

CONTRACT

FOR

Whitestone Culvert Replacement

PROJECT NUMBER: Culvert Replacement

SOLICITATION NUMBER: 18-025

LET DATE: January 2019

Douglas County Board of Commissioners
Purchasing Department
8700 Hospital Drive
Douglasville, GA 30134

SECTION I

BID PROPOSAL

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DOUGLAS COUNTY BOARD OF COMMISSIONERS
INVITATION TO BID

WHITESTONE BLVD CULVERT REPLACEMENT
SOLICITATION 18-025

NOTICE TO CONTRACTORS

Sealed Bids will be received by The Douglas County Board of Commissioners in the Douglas County Purchasing Department, 3rd Floor, Douglas County Courthouse, 8700 Hospital Drive, Douglasville, Georgia 30134, until Friday, February 15, 2019 @ 2:00 PM. Bids may be mailed or hand delivered. Bids shall be opened and read publicly at 2:00pm Friday, February 15, 2019 in the Purchasing Department, 3rd Floor of the Douglas County Courthouse.

Questions regarding this Invitation to Bid are to be delivered to:

Douglas County Purchasing Department
Mr. Bill Peacock, Purchasing Director
8700 Hospital Drive
Douglasville, Georgia 30134
Fax: 770.920.7219
Email: bpeacock@co.douglas.ga.us

All questions must be received by 5:00pm Friday, February 1, 2019 either by e-mail, mail or fax. No questions by telephone will be accepted. All responses will be provided by or no later than 5:00pm Wednesday, February 6, 2019. No other County staff or officials associated with this Project should be contacted regarding this bid. DOING SO, MAY RESULT IN BIDDER'S DISQUALIFICATION.

The work to be bid consists of furnishing all materials, labor, and equipment for:

Whitestone Culvert Replacement
Project Number: Culvert Replacement

All Bids shall be accompanied by a Bid Bond in favor of the Board of Commissioners of Douglas County in the amount of at least five percent (5%) of the Bid for the complete work. The Bid Bond shall be forfeited to the Board of Commissioners of Douglas County, Georgia as liquidated damages if the Bidder fails to execute the Contract and provide Performance Bond, Payment Bond and Liability Insurance Certificate within fifteen (15) calendar days after being notified that he has been awarded the contract.

Payments will be made in accordance with the Douglas County's Financial Policy. The County typically makes payments within 30-45 days after receipt of an approved invoice or certified payment request from the Engineer **(ORIGINAL INVOICE FROM CONTRACTOR IS REQUIRED BEFORE PAYMENT WILL BE MADE)**.

All bidders must be Pre-Qualified with Georgia Department of Transportation (GDOT) and all subcontractors must be registered with GDOT. Qualifications of the Bidder will be reviewed before the Award of the Contract. The County may consider Award of the Contract to other than low Bidder.

The Douglas County Board of Commissioners reserves the right to reject any and all Bids and to waive any informalities.

Notice to Proceed (NTP) on this Project will be issued following receipt of the correct and fully executed Contract Documents and upon an approved Purchase Order in the full contract amount.

Proposal Forms for bidding this project are required to be purchased from Superior Reprographics, Inc., 591 Thornton Road**,** Lithia Springs, Georgia, 30122. Phone: 770-944-7293, FAX 770-944-8975, or email print@superiorreprographics.com**.**

The cost for the Bid Forms will be **$0.00** per set (includes tax). Please reference **Douglas County Solicitation 18-025.** Purchasing arrangements for Proposal Forms are strictly the responsibility of the bidder. Superior Reprographics, Inc. is the only approved source for these plans and Proposal Forms (contract bid documents). Bidders must allow **24 hours** printing time for each order.

Bidders are cautioned not to obtain bid documents from any other source, than the one mentioned above, to insure that bid documents are complete and include the latest amendments/changes. **IT IS THE BIDDER'S RESPONSIBILITY TO INSURE THAT HIS BID DOCUMENTS ARE COMPLETE AND CORRECT PRIOR TO BID SUBMITTAL.**

A copy of the Bid Form will be available for review at the Douglas County Purchasing Office (770-920-7247), 3rd Floor, Douglas County Courthouse, 8700 Hospital Drive, Douglasville, Georgia 30134 between the hours of 8:00am – 5:00pm Monday through Friday.

Completion Date for this Contract shall be:

270 (TWO HUNDRED SEVENTY) CALENDAR DAYS FROM NTP DATE

Bids shall be submitted in a sealed envelope, so marked as "**Solicitation 18-025 Whitestone Blvd Culvert Project"**, as well as the Bidder's name, addressed to the Douglas County Board of Commissioners, **ATTENTION:** Purchasing Director's Office, 8700 Hospital Drive, Douglasville, Georgia, 30134**.**

No Bid will be received or accepted after the above specified time and date of the Bid Opening. Bids submitted after the designated time and date will be deemed invalid and returned unopened to the Bidder.

DOUGLAS COUNTY

PROPOSAL INDEX

Project No. Whitestone Culvert Replacement LET DATE: January 2019

This contract is broken into four sections as follows:

SECTION I	THE BIDDING DOCUMENTS NEEDED TO BID THIS PROJECT
SECTION II	THE CONTRACT DOCUMENTS NEEDED TO EXECUTE THE CONTRACT AS THE SELECTED BIDDER.
SECTION III	GENERAL CONDITIONS OF THE CONTRACT

GENERAL REQUIREMENTS

1. The work on this Project shall be governed by the project specifications in this document, the 2013 Edition of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, Special Provisions, and Current Edition of the GDOT State of Georgia Supplemental Specifications Construction of Transportation Systems.

   The materials used in The Work shall meet all quality requirements of the Contract. Materials will not be considered as finally accepted until all tests, including any to be taken from the finished work, have been completed and evaluated.

   Upon request by the Engineer, the Contractor shall furnish formal written invoices from the materials suppliers. The invoices shall show the quantities and the dates shipped.

2. **DEFINITIONS AND TERMS:** Delete the following paragraphs from Section 101 of the 2013 Edition of the Georgia Department of Transportation State of Georgia Standard Specifications Construction of Transportation System and replace with the following:

DELETE:	**REPLACE WITH:**
101.10 Board	**THE DOUGLAS COUNTY BOARD OF COMMISSIONERS**
101.13 Chief Engineer	**THE DIRECTOR OF THE DOUGLAS COUNTY DEPARTMENT OF TRANSPORTATION** or appointee acting as his duly authorized representative
101.14 Commissioner	**THE CHAIRMAN OF THE DOUGLAS COUNTY BOARD OF COMMISSIONERS**
101.22 Department	**THE DOUGLAS COUNTY DEPARTMENT OF TRANSPORTATION**
101.24 Engineer	Same as **101.13** - Chief Engineer (above)
101.62 State Highway Engineer	Same as **101.13** - Chief Engineer (above)
101.63 State	**THE DOUGLAS COUNTY BOARD OF COMMISSIONERS**
101.81 Treasurer	**THE DIRECTOR OF PURCHASING**

3. **CONTRACT COMPLETION DATE:** This Contract shall be completed on or before **270 (TWO HUNDRED SEVENTY) CALENDAR DAYS FROM NOTICE TO PROCEED DATE.**

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

CERTIFICATIONS

Failure to complete appropriate certification requirements identified below or submission of a false certification shall render the Bid non-responsive.

EXAMINATION OF PLANS AND SPECIFICATIONS

I certify that I have carefully examined the Plans for this project and the Georgia Department of Transportation State of Georgia Standard Specifications Construction of Transportation System, 2013 Edition, and current edition of the GDOT State of Georgia Supplemental Specifications Modifying the 2013 Standard Specifications Construction of Transportation Systems and the Special Provisions included in and made a part of this Proposal, and have also personally examined the site of the work. On the basis of the said specifications and plans, I propose to furnish all necessary machinery, tools, apparatus and other means of construction, and do all the work and furnish all the materials, in the manner specified.

I also hereby agree that Douglas County would suffer damages in a sum equal to at least the amount of the enclosed Proposal Guaranty, in the event my Proposal should be accepted and a Contract tendered me there under and I should refuse to execute same and furnish Bonds and Liability Insurance as herein required, in consideration of which, I hereby agree that, in the event of such failure on my part to execute said Contract and furnish said Bonds and Liability Insurance within fifteen (15) days after the date of the letter transmitting the Contract to me, the amount of said Proposal Guaranty shall be and is hereby forfeited to Douglas County as liquidated damages as the result of such failure on my part.

I further propose to execute the Contract Agreement described in the Specifications as soon as the work is awarded to me, and to begin and complete the work within the time limit provided or suffer liquidated damages in accordance with applicable specifications and regulations. I also propose to furnish a Performance & Payment Bonds and Liability Insurance, approved by the Douglas County Board of Commissioners, as required by the laws of the State of Georgia. These Bonds shall not only serve to guarantee the completion of the work on my part, but also to guarantee the excellence of both workmanship and materials until the work is finally accepted, as well as to fully comply with all the laws of the State of Georgia.

CONFLICT OF INTEREST

By signing and submitting this Contract, I hereby certify that employees of the company or employees of any company supplying material or subcontracting to do work on this Contract will not engage in business ventures with employees of Douglas County nor shall they provide gifts, gratuities, favors, entertainment, loans or other items of value to employees of this Department.

Also, by signing and submitting this Contract, I hereby certify that I will notify Douglas County through its Engineer of any business ventures entered into between employees of this company or employees of any company supplying material or subcontracting to do work on this Contract with a family member of Douglas County employees.

DRUG-FREE WORKPLACE CERTIFICATION

The undersigned certifies that the provisions of Code Sections 50-24-1 through 50-24-6 of the Official Code of Georgia Annotated, relating to the "Drug-free Workplace Act", have been complied with in full. The undersigned further certifies that:

1. A drug-free workplace will be provided for the Contractor's employees during the performance of the Contract; and

2. Each Contractor who hires a subcontractor to work in a drug-free workplace shall secure from that Subcontractor the following written certification:

"As part of the subcontracting agreement with _____,
(Contractor's Name)

_____
(Subcontractor's Name) certifies to the Contractor that a drug-free workplace will be provided to and for the Subcontractor's employees during the performance of this Contract pursuant to Paragraph (7) of Subsection (b) of Code Section 59-24-3."

Also, the undersigned further certifies that he will not engage in the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana during the performance of the Contract.

NON-COLLUSION, CERTIFICATION

I hereby certify that I have not, nor has any member of the firm(s) or corporation(s), either directly or indirectly, entered into any agreement, participated in any collusion, nor otherwise taken any action in restraint of free competitive bidding in connection with this submitted bid.

It is understood and agreed that this Proposal is one of several competitive bids made to Douglas County, and in consideration of mutual agreements of the bidders, similar hereto, and in consideration of the sum of One Dollar cash in hand paid, receipt whereof is hereby acknowledged, the undersigned agrees that this Proposal shall be an option, which is hereby given by the undersigned to Douglas County to accept or reject this Proposal at any time within the prescribed bid hold period unless the successful bidder agrees in writing to a longer period of time for the Award, and in consideration of the premises, it is expressly covenanted and agreed that this Proposal is not subject to withdrawal by the Proposer or Bidder, during the term of said option.

I hereby acknowledge receipt of the following checked of the Proposal, Plans, Specifications, and/or other documents pertaining to the Contract.

ADDENDA NOS.: 1__2__3__4__5__. I UNDERSTAND THAT FAILURE TO CONFIRM THE RECEIPT OF AMENDMENTS IS CAUSE FOR REJECTION OF BIDS.

Witness my hand and seal this, the _____day of_____, 2019.

Contractor:

The bidder(s) whose signature(s) appears on this document, having personally appeared before me, and being duly sworn, deposes and says that the above statements are true and correct.

_____
(Print Company Name)

By:_____ **(SEAL)**
Corporate President/Vice President
or Individual Owner **or** Partner
(Strike through all except the one which applies).

****

Sworn to and subscribed before me this ___day of _____,2019.

Joint Bidder:

_____ **(SEAL)**
(Notary Public)

_____
(Print Company Name)

My commission expires the _____day of _____20___.

By_____ **(SEAL)**
Corporate President/Vice President
or Individual Owner **or** Partner.
(Strike through all except the one, which applies)

…….
FEDERAL ID NO./IRS NO.

_____

****

Joint Bidder:

_____
Company Name (Print)

By:_____ **(SEAL)**
Corporate President/Vice President
or Individual Owner **or** Partner
(Strike through all except the one which applies).

BID BOND

KNOW ALL MEN BY THESE PRESENTS, THAT WE_____

_____ (hereinafter called the Principal) and_____ (hereinafter called the Surety), a Corporation chartered and existing under the laws of the State of _____ _____with its principal offices in the City of _____ _____and authorized to do business in the State of Georgia, are held and firmly bound unto Douglas County, Georgia, in the full and just sum of : _____ _____D0LLARS, and _____CENTS ($_____) good and lawful money of the United States of America, to be paid upon demand to Douglas County, Georgia, to which payment will and truly to be made, we bind ourselves, our heirs, executors, administrators and assigns jointly and severally and firmly by these presents:

WHEREAS, the Principal is about to submit, or has submitted to Douglas County, Georgia, a Proposal for furnishing materials, labor and equipment for:

WHEREAS, the Principal desires to file this Bond in accordance with law in lieu of a certified Bidder's check otherwise required to accompany this proposal.

NOW, THEREFORE, the conditions of this obligation are such that if the Proposal be accepted, the Principal shall within fifteen (15) days after receipt of notification of the acceptance, execute a Contract in accordance with the Proposal and upon the terms, conditions, and prices set forth in the form and manner required by Douglas County, Georgia, and **execute a sufficient and satisfactory Certificate of Liability Insurance, Performance Bond and Payment Bond payable to Douglas County, Georgia. The Performance Bond shall be 100% of the total Contract Price, and the Payment Bond shall be 110% of the total Contract Price,** in form and with security satisfactory to said Douglas County, Georgia, and otherwise to be and remain in full force and virtue in law; and the Surety shall, upon failure of the Principal to comply with any or all of the foregoing requirements within the time specified above, immediately pay to Douglas County, Georgia, upon demand, the amount hereof in good and lawful money of the United States of America, not as a penalty, but as liquidated damages.

IN TESTIMONY THEREOF, the Principal and Surety have caused these presents to be duly signed and sealed this _____day of _____,2019.

_____(**SEAL**) _____(**SEAL)**

Principal Surety

By:_____ By: _____

Address: _____ Address:_____

_____ _____

Telephone No: _____ Telephone No:_____

INSURANCE REQUIREMENTS

Prior to execution of the Contract, and at all times that the Contract is in force, the Contractor shall obtain, maintain and furnish the County Certificates of Insurance from licensed companies doing business in the State of Georgia and an A.M. Best Rating A-6 or higher and acceptable to the County covering:

1. Statutory Workers' Compensation Insurance
    (a) Employers Liability
        Bodily Injury by Accident - $500,000 Each Accident
        Bodily Injury by Disease - $500,000 Policy Limit
        Bodily Injury by Disease - $500,000 Each Employee

2. Comprehensive General Liability Insurance
3.
    (a) $1,000,000 Limit of Liability per Occurrence for Bodily Injury and Property Damage
    (b) Owner's and Contractor's Protective
    (c) Blanket Contractual Liability
    (d) Blanket "X", "C" and "U"
    (e) Products/Completed Operations Insurance
    (f) Broad Form Property Damage
    (g) Personal Injury Coverage

4. Automobile Liability
5.
    (a) $1,000,000 Limit of Liability per Occurrence for Bodily Injury and Property Damage
    (b) Comprehensive Form covering all Owned, Non-owned and Hired Vehicles

6. Umbrella Liability Insurance

    (a) 4,000,000 Limit of Liability
    (b) Coverage at least as Broad as Primary Coverage as outlined under Items 1, 2, 3 above

5. Douglas County Board of Commissioners (DCBC), its subcontractors and affiliated companies, its officers, directors and employees shall be named on the Certificates of Insurance as Additional Insureds and endorsed onto the policies for Comprehensive General Liability, Automobile Liability and Umbrella Liability Insurance maintained pursuant to this Contract in connection with liability of Douglas County, arising out of Contractor's operations. Copies of the endorsements shall be furnished the County prior to execution of the Contract. Such insurance is Primary Insurance and shall contain a Severability of Interest clause as respects to each Insured. Such policies shall be non-cancelable except on thirty (30) days written notice to the County. Any separate insurance maintained in force by the Additional Insureds named above shall not contribute to the insurance extended by Contractor's Insurer(s) under this Additional Insured Provision.

Certificate Holder Should Read: **Douglas County Board of Commissioners**

Whitestone Culvert Replacement
PROJECT NUMBER: Culvert Replacement

Agent: _____**Telephone No.**_____

Address: _____

CORPORATE CERTIFICATE

I, _____, certify that I am the Secretary of the Corporation named as Contractor in the forgoing Proposal; that _____, who signed Proposal on behalf of the Contractor, was then (title)_____of said Corporation; that said Proposal was duly signed for and in behalf of said Corporation by authority of its Board of Directors, and is within the scope of its corporate powers, that said Corporation is organized under the laws of the State of _____, this _____ day of _____, 2019.

(SEAL)

_____
(Signature)

_____
(Company)

_____
(Address)

_____

_____
(Telephone No)

LIST OF SUBCONTRACTORS

I do _____, do not _____, Propose to subcontract some of the work on this project.

I propose to subcontract work to the following subcontractors:

NAME AND ADDRESS	TYPE OF WORK

Contractor Name: _____

GENERAL NOTES

1. All references in this document, which includes all papers, writings, documents, drawings, or photographs used or to be used, in connection with this document, to the State Highway Department of Georgia, State Highway Department, Georgia State Highway Department, Highway Department, or Department when the context thereof means the State Highway Department of Georgia, and shall be deemed to mean, the Department of Transportation.

2. The data, together with all other information shown on the plans, or in any way indicated thereby, whether by drawings or notes, or in any other manner, are based upon field investigations and are believed to be indicative of actual conditions. However, the same are shown as information only, are not guaranteed and do not bind the Department of Transportation in any way. The attention of the bidder is specifically directed to Sections 102.04, 102.05, 102.06 and 104.03 of the Specifications – current edition.

3. The Whitestone Culvert Replacement work shall be in accordance with the project specifications in this document, applicable sections of the DOT standard specifications and plans entitled "Construction Drawings of Whitestone Blvd Culvert Replacement" prepared by Hughes-Ray Company, Inc., dated 05/11/18.

4. **CONTRACTOR/SUBCONTRACTOR AFFIDAVITS:** On this project, the successful Contractor and each of his Subcontractors shall be required to fill in and sign a copy of the appropriate respective affidavit. The signed affidavits are to be submitted as a part of the Contract and are required before an NTP will be issued.

5. **NOTICE TO PROCEED (NTP)**: On this project, the NTP will be issued upon correct and fully executed Contract Documents between the Successful Bidder and the County and upon approval of a Purchase Order in the contract amount.

6. The Contractor shall have on The Work at all times, as his agent, a competent Superintendent capable of reading and thoroughly understanding the Plans and Specifications, and thoroughly experienced in the type of work being performed who shall receive instructions from the Engineer or his authorized representatives. The Superintendent shall have full authority to execute orders or directions of the Engineer without delay, and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required. Such superintendence shall be furnished, irrespective of the amount of work sublet.

The Superintendent shall notify the Engineer prior to starting any Pay Item Work. The Prime Contractor shall coordinate and be responsible to the Engineer for all activities of subcontractors.

7. The **Contractor shall** fax or email a copy of all required test results to Douglas County Department of Transportation as soon as they are available. Fax number is 770-920-4933, ATTN: Project Manager.

8. **SURETIES:** Douglas County only accepts payment and performance bonds from sureties listed on the US Treasury list of approved sureties.

9. **ASPHALT CEMENT PRICE ADJUSTMENT:** For this contract, no price adjustment shall be considered.

10. The **Contractor shall** furnish advance-warning signs and shall have warning signs at all roads and streets that intersect this road while work is in progress. The signs shall be in accordance

with Section 150 of the Special Provisions of the GDOT Standard. **This work will not be paid for separately, but shall be included in the Bid Price for Item 150, Traffic Control.**

GENERAL NOTES continued . . .

11. In preparation of the work on or along the roadway, the contractor shall place all necessary warning signs and construction barriers to secure the work area so the work can be done in a safe manner . **This will not be paid for separately, but shall be included in the Overall Bid Price.**

12. The Contractor's attention is directed to Section 149 of the Specifications – current edition – Construction Layout. The Contractor shall provide the necessary construction layout. **Cost for this work shall be included in the overall bid price.**

13. **REMOVAL of MISCELLANEOUS ROADWAY ITEMS:** The removal and disposal of Miscellaneous Roadway items, including , but not limited to, Wingwalls, pipe, curbs, pavement, edge preparation grass, weeds, soils , and debris, unacceptable materials, and abandoned obstructions shall become the property and responsibility of the Contractor. Any Miscellaneous Roadway Items to be disposed of shall be done so off the project and in a manner so as to comply with applicable laws. **This work and any Item to be removed that Is not identified as a pay item shall not be paid for separately, but shall be included in the Overall Bid Price.**

14. **REPAIR of MINOR DEFECTS:** Potholes and broken areas caused by the work shall be patched and compacted as directed by the Engineer. Disposal of debris and material is the responsibility of the Contractor and shall be disposed of offsite in accordance with applicable laws.

Except as items are included in the Detailed Estimate/Bid Form, The Contractor shall replace all pavement markings within the project limits in accordance with Section 150 of the Georgia Department of Transportation Standard Specifications, Construction of Transportation System, 2013 Edition, as amended. **This work will not be measured for separate payment, but shall be included in the Lump Sum Bid Price for Item 150 – Traffic Control.**

15. **LIQUIDATED DAMAGES:** Liquidated damages on this project shall be assessed in accordance with Department of Transportation, State of Georgia Supplemental Specification Section 108-Prosecution and Progress Sub-Section 108-08 in the latest edition.

16. **INSPECTION AND ACCEPTANCE:** Upon proper written notice from the contractor of presumptive completion of the entire project, the Engineer will make an inspection. If all construction provided for and contemplated by the Contract is found completed to his/her satisfaction, that inspection shall constitute the Final Inspection and the Engineer will make the final Acceptance and notify the Contractor, in writing, of this 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 Engineer will give the Contractor the necessary instructions for correction of the same and the contractor shall immediately comply with and execute such instructions. **Corrections (Punch List Items) are considered a part of the original bid and will not be considered for additional compensation**.

GENERAL NOTES continued . . .

17. **INTEFERENCE WITH TRAFFIC:** No lane closures or interference with traffic beyond the project limits will be allowed unless approved by the Engineer. Any request for variance to these restricted hours must be made in advance and approved by the Engineer. Night time or weekend will not be allowed. The Department further reserves the right to restrict construction operations at any time, when, in the opinion of the Engineer, the continuance of the work would seriously hinder traffic flow, be needlessly disruptive or unnecessarily inconvenience the traveling or general public.

18. **Utility adjustments**, i.e. manholes, water valves, gas valves, etc. are not included in this contract. However, utility coordination is required between the Contractor and the Utility owner.

19. **Payment** for work satisfactorily completed will be made on a monthly basis for work performed the previous month. The Contractor shall submit a certified, line item, pay request detailing the quantities for which payment is being requested. Each request for payment must be accompanied by a certified statement that all materials and workmanship incorporated into the work, for which the pay request represents, is in accordance with all required Douglas County and or GDOT Specifications

APPENDIX A

BID FORM

Whitestone Blvd Culvert Replacement

PROJECT NUMBER: Culvert Replacement

APPENDIX A

Whitestone Culvert Replacement - Bid Schedule

Item No.	Item Description	Units	Quantity	Unit Price	Bid Amount
150-1000	Traffic Control	LS	1		
	Grading Complete	LS	LS		
163-0232	Temporary Grassing	AC	0.5		
163-0240	Mulch	TN	1		
163-0300	Construction Exit	EA	2		
165-0030	Maintenance of Temporary Silt Fence, TP C	LF	1060		
165-0101	Maintenance of Construction Exit	EA	2		
167-1000	Water Quality Monitoring & Sampling	EA	3		
167-1500	Water Quality Inspections	MO	8		
171-0030	Temporary Silt Fence, TP C	LF	1060		
201-1500	Clearing & Grubbing	AC	0.5		
207-0203	Foundation Backfill Material, TP II	CY	1600		
	Contech Con/Span Precast Bridge Culvert (Headwall, Wingwalls, Footings, etc.)	LS	1		
	Creek Armoring (ArmorFlex & A-jacks)	LS	1		
	Decorative Fence	LF	270		
	Asphalt Pavement (6” GAB, 3.5” Binder, 2” Surface)	SY	460		
441-0104	Concrete Sidewalk (4”) – 5 feet wide	SY	118		
441-0302	Concrete Spillway – TP 2	EA	2		
441-6012	Concrete Curb & Gutter, 6” x 24”, TP 2	LF	1101		
603-1050	Stone Plain Rip Rap for Stream Details, TP A	TN	500		

This unit price bid schedule can be inserted as an amended page in the bid documents. **DO NOT DISASSEMBLE THE BID DOCUMENTS.**

Whitestone Culvert Replacement - Bid Schedule

Item No.	Item Description	Units	Quantity	Unit Price	Bid Amount
670-1080	Water Main, 8 in	LF	172		
670-1500	Cap or Remove Existing Water Main, Remove Storm Sewer Pipe, Demolish & Remove Concrete Wing Walls, Remove Concrete and Asphalt Debris	LS	1		
700-6910	Permanent Grassing	AC	0.5		
700-7000	Agricultural Lime	TN	0.5		
700-8000	Fertilized Mixed Grade	TN	0.25		
700-8100	Fertilizer Nitrogen Content	LB	50		
716-1000	Erosion Control Mats, Waterways	SY	100		
716-2000	Erosion Control Mats, Slopes	SY	595		
641-1100	Guardrail, TP T	LF	300		
641-5001	Guardrail Anchorage, TP 1	EA	2		
641-5012	Guardrail Anchorage, TP 12	EA	2		
				TOTAL BID:	

CONTRACTOR NAME:

CONTRACTOR SIGNATURE:

This unit price bid schedule can be inserted as an amended page in the bid documents. **DO NOT DISASSEMBLE THE BID DOCUMENTS.**

SECTION II

AGREEMENT FOR CONSTRUCTION

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CONTRACT

OATH OF SUCCESSFUL BIDDER

Personally appeared before the undersigned officer duly authorized by law to administer oaths and who, after being first duly sworn, depose and say that they are all the officers, agents, persons, or employees who have acted for or represented
(Company

Name)_____

(Address)_____

(Telephone No.) _____, in bidding or procuring a Contract with

DOUGLAS County, Georgia on the following project(s):

Whitestone Blvd Culvert Replacement

PROJECT NUMBER: Culvert Replacement

And that said (has/have) not by (himself/themselves) or through any persons, officers, agents or employees prevented or attempted to prevent by any means whatsoever competition in such bidding; or by any means whatsoever prevented or endeavored to prevent anyone from making a bid therefore, or induced or attempted to induce another to withdraw a bid for said work.

By: _____
(Signature of Bidder)

_____
(Name Printed)

_____
(Title)

Sworn to and subscribed before me this _____ day
of _____, 2019.

NOTARY PUBLIC
(SEAL)

DOUGLAS COUNTY, GEORGIA

CONTRACT PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, THAT WE

_____ (hereinafter called the Principal) and (hereinafter called the Surety) are held and firmly bound unto Douglas County, Georgia, (hereinafter known as the Owner), for the use of said obligee and all persons doing work or furnishing skill, tools, machinery, supplies, or material under or for the purpose of the Contract hereinafter referred to, in the full and just sum of

_____

_____dollars, and

_____cents

($_____) lawful money of the United States of America, to be paid to said Owner, its successors, and assigns to which payment will and truly be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above bound Principal has entered into a Contract or Contracts with the said Owner, bearing the date of _____, 2019, for furnishing material, labor and equipment for:

Whitestone Blvd Culvert Replacement

PROJECT NUMBER: Culvert Replacement

WHEREAS, it was one of the conditions of the Award by said Owner pursuant to which said Contract was entered into, that these presents shall be executed.

NOW THEREFORE, the conditions of this obligation are such that if the above bound Principal shall in all respects fully comply with the terms and conditions of said Contract, and his obligation thereunder, including the Specifications and Proposal, therein referred to and made a part thereof, and such alterations as may be made in said Specifications as therein provided for, and including one-year guarantee period from date of Final Acceptance, and shall indemnify and save harmless the Owner against and from all costs, expenses, damages, injury or loss, to which the said Owner may be subjected by reason of any wrongdoing, misconduct, want of care of skill, negligence or default, including patent infringement, on part of said Principal, his agents or employees, in the execution or performance of said Contract, and shall promptly pay all just claims for damages or injury to property and for all Work done, or skills, tools and machinery, supplies, labor, and materials furnished and debts incurred by said Principal in or about the construction or improvement contracted for this obligation to be void; otherwise, in full force and effect.

And the said Surety to this Bond, for value received, hereby stipulates and agrees that no change, extensions of time, alterations, or additions to the terms of the Contract or to the Work to be performed thereunder or the Specifications accompanying same shall in any wise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alterations, or additions to the terms of the Contract or to the Work or to the Specifications.

CONTRACT PERFORMANCE BOND

This Bond shall be for the use of all persons doing work or furnishing skill, tools, machinery, or materials under or for the purpose of this Contract, in accordance with the provisions of the Official Code of the State of Georgia, as amended, and is intended to be and shall be construed to be a Bond in compliance with the requirements thereof.

The life of this Bond extends through the Life of the Contract, including the sixty-day maintenance period, and until one year after the Final Acceptance of the Work by the Owner.

IN TESTIMONY THEREOF, the Principal and Surety have caused these presents to be duly signed and sealed in quadruplicate, this _____ day of _____, 2019

CONTRACTOR

(Company Name)

Attest:_____ **By:**
(SEAL)
Title:_____ **Title:**_____

SURETY

(Company Name)

Attest:_____ **By:**
(SEAL)

Title: _____ **Title:**_____

_____
(Local Agent's Signature)

_____
(Name Printed or Typed)

_____
(Company Name)

_____
(Address)

_____
(Telephone No.)

Executed in Quadruplicate

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, THAT WE

_____ as Principal, and _____ as Surety, are held and firmly bound unto DOUGLAS County, in the full sum of **(110% of the Total Contract Price)** _____ _____dollars and _____cents ($_____), for the use and protection of said DOUGLAS County, Georgia and all subcontractors and all persons supplying labor, materials, and machinery, and equipment for the performance of the Work provided for in the Contract hereinafter referred to, for the payment of which well and truly to be made we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally by these presents.

WHEREAS, the above bound Principal has entered into a Contract or Contracts with DOUGLAS County, Georgia, dated the _____ day of _____, 2019, for furnishing material, labor and equipment for:

Whitestone Blvd Culvert Replacement

PROJECT NUMBER: Culvert Replacement

WHEREAS, it was one of the conditions of the Award by DOUGLAS County pursuant to which said Contract was entered into, that these presents shall be executed.

NOW, THEREFORE, the conditions of this obligation are such that if the above bound Principal shall promptly pay all subcontractors and all other persons supplying labor, materials, machinery, and equipment furnished for the performance of the Work provided for by said Contract, and such alterations or additions as may be made therein or in the Plans and Specifications, then this Bond to be void; otherwise, in full force and effect, and

The Surety to this Bond, for value received, agrees that no change, extensions of time, alterations or additions to the terms of the Contract or the Work to be performed thereunder of the Specifications accompanying the same shall in any wise affect its obligation on this Bond, and alterations or additions to the terms of the Contract or the Work or to the Specifications. It is agreed that this Bond is executed pursuant to and in accordance with the provisions of the Official Code of the State of Georgia, as amended, and is intended to be and shall be construed to be a Bond in compliance with the requirements thereof.

PAYMENT BOND

IN WITNESS WHEREOF, the Principal and Surety have caused these presents to be duly signed and sealed in quadruplicate, this _____ day of _____, 2019

CONTRACTOR

(Company Name)

Attest:_____ **By:**_____**(SEAL)**

Title:_____ **Title:**_____

SURETY

(Company Name)

Attest:_____ **By:**_____**(SEAL)**

Title: _____ **Title:**_____

_____
(Local Agent's Signature)

_____
(Name Printed or Typed)

_____
(Company Name)

_____
(Address)

_____
(Telephone No.)

Executed in Quadruplicate

AGREEMENT

THIS AGREEMENT made and entered into this _____ day of _____, 2019 by and between DOUGLAS County, Georgia, (Party of the First Part, hereinafter called the County) and _____, (Party of the Second Part, hereinafter called the Contractor).

WITNESSETH: That the said Contractor has agreed, and by these presents does agree with the said County, for and in consideration of _____ _____ _____dollars and_____cents ($_____) and other good and valuable consideration, and under the penalty expressed in Bonds hereto attached, to furnish all equipment, tools, materials, skill, and labor of every description necessary to carry out and complete in good, firm, and substantial and workmanlike manner, the Work specified, in strict conformity with the Drawings and the Specifications hereinafter set forth, which Drawings and Specifications together with the base bid Proposal made by the Contractor, General Conditions, Special Provisions, Detailed Specifications, and this Agreement, shall all form essential parts of this Contract. The Work covered by this Contract includes all Work indicated on Plans and Specifications and listed in the Proposal entitled:

Whitestone Blvd Culvert Replacement

PROJECT NUMBER: Culvert Replacement

The Contractor shall commence the Work with adequate forces and equipment within ten (10) days from receipt of Notice to Proceed from the County and shall complete the Work on or before **270 (TWO HUNDRED SEVENTY) CALENDAR DAYS FROM NOTICE TO PROCEED DATE.**

Liquidated Damages for this project shall be Eighty four dollars and Zero cents ($151.00), per calendar day past this date, in accordance with Section 108.08, 2013 Edition of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, Special Provisions, and all current Supplemental Specifications.

As full compensation for the faithful performance of this Contract, the County shall pay the Contractor in accordance with the General Conditions and the prices stipulated in the Bid hereto attached.

It is further mutually agreed between the parties hereto that if, at any time after the execution of this Agreement and the Surety Bonds hereto attached for its faithful performance, the County shall deem the Surety or Sureties upon such Bonds to be unsatisfactory, of, if, for any reason, such Bonds cease to be adequate to cover the performance of the Work, the Contractor shall, at his expense, within five (5) days after receipt of Notice from the County so to do, furnish an additional Bond or Bonds in such form and amount, and with such Surety or Sureties as shall be satisfactory to the County. In such event no further payment to the Contractor shall be deemed to be due under this Agreement until such new or additional security for the faithful performance of the Work shall be furnished in manner and form satisfactory to the County.

AGREEMENT

The Contractor hereby assumes the entire responsibility and liability for any and all injury to, or death of any and all persons, including the Contractor's agents, servants, and employees, and in addition thereto, for any and all damages to property caused by or resulting from or arising out of any act or omission in connection with this Contract or the prosecution of work hereunder, whether caused by the Contractor or the Contractor's agents, servants, or employees, or by any of the Contractor's subcontractors or suppliers, or by the County, and the Contractor shall indemnify and hold harmless the County against any and all loss and/or expense which they or either of them may suffer or pay as a result of claims or suits due to, because of, or arising out of any and all such injuries, deaths and/or damage, irrespective of the County (except that the County shall be indemnified for their own sole negligence). The Contractor, if requested, shall assume and defend at the Contractor's own expense, any suit, action or other legal proceedings arising there from, and the Contractor hereby agrees to satisfy, pay, and cause to be discharged or record any judgment which may be rendered against the County arising there from.

