing Compound	903
Steel Reinforcement	905
Geotextile Liner	910
Precast Concrete Slope Paving Blocks	913
Riprap	916
Heavy Riprap	916
Concrete, Grade 3000	1004
Mortar, Type R-3	1005

Provide a retarding admixture, selected from the Qualified Products List, if additional time is required between adding water to the concrete mixture and placing the concrete. Do not exceed the manufacturer's recommended maximum initial set time.

813.03. Construction

A. **Base Preparation.** Excavate or fill to the required subgrade. Compact and shape the subgrade for the following:

1. The bottom of the riprap;
2. Precast and CIP concrete slope paving; or
3. The bottom of the granular material layer.

Dispose of the surplus excavated subgrade material in accordance with subsection 205.03.P. Trim the subgrade to the Class A slope tolerances specified in subsection 205.03.N. Construct the granular material layer in accordance with subsection 301.03, except compact the material to at least 90% of the maximum unit weight.

B. **Precast Concrete Slope Paving.** Place concrete in accordance with the weather and temperature limitations specified in subsection 602.03.T when fabricating precast concrete slope paving. Install the precast units on a layer of granular material base. Fill the joints between precast units

with Type R-3 mortar. Moisten the edges of the precast units when placing the mortar. Place mortar beginning at the lower end of the joints and proceeding to the upper end of the joints. Completely fill the joints between the precast units after consolidation. Remove excess mortar from the surface of the slope paving. Cure and protect the mortar in accordance with subsection 813.03.C.3.

C. **Concrete Slope Paving**

1. **Forms.** Use wood or metal forms that are straight and free of warp and capable of resisting deflection during concrete placement. Form the concrete full depth. Stake forms, including slab division forms, to the required line and grade. Provide straight and continuous slab division joints. Form blocks of the dimensions shown on the plans.

2. **Placing and Finishing Concrete.** Place concrete in accordance with the weather and temperature limitations specified in subsection 602.03.T. Maintain a moist base during concrete placement. Place concrete to the required depth in a continuous operation.

   Place concrete within 1½ hours of adding water into the mix. Do not retemper.

   Consolidate the concrete along the faces of the forms. Tamp the concrete surface to remove voids and strike off with a strike board to the required grade and cross section.

   Finish the concrete surface with a wood float. Round the edges and joints to a ¼-inch radius with a Department-approved finishing tool. Remove edging and finishing tool marks with a float and soft bristle brush.

3. **Curing and Protection.** Cure the concrete by applying a transparent membrane curing compound specified in subsection 903.07.B.

D. **Slope Paving Headers.** Use forms for slope paving headers in accordance with subsection 813.03.C.1.

   If concrete placement is required below the elevation of the slope paving subgrade, or granular material layer, the concrete may be cast neat to the earth, as approved by the Engineer.

   Place steel reinforcement in accordance with subsection 802.03.C. Place and finish slope paving header concrete in accordance with subsection 813.03.C.2. Cure slope paving header concrete in accordance with subsection 813.03.C.3.

E. **Riprap.** Place geotextile liner under the riprap. Place the liner in a key trench at the toe of the slope if the riprap ends at or below a high water

elevation. After the riprap is in place, anchor the geotextile in a key trench at the tops of slopes with a ratio of 1:3 or steeper. Construct the upper key trench to 1½ feet deep or three times the minimum riprap dimension, whichever is greater. Provide a setback between the top of the slope and the upper key trench at least equal to the trench depth. Backfill the upper trench with riprap material unless otherwise directed by the Engineer.

Overlap geotextile seams by at least 2 feet. If laying geotextile horizontally, start at the bottom of the slope and shingle lap additional layers to direct surface runoff. Place riprap onto the geotextile without dumping or dropping riprap into place.

1. **Plain Riprap.** Begin the riprap placement in the trench at the toe of the slope and progress upward. Place individual stones, embedding each stone into the slope, and interlock against adjoining stones. Place random and well-broken joints between consecutive rows of stones. Compact the riprap as construction progresses. Unless using precast concrete blocks, construct riprap at least 18 inches thick, measured perpendicular to the slope.

2. **Grouted Riprap.** Place riprap in accordance with subsection 813.03.E.1. Fill the spaces between the stones with Type R-3 mortar. Place the mortar from joint bottom to top and completely fill the voids between the stones after consolidation. Leave the top surface of the stone exposed. Immediately remove excess mortar with a stiff brush. Cure and protect grouted riprap in accordance with subsection 813.03.C.3.

3. **Heavy Riprap.** Place heavy riprap in accordance with subsection 813.03.E.1. Unless using precast concrete blocks, construct heavy riprap at least 36 inches thick, measured perpendicular to the slope. If using broken concrete, place in two layers with staggered joints and fill voids with smaller pieces of broken concrete, as approved by the Engineer.

813.04. Measurement and Payment

Pay Item	Pay Unit
Slope Paving, Precast Conc	Square Yard
Slope Paving, Conc	Square Yard
Slope Paving Header	Foot
Riprap, Grouted	Square Yard
Riprap, Plain	Square Yard, Ton
Riprap, Plain, LM	Cubic Yard
Riprap, Heavy	Square Yard, Ton
Riprap, Heavy, LM	Cubic Yard

A. **Concrete Acceptance.** Conduct concrete QC as specified in section 1002. The Engineer will conduct QA as specified in section 1003. The Department will pay for this work based on the QA results.

B. **Slope Paving.** The unit prices for slope paving pay items include the cost of admixtures, excavation, and disposal of surplus materials. The unit prices for slope paving pay items also include the cost of granular material, unless the plans include the pay item **Granular Material, Cl**.

C. **Slope Paving Header.** The Engineer will measure **Slope Paving Header** in place, including both sides and the toe.

D. **Riprap.** The unit prices for riprap items include furnishing all materials, equipment, and labor to divert stream flow, clear and prepare grades, excavate and dispose of surplus or unsuitable materials, furnish and place geotextile liner or heavy geotextile liner as applicable, and place the riprap, including headers.

Section 816. Turf Establishment

816.01. Description

This work consists of conducting soil tests, preparing the soil, and placing sod or seed and mulch to permanently stabilize disturbed areas as shown on the plans.

A. Definitions

The following terms apply to this section.

Broadleaf Weed. Any dicotyledonous weedy plant. Broadleaf weeds include, but are not limited to, dandelion, clovers, thistles, and ragweed.

Compost. Mature, stabilized, humus-like material derived from the aerobic decomposition of yard clippings, leaves, and brush with a diameter less than 4 inches.

Dormant Seeding. Seeding placed in late November and December when plant growth ends for the season. Seeds are placed on unfrozen ground and mulched to lie dormant over the winter and germinate the following spring.

Friable. Easily crumbled or pulverized soil.

Friable Condition. Soil in a friable condition is a crumbled, pulverized, worked-up, loosened, or cultivated soil that is free of lumps and clods detrimental to seeding and sodding operations.

Humus. Brown or black material formed by the decomposition of vegetable or animal matter; the organic portion of soil, essential to fertility.

Hydromulching. Spraying mulch combined with water and mulch-anchoring material onto a prepared seed bed.

Hydroseeding. Spraying seed and fertilizer combined with water onto a prepared seed bed.

Muck. Organic matter consisting of decomposed plant material accumulated under conditions of excessive moisture. If organic remains are not identifiable as plant form, the material is considered muck.

Mulch. Material placed over seeding to improve germination by conserving moisture, moderating the soil temperature, and protecting the seed and soil from water and wind erosion.

Mulch Anchor. Glue-type material sprayed over mulch to hold it in place.

Peat. Organic matter consisting of partially decayed plant material accumulated under conditions of excessive moisture. If organic remains are identifiable as plant form, the material is considered peat.

Soil Test. Analysis report of soil nutrient content particle size, pH levels, and organic matter.

Soil Tracking. Horizontal grooves on exposed slopes 1:3 or greater parallel to the contour of the land using tracked construction equipment.

Target Weeds. Weeds the Engineer identifies for removal by spraying or other methods. Target weeds include any plant not included in the specified seed mix.

Turf Reinforcement Mat. Three-dimensional matrix of synthetic or a composite of synthetic and natural materials that is used to permanently control erosion.

816.02. Materials

Provide materials in accordance with the following sections:

Compost..... 917
Topsoil..... 917
Fertilizer 917
Seed 917
Sod 917
Mulch 917
Mulch Anchoring 917
Mulch Blankets..... 917
Turf Reinforcement Mat 917
Weed Control 917
Water 911

816.03. Construction

Establish turf in accordance with this section, the *MDOT Soil Erosion and Sedimentation Control Manual*, and as directed by the Engineer.

A. **Topsoiling.** Before placing topsoil, prepare the foundation. Provide, place, and spread humus bearing topsoil, compost, or both. Use topsoil from within the project limits or from off-site sources meeting the requirements in subsection 917.06. Obtain the Engineer's approval for topsoil placement prior to seeding.

1. **Preparation of Earth Bed.** Seven to 10 days before preparing earth bed, including areas previously mulched or rye seeded for temporary

erosion control, kill existing vegetation by spraying with the non-selective herbicide containing glyphosate.

Construct the earth bed to the required grade and trim.

2. **Placing Topsoil.** Place topsoil meeting the requirements in subsection 917.06. Cover areas requiring seeding or sodding with topsoil, compost, or both, except for slopes constructed of topsoil, muck, or peat.

   Spread topsoil, compost, or both on the prepared areas at least 3 inches deep. Pulverize large clods and lumps. Rake out rocks with a diameter greater than 2 inches, roots, litter, and deleterious material. Dispose of raked-out material in accordance with subsections 205.03.A.3 and 205.03.P.

   Incorporate topsoil and compost into the upper 3 inches of the prepared earth bed. Do not work topsoil or compost if wet. Perform soil tracking prior to seeding on slopes steeper than 1:3. Leave horizontal soil impressions from equipment across the face of the slope, as required by Engineer and noted in the *MDOT Standard Plan R-96* series for soil erosion control measures.

3. **Excavated Topsoil or Salvaged Topsoil.** The Engineer will direct stockpiling excavated or salvaged topsoil within the right-of-way. Maintain the stockpile in a weed-free condition during the entire project duration.

B. **Chemical Fertilizer Nutrient.** Provide and place fertilizer as indicated below.

   In areas requiring sod, uniformly apply granular fertilizer before laying the sod.

   In areas to be broadcast or drill seeded, uniformly apply granular fertilizer to the prepared seed bed.

   Apply the required class of fertilizer to the required locations at the following application rates:

   1. For Class A fertilizer, evenly apply 176 pounds of chemical fertilizer nutrient per acre on a prepared seed bed.
   2. For Class B fertilizer, evenly apply 120 pounds of chemical fertilizer nutrient per acre on a prepared seed bed.
   3. For Class C fertilizer, evenly apply 80 pounds of chemical fertilizer nutrient per acre on established turf.

If using the hydroseeding method, constantly agitate the seed-fertilizer mixture. Do not disk or harrow after placement. Apply fertilizer mixed with seed within 1 hour of mixing.

Remove excess fertilizer from impervious surfaces adjacent to prepared seed and sod beds by sweeping back into beds. Do not use water to flush excess fertilizer into storm drains or surface water. Do not use fertilizer within 15 feet of waters of the state or on frozen or saturated soil.

C. **Seeding.** For each species, provide seed varieties selected from the Qualified Products List. Do not broadcast or hydroseed in conditions that would prevent seed placement as required. Apply turf and specialty seed mixtures in accordance with the mix ratios and seed rates in Table 816-1 and Table 816-2.

Table 816-1:
General Roadside Seed Mix Selection Guide

Turf Seed Mixture		Soil Type	General Location	Seed Rate	Salt Tolerance
TDS	turf dry sandy	Dry sandy to sandy loam	Rural or urban	220 lb/acre	Low to medium
THV	turf heavy soil	Heavy	Rural	220 lb/acre	Medium to high
TUF	turf urban freeway	All types	Urban freeways, blvds., service roads, city streets	220 lb/acre	Medium to high
TGM	turf medium to heavy soil	Medium to heavy	All	220 lb/acre	Low
THM	turf loamy to heavy	Loamy to heavy	Residential and business turf	220 lb/acre	Low to medium

Table 816-2:
Temporary Seeding Mixtures

Seed Mixture		Soil Type	General Location	Seed Rate
CR	cereal rye, <6 mos	All	All	70 lb/acre
TSM 6/24	temporary seeding, 6–24 months	All	All	100 lb/acre
TSM 24+	temporary seeding, >24 months	All	All	200 lb/acre

1. **Permanent Seeding**

   a. **Sowing**. When the seed bed has been properly graded, weeds have been eliminated, and the seed bed has been raked, harrowed, and tracked and is in a friable condition, sow seed with or following the application of fertilizer. Sow seed before applying

mulch. Sow or resow the seed mixture, providing uniform coverage at the rate specified in Table 816-1 or Table 816-2.

Sow using mechanical drills, hydroseeders, or by broadcasting. In areas with 1:4 slopes or flatter, use mechanical drills.

The Department will allow hydroseeding on slopes steeper than 1:4 as approved by the Engineer.

Empty the hydroseeder tank within 1 hour of introducing the seed and/or fertilizer to the tank. Dispose of tank contents that remain in the tank mixed with hydroseeder for longer than 1 hour.

Broadcast in areas requiring resowing or in areas not accessible to a drill or hydroseeder.

The Engineer will visually inspect areas sown for uniformity of application. Resow areas that do not have an average of two seeds per square inch at no additional cost to the Department.

b. **Setting the Seed.** Lightly compact or rake areas sown by broadcast method to incorporate the seed into the top ½ inch of the topsoil. Immediately after setting the seed, mulch in accordance with subsections 816.03.E and 816.03.F.

2. **Temporary Seeding.** Obtain the Engineer's approval for temporary seeding. Place temporary seed only for erosion control or temporary soil stabilization. Do not temporarily seed slopes 1:3 or steeper after placing topsoil; permanently seed these slopes. Sow temporary seed in accordance with subsection 816.03.C.1. Before project completion, replace temporary seeding with permanent seeding as shown on the plans or directed by the Engineer.

3. **Dormant Seeding.** The Engineer will allow dormant seeding in limited areas. Obtain the Engineer's approval prior to dormant seeding. Dormant seed in accordance with subsection 816.03.C.1.

4. **Seasonal Limitations**

a. **Permanent Seeding.** Permanently seed the following locations during the specified periods:

i. Southern Lower Peninsula. South of the north boundary of Township 20 North; April 15 through October 10.

ii. Northern Lower Peninsula. North of the north boundary of Township 20 North; May 1 through October 1.

iii. Upper Peninsula. May 1 through September 20.

b. **Dormant Seeding.** Dormant seed the following locations during the specified periods:

i. Southern Lower Peninsula. South of the north boundary of Township 20 North; after November 15 but not on frozen ground.

ii. Upper Peninsula and Northern Lower Peninsula. North of the north boundary of Township 20 North; after November 1 but not on frozen ground.

c. **Temporary Seeding.** Temporary seed in accordance with the seasonal limitations specified in subsection 816.03.C.4.a.

5. **Inspection.** The Engineer will inspect the seeded turf to ensure that the end result is well established, growing, and vigorous and contains the species required by the seeding mixture.

The Engineer will approve slopes as the Contractor completes permanent restoration on cut slopes, embankment slopes, or portions of slopes. The Engineer will consider each cut or embankment slope on each side of the roadway separately for approval.

Complete weed control in accordance with subsection 816.03.I.

D. **Sodding.** Prepare the topsoil surface, provide and place the sod, and dispose of surplus material. Grade areas required for sodding to Class A slopes in accordance with subsection 205.03.N.

Immediately before laying sod, harrow the topsoil, at least 3 inches deep using a disk, spring tooth drag, spike tooth drag, or other equipment designed to condition the soil. Obtain the Engineer's approval for harrowing equipment. Harrow horizontally across the face of slopes.

Dampen the earth bed before laying the sod. Water the sod immediately after placement, in accordance with subsection 816.03.H. The Engineer will reject sod that has dried out.

Protect sod until placement. Lay sod within 24 hours after cutting. Do not handle sod with pitch forks or dump from vehicles. Do not place frozen sod or place sod on frozen soil. Unless otherwise approved by the Engineer, do not place sod in June, July, or August.

Place sod as shown on the *MDOT Standard Plan R-96* series. Stagger the transverse joints of the sod strips and lay parallel to the flow of water on slopes and in ditches. Place strips with tight joints. Lay sod starting at the base of the slope and work up the slope. Turn edges of sodded areas into the ground and cover with a layer of earth or shoulder material. Compact this material to allow the surface water to flow over the edge of

the sod. Butt the edges of sod firmly against, and level with, paved surfaces.

Work from ladders or treaded planks if necessary to prevent the displacement of sod during sodding operations. Compact sod by tamping immediately after placement. Tamp to a smooth, even surface free of bumps and depressions. Finish the sodded surface to a lawn-like appearance. On slopes steeper than 1:3, use wooden pegs to secure the sod. Space pegs no greater than 2 feet apart and drive flush with the sod surface.

E. **Mulching.** Provide, spread, and anchor mulch material. Place mulch within 1 calendar day after seeding.

Do not mulch during winds that prevent placement and anchoring of the mulch.

Place mulch to allow sunlight to penetrate and air to circulate but thick enough to shade the ground, conserve soil moisture, and prevent or reduce water and wind erosion.

Spread mulch over the surface to a uniform thickness with an application rate of 2 tons per acre. If the Engineer allows dormant seeding, spread the mulch with an application rate of 3 tons per acre. After seed germinates and turf is established, apply herbicide in accordance with subsection 816.03.I.

Maintain the mulched areas and repair areas damaged by erosion, traffic, fire, or other causes before partial or final acceptance. Replace displaced mulch. Repair or replace damaged mulch areas at no additional cost to the Department, unless otherwise provided by subsection 107.11 or section 208.

Replace and anchor mulch that blows away or becomes displaced for reasons attributable to the Contractor, as directed by the Engineer and at no additional cost to the Department.

F. **Mulch Anchoring.** Provide a mulch-anchoring material selected from the Qualified Products List. Spray mulch anchoring immediately after placing mulch. Do not spray if wind prevents the required placement of adhesive. Protect traffic, signs, structures, and other objects from the tackifier material. Immediately remove overspray.

Mix and apply latex base, recycled newsprint, wood fiber, guar gum, and other mulch-tackifier material according to manufacturer’s recommendations or as follows:

1. **Latex-Base.** Mix 15 gallons of adhesive, or the manufacturer's recommended adhesive volume, whichever is greater, with at least 250 pounds of recycled newsprint and 375 gallons of water.
2. **Recycled Newsprint.** Mix 750 pounds of recycled newsprint with 1,500 gallons of water.
3. **Wood Fiber.** Mix 750 pounds of wood fiber with 1,500 gallons of water.
4. **Guar Gum.** Mix 50 pounds of dry adhesive and at least 250 pounds of recycled newsprint with 1,300 gallons of water.
5. **Other Tackifiers.** Mix 150 pounds of dry adhesive, or the manufacturer's recommended adhesive volume, whichever is greater, with at least 250 pounds of recycled newsprint and 1,300 gallons of water.

G. **Mulch Blankets.** Provide, install, and anchor mulch blankets. Provide mulch blankets selected from the Qualified Products List. Place mulch blankets within 1 calendar day after seeding. Secure with net anchors. Place and anchor blankets in accordance with the minimum requirements specified in this subsection or the manufacturer's specifications, whichever is greater.

Overlap blanket edges by 2 inches and shingle lap blanket ends with a 6-inch overlap. Place net anchors along joint edges and blanket centerlines no greater than 2 feet apart. In waterways, shingle lap blankets with an overlap of 12 inches on the downslope edge. Place blankets on backslopes perpendicular to the roadbed. On foreslopes, lay the first strip adjacent to the road, parallel to the road. Lay the remainder of the strips on foreslopes parallel or perpendicular to the road. If installing blankets from the top of the slope, do not allow them to free fall down the slope.

1. **High Velocity Blankets**. Use high-velocity blankets on slopes of 1:2 or steeper and on ditch bottoms, including 12 inches up the front and backslopes.

   The Contractor may substitute high-velocity blankets for mulch blankets at no additional cost to the Department.

2. **Mulch Blankets.** Use mulch blankets on slopes of less than 1:2 next to shoulders and behind curbs. Place mulch blankets with the netting on top and mulch fibers contacting the soil.

   The Contractor may use mulch blankets only on ditch bottoms with ditch gradients no greater than 1.5%.

3. **Turf Reinforcement Mat (TRM)**. Use TRMs for long-term erosion protection and to permanently reinforce vegetation on slopes, ditches, and shorelines.

   Provide the manufacturer's published installation guidelines to the Engineer prior to installation. Install the TRM per the manufacturer's guidelines. Operation of equipment on the slope will not be allowed after placement of the TRM.

H. **Water.** Provide and apply water in accordance with section 911 to sodded and seeded areas at the required rates. The Engineer may adjust watering based on the season and weather conditions.

   1. **Sod**

      a. Water the earth bed with at least 3½ gallons per square yard before laying the sod;

      b. Apply at least 5 gallons per square yard after placing the sod;

      c. Apply an additional 5 gallons per square yard within 24 hours after placing the sod; and

      d. Apply 3½ gallons per square yard of sod, five times at 3- to 5-day intervals.

   2. **Seed**

      a. Water seeded areas at 3½ gallons per square yard or as needed; and

      b. Continue watering regularly after germination begins in order to prevent seeds and seedlings from drying out.

I. **Weed Control.** Provide mowing and/or apply herbicides as directed by the Engineer. Submit the name, label, Material Safety Data Sheets, and application rate of the herbicide to the Engineer and obtain the Engineer's approval before applying.

   To apply herbicides, use a commercial herbicide applicator, licensed in the State of Michigan, and certified by the Michigan Department of Agriculture and Rural Development in the required category. Use application procedures and materials in accordance with federal, state, and local regulations.

   Use equipment that is adequate in size to properly apply the herbicide in a timely manner and that meets federal, state, and local requirements.

   Spray target weeds in the newly seeded turf after the new turf grass is established and will withstand herbicide application.

Target weeds must be eliminated within 14 to 21 days after spraying. Apply additional weed control if the first application does not eliminate all target weeds at no additional cost to the Department. Control target weeds until final acceptance.

Preserve and protect property adjacent to the roadway or work area from injury. Repair damage arising from acts or omissions in the performance of the work at no additional cost to the Department.

J. **Mowing.** Maintain turf at 6 inches or less during construction and until final acceptance. Mowing to be paid for as Weed Control.

K. **Acceptance.** Turf will be accepted when there is sufficient growth across 90% of the restored area to establish the turf bed and prevent soil erosion.