In the event of any such loss, expense, damage, or injury, or if any claim or demand for damages as heretofore set forth is made against the County, the County may withhold from any payment due or thereafter to become due to the Contractor under the terms of this Contract, an amount sufficient in its judgment to protect and indemnify the County from any and all claims, expense, loss, damages, or injury; and the County in its discretion, may require the Contractor to furnish a Surety Bond satisfactory to the County providing for such protection and indemnity, which Bond shall be furnished by the Contractor within five (5) days after written demand has been made therefore. The expense of said Bond shall be borne by the Contractor.

The Contractor, at all times that this Contract is in force, agrees to provide, as a minimum, insurance coverage in accordance with the attached Insurance Requirements. The County shall be named on the Certificate of Insurance as Additional Insured's and endorsed on the Policies for Comprehensive General Liability, Automobile Liability and Umbrella Liability Insurance maintained pursuant to this Contract in connection with liability of the County arising out of Contractor's operations. Copies of the endorsements shall be furnished to the County prior to the execution of the Contract. Such insurance is primary insurance and shall contain a Severability of Interest Clause as respects each insured. Such policies shall be non-cancellable except on thirty (30) days written notice to the County. Any separate insurance maintained in force by the Additional Insured's named above shall not contribute to the insurance extended by Contractor's insurer(s) under this Additional Insured provision.

AGREEMENT

The Contract executed in quadruplicate, constitutes the full agreement between the parties, and the Contractor shall not sublet, assign, transfer, pledge, convey, sell or otherwise dispose of the whole or any part of this Contract or his right, title, or interest therein to any person, firm or corporation without the previous consent of the County in writing.

IN WITNESS WHEREOF, The Parties hereto, acting through their duly authorized agents, have signed and sealed this Agreement.

EXECUTED this _____ day of _____, 201__.

DOUGLAS COUNTY, GEORGIA

Attest:_____ By:_____**(SEAL)**

County Clerk
DOUGLAS COUNTY

Chairman
DOUGLAS COUNTY BOARD OF COMMISSIONERS

CONTRACTOR

Attest:_____ By:_____**(SEAL)**

Title:_____ Title: _____

Approved as to Form:

By:_____

Attorney
DOUGLAS COUNTY, GEORGIA

INSURANCE REQUIREMENTS

Prior to execution of the Contract, and at all times that the Contract is in force, the Contractor shall obtain, maintain and furnish the County Certificates of Insurance from licensed companies doing business in the State of Georgia and an A.M. Best Rating A-6 or higher and acceptable to the County covering:

1. Statutory Workers' Compensation Insurance
   (a) Employers Liability
   Bodily Injury by Accident - $500,000 Each Accident
   Bodily Injury by Disease - $500,000 Policy Limit
   Bodily Injury by Disease - $500,000 Each Employee

2. Comprehensive General Liability Insurance
   (a) $1,000,000 Limit of Liability per Occurrence for Bodily Injury and Property Damage
   (b) Owner's and Contractor's Protective
   (c) Blanket Contractual Liability
   (d) Blanket "X", "C" and "U"
   (e) Products/Completed Operations Insurance
   (f) Broad Form Property Damage
   (g) Personal Injury Coverage

3. Automobile Liability
   (a) $1,000,000 Limit of Liability per Occurrence for Bodily Injury and Property Damage
   (b) Comprehensive Form covering All Owned, Non-owned and Hired Vehicles

4. Umbrella Liability Insurance
   (a) $4,000,000 Limit of Liability
   (b) Coverage at least as Broad as Primary Coverage as outlined under Items 1, 2 and 3 above

7. Douglas County Board of Commissioners (DCBC), its subcontractors and affiliated companies, its officers, directors and employees shall be named on the Certificates of Insurance as Additional Insureds and endorsed onto the policies for Comprehensive General Liability, Automobile Liability and Umbrella Liability Insurance maintained pursuant to this Contract in connection with liability of Douglas County, arising out of Contractor's operations. Copies of the endorsements shall be furnished the County prior to execution of the Contract. Such insurance is Primary Insurance and shall contain a Severability of Interest clause as respects to each Insured. Such policies shall be non-cancelable except on thirty (30) days written notice to the County. Any separate insurance maintained in force by the Additional Insureds named above shall not contribute to the insurance extended by Contractor's Insurer(s) under this Additional Insured Provision.

<u>Certificate Holder Should Read</u>: Douglas County Board of Commissioners

Whitestone Blvd Culvert Replacement

PROJECT NUMBER: Culvert Replacement

Agent:_____ Telephone No. _____

Address: _____

CONTRACTOR AFFIDAVIT AND AGREEMENT

(Contractor, Please Fill This Out For This Contract)

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. 13-10-91, stating affirmatively that the individual, firm, or corporation which is contracting with Douglas County, Georgia has registered with and is participating in a federal work authorization program* (i.e., any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603), in accordance with the applicability provisions and deadlines established in O.C.G.A. § 13-10-91.

The undersigned further agrees that, should it employ or contract with any subcontractor(s) in connection with the physical performance of services pursuant to this contract with Douglas County, Georgia, contractor shall secure from such subcontractor(s) similar verification of compliance with O.C.G.A. § 13-10-91 on the Subcontractor Affidavit provided in Rule 300-10-01-.08 or a substantially similar form. Contractor further agrees to maintain records of such compliance and provide a copy of each such verification to Douglas County, Georgia at the time the subcontractor(s) is retained to perform such service.

_____

EEV/Basic Pilot Program* User Identification Number

_____

(Contractor Name)

_____ _____

BY: Authorized Officer or Agent Date

_____

Title of Authorized Officer or Agent of Contractor

_____

Printed Name of Authorized Officer or Agent

SUBSCRIBED AND SWORN
BEFORE ME ON THIS THE

_____ DAY OF _____, 201__

_____

Notary Public
My Commission Expires:

_____

*As of July 1, 2007, the applicable federal work authorization program is the “EEV/Basic Pilot Program” operated by the U.S. Citizenship and Immigration Services Bureau of the U.S. Department of Homeland Security, in conjunction with the Social Security Administration (SSA)

STATE OF GEORGIA
COUNTY OF DOUGLAS

SUBCONTRACTOR AFFIDAVIT

(Contractor, Please Have Your Subcontractor Fill This Out for This Contract)

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services under a contract with (name of contractor) on behalf of Douglas County, Georgia has registered with and is participating in a federal work authorization program* (i.e., any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603), in accordance with the applicability provisions and deadlines established in O.C.G.A. § 13-10-91.

_____

EEV/Basic Pilot Program* User Identification Number

_____

(Subcontractor Name)

_____ _____

BY: Authorized Officer or Agent Date

_____

Title of Authorized Officer or Agent of Subcontractor

_____

Printed Name of Authorized Officer or Agent

SUBSCRIBED AND SWORN
BEFORE ME ON THIS THE

_____ DAY OF _____, 201__

_____

Notary Public
My Commission Expires:

_____

*As of July 1, 2007 O.C.G.A. § 13-10-91, the applicable federal work authorization program is the “EEV/Basic Pilot Program” operated by the U.S. Citizenship and Immigration Services Bureau of the U.S. Department of Homeland Security, in conjunction with the Social Security Administration (SSA).

STATE OF GEORGIA
COUNTY OF DOUGLAS

SUBCONTRACTOR AFFIDAVIT

(Contractor, Please Have Your Subcontractor Fill This Out for This Contract)

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_____

EEV/Basic Pilot Program* User Identification Number

_____

(Subcontractor Name)

_____ _____

BY: Authorized Officer or Agent Date

_____

Title of Authorized Officer or Agent of Subcontractor

_____

Printed Name of Authorized Officer or Agent

SUBSCRIBED AND SWORN
BEFORE ME ON THIS THE

_____ DAY OF _____, 201__

_____

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STATE OF GEORGIA
COUNTY OF DOUGLAS

SUBCONTRACTOR AFFIDAVIT

(Contractor, Please Have Your Subcontractor Fill This Out For This Contract)

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_____

EEV/Basic Pilot Program* User Identification Number

_____

(Subcontractor Name)

_____ _____

BY: Authorized Officer or Agent Date

_____

Title of Authorized Officer or Agent of Subcontractor

_____

Printed Name of Authorized Officer or Agent

SUBSCRIBED AND SWORN
BEFORE ME ON THIS THE

_____ DAY OF _____, 201__

_____

Notary Public
My Commission Expires:

_____

*As of July 1, 2007 O.C.G.A. § 13-10-91, the applicable federal work authorization program is the "EEV/Basic Pilot Program" operated by the U.S. Citizenship and Immigration Services Bureau of the U.S. Department of Homeland Security, in conjunction with the Social Security Administration (SSA).

STATE OF GEORGIA
COUNTY OF DOUGLAS

SUBCONTRACTOR AFFIDAVIT

(Contractor, Please Have Your Subcontractor Fill This Out For This Contract)

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services under a contract with (name of contractor) on behalf of Douglas County, Georgia has registered with and is participating in a federal work authorization program* (i.e., any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603), in accordance with the applicability provisions and deadlines established in O.C.G.A. § 13-10-91.

_____

EEV/Basic Pilot Program* User Identification Number

_____

(Subcontractor Name)

_____ _____

BY: Authorized Officer or Agent Date

_____

Title of Authorized Officer or Agent of Subcontractor

_____

Printed Name of Authorized Officer or Agent

SUBSCRIBED AND SWORN
BEFORE ME ON THIS THE

_____ DAY OF _____, 201__

_____

Notary Public
My Commission Expires:

_____

*As of July 1, 2007 O.C.G.A. § 13-10-91, the applicable federal work authorization program is the “EEV/Basic Pilot Program” operated by the U.S. Citizenship and Immigration Services Bureau of the U.S. Department of Homeland Security, in conjunction with the Social Security Administration (SSA).

STATE OF GEORGIA
COUNTY OF DOUGLAS

SUBCONTRACTOR AFFIDAVIT

(Contractor, Please Have Your Subcontractor Fill This Out For This Contract)

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services under a contract with (name of contractor) on behalf of Douglas County, Georgia has registered with and is participating in a federal work authorization program* (i.e., any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603), in accordance with the applicability provisions and deadlines established in O.C.G.A. § 13-10-91.

_____

EEV/Basic Pilot Program* User Identification Number

_____

(Subcontractor Name)

_____ _____

BY: Authorized Officer or Agent Date

_____

Title of Authorized Officer or Agent of Subcontractor

_____

Printed Name of Authorized Officer or Agent

SUBSCRIBED AND SWORN
BEFORE ME ON THIS THE

_____ DAY OF _____, 201__

_____

Notary Public
My Commission Expires:

_____

*As of July 1, 2007 O.C.G.A. § 13-10-91, the applicable federal work authorization program is the “EEV/Basic Pilot Program” operated by the U.S. Citizenship and Immigration Services Bureau of the U.S. Department of Homeland Security, in conjunction with the Social Security Administration (SSA).

STATE OF GEORGIA
COUNTY OF DOUGLAS

SECTION III

GENERAL CONDITIONS

SPECIAL REQUIREMENTS

SECTION III

GENERAL CONDITIONS

Unless otherwise directed, all work performed under this contract shall be in accordance with the project specifications in this document, applicable sections of the Georgia Department of Transportation Standard Specifications, Construction of Roads and Bridges, 2013 Edition, Current Edition of the GDOT State of Georgia Supplemental Specifications Modifying the 2013 Standard Specifications Construction of Transportation Systems, Georgia Department of Transportation Standard Details and Drawings, Current Supplemental Specifications.

The work shall be per design as shown on a set of plans entitled “Construction Drawings for Whitestone Blvd Culvert Replacement ” prepared by Hughes-Ray Company, Inc., dated 05/11/18.

SPECIAL REQUIREMENTS

1. The contractor shall take the necessary precautions when removing the existing 60" RCP from the channel prior to demolition of the concrete structures so that the RCP section are not damaged. Existing undamaged RCP concrete sections in the channel are to be brought to the road level and loaded on the truck or trailer provided by the county to haul the pipe to the Public Works yard. Damaged sections of RCP shall be disposed of by the contractor at an appropriate off-site location. The contractor shall coordinate with the county's project inspector for loading of the undamaged RCP. No separate payment will be made for salvaging the existing RCP, the cost associated with this item shall be included in the Lump Sum price bid for item 700-1500 in the bid schedule.

2. The installation of the scour protection devices (A-Jacks and ArmorFlex) is to be performed in strict adherence to the manufacturer's recommendations. The contractor shall require from the vendor from which the systems are procured that there be a certified inspector present during every phase of each item's installation so that they can ensure the items were installed correctly and can further provide the necessary inspection certifications.

3. The contractor shall provide the county with a certification from each of the system vendor's certified inspectors attesting to the proper installation of the systems in accordance with the manufacturer's recommendations.

SECTION IV

SPECIAL PROVISIONS

SECTION 101 - DEFINITIONS AND TERMS:

Delete Section 101 of the 2013 Edition of the State of Georgia Standard Specifications, Construction of Transportation System and add the following:

101.10 Board	THE DOUGLAS COUNTY BOARD OF COMMISSIONERS
101.13 Chief Engineer	DOUGLAS COUNTY DIRECTOR, DEPARTMENT OF TRANSPORTATION
101.14 Commissioner	THE CHAIRMAN OF THE DOUGLAS COUNTY COMMISSIONERS
101.22 Department	THE DOUGLAS COUNTY BOARD OF COMMISSIONERS
101.24 Engineer	Same as 101.13 - Chief Engineer (above)
101.62 State Highway Engineer	Same as 101.13 - Chief Engineer (above)
101.63 State: The State of Georgia	THE DOUGLAS COUNTY BOARD OF COMMISSIONERS
101.81 Treasurer	DOUGLAS COUNTY DIRECTOR OF PURCHASING

SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS:

Section 102.01 PREQUALIFICATION OF BIDDERS: Delete in its entirety and substitute the following:

"Bids will be considered only from experienced and well equipped Contractors engaged in work of this type and magnitude. Contractors must be presently pre-qualified to do this type of work with the Georgia Department of Transportation and have received a Certificate of Qualification in accordance with the Rules and Regulations approved and adopted by the State Transportation Board." Sub-contractors must be registered with the Georgia Department of Transportation.

Bidders may be required to submit evidence setting forth qualifications, which entitle him to considerations as a responsible Contractor. A list of work of similar character successfully completed within the last two years may be required giving the location, size and listing equipment available for use on this work. Before accepting any bid, the County may require evidence of the Contractor's financial ability to successfully perform the work to be accomplished under the contract."

Section 102.05 EXAMINATION OF PLANS, SPECIFICATIONS, SPECIAL PROVISIONS AND SITE OF THE WORK: Add the following paragraph:

SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

"The County will not be responsible for Bidders' errors or misjudgment, nor for any information on local conditions or general laws and regulations." **It is the bidders responsibility to insure that their set of bid documents are complete and correct prior to bid submittal.**

Section 102.06 PREPARATION OF PROPOSAL: Delete Sub-Section 102.06 and Substitute the following:

The Bidder shall submit his Proposal on the form furnished in the bid document package. The blank spaces on the Proposal shall be filled in correctly for each Pay Item (except Alternate Items) and the Bidder shall write in ink the Unit Price or a Lump Sum Price as called for in the Proposal for each Pay Item listed therein. In addition, the Bidder shall also show the products of the respective Unit Prices and quantities and the total amount of the Bid by adding the amounts of all Bid Items. In the event of a discrepancy in any of the figures, the Unit Price will govern and the Bid will be recalculated.

In the case of Alternate Items, Unit Prices shall be entered for only one alternate.

The Non-Collusion Certificate on the County's standard form included in the Proposal shall be executed.

Proposal Forms for bidding this project are required to be purchased from Superior Reprographics, Inc., 591 Thornton Road**,** Lithia Springs, Georgia, 30122. Phone: 770-944-7293, FAX 770-944-8975, or email print@superiorreprographics.com**.**

If the Proposal is made by an individual, its name and post office address shall be shown; if by a partnership, the name and post office address of one member of the partnership shall be shown; if by a corporation, the Proposal shall show the name, title and business address of the officer signing the Proposal. The Bidder's Proposal shall be signed in ink by the individual, by one or more members of a partnership, or by one or more of the officers of a corporation whichever is applicable. In the event of a joint venture, the Proposal shall be signed in ink by each individual involved, by each partnership through one or more of its members, or by each corporation through one or more officers of the corporation, whichever is applicable. Proposals not properly signed may be disqualified and rejected.

Section 102.07 REJECTION OF PROPOSALS: Delete Sub-Section 102.07 paragraph "G" and add the following subparagraphs:

"I. The County reserves the right to reject, for any reason, any and all bids, to waive technicalities, and to make an award as deemed in its best interest. It is understood that all bids are made subject to this Agreement, that the County reserves the right to award the bid to the lowest responsive and responsible Bidder, and in arriving at this decision, full consideration will be given to the reputation of the Bidder, his financial responsibility, and work of this type successfully completed.

"J. The County also reserves the right to reject any and all bids from any person, firm, or corporation who is in arrears in any debt or obligation to Douglas County, Georgia."

Section 102.09 DELIVERY OF PROPOSALS: Delete Subsection 102.09 and Substitute the following:

SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

Each Proposal, together with the Proposal Guaranty, shall be submitted in a sealed envelope so marked as to identify its contents without being opened. Proposal forms are not transferable. Proposals will be received until the time and date set in the Notice To Contractors and shall be in the hands of the officials indicated by that time. Proposals received after the advertised cutoff time established for submission of Proposals will be returned unopened to the Bidder.

Section 102.15 ADDENDA AND INTERPRETATION: Add the following as 102.15:

"No interpretation of the meaning of the Contract Documents will be made orally to any Bidder. Any request for such interpretation should be in writing addressed to the Douglas County Purchasing Office (770-920-7247), 3rd Floor Douglas County Courthouse, 8700 Hospital Drive, Douglasville, Georgia 30134. Each such interpretation shall be given in writing, separately numbered and dated, and furnished to each interested Bidder. Any request not received in time to accomplish such interpretation and distribution will not be accepted."

SECTION 103 - AWARD AND EXECUTION OF CONTRACT

Section 103.02 AWARD OF CONTRACT: Delete in its entirety and substitute the following:

"The contract, if awarded, shall be awarded to the lowest responsive, reliable, and responsible bidder. Douglas County reserves the right to exercise exclusive discretion as to the responsibility of any bidder.

The contract shall be executed on the forms attached, will be subject to all requirements of the Contract Document, and shall form a binding Contract between the contracting parties."

The Contract will be awarded by the County, if at all, within 90 calendar days after the opening of the Proposals, unless the successful Bidder agrees in writing to a longer period for the award.

Single as well as multiple Proposals for a project will be publicly opened and read. If only one Proposal is received on a project and the amount of that Proposal is equal to or less than the Department's cost estimate for the project, as certified by the Chief Engineer, that cost estimate will be read. If only one Proposal is received and the amount of that Proposal exceeds the Department's cost estimate for the project, the Department may, at its option, exercise one of the following:

1. Award the Contract as bid.
2. Negotiate a price which is fair and reasonable and award the Contract as negotiated.
3. Reject the Proposal and re-advertise, perform the work itself, or abandon the project.
4.

In all cases, the negotiated price shall not be greater than the price bid. Prior to negotiations, the Department will inform the bidder of the Department's estimate for the project.

Award to the successful bidder will be made public through the publication of the Award announcement. If the successful bidder fails to execute the Contract and file acceptable Bonds within the period set forth in Subsection 103.07 thereby causing cancellation of the Award and forfeiture of the Proposal Guaranty, the Department may award the Contract to the next lowest reliable bidder, re-advertise, abandon the project, or perform the work itself.

SECTION 103 - AWARD AND EXECUTION OF CONTRACT

Section 103.04 RETURN OF PROPOSAL GUARANTY: Delete in its entirety and substitute the following:

All Bid Guaranties may be retained until the Contract and Contract Bond have been signed and approved. Early release of Bid Guaranties will be considered if a request is made in writing.

Section 103.06 EXECUTION AND APPROVAL OF CONTRACT: Delete in its entirety and substitute the following:

The Contract shall be signed by the successful Bidder and returned within 15 calendar days after the date of the letter transmitting the Contract to the Bidder. No Contract shall be considered as effective until it has been fully executed by all of the parties.

Section 103.07 FAILURE TO EXECUTE CONTRACT: Delete in its entirety and substitute the following:

"Failure to execute the Contract, Contract Performance and Payment Bond, or furnish satisfactory proof of carriage of the insurance required within ten days after the date of Notice of Award of the Contract may be just cause for the annulment of the award and for the forfeiture of the proposal guaranty to Douglas County, not as a penalty, but as liquidation damages sustained. At the discretion of the County, the award may then be made to the next lowest responsible Bidder, or the Work may be re-advertised or constructed by County forces. The Contract and Contract bonds shall be executed in quadruplicate."

SECTION 104 - SCOPE OF WORK

Section 104.03.A - AUTHORITY TO MAKE CHANGES: Delete the second paragraph and substitute the following:

Whenever an alteration in character of work involves a substantial change in the nature of the design or in the type of construction or materially increases or decreases the cost of performance, a Supplemental Agreement acceptable to both parties shall be executed before work is started on such alteration, except that in the absence of a Supplemental Agreement acceptable to both parties, the Engineer may direct that the work be done either by Force Account or at existing Contract prices subject to the provisions of Sub-Section 105.13. Any Force Account Agreement must be in writing, specifying the terms of payment, signed by the State Highway Engineer and agreed to in writing by the Contractor.

All work shall be performed as directed and in accordance with the Specifications

SECTION 107 - Legal Regulations and Responsibility to the Public

The contractor shall pay particular attention to the requirements in Section 107 of the standard DOT specifications, as amended, to ensure that all work is performed in compliance with these requirements at all times. The Contractor shall keep fully informed of all Federal and State laws, all local laws, ordinances, codes, 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, codes, regulations, orders, decrees, and permits; and shall protect and indemnify the Department and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, code, regulation, order, decrees, and permits, whether by himself, his employees, subcontractors, or agents.

Section 107.18 ACQUISITION OF RIGHT OF WAY: Add the following paragraph:

"The Contractor shall inspect all easements and right-of-way to insure that the County has obtained all land and right-of-way necessary for completion of the Work to be performed pursuant to the Contract Documents. The Contractor shall comply with all stipulations contained in easements acquired by the County."

Section 107.21 CONTRACTORS RESPONSIBLILITY FOR UTILITY PROPERTY AND SERVICE: Add the following sentence to Paragraph A:

"The Contractor is responsible for the location of above and below ground utilities and structures which may be affected by the Work."

SECTION 108- Prosecution and Progress

Delete the fifth paragraph from Subsection 108.01 and substitute the following:

No Subcontracts, or transfer of Contract, shall in any case release the Prime Contractor of his/her liability under the contracts & bonds. No Subcontractor shall commence work in advance of the written approval of the Subcontract by the Department. Except for certain items exempted by the State Transportation Board, each Subcontractor shall be prequalified or registered with the Department. Each Subcontract for a Registered Subcontractor shall not exceed $ 1,000,000.00 and Subcontracts for Prequalified Contractors shall not exceed their current capacity. Prequalified or Registered Subcontractors shall be qualified or registered with the Department in accordance with Chapter 672-5 of the Rules and Regulations Governing the Prequalification of Prospective Bidders adopted by the State Transportation Board.

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SECTION NO. 01010

SUMMARY OF WORK

1.01 LOCATION

A. The work described by the Specifications is located in Douglas County, Georgia. The exact location is shown on the Drawings.

1.02 WORK INCLUDED

A. The work to be done under this Contract consists of furnishing all labor, equipment and materials required for construction of **WHITESTONE BLVD CULVERT REPLACEMENT,** which includes installing CONSPAN Bridge System and associated roadway improvements, and all associated work.

B. All work shall be in accordance with GDOT, Douglas County and Douglasville-Douglas County Water Sewer Authority.

All work shall be performed according to the requirements of the construction drawings and specifications.

1.03 WORK COORDINATION

A. The Contractor shall coordinate his work with third parties (such as public utilities and telephone company) in areas where such parties may have rights to underground property or facilities, and request maps or other descriptive information as to the nature and location of such underground facilities or property.

B. The Contractor shall also coordinate his work with owners of private and public property where access is required for the performance of the work. Legal access will be acquired and provided by the Owner.

1.04 CONDITIONS AT THE SITES

A. The Contractor shall make all necessary investigations to determine the existence and location of underground utilities.

B. The Contractor will be held responsible for any damage to and for maintenance and protection of existing utilities and structures.

C. Nothing in these Contract Documents or associated Drawings shall be construed as a guarantee that such utilities are in the location indicated or that they actually exist, or that other utilities are not within the area of the operations.

1.05 Quantities

A. The Owner reserves the right to alter the quantities of work to be performed or to extend or shorten the improvements at any time when and as found necessary, and the Contractor shall perform the work as altered, increased or decreased. Payment for such increased or decreased quantity will be made in accordance with the Instructions to Bidders. No allowance will be made for any change in anticipated profits nor shall such changes be considered as waiving or invalidating any conditions or provisions of the Contract and Bond.

END OF SECTION

Part 1 General

1.01 Scope

A. The Bid lists each item of the Project for which payment will be made. No payment will be made for any items other than those listed in the Bid.

B. Required items of work and incidentals necessary for the satisfactory completion of the work which are not specifically listed in the Bid, and which are not specified in this Section to be measured or to be included in one of the items listed in the Bid, shall be considered as incidental to the work. All costs thereof, including Contractor's overhead costs and profit, shall be considered as included in the lump sum or unit prices bid for the various Bid items. The Contractor shall prepare the Bid accordingly.

C. Work includes furnishing all plant, labor, equipment, tools and materials and performing all operations required to complete the work satisfactorily in place as specified and as indicated on the Drawings.

1.02 Descriptions

A. Measurement of an item of work will be by the unit indicated in the Bid.

B. Final payment quantities shall be determined from the record drawings. The record drawing lengths, dimensions, quantities, etc. shall be determined by a survey after the completion of all required work. Said survey shall conform to Section 01720 of these Specifications. The precision of final payment quantities shall match the precision shown for that item in the Bid.

C. Payment will include all necessary and incidental related work not specified to be included in any other item of work listed in the Bid.

D. Unless otherwise stated in individual sections of the Specifications or in the Bid, no separate payment will be made for any item of work, materials, parts, equipment, supplies or related items required to perform and complete the work. The costs for all such items required shall be included in the price bid for item of which it is a part.

E. Payment will be made by extending unit prices multiplied by quantities provided and then summing the extended prices to reflect actual work. Such price and payment shall constitute full compensation to the Contractor for furnishing all plant, labor, equipment, tools and materials and for performing all operations required to provide to the Owner the entire Project complete in place as specified and as indicated on the Drawings.

F. “Products” shall mean materials or equipment permanently incorporated into the work.

1.03 Cash Allowances

A. General

1. The Contractor shall include in the Bid Total all allowances stated in the Contract Documents. These allowances shall cover the net cost of the services provided by a firm selected by the Owner. The Contractor's handling costs, labor, overhead, profit and other expenses contemplated for the original allowance shall be included in the items to which they pertain and not in allowances.

2. No payment will be made for nonproductive time on the part of testing personnel due to the Contractor's failure to properly coordinate testing activities with the work schedule or the Contractor's problems with maintaining equipment in good working condition. The Contractor shall make all necessary excavations and shall supply any samples of materials necessary for conducting compaction and density tests.

3. No payment shall be provided for services that fail to verify required results.

B. Should the net cost be more or less than the specified amount of the allowance, the Contract will be adjusted accordingly by change order. The amount of change order will not recognize any changes in handling costs at the site, labor, overhead, profit and other expenses caused by the adjustment to the allowance.

C. Documentation

1. Submit copies of the invoices with each periodic payment request from the firm providing the services.

2. Submit results of services provided which verify required results.

D. Schedule of Cash Allowances (If utilized in Bid Form. If no cash allowances are used in bid form, then contractor shall provide these items and shall include their costs inside other bid items.)

1. Soils and Concrete Testing: Allow the amount provided in the Bid for the services of a geotechnical engineering firm and testing laboratory to verify soils conditions including trench excavation and backfill, and similar issues and for the testing of concrete cylinders for poured in place concrete.

2. Construction Verification Surveying

a. Allow the amount provided in the Bid for construction layout by an independent surveying firm selected by the Owner to perform horizontal and vertical layout for the Contractor.

3. Blasting Monitoring: Allow the amount provided in the Bid for the services of an independent qualified specialty subcontractor to monitor the blasting when directed by the Owner.

4. NPDES Monitoring: Allow the amount provided in the Bid for the services of an independent qualified specialty subcontractor to provide NPDES monitoring & reporting for the Owner.

5. Construction Administration: Allow the amount provided in the bid for the Owner’s consultant to provide construction administration for the project.

1.04 Clearing and Grubbing

A. No separate payment shall be made for clearing and grubbing.

B. The cost of moving and reestablishing landscape features, including labor and materials, shall be included in the unit price bid for the item to which it pertains.

1.05 Erosion and Sedimentation Control

A. General

1. No separate payment shall be made for temporary and/or permanent erosion and sedimentation controls, except as noted below. All other temporary and/or permanent erosion and sedimentation control costs shall be included in the unit price bid for the item to which it pertains.

2. No payment will be made for any portion of the Project for which temporary erosion and sedimentation controls are not properly maintained.

3. Quantities for payment shall be based upon actual quantity constructed and authorized by the Owner.

4. No separate payment shall be made for NPDES Permit Specialty Work.

B. Construction Exits: All costs for construction exits, including installation, maintenance, repair, and removal, shall be included in the unit price bid for Construction Exits.

C. Type “C” Silt Fence: All costs for silt fence, including installation, maintenance, repair, replacement, and removal shall be included in the unit price bid for Type “C” Silt Fence.

D. Type “A” Silt Fence: All costs for silt fence, including installation, maintenance, repair, replacement, and removal shall be included in the unit price bid for Type “A” Silt Fence.

E. Haybales: All costs for haybales, including installation, maintenance, repair, replacement, and removal shall be included in the unit price bid for haybales.

F. Rip Rap: The cost of all rip rap, including filter fabric shown on the Drawings, specified or directed by the Engineer shall be included in the unit price bid for Rip Rap.

G. Inlet Filter: All costs for inlet filters, including installation, maintenance, repair and removal, shall be included in the unit price bid for Inlet Filters.

H. Temporary Stream Crossing: No separate payment shall be made for temporary stream crossing. The cost shall be included in the item in which it pertains.

I. Grassing: All cost for temporary & permanent grassing shall be paid based on percent (%) complete of permanent grassing. No additional payment will be made for re-grassing. It is the responsibility of the Contractor to achieve permanent grassing in accordance with NPDES Notice Of Termination guidelines prior to final release of retainage for the project.

J. Filter Ring: All costs for inlet filters, including installation, maintenance, repair and removal, shall be included in the unit price bid for Filter Rings.

K. Check Dam: All costs for inlet filters, including installation, maintenance, repair and removal, shall be included in the unit price bid for Check Dams.

1.06 Earthwork

A. Earth Excavation

1. No separate payment will be made for earth excavation. The cost of such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

2. No separate payment will be made for providing sheeting, bracing and timbering.

B. Rock Excavation

1. Rock excavation will be paid for separately at the unit price bid.

2. Payment will be made for measured quantity of rock excavated, at the unit price bid per cubic yard. The unit price for rock excavation shall include the cost of rock excavation, the cost of disposing of rock, the cost of providing sufficient and suitable fill material and all costs incidental thereto. The allowable volume of rock excavation for payment, unless otherwise authorized by the Engineer, shall be based on the measurements described below. No allowance shall be made for excavation beyond the required dimensions.

3. Horizontal measurement shall be to the actual dimension of the excavation, but not exceeding one foot beyond the outer surface of the structure or a minimum of two feet from a wall.

4. Depth measurement shall be made from the original top of rock to the bottom of the structure or ditch as specified, or to the bottom of the rock, whichever has the higher elevation.

5. The Engineer must be given reasonable notice to measure all rock.

C. Foundation Excavation

1. Costs for undercutting, foundation preparation, and removal and replacement of unsuitable material,where shown on the Drawings or specified, shall be included in the appropriate lump sum bid.

2. Payment for removal and replacement of unsuitable material which is ordered by the Engineer which is not shown on the Drawings or specified shall be made at the unit price bid for:

   a. Replacement with Crushed Stone

   b. Replacement with Earth Material

3. Where ordered by the Engineer, undercutting of rock and replacement with crushed stone will be paid for at the unit price bid for rock excavation. The quantity shall equal one foot of depth over the horizontal dimensions authorized by the Engineer.

4. No separate payment will be made for concrete backfill of trenches beneath structures. The cost of this work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

5. Additional costs of corrective work, made necessary by unauthorized excavation of earth or rock, shall be borne by the Contractor.

D. Dewatering: No separate payment will be made for dewatering required to accomplish the work.

E. Backfilling: No separate payment will be made for backfilling or excavation, hauling and placement of borrow material. The cost of all such work and all costs incidental thereto shall be included in the unit price bid for the item to which the work pertains.

1.07 Trench Excavation and Backfill

A. No separate or additional payment will be made for any special or unique method, means, techniques or equipment necessary for the Contractor's compliance with these Specifications, regulatory requirements, permits, laws or regulations which govern this Project.

B. Trench Excavation: No separate payment will be made for trench excavation. All costs shall be Included in the unit price bid for the item to which it pertains at the appropriate depth.

C. Sheeting, Bracing and Shoring: No separate payment will be made for providing any sheeting, bracing and shoring.

D. Rock Excavation:

1. Rock excavation shall be paid for as an extra in addition to payment for pipe provided for elsewhere in these Specifications. Payment will be made for the measured quantity of rock excavated, at the unit price bid.

2. The unit price bid for Rock Excavation shall include all costs of rock excavation, the cost of additional bedding and backfill material as specified and all costs incidental thereto.

3. The maximum allowable volume of rock excavation for payment shall be based on a trench width equal to the outside diameter of the pipe barrel plus 18-inches but not less than 36-inches and a depth of rock on the pipe centerline, from the top of the rock to the bottom of the rock or the specified bottom of the trench, whichever has the higher elevation.

4. The Engineer must be given reasonable notice to measure all rock.

5. No allowance shall be made for excavating to extra widths for construction of manholes or other appurtenances, for excavating to sloping sides, or for excavations made necessary by the physical limitations of the Contractor's equipment. Cost of such additional rock excavation shall be included in the unit price bid for the item to which it pertains.

6. Payment for blasting monitoring shall be made from the “Blasting Monitoring” cash allowance. A fee must be agreed upon by the Engineer prior to the Contractor employing an independent, qualified specialty subcontractor to monitor the blasting. If the Contractor employs the specialty subcontractor prior to the Engineer's approval of the fee, all such costs are subject to non-reimbursement.

E. Dewatering Excavations: All costs of equipment, labor and materials required for dewatering shall be included in the price bid for the item to which it pertains.

F. Trench Foundation and Stabilization

1. No payment for trench stabilization shall be authorized until after the trench has been dewatered. If the pipe is installed in an inadequately prepared trench bottom, the Engineer shall notify the Contractor in writing of the deficiency and will not authorize payment for that portion of that length of pipe which was improperly installed.

2. Payment for trench stabilization shall be made on the basis of the amount authorized and the unit price bid for Trench Stabilization and approved by the owner's representative. Payment shall include all costs for the removal and disposal of the unsuitable material and replacement with crushed stone. No additional payment will be made for material required for specified bedding.

G. Bedding and Haunching

1. No additional payment will be made for additional trench depth.

2. No separate payment will be made for material used to provide specified bedding. The cost of all bedding materials shall be included in the unit price bid for the item to which it relates, except for trench stabilization.