816.04. Measurement and Payment

Pay Item	Pay Unit
Compost Surface, Furn, LM	Cubic Yard
Compost Surface, Furn, __ inch	Square Yard
Topsoil Surface, Salv, LM	Cubic Yard
Topsoil Surface, Salv, __ inch	Square Yard
Topsoil Surface, Furn, LM	Cubic Yard
Topsoil Surface, Furn, __ inch	Square Yard
Fertilizer, Chemical Nutrient, Cl __	Pound
Seeding, Mixture __	Pound
Sodding	Square Yard
Mulch	Square Yard
Mulch Anchoring	Square Yard
Mulch Blanket	Square Yard
Mulch Blanket, High Velocity	Square Yard
Turf Reinforcement Mat	Square Yard
Water, Sodding/Seeding	Unit
Weed Control	Acre

A. **Compost.** The Engineer will measure **Compost Surface, Furn LM** at the source before hauling to the project.

The Engineer will measure **Compost Surface, Furn, __ inch** in place.

B. **Topsoil.** The Engineer will measure **Topsoil Surface, Salv, LM** at the source before placement at the final location.

The Engineer will measure **Topsoil Surface, Salv, __ inch** in place.

The Engineer will measure **Topsoil Surface, Furn, LM** at the source before hauling to the project.

The Engineer will measure **Topsoil Surface, Furn, __ inch** in place.

C. **Fertilizer, Chemical Nutrient.** The Engineer will measure **Fertilizer, Chemical Nutrient, Cl __** of the type required by the weight of nutrient in the fertilizer. The Engineer will determine the weight of chemical fertilizer nutrient for payment using the following formula:

$$T = W \times \sum N \qquad \text{Formula 816-1}$$

Where:

T = Weight of chemical fertilizer nutrients applied;
W = Total fertilizer weight applied; and
N = Percentages of nutrients contained in the fertilizer used.

D. **Sod.** The Engineer will measure **Sodding** in place.

E. **Mulching Material.** The Engineer will measure the following types of **Mulch Blanket** in place:

1. Excelsior mulch blankets;
2. Straw mulch blankets;
3. High-velocity excelsior mulch blanket; and
4. High-velocity straw mulch blanket.

For straw mulch, provide the Engineer with tickets, in triplicate, at the time of delivery, showing the number of bales and weight of each load. Weigh the mulch on scales in accordance with subsections 104.01.F and 109.01.B.6.

The unit price for **Mulch** includes providing and spreading straw mulch at the rate shown on the plans. If the Engineer allows dormant seeding, the Department will pay for mulching it at 1.5 times the unit price for **Mulch**.

The unit price for **Mulch Blanket, High Velocity** includes the cost of providing, placing, and anchoring the blankets.

The unit price for **Mulch Blanket** includes the cost of providing, placing, and anchoring the blankets. If the Contractor substitutes **Mulch Blanket, High Velocity** for **Mulch Blanket**, the Department will pay for the substitution at the unit price for **Mulch Blanket**.

The Engineer will measure **Mulch Anchori**ng in place. The unit price for **Mulch Anchoring** includes the cost of providing and spraying the tackifier.

F. **Turf Reinforcement Mat.** The Engineer will measure **Turf Reinforcement Mat** in place. It includes the cost of providing, placing,

and anchoring mats. Overlapping of material will not be included in the measurement.

G. **Water, Sodding, and Seeding.** The Engineer will measure water for sodding/seeding in units; each unit is equal to 1000 gallons.

H. **Weed Control.** The Engineer will measure and pay for **Weed Control** in place 14 to 21 days after application.

I. **Seeding, Mixture.** The Engineer will measure **Seeding, Mixture** of the type required, in pounds of seed applied.

Section 901. Cement and Lime

901.01. General Requirements

Provide facilities for sampling and inspecting cement at the mill, distribution point, and project. Store cement to allow access for inspection and identification of each shipment.

Ensure that Portland cement does not develop false set if tested by the mortar method specified in ASTM C359. The Department defines false set as occurring if penetration is less than 5 mm at 5-, 8-, or 11-minute intervals. The Department will apply these limits if difficulties arise from premature stiffening during the concrete placement or finishing.

Before concrete placement, provide the Engineer a copy of the Certification of Quality of Cement, as provided by the producer.

901.02. Testing

Cement and lime materials testing must be in accordance with the specified ASTM, AASHTO, or Department methods, as modified by this section.

901.03. Portland Cement

A. **Type I, Type II, and Type III Portland Cements.** Type I, Type II, and Type III Portland cements must meet the requirements of ASTM C150/C150M. The requirements for time of setting by Gillmore Needle or Vicat Needle and the 7-day and 28-day compressive strength apply.

B. **Blended Cements.** Blended cements must meet the requirements of ASTM C595/C595M.

901.04. Masonry Cement

Masonry cement must meet the requirements of ASTM C91/C91M, Type N, Type S, or Type M.

901.05. Hydrated Lime

Hydrated lime must meet the requirements of ASTM C207, Type S, or Type SA.

901.06. Slag Cement

Slag cement must meet the requirements of ASTM C989/C989M, Grade 100, minimum.

901.07. Fly Ash

Fly ash must meet the requirements of ASTM C618, Class F or Class C, except that the loss on ignition must not exceed 5% and the air-entraining admixture uniformity requirement in ASTM C168, Table 3 of Supplementary Optional Physical Requirements, applies.

901.08. Silica Fume, Dry-Densified

Dry-densified silica fume must meet the requirements of ASTM C1240.

Section 902. Aggregates

902.01. General Requirements

The Department may re-inspect and retest aggregates regardless of inspection at the producing plant. Provide safe access to the material for sampling from haul units or stockpiles.

Do not use spent metal casting foundry sand unless the contract expressly allows for its use.

Do not contaminate aggregate during loading or measurement.

902.02. Testing

Test aggregate materials in accordance with the following:

Material	Test
Wire Cloth and Sieves	AASHTO M92
Materials Finer than 75 mm (No. 200) Sieve in Mineral Aggregates by Washing	AASHTO T11
Specific Gravity and Absorption of Coarse Aggregate	AASHTO T85
Specific Gravity and Absorption of Fine Aggregates	AASHTO T84
Sieve Analysis of Fine and Coarse Aggregate	AASHTO T27
Sampling and Testing Fly Ash	ASTM C311/C311M
Organic Impurities in Fine Aggregate	AASHTO T21
Sieve Analysis of Mineral Filler	AASHTO T37
Mortar Strength	AASHTO T71
Particle Size Analysis	AASHTO T88
Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test	AASHTO T176
Uncompacted Void Content of Fine Aggregate	AASHTO T304
Sand Equivalent of Fine Aggregate	ASTM D2419
Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate	ASTM D4791
Water Asphalt Preferential Test	MTM 101
Los Angeles (LA) Abrasion Resistance of Aggregate	MTM 102
Insoluble Residue in Carbonate Aggregate	MTM 103

Sampling Aggregates ..... MTM 107
Loss by Washing ..... MTM 108
Sieve Analysis of Aggregate ..... MTM 109
Deleterious and Objectionable Particles ..... MTM 110
Aggregate Wear Index ..... MTM 111
Aggregate Wear Index ..... MTM 112
Selection and Preparation of Coarse Aggregate Samples for Freeze-Thaw Testing ..... MTM 113
Making Concrete Specimens for Freeze-Thaw Testing on Concrete Coarse Aggregate ..... MTM 114
Freeze-Thaw Testing of Coarse Aggregate ..... MTM 115
Crushed Particles in Aggregates ..... MTM 117
Angularity Index of Fine Aggregate ..... MTM 118
Sampling Open-Graded Drainage Course Compacted in Place ..... MTM 119
Dry Unit Weight (Loose Measure) of Coarse Aggregate ..... MTM 123
Determining Percentage of Flat Particles, Elongated Particles, or Flat and Elongated Particles in Aggregate ..... MTM 130
Determining Specific Gravity and Absorption of Coarse Aggregates ..... MTM 320
Determining Specific Gravity and Absorption of Fine Aggregates ..... MTM 321

A. **Definitions.** The Department uses the following terminology in the testing and acceptance of aggregates:

Base Fineness Modulus. Average fineness modulus typical of the source for a specific fine aggregate.

Cobblestones (Cobbles). Rock fragments, usually rounded or semi-rounded, with an average dimension between 3 and 10 inches.

Crushed Concrete Aggregate. Crushed Portland cement concrete.

Crushed Particles. Particles with at least one fractured face. The contract will specify the number of fractured faces based on required use. Unless otherwise specified, one fractured face is considered a crushed particle.

Iron Blast Furnace Slag. Synthetic nonmetallic byproduct simultaneously produced with pig iron in a blast furnace that consists primarily of a fused mixture of oxides of silica, alumina, calcium, and magnesia.

Manufactured Fine Aggregate. 100% crushed rock, gravel, iron blast-furnace slag, reverberatory furnace slag, or steel furnace slag.

Natural Aggregates. Aggregates that originated from stone quarries, gravel, sand, or igneous/metamorphic rock deposits.

Natural Sand 2NS and 2MS. Fine, clean, hard, durable, uncoated particles of sand free of clay lumps and soft or flaky granular material resulting from the natural disintegration of rock and used in concrete mixtures, mortar mixtures, and intrusion grout for pre-placed aggregate concrete.

Relative Density (oven dry [OD]). Specific gravity of aggregate that is dried or assumed to be dried. The aggregate is considered dried when it has been maintained at a temperature of 110 ± 5°C for sufficient time to remove all combined water by reaching a constant mass.

Reverberatory Furnace Slag. Nonmetallic byproduct of refined copper ore.

Salvaged Aggregate. Dense-graded aggregate or open-graded aggregate saved or manufactured from Department project sources that may consist of natural aggregate or blast furnace slag with particle sizes no greater than 2 inches and no visible organic or foreign matter.

Slag Aggregates. Byproducts formed in the production of iron, copper, and steel.

Soft Particles. Structurally weak particles or particles experiencing environmental deterioration, including shale, siltstone, friable sandstone, ochre, coal, and clay ironstone.

Steel Furnace Slag. Synthetic byproduct of basic oxygen, electric, or open-hearth steel furnaces that consist primarily of a fused mixture of oxides of calcium, silica, iron, alumina, and magnesia.

Stone Sand 2SS. Sand manufactured from stone sources. The sources must meet the physical requirements for coarse aggregate 6A prior to crushing. Stone sand in concrete base course or structural concrete is allowed only if not exposed to vehicular traffic.

902.03. Coarse Aggregates for Portland Cement Concrete

For coarse aggregates for Portland cement concrete, use Michigan Class 6AAA, 6AA, 6A, 17A, and 26A coarse aggregate produced from natural aggregate, iron blast furnace slag, or reverberatory furnace slag sources.

The Contractor may produce Michigan Class 6A, 17A, and 26A from crushed Portland cement concrete for uses specified in this subsection.

Ensure that the relative density (OD) falls within the limits established by freeze-thaw testing.

Provide coarse aggregates for Portland cement concrete in accordance with Table 902-1, Table 902-2, and this subsection.

A. **Slag Coarse Aggregate.** Use slag coarse aggregate consisting of iron blast furnace slag or reverberatory furnace slag with a dry (loose measure) unit weight of at least 70 pounds per cubic foot in accordance with MTM 123.

B. **Crushed Concrete Coarse Aggregate.** Use Department-owned concrete on the project to produce crushed concrete coarse aggregate. The Contractor may use crushed concrete coarse aggregate in the following concrete mixtures: curb and gutter, valley gutter, sidewalk, concrete barriers, driveways, temporary pavement, interchange ramps with a commercial average daily traffic (ADT) of less than 250, and concrete shoulders.

   Do not use crushed concrete coarse aggregate in the following: mainline pavements or ramps with a commercial ADT greater than or equal to 250, concrete base course, bridges, box or slab culverts, headwalls, retaining walls, pre-stressed concrete, or other heavily reinforced concrete.

   Avoid contamination with non-concrete materials, including joint sealants, hot mix asphalt (HMA) patching, and base layer aggregate or soil, when processing crushed concrete coarse aggregate. Limit contamination particles retained on the ⅜-inch sieve to no greater than 3.0%, based on a particle count of the total retained ⅜-inch aggregate particles. Aggregate stockpile contaminated with building brick, wood, or plaster will be rejected. Steel reinforcement pieces may remain in the stockpile if they can pass the maximum grading sieve size without aid. Ensure that the fine aggregate portion of the gradation does not exceed a liquid limit of 25.0% or a plasticity index of 4.0.

   The Engineer will test the freeze-thaw durability of crushed concrete coarse aggregate for each project. After the Department's central laboratory receives the aggregate samples from the supplier, each test will require at least 3 months.

   Crush concrete ensuring that it maintains uniform aggregate properties with no apparent segregation. The relative density (OD) must not vary more than ±0.05 and absorption by more than ±0.40. Separate crushed concrete aggregate according to the original coarse aggregate type, except in the following situations:

1. If the weighed quantities of each aggregate type retained on the No. 4 sieve do not differ from the average quantities obtained from at least three representative samples by more than 10%; or
2. If using aggregate produced from concrete pavement with only one type of aggregate but repaired with concrete patches with a different aggregate type.

C. **Aggregates for Optimized Gradation**

1. **Coarse Aggregate Requirements**

a. Coarse aggregate includes all aggregate particles greater than or retained on the $^{3}/_{4}$-inch sieve.

b. The physical requirements for the coarse aggregate are as specified in Table 902-1 and as follows:

i. High-performance concrete mixtures – Class 6AAA; and

ii. All other concrete mixtures requiring optimized gradation – Class 6AA.

c. The maximum loss by washing (LBW) per MTM 108 is 2.0% for materials produced entirely by crushing rock, boulders, cobbles, slag or concrete; otherwise 1.0%.

d. The maximum 24-hour soak absorption is 2.50%.

2. **Intermediate Aggregate Requirements**

a. Intermediate aggregate includes all aggregate particles passing the $^{3}/_{4}$-inch sieve through those retained on the No. 4 sieve.

b. The physical requirements for intermediate aggregate are as specified in Table 902-1 for Class 26A.

c. The maximum LBW per MTM 108 is 3.0%.

3. **Fine Aggregate Requirements**

a. Fine aggregate includes all aggregates particles passing the No. 4 sieve.

b. The fine aggregate must meet the requirements of subsection 902.08.

902.04. Chip Seal Aggregates

For single chip seal, use 34CS aggregate with a maximum moisture content in accordance with Table 902-8 and as described in MDOT's *Procedures for*

Aggregate Inspection, calculated in accordance with section 109 at the time of placement, and in accordance with Table 902-7 and Table 902-8.

For double chip seal, use CS-T aggregate with a maximum moisture content in accordance with Table 902-8 and as described in MDOT's *Procedures for Aggregate Inspection*, calculated in accordance with section 109 at the time of placement, and in accordance with Table 902-7 and Table 902-8.

902.05. Dense-Graded Aggregates for Base Course, Surface Course, Shoulders, Approaches, and Patching

When necessary, combine fine aggregate with natural aggregate, iron blast-furnace slag, reverberatory furnace slag, or crushed concrete to produce Michigan Class 21AA, 21A, 22A, 23A, and 23AA dense-graded aggregates in accordance with Table 902-1, Table 902-2, and this subsection.

The use of crushed concrete is prohibited on the project within 100 feet of any water course (stream, river, county drain, etc.) and lake regardless of the application or location of the water course or lake relative to the project limits.

Dense-graded aggregate produced by crushing Portland cement concrete must not contain more than 5.0% building rubble or HMA by particle count. The Department defines building rubble as building brick, wood, plaster, or other material. Pieces of steel reinforcement capable of passing through the maximum grading sieve size without aid are allowed.

Do not use Class 21AA, 21A, or 22A dense-graded aggregate produced by crushing Portland cement concrete to construct an aggregate base or an aggregate separation layer when the dense-graded layer drains into an underdrain unless at least one of the following conditions apply:

A. A vertical layer of at least 12 inches of granular Class I, II, IIA, or IIAA exists between the dense-graded aggregate layer and an underdrain; or

B. A geotextile liner or blocking membrane that will be a barrier to leachate is placed between the crushed concrete and the underdrain.

Produce Class 23A dense-graded aggregate from steel furnace slag for use only as an unbound aggregate surface course or an unbound aggregate shoulder.

902.06. Open-Graded Aggregates for Earthwork, Open-Graded Drainage Courses, and Underdrains

Use Michigan Class 4G, 34G, 34R, and 46G open-graded aggregates produced from natural aggregate, iron blast-furnace slag, or reverberatory furnace slag in accordance with Table 902-1 and Table 902-2. Class 4G may be produced from crushed concrete.

The use of crushed concrete is prohibited on the project within 100 feet of any water course (stream, river, county drain, etc.) and lake regardless of the application or location of the water course or lake relative to the project limits.

Open-graded aggregate 4G produced by crushing Portland cement concrete must not contain more than 5.0% building rubble or HMA by particle count. The Department defines building rubble as building brick, wood, plaster, or other material. Pieces of steel reinforcement capable of passing through the maximum grading sieve size without aid are allowed.

902.07. Granular Materials for Fill and Subbase

Use granular materials consisting of sand, gravel, crushed stone, iron blast-furnace slag, reverberatory furnace slag, or a blend of aggregates in accordance with Table 902-3 and this subsection.

The Contractor may make the following substitutions:

A. Class I, Class IIAA, or Dense-Graded Aggregate 21A, 21AA, or 22A material for Class II material;

B. Class I, Class II, Class IIA, Class IIAA, Class IIIA, or Dense-Graded Aggregate 21A, 21AA, or 22A material for Class III material;

C. Class I material for Class IIAA material; and

D. Dense-Graded Aggregate 21A, 21AA, or 22A material for Class IIA.

Do not use material with cementitious properties or with permeability characteristics that do not meet design parameters for subbase.

Granular material produced from crushed Portland cement concrete is not permitted.

The Engineer may allow the placement of granular material produced from steel furnace slag below the top 3 feet of the embankment and fill.

902.08. Fine Aggregates for Portland Cement Concrete and Mortar

Test for organic impurities in accordance with AASHTO T21. The aggregate must not produce a color darker than Organic Plate No. 3 (Gardener Color Standard No. 11). The Engineer may approve the use of fine aggregate that fails the test for organic impurities based on one of the following:

A. The discoloration resulted from small quantities of coal, lignite, or similar discrete particles, or

B. The tested concrete develops a relative 7-day strength of at least 95% in accordance with AASHTO T71.

Uniformly grade the aggregate from coarse to fine in accordance with Table 902-4. Fine aggregate 2NS, 2SS, and 2MS must meet fineness modulus requirements in Table 902-4.

Do not use crushed Portland cement concrete fine aggregate in concrete mixtures.

902.09. Aggregate General Requirements for HMA Mixtures

Use aggregate materials meeting the requirements of Table 902-5 and Table 902-6 for the HMA mix number and type required, respectively.

A. **Coarse Aggregates.** For HMA mixtures, use natural aggregate, iron blast-furnace slag, reverberatory furnace slag, steel furnace slag, or crushed concrete as coarse aggregate.

B. **Fine Aggregates.** For HMA mixtures, use natural aggregate, iron blast-furnace slag, reverberatory furnace slag, steel furnace slag, manufactured fine aggregate, or a uniformly graded blend as fine aggregate. Fine aggregates must be clean, hard, durable, uncoated, and free of clay lumps, organic matter, soft or flakey material, and other foreign matter.

902.10. Surface Treatment Aggregates

A. **Paver-Placed Surface Seal.** For paver-placed surface seal, use aggregate 27SS or 30SS consisting of material meeting the requirements in subsection 902.09.B and in accordance with Table 902-7 and Table 902-8.

B. **Micro-Surfacing.** For micro surfacing, use 2FA and 3FA aggregates consisting of crushed material from a quarried stone, natural gravel, slag source, or a blend in accordance with Table 902-7 and Table 902-8.

C. **Slurry Seal.** For slurry seal, use 2FA aggregate consisting of crushed material from a quarried stone, natural gravel, slag source, or a blend in accordance with Table 902-7 and Table 902-8.

902.11. Mineral Filler for HMA Mixtures

For HMA mixtures, use dry, 3MF mineral filler consisting of limestone dust, dolomite dust, fly ash collected by an electrostatic precipitation method, slag, or hydrated lime with 100% passing the No. 30 sieve and 75% to 100% passing the No. 200 sieve. Mineral filler must be from a Department-approved source or must be tested on a per-project basis. The free carbon content of the fly ash sample must not exceed 12% by weight as measured by the loss on ignition test in accordance with ASTM C311/C311M.

Table 902-1:
Grading Requirements for Coarse Aggregates, Dense-Graded Aggregates, and Open-Graded Aggregates

Material Type	Series/ Class	Item of Work by Section Number (Sequential)	Sieve Analysis (MTM 109) Total % Passing[a]										LBW (MTM 108) % Passing
			2½ inch	2 inch	1½ inch	1 inch	¾ inch	½ inch	⅜ inch	No. 4	No. 8	No. 30	No. 200[a]
Coarse aggregates	6AAA[b]	602, 1004	—	—	100	90–100	60 – 85	30–60	—	0–8	—	—	≤1.0[c]
	6AA[b]	406, 602, 706, 708, 806, 1004, 1006	—	—	100	95–100	—	30–60	—	0–8	—	—	≤1.0[c]
	6A	206, 401, 402, 406, 602, 603, 706, 806, 1004, 1006	—	—	100	95–100	—	30–60	—	0–8	—	—	≤1.0[c]
	17A	401, 406, 706, 708, 1004	—	—	—	100	90–100	50–75	—	0–8	—	—	≤1.0[c]
	25A		—	—	—	—	100	95–100	60–90	5–30	0–12	—	≤3.0
	26A	706, 712, 1004, 1006	—	—	—	—	100	95–100	60–90	5–30	0–12	—	≤3.0
	29A	1004	—	—	—	—	—	100	90–100	10–30	0–10	—	≤3.0
Dense-graded aggregates	21AA	302, 304, 305, 306, 307	—	—	100	85–100	—	50–75	—	—	20–45	—	4–8[d][e]
	21A	302, 305, 306, 307	—	—	100	85–100	—	50–75	—	—	20–45	—	4–8[d][e]
	22A	302, 305, 306, 307	—	—	—	100	90–100	—	65–85	—	30–50	—	4–8[d][e,f]
	23A	306, 307	—	—	—	100	—	—	60–85	—	25–60	—	9–16[e]
	23AA	306, 307	—	—	—	100	—	—	60–85	—	25–60	—	9–16[e]

Table 902-1 (cont.):
Grading Requirements for Coarse Aggregates, Dense-Graded Aggregates, and Open-Graded Aggregates

Material Type	Series/ Class	Item of Work by Section Number (Sequential)	Sieve Analysis (MTM 109) Total % Passing[a]										LBW (MTM 108) % Passing
			2½ inch	2 inch	1½ inch	1 inch	¾ inch	½ inch	⅜ inch	No. 4	No. 8	No. 30	No. 200[a]
Open-graded aggregates	4G [g]	303	—	—	100	85–100	—	45–65	—	—	15–30	6–18	≤6.0
	4G [h]	303	—	—	100	85–100	—	45–70	—	—	15–35	8–22	≤8.0
	34R	401, 404, 406	—	—	—	—	—	100	90–100	—	0 – 5	—	≤3.0
	34G	404, 406	—	—	—	—	—	100	95–100	—	0 – 5	—	≤3.0
	46G	206, 208, 401, 402, 406, 916	—	—	100	95-100	—	30-60	—	0-8	—	—	≤3.0

(a) Based on dry weights.

(b) Class 6AAA will be used exclusively for all mainline and ramp concrete pavement when the directional commercial ADT is greater than or equal to 5,000 vehicles per day. Other requirements apply for high-performance concrete.

(c) Loss by washing (LBW) will not exceed 2.0% for material produced entirely by crushing rock, boulders, cobbles, slag, or concrete.

(d) When used for aggregate base courses, surface courses, shoulders, and approaches and the material is produced entirely by crushing rock, boulders, cobbles, slag, or concrete, the maximum limit for LBW must not exceed 10%.

(e) The limits for LBW of dense-graded aggregates are significant to the nearest whole percent.

(f) For aggregates produced from sources in Berrien County, the LBW must not exceed 8% and the sum of LBW, and shale particles must not exceed 10%.

(g) Gradation prior to placement and compaction.

(h) Gradation compacted in-place, sampled from the grade in accordance with MTM 119.

Table 902-2:
Physical Requirements for Coarse Aggregates, Dense-Graded Aggregates, and Open-Graded Aggregates[a]

		Gravel, Stone, and Crushed Concrete						Slag[b]		All Aggregates
Material Type	**Series/ Class**	**Crushed Material, % min. (MTM 117)**	**Loss, % max, LA Abrasion (MTM 102)**	**Soft Particles, % max. (MTM 110)**	**Chert, % max. (MTM 110)**	**Sum of Soft Particles and Chert, % max. (MTM 110)**	**Freeze-Thaw Dilation, % per 100 cycle max. (MTM 115)[c]**	**Sum of Coke and Coal Particles, % max. (MTM 110)**	**Freeze-Thaw Dilation, % per 100 cycles max. (MTM 115)[c]**	**Flat and Elongated Particles, ratio % max. (ASTM D4791) (MTM 130)**
Coarse aggregates[d]	6AAA	—	40	2.0[e]	2.5	4.0	0.040[f]	1.0	0.040[f]	3:1–15.0[g]
	6AA[h]	—	40	2.0[e]	—	4.0	0.067[i]	1.0	0.067	—
	6A[h]	—	40	3.0[e]	7.0	9.0	0.067	1.0	0.067	—
	17A[h]	—	40	3.5[e]	8.0	10.0	0.067[i]	1.0	0.067	—
	25A	95	45	8.0[j]	—	8.0	—	1.0	—	3:1–20.0[k]
	26A[h]	—	40	2.0[e]	—	4.0	0.067	1.0	0.067	—
	29A	95	45	8.0[j]	—	8.0	—	1.0	—	3:1–20.0[k]
Dense-graded aggregates[l]	21AA	95	50	—				—		—
	21A	25	50	—				—		—
	22A	25	50	—				—		—
	23A	25	50	—				—		—
	23AA	95	50	—				—		—

Table 902-2 (cont.):
Physical Requirements for Coarse Aggregates, Dense-Graded Aggregates, and Open-Graded Aggregates[a]

		Gravel, Stone, and Crushed Concrete						Slag[b]		All Aggregates
Material Type	**Series/ Class**	**Crushed Material, % min. (MTM 117)**	**Loss, % max, LA Abrasion (MTM 102)**	**Soft Particles, % max. (MTM 110)**	**Chert, % max. (MTM 110)**	**Sum of Soft Particles and Chert, % max. (MTM 110)**	**Freeze-Thaw Dilation, % per 100 cycle max. (MTM 115)[c]**	**Sum of Coke and Coal Particles, % max. (MTM 110)**	**Freeze-Thaw Dilation, % per 100 cycles max. (MTM 115)[c]**	**Flat and Elongated Particles, ratio % max. (ASTM D4791) (MTM 130)**
Open-graded aggregates	4G	95	45[m]	—				—		—
	34R	≤20	45[m]	—				—		—
	34G	100	45[m]	—				—		—
	46G	95	45[m]	—				—		—

Table 902-2 (cont.):
Physical Requirements for Coarse Aggregates, Dense-Graded Aggregates, and Open-Graded Aggregates[a]

(a) See subsections 902.03.B, 902.05, and 902.06 for additional physical requirements for coarse aggregate, dense-graded aggregates, and open-graded aggregates, respectively.

(b) Iron blast furnace and reverberatory furnace slag must contain no free (unhydrated) lime.

(c) If the relative density (OD) is >0.04 less than the relative density (OD) of the most recently tested freeze-thaw sample, the aggregate will be considered to have changed characteristics and be required to have a new freeze-thaw test per MTM 113 conducted prior to use on Department projects.

(d) Grade 3500 concrete requires an optimized aggregate gradation as specified in section 604. Use aggregates only from geologically natural sources.

(e) Clay-ironstone particles must not exceed 1.0% for 6AAA, 6AA, and 26A, and 2.0% for 6A and 17A. Clay-ironstone particles are also included in the percentage of soft particles for these aggregates.

(f) Maximum freeze-thaw dilation is 0.067 when the directional commercial ADT is less than 5,000 vehicles per day. Maximum dilation is 0.040 for all high-performance concrete.

(g) ASTM D4791 Section 8.4 will be followed. The test will be performed on the material retained down to and including the 3/8-inch sieve.

(h) Except for pre-stressed beams, the sum of soft and chert particles may be up to 3.0% higher than the values determined from the sample tested for freeze-thaw durability. However, under no circumstances will the deleterious particle percentages exceed the specification limits in Table 902-2. In addition, a source may be restricted to a minimum percent crushed not to exceed 15% less than the percent crushed in the freeze-thaw sample. When the freeze-thaw dilation is between 0.040 and 0.067% per 100 cycles, more restrictive limits will be applied.

(i) Maximum dilation of 0.010 for pre-stressed concrete beams.

(j) Friable sandstone is included in the soft particle determination for chip seal aggregates.

(k) ASTM D4791 Section 8.4 will be followed. The test will be performed on the material retained down to and including the No. 4 sieve.

(l) Quarried carbonate (limestone or dolomite) aggregate may not contain over 10% insoluble residue finer than No. 200 sieve when tested in accordance with MTM 103.

(m) If a blend of different aggregate sources, the abrasion value applies to each source.

Table 902-3:
Grading Requirements for Granular Materials

Material	Sieve Analysis (MTM 109), Total % Passing[a]									LBW % Passing No. 200[a][b]
	6 inch	3 inch	2 inch	1 inch	½ inch	⅜ inch	No. 4	No. 30	No. 100	
Class I	—	—	100	—	45–85	—	20–85	5–30	—	0–5
Class II[c]	—	100	—	60–100	—	—	50–100	—	0–30	0–7
Class IIA[c]	—	100	—	60–100	—	—	50–100	—	0–35	0–10
Class IIAA	—	100	—	60–100	—	—	50–100	—	0–20	0–5
Class III	100	95–100	—	—	—	—	50–100	—	—	0–15
Class IIIA	—	—	—	—	—	100	50–100	—	0–30	0–15

(a) Test results based on dry weights.

(b) Use test method MTM 108 for LBW.

(c) Except for use in granular blankets, Class IIA granular material may be substituted for Class II granular material for projects in the following counties: Arenac, Bay, Genesee, Gladwin, Huron, Lapeer, Macomb, Midland, Monroe, Oakland, Saginaw, Sanilac, Shiawassee, St. Clair, Tuscola, and Wayne.

Table 902-4:
Grading Requirements for Fine Aggregates

Material	Sieve Analysis (MTM 109), Total % Passing[a]							LBW % Passing No. 200[a][b]	Fineness Modulus Variation[c]
	⅜ inch	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100		
2NS	100	95–100	65–95	35–75	20–55	10–30	0–10	0–3.0	±0.20[d]
2SS[e]	100	95–100	65–95	35–75	20–55	10–30	0–10	0–4.0	±0.20[d]
2MS	—	100	95–100	—	—	15–40	0–10	0–3.0	±0.20[d]

(a) Test results based on dry weights.

(b) Use test method MTM 108 for LBW.

(c) Aggregate having a fineness modulus differing from the base fineness modulus of the source by the amount exceeding the maximum variation specified in the table will be rejected. Use ASTM C136.

(d) The base fineness modulus will be supplied by the aggregate producer at the start of each construction season and be from 2.50 to 3.35. The base fineness modulus, including the permissible variation, will be from 2.50 to 3.35.

(e) Quarried carbonate (limestone or dolomite) cannot be used for any application subject to vehicular traffic.

Table 902-5:
Superpave Final Aggregate Blend Gradation Requirements

	Mix Number				
Standard Sieve	**5**	**4**	**3 Leveling Course**	**3 Base Course**	**2**
	% Passing Criteria (Control Points)				
1½ inch	—	—	—	—	100
1 inch	—	—	100	100	90–100
$^{3}/_{4}$ inch	—	100	90–100	90–100	≤90
$^{1}/_{2}$ inch	100	90–100	≤90	≤90	—
$^{3}/_{8}$ inch	90–100	≤90	—	—	—
No. 4	≤90	—	—	—	—
No. 8	47–67	39–58	35–52	23–52	19–45
No. 16	—	—	—	—	—
No. 30	—	—	—	—	—
No. 50	—	—	—	—	—
No. 100	—	—	—	—	—
No. 200	2.0–10.0	2.0–10.0	2.0–8.0	2.0–8.0	1.0–7.0

Table 902-6:
Superpave Final Aggregate Blend Physical Requirements

Est. Traffic (million ESAL)	Mix Type	Minimum Criteria						Maximum Criteria					
		% Crushed[a]		Fine Aggregate Angularity		% Sand Equivalent		LA Abrasion % Loss[b]		% Soft Particles[c]		% Flat and Elongated Particles[d]	
		Course(s)						Course(s)					
		Top and Leveling	Base	Top and Leveling	Base	Top and Leveling	Base	Top and Leveling	Base	Top and Leveling	Base	Top and Leveling	Base
<0.3	EL	55 / —	—	—	—	40	40	45	45	10	10	—	—
≥0.3 – <3	EML	75 / —	50 / —	43	40	40	40	35	40	5	5	10	10
≥3 – <30	EMH	90 / 85	80 / 75	45	40	45	45	35	35	3	4.5	10	10
≥30 – <100	EH	100 / 100	95 / 90	45	45	50	50	35	35	3	4.5	10	10

ESAL = equivalent single-axle load

(a) XX / YY denotes that XX% of the coarse aggregate has one fractured face and YY% has at least two fractured faces.

(b) If a blend of different aggregate sources, the abrasion value applies to each source.

(c) Soft particles maximum is the sum of the shale, siltstone, ochre, coal, clay-ironstone, and particles that are structurally weak or non-durable in service.

(d) Maximum by mass with a 1:5 aspect ratio.

Table 902-7:
Capital Preventive Maintenance Final Aggregate Blend Gradation Requirements

	Mechanical Analysis, Total % Passing										
Material	**¾ inch**	**½ inch**	**⅜ inch**	**¼ inch**	**No. 4**	**No. 8**	**No. 16**	**No. 30**	**No. 50**	**No. 100**	**No. 200[a]**
27SS	100	85–100	55–80	—	22–38	19–32	15–24	11–18	8–14	5–10	4–7[b]
30SS	—	100	85–100	—	22–38	19–32	15–24	11–18	8–14	5–10	4–7[b]
34CS[c]	100	100	90–100	—	0–15	0–5	—	—	—	—	≤2
CS-T[c]	100	100	100	85–100	—	0–15	—	—	—	—	≤2
2FA	—	—	100	—	90–100	65–90	45–70	30–50	18–30	10–21	5–15[b]
3FA	—	—	100	—	70–90	45–70	28–50	19–34	12–25	7–18	5–15[b]

(a) Includes mineral filler.
(b) No. 200 limits are significant to the nearest whole percent.
(c) All aggregate must be washed.

Table 902-8:
Capital Preventive Maintenance Aggregate Blend Physical Requirements

Material		% Crushed (Min.) MTM 117[k]	Angularity Index (Min.) MTM 118	Uncompacted Void (Min.) AASHTO T304	LA Abrasion (% Loss Max.) MTM 102[f]	Aggregate Wear Index (AWI) (Min.) MTM 111, 112[h]	Soft Particles (% Max.) MTM 110	Sand Equivalent (% Min.) AASHTO T176	Flat, Elongated, or Flat and Elongated (% Max.) ASTM D4791	Absorp. (% Max.) AASHTO T85	Micro-Deval (% Loss Max.) AASHTO T327
27SS[e]		100 / 90	—	40	35	260	5.0[a]	45	25.0[b]	3.0	18
30SS[e]		100 / 90	—	40	35	260	5.0[a]	45	25.0[b]	3.0	18
34CS[j]	ADT ≥ 4,000	100 / 90	—	—	35[g]	260[i]	3.5[a]	—	15.0[b]	—	—
	ADT < 4,000	95 / 85	—	—	35[g]	220	3.5[a]	—	15.0[b]	—	—
CS-T[j]	ADT ≥ 4,000	100 / 90	—	—	35[g]	260[i]	3.5[a]	—	—	—	—
	ADT < 4,000	95 / 85	—	—	35[g]	220	3.5[a]	—	—	—	—
2FA		—	4.0[c]	—	45	260	—	60[d]	—	—	—
3FA		—	4.0	—	45	260	—	60	—	—	—

(a) Sum of shale, siltstone, clay-ironstone, and structurally weak.

(b) For material retained on the No. 4 sieve and above, ensure that the ratio between length to width, width to thickness, and length to thickness is no greater than 3:1.

(c) Angularity Index must exceed 2.0 for at least 50% of the blending sands for slurry seal applications.

(d) Does not apply to slurry seals.

(e) Must be 100% virgin aggregate.

(f) If a blend of different aggregate sources, the abrasion value applies to each source.

(g) Natural aggregate. LA abrasion maximum loss of 45% for iron blast-furnace slag aggregate.

(h) Does not apply to a shoulder chip seal or interlayer application.

(i) Single-chip seals. For double-chip seals, a 260 min. AWI of a 60/40 weighted average in which the top course will be weighted at 60% and base course will be weighted at 40% with the higher AWI aggregate as the top course.

(j) Moisture content at time of placement ≤4%.

(k) XX / YY denotes that XX% of the coarse aggregate has one fractured face and YY% has at least two fractured faces.

Section 903. Admixtures and Curing Materials for Concrete

903.01. Air-Entraining Admixtures

Select liquid air-entraining admixtures for Portland cement concrete from the Qualified Products List.

903.02. Liquid Chemical Admixtures

Select liquid chemical admixtures for use in Portland cement concrete from the Qualified Products List. Liquid chemical admixtures must not contain a chloride ion content greater than 0.5% by weight.

The Department uses the following ASTM C494/C494M terms for chemical admixtures:

Table 903-1:
ASTM C494/C494M Terms for Chemical Admixtures

Type	Term
A	Water-reducing admixtures
C	Accelerating admixtures
D	Water-reducing and -retarding admixtures
E	Water-reducing and -accelerating admixtures
F	Water-reducing, high-range admixtures
G	Water-reducing, high-range, and -retarding admixtures

The Department refers to water-reducing and mid-range admixtures not included in ASTM C494/C494M as Type MR.

903.03. Latex Admixtures

Formulated latex admixture for modifying mortar or concrete mixtures must be a non-toxic, film forming, polymeric emulsion to which all stabilizers are added at the point of manufacture. Latex admixtures must be homogeneous and uniform in composition.

A. **Physical Properties.** White latex styrene butadiene modifier must have between 46.0 and 49.0% solids; pH, as shipped, between 8.5 and 11.0; and a shelf life of at least 2 years.

B. **Storage.** Protect latex admixtures from freezing. Do not expose latex admixtures to temperatures greater than 85°F for more than 10 days.

903.04. Calcium Chloride Concrete Accelerators

Do not use calcium chloride in prestressed concrete, superstructure concrete, concrete for bridge railings, or concrete containing galvanized steel or aluminum.

Flake or pellet calcium chloride for on-the-job preparation of admixture solutions must meet the requirements of ASTM D98 for 77% grade or 94% grade. Determine the percentage of calcium and magnesium chlorides in accordance with ASTM D345. Provide flake or pellet Type S (solid) material.

Calcium chloride admixture, delivered to the job in solution, must conform to the following chemical composition:

A. From 32.0 to 35.0% calcium chloride ($CaCl_2$) anhydrous;

B. No greater than 1.0% total magnesium as $MgCl_2$;

C. No greater than 2.0% total alkali chlorides calculated as NaCl; and

D. No greater than 0.5% other impurities.

903.05. Polypropylene Fibers

Use 100% virgin polypropylene fibers, ¾ inch long, that meet the requirements of ASTM C1116/C1116M, Type III.

903.06. Concrete Curing Materials for Pavements

A. **White Membrane Curing Compound.** White membrane curing compound must meet the requirements of ASTM C309, Type 2, and be packaged in clean containers.

   Before use and before transferring the compound between containers, agitate the compound to a uniform consistency and ensure that pigment is uniformly suspended.

B. **Transparent Membrane Curing Compound for Base Course.** Transparent membrane curing compound must meet the requirements of ASTM C309, Type 1-D, Class B with fugitive dye.

903.07. Concrete Curing Materials for Structures

A. **White Membrane Curing Compound for Bridge Decks.** Provide white-pigmented, modified, linseed-oil-based material that is either water soluble or an emulsion type that meets the requirements of ASTM C309, Type 2, except that the reflectance requirement and drying time do not apply. Compound must be packaged in clean containers.

Before transferring the compound between containers and applying, agitate the compound to a uniform consistency and ensure uniform suspension of the pigment.

B. **Transparent Membrane Curing Compound.** Transparent membrane curing compound must meet the requirements of ASTM C309, Type 1-D, Class B, with fugitive dye.

C. **Insulating Blankets.** Insulating blankets must have vapor-retarding liners that completely enclose the insulating mat, are bonded to both sides of the insulating mat, and have one reflective face. Blankets must have thicknesses or R-values meeting the requirements of Table 706-1.

Insulating blanket must have a thermal conductivity (k) no greater than 0.27 BTU per hour per square foot temperature gradient of 1°F per inch of thickness at a mean temperature of 75°F when tested in accordance with ASTM C177.

D. **Polystyrene Insulation.** Expanded polystyrene must be cut from preformed material with an average cell diameter no greater than 0.04 inch and as specified in Table 903-2:

Table 903-2:
Polystryene Insulation Specifications

Property	Specification	Test Method
Density	≥0.90 lb/ft³	ASTM C303
Compressive strength	≥9.0 psi	ASTM D1621
Flexural strength	≥25.0 psi	ASTM C203
Water absorption	≤2.0% by volume	ASTM C272/C272M
Thermal conductivity	≤0.27 BTU/hr/ft²[(a)]	ASTM C177

(a) For a temperature gradient of 1°F per inch of thickness at a mean temperature of 75°F

Section 905. Steel Reinforcement

905.01. General Requirements

Steel reinforcement for use in concrete structures and pavements must meet the requirements of this section.

905.02. Testing

Test steel reinforcement in accordance with ASTM A370, ASTM E8/E8M, or other specified ASTM, AASHTO, or Department methods, as modified by this section.

If requested, provide the Engineer with two copies of the chemical analysis of reinforcing bars in accordance with the relevant ASTM specifications.

905.03. Bar Reinforcement for Structures

Deformed steel bars used for non-prestressed concrete reinforcement must meet the requirements of ASTM A615/A615M, ASTM A706/A706M, or ASTM A996/A996M (Type A or Type R) for Grade 60 steel bars, unless otherwise required.

Deformed steel bars used for prestressed concrete reinforcement must meet the requirements of ASTM A615/A615M, ASTM A706/A706M, or ASTM A996/A996M (Type A) for Grade 60 steel bars, unless otherwise required.

A. **Bending**. Shop cold bend bar reinforcement to the shapes shown on the plans. Complete all field bending cold. Do not heat bars during bending.

The diameter of a bar bend, measured on the inside of the bar, must meet the requirements of Table 905-1.

Table 905-1:
Minimum Bend Diameters

ASTM Bar Designation No.	Minimum Inside Diameter of Bend (bar diameters)
No. 3 – No. 8	6
No. 9 – No. 11	8
No. 14, No. 18	10
Stirrups and ties, No. 3 – No. 5	4

Cut and bend bars in accordance with the *CRSI Manual of Standard Practice* and the *ACI Detailing Manual*.

B. **Bundling and Tagging.** Ship bar reinforcement in standard bundles, tagged and marked in accordance with the *CRSI Manual of Standard Practice*.

C. **Epoxy Coating.** Epoxy-coated steel reinforcement bars must be coated in accordance with ASTM A775/A7775M. Epoxy-coated steel-welded wire reinforcement must be coated in accordance with ASTM A884/A884M, Class A, Type 1. The following exceptions and additions apply:

1. Select coating material from the Qualified Products List.
2. The Department may test samples to verify thickness of coating, adhesion of coating, and holidays. Coat more steel reinforcement than shown on the plans to allow splicing to replace steel reinforcement removed for test samples.
3. Include written certification from the coating applicator that the steel reinforcement was cleaned, coated, and tested in accordance with ASTM A775/A775M (for reinforcing bars) or ASTM A884/A884M (for reinforcing wire).
4. Repair damage to the coating in accordance with subsection 706.03.E.8.

D. **Bar Chairs and Wire Ties for Epoxy-Coated Steel Reinforcement.** Bar chairs and wire ties required for placing and fastening steel reinforcement must conform to the following:

1. Bar chairs must be plastic-coated wire, epoxy-coated wire, or plastic.
2. Wire ties must be plastic-coated wire, epoxy-coated wire, or molded plastic clips.
3. Tie-down wires must be plastic coated.

905.04. Bar Reinforcement for Pavements

Bar reinforcement for pavement tie bars and bars for use as dowels for load transfer in pavement expansion joints and contraction joints must meet the requirements of section 914.

905.05. Dowels and Bar Reinforcement for Curb, Glare Screen, Concrete Barriers, and Filler Walls

Deformed steel bars must meet the requirements of ASTM A615/A615M, ASTM A706/A706M, or ASTM A996/A996M (Type A or Type R) for Grades 40, 50, or 60 as applicable.

905.06. Steel-Welded Wire Reinforcement

Deformed steel-welded wire reinforcement must meet the requirements of ASTM A1064/A1064M and be fabricated as required.

905.07. Strand for Prestressed Concrete

Strands for prestressed concrete must have a 0.500-inch nominal diameter and a 0.153-square-inch cross sectional area or a 0.6000-inch nominal diameter and a 0.217-square-inch cross sectional area and must meet the requirements of ASTM A416/A416M for Grade 270, low relaxation strand, as required.