3. No additional payment will be made for improved bedding required to compensate for over excavation of the trench.

H. Initial Backfill

1. No separate payment shall be made for initial backfill.

2. No separate payment shall be made for drying out the initial backfill material in order to meet the compaction requirements.

3. No separate payment shall be made for the adding of moisture to the initial backfill materials in order to meet the compaction requirements.

4. No separate payment shall be made for providing select backfill material if the insitu material cannot meet the compaction requirements, except as may be allowed in Paragraph J of this Article of the Specifications.

I. Final Backfilling

1. No additional payment will be made for additional material when excavated materials are used.

2. No separate payment shall be made for drying out the final backfill material in order to meet the compaction requirements.

3. No separate payment shall be made for the adding of moisture to the final backfill materials in order to meet the compaction requirements.

4. No additional payment will be made for providing select backfill material if the insitu material cannot meet the compaction requirements, except as may be allowed in Paragraph J of this Article of the Specifications.

J. Select Backfill

1. No payment will be made for select backfill unless authorized by the Owner.

2. No payment shall be made for select backfill where in situ soils do not meet the moisture requirements.

3. Paragraph D of this Article of the Specifications state the methods of payment for select backfill material associated with rock excavation.

4. If authorized by the Owner, payment for removal and replacement of unsuitable backfill material will be made at the unit price bid for Removal of Unsuitable Material and Replacement With:

a. Crushed Stone

b. Suitable Earth Material

5. If authorized by the Owner, measurement for payment shall be based on a trench width equal to the outside diameter of the pipe barrel plus 18-inches but not less than 36-inches and a depth measured at the pipe centerline, from the top of the unsuitable material to the bottom of the unsuitable material or the specified bottom of the trench, whichever has the higher elevation. If under pavement, the measured depth shall be extend to the pavement sub grade. No payment

will be made for additional excavation as a result of the Contractor's means and methods such as trench box width or sloped trenches, even if these measures are taken as a result of OSHA requirements or other reasons.

1.08 Bore and Jack Casings

A. Payment for casing shall be made only at the completion of all work specified for the casing installation. No partial payment shall be made for the construction of the casing.

B. Casing pipe may be included in Partial Payment Requests as stored materials, if the casing pipe is stored at the Project site. Casing pipe which has been properly installed, but has not yet been paid for as installed casing, may also be included as stored materials.

C. In the event that rock is encountered during the installation of the pipe casing which, the Engineer must verify then the Engineer may authorize the Contractor to complete the crossing by another method via a change order.

D. No additional payment shall be made for rock excavation through the casing.

E. Payment for pipe in casing shall be made only at the completion of all work specified for the pipe installation.

1.09 Removing and Replacing Pavement

A. Payment for removing and replacing pavement, for asphalt pavement, concrete pavement and gravel driveways or concrete sidewalks, will be made as a separate item based on the conditions set forth in Paragraphs B, C, and E below. The unit price bid shall include all costs associated with removing and replacing pavement or sidewalks, including providing select backfill if necessary, traffic control and temporary measures for maintaining traffic.

B. Payment shall be made only for those areas which are shown on the Drawings for pavement or sidewalks to be removed and replaced.

C. Quantities of the actual amount replaced shall not exceed the amount shown on the Drawings. Under no circumstances, including if pavement or sidewalks are damaged due to collapsing soils or the Contractor's means and methods, shall additional payment be made for removing and replacing pavement or sidewalks.

D. Payment for soils testing shall be made from the "soils and concrete testing" cash allowance. No payment shall be made for tests that fail to verify required results.

E. No additional payment will be made for removing and replacing damaged adjacent pavement or sidewalks.

F. Costs for removal and replacement of curb and gutter, concrete drainage flumes or other roadway or drainage features shall be included in the unit price bid for the item to which it pertains, unless otherwise noted in this Section of the Specifications.

1.10 Sewers and Accessories

A. Owner Furnished Materials

1. No additional payment shall be made on account of delays in delivery of materials furnished by the Owner.

2. Any delivery waiting charges shall be paid by the Contractor.

3. Should any material be damaged, lost or fail under test, and in the opinion of the Engineer, such failure or damage is the result of improper handling, it shall be replaced in kind by the Contractor at no cost to the Owner.

4. No payment shall be made for receiving, handling and distributing materials furnished by the Owner.

5. Fittings, solid sleeves and special bell pipe installed for the convenience of the Contractor, shall not be paid for.

B. Existing Utilities and Obstructions

1. Horizontal Conflict: Payments for conflicts with existing utilities shall be made only where additional manholes and/or additional lengths of pipe are approved by the Engineer. Said payment shall be made at the unit prices in the Bid. No other payment will be made for any delay or extra cost encountered by the Contractor due to protection, avoidance or relocation of existing utilities, mains or services or changing the horizontal alignment of the sewer.

2. Vertical Conflict: Where authorized by the Engineer, payment for additional depth of cut required to avoid vertical conflicts shall be made at the unit prices bid for gravity sewer. No payment will be made for relocation of existing utilities.

C. Location and Grade

1. Owner shall provide construction layout through cash allowance item.

D. Construction Along Highways, Streets and Roadways: No separate payment shall be made for traffic control or maintaining highways, streets, roadways and driveways.

E. Laying and Jointing Pipe and Accessories

1. Measurement for payment at the unit price for gravity sewer shall be made from centerline of manhole to centerline of manhole or to inside face of structure wall penetrated. Depth of cut shall be measured from pipe invert to ground level at pipe centerline. Cut sheets prepared by the Contractor and approved by the Engineer shall be the basis for payment.

2. Force Mains

a. Payment for force main shall be made for the quantity provided. Measurement for payment shall be made along the centerline of the pipe, through valves and fittings. No payment shall be made for sections of pipe which are not installed.

b. The unit price bid for fittings shall include the fittings and joint accessories and the cost of all related blocking. Weight, for fittings shall be AWWA C 110 standard weight for all mechanical joint ends and shall not include the weight of bolts, glands, or cement lining.

c. The unit price bid for air valves shall include the cost of providing the air valve, plug valve, tee, precast concrete product, frame and cover, crushed stone and all related items as shown on the Drawings.

3. Payment for Sewer Service Lateral Relocations for building connections shall be made based on the quantity installed at the unit price bid. The price bid shall include furnishing and installing the all fittings, pipe and all other required work. No additional payment will be made for plugging or cutting the existing sewer pipe to redirect the service lateral.

4. No additional payment will be made for replacement of defective materials.

5. No additional payment will be made for maintaining flow while placing the new sewer in service.

6. No separate payment will be made for plugging, abandoning or removing existing sewers. For sewers that are to be removed, no additional payment will be made for removing the sewer from its trench, disposing it off-site, or any other incidental requirements.

7. No separate payment shall be made for detection tape.

8. No payment will be made for cutting and beveling pipe.

9. Where dissimilar pipe materials are connected with adaptor couplings, the cost of such shall be included in the item to which it pertains.

F. Manhole and Precast Concrete Product Construction

1. All costs for constructing the manhole bases, including but not limited to the precast concrete base, the transition slab for bases larger than four foot diameter, rubber boots, inverts, frame and cover, and connecting the pipes to the manhole, shall be included in the unit price bid for the appropriate size precast concrete manhole Base.

2. Measurement for payment at the unit price for precast concrete manhole Risers shall be made from the top of the manhole frame and cover to:

a. The top inside lip of the manhole base for 4-Foot diameter bases.

b. The top inside lip of the transition slab for 5-Foot diameter and larger or square bases.

3. Connect to existing tie in: The unit price bid for these items shall include all work as shown on contract documents including all incidentals. No additional payment will be made unless approved by owner’s representative.

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4. Structure/Manhole Over Existing Sewer: The unit price bid for Structure/Manhole Over Existing Sewer shall include all additional costs for labor and materials required to cut the existing pipe, necessary plugs, and maintain continuous service in the existing sewer. Payment for this work is in addition to the payment provided for the new manhole base and riser as described Paragraphs E.1 and E.2 above.

5. Outside Drop Connections: The unit price bid for Outside Drop Connections shall include penetrations of the manhole wall, sealing the connections, forming new inverts, and all pipe, fittings, and other materials required to make the connection as shown on the Drawings. Payment for drop connections will be made only at locations shown on the Drawings, or otherwise directed by the Engineer, where the difference in elevation of the incoming sewer is greater than two feet from that of the outgoing sewer's invert.

6. Existing Manhole Lining: The unit price bid for Manhole Lining shall include cleaning and preparation of the manhole, installing the liner, and all other requirements for manhole rehabilitation as shown on the Drawings or as required in Section 02731 of these Specifications.

G. Concrete Encasement: The unit price bid for concrete encasement shall include all labor and materials required to encase the pipe with concrete where shown and as detailed on the Drawings.

H. Polyethylene Encasement: Payment for polyethylene encasement shall be made at the unit price bid for polyethylene encasement. The unit price bid shall include all labor and materials, including tape.

I. Air Release Valve Manhole: All costs of the air release valve, manhole, and other appurtenances, as shown on the Drawings, shall be included in the unit price bid. Payment shall include excavation, backfill, all fittings (both ductile iron and stainless steel), stainless steel piping and the plug valve.

J. All costs related to the implementation of the easement and permit stipulations shall be included in the unit price bid for the item to which it pertains.

K. Clean-up and Testing

1. Payment for Clean-up and Testing shall be made at the unit price shown for clean-up and testing. Any other cost for labor, materials and equipment required for clean-up shall be included in the unit price bid for the item to which it pertains. No payment for clean-up and testing shall be made for any length of line unless both testing and clean-up have been performed satisfactorily for that segment of line for which payment is being requested.

2. Payment for Clean-up and Testing of sewer service laterals shall not be included in quantities bid for Clean-up and Testing and the cost of such shall be included in the item in which it pertains.

3. Clean-up and Testing of all piping shown on contract documents shall be included in the lump sum price bid.

1.11 Water Mains and Accessories

A. Owner Furnished Materials

1. No additional payment shall be made on account of delays in delivery of materials furnished by the Owner.

2. Any delivery waiting charges shall be paid by the Contractor.

3. Should any material be damaged, lost or fail under test, and in the opinion of the Engineer, such failure or damage is the result of improper handling, it shall be replaced in kind by the Contractor at no cost to the Owner.

4. No payment shall be made for receiving, handling and distributing materials furnished by the Owner.

5. Fittings, solid sleeves and special bell pipe installed for the convenience of the Contractor, shall not be paid for.

B. Existing Utilities and Obstructions

1. Horizontal Conflict: Payments for conflicts with existing utilities shall be made only where additional manholes and/or additional lengths of pipe are approved by the Engineer. Said payment shall be made at the unit prices in the Bid. No other payment will be made for any delay or extra cost encountered by the Contractor due to protection, avoidance or relocation of existing utilities, mains or services or changing the horizontal alignment of the sewer.

2. Vertical Conflict: Where authorized by the Engineer, payment for additional depth of cut required to avoid vertical conflicts shall be made at the unit prices bid for gravity sewer. No payment will be made for relocation of existing utilities.

C. Location and Grade

1. Owner shall provide construction layout through cash allowance item.

D. Construction Along Highways, Streets and Roadways: No separate payment shall be made for traffic control or maintaining highways, streets, roadways and driveways.

E. Laying and Jointing Pipe and Accessories

1. Measurement for payment at the unit price for water main shall be made from valve to valve. Cut sheets prepared by the Contractor and approved by the Engineer shall be the basis for payment.

2. Water Mains

a. Payment for water main shall be made for the quantity provided. Measurement for payment shall be made along the centerline of the pipe, through valves and fittings. No payment shall be made for sections of pipe which are not installed.

b. The unit price bid for fittings shall include the fittings and joint accessories and the cost of all related blocking. Weight, for fittings shall be AWWA C 110 standard weight for all mechanical joint ends and shall not include the weight of bolts, glands, or cement lining.

c. The unit price bid for valves shall include the cost of providing the valve, valve marker, valve stem, valve box and valve concrete collar, concrete blocking crushed stone and all related items as shown on the Drawings.

3. Payment for Water Service Installations or Relocations for connections shall be made based on the quantity installed at the unit price bid. The price bid shall include furnishing and installing the all fittings, pipe, valve box and all other required work. No additional payment will be made for plugging or cutting the existing water line service pipe to redirect the service.

4. No additional payment will be made for replacement of defective materials.

5. No additional payment will be made for maintaining flow while placing the new water service in service.

6. No separate payment will be made for plugging, abandoning or removing existing water meters and lines. For water lines that are to be removed, no additional payment will be made for removing the water or meter from its trench, disposing it off-site and/or replacing meter in new meter box, or any other incidental requirements.

7. No separate payment shall be made for detection tape.

8. No payment will be made for cutting and beveling pipe.

F. Fire Hydrants, Tees, Valves, Reducers and Bends Construction

1. All costs for constructing the fire hydrants, valves, reducers, and bends including all required materials and concrete blocking and rodding shall be included in the unit price bid for the appropriate bid item.

2. Reserved

3. Connection to existing water main (tie in): The unit price bid for these items shall include all work as shown on contract documents including all incidentals. No additional payment will be made unless approved by owner's representative.

G. Concrete Encasement: The unit price bid for concrete encasement shall include all labor and materials required to encase the pipe with concrete where shown and as detailed on the Drawings.

H. Polyethylene Encasement: Payment for polyethylene encasement shall be made at the unit price bid for polyethylene encasement. The unit price bid shall include all labor and materials, including tape.

I. All costs related to the implementation of the easement and permit stipulations shall be included in the unit price bid for the item to which it pertains.

J. Clean-up and Testing

1. Payment for Clean-up and Testing shall be made at the unit price shown for clean-up and testing. Any other cost for labor, materials and equipment required for clean-up shall be included in the unit price bid for the item to which it pertains. No payment for clean-up and testing shall be made for any length of line unless both testing and clean-up have been performed satisfactorily for that segment of line for which payment is being requested.

2. Payment for Clean-up and Testing of water services shall not be included in quantities bid for Clean-up and Testing and the cost of such shall be included in the item in which it pertains.

3. Clean-up and Testing of all piping shown on contract documents shall be included in the lump sum price bid.

END OF SECTION

Part 1 General

1.01 Scope

A. Construction staking shall include all of the surveying work required to layout the Work and control the location of the finished Project. The Contractor shall have the full responsibility for constructing the Project to the correct horizontal and vertical alignment, as shown on the Drawings, as specified, or as ordered by the Owner. The Contractor shall assume all costs associated with rectifying work constructed in the wrong location.

B. From the information shown on the Drawings and the information to be provided as indicated under Project Conditions below, the Contractor shall:

1. Be responsible for setting reference points and/or offsets, establishment of baselines, and all other layout, staking, and all other surveying required for the construction of the Project.

2. The Contractor shall safeguard all reference points, stakes, grade marks, horizontal and vertical control points.

3. Stake out the permanent and temporary easements or the limits of construction to ensure that the Work is not deviating from the indicated limits.

C. Baselines shall be defined as the line to which the location of the Work is referenced, i.e., edge of pavement, road centerline, property line, right-of-way or survey line.

D. Record Drawing surveys shall be performed in accordance with Section 01720 of these Specifications.

1.02 Project Conditions

A. The Drawings provide the location and/or coordinates of principal components of the Project. The alignment of some components of the Project may be indicated in the Specifications. The Owner may order changes to the location of some of the components of the Project or provide clarification to questions regarding the correct alignment.

B. The Contractor will provide the following:

1. A land surveying firm, registered in the State of Georgia, to perform construction layout.

C. A topographic survey is included on the Drawings.

END OF SECTION

Section 01060
Regulatory Requirements

Part 1 General

1.01 Scope

A. Permits and Responsibilities: The Contractor shall, without additional expense to the Owner, be responsible for obtaining all necessary licenses and permits, including but not limited to, building permits, electrical permits and for complying with any applicable federal, state, county and municipal laws, codes and regulations, in connection with the prosecution of the Work.

B. The Contractor shall take proper safety and health precautions to protect the Work, the workers, the public and the property of others.

C. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the Work, except for any completed unit of construction thereof which may heretofore have been accepted.

D. All work shall be completed in compliance with GDOT, Douglas County and Douglasville - Douglas County Water Sewer Authority rules and regulations

END OF SECTION

Codes and Standards

Part 1 General

1.01 Description

A. Whenever reference is made to conforming to the standards of any technical society, organization, body, code or standard, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the time of advertisement for Bids. This shall include the furnishing of materials, testing of materials, fabrication and installation practices. In those cases where the Contractor's quality standards establish more stringent quality requirements, the more stringent requirement shall prevail. Such standards are made a part hereof to the extent which is indicated or intended.

B. The inclusion of an organization under one category does not preclude that organization’s standards from applying to another category.

C. In addition, all work shall comply with the applicable requirements of local codes, utilities and other authorities having jurisdiction.

D. All material and equipment, for which a UL Standard, an AGA or NSF approval or an ASME requirement is established, shall be so approved and labeled or stamped. The label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.

E. The standards which apply to this Project are not necessarily restricted to those organizations which are listed in Article 1.02.

1.02 Standard Organizations

A. Piping and Valves

- ACPA American Concrete Pipe Association
- ANSI American National Standards Institute
- API American Petroleum Institute
- ASME American Society of Mechanical Engineers
- AWWA American Water Works Association
- CISPI Cast Iron Soil Pipe Institute
- DIPRA Ductile Iron Pipe Research Association
- FCI Fluid Controls Institute
- MSS Manufacturers Standardization Society
- NCPI National Clay Pipe Institute
- NSF National Sanitation Foundation
- PPI Plastic Pipe Institute
- Uni-Bell PVC Pipe Association

B. Materials

- AASHTO American Association of State Highway and Transportation Officials
- ANSI American National Standards Institute
- ASTM American Society for Testing and Materials

C. Painting and Surface Preparation

- NACE National Association of Corrosion Engineers
- SSPC Steel Structures Painting Council

D. Electrical and Instrumentation

- AEIC Association of Edison Illuminating Companies
- AIEE American Institute of Electrical Engineers
- EIA Electronic Industries Association
- ICEA Insulated Cable Engineers Association
- IEC International Electrotechnical Commission
- IEEE Institute of Electrical and Electronic Engineers
- IES Illuminating Engineering Society
- IPC Institute of Printed Circuits
- IPCEA Insulated Power Cable Engineers Association
- ISA ISA – The Instrumentation, Systems, and Automation Society
- NEC National Electric Code
- NEMA National Electrical Manufacturers Association
- NFPA National Fire Protection Association
- REA Rural Electrification Administration
- TIA Telecommunications Industries Association
- UL Underwriter's Laboratories
- VRCI Variable Resistive Components Institute

E. Aluminum

- AA Aluminum Association
- AAMA American Architectural Manufacturers Association

F. Steel and Concrete

- ACI American Concrete Institute
- AISC American Institute of Steel Construction, Inc.
- AISI American Iron and Steel Institute
- CRSI Concrete Reinforcing Steel Institute
- NRMA National Ready-Mix Association
- PCA Portland Cement Association

- PCI Prestressed Concrete Institute

G. Welding

- ASME American Society of Mechanical Engineers
- AWS American Welding Society

H. Government and Technical Organizations

- AIA American Institute of Architects
- APHA American Public Health Association
- APWA American Public Works Association
- ASA American Standards Association
- ASAE American Society of Agricultural Engineers
- ASCE American Society of Civil Engineers
- ASQC American Society of Quality Control
- ASSE American Society of Sanitary Engineers
- CFR Code of Federal Regulations
- CSI Construction Specifications Institute
- EDA Economic Development Administration
- EPA Environmental Protection Agency
- FCC Federal Communications Commission
- FmHA Farmers Home Administration
- FS Federal Specifications
- IAI International Association of Identification
- ISEA Industrial Safety Equipment Association
- ISO International Organization for Standardization
- ITE Institute of Traffic Engineers
- NBFU National Board of Fire Underwriters
- (NFPA) National Fluid Power Association
- NBS National Bureau of Standards
- NISO National Information Standards Organization
- OSHA Occupational Safety and Health Administration
- SI Salt Institute
- SPI The Society of the Plastics Industry, Inc.
- USDC United States Department of Commerce
- WEF Water Environment Federation

I. General Building Construction

- AHA American Hardboard Association
- AHAM Association of Home Appliance Manufacturers
- AITC American Institute of Timber Construction
- APA American Parquet Association, Inc.
- APA American Plywood Association
- BHMA Builders Hardware Manufacturers Association

- BIFMA Business and Institutional Furniture Manufacturers Association
- DHI Door and Hardware Institute
- FM Factory Mutual Fire Insurance Company
- HPMA Hardwood Plywood Manufacturers Association
- HTI Hand Tools Institute
- IME Institute of Makers of Explosives
- ISANTA International Staple, Nail and Tool Association
- ISDSI Insulated Steel Door Systems Institute
- IWS Insect Screening Weavers Association
- MBMA Metal Building Manufacturers Association
- NAAMM National Association of Architectural Metal Manufacturers
- NAGDM National Association of Garage Door Manufacturers
- NCCLS National Committee for Clinical Laboratory Standards
- NFPA National Fire Protection Association
- NFSA National Fertilizer Solutions Association
- NKCA National Kitchen Cabinet Association
- NWMA National Woodwork Manufacturers Association
- NWWDA National Wood Window and Door Association
- RMA Rubber Manufacturers Association
- SBC SBCC Standard Building Code
- SDI Steel Door Institute
- SIA Scaffold Industry Association
- SMA Screen Manufacturers Association
- SPRI Single-Ply Roofing Institute
- TCA Tile Council of America
- UBC Uniform Building Code

J. Roadways

- AREA American Railway Engineering Association
- DOT Department of Transportation

K. Plumbing

- AGA American Gas Association
- NSF National Sanitation Foundation
- PDI Plumbing Drainage Institute
- SPC SBCC Standard Plumbing Code

L. Refrigeration, Heating, and Air Conditioning

- AMCA Air Movement and Control Association
- ARI American Refrigeration Institute
- ASHRAE American Society of Heating, Refrigeration, and Air Conditioning Engineers
- ASME American Society of Mechanical Engineers

- CGA Compressed Gas Association
- CTI Cooling Tower Institute
- HEI Heat Exchange Institute
- IIAR International Institute of Ammonia Refrigeration
- NB National Board of Boilers and Pressure Vessel Inspectors
- PFMA Power Fan Manufacturers Association
- SAE Society of Automotive Engineers
- SMACNA Sheet Metal and Air Conditioning Contractors National Association
- SMC SBCC Standard Mechanical Code
- TEMA Tubular Exchangers Manufacturers Association

M. Equipment

- AFBMA Anti-Friction Bearing Manufacturers Association, Inc.
- AGMA American Gear Manufacturers Association
- ALI Automotive Lift Institute
- CEMA Conveyor Equipment Manufacturers Association
- CMAA Crane Manufacturers Association of America
- DEMA Diesel Engine Manufacturers Association
- MMA Monorail Manufacturers Association
- OPEI Outdoor Power Equipment Institute, Inc.
- PTI Power Tool Institute, Inc.
- RIA Robotic Industries Association
- SAMA Scientific Apparatus Makers Association

1.03 Symbols

Symbols and material legends shall be as scheduled on the Drawings.

END OF SECTION

Part 1 General

1.01 Scope

A. Work under this Section includes all scheduling and administering of pre-construction and progress meetings as herein specified and necessary for the proper and complete performance of this Work.

B. Scheduling and Administration by Owner:

1. Prepare agenda.
2. Make physical arrangements for the meetings.
3. Preside at meetings.
4. Record minutes and include significant proceedings and decisions.
5. Distribute copies of the minutes to participants.

1.02 Preconstruction Conference

A. The Owner shall schedule the preconstruction conference prior to the issuance of the Notice to Proceed.

B. Representatives of the following parties are to be in attendance at the meeting:
1. Owner.
2. Engineer.
3. Contractor and superintendent.
4. Major subcontractors.
5. Representatives of governmental or regulatory agencies when appropriate.

C. The agenda for the preconstruction conference shall consist of the following as a minimum:
1. Distribute and discuss a list of major subcontractors and a tentative construction schedule.
2. Critical work sequencing.
3. Designation of responsible personnel and emergency telephone numbers.
4. Processing of field decisions and change orders.
5. Adequacy of distribution of Contract Documents.
6. Schedule and submittal of shop drawings, product data and samples.
7. Pay request format, submittal cutoff date, paydate and retainage.
8. Procedures for maintaining record documents.
9. Use of premises, including office and storage areas and Owner's requirements.
10. Major equipment deliveries and priorities.
11. Safety and first aid procedures.
12. Security procedures.
13. Housekeeping procedures.
14. Work hours.

1.03 Project Coordination Meetings

A. Schedule regular bi-monthly meetings as directed by the Owner.

B. Hold called meetings as the progress of the Work dictates.

C. The meetings shall be held at the location indicated by the Owner.

D. Representatives of the following parties are to be in attendance at the meetings:

1. Owner.
2. Engineer.
3. Contractor and superintendent.
4. Major subcontractors as pertinent to the agenda.
5. Representatives of governmental or other regulatory agencies as appropriate.

E. The minimum agenda for progress meetings shall consist of the following:

1. Review and approve minutes of previous meetings.
2. Review work progress since last meeting.
3. Note field observations, problems and decisions.
4. Identify problems which impede planned progress.
5. Review off-site fabrication problems.
6. Review Contractor's corrective measures and procedures to regain plan schedule.
7. Review Contractor's revision to the construction schedule as outlined in the Supplementary Conditions.
8. Review submittal schedule; expedite as required to maintain schedule.
9. Maintenance of quality and work standards.
10. Review changes proposed by Owner for their effect on the construction schedule and completion date.
11. Complete other current business.

END OF SECTION

Construction Schedules

Part 1 General

1.01 Scope

A. The work under this Section includes preparing, furnishing, distributing, and periodic updating of the construction schedules as specified herein.

B. The purpose of the schedule is to demonstrate that the Contractor can complete the overall Project within the Contract Time and meet all required interim milestones.

1.02 Submittals

A. Overall Project Schedule (OPS)

1. Submit the schedule within 10 days after date of the Notice to Proceed.

2. The Engineer will review the schedule and return it within 10 days after receipt.

3. If required, resubmit within 10 days after receipt of a returned copy.

B. Near Term Schedule (NTS)

1. Submit the first Near Term Schedule within 10 days of the Notice to Proceed.

2. The Engineer will review the schedule and return it within 10 days after receipt.

C. Submit an update of the OPS, NTS, and narrative with each progress payment request.

D. Submit the number of copies required by the Contractor, plus six copies to be retained by the Engineer.

1.03 Approval

Approval of the Contractor's detailed construction program and revisions thereto shall in no way relieve the Contractor of any of Contractor's duties and obligations under the Contract. Approval is limited to the format of the schedule and does not in any way indicate approval of, or concurrence with, the Contractor's means, methods and ability to carry out the Work.

1.04 Overall Project Schedule (OPS)

A. The Contractor shall submit to the Owner for approval a detailed Overall Project Schedule of the Contractor's proposed operations for the duration of the Project. The OPS shall be in the form of a Gantt/bar chart.

B. Gantt/Bar Chart Schedule

1. Each activity with a duration of five or more days shall be identified by a separate bar. Activities with a duration of more than 20 days shall be sub-divided into separate activities.

2. The schedule shall include activities for shop drawing preparation and review, fabrication, delivery, and installation of major or critical path materials and equipment items.

3. The schedule shall show the proposed start and completion date for each activity. A separate listing of activity start and stop dates and working day requirements shall be provided unless the information is shown in text form on the Gantt/bar chart.

4. The schedule shall identify the Notice to Proceed date, the Contract Completion date, major milestone dates, and a critical path.

5. The schedule shall be printed on a maximum 11 x 17-inch size paper. If the OPS needs to be shown on multiple sheets, a simplified, one page, summary bar chart showing the entire Project shall be provided.

6. The schedule shall have a horizontal time scale based on calendar days and shall identify the Monday of each week.

7. The schedule shall show the precedence relationship for each activity.

1.05 Near Term Schedule (NTS)

A. The Contractor shall develop and refine a detailed Near Term Schedule showing the day to day activities with committed completion dates which must be performed during the upcoming 14 day period. The detailed schedule shall represent the Contractor's best approach to the Work which must be accomplished to maintain progress consistent with the Overall Project Schedule.

B. The Near Term Schedule shall be in the form of Gantt/bar chart and shall include a written narrative description of all activities to be performed and describe corrective action to be taken for items that are behind schedule.

1.06 Updating

A. Show all changes occurring since previous submission of the updated schedule.

B. Indicate progress of each activity and show actual completion dates.

C. The Contractor shall be prepared to provide a narrative report at the Project Coordination Meetings. The report shall include the following:

1. A description of the overall Project status and comparison to the OPS.

2. Identify activities which are behind schedule and describe corrective action to be taken.

3. A description of changes or revisions to the Project and their effect on the OPS.

4. A description of the Near Term Schedule of the activities to be completed during the next 14 days. The report shall include a description of all activities requiring participation by the Engineer and/or Owner.

END OF SECTION

Part 1 General

1.01 Scope

A. The Contractor shall furnish all equipment and labor materials required to provide the Owner with digital construction videos and photographs of the Project.

B. Photo and video files shall become the property of the Owner and none of the videos or photographs shall be published without express permission of the Owner.

1.02 Pre and Post Construction Videos and Photographs

A. Prior to the beginning of any work, the Contractor shall take videos and photographs of the work area to record existing conditions.

B. Following completion of the work, another set of videos and photographs shall be made showing the same areas and features as in the pre-construction videos and photographs.

C. All conditions which might later be subject to disagreement shall be shown in sufficient detail to provide a basis for decisions.

1.03 File Format, Media and Submittals

A. Photographs shall be in “jpg” format.

B. Videos shall be in a format viewable by Microsoft Windows Media Player. Audio narration is desirable.

C. Files shall be named such that what is being viewed is self evident.

D. Files shall be submitted on a compact disk (CD) or a digital video disk (DVD). If submitted on DVD, disk shall be recorded in “Minus R” format.

E. The pre-construction videos and photographs shall be submitted to the Engineer within 10 calendar days after the date of receipt by the Contractor of Notice to Proceed. Post-construction videos and photographs shall be provided prior to final acceptance of the Project.

END OF SECTION

Part 1 General

1.01 Scope

A. The work under this Section includes submittal to the Owner of shop drawings, product data and samples required by the various Sections of these Specifications.

B. Submittal Contents: The submittal contents required are specified in each Section.

C. Definitions: Submittals are categorized as follows:

1. Shop Drawings

a. Shop drawings shall include technical data, drawings, diagrams, procedure and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawing is prepared.

b. Provide newly-prepared information, on reproducible sheets, with graphic information at accurate scale (except as otherwise indicated) or appropriate number of prints hereof, with name or preparer (firm name) indicated. The Contract Drawings shall not be traced or reproduced by any method for use as or in lieu of detail shop drawings. Show dimensions and note dimensions that are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements. Do not allow shop drawings to be used in connection with the Work without appropriate final “Action” markings by the Owner.

c. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, specification section, schedule or room numbers shown on the Contract Drawings.

d. Minimum assembly drawings sheet size shall be 24 x 36-inches.

e. Minimum detail sheet size shall be 8-1/2 x 11-inches.

f. Minimum Scale:

(1) Assembly Drawings Sheet, Scale: 1-inch = 30 feet.

(2) Detail Sheet, Scale: 1/4-inch = 1 foot.

2. Product Data

   a. Product data includes standard printed information on materials, products and systems, not specially prepared for this Project, other than the designation of selections from among available choices printed therein.

   b. Collect required data into one submittal for each unit of work or system, and mark each copy to show which choices and options are applicable to the Project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked and special coordination requirements.

3. Samples

   a. Samples include both fabricated and un-fabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.

   b. Provide units identical with final condition of proposed materials or products for the work. Include “range” samples, not less than three units, where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Owner’s selection is required. Prepare samples to match the Owner’s sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and “kind” by the Owner. Owner will note “test” samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.

4. Miscellaneous submittals related directly to the Work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the Work but not processed as shop drawings, product data or samples.

1.02 Specific Category Requirements

A. General: Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal. Submittals shall contain:

1. The date of submittal and the dates of any previous submittals.

2. The Project title.

3. Numerical submittal numbers, starting with 1.0, 2.0, etc. Revisions to be numbered 1.1, 1.2, etc.
4. The Names of:

    a. Contractor

    b. Supplier

    c. Manufacturer

5. Identification of the product, with the Specification Section number, permanent equipment tag numbers and applicable Drawing No.

6. Field dimensions, clearly identified as such.

7. Relation to adjacent or critical features of the Work or materials.

8. Applicable standards, such as ASTM or Federal Specification numbers.

9. Notification to the Owner in writing, at time of submissions, of any deviations on the submittals from requirements of the Contract Documents. The notification of deviation shall be clearly marked by the Contractor in the body of the submittal and stated in text in the Contractor's remarks on the transmittal document of the submittal. Indicate the reasons for the deviations and the benefits to the Project.

10. Identification of revisions on resubmittals.

11. An 8 x 3-inch blank space for Contractor and Owner stamps.

12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria and coordination of the information within the submittal with requirements of the Work and of Contract Documents.

13. Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.03 Routing of Submittals

A. Submittals and routine correspondence shall be routed as follows:

1. Supplier to Contractor (through representative if applicable)
2. Contractor to Owner and Engineer
3. Owner to Engineer
4. Engineer to Contractor
5. Contractor to Supplier

Part 2 Products

2.01 Shop Drawings

A. Unless otherwise specifically directed by the Owner, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.

B. Submit all shop assembly drawings, larger than 11 x 17-inches, in the form of one reproducible transparency with two opaque prints or bluelines.

C. Submit all shop drawings, 11 x 17-inches and smaller, in the form of six opaque prints or bluelines.

D. One reproducible for all submittals larger than 11 x 17-inches and no more than three prints of other submittals will be returned to the Contractor.

2.02 Manufacturer's Literature

A. Where content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Owner’s review.

B. Submit the number of copies which are required to be returned (not to exceed three) plus six copies which will be retained by the Owner.

2.03 Samples

A. Samples shall illustrate materials, equipment or workmanship and established standards by which completed work is judged.

B. Unless otherwise specifically directed by the Owner, all samples shall be of the precise article proposed to be furnished.

C. Submit all samples in the quantity which is required to be returned plus one sample which will be retained by the Owner.

Part 3 Execution

3.01 Contractor's Coordination of Submittals

A. Prior to submittal for the Owner's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:

1. Determine and verify all field dimensions and conditions, catalog numbers and similar data.

2. Coordinate as required with all trades and all public agencies involved.

3. Submit a written statement of review and compliance with the requirements of all applicable technical Specifications as well as the requirements of this Section.

4. Clearly indicate in a letter or memorandum on the manufacturer's or fabricator's letterhead, all deviations from the Contract Documents.

B. Each and every copy of the shop drawings and data shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Owner without the Contractor's stamp will be returned to the Contractor for conformance with this requirement.

C. The Owner may backcharge the Contractor for costs associated with having to review a particular shop drawing, product data or sample more than two times to receive a "No Exceptions Taken" mark.

D. Grouping of Submittals

1. Unless otherwise specifically permitted by the Owner, make all submittals in groups containing all associated items.

2. No review will be given to partial submittals of shop drawings for items which interconnect and/or are interdependent. It is the Contractor's responsibility to assemble the shop drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to the Owner along with Contractor's comments as to compliance, non-compliance or features requiring special attention.