Identify each reel or pack number and provide a Test Data Certification, including a load elongation curve to at least 1% elongation.

Protect prestress strands from physical damage, rust, and contaminants.

905.08. Tendons for Lateral Post Tensioning of Box Beams

Tendons for lateral post tensioning of box beams must meet the requirements of ASTM A416/A416M for Grade 270 steel strand or ASTM A722/A722M for high-strength steel bars.

If selecting bars, consider the tolerances allowed in manufacturing and placing precast concrete box beams and determine the required bar lengths accordingly.

Section 908. Miscellaneous Metal Products

908.01. General Requirements

Miscellaneous metal products must meet the requirements of this section and the contract.

908.02. Testing

Miscellaneous metals product testing will be in accordance with the specified ASTM, AASHTO, or Department methods, as modified by this section.

908.03. Malleable Iron Castings

Malleable iron castings must meet the requirements of ASTM A47/A47M for Grade 22010.

908.04. Steel Castings

Steel castings for steel construction must meet the requirements of ASTM A148/A148M for Grade 90-60 carbon steel castings, as shown on the plans, unless otherwise approved by the Engineer. Steel castings must be heat treated by full annealing, unless otherwise required.

Blow holes on finished castings must be located so that a straight line laid in any direction will not cut a total length of cavity greater than 1 inch in any 12 inches. Single blow holes must not exceed 0.500 square inch or have a depth that will affect the strength of the casting.

908.05. Iron Castings

Gray iron castings must meet the requirements of AASHTO M306, Class 35B, for manholes, catch basins, leaching basins, inlets, iron steps, and bridge deck drains. Ductile iron castings meeting the requirements of AASHTO M306, Grade 70-50-05 or Grade 80-55-06, are an acceptable alternative to gray iron when shown on the plans. Castings must be certified to proof load testing of 50,000 pounds. Coat exposed casting surfaces with asphaltic paint. The coating must be smooth, tough, and tenacious when cold and must not scale-off, tack, or become brittle.

908.06. Bronze or Copper-Alloys for Structures

Washers, bearing, and expansion plates for bridges must meet the requirements of ASTM B22/B22M for Copper Alloy UNS No. C91100 bronze castings or the requirements of ASTM B100 for Copper Alloy UNS No. C51000 copper alloy plates and sheets. Provide bronze castings that are free of deleterious material, casting faults, injurious blow holes, and other defects.

Finished parts must be within 5% of the required thickness and within 0.125 inch of the required width and length shown on the plans. Mating curved surfaces must have a curvature radius no greater than +0.010 inch on concave surfaces and no less than −0.010 inch on convex surfaces shown on the plans. Flat machined surfaces must meet the required dimensions within 0.0005 inch per 1.0 inch.

The surface roughness of bronze or steel must not be greater than 125 micro inches per inch root mean square.

908.07. Sheet Lead

Sheet lead must meet the requirements of ASTM B29 for desilverized pig lead.

908.08. Sheet Copper

Sheet copper must meet the requirements of ASTM B370.

908.09. Tubing, Steel Railings

A. **Base Plates, Angles, and Post Elements.** Base plate, angle, rail splice, and non-tubular post elements must meet the material requirements of ASTM A36/A36M and galvanizing requirements of ASTM A123/A123M. Tubular post elements must meet the material requirements of ASTM A500/A500M, Grade B, and galvanizing requirements of ASTM A123/A123M. Silicon content must be less than 0.06% or from 0.15 to 0.25%. Base plate and post elements must meet the Charpy V-notch impact requirements specified in subsection 906.04.A at a test temperature of 10°F.

B. **Rail Elements.** Rail elements must meet the material requirements of ASTM A500/A500M, Grade B, and galvanizing requirements of ASTM A123/A123M. Silicon content must be less than 0.06% or from 0.15 to 0.25%.

Provide the Engineer with one copy of the Mill Test Report (MTR) verifying chemical and physical requirements for structural steel rail elements. Provide an affidavit stating that the material meets specifications. If the MTR is unavailable, arrange for tests of chemical and physical properties and provide certified copies of the test reports and affidavits to the Engineer at no additional cost to the Department. The Contractor has the option of re-testing a rail sample if it failed elongation and passed all other chemical and physical requirements.

The Contractor must drop-weight tear test rail elements from all heats supplied in accordance with ASTM E436 except as modified herein. Drop-weight tear testing is not required on hollow structural section (HSS)

2 by 2 rail elements. Do not heat treat failed heats and do not provide failed heats to the fabricator. The Contractor must conduct the drop-weight tear test on each heat at 0°F on 2- by 9-inch specimens, supported to achieve a 7-inch span.

The Contractor must test three specimens from each of three sides that do not contain a weld to determine the percent shear area. The Contractor must disregard the shear areas of the three specimens from the side with the lowest average shear area and base the final average on the remaining six specimens. Material with an average percent shear area below 50% is not allowed; however, if the average percent shear area is between 30 and 50%, the Department will allow the Contractor to retest the material. The retest sampling frequency is three times that of the first test, and all sample test results must be included in calculating the average. Retested material must have a minimum average percent shear area of 50%.

The manufacturer of the tubular railing must identify the product as follows:

1. Place identification before galvanizing;
2. Include heat number or other code traceable to the heat number;
3. Include manufacturer's unique identification code;
4. Place identification on only one section face;
5. Repeat identification at no more than 4-foot intervals;
6. Do not extend identification into the curved surfaces at corners of section; and
7. Do not place identification on side facing traffic or side opposite traffic.

C. **Hardware.** Railing anchor studs must meet the requirements of ASTM A449, Type 1. Structural bolts must meet the requirements of ASTM F3125/F3125M, Grade A325, Type 1. Round head structural bolts must meet the requirements of ASTM A449, Type 1. The material for the railing hand hole screws must meet the requirements of ASTM A276/A276M, Type 304. Nuts must meet the requirements of ASTM A563, Grade DH, or AASHTO M292, Grade 2H. Flat, circular washers must meet the requirements of ASTM F436/F436M. Lock washers must be steel, regular, helical spring washers meeting the requirements of ASME B18.21.1.

Bolts, anchor studs, nuts, and washers must be hot-dip galvanized in accordance with AASHTO M232. Galvanized nuts must be tapped oversize in accordance with ASTM A563 and meet supplementary requirements S1 and S2.

908.10. Hardware for Timber Construction

Machine bolts, drift bolts, and dowels for timber construction must be made of structural grade steel.

Washers must be cast iron ogee or malleable castings. Nails must be cut or round wire of standard form. Spikes must be cut or wire spikes or boat spikes. Galvanize in accordance with AASHTO M232 when required.

908.11. Steel Beam Guardrail Elements, Hardware, and Steel Sleeves

A. **Steel Beam Elements and End Sections.** Unless otherwise specified on the plans and details, provide steel beam elements and terminal end shoes meeting the requirements of AASHTO M180 for Class A guardrail. Thrie beam elements for bridge rail retrofit, special end shoes, and thrie beam terminal connectors must meet the requirements of AASHTO M180 for Class B guardrail.

Provide steel beam elements and end sections in the required shape. Steel beam elements and end sections must be hot-dip zinc coated after fabrication in accordance with AASHTO M180 for Type II zinc coatings. W-beam elements may be hot-dip zinc coated before or after fabrication.

B. **Hardware.** Bolts, nuts, washers, and other guardrail hardware must be hot-dip galvanized in accordance with AASHTO M232.

Bolts must meet the requirements of ASTM A307, Grade A. Nuts must meet the requirements of ASTM A563, Grade A with supplementary requirement S1. Flat circular washers must meet the requirements of ASTM F436/F436M.

Beveled square or rectangular washers must meet the requirements of ASTM F436/F436M and the dimensions shown on the plans.

Bolts and nuts for making splices and connections of beam elements, other than at bridge barrier railings, must meet the requirements of AASHTO M180. Provide bolts meeting one of the bolt head configurations of AASHTO M180 (Alternate No. 1 or 2) except within the limits of guardrail approach terminals. Hardware for guardrail approach terminals must conform to manufacturer’s specifications.

Structural bolts for connections at bridge railings must conform to ASTM F3125/F3125M, Grade A325, Type 1. Nuts must meet the requirements of ASTM A563, Grade DH, or ASTM A194/A194M, Grade 2H. Flat circular washers must meet the requirements of ASTM F436/F436M.

Wire rope and fittings for the cable anchorage must conform to AASHTO M30. Wire rope must be Type II with a Class B coating.

C. **Steel Sleeves, Soil Plates, and Bearing Plates.** Provide steel sleeves with the inside dimensions shown on the plans within a tolerance, after galvanizing, of +⅛ inch. Provide steel plates in the sizes shown on the plans but no more than 0.250 inch larger.

Steel for the sleeves and plates for wood guardrail posts must meet the requirements of ASTM A36/A36M or ASTM A1011/A1011M for Grade 36 or Grade 40.

Steel sleeves must have one or two complete penetration longitudinal welds that run along the length of the sleeve.

Hot-dip galvanize sleeves and plates in accordance with AASHTO M111. The weight of the zinc coating on the sleeves must average at least 2.0 ounces per square foot and each sleeve must have at least 1.7 ounces of zinc coating per square foot. The weight of the zinc coating on plates must average at least 2.3 ounces per square foot, and each plate must have at least 2.0 ounces of zinc coating per square foot.

908.12. Steel Posts for Guardrail

Steel posts for guardrail must be W6 by 9 or W6 by 8.5 section steel posts of the length shown on the plans for guardrail. Each steel post must weigh at least 9.0 pounds per foot. Posts must be fabricated from ASTM A36/A36M structural steel.

Hot-dip galvanize posts in accordance with AASHTO M111 to produce an average coating weight of at least 2.0 ounces per square foot of surface area.

908.13. Guardrail Reflectors

Fabricate guardrail reflectors from at least 13-gauge steel sheets, galvanized in accordance with ASTM A653/A653M, coating designation G210, and as required. Use Type XI reflective sheeting meeting the requirements of subsection 919.03.B.

Prepare galvanized surfaces in accordance with the sheeting manufacturer's recommendations before applying the sheeting. Bond reflective material to the galvanized steel.

908.14. Anchor Bolts, Nuts, and Washers

A. **General.** The fabricator or supplier must provide a Mill Test Report (MTR) that shows compliance with ASTM F1554 for the grade specified in the contract in addition to the following:

1. Heat number;
2. Yield strength;

3. Tensile strength;
4. Elongation;
5. Reduction of area; and
6. Charpy V-notch.

Provide the furnace lot number for all heat-treated anchor bolts. Order additional bolts to replace those used for Department testing. Each anchor bolt must be provided with two washers and two nuts unless otherwise required in the contract.

Provide bolts, nuts, and washers in the size and shape shown on the plans and hot-dip galvanized in accordance with AASHTO M232. Galvanize the exposed threaded end of anchor bolts a minimum of 20 inches.

Nuts must meet the requirements of ASTM A563, Grade DH, or ASTM A194/A194M, Grade 2H. Lubricate nuts in accordance with ASTM A563, supplementary requirement S1 and S2. Re-tap nuts after galvanizing in accordance with ASTM A563. Provide flat, circular washers meeting the requirements of ASTM F436/F436M.

B. **Anchor Bolts and Nuts for Cantilever and Truss Sign Supports, Light Standards, Dynamic Message Sign, CCTV Poles, Tower Lighting Units, and Traffic Signals Mast Signal Arm Poles.** Steel anchor bolts must meet the requirements of subsection 908.14.A except that anchor bolt material must meet ASTM F1554, Grade 55, supplemental requirements S1, S3, and S4.

Table 908-1:
Anchor Bolt Specifications

Characteristic	Specification
Yield strength	55 ksi
Ultimate strength	75–95 ksi
Elongation (2-inch gauge)	≥21%[(a)]
Reduction in area	≥30%[(b)]
Longitudinal Charpy V-notch	≥15 ft-lb at 40°F

(a) Elongation (8-inch gauge), minimum 18% for bolts tested full section

(b) Bolts >2 to 2.5 inches, 22% minimum; >2.5 to 3 inches, 20% minimum

The Department will perform Charpy V-notch toughness tests on specimens in accordance with frequency (P) testing of AASHTO T243 orienting the notch perpendicular to the longitudinal axis of the anchor

bolt. If necessary, heat treat steel to meet Charpy V-notch toughness requirements.

Bolt threads must meet the requirements of ASME B1.1, 8UN series, Class 2A tolerances, before coating. After coating, the maximum limit of pitch and major diameter for bolts with a diameter no greater than 1 inch may exceed the Class 2A limit by no more than 0.021 inch and by no greater than 0.031 inch for bolts greater than 1 inch in diameter.

Nut threads must meet the requirements of ASME B1.1, 8UN series, Class 2B tolerances. Tap nuts for anchor bolts less than 1 inch in diameter no greater than 0.021 inch and nuts for anchor bolts equal to or greater than 1 inch in diameter no greater than 0.031 inch.

C. **Anchor Bolts for Traffic Signal Strain Poles.** Provide anchor bolts that meet subsection 908.14.A with the following exceptions and additions:

1. ASTM F1554, Grade 105, supplementary requirement S3;
2. Coarse pitch threads are acceptable if the anchor bolts meet required tolerances;
3. Bolts must be threaded at least 9 inches at the upper end; and
4. Each anchor bolt must be provided with one steel lock washer meeting the requirements of ASME B18.21.1.

D. **Anchor Bolts for Other Purposes.** Steel anchor bolts must meet subsection 908.14.A except that anchor bolt material must meet ASTM F1554, Grade 36, supplementary requirements.

Section 909. Drainage Products

909.01. General Requirements

Use the pipe materials shown in Table 401-1 and Table 402-1 for culverts or sewers if only the size and class are specified by the contract. Construct drainage structures and underdrains as required.

Provide galvanized corrugated steel or aluminum structural plates as required. Galvanized corrugated steel structural plates must meet the requirements of AASHTO M167M/M167. Corrugated aluminum structural plates must meet the requirements of ASTM B790/B790M or Section 12 of the *AASHTO LRFD [Load and Resistance Factor Design] Bridge Specifications*.

Provide sanitary sewer or industrial waste systems in accordance with the contract. Install sanitary sewer or industrial waste systems using a compression gasket as specified in subsection 909.03.

909.02. Testing

Test drainage products in accordance with AASHTO or ASTM specifications unless otherwise specified in this section.

Verify that each concrete pipe manufacturer provides a calibrated standard testing machine to determine the strength of the product. The manufacturer must provide labor and materials to perform strength tests.

909.03. Watertight Joints for Sewers and Culverts

Provide watertight joint systems selected from the Qualified Products List. Ensure that watertight joint systems meet the pressure test requirements of MTM 723 and the specifications for the materials used in assembling the pipe system.

Use flexible rubber compression gaskets meeting the requirements of ASTM C443 for concrete pipe, ASTM F477 for plastic pipe, AASHTO M36 for corrugated metal pipe, and AASHTO M196 for corrugated aluminum pipe. As an alternative to the AASHTO M36 requirements for metal pipe, the Contractor may use gasket material meeting the low temperature flexibility and elevated temperature flow test requirements of ASTM C990, excluding the requirements for softening point, flash point, and fire point.

External rubber gaskets, mastic, and protective film must meet the requirements of ASTM C877 or C990.

909.04. Concrete Pipe Products

A. **Reinforced Concrete Circular Pipe.** Provide reinforced concrete circular pipe meeting the requirements of AASHTO M170 or AASHTO M242. If using AASHTO M242 pipe, the design loads must meet the requirements of AASHTO M170.

If using AASHTO M170 pipe, apply the following exceptions and additions:

1. The Contractor may use the circular pipe designs specified in Table 909-1, Table 909-2, Table 909-3, and Table 909-4 in addition to the circular pipe designs in Table 2, Table 3, Table 4, and Table 5 of AASHTO M170.
2. Cast or drill lift holes and seal with concrete plugs after installing the pipe. Cast lift holes in circular pipe with elliptical reinforcing along the top centerline of the pipe.
3. Use circular reinforcement in circular pipe for use in pipe culverts and sewers jacked in place. The concrete absorption test requirements will be waived if the load required to produce the 0.01-inch crack exceeds the minimum load by at least 20%.

If using stirrup supports, use indentations or waterproof paint to mark the top and bottom centerline of the pipe, inside and out, on each end of the pipe. Symmetrically place stirrup supports around the centerline in the top and bottom portion of the pipe. Pass stirrups around and in contact with each inside circumferential reinforcing member. Space the stirrups in accordance with Table 909-2, Table 909-3, and Table 909-4. Do not use more than three sections of stirrup material in one support line. Ensure a section length of at least 30 inches for each stirrup.

B. **Reinforced Concrete Elliptical Pipe.** Provide reinforced concrete elliptical pipe meeting the requirements of AASHTO M207. The concrete absorption test requirement will be waived if the load required to produce the 0.01-inch crack exceeds the required minimum load by at least 20%.

The Contractor may use the horizontal elliptical pipe designs specified in Table 909-5 and Table 1 of AASHTO M207.

C. **Non-Reinforced Concrete Pipe.** Provide non-reinforced concrete pipe meeting the requirements of AASHTO M86. Place required markings on the barrel of the pipe near the socket. Ensure that the markings remain legible during delivery of the pipe to the project.

D. **Precast Concrete Box Sections.** Use precast concrete box sections as required and in accordance with ASTM C1577.

E. **Concrete End Sections.** Provide precast concrete end sections fabricated using material meeting the requirements of AASHTO M170 for Class II and as shown on the plans. Provide wet-cast concrete for end sections with an entrained air content of 5.5 to 8.5%. When using the dry cast process, use at least 658 pounds of cement per cubic yard of concrete and use a liquid air-entraining agent at the dosage recommended by the manufacturer for dry cast concrete.

Use tongue and groove joints to make connections to pipe culverts.

F. **Pipe Culverts Jacked in Place.** For pipe culverts jacked in place, use reinforced concrete pipe at least 36 inches in diameter, meeting the requirements of AASHTO M170 for Class V, Wall B or C, with full circular reinforcing.

G. **Precast Concrete Three-Sided and Arch Sections.** Use precast concrete three-sided and arch sections as required and in accordance with ASTM C1504.

909.05. Metal Pipe Products

For metal pipe products, refer to Table 909-6 for the minimum wall thickness, or refer to Table 909-7 through Table 909-17, and Table 909-20 to determine the required wall thickness.

Refer to Table 909-19 for gauge equivalents for specified nominal thicknesses.

A. **Corrugated Steel Pipe.** Provide circular and pipe arch corrugated steel pipe meeting the requirements of AASHTO M36 for metallic-coated pipe. For polymer-precoated pipe, provide circular and pipe arch corrugated steel pipe meeting the requirements of AASHTO M245 and using an ethylene acrylic acid film selected from the Qualified Products List.

The Contractor may use Type IA and Type IIA dual-wall polymer-precoated galvanized corrugated steel pipe of the wall thicknesses specified in Table 909-20 and specified in subsection 909.05.

1. **Steel Sheet**. Provide corrugated steel pipe from zinc-coated sheets meeting the requirements of AASHTO M218 or from aluminum-coated sheets meeting the requirements of AASHTO M274.

On zinc-coated steel sheet for polymer-precoated corrugated steel pipe, use ethylene acrylic acid film selected from the Qualified Products List meeting the requirements of AASHTO M246 for Grade 250/250 polymer. Use only lock seam pipe.

Verify that the metallic coating weight on individual samples of fabricated pipe or steel sheet meets the single spot and triple spot test

requirements in accordance with AASHTO M218. Refer to Table 909-6, Table 909-7, Table 909-8, Table 909-9, Table 909-10, Table 909-11, and 909-20 for the specified nominal sheet thickness for a given diameter, class, and size of corrugation of culvert or sewer pipe.

Provide pipe less than 12 inches in diameter, fabricated from steel sheet with a minimum thickness of at least 0.064 inch (16 gauge).

2. **End Finish for Helical Corrugated Pipe.** For helical corrugated pipe, except perforated pipe, with diameters of at least 12 inches, reroll the pipe ends to form at least two circumferential corrugations in accordance with AASHTO M36 or AASHTO M245. This end treatment for perforated pipe and pipe with diameters less than 12 inches and pipe that spans the road surface in a single section is optional for the fabricator.

3. **Coupling Bands**. To connect sections of pipe and to attach end sections to culvert pipe with diameters of at least 12 inches, except perforated pipe, provide coupling bands circumferentially corrugated with the same size corrugations as on the ends of the pipe or use universal bands with gaskets.

   For coupling bands with diameters no greater than 10 inches, use coupling bands with corrugations matching the pipe corrugations.

   The Contractor may connect perforated pipe with a diameter no greater than 12 inches with smooth sleeve-type couplers. For perforated pipe with diameters greater than 12 inches, use coupling bands with corrugations matching the pipe corrugations, dimple bands, or universal bands.

   Provide coupling band connections as specified in subsection 401.03 and meeting the requirements of AASHTO M36 or AASHTO M245.

B. **Corrugated Aluminum Alloy Pipe.** Provide corrugated aluminum alloy pipe meeting the requirements of AASHTO M196, except fabricate pipe from aluminum sheet with the nominal thickness specified in Table 909-12, Table 909-13, Table 909-14, Table 909-15, Table 909-16, and Table 909-17.

   Only use Type IA and Type IIA corrugated aluminum alloy pipe if directed by the Engineer.

C. **Steel End Sections.** Provide steel end sections with coupling bands or hardware as shown on the plans. Metallic coating on the end sections must be the same as the metallic coating on the pipe, except zinc-coated steel end sections may be used with aluminum-coated steel pipe and

polymer-coated steel pipe. Provide metal end sections meeting the requirements of AASHTO M36.

D. **Steel Pipe for Jacking in Place.** Provide steel pipe for jacking in place meeting the requirements of ASTM A53/A53M for Type E or Type S, Grade B, or ASTM A139/A136M for Grade B. Provide a continuous welded joint to create a watertight casing that is capable of withstanding handling and installation stresses. Perform field welding using the shielded metal arc welding process and using E6011 or E7018 electrodes.

909.06. Plastic Pipe Products

Provide smooth-lined corrugated polyethylene (CPE) pipe and required fittings meeting the requirements of AASHTO M294 for Type S.

Provide corrugated polyvinyl chloride (CPV) pipe and required fittings meeting the requirements of AASHTO M304. The Engineer will test CPV pipe in accordance with MTM 728.

If providing a separate fitting or coupling to ensure a watertight joint in corrugated plastic pipe culverts and sewers, use non-corrugated, solid sleeve, fabricated from polyethylene (PE), or polyvinyl chloride (PVC) with a gasket meeting the requirements of subsection 909.03 on both sides of the joint. Do not use split collar couplers.

Provide a pipe indentation in each sleeve in the center to ensure positioning of the pipe sections in the field. Factory-installed sleeves on one end of the pipe sections and place a removable protective material over the exposed gaskets. Lubricate gaskets and sleeves before insertion according to manufacturer's recommendations.