E. Schedule of Submittals

1. Within 30 days of Contract award and prior to any shop drawing submittal, the Contractor shall submit a schedule showing the estimated date of submittal and the desired approval date for each shop drawing anticipated. A reasonable period shall be scheduled for review and comments. Time lost due to unacceptable submittals shall be the Contractor's responsibility and some time allowance for resubmittal shall be provided. The schedule shall provide for submittal of items which relate to one another to be submitted concurrently.

3.02 Timing of Submittals

A. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.

B. In scheduling, allow sufficient time for the Owner’s review following the receipt of the submittal.

3.03 Reviewed Shop Drawings

A. Owner Review

1. Allow a minimum of 5 business days for the Owner’s initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Owner will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow a minimum of 5 business days for reprocessing each submittal. Advise the Owner on each submittal as to whether processing time is critical to progress of the Work, and therefore the Work would be expedited if processing time could be foreshortened.

2. Acceptable submittals will be marked “No Exceptions Taken”. A minimum of three copies will be retained by the Owner for his use and the remaining copies will be returned to the Contractor.

3. Submittals requiring minor corrections before the product is acceptable will be marked “Make Corrections Noted”. The Contractor may order, fabricate and ship the items included in the submittals, provided the indicated corrections are made. Drawings must be resubmitted for review and marked “No Exceptions Taken” prior to installation or use of products.

4. Submittals marked “Amend and Resubmit” must be revised to reflect required changes and the initial review procedure repeated.

5. The “Rejected - See Remarks” notation is used to indicate products which are not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.

6. Only two copies of items marked “Amend and Resubmit” and “Rejected - See Remarks” will be reviewed and marked. One copy will be retained by the Owner and the other copy with all remaining unmarked copies will be returned to the Contractor for resubmittal.

B. No work or products shall be installed without a drawing or submittal bearing the “No Exceptions Taken” notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Owner’s stamp.

C. Substitutions: In the event the Contractor obtains the Owner’s approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using methods approved by the Owner, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.

D. Use of the “No Exceptions Taken” notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract

Documents. The Owner’s review shall not relieve the Contractor of responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.

3.04 Resubmission Requirements

A. Shop Drawings

1. Revise initial drawings as required and resubmit as specified for initial submittal, with the resubmittal number shown.

2. Indicate on drawings all changes which have been made other than those requested by the Owner.

B. Project Data and Samples: Resubmit new data and samples as specified for initial submittal, with the resubmittal number shown.

END OF SECTION

Part 1 General

1.01 Scope

A. This Section includes testing which the Owner may require, beyond that testing required of the manufacturer, to determine if materials provided for the Project meet the requirements of these Specifications.

B. This work also includes all testing required by the Owner to verify work performed by the Contractor is in accordance with the requirements of these Specifications, i.e., concrete strength and slump testing, soil compaction, etc.

C. This work does not include materials testing required in various Sections of these Specifications to be performed by the manufacturer, e.g., testing of pipe.

D. The testing laboratory or laboratories will be selected by the Owner. The testing laboratory or laboratories will work for the Owner.

1.02 Payment for Testing Services

A. The cost of testing services required by the Contract to be provided by the Contractor shall be paid for by the Owner through the CASH ALLOWANCE, i.e., concrete testing, soil compaction, and asphalt testing.

B. The cost of additional testing services not specifically required in the Specifications, but requested by the Owner, shall be paid for by the Owner through the CASH ALLOWANCE.

C. The cost of material testing described in various Sections of these Specifications or as required in referenced standards to be provided by a material manufacturer, shall be included in the price bid for that item and shall not be paid for by the Owner.

D. The cost of retesting any item that fails to meet the requirements of these Specifications shall be paid for by the Contractor. Retesting shall be performed by the testing laboratory working for the Owner.

1.03 Laboratory Duties

A. Cooperate with the Owner and Contractor.

B. Provide qualified personnel promptly on notice.

C. Perform specified inspections, sampling and testing of materials.

1. Comply with specified standards, ASTM, other recognized authorities, and as specified.

2. Ascertain compliance with requirements of the Contract Documents.

D. Promptly notify the Owner and Contractor of irregularity or deficiency of work which are observed during performance of services.

E. Promptly submit three copies (two copies to the Owner and one copy to the Contractor) of report of inspections and tests in addition to those additional copies required by the Contractor with the following information included:

1. Date issued
2. Project title and number
3. Testing laboratory name and address
4. Name and signature of inspector
5. Date of inspection or sampling
6. Record of temperature and weather
7. Date of test
8. Identification of product and Specification Section
9. Location of Project
10. Type of inspection or test
11. Results of test

Observations regarding compliance with the Contract Documents

F. Perform additional services as required.

G. The laboratory is not authorized to release, revoke, alter or enlarge on requirements of the Contract Documents, or approve or accept any portion of the Work.

1.04 Contractor Responsibilities

A. Cooperate with laboratory personnel, provide access to Work and/or manufacturer's requirements.

B. Provide to the laboratory, representative samples, in required quantities, of materials to be tested.

C. Furnish copies of mill test reports.

D. Furnish required labor and facilities to:

1. Provide access to Work to be tested;

2. Obtain and handle samples at the site;

3. Facilitate inspections and tests;

4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory.

E. Notify the laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.

F. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample(s) shall be selected by such laboratory or agency, or the Owner, and shipped to the laboratory by the Contractor at Contractor's expense.

G. Copies of all correspondence between the Contractor and testing agencies shall be provided to the Owner and Engineer.

1.05 Quality Assurance

Testing shall be in accordance with all pertinent codes and regulations and with procedures and requirements of the American Society for Testing and Materials (ASTM).

1.06 Product Handling

Promptly process and distribute all required copies of test reports and related instructions to insure all necessary retesting or replacement of materials with the least possible delay in the progress of the Work.

1.07 Furnishing Materials

The Contractor shall be responsible for furnishing all materials necessary for testing.

1.08 Code Compliance Testing

Inspections and tests required by codes or ordinances or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of, and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.09 Contractor's Convenience Testing

Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.10 Schedules for Testing

A. Establishing Schedule

1. The Contractor shall, by advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements for the testing laboratory to be on site to provide the required testing.

2. Provide all required time within the construction schedule.

B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

C. When the testing laboratory is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the Owner.

1.11 Taking Specimens

Unless otherwise provided in the Contract Documents, all specimens and samples for tests will be taken by the testing laboratory or the Owner.

1.12 Transporting Samples

The Contractor shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

END OF SECTION

Temporary Facilities

Part 1 General

1.01 Scope

A. Temporary facilities required for this work include, but are not necessarily limited to:

1. Temporary utilities such as water and electricity.

2. First aid facilities.

3. Sanitary facilities.

4. Potable water.

1.02 General

A. First aid facilities, sanitary facilities and potable water shall be available on the Project site on the first day that any activities are conducted on site. The other facilities shall be provided as the schedule of the Project warrants.

B. Maintenance: Use all means necessary to maintain temporary facilities in proper and safe condition throughout progress of the Work. In the event of loss or damage, immediately make all repairs and replacements necessary, at no additional cost to the Owner.

C. Removal: Remove all such temporary facilities and controls as rapidly as progress of the Work will permit.

1.03 Temporary Utilities

A. General

1. Provide and pay all costs for all water, electricity and other utilities required for the performance of the Work.

2. Pay all costs for temporary utilities until Project completion.

3. Costs for temporary utilities shall include all power, water and the like necessary for testing equipment as required by the Contract Documents.

B. Temporary Water: Provide all necessary temporary piping, and upon completion of the Work, remove all such temporary piping. Provide and remove water meters.

C. Temporary Electricity

1. Provide all necessary wiring for the Contractor's use.

2. Furnish, locate and install area distribution boxes such that the individual trades may use, their own construction type extension cords to obtain adequate power, and artificial lighting at all points where required by inspectors and for safety.

1.04 First Aid Facilities

The Contractor shall provide a suitable first aid station, equipped with all facilities and medical supplies necessary to administer emergency first aid treatment. The Contractor shall have standing arrangements for the removal and hospital treatment of any injured person. All first aid facilities and emergency ambulance service shall be made available by the Contractor to the Owner and the Owner's personnel.

1.05 Sanitary Facilities

Prior to starting the Work, the Contractor shall furnish, for use of Contractor's personnel on the job, all necessary toilet facilities which shall be secluded from public observation. These facilities shall be either chemical toilets or shall be connected to the Owner's sanitary sewer system. All facilities, regardless of type, shall be kept in a clean and sanitary condition and shall comply with the requirements and regulations of the area in which the Work is performed. Adequacy of these facilities will be subject to the Owner's review and maintenance of same must be satisfactory to the Owner at all times.

1.06 Potable Water

The Contractor shall be responsible for furnishing a supply of potable drinking water for employees, subcontractors, inspectors, engineers and the Owner who are associated with the Work.

1.07 Parking Facilities

Parking facilities for the Contractor's and Contractor's subcontractors' personnel shall be the Contractor's responsibility. The storage and work facilities provided by the Owner will not be used for parking by the Contractor's or subcontractor's personnel.

END OF SECTION

Section 01540
Job Site Security

Part 1 General

1.01 Barricades, Lights and Signals

A. The Contractor shall furnish and erect such barricades, fences, lights and danger signals and shall provide such other precautionary measures for the protection of persons or property and of the Work as necessary. Barricades shall be painted in a color that will be visible at night. From sunset to sunrise, the Contractor shall furnish and maintain at least one light at each barricade and sufficient numbers of barricades shall be erected to keep vehicles from being driven on or into any Work under construction.

B. The Contractor will be held responsible for all damage to the Work due to failure of barricades, signs and lights and whenever evidence is found of such damage, the Contractor shall immediately remove the damaged portion and replace it at Contractor's cost and expense. The Contractor's responsibility for the maintenance of barricades, signs and lights shall not cease until the Project has been accepted by the Owner.

C. Traffic control devices shall comply with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways.

END OF SECTION

Section 01562
Dust Control

Part 1 General

1.01 Scope

Limit blowing dust caused by construction operations by applying water or employing other appropriate means or methods to maintain dust control, subject to the approval of the Owner. As a minimum, this may require the use of a water wagon twice a day to suppress dusty conditions.

1.02 Protection of Adjacent Property

A. The Bidders shall visit the site and note the buildings, landscaping, roads, parking areas and other facilities near the Work site that may be damaged by their operations. The Contractor shall make adequate provision to fully protect the surrounding area and will be held fully responsible for all damages resulting from Contractor's operations.

B. Protect all existing facilities (indoors or out) from damage by dust, fumes, spray or spills (indoors or out). Protect motors, bearings, electrical gear, instrumentation and building or other surfaces from dirt, dust, welding fumes, paint spray, spills or droppings causing wear, corrosion, malfunction, failure or defacement by enclosure, sprinkling or other dust palliatives, masking and covering, exhausting or containment.

END OF SECTION

Section 01610
Transportation and Handling

Part 1 General

1.01 Scope

A. The Contractor shall provide transportation of all equipment, materials and products furnished under these Contract Documents to the Work site. In addition, the Contractor shall provide preparation for shipment, loading, unloading, handling and preparation for installation and all other work and incidental items necessary or convenient to the Contractor for the satisfactory prosecution and completion of the Work.

B. All equipment, materials and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the Work.

1.02 Transportation

A. All equipment shall be suitably boxed, crated or otherwise protected during transportation.

B. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall ensure that the weights of the assembled sections do not exceed the capacity of the cranes or hoisting equipment.

C. Small items and appurtenances such as gauges, valves, switches, instruments and probes which could be damaged during shipment shall be removed from the equipment prior to shipment, packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

1.03 Handling

A. All equipment, materials and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation.

B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice.

C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.

D. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

END OF SECTION

Section 01611
Storage and Protection

Part 1 General

1.01 Scope

The work under this Section includes, but is not necessarily limited to, the furnishing of all labor, tools and materials necessary to properly store and protect all materials, equipment, products and the like, as necessary for the proper and complete performance of the Work.

1.02 Storage and Protection

A. Storage

1. Maintain ample way for foot traffic at all times, except as otherwise approved by the Owner.

2. All property damaged by reason of storing of material shall be properly replaced at no additional cost to the Owner.

3. Packaged materials shall be delivered in original unopened containers and so stored until ready for use.

4. All materials shall meet the requirements of these Specifications at the time that they are used in the Work.

5. Store products in accordance with manufacturer's instructions.

B. Protection

1. Use all means necessary to protect the materials, equipment and products of every section before, during and after installation and to protect the installed work and materials of all other trades.

2. All materials shall be delivered, stored and handled to prevent the inclusion of foreign materials and damage by water, breakage, vandalism or other causes.

3. Substantially constructed weathertight storage sheds, with raised floors, shall be provided and maintained as may be required to adequately protect those materials and products stored on the site which may require protection from damage by the elements.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary for the approval of the Owner and at no additional cost to the Owner. Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel and sheet construction products shall be stored with one end elevated to facilitate drainage.

D. Unless otherwise permitted in writing by the Owner, building products and materials such as cement, grout, plaster, gypsum board, particleboard, resilient flooring, acoustical tile, paneling, finish lumber, insulation, wiring, etc., shall be stored indoors in a dry location. Building products such as rough lumber, plywood, concrete block and structural tile may be stored outdoors under a properly secured waterproof covering.

E. Tarps and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

1.03 Extended Storage

In the event that certain items of major equipment such as air compressors, pumps and mechanical aerators have to be stored for an extended period of time, the Contractor shall provide satisfactory long-term storage facilities which are acceptable to the Owner. The Contractor shall provide all special packaging, protective coverings, protective coatings, power, nitrogen purge, desiccants, lubricants and exercising necessary or recommended by the manufacturer to properly maintain and protect the equipment during the period of extended storage.

END OF SECTION

Substitutions and Options

Part 1 General

1.01 Scope

This Section outlines the restrictions and requirements for substitutions, product and manufacturer options, and construction method options.

1.02 Definitions

A. For the purposes of these Contract Documents, a “substitute item” shall be defined as one of the following:

1. A product or manufacturer offered as a replacement to a specified product or manufacturer.

2. A product or manufacturer offered in addition to a specified product or manufacturer.

B. For the purposes of these Contract Documents, a “substitute construction method” shall be defined as one of the following:

1. A mean, method, technique, sequence or procedure of construction offered as a replacement for a specified mean, method, technique, sequence or procedure of construction.

2. A mean, method, technique, sequence or procedure of construction offered in addition to a specified mean, method, technique, sequence or procedure of construction.

1.03 General

A. An item or construction method, which is offered where no specific product, manufacturer, mean, method, technique, sequence or procedure of construction is specified or shown on the Drawings, shall not be considered a substitute and shall be at the option of the Contractor, subject to the provisions in the Contract Documents for that item or construction method.

B. For products specified only by a referenced standard, the Contractor may select any product by any manufacturer, which meets the requirements of the Specifications, unless indicated otherwise in the Contract Documents.

C. If the manufacturer is named on the Drawings or in the Specifications as an acceptable manufacturer, products of that manufacturer meeting all requirements of the Specifications and Drawings are acceptable.

D. Whenever the Engineer's design is based on a specific product of a particular manufacturer, that manufacturer will be shown on the Drawings and/or listed first in the list of approved manufacturers in the Specifications. Any Bidder intending to furnish products of other than the first listed manufacturer, or furnish substitute items, shall

    1. Verify that the item being furnished will fit in the space allowed, perform the same functions and have the same capabilities as the item specified.

    2. Include in its Bid the cost of all accessory items which may be required by the other listed substitute product,

    3. Include the cost of any architectural, structural, mechanical, piping, electrical or other modifications required, and

    4. Include the cost of required additional work by the Engineer, if any, to accommodate the item.

E. Whenever a product specification includes minimum experience requirements which the manufacturer selected by the Contractor cannot meet, the manufacturer shall furnish the Owner with a cash deposit, or bond acceptable to the Owner in an amount equal to the cost of the product, which shall remain in effect until the experience requirement has been met.

1.04 Approvals

A. Approval, of a substitution as an acceptable manufacturer, of the Engineer is dependent on determination that the product offered:

    1. is essentially equal in function, performance, quality of manufacture, ease of maintenance, reliability, service life and other criteria to that on which the design is based, and

    2. will require no major modifications to structures, electrical systems, control systems or piping systems.

1.05 Substitutions and Options

A. No substitutions will be considered for the manufacturers listed in the Bid.

B. After Notice to Proceed

1. Substitute items will be considered only if the term “equal to” precedes the names of acceptable manufacturers in the Specification.

2. Where items are specified by referenced standard or specified as indicated above in Article 1.03, Paragraph A, such items shall be submitted to the Engineer for review.

3. The Contractor shall submit shop drawings on the substitute item for the Engineer's review in accordance with the Section 01340.

C. Prior to Opening of Bids

1. No consideration or approvals will be made for products specified by a referenced standard, or specified as indicated in Article 1.03, Paragraph A above. Such consideration may occur only after the Notice to Proceed.

2. No consideration or approvals will be made for products being offered where the term “equal to” precedes the name of an approved product. Such substitution consideration may occur only after the Notice to Proceed.

END OF SECTION

Part 1 General

1.01 Scope

This Section covers the general cleaning which the Contractor shall be required to perform both during construction and before final acceptance of the Project unless otherwise shown on the Drawings or specified elsewhere in these Specifications.

1.02 Quality Assurance

A. Daily, and more often if necessary, conduct inspections verifying that requirements of cleanliness are being met.

B. In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

1.03 Hazardous Material and Waste

A. The Contractor shall handle hazardous waste and materials in accordance with applicable local, state, and federal regulations. Waste shall also be disposed of in approved landfills as applicable.

B. The Contractor shall prevent accumulation of wastes which create hazardous conditions.

C. Burning or burying rubbish and waste materials on the site shall not be allowed.

D. Disposal of hazardous wastes or materials into sanitary or storm sewers shall not be allowed.

1.04 Disposal of Surplus Materials

Unless otherwise shown on the Drawings, specified or directed, the Contractor shall legally dispose off the site all surplus materials and equipment from demolition and shall provide suitable off-site disposal site, or utilize a site designated by the Owner.

Part 2 Products

2.01 Cleaning Materials and Equipment

Provide all required personnel, equipment and materials needed to maintain the specified standard of cleanliness.

2.02 Compatibility

Use only the cleaning materials, methods and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Engineer.

Part 3 Execution

3.01 Progress Cleaning

A. General

1. Do not allow the accumulation of scrap, debris, waste material and other items not required for construction of this Work.

2. At least each week, and more often if necessary, completely remove all scrap, debris and waste material from the job site.

3. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the environment.

B. Site

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris and waste material. Remove all such items to the place designated for their storage.

2. Restack materials stored on site weekly.

3. At all times maintain the site in a neat and orderly condition which meets the approval of the Engineer.

3.02 Final Cleaning

A. Definitions: Unless otherwise specifically specified, “clean” for the purpose of this Article shall be interpreted as the level of cleanliness generally provided by commercial building maintenance subcontractors using commercial quality building maintenance equipment and materials.

B. General: Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris and waste. Conduct final progress cleaning as described in 3.01 above.

C. Site: Unless otherwise specifically directed by the Engineer, hose down all paved areas on the site and all public sidewalks directly adjacent to the site; rake clean other surfaces of the grounds. Completely remove all resultant debris.

D. Structures

1. Remove all traces of soil, waste material, splashed material, and other foreign matter to provide a uniform degree of exterior cleanliness. Visually inspect all exterior surfaces and remove all traces of soil, waste material, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with water, the Engineer may require light sandblasting or other cleaning at no additional cost to the Owner.

2. Visually inspect all interior surfaces and remove all traces of soil, waste material, smudges and other foreign matter. Remove all paint droppings, spots, stains and dirt from finished surfaces.

3. Clean all glass inside and outside.

4. Polish all surfaces requiring the routine application of buffed polish. Provide and apply polish as recommended by the manufacturer of the material being polished.

E. Post-Construction Cleanup: All evidence of temporary construction facilities, haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other evidence of construction, as directed by the Engineer.

F. Restoration of Landscape Damage: Any landscape feature damaged by the Contractor shall be restored as nearly as possible to its original condition at the Contractor's expense. The Engineer will decide what method of restoration shall be used.

G. Timing: Schedule final cleaning as approved by the Engineer to enable the Owner to accept the Project.

3.03 Cleaning During Owner's Occupancy

Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning of the occupied spaces shall be as determined by the Engineer in accordance with the Supplementary Conditions of the Contract Documents.

END OF SECTION

Record Documents

Part 1 General

1.01 Scope

A. The work under this Section includes, but is not necessarily limited to, the compiling, maintaining, recording and submitting of project record documents as herein specified.

B. Record documents include, but are not limited to:

1. Drawings;

2. Specifications;

3. Change orders and other modifications to the Contract;

4. Engineer field orders or written instructions, including Requests for Information (RFI) and Clarification Memorandums;

5. Reviewed shop drawings, product data and samples;

6. Test records.

C. The Contractor shall maintain on the Project site throughout the Contract Time an up to date set of Record Drawings.

1.02 Maintenance of Documents and Samples

A. Storage

1. Store documents and samples in the Contractor's field office, City of Temple’s Director of Public Works Office or available on site, apart from documents used for construction.

2. Provide files and racks for storage of documents, as deemed necessary by the Owner.

B. File documents and samples in accordance with format of these Specifications.

C. Maintenance

1. Maintain documents in a clean, dry, legible condition and in good order.

2. Do not use record documents for construction purposes.

3. Maintain at the site for the Owner one copy of all record documents.

D. Make documents and samples available at all times for inspection by Engineer.

E. Failure to maintain the Record Documents in a satisfactory manner may be cause for withholding of a certificate for payment.

1.03 Quality Assurance

A. Unless noted otherwise, Record Drawings shall provide dimensions, distances and coordinates to the nearest 0.1 foot.

B. Unless noted otherwise, Record Drawings shall provide elevations to the nearest 0.01 foot for all pertinent items constructed by the Contractor.

1.04 Recording

A. Label each document “Project Record” in neat, large printed letters.

B. Recording

1. Record information concurrently with construction progress.

2. Do not conceal any work until required information is recorded.

1.05 Record Drawings

A. Record Drawings shall be reproducible, shall have a title block indicating that the drawings are Record Drawings, the name of the company preparing the Record Drawings, and the date the Record Drawings were prepared. The Owner will provide Final Record Drawings based on Contractors Mark up Record Drawings.

B. Legibly mark drawings to record actual construction, including:

1. All Construction

a. Changes of dimension and detail.

b. Changes made by Requests for Information (RFI), field order, clarification memorandums or by change order.

c. Details not on original Drawings.

1.06 Specifications

A. Legibly mark each section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Requests for Information (RFI), field order, clarification memorandums, or by change order.

1.07 Submittal

A. At contract closeout, deliver Record Documents to the Engineer for the Owner.

B. Final Record Drawings to be provided by Owner.

C. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date

2. Project title and number

3. Contractor's name and address

4. Title and number of each record document

5. Signature of Contractor or Contractor's authorized representative

END OF SECTION

Warranties and Bonds

Part 1 General

1.01 Project Maintenance and Warranty

A. Maintain and keep in good repair the Work covered by these Drawings and Specifications until acceptance by the Owner.

B. The Contractor shall warrant for a period of one year from the date of Owner's written acceptance of certain segments of the Work and/or Owner's written final acceptance of the Project, as defined in the Contract Documents, that the completed Work is free from all defects due to faulty products or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects. The Owner will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments or other work that may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect throughout the warranty period.

C. The Contractor shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of improper operation or maintenance, or as a result of improper work or damage by another Contractor or the Owner, or to perform any work which is normally performed by a maintenance crew during operation.

D. In the event of multiple failures of major consequences prior to the expiration of the one year warranty described above, the affected unit shall be disassembled, inspected and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the failure shall be replaced. A new 12 month warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation. As used herein, multiple failure shall be interpreted to mean two or more successive failures of the same kind in the same item or failures of the same kind in two or more items. Major failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts, broken or chipped gear teeth, premature bearing failure, excessive wear or excessive leakage around seals. Failures which are directly and clearly traceable to operator abuse, such as operations in conflict with published operating procedures or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over-or under-lubrication and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the one year warranty. Should multiple failures occur in a given item, all products of the same size and type shall be disassembled, inspected, modified or replaced as necessary and re-warranted for one year.

E. The Contractor shall, at Contractor's own expense, furnish all labor, materials, tools and equipment required and shall make such repairs and removals and

shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship or faulty materials, in any Warranties and Bonds part of the Work performed by the Contractor. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or erosion after backfilling or placement.

F. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the Contract. Any and all damage to any facility not designated for removal, resulting from the Contractor's operations, shall be promptly repaired by the Contractor at no cost to the Owner.

G. The Contractor shall be responsible for all road and entrance reconstruction and repairs and maintenance of same for a period of one year from the date of final acceptance. In the event the repairs and maintenance are not made immediately and it becomes necessary for the owner of the road to make such repairs, the Contractor shall reimburse the owner of the road for the cost of such repairs.

H. In the event the Contractor fails to proceed to remedy the defects upon notification within 15 days of the date of such notice, the Owner reserves the right to cause the required materials to be procured and the work to be done, as described in the Drawings and Specifications, and to hold the Contractor and the sureties on Contractor's bond liable for the cost and expense thereof.

I. Notice to Contractor for repairs and reconstruction will be made in the form of a registered letter addressed to the Contractor at Contractor's home office.

J. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability within the law of the place of construction.

END OF SECTION

SECTION 02110
Clearing and Grubbing

PART 1 GENERAL

1.01 SCOPE

A. Clearing and grubbing includes, but is not limited to, removing from the Project site, trees, stumps, roots, brush, structures, abandoned utilities, trash, debris and all other materials found on or near the surface of the ground in the construction area and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated. Precautionary measures that prevent damage to existing features to remain will be considered part of the Work.

B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.

1.02 QUALITY ASSURANCE

A. The Contractor shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.

B. Open burning will not be allowed.

1.03 JOB CONDITIONS

Location of the Work: The area to be cleared and grubbed is shown schematically on the Drawings or specified below. It includes all areas designated for construction.

PART 2 PRODUCTS

2.01 EQUIPMENT

The Contractor shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks, loaders and root rakes.

PART 3 EXECUTION

3.01 SCHEDULING OF CLEARING

A. The Contractor shall clear at each construction site only that length of the sanitary sewer easement, permanent or construction easement which would be the equivalent of one month's pipe laying.

B. The Engineer may permit clearing for additional lengths of the pipe line provided that temporary erosion and sedimentation controls are in place and a satisfactory stand of temporary grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above.

C. A satisfactory stand of grass shall have no bare spots larger than one square yard. Bare spots shall be scattered and the bare area shall not comprise more than one percent of any given area.

3.02 CLEARING AND GRUBBING

A. Clear and grub the permanent easement or 10 feet on each side of the pipeline, whichever is greater, before excavating. Remove all trees, growth, debris, stumps and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.

B. Materials to be cleared, grubbed and removed from the Project site include, but are not limited to, all trees, stumps, roots, brush, trash, organic matter, paving, miscellaneous structures, houses, debris and abandoned utilities.

C. Grubbing shall consist of completely removing roots, stumps, trash and other debris from all graded areas so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.

D. All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed of. Piling and butts of utility poles shall be removed to a minimum depth of two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.

E. Landscaping features shall include, but are not necessarily limited to, fences, cultivated trees, cultivated shrubbery, property corners, man-made improvements, subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features. Fences shall be provided with a gate across the permanent easement. Existing structures shall be relocated such that they are off the easement.

F. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as rip rap.

G. Where the tree limbs interfere with utility wires, or where the trees to be felled are in

close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.

H. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.

I. All fences adjoining any excavation or embankment that, in the Contractor's opinion, may be damaged or buried, shall be carefully removed, stored and replaced. Any fencing that, in the Engineer's opinion, is significantly damaged shall be replaced with new fence material.

J. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the limits of the construction area but not directly within excavation and/or fill limits. The Contractor shall be held liable for any damage the Contractor's operations have inflicted on such property.

K. The Contractor shall be responsible for all damages to existing improvements resulting from Contractor's operations.

3.03 DISPOSAL OF DEBRIS

The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except with written consent of the property owner. In no case shall any material or debris be left on the Project, shoved onto abutting private properties or buried on the Project.

END OF SECTION

Part 1 General

1.01 Description

A. The work covered in this Section consists of implementing best management practices (BMPs) to prevent and minimize erosion and resultant sedimentation in all disturbed areas during and after construction. The contractor shall furnish all material, labor and equipment necessary for the proper installation, maintenance, monitoring, reporting and removal (where applicable) of erosion prevention and control measures and to cause compliance with the General NPDES Permit.

B. Related Work:

1. Erosion and Sediment Control – Section 02125
2. Lawns & Grasses – Section 02920
3. Erosion and Sedimentation Control (E&SC) Plan

1.02 Submittals

A. The following submittals shall be made in accordance with the requirements of this Section of Secondary Permittees and updated Construction Schedule information.

1. Revised Notice of Intent (NOI) with updated Operator Information, an updated list of Secondary Permittees and updated Construction Schedule information.

2. Credentials of Qualified Personnel

a. Prior to construction activities, the Contractor shall submit to the Owner in writing the name(s) of the Contractor's designated Qualified Personnel and shall provide credentials indication that the named Qualified Person has completed an appropriate erosion and sediment courses that fulfills the requirements of the NPDES Permit.

b. If the Contractor is to use subcontractors for any portion of the work which includes land disturbing activities, then the Contractor shall provide in writing the name of and credentials for at least one individual employed by the subcontractor that has attended the two hour subcontractor NPDES Erosion and Sedimentation Control Awareness Course.

c. The owner reserves the right to reject any candidate it deems unqualified for the position and, furthermore, may require the Contractor to replace an unqualified individual with a substitute at anytime throughout the life of the project, at no additional cost to the Owner.

3. Inspection Checklists and Reports

4. Monitoring Reports

5. Notice of Termination

B. Shop drawings and product data for materials furnished under the E&SC Plan and this section shall be submitted to the Owner in conformance with the requirements of Section 01340 (Shop Drawings, Product data and Samples) of these Specifications.

1.03 References

A. Contractor shall be familiar with the following referenced documents. These documents shall be complied with as applicable.

1. General NPDES Permit

2. Manual for Erosion and Sedimentation Control in Georgia (latest edition).

3. State of Georgia Department of Transportation Standard Specifications, Construction of Roads and Bridges (the GDOT specifications), latest edition.

4. National Stone Association, Aggregate Classification (the NSA Classification).

5. Erosion and Sedimentation Control Plan (E&SC Plan) as required by the NPDES Permit.

B. The General NPDES Permit is incorporated into these specifications by reference. A copy of the permit may be downloaded from the Georgia Environmental Protection Division website:

http://www.gaepd.org/Documents /techguide_wpb.html#sw

1.04 Definitions

A. Engineer: For the purpose of this section the term engineer is synonymous with consulting engineer, licensed professional, designer, and consultant used in permits, laws, rules, regulations, ordinances and other soil erosion and sediment control references. For the purposes of this Specification the Owner may at any time during the project provide direction. This direction shall be considered equivalent to direction from the Engineer.

B. Construction manager: For the purposes of this section the term Construction Manager refers to a person or representative for the Owner

performing construction oversight and managing construction activities and inspections.

C. Contractor: For the purposes of this section the term Contractor is synonymous with General Contractor, Discharger, Operator, Primary Permittee and Permittee (permit holder) as used in permits, laws, rules, regulations, ordinances, and other soil erosion and sediment control references.

D. Qualified Personnel or Qualifies Person: For the purposes of this Section, the terms Qualified Personnel and Qualified Person mean a person who has successfully completed an erosion and sediment controls short course eligible for continuing education units, or an equivalent course approved by Environmental Protection Division of the Georgia Department of Natural Resources and the State Soil and Water Conservation Commission.

E. Other Definitions: Definitions as listed in the NPDES Permit shall apply in this Section.

1.05 Regulatory Compliance

A. Land disturbance activities are not authorized to begin until after all required erosion and sediment control permits are obtained from the United States, the State of Georgia, and/or Local Issuing Authority. The Contractor is the Operator, and therefore a Co-Primary Permittee, under the provisions of the NPDES Permit. As such, Contractor shall comply with requirements specified in the Contract Documents or by the Owner. Contractor shall also comply with all other laws, rules, regulations, ordinances and requirements concerning soil erosion and sediment control established in the United States, the State of Georgia, and /or Local Issuing Authority. The following documents and the documents referenced therein define the regulatory requirements for this section.

1. NPDES Permit: The Georgia National Pollutant Discharge Elimination System (NPDES) General Permit governs land disturbance or construction activities of one acre or more. On applicable sites, the Contractor is responsible for complying with terms and conditions of this permit.

2. “Manual for Erosion and Sediment Control in Georgia”, latest edition: Contractor shall follow Practices and Standards of the Georgia Soil and Water Conservation Commission Manual for Erosion and Sediment Control in Georgia.

B. Fines resulting from non-compliance with the NPDES permit shall be paid by the Contractor at no additional expense to the Owner.

Part 2 Regulatory Compliance

As specified in the E&SC Plan, Section 02125, and Section 02920.

Part 3 Execution

3.01 Notice of Intent (NOI)

A. The NOI shall be signed by the Contractor as Operator in accordance with the Signatory Requirements of the NPDES Permit and returned to the Owner for submission to EPD. The Owner will provide the NOI to the Contractor for signature and copies will be provided to the Contractor by the Owner.

B. The NOI must be submitted in accordance with the NPDES Permit at least fourteen days prior to the start of construction activities. The Contractor may not start construction activities until authorized to do so under the terms and conditions of the NPDES Permit.

3.02 Installation

A. Erosion control measures shall be installed as shown on the Contract Drawings and in accordance with Section 02125 - Erosion and Sediment Control and Section 02920 – Lawns and Grassing.

B. Rainfall and storm water monitoring equipment shall be installed as identified in the Erosion and Sedimentation Control Plan (E&SC Plan) and/or as shown on the Contract Drawings.

3.03 Inspections and Reporting

A. The Engineer who prepared the Erosion and Sedimentation Control Plan shall inspect the installation of the erosion control measures within 7 days after initial construction activities begin. The Contractor shall be responsible for notifying the Engineer of when the 7 day period is to occur. The Engineer shall notify the Primary Permittee of any deficiencies. The Contractor must correct all deficiencies within two (2) business days of receipt of the Engineer's inspection report.

B. The Contractor will designate a Qualified Person who shall perform all inspections required by the NPDES Permit and this Specification.

C. Reports

1. All inspections shall be summarized in a report. A sample inspection checklist is included at the end of this section for the Contractor's reference and/or use.

2. Reports shall identify any deficiencies and incidents of non-compliance, major observations relating to the E&SC Plan, and any revisions or amendments to the E&SC Plan. Where incidents of non-compliance are not identified within the report, the report shall contain a certification that the facility is in compliance with the E&SC Plan and the NPDES Permit.

3. All inspection reports shall contain a summary of the inspection, the name and signature of the Qualified Person making the inspection, and the date of the inspection.

4. Inspection reports shall be kept on the project site at all times.

5. A copy of all inspection reports shall be submitted to the Owner or the Owner's designated representative on a weekly basis for review and retention. The Owner may withhold payments to the Contractor if such reports are not submitted in a timely manner.

6. All reports shall contain signed certification statements as requires by the NPDES Permit.

7. If a deficiency or incident of non-compliance occurs, the Contractor shall report the violation to the EPD by the 15th of the month following the violation.

3.04 Maintenance

A. Erosion and sediment controls as described in these Contract Documents shall be maintained in good working condition throughout the life of the Project. Any part of the erosion and sediment control components found to be damaged or defective shall be promptly repaired or replaced.