909.07. Pipe for Underdrains

A. **Smooth Plastic Pipe for Underdrain.** Provide smooth plastic pipe for underdrain, fabricated from PVC pipe meeting the requirements of AASHTO M278. For pipes no greater than 6 inches in diameter, the Contractor may use acrylonitrile-butadiene-styrene (ABS) pipe meeting the requirements of ASTM D2751 for SDR 35 with perforations meeting the requirements of AASHTO M278, except that the joint tightness requirements do not apply.

B. **Corrugated Plastic Tubing for Underdrain.** Provide corrugated plastic tubing for underdrain meeting the requirements of AASHTO M252 for PE tubing or ASTM F949 for PVC tubing. Ensure that the perforations for PE and PVC tubing meet the requirements of AASHTO M252.

C. **Underdrain Outlets.** Provide PVC pipe underdrain outlets meeting one of the following requirements:

1. ASTM D1785 Schedule 40;
2. ASTM D2665;
3. ASTM D3034, for Type SDR 23.5; or
4. Corrugated steel pipe in accordance with subsection 909.05.A.

D. **Connections.** Seal connections with tape recommended by the manufacturer for underground service conditions. Provide tape resistant to moisture and organic growth.

909.08. Pipe for Downspouts

A. **Bridge Deck Downspouts.** Provide bridge deck downspouts of PE pipe meeting the requirements of ASTM F714, PE 4710, DR 26, Schedule 80 PVC. The Contractor may provide bridge deck downspouts of fiberglass-reinforced thermosetting resin pipe with a short-term rupture hoops tensile stress of at least 30,000 psi in accordance with ASTM D2996. PVC pipe must be in accordance with ASTM D1785 and ASTM D4216 to prevent changes in color, physical properties, and appearance due to weathering.

B. **Culvert, Downspouts.** If shown on the plans, provide other culvert downspouts made from one of the following:

1. Corrugated steel pipe as specified in subsection 909.05.A;
2. Corrugated aluminum alloy pipe as specified in subsection 909.05.B; or
3. CPE pipe meeting the requirements of AASHTO M294 for Type C.

Provide fittings required for CPE pipe meeting the requirements of AASHTO M294.

Seal joints between lengths of pipe, as recommended by the pipe manufacturer, to form silt-tight joints. Provide end sections as shown on the plans and specified in subsection 909.04.D or subsection 909.05.C.

C. **Bridge Deck Drain Extensions.** Provide bridge deck drain extensions as an integral component of the drain casting assembly in accordance with *MDOT Standard Plan B-101* series.

909.09. Cold-Applied Pipe Joint Sealer

Provide asphaltic material for sealing joints in concrete or clay pipe that can be spread on the joints with a trowel at an air temperature from 14 to 100°F.

The material must not flow, crack, or become brittle if exposed to the atmosphere. Verify that the material adheres to the concrete or clay to make a watertight seal.

Deliver the sealer to the project in sealed containers. Protect the sealer from contamination. Mark the container with “Cold Applied Pipe Joint Sealer” and the brand name, net volume or weight, and application requirements.

909.10. Drainage Marker Posts

Provide drainage marker posts meeting the requirements for plastic or steel delineator posts as specified in section 919 or the requirements for steel line fence posts in section 907, except provide posts at least 6 feet long. The Contractor may submit alternative post materials to the Engineer for approval.

909.11. Rodent Screens

Provide rodent screens of hardware cloth meeting the requirements of ASTM A740 with an opening size no greater than 0.30 inch, except provide wire of a nominal size of 0.057 inch and a minimum zinc coating weight of 0.59 ounce per square foot of uncoated wire surface, applied after weaving. The Contractor may substitute fabric made of Type 304 stainless steel wire with an opening no greater than 0.30 inch and a 0.057-inch nominal wire diameter. The Contractor may submit other screens with openings no greater than 0.30 inch to the Engineer for approval.

Form the screen using a punch and die. After shaping, ensure that the fabric forms a cylinder slightly larger than the inside diameter of the outlet pipe.

Table 909-1:
Additional Designs For Class II Reinforced Concrete Pipe
(AASHTO M170 Table 2 Extended)

Internal Diameter of Pipe (inch)	Minimum Wall Thickness (inch)	Reinforcement per Foot of Pipe Wall (sq in)			
		Circular Reinforcement in Circular Pipe		Elliptical Reinforcement in Circular Pipe	
		Inner Cage	Outer Cage	Inner Circular Cage	Elliptical Cage
114	9.5	0.56	0.34	0.22	0.34
120	10	0.61	0.37	0.24	0.37
126	10.5	0.65	0.39	0.26	0.39
132	11	0.70	0.42	0.28	0.42
144	12	0.80	0.48	0.32	0.48

Notes:
D-load = pound-force per linear foot per foot of diameter
D-load to produce a 0.01-inch crack: 1,000
D-load to produce the ultimate load: 1,500
Concrete strength: 5,000 psi

Table 909-2:
Additional Designs for Class III Reinforced Concrete Pipe (AASHTO M170 Table 3 Extended)

Internal Diameter of Pipe (inch)	Minimum Wall Thickness (inch)	Reinforcement per foot of Pipe Wall (sq in)				Stirrup Support System					
		Circular Reinforcement in Circular Pipe		Elliptical Reinforcement in Circular Pipe							
		Inner Cage	Outer Cage	Inner Circular Cage	Elliptical Cage	Minimum Area per Support Element, (sq in)[a]	No. of Lines[b]	Long. Spacing (inch)	Circum. Spacing on Inner Cage (inch)	Amplitude of Supports (inch)[c]	Ave. Area (sq in per ft per line)[d]
114	9½	0.69	0.41	0.28	0.41	0.041	5	2	6⅛	6.68	0.242
120	10	0.74	0.44	0.30	0.44	0.041	5	2	6½	7.16	0.242
126	10½	0.79	0.47	0.32	0.47	0.041	5	2	6⅞	7.68	0.242
132	11	0.85	0.51	0.34	0.51	0.041	5	2	7¼	8.16	0.242
144	12	0.97	0.58	0.39	0.58	0.041	5	2	8	9.16	0.242

Notes:
D-load = pound-force per linear foot per foot of diameter
D-load to produce a 0.01-inch crack: 1,350
D-lad to produce the ultimate load: 2,000
Concrete strength: 5,000 psi
Where a stirrup system is shown for a given size, it must be used with the circumferential reinforcement design selected.

(a) Two times the cross-sectional area of the wire used in the stirrup support system using 2- × 8-inch pattern for inner cage steel.

(b) Number of longitudinal lines required in the top and in the bottom portions of the pipe.

(c) Overall width of each line of stirrup support system using 2- × 8-inch pattern for inner cage steel. Use with Shearlock stirrups or S-stirrups or equal.

(d) Minimum area per support times number of supports per foot using 2- × 8-inch pattern for inner cage steel.

Table 909-3:
Additional Designs for Class IV Reinforced Concrete Pipe (AASHTO M170 Table 4 Extended)

Internal Diameter of Pipe, (in)	Minimum Wall Thickness, (in)	Reinforcement per Foot of Pipe Wall (sq in)				Stirrup Support System					
		Circular Reinforcement in Circular Pipe		Elliptical Reinforcement in Circular Pipe							
		Inner Cage	Outer Cage	Inner Circular Cage	Elliptical Cage						
		Concrete Strength, 5,500 psi				Minimum Area per Support Element (square inch)[a]	Number of Lines[b]	Long. Spacing (inch)	Circum. Spacing on Inner Cage (inch)	Amplitude of Supports (inch)[c]	Ave. Area (square inch per foot per line)[d]
78	7½	0.87	0.52	0.35	0.52						
84	8	1.00	0.60	0.40	0.64						
—	—	Concrete Strength, 5,000 psi									
78	7½	0.69	0.41	0.28	0.41	0.028	11	2	4⅛	4.67	0.167
84	8	0.74	0.44	0.30	0.44	0.028	11	2	4⅝	5.17	0.167
90	8	0.85	0.51	0.34	0.51	0.028	11	2	4⅝	5.17	0.167
96	8½	0.91	0.55	0.36	0.55	0.028	11	2	5⅛	5.67	0.167
102	8½	1.02	0.61	0.41	0.61	0.033	11	2	5⅛	5.67	0.195
108	9	1.07	0.64	0.43	0.64	0.043	11	2	5⅝	6.17	0.260
114	9½	1.02	0.61	0.41	0.61	0.047	11	2	6⅛	6.67	0.279
120	10	1.10	0.66	0.44	0.66	0.050	11	2	6½	7.17	0.298
126	10½	1.17	0.70	0.47	0.70	0.053	11	2	6⅞	7.67	0.316
132	11	1.25	0.75	0.50	0.75	0.056	11	2	7¼	8.17	0.335
144	12	1.42	0.85	0.57	0.85	0.064	11	2	8	9.17	0.381

Table 909-3 (cont.):
Additional Designs for Class IV Reinforced Concrete Pipe (AASHTO M170 Table 4 Extended)

Notes:

D-load = pound-force per linear foot per foot of diameter
D-load to produce a 0.01-inch crack: 2,000
D-load to produce the ultimate load: 3,000
Where a stirrup system is shown for a given size, it must be used with the circumferential reinforcement design selected.

(a) Two times the cross-sectional area of the wire used in the S-stirrups.

(b) Number of longitudinal lines required in the top and in the bottom portions of the pipe.

(c) Overall width of each line of stirrup support system using 2- × 8-inch in pattern for inner cage steel. Use with Shearlock stirrups or S-stirrups or equal.

(d) Minimum area per support times number of supports per foot using 2- × 8-inch pattern for inner cage steel.

Table 909-4:
Additional Designs for Class V Reinforced Concrete Pipe (AASHTO M170 Table 5 Extended)

Internal Diameter of Pipe (inch)	Wall Thickness (inch min.)	Reinforcement per Foot of Pipe Wall (sq in)				Stirrup Support System					
		Circular Reinforcement in Circular Pipe		Elliptical Reinforcement in Circular Pipe							
		Inner Cage	Outer Cage	Inner Circular Cage	Elliptical Cage	Minimum Area per Support Element (sq in)[a]	Number of Lines[b]	Long. Spacing (inch)	Circum. Spacing on Inner Cage (inch)	Amplitude of Supports (inch)[c]	Ave. Area, (square inch per foot per line)[d]
54	5½	0.64	0.38	0.26	0.38	0.028	15	2	2⅛	2.68	0.167
60	6	0.70	0.42	0.28	0.42	0.028	14	2	2⅝	3.20	0.167
66	6½	0.79	0.47	0.32	0.47	0.028	13	2	3⅛	3.68	0.167
72	7	0.87	0.52	0.35	0.52	0.028	12	2	3⅝	4.16	0.167
78	7½	0.92	0.55	0.37	0.55	0.028	11	2	4⅛	4.68	0.167
84	8	0.99	0.59	0.40	0.59	0.033	11	2	4⅝	5.16	0.195
90	8	1.13	0.68	0.45	0.68	0.040	11	2	4⅝	5.16	0.248
96	8½	1.20	0.72	0.48	0.72	0.043	11	2	5⅛	5.68	0.260
102	8½	1.34	0.80	0.54	0.80	0.051	11	2	5⅛	5.68	0.307
108	9	1.51	0.91	0.60	0.91	0.061	11	2	5⅝	6.16	0.363
114	9½	1.51	0.91	0.60	0.91	0.062	11	2	6⅛	6.68	0.372
120	10	1.62	0.97	0.65	0.97	0.067	11	2	6½	7.16	0.400

Table 909-4 (cont.):
Additional Designs for Class V Reinforced Concrete Pipe (AASHTO M170 Table 5 Extended)

Internal Diameter of Pipe (inch)	Wall Thickness (inch min.)	Reinforcement per Foot of Pipe Wall (sq in)				Stirrup Support System					
		Circular Reinforcement in Circular Pipe		Elliptical Reinforcement in Circular Pipe							
		Inner Cage	Outer Cage	Inner Circular Cage	Elliptical Cage	Minimum Area per Support Element (sq in)[a]	Number of Lines[b]	Long. Spacing (inch)	Circum. Spacing on Inner Cage (inch)	Amplitude of Supports (inch)[c]	Ave. Area, (square inch per foot per line)[d]
126	10½	1.73	1.04	0.69	1.04	0.070	11	2	6⅞	7.68	0.419
132	11	1.84	1.10	0.74	1.10	0.074	11	2	7¼	8.16	0.446
144	12	2.09	1.25	0.84	1.25	0.082	11	2	8	9.16	0.493

Notes:

D-load = pound-force per linear foot per foot of diameter
D-load to produce a 0.01-inch crack: 3,000
D-load to produce the ultimate load: 3,750
Concrete strength: 6,000 psi
Where a stirrup system is shown for a given size, it must be used with the circumferential reinforcement design selected.

(a) Two times the cross-sectional area of the wire used in the Stirrups Support System using 2 × 8-inch pattern for inner cage steel. Use with Shearlock stirrups or S-stirrups or equal.

(b) Number of longitudinal lines required in the top and in the bottom portions of the pipe.

(c) Overall width of each line of stirrups.

(d) Minimum area per support times number of supports per foot using 2 × 8-inch pattern for inner cage steel.

Table 909-5:
Additional Designs for Horizontal Elliptical Pipe

Specified Diam., Equiv. Round Size (inch)	Specified Rise by Span (inch)	Min. Wall Thick (inch)	Reinforcement (square inch per foot)													
			Class HE-A		Class HE-I		Class HE-II		Class HE-III		Class HE-IV					
			D-Loads										Stirrup Support System			
			0.01 = 600		0.01 = 800		0.01 = 1000		0.01 = 1350		0.01 = 2000		Min. Area per Support Element (square inch)	Number of Lines[a]	Long. Spacing (inch)	Circum. Spacing on Inner Cage (inch)[b]
			Ult = 900		Ult = 1200		Ult = 1500		Ult = 2000		Ult = 3000					
			In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage				
48	38 × 60	5½	—	—	—	—	—	—	—	—	0.70	0.70	0.13	15	2	3.000
54	43 × 68	6	—	—	—	—	—	—	—	—	0.82	0.82	0.15	15	2	3.375
60	48 × 76	6½	—	—	—	—	—	—	—	—	0.94	0.94	0.17	15	2	3.750
66	53 × 83	7	—	—	—	—	—	—	—	—	0.99	0.99	0.17	15	2	4.125
72	58 × 91	7½	—	—	—	—	—	—	—	—	1.11	1.11	0.19	15	2	4.500
84	63 × 98	8	—	—	—	—	—	—	—	—	1.21	1.21	0.21	15	2	4.875
78	68 × 106	8½	—	—	—	—	—	—	—	—	1.33	1.33	0.22	15	2	5.250
90	72 × 113	9	0.28	0.28	0.40	0.40	0.58	0.58	—	0.84	1.43	1.43	0.24	15	2	5.625
96	77 × 121	9½	0.30	0.30	0.45	0.45	0.65	0.65	0.92	0.92	1.56	1.56	0.26	15	2	6.000
102	82 × 128	9¾	0.33	0.33	0.52	0.52	0.73	0.73	1.03	1.03	1.72	1.72	0.28	15	2	6.188
108	87 × 136	10	0.36	0.36	0.60	0.60	0.83	0.83	1.16	1.16	1.92	1.92	0.30	15	2	6.375
114	92 × 143	10½	0.40	0.40	0.64	0.64	0.88	0.88	1.23	1.23	2.02	2.02	0.32	15	2	6.750
120	97 × 151	11	0.44	0.44	0.70	0.70	0.96	0.96	1.32	1.32	2.16	2.16	0.34	15	2	7.125

Table 909-5 (cont.):
Additional Designs for Horizontal Elliptical Pipe

Specified Diam., Equiv. Round Size (inch)	Specified Rise by Span (inch)	Min. Wall Thick (inch)	Reinforcement (square inch per foot)													
			Class HE-A		Class HE-I		Class HE-II		Class HE-III		Class HE-IV					
			D-Loads										Stirrup Support System			
			0.01 = 600		0.01 = 800		0.01 = 1000		0.01 = 1350		0.01 = 2000		Min. Area per Support Element (square inch)	Number of Lines[a]	Long. Spacing (inch)	Circum. Spacing on Inner Cage (inch)[b]
			Ult = 900		Ult = 1200		Ult = 1500		Ult = 2000		Ult = 3000					
			In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage				
132	106 × 166	12	0.53	0.53	0.81	0.81	1.09	1.09	1.49	1.49	2.40	2.40	0.38	15	2	7.875
144	116 × 180	13	0.61	0.61	0.91	0.91	1.21	1.21	1.64	1.64	2.62	2.62	0.42	15	2	8.625
Concrete strength (psi)			4,000		4,000		4,000		5,000		48 inch, 54 inch, 60 inch 4,000					
											66-144 inch 5,000					

Note: Where a stirrup system is shown for a given size, it must be used with the circumferential reinforcement design selected.

(a) Number of longitudinal lines required in the top and in the bottom portions of the pipe.

(b) Overall width of each line of stirrups.

Table 909-6:
References for Spiral Ribbed and Corrugated Metal Pipes

	Driveway Culverts and Downspouts	Culverts	Sewers
	Minimum Design Life		
Pipe Material Type	**25 years**	**50 years**	**70 years**
Galvanized spiral ribbed metal pipe	Table 909-8	0.109[(a)]	0.168[(a)]
Aluminized Type 2 spiral ribbed metal pipe	Table 909-8	Table 909-11	0.138[(a)]
Polymer-precoated spiral ribbed metal pipe	Table 909-8	Table 909-8	Table 909-8
Galvanized corrugated metal pipe	Table 909-7	Table 909-9	0.168[(a),(b)]
Aluminized Type 2 corrugated metal pipe	Table 909-7	Table 909-10	0.138[(a),(b)]
Polymer-precoated corrugated galvanized pipe	Table 909-7	Table 909-7	Table 909-7[(b)]
Aluminum pipe	Table 909-12	Table 909-13	Table 909-14
Aluminum spiral ribbed pipe	Table 909-15	Table 909-16	Table 909-17
Dual-wall polymer-precoated galvanized corrugated steel pipe	Table 909-20	Table 909-20	Table 909-20

Notes:

Minimum wall thickness in inches to meet structural and durability requirements for various metal pipes to meet the design life.
Numbers represent the minimum durability gage requirements for the specific pipe material.
Table 909-7 represents the minimum structural gauge thickness requirements for corrugated steel pipe.
Table 909-8 represents the minimum structural gauge thickness requirements for spiral ribbed steel pipe.

(a) Required wall thickness (inch).

(b) Permitted for 12- to 18-inch-diameter 2⅔- × ½-inch helically corrugated pipe only.

Table 909-7:
Wall Thickness Requirements in Inches, Based on Diameter Class of Pipe and Size of Corrugation

Pipe Diameter (inch)	Depth of Cover							
	0–16 feet		>16–24 feet			>24–32 feet		
	Corrugation Size (inch)							
	2⅔ × ½	3 × 1, 5 × 1	2⅔ × ½	3 × 1	5 × 1	2⅔ × ½	3 × 1	5 × 1
	Required Wall Thickness (inch)							
12–30	0.064	—	0.064	—	—	0.064	—	—
36–48	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064
54	0.079	0.064	0.079	0.064	0.064	0.079	0.064	0.064
60	0.109	0.064	0.109	0.064	0.064	0.109	0.064	0.064
66	0.138	0.064	0.138	0.064	0.064	0.138	0.064	0.064
72	0.138	0.064	0.138	0.064	0.064	0.138	0.064	0.064
78	0.168	0.064	0.168	0.064	0.064	0.168	0.064	0.064
84	0.168	0.064	0.168	0.064	0.064	0.168	0.064	0.079
90	—	0.064	—	0.064	0.064	—	0.079	0.079
96	—	0.079	—	0.079	0.079	—	0.079	0.079
102	—	0.079	—	0.079	0.079	—	0.079	0.109
108–120	—	0.109	—	0.109	0.109	—	0.109	0.109
126	—	0.138	—	0.138	0.138	—	0.138	0.138
130–136	—	0.138	—	0.138	0.138	—	0.138	0.138
144	—	0.168	—	0.168	0.168	—	0.168	0.168

Table 909-8:
Wall Thickness Requirements in Inches Based on Diameter, Class of Pipe, and Size of Ribs

Pipe Diameter (inch)	Depth of Cover					
	0–16 feet		>16–24 feet		>24–32 feet	
	Corrugation Size (inch)					
	¾ × ¾ × 7½	¾ × 1 × 11½	¾ × ¾ × 7½	¾ × 1 × 11½	¾ × ¾ × 7½	¾ × 1 × 11½
	Required Wall Thickness (inch)					
18–36	0.064	0.064	0.064	0.064	0.064	0.064
42	0.064	0.064	0.064	0.064	0.064	0.079
48	0.064	0.064	0.064	0.079	0.064	0.079
54	0.079	0.064	0.079	0.079	0.079	0.109
60	0.079	0.079	0.079	0.079	0.079	0.109
66	0.109	0.079	0.109	0.109	0.109	0.109
72–78	0.109	0.109	0.109	0.109	0.109	0.109
84	—	0.109	—	0.109	—	0.109

Table 909-9:
Wall Thickness Requirements in Inches Based on Class of Pipe and Size of Corrugation

Pipe Diameter (inch)	Class A and Class B		Class C		Class D		
	Corrugation Size (inch)						
	2⅔ × ½	3 × 1, 5 × 1	2⅔ × ½	3 × 1, 5 × 1	2⅔ × ½	3 × 1	5 × 1
	Required Wall Thickness (inch)						
12–30	0.109	—	0.109	—	0.109	—	—
36–60	0.109	0.109	0.109	0.109	0.107	0.109	0.109
66–72	0.138	0.109	0.138	0.109	0.138	0.109	0.109
78–84	0.168	0.109	0.168	0.109	0.168	0.109	0.109
90–102	—	0.109	—	0.109	—	0.109	0.109
108–120	—	0.109	—	0.109	—	0.109	0.109
126	—	0.138	—	0.138	—	0.138	0.138
130–136	—	0.138	—	0.138	—	0.138	0.138
144	—	0.168	—	0.168	—	0.168	0.168

Table 909-10:
Wall Thickness Requirements in Inches Based on Diameter, Class of Pipe and Size of Corrugation

Pipe Diameter (inch)	Class A and B		Class C			Class D		
	Corrugation Size (inch)							
	2⅔ × ½	3 × 1, 5 × 1	2⅔ × ½	3 × 1	5 x 1	2⅔ × ½	3 × 1	5 x 1
	Required Wall Thickness (inch)							
12–30	0.079	—	0.079	—	—	0.079	—	—
36–54	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079
60	0.109	0.079	0.109	0.079	0.079	0.109	0.079	0.079
66–72	0.138	0.079	0.138	0.079	0.079	0.138	0.079	0.079
78–84	0.168	0.079	0.168	0.079	0.079	0.168	0.079	0.079
90–96	—	0.079	—	0.079	0.079	—	0.079	0.079
102	—	0.079	—	0.079	0.079	—	0.079	0.109
108–120	—	0.109	—	0.109	0.109	—	0.109	0.109
126	—	0.138	—	0.138	0.138	—	0.138	0.138
130–136	—	0.138	—	0.138	0.138	—	0.138	0.138
144	—	0.168	—	0.168	0.168	—	0.168	0.168