B. Changes to the E&SC Plan during the course of construction shall be "red-lined" on a set of documents that are to be kept on site at all times.

C. After completion of area surfacing, and with the approval of Owner or Owner's Construction Manager, the Contractor shall remove and dispose off-site all temporary erosion control measures and shall restore the ground to its original condition.

3.05 Monitoring and Reporting

A. The Contractor shall monitor and record daily (once each twenty-four hour period) rainfall data in accordance with the E&SC Plan and the NPDES Permit. Rainfall measurements shall be made at the same time each day.

1. The following information shall be recorded for each daily rainfall measurement:

   a. Project name and number

   b. Contractor's Qualified Person

   c. Date and time

   d. Reading and name of person taking reading

B. The Contractor shall be responsible for the sampling of storm water discharges from the project site. The Contractor must address all requirements stipulated in the E&SC Plan and the NPDES Permit including, but not limited to, the following:

1. Sample type and sample containers.

2. Sampling points.

3. Sampling methods and procedures for handling samples.

4. Analytical method used to analyze samples, name of person performing analysis, time of analysis.

5. Sampling timing and frequency.

6. Reporting of results.

C. The Contractor shall prepare and submit a monthly summary of the monitoring results to the EPD as required in the NPDES permit with copies being provided to the Owner. The summary shall be submitted in a timely fashion so as to allow sufficient time for Owner review and transmittal to EPD by the 15th of the ensuing month. A sample Storm Water Monitoring Data form is included at the end of this section for the Contractor's use.

D. The Owner reserves the right to use its own resources to duplicate monitoring and verify the work required by the Contractor in this Section.

3.06 Notice of Termination (NOT)

A. When all construction activities have ceased, final stabilization has been implemented by the Contractor, and the site is in compliance with the NPDES permit, the Contractor shall provide a written statement to the Owner that the site is in compliance with the NPDES permit and that Contractor is prepared to sign and submit the Notice of Termination. The Contractor shall arrange for a final inspection with the Owner. Upon acceptance, the Contractor shall make the final submittal of the Notice of Termination (NOT) to EPD. A copy of the NOT may be downloaded from the Georgia Environmental Protection Division website:

http://www.gaepd.org/Documents/epdforms_wpb.html#storm

END OF SECTION
(Sample forms follow)

STORM WATER MONITORING DATA

Primary Permittee: _____ **&** _____ **(Contractor)**

Project Name: _____

Project Location: _____

Date Sampled	Rainfall Amount (Inches)	Exact Location of Sample	Time Sampled	Sampling Technique (Manual or Automatic)	Sampled By	Date of Analysis	Time Analyzed	Analyzed By	Analytical Technique or Method Used (Meter #)	Results (NTU)

Certification Statement:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

_____

Signature of Authorized Person or Duly Authorized Representative

SECTION 02200 – SITE PREPARATION

PART 1 -GENERAL

1.1 SCOPE

A. This Section described materials and equipment to be utilized and requirements for their use in preparing the work site for construction. The Contractor shall furnish all materials, equipment and labor necessary to complete the work.

B. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

1.2 CLEARING AND GRUBBING

A. Within the limits shown on the Drawings, the site will be cleared and grubbed to prepare for construction.

B. Clearing

1 All vegetation such as trees, shrubs, brush, logs, upturned stumps and roots of downed trees, and other similar items shall be removed and disposed of properly by the Contractor as specified below. Cultivated growth shall be removed and trees felled as necessary within the construction work site and as indicated.

2 Where the tree limb structure interferes with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the appropriate utility.

3 All buildings, fences, lumber piles, trash and obstructions, except utility poles shall be removed and disposed of by the Contractor. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.

4 All fences adjoining any excavation or embankment that may be damaged or buried shall be carefully removed, stored and replaced.

C. All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed of properly by the Contractor as specified below. Piling and butts of utility poles shall be removed to a minimum depth of two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.

1.3 PRELIMINARY GRADING

A. Before beginning construction, the Contractor shall grade the entire work site to conform, in general, to the finish elevations shown on the Drawings. The Drawings show both existing contour elevations and finished contour elevations.

1.4 TESTING AND INSPECTION SERVICES

A. Soil testing will be performed by an independent testing laboratory selected by and paid for by the Owner. Payment for soil testing shall be made by the Contractor from the “Soils And Concrete Testing” cash allowance.

B. The soils testing laboratory is responsible for the following:

1 Compaction tests in accordance with ASTM D 698.

2 Field density tests for each two feet of lift; one test for each 5,000 square feet of fill.

3 Inspecting and testing stripped site, subgrades and proposed fill materials.

C. The Contractor's duties relative to testing include:

1 Notifying the laboratory of conditions requiring testing.

2 Coordinating with the laboratory for field testing.

3 Providing representative fill soil samples to laboratory for test purposes. Provide samples of each fill soil.

4 Paying costs for additional testing performed beyond the scope of that required and for retesting where initial tests reveals non-conformance with specified requirements.

D. Inspection

1 Earthwork operations, suitability of excavated materials for fill and backfill, and placing the compaction of fill and backfill is subject to inspection. The Engineer will observe earthwork operations.

2 Foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer to verify suitable bearing and construction.

PART 2 -PRODUCTS (NOT USED)

PART 3 -EXECUTION

3.1 PREPARATION

A. Maintain bench marks, monuments and other reference points. Re-establish, at no cost to the Owner, any such reference points if disturbed or destroyed.

3.2 CLEARING

A. Clear areas required for access to site and execution of work.

B. Remove trees and shrubs within the area to be cleared.

C. Clear undergrowth and deadwood, without disturbing subsoil.

3.3 DISPOSAL OF REFUSE

A. The refuse resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except with written consent of the property owner. In no case shall any material be left on the Project, shoved onto abutting private properties, or be buried in embankments or trenches on the Project.

B. When approved in writing by the Engineer and when authorized by the proper authorities, the Contractor may dispose of such refuse by burning on the site of the Project provided all requirements set forth by the authorities are met. The authorization to burn shall not relieve the Contractor in any way from damages which may result from Contractor's operations. On easements through private property, the Contractor shall not burn on the site.

END OF SECTION

SECTION 02210 – SUBSURFACE CONDITIONS

PART 1 -General

1.1 Description

A. Soil boring logs are shown in the Report of Geotechnical Investigation prepared by:
Geo Hydro Engineers
1000 Cobb Place Blvd, Suite 290
Kennesaw, GA 30144
November 17, 2017
See attached reports

B. This soil investigation information is offered as an aid in bidding only and is not a part of the Contract Documents. The boring logs are available for the Contractor's information, but are not a warranty of subsurface conditions. The Owner, Engineer and geotechnical engineer assume no responsibility for any variation between materials encountered during construction and those indicated on the boring logs, nor for any variation between the location of the water table encountered and that indicated on the boring logs at the date borings were taken.

C. Additional Investigation: The Contractor shall visit the site and become acquainted with site conditions. Prior to bidding, prospective Contractors may make their own site and subsurface investigations to satisfy themselves with site and subsurface conditions. The Contractor shall be responsible for obtaining rights of ingress and egress to private property for site and subsurface investigation and shall assume all responsibility for any damage to property caused as a result of the Contractor's investigation.

D. Location of Borings: Contractors shall be responsible for making their own determination of the location of the soil borings on this Project.

END OF SECTION

SECTION 02220 – DEMOLITION OF EXISTING FACILITIES

PART 1 -GENERAL

1.1 SCOPE

A. The work in this Section consists of furnishing all material and equipment and performing all labor necessary for demolishing and disposing of designated facilities indicated on the Drawings, and in accordance with Standard Specifications and regulatory agencies requirements for Federal, State, County and local Municipalities. It is the requirement of the Contractor to abide by all laws, standard details and specifications, rules and regulations whether or not noted on plans. If a conflict exists between the Contract Documents and Federal, State, County and/or local Municipalities, Contractor shall follow applicable rules and notify Engineer.

1.2 SUBMITTALS

A. The Contractor shall submit a written request, to include a detailed demolition procedure, to the Owner for approval at least 10 days before demolition is started. The demolition procedure shall include a detailed description of the methods and equipment to be used for each operation and the sequence of work. The demolition procedures shall provide for safe conduct of work, protection of the property, which is to remain undisturbed and coordination with other work or operation which may be in progress.

PART 2 -PRODUCTS (NOT USED)

PART 3 -EXECUTION

3.1 DEMOLITION

A. All material shall be removed as shown on the demolition drawings necessary for construction, or in any event, to a minimum depth of three feet below finished grades as shown on the Drawings.

B. Any structure, or part thereof, remaining below grade shall be mechanically fractured so that subsurface water will freely pass through the slab or floor of the structure, and so that no void will remain after backfilling the work site to grade as shown on the Drawings.

C. The Contractor shall be responsible for removing all existing service connections to the buildings or site and permanently plugging the pipes where required in accordance with requirements of the utility companies concerned.

D. The Contractor will be responsible for any damage caused to other structures, and shall be held liable for any and all repairs, replacement of parts or renovations required to restore any structure, portion of structure, equipment or items, not intended for demolition. The Contractor shall restore any damaged facilities to their condition prior to demolition provided the damage was result of the demolition. If the Contractor does not repair any such damage immediately, or if the repairs are not suitable to the Owner, the Owner reserves the right to have such repairs made by another party and deduct the cost of required repairs from money due Contractor.

E. Dust-tight, weathertight partitions shall be erected to protect existing facilities from dust and weather while wrecking is in progress and until such time as closures have been made. Partitions may be constructed of wood and shall have a covering of tarred roofing felt on the weather side.

F. All salvageable metal materials shall remain the property of the Owner and shall be cleaned and stored on the Owner's property as directed by the Owner.

3.2 DISPOSAL

A. All materials, which are not delivered to the Owner as specified above, shall become the property of the Contractor, and shall be demolished, moved or otherwise disposed of at the option of the Contractor by a method approved by the Owner.

B. All demolished structures, equipment and materials shall be removed from the work site by the Contractor.

C. All demolished structures, equipment and materials which are either left in place or removed to the disposal site shall be in a non-hazardous condition.

END OF SECTION

SECTION 02230 – REMOVAL OF EXISTING EQUIPMENT AND PIPING

PART 1 -GENERAL

1.1 Scope

A. The work covered under this Section includes furnishing all labor, equipment and material required to remove, handle, store and dispose of all materials from existing structures and piping as shown on the Drawings, directed by the Engineer or required for the completion of the work, including all necessary excavation and backfilling.

B. The Contractor shall remove from existing structures and store as directed or dispose of in an approved manner, all valves and piping, mechanical equipment, plumbing, heating, electrical and ventilating fixtures, pipes, ducts, wires and equipment, doors and windows, floor grating and cover plates, steel stairs, pipe railing and the like which are not to remain in service in the finished work, whether or not shown on the Drawings and/or specified herein.

C. The work specified herein and shown on the Drawings is intended to give a general idea of the scope of this work but must not be construed as covering it entirely. The Contractor shall visit the site and judge the amount of work required and the problems Contractor might encounter in the performance of the work.

PART 2 -PRODUCTS

2.1 Materials

A. All concrete, mortar, grout, steel reinforcement and backfill used in patching, plugging or repairing shall comply in all respects with the applicable material requirements of these Specifications.

PART 3 -EXECUTION

3.1 REMOVAL

A. The Contractor shall exercise full care and shall use such methods and equipment during removal as will maintain the usefulness of the various materials and equipment removed. The sequence and order of removal and the method of storing and disposal of removed equipment and piping shall be at all times subject to the direction and approval of the Engineer.

B. Any damage done to structures or equipment during removal and any patching, plugging of holes or repairs necessitated because of removal of equipment and piping shall be repaired as directed by, and to the satisfaction of, the Engineer and the cost thereof shall be included in the Contract Price.

C. Equipment specified to be removed shall be removed completely, including all related accessories and concrete bases. Any embedded items such as anchor bolts, steel reinforcement, conduit and piping shall be cut off 1-inch below adjacent finished surfaces. The surface shall then be repaired to match adjacent surfaces in finish and appearance.

D. Prior to removing any electrical equipment, all power to the equipment shall be shut off and properly locked out. All power and control wiring for the equipment shall then be disconnected at the starter or circuit breaker, as applicable, and removed from the conduit. Unused conduits shall be plugged.

E. Blemishes or unsightly areas on walls and floors left after removal of equipment shall be cleaned and refinished as necessary to match adjacent surfaces.

F. All holes and openings left after removal of equipment shall be filled or plugged to provide a neat and workmanlike appearance.

G. Where piping designated for removal passes through concrete walls, the openings shall be suitably plugged or capped. Wall pipes and wall sleeves shall be sealed with blind flanges or mechanical joint plugs. Steel pipe sleeves shall be filled with non-shrink grout.

H. Where equipment or piping designated for removal serves to support other equipment or piping designated to remain in service, the Contractor shall provide permanent supports in place of the removed equipment and piping. Where it is necessary to temporarily remove other equipment, piping or electrical work in order to gain access to an item of equipment or piping designated for removal, the Contractor shall restore all such equipment, piping or electrical work to its original condition.

I. Abandoned Piping: Existing vitrified clay, concrete, PVC, cast iron and steel piping to be abandoned shall be cut and plugged or capped at each end. Where existing piping interferes with new piping or construction, it shall be removed beyond the limits required for the proper completion of the work and the open ends plugged or capped. Unless otherwise shown, lines shall be plugged or capped at least 1-inch behind or below finished building surfaces and at least 12-inches below outside grade surfaces.

J. Piping and Valves Reinstallation: The Contractor shall include in the Contract Price the cost of removing, refitting, and reinstalling certain pipe, fittings and valves as shown on the Drawings or as deemed by the Engineer to be satisfactory for reuse.

K. Removal of Existing Concrete and Masonry: Existing concrete and masonry shall be removed and disposed of in accordance with the requirements of the Removal of Existing Concrete and Masonry Section of these Specifications.

L. Storage: All materials removed shall remain the property of the Owner and shall be carefully moved and stored on the plant site where directed by the Engineer. Mechanical and electrical equipment shall be stored indoors. If the equipment is too large to store indoors, it shall be stored outdoors above ground and under cover.

M. Disposal: The Engineer will direct the Contractor to assume ownership of and dispose of off-site any removed equipment, piping and materials which the Engineer deems worthless. The cost of disposing of any or all of the removed equipment, piping and materials shall be included in the lump sum prices bid and no separate payment will be made therefore.

END OF SECTION

TREE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the protection and trimming of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.

B. Related Sections include the following:
   1. Division 2 Section "Site Clearing".
   2. Division 2 Section "Earthwork".

1.3 SUBMITTALS

A. Certification: In the event a tree designated as being within a **tree save area** or **outside the limits of work** is damaged during construction the Contractor shall employ a qualified arborist to assess the health and likely survival of the tree or trees.

B. Maintenance Recommendations: From a qualified arborist for care and protection of trees affected by construction during and after completing the Work.

1.4 QUALITY ASSURANCE

A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site on a full-time basis during execution of the Work.

B. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where Project is located.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyethylene Fence: 4'-0" high, nontoxic, U. V. stabilized, high density polyethylene, high visibility bright orange colored safety fence with 3 ½" x 1 ½" oval mesh openings and with a minimum breakload of 740 lbs. per foot. Posts shall be 2" x 2" x 6' - 0" long wooden posts spaced at no more than 8 feet on center..

PART 3 - EXECUTION

3.1 PREPARATION

A. Temporary Fencing: Install temporary fencing located as indicated or outside the drip line of trees to protect remaining vegetation from construction damage.

   1. Install chain link fence according to ASTM F 567 and manufacturer's written instructions.

B. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

C. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root systems.

D. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations within drip line on trees.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.

D. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond drip line of trees. Maintain existing grades within drip line of trees.

1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.4 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.

B. Remove and replace dead and damaged trees that the qualified arborist determines to be incapable of restoring to a normal growth pattern.

1. Provide new trees of 6-inch caliper size and of a species selected by Architect when trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced.

3.5 DISPOSAL OF WASTE MATERIALS

A. Burning may not be permitted on-site. Verify with local jurisdiction.

B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

END OF SECTION 02231

SECTION 02235 – REMOVAL OF EXISTING CONCRETE AND MASONRY

PART 1 -GENERAL

1.1 SCOPE

A. The work described in this Section includes furnishing all labor, equipment and materials to demolish, remove, handle and dispose of all existing concrete and masonry, both plain and reinforced, from existing structures as shown on the Drawings, directed by the Engineer or required for the proper completion of the work, including all excavation and backfilling.

B. Where structural tile and brick is removed from existing structures, the work shall include all patching and reconditioning to restore the remaining tile or brick to its existing state and to provide a proper joint for joining the existing to new construction.

C. Where concrete is cut from existing structures under this Section to permit setting or inserting pipes, flumes, equipment or appurtenances, the work shall include all re-concreting, dressing and finishing of openings to the required lines and dimensions or as necessary for the placing and fixing of inserts.

PART 2 -PRODUCTS

2.1 MATERIALS

A. Tile and brick used for the patching of existing masonry shall be of the same size, color and texture as the tile and brick which they abut. Salvageable tile and brick units which are removed in performing the required alterations may be reused if the exposed faces and edges of the units are in good condition. If satisfactory units are not obtainable through salvage operations, the Contractor shall furnish the required units of new material of similar quality, color and texture.

B. All concrete, grout, steel reinforcement, backfill and other materials furnished in conjunction with this work shall conform in all respects to the applicable material requirements of these Specifications.

PART 3 -EXECUTION

3.1 MODIFICATION TO EXISTING CONCRETE AND MASONRY

A. Existing concrete and masonry to be removed as a part of structural modifications to existing facilities, shall be broken by air hammer and chisel in such manner as to leave adjoining portions of the structure in an undisturbed condition. Blasting shall not, under any circumstances, be used in the removal of concrete or masonry.

B. In removing existing concrete and masonry, special care shall be taken to cut it as closely as possible to the required shape and with no projection into the neat outside line of new work. The surfaces of all concrete and masonry shall be sufficiently rough to bond well with the new work.

C. The Contractor shall take every precaution not to disturb the walls, floors, foundations and footings of existing structures when necessary to remove existing concrete or masonry adjacent thereto. This shall be done by bracing, needling, shoring and installation of other supports as necessary to assure the safety of the structures which are to remain.

D. All walls, footings, floor slabs, columns and other items of existing work directly adjoining new work to be installed at levels lower than existing conditions at locations where designated on the Drawings or directed by the Engineer shall be underpinned as required for safety and by conditions at the site. Responsibility for the adequacy and safety of all underpinning, shoring and bracing shall rest solely upon the Contractor and this work shall be done in such a manner as will positively prevent settlement of or damage to existing work that is to remain.

3.2 PREPARATION FOR BONDING TO NEW WORK

A. Before any new concrete or masonry is built on or against existing concrete or masonry, the latter shall be scrupulously freed from all dirt, gravel, boulders, ice, snow or other objectionable substances.

B. Existing reinforcement shall lap the reinforcement in the new concrete or masonry as shown on the Drawings or as directed by the Engineer.

C. For new or enlarged openings in existing concrete, existing reinforcing steel shall extend into the new finishing concrete, which shall have a minimum thickness of 3-inches on all surfaces forming the opening.

D. For new openings in existing concrete to accommodate wall pipe or pipe sleeves, the existing reinforcing steel shall be cut only when bending of the reinforcement is not sufficient to permit accurate placement of the pipe. Cutting shall be done only at the Engineer's direction.

E. Bonding of new concrete to existing concrete shall be in accordance with the requirements of Cast-in-Place Concrete Section of these Specifications.

F. Bonding of grout to existing concrete shall be in accordance with the requirements of Grouting Section of these Specifications.

3.3 DISPOSAL OF MATERIAL

A. Unless otherwise directed by the Engineer, all materials removed under this Section shall be removed from the site and disposed of at the Contractor's expense. Point of disposal shall be subject to approval of the Engineer, the property owner and the local jurisdiction responsible for the issuance of dumping permits.

END OF SECTION

SECTION 02240 – DEWATERING

PART 1 -GENERAL

1.1 SCOPE

A. This Section shall apply to all excavation, except trench excavation.

B. Construct all permanent work in areas free from water. Design, construct and maintain all wells, pumps, vacuum systems, sumps, dikes, levees, cofferdams and diversion and drainage channels as necessary to maintain the areas free from water and to protect the areas to be occupied by permanent work from water damage. Remove temporary works after they have served their purpose.

C. The Contractor shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials and structures damaged by water, both surface and subsurface, to the lines, grades and conditions existing prior to the damage, at no additional cost to the Owner.

PART 2 -PRODUCTS (NOT USED)

PART 3 -EXECUTION

3.1 CARE OF WATER

A. Except where the excavated materials are designated as materials for permanent work, material from required excavation may be used for dikes, levees, cofferdams and other temporary backfill.

B. Furnish, install, maintain and operate necessary pumping and other equipment for dewatering the various parts of the work and for maintaining the foundation and other parts free from water as required for constructing each part of the work.

C. Install all drainage ditches, sumps and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables and to drain impervious surfaces at final excavation elevation.

D. Dewater by means which will insure dry excavations, preserve final lines and grades, do not disturb or displace adjacent soil.

E. All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic or the work of other contractors, and in accordance with all pertinent laws, ordinances and regulations.

F. Do not overload or obstruct existing drainage facilities.

G. After they have served their purpose, remove all temporary protective work at a satisfactory time and in a satisfactory manner. All diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled and processed under the same Specifications as those governing the compacted fill. Fill or grout all temporary dewatering wells unless otherwise directed by the Engineer.

H. When the temporary works will not adversely affect any item of permanent work or the planned usage of the Project, the Contractor may be permitted to leave such temporary works in place. In such instances, breeching of dikes, levees and cofferdams may be required.

3.2 DEWATERING

A. By the use of well points, pumps, tile drains or other approved methods, the Contractor shall prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed.

B. Excavations shall be continuously dewatered to maintain a ground water level no higher than three to four feet below the lowest point in the excavation. Dewatering systems shall be designed to allow for localized variations in the depth of excavations required to reach a suitable foundation. Dewatering shall be accomplished well enough in advance of excavation to ensure that groundwater is already lowered prior to completing the final excavation to finish subgrade.

C. All destabilized subgrade conditions caused by inadequate or untimely dewatering operations shall be undercut and backfilled with suitable backfill material at no additional cost to the Owner.

D. Piezometric observation wells are required to monitor the ground water level to insure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of structures.

END OF SECTION

SECTION 02245–GROUNDWATER CONTROL

PART 1 -GENERAL

1.1 SCOPE

A. Groundwater control includes construction and procedures required to remove excessive groundwater that may be encountered in subgrades and soils to be excavated.

B. Temporary groundwater control consists of trenching, pumping, dewatering and draining of groundwater as required to advance the work.

1.2 QUALITY ASSURANCE

A. The Contractor shall notify the Engineer for inspection of trenches prior to construction of underdrains.

B. Completed underdrains shall be inspected by the Engineer prior to backfilling.

C. Work on DOT and county street rights-of-way shall be in accordance with the State Department of Transportation Standard Specifications as well as County and Local Municipalities Standard Specifications, based on the type right of way the work is to be accomplished.

PART 2 -PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

A. Underdrain Materials: Filter cloth for underdrains shall be a pervious sheet of synthetic polymer filaments, woven from continuous filaments. Filter cloth shall be the type recommended by the manufacturer for the intended application. The filter cloth specification shall be subjected to the Engineer's approval. Drainage fill shall be Size No. 57 crushed stone, meeting ASTM C 33.

B. Pervious Backfill: Pervious backfill shall be natural or manufactured sand or crushed stone, free-draining and predominant in sand size particles.

C. Underdrain Pipe

1 PVC perforated sewer pipe meeting ASTM D 3034 or Engineer Approved equal. If Contractor elects to utilize alternative material, Contractor shall follow substitution and submittal procedures as defined in the Contract Documents.

PART 3 -EXECUTION

3.1 GENERAL

A. Temporary groundwater control shall be employed wherever wet soils are encountered in subgrades and in soils to be excavated.

1. In soils to be excavated, a system of ditches shall be maintained ahead of the work to allow the soil to drain. Ditches shall be of the number and depth required to allow free-draining of the soil. Means of removing the water from ditches shall be provided. This work shall be incidental to the grading operation.

2 Groundwater in utility trenches shall be handled in accordance with generally accepted practice.

3 In paving subgrade areas, ditches may be excavated below subgrade, only if approved by the Engineer.

B. Underdrains

1 Pipe, where specified, shall be laid true to line and grade and shall show a full circle of light when lamped.

2 Access to ends of pipe shall be provided at changes in grade and direction to allow inspection and flushing of underdrains after partial or complete backfilling.

3 All underdrain pipe shall be flushed and inspected prior to final closure.

4 Filter fabric for underdrains shall be laid in a trench and folded back to allow drainage fill and pipe, if specified, to be inserted. The drainage fill shall be compacted. The fabric sides shall then be lapped a minimum of 12-inches across the top of the gravel. Any rips or tears in the fabric shall be repaired by lapping a separate fabric section 12-inches beyond the tear in each direction.

5 Backfill shall be carefully placed and compacted to prevent damage or movement of filter cloth.

END OF SECTION

SECTION 02274

RIPRAP

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish all plant, labor and materials and perform all operations necessary for placing riprap, consisting of broken stone or concrete with a plastic filter fabric under-layment, to the lines, grades, and dimensions shown in the Construction Documents.

PART 2 - PRODUCTS

2.01 RIPRAP

A. The riprap shall be classified as follows:

	Class 1	**Class 2**	**Class 3**
Maximum Stone Size	12”	18”	24”
Median Stone Size	6”	12”	18”
Minimum Layer Thickness	18”	27”	36”

B. Class I riprap shall be used unless otherwise noted in the Construction Documents.

2.02 FILTER FABRIC

A. Fabric: A pervious sheet of plastic monofilament yarn woven into a uniform pattern with distinct and measurable openings, providing an Equivalent Opening Size (EOS) of 40 to 80 with an open area not exceeding 36 percent unless otherwise noted in the Construction Documents, and conforming to the physical strength requirements in Table No. 1. Provide fabric that is calendered or otherwise finished so that the yarns will retain their relative position with respect to each other, and with the edges of the fabric selvaged or otherwise finished to prevent the outer yarn from pulling away from the fabric.

B. Yarn: A long-chain synthetic polymer composed of at least 85 percent by weight of propylene, ethylene or vinylidenechloride, and containing stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultra-violet and heat exposure.

TABLE 1 PHYSICAL STRENGTH REQUIREMENTS

Physical Property	Test Procedures	Acceptable Test Results
Grab Tensile Strength	ASTM D 1682	200 pound minimum
Elongation (Min/Max)	ASTM D 1682	20/70%
Bursting Strength	ASTM D 751	500 psi minimum
Puncture Strength	ASTM D 751	150 pound minimum
Abrasion Resistance	ASTM D 4157 and D 4158	55 pound minimum
Seam Strength	ASTM D 1683	200 pounds minimum

PART 3 - EXECUTION

3.01 INSTALLATION

A. Plastic Filter Fabric:

1. In areas on which filter fabric is to be placed, provide a uniform slope with a reasonably smooth surface, free from mounds and windrows and free of any debris or projections which could damage the filter material to be placed upon it.
2. Place the material loosely laid (not stretched) and overlap adjacent strips by a minimum of 8 inches. Anchor the fabric in place with plastic securing pins (as recommended by the filter fabric manufacturer) inserted through the fabric along, but not closer than 2 inches to, each edge and to the extent necessary to prevent displacement before or during placement of the fabric or other material.
3. Stagger vertical laps at least 5 feet. Use full rolls wherever possible, in order to minimize the number of vertical laps. No grommets are required. Carefully place riprap on the filter material without dropping it through a free fall greater than three feet. Replace or repair any plastic filter material damaged or displaced before or during placement of riprap.

B. Riprap: Place and arrange riprap to form a compact layer conforming to the neat lines called for on the Construction Documents and to the specified thickness, plus or minus 3 inches. Place in such manner that the small pieces are not segregated, but are evenly distributed so that they fill the voids between the larger pieces.

END OF SECTION

SECTION 02300 – EARTHWORK

PART 1 -GENERAL

1.1 SCOPE

A. This Section includes earthwork and related operations, including, but not limited to, clearing and grubbing the construction site, dewatering, excavating all classes of material encountered, pumping, draining and handling of water encountered in the excavations, handling, storage, transportation and disposal of all excavated and unsuitable material, construction of fills and embankments, backfilling around structures and pipe, backfilling all trenches and pits, compacting, all sheeting, shoring and bracing, preparation of subgrades, surfacing and grading, and any other similar, incidental, or appurtenant earthwork operation which may be necessary to properly complete the work.

B. The Contractor shall provide all services, labor, materials and equipment required for all earthwork and related operations necessary or convenient to the Contractor for furnishing complete work as shown on the Drawings or specified in these Contract Documents, in accordance with State DOT Standard Specifications and County/local Municipalities Standard Specifications.

1.2 GENERAL

A. The elevations shown on the Drawings as existing are taken from the best existing data and are intended to give reasonably accurate information about the existing elevations. They are not precise and the Contractor shall become satisfied as to the exact quantities of excavation and fill required.

B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.

C. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material.

D. Earthwork within the rights-of-way of the Department of Transportation, the County Road Department and the respective cities shall be done in accordance with requirements and provisions of the permits issued by those agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these Specifications.

E. The Contractor shall control grading in a manner to prevent surface water from running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can be uninterrupted in existing gutters, other surface drains or temporary drains. Free access must be provided to all fire hydrants and meters.

F. Excavation work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition or condition thereof.

G. Tests for compaction and density shall be conducted by an independent testing laboratory selected by the Owner. Costs of compaction tests performed by an independent testing laboratory shall be paid for directly by the Owner and not as a part of this Contract. The Contractor shall make all necessary excavations and shall supply any samples of materials necessary for conducting compaction and density tests. The cost of all retests made necessary by the failure of materials to conform to the requirements of these Contract Documents shall be paid by the Contractor.

H. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations latest edition, and shall be conducted in a manner acceptable to the Engineer, and in conformance with State DOT and County/Municipalities Standard Specifications.

I. Any special construction problems which might arise as a result of nearby watercourses and floodplains, particularly in areas where construction activities may encounter water-bearing sands and gravels or limestone solution channels, will be treated as an unforeseen condition.

PART 2 -PRODUCTS

MATERIALS AND CONSTRUCTION

A. Earthwork Materials

1 Fill Material, General

a. Approval Required: All fill material shall be in accordance with Project Geotechnical Report as prepared by Terracon Consultants, Inc. subject to the approval of the independent testing laboratory, and Engineer.

b. Notification: For approval of imported fill material, notify the Engineer at least two weeks in advance of intention to import material, designate the proposed borrow area and permit the Project Geotechnical Engineer to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

2 On-Site Fill Material: All on-site fill material shall be soil exclusive of organic matter, frozen lumps or other deleterious substances. On-site fill material shall contain no rocks or lumps over 3-inches maximum in dimension.

3 Imported Fill Materials: All imported fill material shall meet the requirements defined in the Project Geotechnical Report.

4 Sand Cushions and Sand Fill: Material shall be in conformance with State DOT and County/Municipalities Standard Specifications.

5 Coarse Aggregate: Material shall be in conformance with State DOT and County/Municipalities Standard Specifications.

6 Fine Aggregate: Material shall be in conformance with State DOT and County/Municipalities Standard Specifications.

7 Pea Gravel: Material shall be in conformance with State DOT and County/Municipalities Standard Specifications.

8 Top Soil: Material shall be in conformance with State DOT and County/Municipalities Standard Specifications..

B. Sheeting, Bracing and Timbering: The Contractor shall furnish, place and maintain all sheeting, bracing and timbering required to properly support trenches and other excavations in open cut and to prevent all movement of the soil, pavement, structures or utilities outside of the trench or pit.

1. General

   a. Cofferdams and bracing design, including computations, shall be prepared before commencing construction operations. Drawings and design computations shall be signed and sealed by a professional engineer registered in the State of Arizona. The Drawings and design computations shall not be submitted to the Engineer.

   b. Sheeting, bracing and timbering shall be so placed as to allow the work to be constructed to the lines and grades shown on the Drawings and as ordered by the Engineer.

   c. If at any time the method being used by the Contractor for supporting any material or structure in or adjacent to any excavation is not reasonably safe, the Contractor shall provide additional bracing and support necessary to furnish the added degree of safety.

   d. All sheeting in contact with the concrete or masonry shall be cut off as directed by the Engineer and left in place.

2. Timber: Timber may be substituted for steel sheet piling when approved by the Engineer. Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.

3. Steel Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and/or live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities. Steel piling within three feet of an existing building structure or pipeline shall remain in place, unless otherwise directed by engineer.

4. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the structures and adjacent property. Leave sheeting in place when in the opinion of the Engineer it cannot be safely removed. Cut off sheeting left in place at least two feet below the surface.

C. Other Materials: All other materials not specifically described but required for proper completion of the work of this Section shall be as selected by the Contractor subject to the approval of the Engineer.

D. Stockpile Area: The stockpile area as directed by the Engineer, shall be used to stockpile soil material for backfilling around structures and to stockpile needed topsoil.

PART 3 -EXECUTION

3.1 GENERAL

A. Safety: Comply with local regulations and with the provisions of the “Manual of Accident Prevention in Construction” of the Associated General Contractors of America, Inc., Occupational Safety and Health Act and all other applicable safety regulations.

B. Topsoil

1 Remove all topsoil to a depth (not less than 1 foot below existing grade) at which subsoil is encountered, from all areas under buildings, pavements, and from all areas which are to be cut to lower grades or filled.

2 With the Engineer's approval, topsoil to be used for finish grading may be stored on the site.

3 Other topsoil may be used for fill in non-critical areas with approval of the Engineer.

C. Bracing and Sheeting

1 Furnish, put in place, and maintain all sheeting, bracing and shoring as may be required to properly support the sides of all excavations and to prevent all movement of earth which could in any way injure the work, adjacent property or workers.

2 Properly support all excavations in locations indicated on the Drawings and where necessary to conform to all pertinent rules and regulations and these Specifications, even though such locations are not indicated on the Drawings.

3 Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the work and adjacent property.

4 Do not leave any sheeting or bracing in the trench or excavation after completion of the work, unless approved by the Engineer.

D. Obstructions

1 Remove and dispose of all trees, stumps, roots, boulders, sidewalks, driveways, pavement, pipes and the like, in accordance with all Federal, State, and Local Regulations, as required for the performance of the work.

2 Exercise care in excavating around catch basins, inlets and manholes so as not to disturb or damage these structures.

3 Avoid removing or loosening castings or pushing dirt into catch basins, inlets and manholes.

4 Damaged or displaced structures or casting shall be repaired, replaced and dirt entering the structures during the performance of the work shall be removed at no additional cost to the Owner.

E. Utilities to be Abandoned

1 When pipes, conduits, sewers or other structures are removed from the trench leaving dead ends in the ground, such ends shall be fully plugged or sealed with brick and non-shrink grout.

2 Abandoned structures such as manholes or chambers shall be entirely removed unless otherwise specified or indicated on the Drawings.

3 All materials from abandoned utilities which can be readily salvaged shall be removed from the excavation and stored on the site at a location as directed by the Owner.

4 All salvageable materials will remain the property of the Owner unless otherwise indicated by the Owner.

F. Extra Earth Excavation

1 In case soft or excessively wet material which, in the opinion of the Engineer, is not suitable, is encountered below the final subgrade elevation of an excavation or underneath a structure, the Engineer may order the removal of this material and its replacement with crushed stone or other suitable material in order to make a suitable foundation for the construction of the structure.