Table 909-11:
Wall Thickness Requirements in Inches Based on Diameter, Class of Pipe, and Size of Ribs

Pipe Diameter (inch)	Class A and B		Class C		Class D	
	Corrugation Size (inch)					
	¾ × ¾ × 7½	¾ × 1 × 11½	¾ × ¾ × 7½	¾ × 1 × 11½	¾ × ¾ × 7½	¾ × 1 × 11½
	Required Wall Thickness (inch)					
18–48	0.079	0.079	0.079	0.079	0.079	0.079
54–60	0.079	0.079	0.079	0.079	0.079	0.109
66–78	0.109	0.109	0.109	0.109	0.109	0.109
84	—	0.109	—	0.109	—	0.109

Table 909-12:
Wall Thickness Requirements in Inches, Based on Class of Pipe and Size of Corrugation, Lock Seam Pipe Only

Pipe Diameter (inch)	Depth of Cover					
	0–16 feet		>16–24 feet		>24–32 feet	
	Corrugation Size (inch)					
	2⅔ × ½	3 × 1	2⅔ × ½	3 × 1	2⅔ × ½	3 × 1
	Required Wall Thickness (inch)					
12–27	0.060	0.060	0.060	0.060	0.060	0.060
30–36	0.075	0.060	0.075	0.060	0.075	0.060
42–54	0.105	0.060	0.105	0.060	0.105	0.060
60	0.135	0.075	0.135	0.075	0.135	0.075
66–72	0.164	0.075	0.164	0.075	0.164	0.075
78	—	0.075	—	0.075	—	0.075
84–96	—	0.105	—	0.105	—	0.105
102–108	—	0.135	—	0.135	—	0.135
112–120	—	0.164	—	0.164	—	0.164

Table 909-13:
Wall Thickness Requirements in Inches, Based on Class of Pipe and Size of Corrugation, Lock Seam Pipe Only

Pipe Diameter (inch)	Class A, B, C, D Corrugation Size (inch)	
	2⅔ × ½	3 × 1
	Required Wall Thickness (inch)	
12–36	0.075	0.075
42–54	0.105	0.075
60	0.135	0.075
66–72	0.164	0.075
78	—	0.075
84–96	—	0.105
102–108	—	0.135
112–120	—	0.164

Table 909-14:
Wall Thickness Requirements in Inches, Based on Class of Pipe and Size of Corrugation, Lock Seam Pipe Only

Pipe Diameter (inch)	Class A, B, C, D Corrugation Size (inch)	
	2⅔ × ½	3 × 1
	Required Wall Thickness (inch)	
12–54	0.105	0.105
60	0.135	0.105
66–72	0.164	0.105
78–96	—	0.105
102–108	—	0.135
112–120	—	0.164

Table 909-15:
Wall Thickness Requirements in Inches, Based on Diameter, Class of Pipe, and Size of Rib, Lock Seam Pipe Only

Pipe Diameter (inch)	Class F, ¾ × ¾ × 7½
	Required Wall Thickness (inch)
18–24	0.060
30–36	0.075
42–54	0.105
60–66	0.135

Table 909-16:
Wall Thickness Requirements in inches, Based on Diameter, Class of Pipe, and Size of Rib, Lock Seam Pipe Only

	Class A, B, C, D ¾ × ¾ × 7½
Pipe Diameter (inch)	Required Wall Thickness (inch)
18–36	0.075
42–54	0.105
60–66	0.135

Table 909-17:
Wall Thickness Requirements in Inches, Based on Diameter, Class of Pipe, and Size of Rib, Lock Seam Pipe Only

	Class A, B, C, D ¾ × ¾ × 7½
Pipe Diameter (inch)	Required Wall Thickness (inch)
18–54	0.105
60–66	0.135

Table 909-18:
Jacked-in-Place Steel Pipe Nominal OD and Wall Thickness

Nominal Size (inch)	Nominal Outside Diameter (inch)	Wall Thickness (inch)
2	2.375	0.154
4	4.500	0.188
6	6.625	0.188
8	8.625	0.188
10	10.750	0.188
12	12.750	0.188
14	14.000	0.250
16	16.000	0.250
18	18.000	0.250
20	20.000	0.250
24	24.000	0.250
30	30.000	0.312
36	36.000	0.312
42	42.000	0.438
48	48.000	0.500
54	54.000	0.563

Table 909-19:
Gage Equivalents to Nominal Thickness

Sheet Gauge Number	Nominal Thickness	
	Galvanized	Aluminum Alloy
18	0.052	0.048
16	0.064	0.060
14	0.079	0.075
12	0.109	0.105
10	0.138	0.135
8	0.168	0.164
7	0.188	—
5	0.218	—
3	0.249	—
1	0.280	—

Table 909-20:
Dual Wall Polymer-Precoated Galvanized Corrugated Steel Pipe Wall Thickness Requirements in inches Based on Diameter and Size of Corrugation

Diameter of Pipe (inch)	Corrugation Size (inch)			
	2⅔ × ½		3 × 1	
	Shell	Liner	Shell	Liner
	Required Wall Thickness (inch)			
36–48	0.064	0.052	0.064	0.052
54	0.079	0.052	0.064	0.052
60	0.109	0.052	0.064	0.052
66–72	0.138	0.052	0.064	0.052
78–84	0.168	0.052	0.064	0.052
90–102	—	—	0.079	0.052
108–120	—	—	0.109	0.052
126–136	—	—	0.138	0.052
144	—	—	0.168	0.052

Table 909-21:
Corrugated Steel Pipe (CSP) AASHTO LRFD Cover Heights for CSP Pipe-Arch 3 x 1 inch

Span x Rise (inch)	Equiv Diam. (inch)	Min. Nominal Thickness (inch)[(a)]	Min. Cover (feet)	Max. Cover (feet)
53 x 41	48	0.079	2.0	11
60 x 46	54	0.079	2.0	20
66 x 51	60	0.079	1.2	20
73 x 55	66	0.079	1.2	20
81 x 59	72	0.079	1.5	16
87 x 63	78	0.079	1.5	16
95 x 67	84	0.079	1.5	16
103 x 71	90	0.079	1.5	16
112 x 75	96	0.109	1.5	16
117 x 79	102	0.109	1.5	16
128 x 83	108	0.138	1.5	16
137 x 87	114	0.138	1.6	16
142 x 91	120	0.138	1.6	16

(a) Manufacturing limitations include a 0.079-inch minimum nominal thickness for 3- x 1-inch pipe-arch.

Table 909-22:
Corrugated Steel Pipe (CSP) AASHTO LRFD Cover Heights for CSP Pipe-Arch, 5 x 1 inch

Span x Rise (inch)	Equiv Diam. (inch)	Min. Nominal Thickness (inch)[(a)]	Min. Cover (feet)	Max. Cover (feet)
53 x 41	48	0.109	2.0	11
60 x 46	54	0.109	1.2	20
66 x 51	60	0.109	1.2	20
73 x 55	66	0.109	1.2	20
81 x 59	72	0.109	1.5	16
87 x 63	78	0.109	1.5	16
95 x 67	84	0.109	1.5	16
103 x 71	90	0.109	1.5	16
112 x 75	96	0.109	1.5	16
117 x 79	102	0.109	1.5	16
128 x 83	108	0.138	1.5	16
137 x 87	114	0.138	1.6	16
142 x 91	120	0.138	1.6	16

(a) Manufacturing limitations include a 0.109-inch minimum nominal thickness for 5- x 1-inch pipe-arch.

Table 909-23:
Corrugated Steel Pipe (CSP) AASHTO LRFD Cover Heights for CSP Pipe-Arch 2⅔ inch x ½ inch

Span x Rise (inch)	Equiv Diam. (inch)	Min. Nominal Thickness (inch)	Min. Cover (feet)	Max. Cover (feet)
17 x 13	15	0.064	1.9	12
21 x 15	18	0.064	2.0	12
24 x 18	21	0.064	1.9	12
28 x 20	24	0.064	2.0	12
35 x 24	30	0.064	2.0	12
42 x 29	36	0.064	2.0	12
49 x 33	42	0.079	2.0	12
57 x 38	48	0.109	2.0	11
64 x 43	54	0.109	2.0	11
71 x 47	60	0.138	2.0	11
77 x 52	66	0.168	2.0	12
83 x 57	72	0.168	2.0	12

Table 909-24:
Corrugated Steel Pipe (CSP) AASHTO LRFD Cover Heights for CSP Pipe-Arch ¾ inch x ¾ inch x 7½ inch Spiral Rib Pipe

Span x Rise (inch)[a]	Equiv Diam. (inch)	Min. Nominal Thickness (inch)	Min. Cover (feet)	Max. Cover (feet)
20 x 16	18	0.064	1.6	15
23 x 19	21	0.064	1.7	14
27 x 21	24	0.064	1.8	13
33 x 26	30	0.064	1.8	13
40 x 31	36	0.064	1.9	13
46 x 36	42	0.064	1.8	13
53 x 41	48	0.064[b]	1.9	13
60 x 46	54	0.079	1.3	20
66 x 51	60	0.079[b]	1.3	20
73 x 55	66	0.109	1.3	20
81 x 59	72	0.109[b]	1.5	16
87 x 63	78	0.138	1.5	16
95 x 67	84	0.138	1.5	16
103 x 71	90	0.138[b]	1.5	16

(a) ASTM A760 makes provisions for two additional sizes: 112 x 75 inch and 117 x 79 inch.

(b) Trench installation only. Embankment installations may be used for the heavier gauges.

Section 910. Geosynthetics

910.01. General Requirements

Geosynthetics must be composed of long chain synthetic fiber of at least 85% (by weight) polyolefins or polyesters. Geosynthetics must be capable of resisting degradation from chemicals, mildew, rot, and ultraviolet (UV) light.

Deliver and store geosynthetics in packaging capable of resisting UV radiation, contaminants, and moisture. Label each unit of material with product information including supplier and lot identification. Do not expose geosynthetics to direct sunlight for prolonged periods. Repair or replace damaged geosynthetics at no additional cost to the Department.

910.02. Testing

Geosynthetic testing will be in accordance with the specified ASTM or Department methods, as modified by this section.

Geosynthetics must meet the physical property requirements shown in Tables 910-1 and 910-2. The directional property values listed in Table 910-1 specify values for the weaker principal direction.

910.03. Geotextiles

Geotextiles are flexible, permeable fabrics, consisting of synthetic fibers or yarns oriented into a dimensionally stable network. Woven geotextiles must have sealed or selvaged edges to prevent raveling.

A. **Geotextile Blanket.** Geotextile for filtration applications, including trench lining, ditch lining, streambed protection, pipe wrap, joint wrap, drainhole and weephole filter, granular blanket separation, and filter bags must be non-woven and meet the requirements shown in Table 910-1 for geotextile blanket.

B. **Geotextile Liner.** Geotextile for erosion control in riprap and similar applications must be non-woven and meet the requirements shown in Table 910-1 for geotextile liner. Geotextile for use with heavy riprap must be non-woven and meet the requirements shown in Table 910-1 for heavy geotextile liner.

C. **Geotextile Separator.** Geotextile used to prevent intermixing of dissimilar aggregate or soil layers must meet the requirements shown in Table 910-1 for geotextile separator. Geotextiles separators with grab tensile elongation-at-break less than 50% must meet the requirements shown in Table 910-1 for woven geotextile separator. Geotextiles with grab tensile elongation-at-break equal to or greater than 50% must meet the strength requirements shown in Table 910-1 for non-woven geotextile separator.

D. **Stabilization Geotextile.** Geotextile used to prevent intermixing of soft subgrade and subbase materials must meet the requirements shown in Table 910-1 for stabilization geotextile.

Stabilization geotextile with grab tensile elongation-at-break less than 50% must meet the requirements shown in Table 910-1 for woven stabilization geotextile. Geotextiles with grab tensile elongation-at-break equal to or greater than 50% must meet the strength requirements shown in Table 910-1 for non-woven stabilization geotextile.

910.04. Silt Fence Geotextile

Select geotextile for fabricating silt fence from the Qualified Products List. Geotextile for silt fence must have a nominal height of 3 feet and must meet the requirements shown in Table 910-1 for silt fence. Geotextile for silt fence must have a retained strength of at least 70% after 500 hours of UV exposure when tested in accordance with ASTM D4355/D4355M. Fabricate silt fence according to subsection 916.02.

910.05. Drainage Geocomposites

Drainage geocomposites must meet the requirements shown in Table 910-1 and this subsection.

Prefabricated geocomposites for drainage applications must consist of a geotextile bonded to or wrapped around a polymer core having corrugated, dimpled, tubular, or net (mesh) configurations. Geocomposites must have sufficient flexibility and durability to withstand installation, handling, and permanent loading stresses.

Fittings for geocomposite installations must be manufactured by the geocomposite manufacturer or meet the published specifications of the geocomposite manufacturer. Provide tape used to seal connections with adhesive resistant to moisture and organic growth and recommended by the manufacturer for underground service conditions.

Obtain the Engineer’s approval for all components of the geocomposite system before installation.

A. **Wall Drain.** Wall drains for single-direction cross-planar flow must consist of an impermeable polymer core with geotextile bonded to one side. The geocomposite must have a minimum crush strength of 4,000 pounds per square foot at no more than 18% deformation when tested according to MTM 411.

B. **Geocomposite Net.** The Engineer may allow geocomposite net consisting of geotextile blanket bonded to both sides of a mesh core as an alternative to open-graded aggregate drainage layers.

The Engineer will approve the geocomposite net based on durability, drainage capacity, crush resistance, tensile strength, and thickness.

910.06. Road Grade Biaxial Geogrid

The geogrid must be a regular grid structure and must have aperture geometry and rib and junction cross-section sufficient to permit significant mechanical interlock with the material being reinforced. The geogrid must have significant dimensional stability through all ribs and junctions of the grid structure. The geogrid must maintain its reinforcement and interlock capabilities under repeated dynamic loads while in service. The geogrid must also be resistant to UV degradation, to damage under normal construction practices, and to all forms of biological or chemical degradation normally encountered in highway construction.

The geogrid must be composed of polypropylene, HDPE, or polyester virgin resins. The protective coatings of polyester geogrids must contain less than 5% filler content. Repair damaged coating prior to backfilling. The geogrid must meet the physical property requirements of Table 910-2.

Table 910-1:
Physical Requirements for Geotextiles

	Property				
	Grab Tensile Strength (min.) (lb)	Trapezoid Tear Strength (min.) (lb)	Puncture Strength (min.) (lb)	Permittivity (min.) (per second)	Apparent Opening Size (max.) (mm)
	Test Method				
Geotextile Category	ASTM D4632/ D4632M	ASTM D4533/ D4533M	ASTM D6241	ASTM D4491/ D4491M	ASTM D4751
Geotextile blanket[(a)]	120	45	230	0.5	0.21
Geotextile liner	200	75	440	0.5	0.21
Heavy geotextile liner	270	100	620	0.5	0.21
Woven geotextile separator	270	100	620	0.05	0.425
Non-woven geotextile separator	200	75	440	0.5	0.425
Woven stabilization geotextile	270	100	620	0.05	0.50
Non-woven stabilization geotextile	270	100	620	0.5	0.50
Silt fence	100[(b)]	45	—	0.1	0.60
Drainage geocomposites	200	75	440	0.5	0.21

(a) For pipe wrap where backfill around the pipe meets granular material Class IIAA requirements; geotextiles, including knitted polyester sock, which meet the following minimum requirements in the applied condition, are permitted: mass/unit area: 3.0 oz/yd²; Mullen burst strength: 100 psi; maximum apparent opening size must be 0.30 mm for pavement and foundation underdrains and 0.60 mm in other areas. The fluid displacement rate for the Mullen burst test equipment must be 170 mL/min ± 5 mL/min. Subtract tare strength from the ultimate burst strength as specified in ASTM D3786/D3786M.

(b) Elongation at the specified grab tensile strength no greater than 40% for silt fence.

Table 910-2:
Physical Requirements for Road Grade Biaxial Geogrid

Property	Minimum Value (except where noted below)	Test Method
Interlock open area	60%	U.S. Army Corps of Engineers[a]
Ultimate strength		ASTM D6637/D6637M[b]
MD[c]	1200 lb/ft	
MD[c]	1950 lb/ft	
Individual junction strength		ASTM D7737/D7737M
MD[c]	130 lb	
CMD[c]	170 lb	
Tensile modulus (2%)		ASTM D6637/D6637M[b]
MD[c]	18,000 lb/ft	
CMD[c]	30,000 lb/ft	
Aperture size		Measured
MD[c]	1.0 inch (nominal value)	
CMD[c]	1.3 inch (nominal value)	

(a) Percent open area measured without magnification by means of U.S. Army Corps of Engineers method as specified in CW 02215, Civil Works Construction Guide Specification for Plastic Filter Fabric (1977).

(b) Ultimate strength and tensile modulus at 2% elongation measured by means of ASTM D6637/D6637M. No offset allowances or specimen pretensioning are made in calculating tensile modulus.

(c) MD (machine direction) and CMD (cross-machine direction) refer to the principal directions of the manufacturing process.

Section 911. Water

911.01. General Requirements

Water must be clean, clear, and free of oil, salt, acid, alkali, organic matter, chlorides, or other deleterious material.

911.02. Turf, Turf Establishment, and Landscape Plants

Provide water from a potable or non-potable water source approved by the Engineer. Use irrigation-quality water that is free of elements harmful to plant growth.

911.03. Mixing or Curing Concrete, Mortar, Grout, and Other Cementitious Products

Potable water from sources approved by the Michigan Department of Public Health or equivalent approved by the Engineer is acceptable without testing.

Surface water from sources including, but not limited to, ditches, lakes, ponds, quarries, rivers, streams, wetlands, and other similar untreated sources is prohibited for mixing or curing concrete, mortar, grout, and other cementitious products. Stationary concrete batch plants may use surface water if the facility has established at least a 5-year history of producing consistent concrete products meeting the required specifications. Stationary concrete batch plants using surface water are required to meet the non-potable water sampling and testing requirements.

Non-potable must meet the requirements of Table 911-1. Do not use non-potable water unless approved by the Engineer.

Test non-potable water prior to use, once per month (once per 6 months for stationary concrete batch plants) thereafter, and at any time the water source may be deemed out of compliance due to changing site conditions as determined by the Engineer. Water must be sampled and tested by a qualified independent testing laboratory having no association with the supply or production of materials produced by that concrete facility at the expense of the Contractor. Submit test results to the Engineer for approval prior to use and within 3 days of completion of testing. If water fails to meet the requirements of this specification, immediately suspend use of water source, bring water into compliance, and retest. Do not resume use of the water source until approved by the Engineer.

Table 911-1:
Non-Potable Water Requirements

Property	Test Method	Specification
Total solids	ASTM C1602	≤0.30%
Total organic content / carbon	SM 2540 E	≤0.05%
Alkalinity-acidity (pH)	ASTM D1067	5.5–8.5
Chloride (Cl-)	ASTM D512	≤0.05%
Time of setting	ASTM C1602	–1:00 hour to +1:30 hours of control
7-day compressive strength	ASTM C1602	≥90% of control

Section 913. Masonry Units

913.01. General Requirements

Clay brick, concrete brick, concrete block, salvaged paving brick, precast reinforced concrete units, and structural tile for masonry structures must meet the requirements of this section.

913.02. Testing

Testing will be in accordance with the specified ASTM or AASHTO method as modified by this section.

913.03. Brick

A. **Brick Dimensions.** Brick must meet the following nominal size limitations:

1. Depth – 2 to 2½ inches;
2. Width – 3½ to 3¾ inches; and
3. Length – 7½ to 8 inches.

Brick for a single structure must be of one nominal size and must not vary from the manufacturer's specified standard dimensions by more than ±⅛ inch in any dimension. However, clay brick may vary in length by ±¼ inch, and up to 2% of the contract's clay brick quantity may exceed the dimensional tolerances.

B. **Clay Brick.** Clay brick to construct manholes, catch basins, and similar structures must meet the requirements of ASTM C32 for Grade MS.

Recessed or cored brick is acceptable.

Salvaged paving brick meeting the requirements of this section is acceptable.

C. **Concrete Brick.** Concrete brick must meet the requirements of ASTM C55 for concrete building brick.

Recessed or cored brick is acceptable.

D. **Sand-Lime Brick.** Sand-lime brick for masonry structures must meet the requirements of ASTM C73 for Grade SW and the following 5-hour boiling test water absorption requirements:

1. Average of five bricks – 18% maximum; and
2. Individual brick – 20% maximum.

913.04. Concrete Masonry Units for Structures Other than Drainage Structures

A. **Load-Bearing Units.** Hollow, load-bearing, concrete masonry units must meet the requirements of ASTM C90, Normal Weight.

B. **Non-Load-Bearing Units.** Hollow, non-load bearing, concrete masonry units must meet the requirements of ASTM C129, Normal Weight.

913.05. Concrete Block for Drainage Structures

Concrete blocks for manholes, catch basins, and inlets must meet the requirements of ASTM C139 except as modified by this subsection.

A. **Shape.** Block must be solid with parallel inside and outside surfaces, curved to the required radii, and must have a groove or other Department-approved joint at the ends.

B. **Size.** The block manufacturer will select the nominal block dimensions for length and height. Blocks must have a nominal width of 6, 8, or 12 inches, ±3%, as shown on the plans.

Where standard plans call for 12-inch-thick drainage structure walls, the Contractor may use two 6-inch-wide blocks to meet the required width. Blocks must be designed for length so that only full or half-length blocks are required to lay the circular wall of any one course.

The shape of blocks for use in the cones or tops of manholes or other structures must allow for constructing the structure as shown on the plans with inside and outside joints not to exceed ¼ inch in thickness.

913.06. Precast Reinforced Concrete Units for Drainage Structures

Circular precast concrete units with circular reinforcement for tops, risers, and sump bases for manholes, catch basins, and inlets must meet the requirements of AASHTO M199 and the following additions and exceptions:

A. Units must have the internal diameter shown on the plans and must accept standard covers.

B. The joint with the vertical wall of the structure must be the same design as the joints in the circular pipe sections to allow a uniform bearing on the full wall thickness of the pipe.

C. Construct openings for pipe inlets or outlets in the riser sections of drainage structures by blocking out the openings when casting the sections by scribing the openings in the green concrete and removing the green concrete from the openings or by drilling out the openings from cured concrete with a water-cooled diamond bit.