2 All extra excavation made at the order of the Engineer will be paid for on the basis of the actual volume of the excavation as measured by the Engineer. No measurement for payment shall be made until all dewatering as specified in the Dewatering Section has been successfully accomplished.

G. Cutting Paved Surfaces and Similar Improvements

1 Remove existing pavement as necessary for installing pipe utilities and appurtenances or as otherwise shown on the Drawings.

2 Before removing any pavement, mark the pavement neatly, paralleling pipe lines and existing street lines. Space the marks the width of the trench.

3 Break asphalt pavement along the marks using jack hammers or other suitable tools. Break concrete pavement along the marks by use of jack hammers or by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.

4 Do not pull pavement with machines until completely broken and separated from pavement to remain.
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5 Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement. No additional payment will be made for removing and replacing damaged adjacent pavement.
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6 Remove and replace sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
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7 The Contractor may tunnel under curbs that are encountered. Remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.2 EXCAVATION

A. Method

1 All excavation shall be by open cut from the surface except as indicated on the Drawings.

2 All excavations for pipe appurtenances and structures shall be made in such manner and to such depth and width as will give ample room for building the structures and for bracing, sheeting and supporting the sides of the excavation, for pumping and draining groundwater and wastewater which may be encountered, and for the removal from the excavation of all materials excavated.

3 Take special care so that the soil below the bottom of the structure to be built is left undisturbed.

B. Grades

1 Excavate to grades indicated on the Drawings.

2 Where excavation grades are not indicated on the Drawings, excavate as required to accommodate installation.

C. Disposal of Excavated Material

1 Remove and properly dispose of all excavated material not needed to complete filling, backfilling and grading in accordance with all Federal, State, and Local Regulations.

2 Dispose of excavated material off site at locations secured by the Contractor and in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or on any street or alley. No debris shall be deposited on any private property except by written consent of the property owner. In no case shall any material be left on the Project, shoved onto abutting private properties, or be buried in embankments or trenches on the Project.

3.3 EXCAVATING FOR STRUCTURES

A. Earth Excavation

1 Earth excavation shall include all substances to be excavated other than rock. Earth excavation for structures shall be to limits not less than two feet outside wall lines, to allow for formwork and inspection, and further as necessary to permit the trades to install their work. All materials loosened or disturbed by excavation shall be removed from surfaces to receive concrete or crushed stone.

2 No separate payment will be made for earth excavation. The cost of such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

B. Rock Excavation

1. Definition of Rock: Any material which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds (comparable to Caterpillar D 8K or comparable to Caterpillar 977 front-end loader, and occupying an original volume of at least one cubic yard). The Engineer shall be the sole determinant as to the limits to which the material is classified as rock.

2. Excavation: Where rock is encountered within excavation for structures, it shall be excavated to the lines and grades indicated on the Drawings or as otherwise directed by the Engineer. The Contractor shall be responsible for obtaining any blasting permits required.

3. Blasting: Blasting operations shall be conducted in accordance with all existing ordinances and regulations. All structures shall be protected from the effects of the blast. The blasting shall be done by licensed experienced workers. Dispose of excavated rock in accordance with applicable federal, state, county and local regulations.

a. If, in the sole opinion of the Engineer, the Contractor persistently uses excessive blasting charges or blasts in an unsafe or improper manner, the Engineer will direct the Contractor to employ an independent, qualified blasting consultant, approved by the Engineer, to supervise the preparation for each blast and approve the quantity of each charge. The cost of the blasting consultant will be paid for by the Contractor and the Contractor shall not be reimbursed through the Contract allowance. The qualified blasting consultant when required to perform drilling and blasting will be paid for by the Contractor.

b. The Contractor will notify the Inspector before any charge is set and prior to blasting. Following review by the inspector regarding the proximity (normally within 300 linear feet) of permanent structures to the blasting site, the Engineer may direct the Contractor to employ an independent qualified specialty subcontractor, approved by the Engineer, to monitor the blasting by use of seismograph, identify areas where light charges must be used, conduct pre-event and post-event inspections of all structures, including photographs or videos, and maintain a detailed written log. The cost of this independent qualified specialty subcontractor will be paid for through the Contract allowance. The specialty subcontractor allowance will be used only to pay for a specialty subcontractor when directed by the Engineer to monitor blast, conduct pre-event and/or post-event inspections and maintain a log of these activities.

c. Any damage done shall be promptly repaired by the Contractor at the Contractor's own expense.

d. Rock excavation will be paid for as an extra in addition to payment for earth excavation provided for elsewhere in these Specifications. Payment will be made for measured quantity of rock excavated, at the unit price bid per cubic yard. The unit price for rock excavation shall include the cost of rock excavation, the cost of handling sufficient and suitable fill material and all costs incidental thereto. The allowable volume of rock excavation for payment, unless otherwise authorized by the Engineer, shall be based on the following measurements:

1) Horizontal measurement shall be to the actual dimension of the excavation, but not exceeding one foot in the clear outside the outer surface of the structure or a minimum of two feet from a wall.
2) Depth measurement shall be made from the original top of rock to the bottom of the structure as constructed, or to the bottom of the rock, if above grade.

a) No allowance shall be made for overcutting or for excavation below the required elevations. The Engineer must be given reasonable notice to measure all rock.
b) If excess excavation is made or the material becomes disturbed so as to require removal below final subgrade elevations or beyond the prescribed limits, the resulting space shall be refilled with Class “C” concrete in accordance with the Cast-In-Place Concrete Section of these Specifications.

C. Excavation for Foundations: Footings and slabs on grades shall rest on undisturbed earth, rock or compacted materials to insure proper bearing.

1. Unsuitable Foundation Material

a. Any material in the opinion of the Engineer which is unsuitable for foundation shall be removed and replaced with compacted crushed stone, or with compacted fill material as directed by the Engineer. Materials shall meet the Standards defined in the Project Geotechnical Report.

b. No determination of unsuitability will be made until all requirements for dewatering are satisfactorily met.

c. Where shown on the Drawings, removal and replacement of unsuitable material shall be included in the lump sum bid. Payment for removal and replacement of unsuitable material not shown on the Drawings shall be made at the unit price bid.

2. Foundation in Rock

a. Foundations for a structure shall be on similar materials. Should excavation for a foundation be partially in rock, the Contractor shall undercut that portion of the rock 12-inches and bring the excavation to grade per Project Geotechnical Report or Project Engineer.

b. Where ordered by the Engineer, undercutting of rock and replacement with crushed stone will be paid for at the unit price bid for rock excavation. The quantity shall equal one foot of depth over the horizontal dimensions authorized by the Engineer.

3. Pipe Trenches Beneath Structures

a. Where piping or conduit passes beneath footings or slabs resting on grade, trenches shall be excavated to provide a minimum of 6-inches clearance from all surfaces of the pipe or conduit. The trench shall be backfilled to the base of the structure with concrete.

b. No separate payment will be made for concrete backfill of trenches beneath structures. The cost of this work and all costs incidental to it shall be included in the price bid for the item to which the work pertains.

4. Unauthorized Excavation

a. Care shall be taken that excavation does not extend below bottom levels of footings or slabs on earth or rock. Should the excavation, through carelessness or neglect, be carried below such levels, the Contractor shall fill in the resulting excess excavation with concrete under footings and compacted material as defined in the Project Geotechnical Report or other Engineer approved material under slabs. Should excavation be carried beyond outside lines of footings such excess excavation shall be filled with concrete, or formwork shall be provided, as directed by the Engineer.

b. Additional costs of corrective work, made necessary by unauthorized excavation of earth or rock, shall be borne by the Contractor.

D. Unsuitable Bearing

1 If suitable bearings for foundations are not encountered at the elevations indicated on the Drawings, immediately notify the Engineer.

2 Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.

3.4 FILL

A. Controlled Fill

1 1. The fill for roadways, parking areas, walks, structures, and building slabs on grade shall be controlled fill.

2 After the existing ground or excavated area has been proofrolled and examined by the Engineer, all holes and other irregularities shall be filled and compacted before the main fill is placed.

3 The fill shall be placed in even layers not exceeding 8-inches in depth and shall be thoroughly compacted as herein specified.

4 If an analysis of the soil being placed shows a marked difference from one location to another, the fill being placed shall not be made up of a mixture of these materials.

5 Each different type of material shall be handled continuously so that field control of moisture and density may be based upon a known type of material.

6 No fill shall be placed following a heavy rain without first making certain on isolated test areas that compaction can be obtained without damage to the already compacted fill.

B. Proofrolling

1 All areas where roadways, parking areas, sidewalks, structures, and buildings are to be constructed on cut areas, compacted fill, and other areas where indicated on the Drawings, shall be proofrolled to detect soft spots prior to the placement of fill material and after placement of fill, which shall be construction of foundations.

2 Proofrolling shall consist of moving a 20-30 ton loaded dump truck or other pneumatic tire roller over the subgrade before the subgrade is shaped. Proofrolling shall be witnessed by the Engineer.

3 Pneumatic-tired rollers shall have not fewer than four pneumatic tired wheels which shall be of such size and ply that tire pressures can be maintained between 80 and 100 pounds per square inch for 25,000 pound wheel load during rolling operations. Unless otherwise required, rolling shall be done with tires inflated to 90 psi. The roller wheels shall be located abreast in a rigid steel frame. Each wheel shall be loaded with an individual weight box so that each wheel will bear an equal load when traversing uneven ground. The weight boxes shall be suitable for ballast loading such that the load per wheel shall be 25,000 pounds. The spacing of the wheels shall insure that the distance between the nearest edges of adjacent tires shall be not greater than one-half of the tire width of a single tire at the operating pressure for a 25,000 pound wheel load. The roller shall be operated no faster than 10 miles per hour.

4 Subgrade shall be proofrolled with six passes of the truck or roller. Depressions that develop during the proofrolling operation shall be filled with suitable material and those filled areas shall be proofrolled with six passes of the roller. If, after having been filled and proofrolled, the subgrade still contains depressions, the area shall be undercut to the full depth of the soft material or five feet whichever is less, backfilled, recompacted, and rolled to achieve a subgrade acceptable to the Engineer.

5 After the proofrolled subgrade has been accepted by the Engineer, the surface of the subgrade shall be finish rolled with a smooth steel wheel roller weighing not less than 10 tons. Finished surface of the subgrade shall be within a tolerance of 1/4-inch at every point.

6 Conduits, pipes, culverts and underdrains shall be neither disturbed nor damaged by proofrolling operations. Rollers shall neither pass over, nor approach closer than five feet to, conduits, pipes, culverts and underdrains unless the tops of those products are deeper than three feet.

C. Placement

1 Prior to placement of any material in embankments, the area within embankment limits shall be stripped of topsoil and all unsuitable materials removed as described in the Project Geotechnical Report.

2 Fill materials shall be placed in continuous approximately horizontal layers extending the full width of the embankment cross-section and the full dimension of the excavation where practical and having a net compacted thickness of not over 6-inches.

3 Fill materials shall be placed at optimum moisture content within practicable limits (not less than one percent below optimum). Optimum moisture shall be maintained by sprinkling the layers as placed or by allowing materials to dry before placement.

D. Compaction

1 Fill materials shall be compacted to dry densities as determined by the Standard Proctor Compaction Test performed in accordance with ASTM D 698.

2 Fill materials supporting roadways, parking areas, sidewalks, structures, and buildings, and backfill around structures, buildings, and walls shall be compacted to 98 percent of the maximum dry density. The top 12-inches of fill material supporting roadways, parking areas, sidewalks, structures, and buildings shall be compacted to 100 percent of the maximum dry density. Fill placed for general site grading shall be compacted to 95 percent of the maximum dry density.

3 Compaction of embankments shall be by sheepsfoot rollers with staggered, uniformly spaced knobs and suitable cleaning devices. The projected area of each knob and the number and spacing of the knobs shall be such that the total weight of the roller and ballast when distributed over the area of one row of knobs shall be 250 psi. Placement and compaction of materials shall extend beyond the final contours sufficiently to insure compaction of the material at the resulting final surface. Final contours shall then be achieved by a tracked bulldozer shaping the face of the embankment.

4 Compaction of backfill around structures shall be accomplished by heavy power tamping equipment.

5 If tests indicate that density of fill is less than that specified, the area shall be either recompacted or undercut, filled, and compacted until specified density is achieved.

E. Final Grading: Upon completion of construction operations, the area shall be graded to finish contour elevations and grades shown on the Drawings. Graded areas shall be made to blend into conformation with remaining ground surfaces. All surfaces shall be left smooth and free to drain.

F. Excess Material

1 Any excess earth excavation and unsuitable materials shall be placed on the site as directed by the Engineer. Surfaces and slopes of waste fills shall be left smooth and free to drain.

2 No separate payment will be made for backfilling. The cost of all such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

G. Moisture

1 All fill shall be compacted with the moisture content as established by the 98 percent intercept on the moisture density curves or the moisture content at the shrinkage limit, whichever is less.

2 If fill material is too wet, provide and operate approved means to assist the drying of the fill until suitable for compaction.

3 If fill material is too dry, provide and operate approved means to add moisture to the fill layers.

3.5 BACKFILLING

A. Backfill carefully to restore the ground surface to its original condition. Dispose of surplus material.

B. Compact backfill underlying roadways, parking areas, sidewalks, structures, and buildings to 98 percent of the maximum dry density.

C. Backfill for Pipe

1 Initial: Place initial backfill material carefully around the pipe above bedding in uniform 6-inch layers to a depth of at least 18-inches above the pipe bell. Compact each layer thoroughly with suitable hand tools. Do not disturb or damage the pipe. Backfill on both sides of the pipe simultaneously to prevent side pressures. Initial backfill material is earth material excavated from the trench which is clean and free of rock, organics, and other unsuitable material. If materials excavated from the trench are not suitable for use as initial backfill material, obtain suitable materials elsewhere.

2 Final: After initial backfill material has been placed and compacted, backfill with general excavated material. Place backfill material in uniform layers and thoroughly compact with heavy power tamping tools of the “Wacker” type.

3 Settlement: If trenches settle, re-fill and grade the surface to conform to the adjacent surfaces.

4 Additional Material

a. Where final grades above the pre-existing grades are required to maintain minimum cover, additional fill material will be shown on the Drawings.

b. Utilize excess material excavated from the trench if the material is suitable. No additional payment will be made for additional material when excavated materials are used.

c. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide suitable additional fill material. Payment for additional material imported to the job site will be made for the quantity of materials provided at the unit price bid.

D. Backfilling Around Structures

1. General

a. Remove debris from excavations before backfilling.

b. Do not backfill against foundation walls until so directed by the Engineer nor until all indicated perimeter insulation and/or waterproofing is in place.

c. Protect such insulation and/or waterproofing during filling operations.

d. Wherever possible, backfilling shall be simultaneous on both sides of walls to equalize lateral pressures.

e. Do not backfill against walls until all permanent construction is in place to furnish lateral support on both top and bottom of wall.

f. Backfilling against walls is to take place after all the concrete in the affected members has attained the specified strengths.

2. Materials: Backfill material placed against structures built or encountered during the work of this Section shall be suitable fill material. No broken concrete, bricks or similar materials will be permitted as backfill.

3.6 GRADING

A. General: Perform all rough and finish grading required to attain the elevations indicated on the Drawings. Perform finish grading to an accuracy of + 0.10 foot.

B. Compact backfill underlying roadways, parking areas, sidewalks, structures and buildings to 98 percent of the maximum dry density. The top 12-inches of backfill shall be compacted to 100 percent of the maximum dry density.

C. Treatment After Completion of Grading

1 After grading is completed, permit no further excavation, filling or grading, except with the approval of the Engineer.

2 Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.7 SURFACE WATER CONTROL

A. Regulations and Permits: Obtain all necessary soil erosion control permits in accordance with the State Environmental Protection Agency, and all pertinent rules, laws, and regulations of all applicable federal, state, county and municipal regulatory agencies.

B. Unfavorable Weather

1 Do not place, spread or roll any fill material during unfavorable weather conditions.

2 Do not resume operations until moisture content and fill density are satisfactory to the Engineer.

C. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collected in depressions.

D. Pumping and Drainage

1 Provide, maintain and use at all times during construction adequate means and devices to promptly remove and dispose of all water from every source entering the excavations or other parts of the work.

2 Dewater by means which will insure dry excavations, preserve final lines and grades, do not disturb or displace adjacent soil.

3 All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic or the work of other contractors, and in accordance with all pertinent laws, ordinances and regulations.

4 Do not overload or obstruct existing drainage facilities.

3.8 SETTLEMENT

A. The Contractor shall be responsible for all settlement of backfill, fills and embankments which may occur within one year after final acceptance of the Work by the Owner.

B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from the Engineer or Owner.

3.9 CLEANING

A. Upon completion of the work of this Section, remove all rubbish, trash and debris resulting from construction operations. Remove surplus equipment and tools. Leave the site in a neat and orderly condition acceptable to the Engineer, and in conformance with Section 01 74 23 of these Specifications.

END OF SECTION

SECTION 02315 – EXCAVATION AND FILL

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to Work of this section.

1.2 STANDARDS

A. The following Standards are listed in this specification:

ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C150	Standard Specification for Portland Cement
ASTM D448	Standard Classification for Sizes of Aggregates for Road and Bridge Construction
ASTM D698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft)
ASTM D1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))
ASTM D1621	Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D2487	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table ASTM D4254 Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D4716	Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products
ASTM D4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D4759	Standard Practice for Determining the Specification Conformance of Geosynthetics
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

B. State Department of Transportation Standard Specifications

C. County and Municipalities Standard Specifications

1.3 DESCRIPTION OF WORK

A. Earthwork: The extent of earthwork is indicated on the drawings. The work, in general, includes the following items:

1. Excavation and backfill for building structure and foundation.

2 Preparation of subgrade for building slabs, and walks.

3 Excavation and backfill in conjunction with underground mechanical and electrical utilities under slabs on grade, and mechanical and electrical appurtenances that are buried under the building slab.

4 Rough and finish grading adjacent to the building.

B. Excavation Definition: "Excavation" consists of removal of all material encountered to required subgrade elevations indicated and subsequent disposal of all materials removed.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with all applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Services:

1. Owner's Testing Laboratory: The Owner will engage a soil testing and inspection service for quality control testing during earthwork operations.

C. Depth of Bearing Strata: It is to be understood that site soil conditions are variable across the site. Footing design dimensions and bearing elevations shown are minimums. The design of the footings is based on the assumed strata bearing capacity at the elevation shown on the drawings and as indicated in the General Notes. If the indicated depth of footing excavation is reached without developing the required strata bearing capacity, the Owner's Geotechnical Engineer will observe conditions and recommend additional excavation or other measures as appropriate to conditions. Revisions will be paid for in accordance with the Contract condition relative to changes in the Work.

D. Survey Work, Grades, and Elevations:

1 Grades and Elevations: Finished grades indicated by spot elevation and normal contour line elevations denote finished top surface elevations. Report conflicts, errors and inconsistencies in grades and elevations to Architect/Engineer for resolution. Do not proceed with the work in questionable areas until conflicts are resolved by the Architect/Engineer.

2 Survey Work: Lay out work to the lines and levels required before excavation. Record actual measurements of each footing and mat plan centerline location, bottom elevation, deviation from specified tolerances, and all other pertinent data as required.

1.5 SUBMITTALS

A. Laboratory Test Reports: Submit the following reports directly to the Architect/Engineer from the testing services, with copy to Contractor:

1. Test reports on borrow and fill material including optimum moisture-maximum density curve for each type of soil.

2 Verification reports of each footing subgrade.

3 Field density test reports.

4 Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

5 All other test reports as required by "Testing Laboratory Services", and other specification sections.

6 Product Data.

1.6 JOB CONDITIONS

A. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data are made available for convenience of Contractor. Additional test borings and other exploratory operations may be made by the Contractor at no cost to the Owner.

B. Removal of Items Remaining from Demolition: Include as part of earthwork the breaking up and removal of all concrete slabs, pavements, footings, foundations, cisterns, septic tanks, abandoned underground utility lines and all other obstructions remaining from previous demolition operations that may have occurred.

C. Existing Utilities:

1 The drawings indicate the locations of known active and inactive above grade and below grade utilities. Locate all existing underground utilities in areas of work before proceeding. Provide adequate support and protection during earthwork operations of utilities that are to remain in place. Demolish and completely remove from the site existing utilities indicated to be removed. Coordinate with utility companies for proper shut-off of services for active lines.

2 If any active utility not indicated in drawings is encountered, notify Architect/Engineer and protect from damage until instructions for proper disposition of the utility are given by the Architect/Engineer. Perform the requested work in compliance with rules and regulations of authority having jurisdiction.

3 Repair active utilities scheduled to remain that are damaged by earthwork operations to the satisfaction of the utility owner.

4 If any inactive utility not indicated on the drawings is encountered, remove, plug, or cap as directed by the Architect/Engineer. Obtain any necessary data relative to proposed abandonment of existing utility service from authority having jurisdiction.

5 Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Architect/Engineer and then only after acceptable temporary utility services have been provided. Provide minimum of 48-hour notice to Architect/Engineer, and receive written notice to proceed before interrupting any utility

D. Use of Explosives:

1 The use of explosives is not permitted.

2 Do not bring explosives onto the site or use in the work without prior written approval from authorities having jurisdiction. The Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

E. Protection of Persons and Property:

1 Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.

2 Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

3 Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

4 Accidental or Careless Damage to Work Intended to Remain in Place: Restore to a condition as good or better than existed before work was commenced as approved by the Architect/Engineer and at no additional cost to the Owner.

PART 2 -PRODUCTS

2.1 DEFINITION OF SOIL MATERIALS

A. Unsatisfactory Soil Materials: Unsatisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups GC, ML, MH, CH, OL, OH, and PT. Groups SC and CL are also unsatisfactory unless conforming to requirements specified below.

B. Fill and Backfill: - All fill & backfill to meet requirements defined in project Geotechnical Report

1 Definition: "Fill" is soil material that is used to raise existing grades such as under foundation slabs or above footings, or to replace unsuitable material. “Backfill" is soil material that is used to fill an excavation, to fill against the structure, or to fill behind foundation walls.

2 Select Fill: "Select fill" material shall be used as noted on the drawings as fill and/or backfill and shall conform to one of the following:

a. Sandy clay or clayey sand having a plasticity index less than 30. Material shall be free of debris, roots, vegetation, organic matter and all other deleterious substances and free of rock or gravel greater than 4" in any dimension.

3. Drainage Fill: "Drainage fill" shall be used as noted on the drawings as fill material that is used around a drainage pipe in a wall drainage system or under a foundation slab as part of an underfloor drainage system and shall conform to the following: Washed evenly graded mixture of crushed stone or crushed or uncrushed gravel, ASTM C33; coarse-aggregate grading Size 56; with 100% passing a 1 1/2" sieve and not more than 5% passing a No. 4 sieve.

4. Drainage Backfill: "Drainage backfill" shall be used as noted on the drawings as backfill material that is used behind a foundation wall as part of a wall drainage system Drainage backfill must be compatible with any drainage fill material to which it comes in contact as part of the complete wall drainage system. Drainage backfill shall conform to the following:

a. Washed evenly graded mixture of crushed stone or crushed or uncrushed gravel, ASTM D448; coarse-aggregate grading Size 57; with 100% passing a 1 1/2" sieve and not more than 5% passing a No. 8 sieve.

5. Granular Base under slab-on-grade: "Granular Base" material shall be used as noted on the drawings as fill material between the moisture retarder and the slab and shall be a clean, well-graded, granular mixture of crushed stone, crushed, recycled concrete, or crushed or uncrushed gravel that is trimmable, compactable, and drains well.

Subject to compliance with requirements, the following materials are acceptable:

Crushed, recycled concrete with 100% passing the 1 1/2 inch sieve, 45% to 60% passing the 3/8" sieve, 25% to 40% passing the #4 sieve, 20% to 35% passing the #8 sieve, 10% to 30% passing the #100 sieve, and 0% to 5% passing the #200 sieve.

6. Leveling Sub-base under Moisture Retarder: "Leveling Sub-Base" shall be used as noted on the drawings as a thin smoothing layer over the sub-grade and directly below the moisture retarder. The material shall be a clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D448, size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; meeting deleterious substance limits of ASTM C33 for fine aggregates.

7. Use of On-site Materials: On-site materials may be used for fill and backfill only when approved by the Owner's Testing Laboratory.

C. Approval: All soil materials used for the project shall be approved by the Owner's Testing Laboratory prior to hauling or placement. Soil materials used for fill and backfill shall be retested and reapproved each time the source or character of the material changes.

D. Filter Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile: made from polyolefins, polyesters, or polyamides: and with the following minimum properties determined according to ASTM D4759 and referenced standard test methods:

Puncture Resistance: 50 lbf; ASTM D4833 Water Flow Rate; 90 gpm per sq. ft.; ASTM D4491 Apparent Opening Size; No. 50; ASTM D4751 Weight; 8 ounces per square yard

E. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polylolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

Grab Tensile Strength: 200 lbf: ASTM D4632 Tear Strength: 75 lbf: ASTM D4533 Puncture Resistance: 90 lbf; ASTM D4833 Water Flow Rate; 4 gpm per sq. ft.; ASTM D4491 Apparent Opening Size; No. 30; ASTM D4751

F. Geocomposite Drainage System: A manufactured system consisting of a geotextile filter fabric specified above that is fusion bonded to a high-impact plastic cuspated core and with the following minimum properties.

Flow rate, @3600 psf and hydraulic gradient = 1.0, ASTM D4716: 5 gpm/ft. width Compressive Strength, ASTM D1621: 15,000 psf

Subject to compliance with requirements, provide one of the following:

"MiraDRAIN MD-2000", TC MiraDRI, Inc., Norcross, GA "Sheet Drain HS", Greenstreak, St. Louis, MO "J-DRain 300", JDR Enterprises, Inc., Alpharetta, GA "Hydraway 100", Solutia, Inc., St. Louis, MO "Enkadrain 9010", Akzo Nobel Geosynthetics Company, Enka, NC

G. Slotted Collector Pipe: Provide Schedule 80 PVC pipe with 0.10 inch slots comprising a minimum of 8% of the total surface area of the pipe but no more than 10%.

PART 3 -EXECUTION

3.1 CLEARING AND GRUBBING

A. Remove all existing slabs, pavements, trash, rubbish, debris, trees, roots, stumps, underbrush, grass, shrubs, plants and other vegetation from within the mass excavation limits.

3.2 PREPARATION

A. Survey Work:

1 Set required lines and levels as required to accurately perform the excavation work.

2 Maintain all bench marks and other reference points.

B. Protection of Existing Work:

1. Protect bench marks and existing structures, utilities, roads, sidewalks, paving , curbs and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. In areas where excavations must be carried to such depths that surcharge from streets, sidewalks, or earth pressure create hazardous conditions, provide sheet piling, shoring and bracing, or combinations thereof, as required to protect excavations. Remove shoring and bracing before backfilling is completed, but not before permanent supporting structure is in place.

2. Protect excavations by laying back sides on a maximum 1:1.5 slope or by other methods as required to prevent cave-ins and loose dirt from falling into excavations.

3. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

4. Notify Architect/Engineer of any unexpected subsurface conditions. Discontinue work in area until Architect/Engineer provides notification to resume work.

3.3 EXCAVATION

A. Classified Excavation: The excavation for this project is classified. The following classifications of excavation will be made when rock excavation is encountered in the work:

1. Earth Excavation: Earth excavation includes excavation of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

2. Rock Excavation in Trenches and Pits: Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42" wide bucket on track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10'-0" in width and pits in excess of 30'-0" in either length or width are classified as open excavation.

3. Rock Excavation in Open Excavations: Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty excavating equipment without drilling, blasting or ripping. Rock excavation equipment is defined as Caterpillar model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170HP flywheel power and developing 40,000 lb. break-out force (measured in accordance with SAE J732C).

   Typical of materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.

   Intermittent drilling, blasting, if permitted, or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

   Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by the Owner's Geotechnical Engineer or other authorized representative. Such excavation will be paid on the basis of contract conditions relative to changes in the work.

4. Rock Payment Lines: Rock payment lines are limited to the following:

   a. Two feet outside of concrete work for which forms are required, except footings.
   b. One foot outside perimeter of footings.
   c. In pipe trenches, 6" below invert elevation of pipe and 2 ft. wider than inside diameter of pipe, but not less than 3 ft. minimum trench width.
   d. Neat outside dimensions of concrete work where no forms are required.
   e. Under slabs on grade, 6" below bottom of concrete slab.

B. Unauthorized Excavation:

1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect/Engineer. Unauthorized excavation, as well as remedial work directed by Architect/Engineer, shall be at Contractor's expense.

2. Under footings, foundation bases, or foundation walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill or compacted No. 57 stone may be used to bring elevation to proper position, when acceptable to Architect/Engineer and approved by the Geotechnical Engineer.

3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect/Engineer.

C. Approval of Subgrade:

1. When excavation has reached required subgrade elevations, notify Owner's Geotechnical Engineer who will make an inspection of conditions.

2. Proofroll exposed subgrade below building with appropriate compaction equipment. Conduct proofrolling operations only in the presence of the Owner's Geotechnical Engineer. Undercut areas which "pump" or "rut" during operations to firm natural soil, and backfill and compact as specified.

3. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material with cement stabilized sand, lean concrete, or select fill as directed by Owner's Geotechnical Engineer.

4. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in the work.

5. Reconstruct subgrades damaged by freezing temperature, frost, rain, accumulated water, or construction activities as directed by the Owner’s Geotechnical Engineer.

D. Stability of Excavations:

1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction and in accordance with the requirements noted in the Geotechnical Report. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

2. Maintain sides and slopes of excavations in safe condition until completion of backfilling. Protect slopes from erosion by covering the slope with material such as polyethylene sheet.

E. Shoring and Bracing:

1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.

2. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

F. Dewatering:

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

3. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches. Do not discharge drainage water lines into municipal sewers without municipal approval. Prevent water running onto adjacent properties and public thoroughfares. Direct surface drainage away from excavated areas.

G. Material Storage:

1. Where required by schedule or site limitations, stockpile satisfactory soil materials and/or select fill where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

2. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.

3. Dispose of excess soil material and waste materials as herein specified.

H. Excavation for Structures:

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10'. Excavations for footings and mats may be neat excavated where possible with sides and top edges free of loose or wet materials. Where neat excavation is not possible, excavate by open cut and allow sufficient distance from the edge of footings and foundations to permit placing and removing concrete formwork, installing services, other construction, and for inspection.

2. In excavating for footings and foundation, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Where unsatisfactory bearing surfaces are encountered, the area shall be undercut as required and backfilled with cement stabilized sand or lean concrete as directed by the Geotechnical Engineer. Trim bottoms to required lines and grades to leave solid, clean, level and flat base to receive other work.

3. Protect soils exposed at the base of completed foundation excavations against disturbance from construction activities and changes in moisture content. Excavations shall not be left overnight unless it is protected with a minimum 2" thick seal slab of lean concrete. Where the bottom of the excavation will be exposed to movement of crawler type heavy equipment, the contractor may leave about one foot of undisturbed soil above indicated bottom of footing elevations until just prior to final excavation.

4. Mat Excavation: The final one foot of mat excavation shall be performed over small areas and shall produce minimal disturbance to the bearing surface. As soon as the excavated area is cleaned, all loose material removed, and soft spots filled, the bearing area shall be immediately covered with a 3" unreinforced seal slab of lean concrete before proceeding to the next area of excavation.

5. For pile foundations, stop excavations from 6" to 12" above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material, and excavate to final grade, leaving solid base to receive concrete pile caps.

I. Excavation and Backfilling for Trenches:

1. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.

2. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to keep the top of pipe or conduit below the frost line.

3. Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed stone or gravel prior to installation of pipe.

4. For pipes or conduit 5" or less in nominal size and for flat-bottomed multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

5. For pipes or conduit 6" or larger in nominal size, tanks and other mechanical/electrical work indicated to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6" below bottom of work to be supported.

6. Except as otherwise indicated, excavate for exterior waterbearing piping (water, seam, condensate, drainage) so top of piping is not less than 3'-6" below finished grade.

7. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

8. Backfill trenches with concrete where trench excavations are close to column or wall footings such that the bottom of the excavation is below the zone of influence of such footings, or which pass under wall footings. The zone of influence of a footing is defined by 45 degree planes extending downward from the bottom edges of the footing. Place concrete to level of bottom of adjacent footing. In other locations, backfill trenches with select fill.

9. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Geotechnical Engineer or other authorized Owner's representative. Use care in backfilling to avoid damage or displacement of pipe systems.

10. For piping or conduit less than 2'-6" below surface of roadways, provide 4" thick concrete base slab support. After installation and testing of piping or conduit, provide minimum 4" thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.

J. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.

3.4 PLACING FILL AND BACKFILL

A. Location: Place satisfactory and approved soil material in layers to required subgrade elevations for each area classification listed below:

1. Excavations: In excavations use select fill or approved excavated material. Place in layers to required subgrade elevations.

2. Building Slabs: Under building slabs use select fill as shown on the drawings. Place fill between the top of footings and mats and the building slab or the bottom of the drainage course.

3. Around Footings and Mats: Backfill around the formed edges of footings and mats with lean concrete or cement-stabilized sand.

4. Behind Foundation Walls: Behind foundation walls, use drainage fill around the wall drain and drainage backfill over the drainage fill and wall drain up to within two feet of grade. Use fill material at the top 24" of the wall backfill. Use thin lifts and light compaction equipment to avoid overstressing walls.

5. Under Walks: Use minimum 6" deep course of base or subbase material, or approved excavated material.

6. Backfill Adjacent to Structures: Backfill against the structure with select fill up to within two feet of grade. Use impervious fill material at the top 24" of backfill adjacent to structures.

7. Under Steps: Use minimum 6" course of subbase or base material.

8. Under Piping and Conduit: Under piping and conduit use subbase or base material, shaped to fit bottom of trench.

B. Prior to Backfill Placement: Backfill excavations as promptly as work permits but not until completion of each of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

2. Inspection, testing, approval, and recording locations of underground utilities.

3. Removal of concrete formwork.

4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.

5. For basement walls, until floor construction at top of wall is complete.

6. Removal of trash and debris.

7. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

C. Ground Surface Preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

2. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

D. Grading:

1. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

2. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes to the following tolerances:

    a. Lawn or Unpaved Areas: Plus or minus 1 inch.
    b. Walks: Plus or minus 1 inch.

3. Grading Surface of Fill Under Building Slabs: Provide final grades within a tolerance of 1/2" when tested with a 12' straightedge.

4. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

5. Allowance for Compaction and Settlement: Allow for natural compaction and settlement during grading operations. Where excessive settlement occurs, scarify settled areas, fill and compact to required subgrade levels.

3.5 COMPACTION

A. General: Control all soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below. Place backfill and fill materials in thin, horizontal, loose lifts not more than 8 inches in depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of standard Proctor maximum dry density determined in accordance with ASTM D 698.

1. Structures, Building Slabs and Steps, and Pavements: In accordance with Project Geotechnical Report.

2. Behind Foundation Wall: In accordance with Project Geotechnical Report.

3. Lawn or Unpaved Areas: In accordance with Project Geotechnical Report.

4. Walkways: In accordance with Project Geotechnical Report.

C. Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.6 FIELD QUALITY CONTROL

A. Refer to Section entitled “Testing Laboratory Services” for required quality control testing during construction.

3.7 MAINTENANCE

A. Protection of Graded Areas:

1 Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

2 Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.8 DISPOSAL OF EXCESS WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.