D. Openings in the riser sections must be 3 inches larger than the OD of the inlet or outlet pipe. The interior spacing between openings in a riser section must be at least 12 inches.

E. Obtain the Engineer's approval for the design of units for structure tops and for the design of sump risers with base units. Request approval for sump riser and base units used together.

913.07. Precast Concrete Bases for Drainage Structures

Precast concrete bases for drainage structures for sewers less than 48 inches in diameter must be cast with Grade 3000 or Grade 4000 concrete.

913.08. Structural Tile

A. **Load-Bearing Units.** Structural clay load-bearing tile must meet the requirements of ASTM C34 for Grade LBX.

B. **Non-Load-Bearing Units.** Structural clay non-load-bearing tile must meet the requirements of ASTM C56.

913.09. Precast Concrete Slope Paving Blocks

Blocks must have a compressive strength of at least 2,500 psi for an average of three units with no individual block having a compressive strength of less than 2,000 psi. The average water absorption of three units must be no greater than 10 pounds per cubic foot.

The Department will sample and test precast concrete slope paving blocks in accordance with ASTM C140/C140M with the following exceptions:

A. Test 4 by 4 inch compression test specimens sawn from precast concrete slope paving block units. The specimens will be tested with the load applied in the direction of the thickness of the unit.

B. Determine water absorption using half of the unit used for the compression test specimen.

Section 914. Joint and Waterproofing Materials

914.01. General Requirements

Joint and waterproofing materials for use in concrete construction must meet the requirements of this section.

914.02. Testing

Steel joint material testing must be in accordance with ASTM E8/E8M or ASTM A370 and the ASTM specifications applicable to the specific material.

Other joint and waterproofing material testing must be in accordance with the specified ASTM, AASHTO, or Department methods, as modified by this section.

914.03. Joint Filler for Concrete Construction

Cut joint filler into the shape and to the dimensions shown on the plans. Joint filler must not deform or break due to twisting, bending, or handling when exposed to atmospheric conditions. For concrete pavements, punch holes in the fiber joint filler for load transfer bars in new concrete pavements, as shown on the plans.

A. **Fiber Joint Filler.** Fiber joint filler must meet the requirements of ASTM D1751.

B. **Recycled Rubber Joint Filler.** Recycled rubber joint filler must meet the requirements of ASTM D1751 except that the minimum asphalt content does not apply.

C. **Closed-Cell Polypropylene Foam**. Semi-rigid, closed-cell polypropylene foam joint filler must meet the requirements of ASTM D8139.

914.04. Joint and Crack Sealants for Construction

A. **Hot-Poured Joint and Crack Sealant.** Hot-poured joint and crack sealant must meet the requirements of the Qualified Products List for Hot-Poured, Extra Low Modulus, Joint and Crack Sealant.

   Material containers must be legibly marked with a non-fading, weather-resistant ink or paint. Include the manufacturer’s name or trade name, batch number, recommended pouring temperature, and the maximum safe heating temperature on the label.

B. **Backer Rod for Use with Hot-Poured Joint Sealant.** Backer rod for use with a hot-poured joint sealant must be solid, round, heat-resistant, closed-cell, cross-linked PE foam meeting the requirements of ASTM D5249 for Type I.

914.05. Joint Spall Repair Materials

Select joint spall repair material according to the contract.

914.06. Epoxy Resin Adhesive

Epoxy resin adhesive must be capable of being injected into, and flow along, a crack 0.005 inch wide. Select epoxy-resin adhesive from the Qualified Products List.

Use a fast-setting grout or fast-set temporary seal as recommended by the epoxy resin adhesive manufacturer.

914.07. Dowel Bars for Transverse Expansion and Contraction Joints

Dowel bars must meet the requirements of ASTM A1078/A1078M.

Provide dowel baskets from a Department-approved source. Secure the dowel bars into the baskets by welding or other mechanical method so the dowels maintain alignment during and after concrete placement.

The ends of dowel bars for expansion and contraction joints must be saw cut or sheared and free of burrs. If dowel bars are sheared, ensure that the ends remain round and do not deform. Dowel bars that are not free of burrs, deformation, or other surface defects will be rejected. Protect dowel bars during handling and storage according to ASTM A1078/A1078M.

A. **Coatings for Dowel Bars.** If required, provide dowel bars coated with an epoxy powder coating meeting the requirements of the Qualified Products List. The epoxy powder must be pigmented purple or gray.

   The Engineer may sample and test dowel bars for average coating thickness, and check for chips, cracks, or other damage to the coating and for the presence of a bond breaker, if required, before installation in the concrete construction. Dowels with coatings not meeting the thickness requirements or dowels with coating damage will be rejected.

   Epoxy-coated dowel bars must have an average coating thickness of not less than 0.010 inch or more than 0.014 inch on any bar, with individual determinations on a single bar within 0.004 inch of the average. Coating is not required on the end faces of the bars or on the cylindrical surface within 3 inches of the end fixed in the supporting basket by welding or other mechanical means.

   To prevent bonding to concrete, epoxy-coated dowels must be coated with an asphalt material meeting the requirements of MC 70 or RC 250, as specified in subsection 904.03.B, or an alternative bond-release agent selected from the Qualified Products List. Bond-release agents must provide a pull-out shear bond stress of the dowel bar no greater than

60 psi for initial and final movement of the dowel from the concrete specimen.

The Contractor or supplier may apply asphaltic coatings to the dowel bar and the dowel basket assembly. The manufacturer must apply the alternative bond-release agents to the dowel bar and the dowel basket assembly.

B. **Dowel Bar Expansion Caps.** Dowel bars for expansion joints must include metal or plastic expansion caps as shown on the plans and approved by the Engineer. Expansion caps must be sized to provide a slip fit onto the coated bar.

Expansion caps must have a uniform diameter for a length of at least 4 inches and must include a stop to ensure that the end of the cap remains at least 1 inch away from the end of the dowel bar during concrete placement. Fabricate metal expansion caps from at least 28-gauge sheet steel and close at the sides and end by crimping. Plastic expansion caps must be one piece with a uniform thickness of at least 1/16 inch, entirely closed on the end.

914.08. Devices for Transverse End-of-Pour Joints

Use straight steel tie bar devices for end-of-pour joints.

Straight tie bars for end-of-pour joints must consist of bars of the diameter and length shown on the plans meeting the requirements of ASTM A615/A615M, ASTM A706/A706M, or ASTM A996/A996M (Type R or Type A). Epoxy coat straight tie bars as specified in subsection 905.03.C except that the application of the epoxy coating within 4 inches of each end of the tie bar or the repair of damage to the coating within 4 inches of each end of the bar is not required.

914.09. Lane Ties for Longitudinal Pavement Joints

A. **Straight Tie Bars.** Straight tie bars for longitudinal pavement joints must consist of bars of the diameter and length shown on the plans meeting the requirements of ASTM A615/A615M, ASTM A706/A706M, or ASTM A996/A996M (Type R or Type A). Epoxy coat straight tie bars as specified in subsection 905.03.C except that the application of the epoxy coating within 4 inches of each end of the tie bar or the repair of damage to the coating within 4 inches of each end of the bar is not required.

B. **Bent Tie Bars for Bulkhead Joints.** Bent tie bars for bulkhead joints must consist of bars of the diameter and length shown on the plans. The tie bars must have a yield strength of at least 40,000 psi and be capable of withstanding bending to a 90° angle, re-straightening, and then

withstanding the pull-out test requirements specified in subsection 602.03.F.

Epoxy coat bent tie bars as specified in subsection 905.03.C except that the application of the epoxy coating within 4 inches of each end of the tie bar or the repair of damage to the coating within 4 inches of each end of the bar is not required.

914.10. Structure Expansion Anchors and Bolts

Select expansion anchors from the Qualified Products List in the sizes and shapes shown on the plans. Bolts for flush-type anchors must meet the requirements of ASTM A307 for Grade A.

914.11. Preformed Waterproofing Membranes and Joint Waterproofing

Select preformed waterproofing fabric system, including the manufacturer's recommended primer, from the Qualified Products List.

914.12. Elastomeric Bearings and Pads

A. **Bearings.** Elastomeric bearings must meet the requirements of the *AASHTO LRFD Bridge Construction Specifications*, Subsection 18.2, "Elastomeric Bearings," for 100% virgin polychloroprene (neoprene) or polyisoprene (natural rubber) bearings and must be classified as being of low-temperature Grade 4 or 5.

Laminated bearings must have a shear modulus of 100 psi ±15 psi. Plain bearings must have a shear modulus of 200 psi ±30 psi. Rolled steel sheet laminates must meet the requirements of ASTM A36/A36M or ASTM A1011/A1011M, Grade 36, Grade 40, or Grade 50. Blast-clean the surfaces of the laminates where elastomers are to be bonded.

Elastomeric bearings must be tested and accepted in accordance with Section 8 of AASHTO M251 except that the definition of a lot specified in Subsection 8.2 of AASHTO M251 is revised as follows: Sampling, testing, and acceptance consideration will be made on a lot basis. A lot of bearings must be considered to be a group of bearings that are manufactured over a 4-month period from the same elastomer recipe, cured under the same conditions, and type (plain, fabric laminated, or steel-laminated).

B. **Leveling Pads.** Elastomeric leveling pads (1/8 inch thick or as specified in the contract) must meet the requirements of the *AASHTO LRFD Bridge Construction Specifications*, Subsection 18.2, "Elastomeric Bearings," for 100% virgin polychloroprene (neoprene) or polyisoprene (natural rubber) bearings and must be classified as being of low-temperature Grade 3. Leveling pads must be plain elastomer and have a hardness between

50 and 70 on the Shore A scale. Provide certification to the Engineer that elastomeric leveling pads conform to this subsection.

Elastomeric leveling pads must be tested and accepted in accordance with Appendix X1 of AASHTO M251 except that a lot is defined to be material that is manufactured from the same elastomer recipe and cured under the same conditions and tested no less than once per year.

914.13. Non-Metallic Washers

Washers used as spacers between pin plates and link plates must be HDPE, non-metallic washers meeting the requirements of ASTM D4976, Group 2, Class 4, Grade 4.

Section 916. Erosion and Sedimentation Control Materials

916.01. Stone Used For Erosion and Sedimentation Control

Provide cobblestone, coarse aggregate 3×1, and riprap for erosion and sedimentation control on slopes, in ditches, and to construct erosion control devices, including check dams. Furnish natural stone that is sound, non-stratified, durable rock. Unless otherwise specified and not prohibited by permit, the Contractor may use sound pieces of broken concrete free of protruding reinforcement. Do not use crushed HMA pavement or broken brick as erosion and sedimentation control material.

A. **Cobblestone.** Furnish cobblestone that consists of rounded or semi-rounded rock fragments with an average dimension from 3 to 10 inches.

B. **Coarse Aggregate 3x1.** Furnish coarse aggregate 3×1 that meets the requirements of commercially graded material with particle sizes from ¾ to 3 inches.

C. **Riprap.** Furnish riprap that is natural stone, solid precast concrete blocks of Grade 3000 concrete, or sound pieces of broken concrete. Riprap must not contain soil. Randomly score the face of the precast concrete blocks to provide plane-of-weakness joints in sections with areas from 4 to 9 square feet. Lifting lugs, cast into concrete blocks, must not project above the finished concrete surface.

   The Department classifies riprap as plain or heavy, based on the horizontal cross section dimensions (“footprint” dimensions) and the in-place thickness of the individual pieces.

   1. **Plain Riprap.** Provide natural stone and broken concrete with footprint dimensions from 8 to 16 inches and an in-place thickness of at least 16 inches. The Contractor may use smaller pieces to fill spaces for better slope protection.

      Provide precast concrete block at least 6 inches thick with a surface area no greater than 15 square feet.

   2. **Heavy Riprap.** The smallest footprint dimension for natural stone and broken concrete must be at least 16 inches. The maximum-to-minimum dimension ratio must be no greater than 3:1. The in-place thickness must be at least 36 inches.

      Provide precast concrete block at least 16 inches thick with a surface area no greater than 20 square feet.

D. **Requirements for Specific Erosion and Sedimentation Control Applications**

1. **Checkdams.** Construct checkdams for ditches with grades less than 2% using cobblestone or broken concrete from 2 to 4 inches. Construct checkdams for ditches with grades 2% or greater using cobblestone or broken concrete from 3 to 10 inches.
2. **Stone Filled Bags.** Furnish coarse aggregate 6A, or open-graded aggregate 46G.
3. **Sand Filled Bags.** Furnish Class II granular material.
4. **Aggregate Cover.** Furnish dense-graded aggregate 21AA, open-graded aggregate 46G, coarse aggregate 6A, or coarse aggregate 3×1 produced natural aggregate, iron blast-furnace slag, reverberatory furnace slag, or crushed Portland cement concrete.
5. **Gravel Access Approach.** Furnish coarse aggregate 3×1, or as approved by the Engineer, that is produced from natural aggregate, iron-blast furnace slag, reverberatory furnace slag, or crushed Portland cement concrete.

916.02. Silt Fence

Geotextile for an erosion-control silt fence must meet the requirements of subsection 910.04.

Attach geotextile to machine-pointed, No. 2 common grade hardwood posts with at least five staples through wood lath at least ⅜ inch thick and 2.0 feet long. Maximum post spacing is 6½ feet.

Furnish posts at least 36 inches long with a cross sectional area of at least 2¼ square inches and a smallest dimension of 1½ inches.

Identify the fabricator with at least two permanent markings or affixed labels on each assembled roll of silt fence.

916.03. Temporary Plastic Sheet or Geotextile Cover

Mend or patch torn or punctured plastic sheets or geotextile cover with additional material of the same quality.

A. **Sheeting Material.** Furnish plastic sheeting material at least 6.0 mils thick with a UV ray inhibitor or PVC at least 10 mils thick. Use PVC material instead of plastic sheet from November 15 to April 1 or if expecting freezing conditions. Store and handle plastic sheet and PVC material in accordance with the manufacturer's recommendations. Do not expose sheeting material to heat or direct sunlight that would diminish strength or toughness.

B. **Geotextile Cover.** Geotextile cover must meet the requirements of subsection 910.03.A for geotextile blanket.

916.04. Inlet Protection Fabric Drop

Furnish geotextile silt fence fabric meeting the requirements of subsection 916.02 or geotextile blanket meeting the requirements of subsection 910.03.A. Furnish 34R or 6A for gravel filter berm.

916.05. Inlet Protection Geotextile and Stone and Drop Inlet Sediment Trap

Furnish geotextile blanket meeting the requirements of subsection 910.03.A. Furnish 34R, 46G, or 6A.

916.06. Sand Fence and Dune Stabilization

Furnish HDPE mesh fabric with a design opening of ½ to 1 inch. Minimum sand fence height is 4 feet.

916.07. Turbidity Curtain

Deliver turbidity curtain pre-assembled that includes the geosynthetic fabric, connection and securing mechanisms, flotation devices, stakes, and ballast chain.

A. **Geosynthetic.** Provide geosynthetic for turbidity curtain meeting the minimum physical requirements for stabilization geotextile that except permittivity must be no greater than 0.2 second^{-1} as specified by ASTM D4491/D4491M, and the trapezoidal tear strength must be least 50 pounds in accordance with ASTM D4533/D4533M.

The Contractor may use polymer-impregnated geosynthetics instead of meeting permittivity and opening size requirements.

Hemmed pockets to accommodate flotation devices and bottom weights must be sewn or heat bonded. Panel ends must include metal grommets through a reinforced hem. Tie connections between panels with synthetic or wire rope to prevent water flow through the joint.

B. **Flotation.** Furnish closed cell polystyrene flotation devices. Determine the required buoyancy based on site conditions. Flotation devices must ensure adequate freeboard to prevent overtopping.

C. **Stakes.** If using stakes to maintain curtain alignment, provide hardwood or steel stakes of lengths and cross sections capable of supporting the curtain. The Contractor may use external supports with embedment depths greater than 1½ feet. Maximum stake spacing is 6½ feet.

D. **Hardware.** Hardware, including stakes, ballast chain, connection bolts, reinforcement plates, and tension cables, must be galvanized, stainless steel, or aluminum and corrosion resistant. The mass of the ballast chain must be at least 0.7 pound per foot and be capable of maintaining the geosynthetic in a vertical position.

Section 917. Turf and Landscaping Materials

917.01. General Requirements

Nursery stock, seed, sod, mulching material, and chemical fertilizer nutrients must meet the requirements of this section. Provide documentation of inspection for plant diseases and insect infestation in accordance with state and federal laws.

917.02. Testing

The Engineer will require visual inspection or other acceptance tests of landscaping material as specified in this section or the MDOT's *Materials Quality Assurance Manual*.

917.03. Nursery Stock

Nursery stock must come from nurseries in Zone 4 or Zone 5 of the 2012 United States Department of Agriculture (USDA) Hardiness Zone Map for landscaping in Michigan's Lower Peninsula.

Nursery stock for landscaping in Michigan's Upper Peninsula must come from nurseries in Zone 3 or Zone 4.

Nurseries in Zone 6 of the Upper Great Lakes Region are allowed as follows:

A. At or north of latitude 40 degrees North;

B. Zone 6b includes only nurseries in counties that border the Great Lakes; and

C. Zone 6 plants are not acceptable for use in Upper Peninsula or in Lower Peninsula counties north of US-10 except for counties bordering Lake Michigan.

Nursery stock must meet the requirements of ANSI Z 60.1.

Nursery stock must be true to the type and name specified by the American Joint Committee on Horticultural Nomenclature's *Standardized Plant Names*. Label each plant type with the size, species, and variety. Include the common and scientific names on the label. Provide first-class quality stock with well-developed branch systems and vigorous, healthy root systems. Ensure uniform and straight tree trunks. Nursery stock grown in sandy soils or any damaged, diseased, under-developed, or infected plant material will be rejected. Provide trees, ornamentals, and shrubs as noted on the plans.

Notify the Engineer a minimum of 24 hours before stock delivery. Provide an invoice showing plant sizes, species, and varieties for each shipment. Plants will not be accepted until the stock is delivered and inspected at the project.

The Engineer may examine plants at the nursery by removing soil from the root systems of balled or container grown plants or by digging in the nursery row. The Department will not pay for plants that fail the Engineer's inspection.

A. **Deciduous Shade Trees.** Deciduous shade trees must be straight and symmetrical with a persistent, central main leader. The crown must be in proportion to the total height of the tree.

   Clumps must have at least two stems originating from a common base at the groundline.

B. **Small Trees, Ornamentals, and Shrubs.** Small trees, ornamentals, and shrubs must be well formed with a crown typical of each species or variety. Pruning, shearing, or sculpting plants to meet the sizes shown on the plans is not allowed.

C. **Evergreen Trees.** Evergreen trees must be typical of the species and not sheared or color treated. Do not use evergreen trees grown for Christmas trees. Antitranspirant protection for evergreen trees is allowed.

D. **Vines, Ground Cover, and Herbaceous Ornamental Plants.** Plants must be in individual containers, at least 1 year old, grown in pots long enough to ensure root growth capable of holding soil in place and retaining the container shape when removed from the pot. Vines must have at least four runners 1½ feet long. Leaf and stem structure of ground cover plants must be proportional to the root systems and typical of species or variety. Provide herbaceous plants in a heathy and vigorous growing condition.

917.04. Balling Material

Use untreated burlap as balling material. Do not use synthetic balling materials such as nylon or plastic.

917.05. Bracing and Guying Materials

A. **Wire.** For trees less than 4 inches in diameter, provide No. 11 galvanized steel guy wire. For trees with a diameter greater than 4 inches, provide No. 9 galvanized steel guy wire. Provide new wire free of bends and kinks.

B. **Hose.** Provide ¾-inch reinforced rubber garden hose or steam hose.

C. **Stakes.** Provide green metal T-section posts without anchor plates for bracing trees. For shade trees, the minimum post length is 8 feet. For evergreen trees, the minimum post length is 6 feet.

Provide nominal 2- by 4-inch stock stakes 24 inches long for guying plants. Stakes must be beveled on two or four sides to provide a point on one end.

917.06. Topsoil

The Engineer will review the topsoil testing report to determine whether it meets the organic matter, pH, gradation, and nutrient levels as stated in Table 917-1. Ensure that the topsoil is contamination-free and clean at the source prior to transport to the project site. Obtain the Engineer's approval for salvaged topsoil prior to use. Topsoil must meet the following requirements:

A. **Testing Reports**. Reports must contain at a minimum the following tests and the recommendation from the laboratory for amending the soil.

1. Mechanical gradation (particle size analysis);
2. Sand/Silt/clay content determined by hydrometer test of soil passing the No. 200 sieve;
3. Organic matter determined by an ash burn test or Walkley/Black test; and
4. Chemical analysis for nitrate nitrogen, ammonium nitrogen, phosphorus, potassium, calcium, aluminum, lime requirements, and acidity (pH).

Table 917-1:
Topsoil Requirements

Requirement	Loam	Sandy Loam	Silty Loam	Clay Loam	Test Method
Passing ¾-inch sieve	100%	100%	100%	100%	ASTM D6913
Passing No. 4 sieve	>85%	>95%	>90%	>90%	ASTM D6913
Clay	10–30%	0–20%	0–25%	25–40%	ASTM D6913
Silt	30–50%	0–30%	50–90%	15–55%	ASTM D6913
Sand	25–65%	45–85%	0–50%	20–50%	ASTM D6913
Organic matter	3–10%	3–10%	3–10%	3–10%	ASTM D2974
pH	5.5–7.5	5.5–7.5	5.5–7.5	5.5–7.5	ASTM G51

917.07. Compost

The Engineer will review the compost test results to determine whether they meet the U.S. Composting Council's requirements. The Engineer will also visually inspect and approve the compost at the composting site for physical contaminants.

Compost must be mature, stabilized, humus like, and dark brown or black compost derived from the aerobic decomposition of yard clippings or other compostable materials as defined in the Natural Resources and Environmental Protection Act, Part 115, Solid Waste Management, MCL 324.11501 et seq., and federal laws. Compost must be certified through the US Composting Council's Seal of Testing Assurance Program and meet the following requirements:

A. Must be capable of supporting plant growth;

B. Must be free of objectionable odor, plastic, glass, metal, and other physical contaminants;

C. Must not contain viable weed seeds or other plant parts capable of reproducing with the exception of airborne weed species; and

D. Must not produce visible free water or dust during handling.

917.08. Peat Moss

Peat moss must consist of finely shredded sphagnum or fibrous peat moss of a Department-approved commercial grade, free of woody substance.

917.09. Fertilizers

Provide standard, commercial, packaged, or bulk product fertilizers in granular or liquid form. Each container of packaged fertilizer must be marked with the content analysis showing the minimum percentages of total nitrogen, available phosphoric acid, and soluble potash. If providing bulk fertilizer, provide an invoice with each shipment indicating the minimum percentages of total nitrogen, available phosphoric acid, and soluble potash.