3.9 UNIT PRICES

A. Basis of Bids: Include excavation work and other earthwork necessary to produce the work required.

B. Changes in the Work: Payment for changes in earthwork will be made on the actual net volume change of foundation in place and accepted based on design dimensions shown. No additional compensation will be made for excavation, concrete fill, reinforcing, or other costs due to unauthorized over-excavating in any dimension.

C. Unit Prices: Quote Unit Prices which include full compensation for labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casing as required, dewatering, and other necessary items for complete installation. Provide Unit Prices for the following items, as set forth in the Contract conditions, which will apply in the event additions to or deductions from the Work are required and authorized by a written order from the Architect and approved by the Owner to the Contractor. Refer to Section 03 30 00 for concrete, reinforcing steel, and dowel Unit Price requirements.

1. Soil excavation, per cu. yd.

2. Rock excavation, per cu. yd.

3. Select fill material, placement, and compaction, per cu. yd.

4. Cement stabilized sand and/lean concrete material and placement, per cu. yd.

END OF SECTION 02315

SECTION 02320 – TRENCH EXCAVATION AND BACKFILL

PART 1 -GENERAL

1.1 SCOPE

A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the site utilities, including all pipelines, electrical conduits and duct banks shown on the Drawings and as specified. All work to be in accordance with State DOT and County/Municipalities Standard Specifications.

B. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the utility and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.

C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.

D. The trench is divided into five specific areas:

1 Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.

2 Bedding: The area above the trench bottom (or foundation) and below the bottom of the utility.

3 Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.

4 Initial Backfill: The area above the haunching material and below a plane 18-inches above the top of the barrel of the pipe or the top of duct bank.

5 Final Backfill: The area above a plane 18-inches above the top of the utility.

E. The choice of method, means, techniques and equipment rests with the Contractor. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material proximity of man-made improvements to be protected, and prevailing practice in the area.

1.2 QUALITY ASSURANCE

A. Density: Determination of soil density shall conform to the requirements of Section “Earthwork” of these Specifications.

B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed in accordance with Sections Structural Testing Laboratory Services and Earthwork of these Specifications.

C. Field density tests for each two feet of lift, one test for each 2,000 feet of pipe installed or more frequently if ordered by the Engineer.

1.3 SAFETY

A. Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P “Excavation, Trenching & Shoring” as described in OSHA publication 2226.

PART 2 -PRODUCTS

2.1 TRENCH FOUNDATION MATERIALS

A. Crushed stone or surge stone shall be utilized for trench foundation (trench stabilization).

B. Crushed stone shall be as specified in Part 2 of Section Earthwork of these Specifications.

C. Surge stone shall be crushed limestone and shall meet the requirements of the State Department of Transportation Standard Specifications.

2.2 BEDDING AND HAUNCHING MATERIALS

A. Unless specified otherwise, bedding and haunching materials shall be crushed stone as specified in Part 2 of Section labeled Earthwork.

B. Bedding and haunching materials for gas piping shall be fine aggregate as specified in Part 2 of Section labeled Earthwork.

C. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, provide select material conforming to the requirements of this Section at no additional cost to the Owner.

D. Filter Fabric [Woven Type]

1. Filter fabric associated with bedding shall be a polypropylene woven fabric. The fabric shall be a high modulus type with good separation capabilities. The fabric shall be inert to biological degradation and naturally occurring chemicals, alkalies and acids.

Fabric Property	Unit	Test Method	Minimum Value
Grab Tensile Strength	lbs.	ASTM D 4632	200
Grab Tensile Elongation	%	ASTM D 4632	30 (max.)
Mullen Busrst Strength	psi	ASTM D 3786	400
Trapezoid Tear Strength	lbs.	ASTM D 4533	75
Puncture Strength	lbs.	ASTM D 3787	75
Fabric Property	Unit	Test Procedure	Average Value

2. The fabric shall have an equivalent opening size (EOS or AOS) of 20 to 45. The fabric shall also conform to the minimum property values listed in the following table:

3. If ordered by the Engineer, the filter fabric manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of 10 days during initial pipe installation.

4. Filter fabric shall be Mirafi 500X, Amoco 2002 or Exxon GTF-200.

E. Filter Fabric [Non-Woven Type]

1. Filter fabric associated with bedding shall be a UV stabilized, spunbonded, continuous filament, needlepunched, polypropylene, nonwoven geotextile.

2. The fabric shall have an equivalent open size (EOS or AOS) of 120 -70. The fabric shall also conform to the minimum property values listed in the following table:

Fabric Property	Unit	Test Method	Minimum Value
Grab Tensile Strength	lbs.	ASTM D 4632	200
Grab Tensile Elongation	%	ASTM D 4632	30 (max.)
Mullen Busrst Strength	psi	ASTM D 3786	400
Trapezoid Tear Strength	lbs.	ASTM D 4533	75
Puncture Strength	lbs.	ASTM D 3787	75

Fabric Property	Unit	Test Procedure	Average Value	
			Typical	Minimum
Weight	oz/yd.2	ASTM D 3776	8.3	
Thickness	mils	ASTM D 1777	105	
Grab Strength	lbs.	ASTM D 4632	240	210
Grab Elongation	%	ASTM D 4632	>50	50
Tear Strength	lbs.	ASTM D 4533	100	85
Mullen Burst	psi	ASTM D 3786	350	320
Puncture Resistance	lbs.	ASTM D 4833	115	100
Permittivity	sec-1	ASTM D 4491	1.7	
Water Permeability	cm/sec	ASTM D 4491	0.4	

3. If ordered by the Engineer, the filter fabric manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of 10 days during initial pipe installation.

4. Filter fabric shall be Polyfelt TS 700, Trevira 1125 or SuPac 7-MP.

2.3 INITIAL BACKFILL

A. Initial backfill material shall be crushed stone or earth materials as specified for bedding and haunching materials.

B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section.

2.4 FINAL BACKFILL

A. Final backfill material shall be general excavated earth materials, shall not contain rock larger than 2-inches at its greatest diameter, cinders, stumps, limbs, man-made wastes and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this Section.

2.5 SELECT BACKFILL

A. Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

2.6 CONCRETE

A. Concrete for bedding, haunching, initial backfill or encasement shall be Class “C” concrete in accordance with Section labeled Cast-In-Place Concrete of these Specifications.

PART 3 -EXECUTION

3.1 TRENCH EXCAVATION

A. Topsoil and grass shall be removed in accordance with the requirements of Section labeled Earthwork.

B. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the utilities and to the dimensions which provide the proper support and protection of the utility and other structures and accessories.

C. Trench Width for Pipelines

1. The sides of all trenches shall be vertical to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.

2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.

3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 9-inches clearance between the rock and any part of the pipe barrel or manhole.

4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher Class or Type of bedding and haunching as shown on the Drawings for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or Owner.

D. Trench Width for Electrical Duct Banks

1 The sides of all trenches for electrical duct banks shall be vertical to a minimum of one foot above the top of the duct bank. The maximum trench width shall be equal to the duct bank width as shown on the Drawings.

2 Wherever the prescribed maximum trench width is exceeded, the Contractor shall backfill around the duct bank with select backfill material at no additional cost to the Owner. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or Owner.

3 Where rock is encountered in trenches, excavate to remove boulders and stones to provide the duct bank to the dimensions shown on the Drawings. The maximum allowable width of rock excavation for payment shall be based upon a trench width equal to the width of duct bank shown on the Drawings.

E. Depth

1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the utilities and bedding to the dimensions shown on the Drawings.

2. Pressure Mains

a. Depth of Trenches: Excavate trenches to provide depths as shown on the Drawings. The depth of cover shall not exceed that as shown on the Drawings by more than two feet, without approval of the Engineer.

b. Excavate trenches to provide a minimum cover of four feet. Within streets or roadways, also excavate to place the top of the pipe a minimum of four feet below the nearest pavement edge.

c. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.

3. Electrical Duct Banks

a. Excavate trenches to provide a minimum cover of 18-inches. At road crossings, excavate to place the top of a duct bank a minimum of 4 feet below the nearest pavement edge.

b. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.

4. Gas Piping

a. Excavate trenches to provide a minimum cover of three feet for gas mains. Within the right-of-way of highways, streets or roadways, also excavate to place the top of the pipe a minimum of three feet below the nearest pavement edge or drainage ditch.

b. Excavate trenches to provide minimum cover of 18-inches for gas service lines.

c. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.

5. Where rock is encountered in trenches for pipelines, excavate to the minimum depth which will provide clearance below the pipe barrel of 8-inches for pipe 21-inches in diameter and smaller and 12-inches for larger pipe, valves and manholes. Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe, manhole or accessory. When rock is encountered in trenches for electrical duct banks, excavate to the minimum depth required to construct the duct banks to the dimensions shown on the Drawings.

F. Excavated Materials

1 Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Top soil shall be carefully separated and lastly placed in its original location.

2 Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or manmade improvements.

3.2 SHEETING, BRACING AND SHORING

A. Sheeting, shoring and bracing shall be in accordance with the requirements of Section Earthwork of these Specifications.

B. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be “dragged” with the bottom of the shield extending below the top of the pipe or utility.

C. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the utility and adjacent property. Leave sheeting in place when in the opinion of the Engineer it cannot be safely removed or is within three feet of an existing structure, utility, or pipeline. Cut off any sheeting left in place at least two feet below the surface.

D. Sheet piling within three feet of an existing structure or utility shall remain in place, unless otherwise directed by the Engineer.

3.3 TRENCH ROCK EXCAVATION

A. Rock excavation shall be in accordance with the requirements of Section Earthwork of these Specifications.

B. Definition of Trench Rock: Any material which cannot be excavated with conventional excavating equipment, and is removed by drilling and blasting, and occupies an original volume of at least one-half cubic yard.

C. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.

3.4 DEWATERING EXCAVATIONS

A. Dewater all excavations in accordance with the requirements of Section Dewatering of these Specifications.

B. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.

C. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

3.5 TRENCH FOUNDATION AND STABILIZATION

A. The bottom of the trench shall provide a foundation to support the utility and its specified bedding. The trench bottom shall be graded to support the utility and bedding uniformly throughout its length and width.

B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the utility, the trench will be determined to be unsuitable and the Engineer shall then authorize payment for trench stabilization.

C. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the Engineer, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone [or surge stone] as directed by the Engineer.

D. Where the replacement of unsuitable material with crushed stone [or surge stone] does not provide an adequate trench foundation, the trench bottom shall be excavated to a depth of at least two feet below the specified trench bottom. Place filter fabric in the bottom of the trench and support the fabric along the trench walls until the trench stabilization, bedding, haunching and pipe have been placed at the proper grade. The ends of the filter fabric shall be overlapped above the pipe.

E. Where the replacement of unsuitable material with crushed stone [or surge stone] does not provide an adequate trench foundation, the trench bottom shall be excavated to a depth of at least two feet below the specified trench bottom. Place the crushed stone [or surge stone] in the bottom of the trench and compact. Place the filter fabric over this stone and support the fabric along the trench walls until the bedding, haunching and pipe have been placed at the proper grade. The ends of the fabric shall be laid over the haunching material prior to the placement of the initial backfill.

F. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.6 BEDDING AND HAUNCHING

A. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.

B. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except at joints.

C. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.

D. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.

E. Gravity Pipelines and Accessories: Lay PVC pipe with minimum Class “B” bedding. Lay all other pipe with Class “C” bedding, unless shown or specified otherwise.

1 Class “A” (Bedding Factor -2.8): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Lay pipe to line and grade on concrete block. Place concrete to the full width of the trench and to a height of one-fourth of the outside diameter of the pipe above the invert.

2 Class “B” (Bedding Factor -1.9): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.

3 Class “C” (Bedding Factor -1.5): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel.

4 HDPE Pipe: Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall be carefully placed by hand and compacted to provide full support under and up to 18-inches over the top of the pipe for pipe 42-inches in diameter and larger, and 12-inches over the top of the pipe for pipe 36-inches in diameter and smaller.

5 Type 5: Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade before installing pipe. After the pipe has been brought to the proper grade, haunching material shall be carefully placed by hand and compacted to the top of the pipe.

F. Manholes: Excavate to a minimum of 12-inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.

G. Water Mains

1. Ductile Iron Pipe

a. Unless otherwise shown on the Drawings or specified, utilize earth materials for bedding and haunching. Type 2, 3, 4 and 5 bedding shall be as detailed on the Drawings.

b. Unless specified or shown otherwise, bedding shall meet the requirements for Type 2 Pipe Bedding. Unless specified or shown otherwise for restrained joint pipe and fittings, bedding shall meet the requirements for Type 3 Pipe Bedding.

2. Polyvinyl Chloride Pipe

a. Unless shown otherwise on the Drawings, utilize earth materials for bedding and haunching.

b. Unless shown otherwise on the Drawings, bedding and haunching shall meet the requirements for Type 2 Pipe Bedding, as detailed on the Drawings.

3. Prestressed Concrete Cylinder Pipe: Bedding and haunching shall meet the requirements of Type 3 Pipe Bedding.

H. Polyethylene Pipe for Gas Service

1 Unless otherwise shown on the Drawings, use fine aggregate materials for bedding and haunching.

2 Unless otherwise shown on the Drawings, bedding and haunching shall meet the requirements for Type 5 pipe bedding as detailed on the Drawings.

I. Excessive Width and Depth

1. Gravity Pipelines: If the trench is excavated to excess width, provide the bedding class with the next higher bedding factor. Crushed stone haunching and initial backfill may be used in lieu of Class “A” bedding, where Class “A” bedding is necessitated by excessive trench width.

2. Water Mains: If the trench is excavated to excess width, provide the next higher type or class of pipe bedding as detailed on the Drawings.

3. If the trench is excavated to excessive depth, provide crushed stone to place the pipe at the proper elevation or grade.

J. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 95 percent of the maximum dry density, unless shown or specified otherwise.

3.7 INITIAL BACKFILL

A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.

B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18-inches above the pipe barrel or duct bank. Layer depths shall be a maximum of 6-inches for pipe 18-inches in diameter and smaller and a maximum of 12-inches for pipe larger than 18-inches in diameter.

C. Backfill on both sides of the pipe simultaneously to prevent side pressures.

D. Compact each layer thoroughly with suitable hand tools or tamping equipment.

E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.

F. For PVC gravity pipelines, crushed stone shall be used for initial backfill up to 6-inches above the pipe barrel.

G. For electrical duct banks, place the first 12-inches of initial backfill materials as specified in this Section. Place in 6-inch layers, compact with suitable hand tools or tamping equipment.

H. If materials excavated from the trench are not suitable for use as backfill materials, provi de select backfill material conforming to the requirements of this Section.

3.8 CONCRETE ENCASEMENT FOR PIPELINES

A. Where concrete encasement is shown on the Drawings for pipelines not under structures, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 6-inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

3.9 CONCRETE ENCASEMENT FOR ELECTRICAL DUCTBANKS

A. Install top of duct bank minimum 18-inches below finished grade with plastic warning tape 12-inches below finished grade.

B. Terminate conduit in end bell at manhole entries.

C. Stagger conduit joints in concrete encasement 6-inches minimum.

D. Provide minimum 3-inch concrete cover at bottom, top, and sides of duct bank. Use suitable separators and chairs installed not greater than four feet on center to provide conduit spacing as indicated. Securely anchor conduit to prevent movement during concrete placement.

E. Where duct bank passes beneath footings or slabs, excavate to provide a minimum of 6-inches clearance between the conduits and the structure. Backfill to the base of the structure with concrete.

3.10 FINAL BACKFILL

A. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:

1 In 6-inch layers, if using light power tamping equipment, such as a “jumping jack”.

2 In 12-inch layers, if using heavy tamping equipment, such as hammer with tamping feet.

3 In 24-inch layers, if using a hydra-hammer.

B. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

C. Backfill carefully to provide a finished grade at the elevations shown on the Drawings.

D. The top 6-inches shall be topsoil obtained as specified in Section Earthwork of these Specifications.

E. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.

G. Remove and dispose of excess or unsuitable materials in accordance with the requirements of Section Earthwork of these Specifications.

3.11 ADDITIONAL MATERIAL

A. Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be as shown on the Drawings. Utilize excess material excavated from the trench, if the material is suitable. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide additional suitable fill material.

3.12 BACKFILL UNDER ROADS

A. Compact backfill underlying pavement and sidewalks, and backfill under dirt and gravel roads to a minimum 98 percent of the maximum dry density. The top 12-inches shall be compacted to a minimum of 100 percent of the maximum dry density.

3.13 DETECTION TAPE

A. Where required, detection tape shall be buried 4 to 10-inches beneath the ground surface directly over the top of the utility. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finished grade surface.

END OF SECTION

SECTION 02335 – SUBGRADE CONSTRUCTION AND PREPARATION

PART 1 -GENERAL

1.1 SCOPE

A. The work described in this Section includes furnishing all labor and equipment necessary for the construction and preparation of part or all of the road bed to receive the immediate construction of a base or pavement thereon.

PART 2 -PRODUCTS (NOT USED)

PART 3 -EXECUTION

3.1 EQUIPMENT

A. All equipment necessary and required for the construction of the subgrade must be on the Project, proven to be in first-class working order and approved by the Engineer before construction will be permitted to begin. This shall consist of at least one motor grader with scarifier and one pneumatic tired roller meeting the requirements of the Arizona Department of Transportation Standard Specifications.

3.2 SUBGRADE PREPARATION

A. Road and drainage excavation and embankment construction shall be performed in accordance with the provisions of Earthwork Section of these Specifications, State DOT and County/Municipalities Standard Specifications.

B. The subgrade shall be prepared to the lines and grades staked by the Engineer and to correspond to the cross section of the bottom of the pavement as indicated on the Drawings or as directed.

C. Where excavation is necessary to prepare the subgrade, the material removed shall be carefully stored or placed for use in completing the roadbed. Unsuitable material shall be wasted as directed by the Engineer.

D. All rock shall be removed to a depth of not less than 6-inches below the surface of the subgrade and all holes or depressions, caused by the removal of rock, or otherwise, shall be backfilled with satisfactory material and thoroughly compacted.

E. Where the roadbed is below grade, the Contractor shall prepare the subgrade by hauling and spreading satisfactory material excavated in channeling, or otherwise. The material shall be spread in layers not to exceed 6-inches in thickness and thoroughly compacted by rolling, using water if directed. Each layer shall have been completed before the succeeding layer is started.

F. Where it is intended or required to use steel forms in the construction of the base of pavement, the subgrade shall be constructed at least 12-inches wider, on each side, than the net width of the base of pavement. For bases or pavements using wooden forms, the subgrade shall be constructed at least 6-inches wider, on each side, than the width of the base or pavement, as indicated on the Drawings or as directed.

G. Where subbases are to be constructed on the subgrade, the limits of the subgrade preparation shall extend across the entire section upon which any subbase course is to be applied, including the shoulders.

H. When the subgrade is being prepared for the construction of a Portland cement concrete base or Portland cement concrete pavement it shall be formed to the approximate grade and cross section. The preparation of the subgrade shall be performed in conformity with the requirements set out in the Section covering the particular type of construction.

3.3 SUBGRADE COMPACTION

A. After the subgrade has been appropriately prepared and shaped, it shall be loosened in its entirety by disking, harrowing or other approved methods to a depth of not less than 6-inches prior to its being compacted to the approved density. The subgrade shall then be thoroughly compacted with the 10 ton roller or pneumatic tired roller. The density shall be 100 percent of AASHTO density when tested by the Standard Specifications for Compaction and Density of Soils, AASHTO Serial Designation T 99 (latest revision). The limits of the subgrade compaction shall extend across the entire section upon which any base or subbase course is to be applied, including the shoulders. Prior to reworking and compacting the subgrade, all vegetation within the limits as set out above shall be removed and properly disposed of as directed by the Engineer.

B. All soft, yielding material, which will not compact readily under the roller, shall be removed as directed. All holes or depressions caused by the removal of material, as described above, shall be backfilled with satisfactory material and the entire surface thoroughly compacted with the roller where possible, or otherwise when directed by the Engineer.

C. The subgrade shall be checked after rolling and adjusted so as to conform to the grade and cross section, as indicated or directed.

D. The final rolling of the subgrade, preparatory to the construction of the Portland cement concrete base or pavement thereon, shall be performed between the forms after they are finally set to line and grade.

3.4 SCOPE OF SUBGRADE

A. The subgrade shall be true to lines, grades and cross sections, must be free from dust or other loose material, must have a uniform bearing power, and shall be prepared and maintained at least 500 feet in advance of the placing of any materials thereon, except between November 1 and April 1 the distance may be reduced to 200 feet if permitted by the Engineer.

3.5 DRAINAGE

A. Grading of the subgrade shall be performed in such a manner that there will not remain on the roadbed, at anytime, berms of earth or other material which will interfere with the immediate drainage of water from the subgrade of the side ditches. All side ditches and drains shall be maintained to provide for proper drainage during the construction.

B. All ditches and drains shall be completed so as to drain the roadbed effectively before the placing of any construction materials will be permitted.

3.6 PROTECTION OF SUBGRADE

A. In handling materials, equipment, tools, etc., the Contractor shall take all precaution necessary to protect the subgrade from damage. Only hauling necessary for the purpose of construction will be permitted on the subgrade after it has been completed.

B. If ruts of 2-inches or more in depth are formed in the subgrade, all construction materials, whether stored or in place, within the range of such ruts, shall be removed and the subgrade shall be reshaped and rolled. All ruts or rough places developing in a completed subgrade shall be smoothed and the subgrade rerolled.

3.7 SUBGRADE CHECKING

A. The subgrade must conform to the lines, grades and cross sections, indicated or directed, before it will be permitted to construct base or pavement thereon, and shall be subject to test just prior to construction.

B. The subgrade for base or pavement requiring steel side forms will be checked by a special tester, as provided in the Section covering this type of construction.

C. All excess material shall be removed until the subgrade is at true elevation. Low subgrade shall be built up to the proper form and elevation when practical to roll, or if not practical to roll, it shall be filled as an integral part of the base or pavement at the Contractor's expense.

3.8 CLEANING

A. The disposal of excess or unsuitable material shall be performed in accordance with the requirements of the Waste Material Disposal Section of these Specifications and final clean-up shall be performed in accordance with the requirements of the Operation and Maintenance Data Section of these Specifications.

END OF SECTION

SECTION 02370 – EROSION AND SEDIMENTATION CONTROL

PART 1 -GENERAL

1.1 SCOPE

A. Submittals and Permits

1 Within 15 days after the date of the Notice to Proceed, the Contractor shall submit description, Drawings and schedule for proposed temporary and permanent erosion and sedimentation controls to the local authority and Engineer. The description and Drawings shall meet the requirements of the State Environmental Protection Agency Regulations and all Federal, State, and Local laws and ordinances. The Contractor shall acquire Land Disturbance Permits from the appropriate authority and shall pay any fees for said permits. The Contractor shall be responsible for submitting to the appropriate authority sufficient documents such that the authority can grant approval. All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor. A copy of the local soil erosion and sedimentation control ordinances is available from the Local Issuing Authority & the State Environmental Protection Agency.

2 Land disturbance activity shall not commence until the Land Disturbance Permit is issued. The Engineer will provide a reproducible drawing of plan sheets to the Contractor for Contractor's use. The reproducible will not bear the Engineer's seal or logo and is provided only for the Contractor's convenience in obtaining land disturbance permits.

3 Description and working drawings shall indicate controls which will ensure that storm water and drainage from the disturbed jobsite areas, which will be denuded, stripped or modified of its naturally existing or artificially established stabilization or protection against erosion, shall pass through some type of filter system before being discharged. These areas shall be kept sufficiently moist to control dust.

4 Submit a written plan for both temporary and permanent grassing. The plan shall include selection of species, dates and rates of application for seeding, fertilizer and mulching.

5 The schedule of values for lump sum Projects shall include separate costs for this work as well as maintenance costs.

B. Basic Principles

1 Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type and condition.

2 Minimize the disturbed area and the duration of exposure to erosion elements.

3 Stabilize disturbed areas immediately.

4 Safely convey run-off from the site to an outlet such that erosion will not be increased off site.

5 Retain sediment on site that was generated on site.

6 Minimize encroachment upon watercourses.

C. Implementation

1 The erosion and sedimentation control measures shown on the Drawings are minimal requirements. The Contractor's methods of operation may dictate additional erosion and sedimentation control measures not shown on the Drawings which shall be the Contractor's responsibility to determine and install said measures. The Contractor's failure to stabilize disturbed areas immediately following intermediate or final grading may dictate additional erosion and sedimentation control measures not shown on the Drawings which shall be the Contractor's responsibility to determine and install said measures.

2 The Contractor shall notify the Engineer of any changes and/or additions to the erosion and sedimentation control plan necessary to accommodate the Contractor's methods of operation. No additional payment shall be made for erosion and sedimentation control measures made necessary by the Contractor's methods of operation.

3 The Contractor shall be solely responsible for control of erosion within the Project site and prevention of sedimentation of any adjacent waterways.

4 The Contractor shall install controls which will ensure that stormwater and drainage from the disturbed area of the Project site shall pass through some type of filter system before being discharged. The filter system must meet the requirements of the Local Issuing Authority & State Environmental Protection Agency.

D. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:

1 Preventing soil erosion at the source.

2 Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.

3 Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.

E. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the Project site.

1.2 QUALITY ASSURANCE

A. General: Perform all work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated herein and these Specifications.

B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

PART 2 -PRODUCTS

2.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL MATERIALS – All materials to meet State DOT, State Environmental Protection Agency and County/Municipalities Standard Specifications.

A. Silt Fence

1. Silt fence shall be polymer type netting with a built-in cord running throughout the top edge of the fabric. Posts shall be either steel or pressure treated fir, southern pine or hemlock and shall be spaced not more than six feet on center. Silt fence shall be provided with netting to provide reinforcing when necessary. Silt fence shall have an Equivalent Opening Size (EOS) of 40 to 100. Silt fence fabric shall have a maximum permeability of 40 gallons per minute per square foot.

2. Silt fence fabric shall be equal to Mirafi 100X, Amoco 1380 or Exxon GTF-100 Series.

B. Silt Fence: Silt fence shall meet the requirements of the State Department of Transportation and State Environmental Protection Agency, Standard Specification, latest edition.

C. Hay bales shall be clean, seed free cereal hay type.

D. Netting shall be 1/2-inch, galvanized steel, chicken wire mesh.

E. Filter stone shall be crushed stone conforming to the State Department of Transportation, State Environmental Protection Agency, County/Municipalities Standard Specifications.

F. Concrete block shall be hollow, non-load-bearing type.

G. Plywood shall be 3/4-inch thick exterior type.

2.2 RIP RAP

A. Use only one method throughout the job.

B. Stone Rip Rap: State Department of Transportation, State Environmental Protection Agency, County/Municipalities Standard Specifications shall apply

C. Sand-Cement Bag Rip Rap

1. The bags shall be of cotton, burlap or fiber reinforced paper capable of containing the sand-cement mixture without leakage during handling and placing. Bags previously used for sugar or any other material which will adversely affect the sand-cement mixture shall not be used. Capacity shall be not less than 0.75 cubic foot, nor more than two cubic feet.

2. Sand and Portland cement shall be mixed at the maximum ratio of 5:1 by weight and shall obtain a minimum compressive strength of 500 psi in seven days. For sand-cement bag rip rap, the amount of water used shall be just enough to make up the optimum moisture content of the aggregate and cement, as determined by AASHTO T 134. When sand-cement rip rap is to be pre-bagged, the sand-cement shall be mixed dry, and after placing each course, the bags shall be wet until sufficient moisture is present for proper cement hydration.

2.3 FILTER FABRIC

A. The filter fabric for use under rip rap shall be a monofilament, polypropylene woven fabric meeting the specifications as established by Task Force 25 for the Federal Highway Administration. The filter fabric shall have an equivalent opening size (EOS) of 70.

B. Filter fabric shall meet the requirements of Trivera Spunbound 011/280. Mirafi 180N or Amoco 4553.

2.4 CONCRETE

A. Concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

B. Provide a concrete mix design for job mixed concrete for the Engineer's approval.

PART 3 -EXECUTION

3.1 GENERAL

A. Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the State Department of Transportation, State Environmental Protection Agency, County/Municipalities Standard Specifications, and all Federal, State & Local Laws and Ordinances.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from entering the creeks. The preferred method is to provide an undisturbed natural buffer, extending a minimal 25 feet from the top of the bank, to filter the run-off. Should this buffer prove infeasible due to construction activities being too close to the creek, or if the amount of sediment overwhelms the buffer, the Contractor shall place silt fences to filter the run-off and, if necessary, place permanent rip rap to stabilize the creek banks. When excavation activities disturb the previously stated preventative measures, or if they are not maintained, or whenever the construction activities cross the creeks, the check dams shall be installed downstream and within 200 feet of the affected area.

B. Silt dams, silt fences, traps, barriers, check dams, appurtenances and other temporary measures and devices shall be installed as indicated on the approved plans and working Drawings, shall be maintained until no longer needed, and shall then be removed. Deteriorated hay bales and dislodged filter stone shall be replaced with new materials. Detention ponds, if constructed, shall be maintained in a condition ensuring that unfiltered water will not leave the pond.

C. Where permanent grassing is not appropriate, and where the Contractor's temporary erosion and sedimentation control practices are inadequate, the Engineer may direct the Contractor to provide temporary vegetative cover with fast growing seedings. Such temporary vegetative cover shall be provided by the Contractor in compliance with State Department of Transportation, State Environmental Protection Agency, County/Municipalities Standard Specifications, specifically in the selection of species, planting dates and application rates for seedings, fertilizer and mulching

D. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor at least weekly and after each rainfall occurrence and cleaned out and repaired by the Contractor as necessary.

E. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

3.3 PERMANENT EROSION CONTROL

A. Permanent erosion control shall include:

1 Restoring the work site to its original contours, unless shown otherwise on the Drawings or directed by the Engineer.

2 Permanent vegetative cover shall be performed in accordance with Article 3.04 of this Section.

3 Permanent stabilization of steep slopes and creeks shall be performed in accordance with Article 3.05 of this Section.

B. Permanent erosion control measures shall be implemented as soon as practical after the completion of pipe installation or land disturbance for each segment of the Project. In no event shall implementation be postponed when no further construction activities will impact that portion or segment of the Project. Partial payment requests may be withheld for those portions of the Project not complying with this requirement.

3.4 GRASSING

A. General

1 All references to grassing, unless noted otherwise, shall relate to establishing permanent vegetative cover as specified herein for seeding, fertilizing, mulching, etc.

2 When final grade has been established, all bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched in an effort to restore to a protected condition. Critical areas shall be sodded as approved or directed by the Engineer.

3 Specified permanent grassing shall be performed at the first appropriate season following establishment of final grading in each section of the site.

4 Permanent grassing shall be of a perennial species.

B. Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Where sod is removed or damaged, replant such areas using sod of the same species of grass at the first appropriate season. Outside of residential or landscaped areas, grass the entire area disturbed by the work on completion of work in any area. In all areas, promptly establish successful stands of grass.

C. Grassing activities shall comply with State Department of Transportation, State Environmental Protection Agency, County/Municipalities Standard Specification, specifically for the selection of species, planting dates and application rates for seeding, fertilizer and mulching. Where permanent vegetative cover (grassing) cannot be immediately established (due to season or other circumstances) the Contractor shall provide temporary vegetative cover. The Contractor must return to the site (at the appropriate season) to install permanent vegetation in areas that have received temporary vegetative cover.

3.5 RIP RAP

A. Unless shown otherwise on the Drawings, rip rap shall be placed in accordance with State Department of Transportation, State Environmental Protection Agency, County/Municipalities Standard Specifications, Standard Details, and where ordered by the Engineer, at all points where banks of streams or drainage ditches are disturbed by excavation, or at all points where natural vegetation is removed from banks of the streams or drainage ditches. Carefully compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction alongside a stream or drainage ditch as well as crossing a stream or drainage ditch.

B. When trenching across a creek, place rip rap a distance of 10 feet upstream and 10 feet downstream from the top of the trench excavation. Place rip rap across creek bottom, across creek banks and extend rip rap placement five feet beyond the top of each creek bank.

C. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers. Unless at creek banks or otherwise shown or specified, rip rap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be two feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the rip rap is placed, the toe ditch shall be backfilled and the excess dirt spread neatly within the construction easement.

D. Placement of Filter Fabric: The surface to receive fabric shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The fabric shall be placed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps. The strips shall be placed to provide a minimum width of one foot of overlap for each joint. The filter fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3-inches of the centerline of the overlap. The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be placed loosely so as to give and therefore avoid stretching and tearing during placement of the stones. The stones shall be dropped no more than three feet during construction. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals or other contaminants.
Any contaminated fabric or any fabric damaged during its installation or during placement of rip rap shall be removed and replaced with uncontaminated and undamaged fabric at no expense to the Owner.

E. Placement of Rip Rap: The rip rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric. This 6-inch layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Rip rap shall be placed with its top elevation conforming to the finished grade or the natural slope of the stream bank and stream bottom.

END OF SECTION

SECTION 2375– NPDES REQUIREMENTS –EPA

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1 Requirements for documentation to be prepared and signed by Owner and Contractor before conducting construction operations, in accordance with terms and conditions of National Pollutant Discharge Elimination System (NPDES) Permit, as stated in the Federal Register Vol. 57 No 175, issued by the Environmental Protection Agency on September 9, 1992.

2 Contractor's responsibility for implement, maintain, and inspect storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and similar other practices shown as required per State Environmental Protection Agency requirements and on the Drawings or specified elsewhere in this or other Specifications.

3 Meet with the Owner's Representative and Architect/Engineer to review implementation of the Storm Water Pollution Prevention Plan (SWPPP) prior to proceeding with earthwork operations.

1.3 NPDES PROCEDURES

A. Retention of Records: Keep a copy of the Storm Water Pollution Prevention Plan at the construction site or at Contractor’s office from date that it became effective to the date of project completion. At Project closeout, Contractor shall submit to Owner all NPDES forms and a copy of the SWPPP. Owner will retain storm water pollution prevention records and date for a period of 3 years from Date of Final Completion.

B. Required Notices: Post the following notices from the date that this SWPPP goes into effect until the date of final site stabilization:

1 Copies of the Notices of Intent (NOI) and Notice of Termination (NOT) submitted by the Owner and a brief project description, as given in Paragraph 1.1 of the SWPPP, shall be posted at the construction site or at Contractor’s office in a prominent place for public viewing.

2 Notice to drivers of equipment and vehicles, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post such notices at every construction exit area.

3 In an easily visible location on site, post a notice of waste disposal procedures.

4 Notice of hazardous material handling and emergency procedures shall be posted with the NOI on site. Keep copies of Material Safety Data Sheets at a location on site that is known to all personnel.

C. Notice of Intent: Owner shall fill out the electronic Notice of Intent (eNOI) available at http://cfpub.epa.gov/npdes/home.cfm?program_id=6 or the State Environmental Protection Agency website. Owner will fill out Owner's Notice of Intent available at http://cfpub.epa.gov/npdes/home.cfm?program_id=6 or the State Environmental Protection Agency website. for the Owner's information required for the Project. Submission of the NOI's to the EPA is required by both Owner and Contractor before start of construction operations.

D. Notice of Termination: Owner shall fill out, sign, and date Contractor's Notice of Termination (NOT) available at http://cfpub.epa.gov/npdes/ or the State Environmental Protection Agency website.. Return signed copy of the Contractor's NOT to Owner. Owner will complete Owner's Notice of Termination and will submit both notices to the EPA. Submission of the NOT's is required by both Owner and Contractor before elimination or ceasing operation of storm water discharge operations.