A. **Landscape Fertilizers**

1. **Planting Fertilizers.** For mixing with peat moss and topsoil, provide ready-mixed granular fertilizer containing equal amounts of phosphorus and potassium by weight. Each cubic yard of prepared soil must contain chemical fertilizer to provide 1 pound of available phosphorus and 1 pound of available soluble potassium.

2. **Watering Fertilizers.** For application during watering, provide water soluble, nitrogen-enriched fertilizer containing 8.3 pounds of available nitrogen per 1,000 gallons of water.

B. **Seeding and Sodding Fertilizers.** Fertilizers in each class must contain a water-insoluble and water-soluble component.

1. **Class A.** Provide and apply as specified by this subsection and as indicated by soil tests:

a. **Water-Insoluble Fertilizer.** Apply 32 pounds of water-insoluble nitrogen per acre (e.g., 128 pounds of ureaform, 115 pounds of isobutylidene diurea). Provide the water-insoluble nitrogen from ureaformaldehydes, coarse grade isobutylidene diurea, or both.

b. **Water-Soluble Fertilizer.** Apply 48 pounds of nitrogen, phosphorous, and potassium nutrient per acre (e.g., 253 pounds of 19-19-19, 400 pounds of 12-12-12). Provide water-soluble fertilizer containing a 1:1:1 ratio of nitrogen, phosphorous, and potassium. Ensure that the fertilizer components include urea, diammonium phosphate, and potassium chloride.

2. **Class B.** Provide and apply as specified by this subsection and as indicated by soil tests:

a. **Water-Insoluble Fertilizer.** Apply 32 pounds of water-insoluble nitrogen per acre. Provide the water-insoluble nitrogen from ureaformaldehydes, coarse grade isobutylidene diurea, or both.

b. **Water-Soluble Fertilizer.** Apply nitrogen at a rate of 48 pounds of nutrient per acre and 40 pounds of potassium per acre. Ensure that fertilizer components include urea and potassium chloride.

3. **Class C.** Provide and apply as specified by this subsection and as indicated by soil tests:

a. **Water-Insoluble Fertilizer.** Apply 32 pounds of water-insoluble nitrogen per acre. Provide water-insoluble nitrogen from ureaformaldehydes, coarse grade isobutylidene diurea, or both.

b. **Water-Soluble Fertilizer.** Apply nitrogen at a rate of 48 pounds of nutrient per acre. Ensure that the fertilizer components include urea.

917.10. Water

Use water that meets the requirements of section 911.

917.11. Seed

Provide the required certified seed mixture as specified in Table 917-2. Select each species of seed from the Qualified Products List. Supply seed in durable bags with a tag marked by the manufacturer and supplier of the blended mix showing the species and variety name, lot number, net weight of contents, purity, and germination.

Table 917-2:
Seed Mixtures

Species	Minimum Purity (%)	Germination (%)	Seed Mixture Proportions (% by weight)							
			TDS	THV	TUF	TGM	THM	CR	TSM 6–24 months	TSM >24 months
Kentucky blue grass	98	85	5	15	10	10	30	—	—	—
Perennial ryegrass	96	85	25	30	20	20	20	—	50	50
Hard fescue	97	85	25	—	20	30	—	—	—	—
Creeping red fescue	97	85	45	45	40	40	50	—	—	—
Fults salt grass	98	85	—	10	10	—	—	—	—	—
Cereal rye	85	85	—	—	—	—	—	100	—	—
Spring oats	85	85	—	—	—	—	—	—	50	50

CR = cereal rye
TDS = turf dry sandy
TGM = turf medium to heavy soil
THM = turf loamy to heavy
THV = turf heavy soil
TSM = temporary seeding (months)
TUF = turf urban freeway

Seed must be tested in accordance with the *AOSA [Association of Official Seed Analysts] Rules for Testing Seeds*. The Engineer will evaluate deficiencies below the percentage required for purity and germination to determine acceptability.

917.12. Sod

Provide sod consisting of a densely rooted blend of at least two bluegrass varieties with at least 30% creeping red fescue content, free of weeds, and grown on the same or similar soil as the topsoil on the project. Obtain the Engineer's approval of the sod in the sod field before harvesting. Before cutting the sod, mow the grass to 3 to 4 inches above the ground surface.

Cut the sod from ½ to ¾ inch thick. If cutting sod into strips, cut in small uniform units of approximately 10 square feet per roll to ensure ease of handling of the sod without tearing or breaking. The sod may be cut, transported, and laid in large rolls with machinery designed for that purpose.

A. **Pegs for Sodding.** Provide pegs of sound wood, at least 10 inches long, with a cross-sectional area of at least 0.75 square inch for pegging sod. Use longer pegs in sandy or similar soils.

917.13. Mulching Materials for Nursery Stock

A. **Shredded Bark.** Provide shredded hardwood bark mulch consisting of tree bark stripped and shredded from saw logs with a debarking machine. Shredded hardwood bark mulch must be capable of passing through a conventional mulch blower. Do not use wood chips or recycled construction material.

917.14. Mulch for Seed

A. **Loose Mulch.** Provide clean, undamaged, and rot-free straw in an air-dry condition for loose mulch. Loose mulch must be free of weed seeds and other deleterious material.

B. **Turf Mulch Blankets.** Select turf mulch blankets from the Qualified Products List. Anchor according to the manufacturer's specifications. No metal stakes or staples are allowed.

1. **High-Velocity Mulch Blankets.** High-velocity mulch blankets must have net covering on two sides. The net must meet the requirements of subsection 917.14.D and be capable of reinforcing the blanket to prevent damage during shipping, handling, and installation.

    a. **High-Velocity Excelsior Mulch Blankets.** Provide high-velocity excelsior mulch blankets that meet the following requirements:

i. Blanket must consist of a uniform layer of interlocking excelsior fibers cut from sound, green timber;

ii. The average roll weight for an entire shipment must be 12 ounces per square yard ±10%;

iii. Blankets must be shipped in tightly compressed rolls; and

iv. Each roll must have the roll weight and the manufacturer's name written or stenciled on the roll wrapper or on an attached tag.

b. **High-Velocity Straw Mulch Blankets.** Provide high-velocity straw mulch blankets that meet the following requirements:

i. Blankets must consist of a uniform layer of clean wheat straw that is free of weeds and weed seed;

ii. When dry, the blankets must weigh 8 ounces per square yard ±10%;

iii. The straw and net must be stitched together to create a uniform mat;

iv. Blankets must be shipped in tightly compressed rolls; and

v. Each roll must have the roll weight and the manufacturer's name written or stenciled on the roll wrapper or on an attached tag.

2. **Mulch Blankets**

a. **Excelsior Mulch Blankets.** Provide excelsior mulch blankets meeting the requirements of high-velocity excelsior mulch blankets except that the blankets must weigh from 8 to 12 ounces per square yard and have netting on one side.

b. **Straw Mulch Blankets.** Provide straw mulch blankets meeting the requirements of high-velocity straw mulch blankets except that the blankets must have netting on one side.

C. **Mulch Anchoring.** Select mulch anchoring material from the Qualified Products List.

1. **Latex-Base.** Provide latex-base mulch-anchoring material composed of 48% styrene, 50% butadiene, and 2% additive by weight. The mulch-anchoring material must contain from 42.0 to 46.0% solids and a pH, as shipped, from 8.5 to 10.0. Protect the emulsion from freezing and prolonged exposure to sunlight.

2. **Recycled Newsprint.** Provide recycled newsprint mulch consisting of specially prepared, biodegradable, shredded, recycled newsprint fibers. The recycled newsprint fiber must:

   a. Have a moisture content (total weight) no greater than 12%;

   b. Have a high-grade newsprint content of at least 96% by weight (oven-dry);

   c. Include tackifier content from 1.5 to 3% by weight;

   d. Have a water-holding capacity of at least 32 ounces per 3.5 ounces of fiber;

   e. Contain a wetting agent and a defoaming agent; and

   f. Contain a nontoxic bright green or blue dyestuff that adheres to the fiber to minimize leaching of the color after application.

3. **Wood Fiber.** Provide specially prepared, biodegradable, air-dried, virgin wood fibers manufactured from 100% whole wood chips. Do not use recycled materials. The wood fiber must:

   a. Have a moisture content (total weight) no greater than 12%;

   b. Have an organic wood fiber content of at least 95% by weight (oven-dry);

   c. Include tackifier content from 3 to 5% by weight;

   d. Have a water-holding capacity of at least 35 ounces per 3.5 ounces of fiber;

   e. Be dyed with a green or blue biodegradable dye; and

   f. Contain no growth- or germination-inhibiting materials.

4. **Guar Gum.** Provide guar gum tackifiers consisting of at least 95% guar gum by weight with the remaining 5% by weight consisting of dispersing and crosslinking additives.

5. **Other Tackifiers.** Provide water-soluble natural vegetable gums, guar gums blended with gelling and hardening agents, or a water-soluble blend of hydrophilic polymers, viscosifiers, sticking aids, and other gums as tackifiers.

D. **Mulch Netting**

1. **Netting.** Provide mulch net with a mesh size from ½ by ½ inch to 1½ by 2 inches, formulated from or treated with a chemical that promotes the breakdown of the net within the first growing season

after placement. Mulch netting must be strong enough to hold the mulch in place and still deteriorate when exposed to sunlight.

2. **Net Anchors.** Provide wood or other biodegradable net anchors at least 6 inches in length. Do not use steel wire staples or pins to anchor mulch blankets or netting.

917.15. Weed Control

Provide herbicides registered for use on highway right-of-way by the Michigan Department of Agriculture & Rural Development and the United States Environmental Protection Agency. Obtain the Engineer's approval of herbicides prior to use. Do not use restricted-use herbicides.

917.16. Growth Preventive Material

Provide cut stump herbicide composed of the ingredients and nominal concentrations as appropriate.

A. **Upland Location**

1. 83% paraffin oil, surface active compounds, and coupling agents with blue colorant

   17% triclopyr, butoxyethyl ester

2. 82% paraffin oil, surface active compounds, and coupling agents with blue colorant

   15% triclopyr, butoxyethyl ester

   3% isopropylamine salt of imazapyr

B. **Wetland or Aquatic Location**

1. 100% triclopyr choline salt with blue colorant

Section 1004. Portland Cement Concrete Mixtures

1004.01. Description

Concrete must consist of a mixture specified by the grade of concrete of portland cement or blended portland cement; fine aggregate; intermediate aggregate, when required or permitted; coarse aggregate; water; and admixture, when required or permitted.

1004.02. Materials

Provide materials in accordance with the following:

Portland Cement 901
Slag Cement 901
Fly Ash 901
Coarse Aggregate 6A, 6AA, 6AAA, 26A, 29A, 17A 902
Intermediate Aggregate 902
Fine Aggregate 2NS, 2SS 902
Concrete Admixtures 903
Water 911

Select aggregates for the required grade of concrete in accordance with Table 1004-1.

Stone sand 2SS is not permitted in concrete exposed to vehicular traffic.

1004.03. General Requirements

A. **Mix Design and Documentation.** Design concrete mixtures meeting the requirements of Table 1004-1. Provide the grade of concrete for the section number reference application specified in Table 1004-1 or as specified in the contract. Concrete grades ending in HP signify high-performance concrete.

Variance requests must be submitted in writing and must include the mix design, JMF, and associated trial batch verification test data. Do not use a grade of concrete with a specified 28-day compressive strength different from what is designated for the application.

B. **Cementitious Materials Content.** Type III cement is not permitted.

Use combined weight of total cementitious materials when determining compliance with the water-cementitious ratio and cementitious material requirements.

All high-performance concrete requires 25 to 40% replacement of portland cement with supplementary cementitious materials (SCM). For all other grades of concrete, replacing portland cement with SCM is permitted. Unless otherwise specified in the contract, do not exceed a total of 40%

replacement by weight of portland cement with SCMs. Acceptable SCMs are listed in subsections 901.06, 901.07, and 901.08.

C. **Optimized Aggregate.** Optimized aggregate gradation is required for high-performance concrete and concrete mixtures that are placed using a pump. Concrete mixtures for tremie and drilled shaft applications do not require optimized aggregate gradation. Prepare the optimized aggregate gradation and perform process control according to the procedure for optimized aggregate gradation in the contract.

Aggregates for mixture requiring optimized aggregate gradation must meet the physical requirements specified in subsection 902.03.C. The physical requirements for aggregates used in concrete mixtures for all other applications are according to the contract.

When high-performance concrete is specified in the contract, provide Grade 3500HP for mainline pavement, shoulder, miscellaneous pavement (including ramps), concrete pavement overlay applications, and bridge substructure applications; Grade 4500HP for bridge deck applications; and either concrete Grade 3500HP or 4500HP for bridge approach slab applications. The Engineer may approve Grade 3500HP or 4500HP for other applications.

Unless otherwise specified in the contract, concrete mixtures with optimized aggregate gradation may be used instead of standard concrete mixtures, as approved by the Engineer.

D. **Air Content.** Air-entrained concrete is required unless otherwise specified.

The percentage of air in fresh concrete must meet the requirements of Table 1004-1. The Engineer will allow non-air-entrained concrete for use in steel piles that are not subject to freezing.

Use ASTM C231/C231M or ASTM C173/C173M to determine the air content of normal weight concrete. Use ASTM C173/C173M to determine the air content of lightweight concrete and concrete containing highly porous aggregates.

E. **Consistency.** Determine consistency using the slump test in ASTM C143/C143M. Ensure that slump does not exceed the specifications in Table 1004-1.

F. **Concrete Admixtures.** Unless otherwise specified in the contract, concrete admixtures must be selected from the Qualified Products List. The different types of admixtures are listed in subsection 903.02.

For night casting, a water-reducing admixture may be used instead of a water-reducing retarding admixture as long as the concrete can be placed

and finished in the sequence specified on the plans prior to initial set, the concrete is not subjected to residual vibration, and the concrete is not within the areas influenced by dead load deflections as a result of adjacent concrete placement operations. When the maximum air temperature is not forecasted to exceed 60°F for the day, the Contractor may use a water-reducing admixture or a water-reducing retarding admixture.

Ensure that concrete in concrete diaphragms contains a water-reducing admixture or a water-reducing retarding admixture.

Set accelerating admixtures are prohibited unless otherwise specified in the contract.

De-foaming (air detraining) admixtures are prohibited.

G. **Concrete Temperature.** Use ASTM C1064/C1064M to determine concrete temperature.

1004.04. Measurement and Payment

The cost of PCC is included in unit prices for related pay items.

The Engineer's QA test results will be used to determine the pay factor and price adjustments. The Contractor's QC will not be used for pay factor and price adjustments.

Pay factor and price adjustments will be applied according to the contract.

Table 1004-1:
Concrete Mixtures

		Concrete Grade								
		3000	**3500**	**3500HP[a],[b]**	**4000**	**4000HP[a],[b]**	**4500**	**4500HP[a],[b]**	**M**	**X**
Compressive strength (psi)	7 day	2200	2600	2600	3000	3000	3200	3200	Commercial-grade concrete containing 517 lb/cyd. Portland cement may be replaced with an SCM.	Unless otherwise specified, Grade X concrete contains 282 lb/cyd of cement.
	28 day	3000	3500	3500	4000	4000	4500	4500		
	70%	2100	2450	2450	2800	2800	3150	3150		
Flexural strength (psi)	7 day	500	550	550	600	600	625	625		
	28 day	600	650	650	700	700	750	750		
	70%	420	455	455	490	490	525	525		
Slump (inch)		[c]–[f]	[c]–[k]	[c]–[k]	[l]–[n]	[l]–[n]	[d]–[f]	[e]–[f]		
Cementitious material content (lb/cyd)		489–517	517–611[o]	470–564[o]	517–611	517–611	517–658	517–658		
Class of coarse aggregate		[p]–[r]								
Maximum w/cm ratio		0.45								
Air content range		5.5 – 8.5%								
Section reference		402, 403, 602, 803, 804, 806, 808, 810, 813, 814, 819	401, 602, 603, 705, 706, 712, 713, 718, 801, 802, 803, 810, 819	401, 602, 603, 706, 712, 713, 718, 801, 802, 803, 810, 819	705, 922	705, 922	706, 711, 712	706, 711, 712	N/A	N/A

HP = high performance

(a) HP mixtures require optimized gradation meeting subsection 1004.03.C.

(b) HP mixtures require 25 to 40% replacement of portland cement with an SCM.

(c) 0- to 3-inch slump for mixtures for pavements.

(d) 0- to 3-inch slump without admixtures or with Type A or D admixture.

(e) 0- to 6-inch slump after the addition of Type MR admixture.

(f) 0- to 7-inch slump after the addition of Type F or G admixture.

(g) 3- to 7-inch slump for tremie applications without admixture or with Type A or D admixture.

(h) 3- to 7-inch slump for tremie applications after the addition of Type MR admixture.

(i) 3- to 8-inch slump for tremie applications after the addition of Type F or G admixture.

(j) 6- to 8-inch slump for dry placed drilled shafts.

(k) 7- to 9-inch slump for wet placed drilled shafts.

(l) 3- to 5-inch slump without admixtures or with Type A or D admixture.

(m) 3- to 6-inch slump after the addition of Type MR admixture.

(n) 3- to 7-inch slump after the addition of Type F or G admixture.

(o) For concrete pavement repair mixtures, use 658 lb/cyd of cement when the weather is forecast to be above 50°F or 752 lb/cyd when the weather is forecast to be 50°F or below.

(p) Use aggregates only from geologically natural sources for pavement, shoulder, miscellaneous pavement (including ramps), concrete pavement overlay, bridge approach slab, structural concrete, drilled shaft, bridge railing, and bridge sidewalk applications.

(q) Unless otherwise required, use Coarse Aggregate 6AA or 17A for exposed structural concrete in bridges, retaining walls, and pump stations.

(r) The flexural and compressive strengths are not part of the specifications but are listed for informational purposes only and are the minimum strengths anticipated for the mix proportions specified for the various grades of concrete when cured under standard conditions.

Section 1005. Mortar and Grout Mixtures

1005.01. Description

This work consists of producing and furnishing mortars and grouts.

1005.02. Materials

Provide materials in accordance with the following:

Portland Cement Type I, Type IA 901
Masonry Cement Type N, Type S, Type M..... 901
Hydrated Lime Type S, Type SA 901
Fine Aggregate 2NS, 2MS 902
Air-Entraining Admixture 903
Water 911

A. **Standard Mortars and Grouts.** Proportion cement and fine aggregates as specified in Table 1005-1 and Table 1005-2 by weight for batches of at least 1 cubic yard and by weight or volume for smaller batches. Add water to obtain a mortar or grout of the required consistency.

B. **Non-shrinking Mortar and Grout, Type H-1 (Non-metallic).** Provide Type H-1 non-shrinking mortar and grout, selected from the Qualified Products List, for filling post-tensioning stress pockets in fascia beams of prestressed box beams, under leveling plates supporting structures, for grouting dowels, and under temporary supports.

C. **Expansive Grout, Type E-1.** Provide Type E-1 expansive grout for filling the void around post-tensioned tendons in precast concrete box beams. Proportion the grout as follows:

1. Type I portland cement, 94 pounds;
2. Water no greater than 5 gallons; and
3. Expansive admixture, as recommended by the manufacturer.

Do not use sand in the grout mixture. Do not use grout containing aluminum or other components that produce hydrogen, carbon dioxide, or oxygen gas.

Ensure that grout attains a 28-day minimum compressive strength of 3,000 psi in accordance with ASTM C942, except proportion the grout as specified in this subsection.

Do not use expansive admixtures, plasticizing, or water-reducing agents that contain chloride ions in excess of 0.50% by weight, fluorides, sulfides, nitrates, thixotropic additives, or chemicals that may contribute to stress corrosion in steel.

Provide admixtures in liquid or solid form. Use a gas-evolving material, well dispersed throughout the admixture. Provide grout with an unrestrained expansion from 5 to 10%, in accordance with ASTM C940/C490M, except proportion the grout as specified in this subsection and determine expansion at 3 hours.

1005.03. Construction

The contractor may remix mortars and grouts.

Do not retemper mortars and grouts or use grout and mortar after it begins to set.

Do not place mortar and grout on materials that are below 40°F. Provide protection to maintain a temperature of 45°F or higher during the curing period.

1005.04. Measurement and Payment

The cost of producing and furnishing mortar and grout is included in the unit prices for other relevant pay items.

Table 1005-1:
Proportioning Standard Mortars and Grouts by Dry Weight

		Materials				Mix Proportions by Dry Weight (lb/cyd)				
Mortar or Grout Type	**General Use**	**Portland Cement**	**Masonry Cement**	**Hydrated Lime**	**Fine Aggregate**	**Portland Cement**	**Masonry Cement**	**Hydrated Lime**	**Fine Aggregate**	**Net Water**
R-1 (grout)	Bond or primer coat	Type I, IA	—	—	2NS	1175	—	—	964	705
R-2 (mortar)[(a)]	Patching spalls; filling space between box beams	—	Type M	—	2MS	—	930	—	2137	415
		Type I	Type N	—	2MS	468	349	—	1991	415
		Type I, IA	—	Type S, SA	2MS	828	—	75	2016	415
		Type I, IA	—	—	2MS,2NS	930	—	—	1966	415
R-3 (mortar)[(a)]	Setting precast concrete barriers; filler between slope protection blocks and riprap	Type I, IA	—	—	2NS	765	—	—	2266	353

(a) Provide an entrained air content of 14% ±4% for mortars by using masonry cement, Type IA portland cement, Type SA lime, or an air-entraining admixture. Do not combine masonry cement and Type IA portland cement or Type IA portland cement and Type SA lime unless tests indicate that the air content is within acceptable limits.

Table 1005-2:
Proportioning Standard Mortars and Grouts by Bulk Volume Parts

Mortar or Grout Type	General Use	Materials				Mix Proportions by Bulk Volume Parts			
		Portland Cement	Masonry Cement	Hydrated Lime	Fine Aggregate	Portland Cement	Masonry Cement	Hydrated Lime	Fine Aggregate
R-1 (grout)	Bond or primer coat	Type I, IA	—	—	2NS	1	—	—	1
R-2 (mortar)[a]	Patching spalls; filling space between box beams	—	Type M	—	2MS	—	1	—	2½
		Type I	Type N	—	2MS	[b]	[b]	—	[b]
		Type I, IA	—	Type S, SA	2MS	[b]	—	[b]	[b]
		Type I, IA	—	—	2MS, 2NS	1	—	—	2½
R-3 (mortar)[a]	Setting precast concrete barriers; filler between slope protection blocks and riprap	Type I, IA	—	—	2NS	1	—	—	3½

(a) Provide an entrained air content of 14% ±4% for mortars by using masonry cement, Type IA portland cement, Type SA lime, or an air-entraining admixture. Do not combine masonry cement and Type IA portland cement, or Type IA portland cement and Type SA lime, unless tests indicate that the air content is within acceptable limits.

(b) Do not proportion by volume if blending cementitious materials (portland cement, masonry cement, or lime).