PART 2 -PRODUCTS -(NOT USED)

PART 3 -EXECUTION

1 NPDES monitoring shall be procured and provided by the Contractor.

END OF SECTION 2375

SECTION 02510 – DISINFECTION OF POTABLE WATER FACILITIES

PART 1 -GENERAL

1.1 SCOPE

A. The work covered by this Section includes furnishing all labor, equipment, materials and chemicals required to disinfect all potable water facilities in accordance with State Environmental Protection Agency, State/County/Municipalities Standard Specifications and the procedures specified herein.

B. Upon completion of the construction and installation of equipment, the Contractor shall sterilize all plant units, piping, pumps, wells and connections thereto, all distribution system piping and storage tanks and any surfaces that shall be in contact with potable water.

1.2 STANDARDS

A. Procedures for disinfecting water mains, water storage facilities, wells and water treatment plants, unless otherwise modified herein, shall conform to the requirements of AWWA Standards C651, C652, C653 and C654.

PART 2 -PRODUCTS

2.1 DISINFECTION AGENT

A. The disinfection agent shall be free chlorine or chlorine compound. The method of application and type of disinfecting agent shall both be acceptable to the Engineer.

PART 3 -EXECUTION

3.1 DISINFECTION PROCEDURE

A. Prior to disinfection, all surfaces shall be thoroughly flushed with clear water after all debris and dirt has been removed.

B. Disinfection shall be accomplished by the application of clear water containing a minimum of 50 parts per million (ppm) of available chlorine: in new lines at least 25 ppm free chlorine shall be applied. The chlorine bearing water shall remain in contact with the surfaces being sterilized for a period of not less than 24 hours. At the end of the contact period the chlorine residual in all units and at extremities of pipe lines and other representative points shall be at least 25 ppm.

C. In the process of chlorinating newly constructed units and newly installed pipe, all valves or other appurtenances shall be operated at least five times while the units and pipelines are filled with the disinfection agent.

D. Upon completion of the disinfection procedure, reduce the chlorine residual of disinfection water to levels required for discharge per requirements of federal, state and local regulatory agencies. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. All units and piping shall be flushed with potable water until the chlorine residual remaining is one part per million or less and the replacement water throughout the units, upon suitable bacteriological tests, has proved to be of acceptable quality and in conformance with State Environmental Protection Agency and State/County/Municipalities specifications for potable water supply requirements. This satisfactory quality of water shall continue for two full days as demonstrated by laboratory examination of samples taken from a tap located and installed in such a way as to prevent outside contamination.

E. No portion of new work shall be placed in service until disinfection has been completed and approved by the Engineer. Should the initial treatment fail to result in acceptable water, the chlorination procedure shall be repeated until satisfactory results are obtained.

END OF SECTION

SECTION 02600 - SITE PIPING MANHOLES AND APPURTENANCES

PART 1 GENERAL

1.1 SCOPE

A. The work covered by this Section includes furnishing all labor, equipment and materials required to install brick and precast concrete manholes; storm drain inlets; and piping appurtenances as described herein and/or shown on the Drawings. All work to be in conformance with State DOT and State/County/Municipalities Standard Specifications, and Standard Specifications for Water & Sewer Construction of the specific State latest edition.

1.2 DESIGN REQUIREMENTS

A. Manholes shall be constructed of specified materials to the sizes, shapes and dimensions and at the locations shown on the Drawings or as otherwise directed by the Engineer. The height or depth of the manhole will vary with the location. Unless shown otherwise on the Drawings, the top of the manhole frame will be at the finished grade of the pavement or 18-inches above the finished ground surface and inverts will be at the elevations shown on the Drawings.

B. Where the difference in the invert elevation of a sewer 18-inches in diameter or smaller and any other sewer intersecting in one manhole is two feet or more, a drop manhole shall be constructed as shown on the Drawings. They shall be similar in construction to the standard manhole except that a drop connection of pipe and fittings of the proper size and material shall be constructed outside the manhole and supported by Class “B” concrete.

1.3 SUBMITTALS

A. Complete shop drawings and product data on all precast manhole bottoms, riser sections, transition slabs and tops shall be submitted in accordance with Section Shop Drawings, Product Data, and Samples of these Specifications.

B. Complete product data on frames, covers and steps shall be submitted to the Engineer in accordance with the requirements of Section Shop Drawings, Product Data, and Samples of these Specifications.

C. Complete product data on all piping appurtenances shall be submitted in accordance with the requirements of Section Shop Drawings, Product Data, and Samples of these Specifications.

1.4 QUALITY ASSURANCE

A. Prior to delivery, all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the Engineer, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials which fail to conform to these Specifications shall be rejected.

B. After delivery to the site, any materials which have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site.

PART 2 PRODUCTS

2.1 MANHOLES

A. Concrete and Reinforcement

1. Concrete used in construction shall be Class “B” concrete conforming to the requirements of Section Cast-In-Place Concrete of these Specifications.

2. Steel reinforcement shall conform to the requirements of Section Concrete Reinforcing of these Specifications.

B. Brick: Brick used in manhole construction shall be either solid or cored, medium hard or better, Grade MS brick conforming to requirements of ASTM C 32 for sewer and manhole brick.

C. Mortar: Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type II and shall conform to ASTM C 150. Sand shall meet the requirements of ASTM C 144.

D. Round Precast Concrete Manholes: Provide manholes and other precast concrete products in accordance with the following:

1. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.

2. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter. Additionally, the wall thickness shall be sufficient for the proper installation of the rubber boots.

3. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.

4. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant.

5. Precast sections shall be manufactured such that the spigot end is at the top of each section.

E. Square and Rectangular Precast Manholes and Vaults

1. Precast concrete sections shall meet the requirements of ASTM C 913. The minimum 28 day compressive strength of the concrete in precast sections shall be 4,000 psi.

2. The design of each structure shall be the responsibility of the manufacturer and shall conform to ACI-318 and the minimum structural design loading requirements as defined in ASTM C 890. The minimum design dead load shall be based on the depth shown on the Drawings or in Table 1 of this Section. The minimum design live load shall be A-12.

3. Transition slabs which connect rectangular or square sections to round riser sections shall be designed by the manufacturer to support the live and dead loads on the slab.

4. Precast sections shall be manufactured such that the spigot end is at the top of each section.

5. Dimensions for square and rectangular manholes are shown on the Drawings.

F. Manhole Frames and Covers

1. Cast iron frames and covers shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.

2. Manhole frames and covers shall be equal to the following: State/County/Municipalities Standard Specifications.

3. All frames and covers shall have machined horizontal bearing surfaces.

4. All manholes shall have watertight frames and covers except where specifically shown otherwise on the Drawings.

5. Watertight covers shall be bolt-down type and shall be equipped with four 1/2-inch stainless steel bolts and a 1/8-inch red rubber or rubber O-ring gasket. Covers shall be rotatable and interchangeable. Bolt holes shall be bored through so that debris entering the bolt hole will 0fall into the manhole. Bolt holes shall have the full 360 degree circle within the cover's radius when bored through the cover.

G. Storm Drain Inlets

1. Frames and gratings shall be of the type shown on the Drawings. Iron castings shall conform to ASTM A 48, Class 30. All castings shall be true to pattern in form and dimensions, free from faults, sponginess, cracks, blowholes and other defects affecting their strength. Bearing surfaces between cast frames and gratings shall be machined, fitted together and match marked to prevent rocking.

2. Inlets, grates and frames in paved and roadway areas shall be rated for a HS-20 loading.

3. Inlets, grates and frames in non-paved and non-roadway areas shall be rated for a minimum 2,000 pound wheel load unless shown otherwise on the Drawings.

4. Minimum clear opening areas shall be as shown on the Drawings.

H. Joint Sealants: Seal joints between precast sections by means of rubber O -ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.

I. Plastic Steps: Manhole steps of polypropylene molded around a steel rod equal to products of M.A. Industries may be used.

J. Rubber Boots: Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

PART 3 -EXECUTION

3.1 GENERAL

A. Excavation for backfilling for all manholes covered under this Section shall conform to the requirements of Section Earthwork of these Specifications.

B. Top Elevations: Build manholes outside of paved areas to 18-inches above finished grade unless otherwise shown on the Drawings or directed by the Engineer. Build manholes in paved areas to existing grades.

C. Drop Connections: Manholes requiring drop connections are shown on the Drawings. Construct drop connections of the same materials as the upstream sewer and in accordance with the details shown on the Drawings.

D. Inlet and Outlet Pipe

1. Inlet and outlet pipes shall be supported outside the manhole in accordance with the requirements of Section Trench Excavation and Backfill of these Specifications.

2. Where required, inlet and outlet pipes shall be cut-off flush with the interior surface of the manhole [or utility vault] walls.

E. Inverts: All inverts shall be of Class “C” concrete meeting the requirements of Section Cast-In-Place Concrete of these Specifications, and shall conform to the shape indicated on the Drawings or as directed by the Engineer. The invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in directions of flow through the inlet shall be made to a true curve with as large a radius as the size of the inlet will permit.

F. Invert Elevations: The invert elevations shown on the Drawings shall be for the invert at the centerline of the manhole. Prior to setting the laser or other vertical alignment control system for the sewer upstream of the manhole, the Contractor shall verify the elevation of the sewer installed at the manhole. Should the elevation differ from that shown on the Drawings, the Contractor shall take the following corrective action:

1. If the sewer is laid at negative grade, the Contractor shall remove and reinstall the sewer at the correct grade at no additional cost to the Owner.

2. If the sewer is laid at a grade less than that shown on the Drawings, thus reducing the sewer's capacity, the Owner may require the sewer to be removed and relaid at the correct grade at no additional cost to the Owner. As a minimum, the grade to the next upstream manhole shall be adjusted such that the next upstream manhole shall be set at the correct elevation.

3. If the sewer is laid at a grade greater than that shown on the Drawings, and if the Contractor can show that there are no conflicts with upstream existing utilities or obstructions, the Contractor shall adjust the grade of the next upstream manhole such that the next upstream manhole shall be set at the correct elevation. If such an adjustment, in the Engineer's opinion, is substantial, the grade adjustment shall be spread over multiple sections of the sewer. If such an adjustment, in the Owner's opinion, significantly reduces the sewer's capacity, the Owner may require the Contractor to remove and relay that portion of the sewer laid at the improper grade.

G. Manholes shall be constructed such that their walls are plumb.

H. The cast iron frame for the manhole cover shall be set at the required elevation and properly anchored to the masonry. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted to conform to the exact slope, crown and grade of the existing adjacent pavement.

I. Masonry work shall be allowed to set for a period of not less than 24 hours. Outside forms, if any, then shall be removed and the manhole backfilled and compacted. All loose or waste material shall be removed from the interior of the manhole. The manhole cover then shall be placed and the surface in the vicinity of the work cleaned off and left in a neat and orderly condition.

J. After backfilling has been completed, the excavated area, if located in a street, alley or sidewalk, shall be provided with a temporary surface.

3.2 BRICK CONSTRUCTION

A. All manhole bases, including curved manhole bases shall be constructed of concrete in accordance with details on the Drawings.

B. After the foundation has been prepared and has been approved by the Engineer, the bottom shall be constructed to the required line and grade. After the bottom has been allowed to set for a period of not less than 24 hours, the manhole shall be constructed thereon, care being exercised to form the incoming and outgoing sewer pipes into the wall of the manhole at the required elevations.

C. Brick shall be laid radially with mortar joints not more than 3/8-inch thick horizontally and not less than 3/8-inch wide vertically at the inside face of the manhole. Each sixth brick course shall be a “Stretcher” course. Inside joints shall be trowel struck flush joints to provide smooth, clean surfaces. Joints shall be

broken in successive layers. Wall thickness for manholes 12 feet and less deep shall be 8-inches. Wall thickness for the portion of manholes over 12 feet deep shall be 12-inches.

D. The manhole steps shall be inserted into the wall of the manhole at the proper locations and elevations as the work progresses and shall be securely embedded in the masonry.

E. Inside and outside walls of all brick manholes shall be covered with cement mortar plaster where shown on the Drawings. Manholes shall be completely waterproof.

3.3 CONSTRUCTION OF CAST-IN-PLACE CONCRETE MANHOLES

A. Cast-in-place manholes shall be constructed in place as shown on the Drawings and in accordance with the requirements of Section Cast-In-Place Concrete of these Specifications.

B. Cast-in-place manholes shall be constructed in place with the base and barrel monolithically cast using removable forms of a material and design approved by the Engineer.

C. The vertical forms, vertical and horizontal wall spacers, steps and placing cone must be carefully positioned and firmly clamped in place before any placement is made. The wall spacers must be located 90 degrees from each other. The forms shall be firmly supported with bottom of forms at the proper elevation to permit the base to be deposited through the vertical forms.

D. The manhole base shall be deposited down through the wall forms onto undisturbed earth or rock bearing. It shall be evenly distributed around the walls and vibrated both inside and outside the forms until there is a minimum slope of 60 degrees from the bottom of the forms to the bearing surface both inside and outside of the manhole. When this is complete and before additional concrete is added, the concrete must be carefully vibrated on each side of each sewer pipe.

E. The base shall be concentric with the manhole and have a minimum diameter of 16-inches greater than the outside diameter of the manhole, and 10-inch minimum thickness under the lowest pipe. Minimum wall thickness shall be 6-inches.

F. Additional concrete must be deposited in evenly distributed layers of approximately 18-inches with each layer vibrated to bond it to the preceding layer. The wall spacers must be raised as the placements are made. The concrete in the area from which the spacer is withdrawn shall be carefully vibrated. Excessive vibration shall be avoided.

G. Adjustment rings shall be provided between the conical section and the manhole frame. The rings shall be cast-in-place using building felt between pours to create a weakened joint or as directed by the Engineer. If adjustment of the lid elevation is called for, concrete “donut” sections or brick shall be used.

H. Form marks and offsets shall not exceed 1-inch on the outside surface of the manhole. Form marks and offsets shall not exceed 1/2-inch inside of the manhole. All offsets on the inside surface of the manhole shall be smoothed and rubbed so there is no projection or irregularity capable of scratching a worker or catching and holding water or solid materials. Honeycombed areas shall be completely removed immediately upon removal of the forms and replaced with concrete as directed by the Engineer.

I. Should circumstances make a joint necessary, a formed groove or reinforcing dowels shall be required in the top of the first placement for shear protection. Immediately before the second placement is made, the surface of the cold joint shall be thoroughly cleaned and wetted with a layer of mortar being deposited on the surface.

3.4 PRECAST MANHOLE CONSTRUCTION

A. Construct manholes as shown on the Drawings and in accordance with the requirements of ASTM C 891.

B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.

C. Brick: Where bricks are used to adjust the frame and cover to grade, bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4-inch thick, on the inside and outside.

D. Pipe Connections for HDPE Pipe: Install the manhole entry pieces as follows:

1. Do not cut the smooth wall manhole entry piece. Instead, cut the spigot end off of standard quarter, half or full length pipe so that the manhole entry piece is properly positioned in the manhole wall.

2. Prepare the field cut end so that a standard sealing ring can be installed for a watertight joint in accordance with manufacturer's recommendations.

3. Connect rubber boot to the manhole entry piece and to the manhole wall using fasteners recommended by the boot manufacturer.

E. Pipe Connections: All sanitary sewer pipes shall be connected to precast concrete manholes by a rubber boot provided in a cored or precast hole of the proper diameter.

F. Pipe Connections: Seal the void between storm water pipes and the manhole with brick and mortar on both the inside and outside.

G. Frames and Covers: Unless frame and cover is at grade, the frame shall be cast into the cone section.

H. Seal all manhole joints and lift holes, both inside and out, with grout. Between precast sections, this is in addition to joint sealant.

3.5 SURFACE PREPARATION AND SHOP PAINTING

A. Frames, covers and steps shall be cleaned, shop primed and shop painted with a bituminous paint in accordance with the requirements of Section Product Options of these Specifications.

3.6 INSPECTION AND TESTING

A. All manholes shall be tested in accordance with the requirements of Section Pipe Testing and Acceptance of these Specifications.

END OF SECTION

SECTION 02630 - SITE PIPING

PART 1 GENERAL

1.1 SCOPE

A. Provide all labor, materials, equipment, and incidentals necessary to construct and disinfect (if required) all piping and appurtenances located outside the buildings and structures and test as shown on the Drawings and as specified herein.

B. Site piping covered under this Section shall begin at the outside face of structures and buildings, except where there is no joint at the outside face, then site piping shall begin not more than two feet beyond the face of the structure or building.

C. Site piping shall include piping in utility vaults and manholes.

D. Gate valves and fire hydrants to be provided under the requirements of the Water Supply system standard specifications. All State/County/Municipalities standard specifications shall be compiled with.

E. In a situation where these Specifications differ from requirements of the Local Issuing Authority, the requirement of the Local Issuing Authority shall govern.

1.2 SUBMITTALS

A. Complete shop drawings and product data on all piping and accessories shall be submitted to the Engineer in accordance with the requirements of Section Shop Drawings, Product Data, and Samples of these Specifications.

B. Shop drawings shall indicate piping layout in plan and/or elevations and shall include a complete schedule of all pipe, fittings, specials, and supports. Special castings shall be clearly detailed showing all pertinent dimensions. Special coatings shall be clearly identified.

C. The Contractor shall furnish the Inspector with lists of all pieces of pipe and fittings in each shipment received. These lists shall give the serial or mark number, weight, class, size and description of each item received.

D. The Contractor shall submit written evidence to the Engineer that the products furnished under this Section will conform with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of pipe materials.

1.3 QUALITY ASSURANCE

A. If ordered by the Engineer, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of five days during initial pipe installation.

PART 2 PRODUCTS

2.1 DUCTILE IRON PIPE (DIP) – Shall meet State/County/Municipalities Standard Specifications.

A. Ductile Iron Pipe

1. Ductile iron pipe shall be utilized where shown on the Drawings.

2. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
4 -12	350
14 -18	350
20	300
24	250
30 -54	200
60 -64	200

3. Flanged pipe minimum wall thickness shall be equal to Special Class 53. Flanges shall be furnished by the pipe manufacturer.

B. Fittings and Accessories

1. Fittings shall be ductile iron and shall conform to AWWA C110/ANSI A21.10 with a minimum rated working pressure of 150 psi.

2. Flanged elbow fittings shall be ANSI pattern using short radius elbows except where noted differently on the Drawings. Special fittings, [cast iron and] ductile iron wall pipes and sleeves shall conform to the dimensions [and details] as shown on the Drawings.

3. All grooved-end fittings shall conform to the laying length requirements of AWWA C110/ANSI A21.10, end preparation requirements of AWWA C606, and wall thickness requirements of AWWA C110/ANSI A21.10.

4. Thrust Collars: Thrust collars shall be welded-on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. Weld-on collars shall be continuously welded to the pipe by the pipe manufacturer.

5. Bosses: Bosses shall be welded-on ductile iron body type and shall be faced and tapped for mechanical joint connection. All welding, fabrication and outlet hole drilling shall be performed by the manufacturer. Outlets shall be free of burrs. Sizes shall be as indicated on the Drawings. The bosses shall be welded on minimum Class 51 ductile iron pipe greater than 12-inches and Class 52 for smaller pipe. Bosses shall be equal to ACIPCO A-96945 for mechanical joint.

6. Solid Sleeves: Solid sleeves shall permit the connection of plain end ductile iron pipe and plain end PVC pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for [long] pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have a mechanical or restrained joint as specified in this Section and as shown on the Drawings. Solid sleeves shall be provided with gaskets suitable for the type of pipe to be connected. Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the Engineer. Solid sleeves shall be manufactured by ACIPCO, U.S. Pipe or McWane (Clow).

C. Joints for Ductile Iron Pipe and Fittings

1. General

a. Joints for ductile iron pipe and fittings and cast iron fittings shall be mechanical joint, flanged joint, restrained joint, push-on joint or grooved-end joint as shown on the Drawings or specified herein.

b. Unless otherwise shown on the Drawings, specified or directed, all ductile iron pipe laid underground shall be joined using push-on type joints.

c. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.

d. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.

2. Mechanical Joints

a. Joints shall conform to AWWA C111/ANSI A21.11.

b. Bolts and nuts shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.

c. Gaskets shall be in accordance with AWWA C111/ANSI A21.11 and shall be constructed of plain rubber.

d. Mechanical joint glands shall be ductile iron.

3. Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice such as ACIPCO “Fastite”, McWane (Clow) “Bell-Tite”, or U.S. Pipe “Tyton” joints.

4. Flanged Joints

a. Flanged joints shall conform to AWWA C115/ANSI A21.15. Flanges shall be ductile iron and shall be furnished by the pipe manufacturer.

b. Gaskets shall be made of 1/8-inch thick, cloth reinforced rubber. Gaskets may be ring type or full face type.

c. Flanged ductile iron pipe 3 through 12-inches or less in length shall have flanges cast solidly to the pipe barrel. Flanges on ductile iron pipe longer than 12-inches may be of the threaded type. Pipe threads shall be of such length that with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be machined to give a flush finish to the pipe and the flange and surface shall be normal to the axis of the pipe. Ductile iron flanges shall be of such design that the flange neck completely covers the threaded portion of the pipe to protect same against corrosion. All pipe with threaded type flanges shall be assembled, faced, and drilled at the point of manufacture, unless otherwise approved by the Engineer.

d. Flange filler shall conform to AWWA C110/ANSI A21.10. Joint bolt length shall be increased by the thickness of the flange filler.

e. Where tap or stud bolts are required, flanges shall be drilled and tapped accordingly.

f. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class [125] flanges shown in ANSI/ASME B16.1.

g. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.

h. Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.

D. Cement Linings: Pipe and fittings shall be cement lined in accordance with AWWA C104/ ANSI/AWWA C104/A21.4.

E. Epoxy Lining

F. Polyethylene Encasement: Ductile iron pipe shall be encased with polyethylene film where shown on the Drawings. Polyethylene film shall have a minimum thickness of 8 mils.

G. Mechanical Pipe Couplings: Pipe couplings shall be installed where shown on the Drawings or as directed by the Engineer.

H. Wall Sleeves and Wall Pipes

1. Where piping passes through concrete structures, furnish and install wall sleeves unless wall pipes or other provisions are specifically shown on the Drawings. Wall sleeves shall be accurately located and securely fastened into position before concrete is poured.

2. Wall Sleeves

a. For pipe sizes smaller than 3-inches, wall sleeves shall be steel oversize sleeves furnished with a full circle, integral, or continuously welded waterstop collar. The sleeve seal shall be the mechanically expanded, synthetic rubber type. Provide all associated bolts, seals and seal fittings, pressure clamps, or plates necessary to achieve a watertight installation. Sleeves shall extend the full thickness of the concrete. Sleeves and seal shall be Link Seal.

b. For larger pipe sizes, wall sleeves shall be statically ductile iron mechanical joint wall sleeves. Unless specified or shown otherwise for a specific situation, wall sleeves shall be mechanical joint bell-plain end type with waterstop/thrust collar. The collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Sleeves shall be constructed with studs and mechanical joint [retainer] gland on the air side of the concrete structure. Provide retainer gland where shown on the Drawings. Where the concrete structure is exposed to dirt on one side and is wet on the other side, construct with studs and glands on the dirt side. Wall sleeves shall be equal to ACIPCO A-10771.

3. Wall Pipes

a. Wall pipes shall be either statically ductile iron with integral waterstop/thrust collar or centrifugally cast ductile iron with a continuously welded waterstop/thrust collar. The welded on collar shall be attached to the pipe by the manufacturer. The collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Wall pipes shall be furnished uncoated on the outside [and cement lined on the inside]. Unless specified or shown otherwise, wall pipes shall be [flange end type].

b. Wall pipes shall be cast and/or fabricated and lined in one manufacturer's facilities and delivered to the job site ready for use.

I. Hydrant Tees: Hydrant tees shall be equal to ACIPCO A-10180 or U.S. Pipe U-592.

J. Anchor Couplings: Lengths and sizes shall be as shown on the Drawings. Anchor couplings shall be equal to Tyler Pipe 5-199 SS Swivel x Swivel and 5-100 MJS (MJ x Swivel).

K. Tapping Saddles: Tapping saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connection shall be flanged or mechanical joint as detailed on the Drawings. Tapping saddles shall be equal to ACIPCO A-10920 (mechanical joint) and ACIPCO A-30920 (flange joint).

L. Tapping Sleeves and Valves (TS&V): Tapping sleeves shall be cast or ductile iron of the split-sleeve, mechanical joint type. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. Valves shall be gate valves furnished in accordance with Section [40 05 23] of these Specifications, with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe. The tapping sleeve and valve shall be supplied by the valve manufacturer. Tapping sleeves shall be American-Darling, Mueller or M & H Valve.

M. Flange Adapters: Flange adapters shall permit the connection of unthreaded, ungrooved, open-ended, ductile iron pipe to ANSI/ASME B16.1, Class 125 flanges. Flange adapters shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The adapter shall be a ductile iron casting incorporating a flange with extended throat, set screws and gasket. The gasket shall provide a compression seal between the adapter, the pipe and the adjacent flange. Flange adapters are to be used only in locations specifically shown on the Drawings or at the direction of the Engineer, and in accordance with the manufacturer's recommendations. Flange adapters shall be manufactured by McWane, Uni-Flange (Series 400) or EBAA Iron.

2.2 REINFORCED CONCRETE PIPE (RCP) - Shall meet State/County/Municipalities Standard Specifications.

A. Reinforced Concrete Pipe (Storm Drains)

1. Pipe: Pipe shall be bell and spigot reinforced concrete conforming to ASTM C 76 for Class III pipe. Wall thickness design shall correspond to Wall B. Reinforced concrete pipe shall be supplied in lengths of at least six feet.

2. Joints: Pipe shall have rubber gasket type joints conforming to ASTM C 443 or ASTM C 361. A rectangular groove shall be supplied in the spigot end to receive the rubber gasket, and it shall be so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch.

3. Acceptance

a. Acceptance for pipe shall be on the basis of plant load-bearing tests, material tests, and inspection of manufactured pipe for visual defects and imperfections as described in Paragraph 5.1.1 of ASTM C 76.

b. Provide results of tests on pipe and joint material performed by an independent testing laboratory approved by the Engineer. Include materials and crushing loads for pipe of each size in accordance with applicable specifications.

c. Each length of pipe shall be stamped by a regular employee of the approved testing laboratory.

d. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves.

2.3 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER OR DRAIN PIPE - Shall meet State/County/Municipalities Standard Specifications.

A. Acceptability of PVC pipe for gravity pipelines is indicated in the following table:

Standard Minimum Thickness Type PVC1	Wall	Acceptable Manufacturers	< 6	8 to 15	18	21	24	30 to 48
ASTM D 3034 SDR 35 12454B	SW	Open Certainteed J-M Pipe	Yes	Yes	No	No	No	No
ASTM F 789 T-3 12164B	SW	Carlon	Yes	Yes	Yes	No	No	No
ASTM F 679 T-1 12454C	SW	Open Sceptor Certainteed	No	No	Yes	Yes	Yes	Yes
ASTM F 794 Series 46 12454C	OP	Ultra-Rib Perma-Loc	No	Yes2	Yes	Yes	Yes	Yes3
ASTM F 794 Series 46 12454C	CP	Vylon	Yes4	Yes4	Yes4	Yes	Yes	Yes

SW - Solid Wall, OP - Open Profile, CP - Closed Profile

1 As specified in ASTM D 1784.

2 Included in Standard, but not manufactured by Perma-Loc less than 18-inches in diameter.

3 Included in Standard, but not manufactured by Ultra-Rib greater than 30-inches in diameter.

4 Included in Standard, but not manufactured by Vylon less than 21-inches in diameter.

B. All pipe shall have a minimum pipe stiffness of 46 psi at five percent deflection as determined by ASTM D 2412.

C. PVC gravity sewer or drain pipe shall be supplied in lengths not longer than 13 feet.

D. Fittings

1. Fittings 15-inches in diameter and less shall be manufactured in accordance with ASTM D 3034. PVC compound shall be 12454B or 12454C as specified in ASTM D 1784.

   a. For sizes 8-inches and less in diameter, fittings shall be molded in one-piece with no solvent welded joints. Minimum socket depths shall be as specified in ASTM D 3034, Table 2.

b. For sizes 10-inches and larger in diameter, fittings shall be fabricated from pipe conforming to ASTM D 3034 using solvent welding. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings shall be delivered ready for use.

2. Fittings 18-inches in diameter and larger shall be fabricated from pipe conforming to ASTM F 679 using solvent welding. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings shall be delivered ready for use.

E. Joints: Joints for pipe and fittings shall be of the integral bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage, when tested in accordance with ASTM D 3212. Gaskets shall meet the requirements of ASTM F 477. The joint system shall be subject to the approval of the Engineer and shall be identical for pipe and fittings.

F. Manhole Connections

1 Solid Wall and Closed Profile Wall Pipe: The sewer shall be connected to manholes utilizing a standard pipe section.

2 Open Profile Wall Pipe: The sewer shall be connected to manholes with an adapter piece. The adapter piece shall have an open profile pipe bell and a solid wall pipe spigot for penetrating the manhole wall.

G. Acceptance: Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe and fittings were manufactured and tested in accordance with the applicable standards.

2.4 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE - Shall meet State/County/Municipalities Standard Specifications.

A. Polyvinyl Chloride Pipe (AWWA C900)

1 All PVC pipe shall have belled ends for push-on type jointing and shall conform to ANSI/AWWA C900, ductile iron pipe equivalent outside diameters. The pipe shall have a Dimension Ratio (DR) of 14 and shall be capable of withstanding a working pressure of 200 psi. Pipe shall be supplied in minimum lengths of 20 feet.

2 All fittings shall be of cast or ductile iron meeting the requirements of AWWA C110/ANSI A21.10 [or AWWA C153/ANSI A21.53] with a minimum rated working pressure of 250 psi. Fittings shall be cement lined in accordance with AWWA C104/ANSI A21.4. Fittings shall be furnished with a bituminous outside coating.

3 Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

B. Schedule PVC Pipe, Less Than 4-Inch Diameter

1 Schedule 40, ASTM D 1785

2 Fittings: Solvent weld socket type, same schedule as piping, ASTM D 2466 or D 2467

3 Solvent Cement: ASTM D 2564

2.5 CAST IRON SOIL PIPE (CISP) - Shall meet State/County/Municipalities Standard Specifications.

A. Underground Sanitary Drainage Pipe and Fittings

1 Provide cast iron pipe, ASTM A 74, Class SV, coated with coal-tar pitch enamel conforming to AWWA C203.

2 Joints shall be bell-and-spigot type, ASTM A 74, with rubber gaskets conforming to ASTM C564.

2.6 HIGH DENSITY POLYETHYLENE PIPE (HDPE) - Shall meet State/County/Municipalities Standard Specifications.

A. HDPE gravity sewer pipe shall be supplied in lengths not longer than 13 feet and shall be “Spirolite”, manufactured by Chevron Plexco/Spirolite Corporation.

B. Pipe and Fittings: HDPE gravity sewer pipe and fittings shall be manufactured in accordance with ASTM F 894. All fittings shall be factory fabricated. No field fabrication of fittings will be permitted. HDPE pipe shall be RSC Class 160.

C. Joints: Joints for pipe and fittings shall be of the bell and spigot type with a confined gasket meeting the requirements of ASTM D 3212. The gasket shall comply with the physical non-pressure requirements of ASTM F 477.

D. Manhole Connections: Provide manhole entry pieces consisting of a three foot section of pipe, approximately, with a smooth surface area at one end and a standard bell or spigot at the other.

E. Acceptance: Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

2.7 COPPER TUBING - Shall meet State/County/Municipalities Standard Specifications.

A. Exposed copper tubing for water or air shall be seamless harddrawn copper tube conforming to the requirements of ASTM B 88, Type L. Buried copper tubing shall be seamless, annealed copper tube conforming to the requirements of ASTM B 88, Type K. Annealed copper tube may be furnished in straight lengths or coils.

B. Fittings for copper tube shall be wrought copper conforming to ASTM B 75 and ANSI B 16.22 for silver brazed joints.

C. Copper tubing [for instrument air service] in sizes 5/8-inch outside diameter and smaller shall be coated, seamless, bright annealed copper tube conforming to ASTM B 68, Type DHP. Wall thickness of copper tube shall be as follows:

Tube Outside Diameter, Inches	Wall Thickness, Inches
1/4	0.030
3/8	0.032
1/2	0.035
5/8	0.040

D. Fittings for annealed copper tube in instrument air service shall be of the flareless, compression type, Hoke “Gyrolok”, Crawford “Swagelok”, or Parker “Trible-Lok”, conforming to ASTM B 16 or B 124.

E. Instrument air tubing shall be factory coated with a layer of black PVC meeting the requirements of ASTM D 1047, IPCEA S-61-402, and applicable UL standards. Minimum coating thickness shall be 0.032-inch. Unless otherwise shown, minimum size of instrument air tubing shall be 3/8-inch outside diameter.

2.8 POLYETHYLENE PIPE FOR GAS SERVICE Shall meet State/County/Municipalities Standard Specifications.

A. Pipe and Fittings

1 Pipe and fittings shall be high molecular weight polyethylene conforming to ASTM D 1248, Grade P34. The pipe shall have a material designation code of PE 3408 in accordance with ASTM D 3350. All pipe shall conform to the requirements of ASTM 2513 and shall be Class B with antioxidant and UV stabilizer.

2 Pipe and fittings shall be SDR 11.

3 Pipe fittings shall meet the requirements of ASTM D 3261 for butt type fittings.

2.9 PERFORATED FOUNDATION DRAINS Shall meet State/County/Municipalities Standard Specifications.

A. Perforated PE Pipe and Fittings:

1 NPS 6 (DN 150) and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.

2 NPS 8 (DN 200) and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.

3 Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.10 CORRUGATED METAL PIPE (CMP) - Shall meet State/County/Municipalities Standard Specifications.

A. Corrugated metal drainage structure material shall conform to the latest revision of AASHTO M190.

B. Corrugated metal drainage structures for applications which are to be bituminous coated shall conform to AASHTO M190.

C. Joints for corrugated metal drainage structures shall be the standard type single piece corrugated coupling bands fabricated of the same material as the drainage structure. The minimum band length shall be 12-inches.

2.11 Miscellaneous Accessories - Shall meet State/County/Municipalities Standard Specifications.

A. Flexible Adapter Couplings

1 Couplings for pipe sizes 15-inches in diameter and less shall be HARCO sleeves designed to connect pipes of dissimilar materials. Adapters shall provide a positive deal against infiltration and exfiltration and remain leakproof and rootproof up to 4.3 psi. The adapter manufacturer shall provide all stainless steel clamps and required accessories.

2 Couplings shall be products of HARCO and shall be installed in accordance with the manufacturer's recommendations.

B. Flexible Adapter Donuts

1 Adapter donuts shall be elastomeric PVC, compressible seals designed for sealing joints between sewer pipes of different sizes and/or dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration and remain leakproof and rootproof up to 4.3 psi.

2 Donuts shall be products of HARCO and shall be installed in accordance with the manufacturer's recommendations.

C. Detection Tape: Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the text describing pipe and material. Tape lettering shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

D. Retainer Glands: Retainer glands shall be ductile iron and shall be equal to ACIPCO A90857.

E. Harness Rods

1 Harness rods shall be manufactured in accordance with ASTM A 36. Harness rods shall be hot dip galvanized before backfilling.

2 Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.

F. Fire Department Connections

1. Provide freestanding Fire Department connections of the Siamese type where shown on the Drawings and properly connected to the riser pipe. The Fire Department connections shall be configured as follows:

LOCATION	INLETS	OUTLETS

2. Fire Department connections shall be cast iron body and shall have a rough brass finish and be complete with aluminum identification plate, caps and chains. Connections shall be marked in accordance with the Standard Fire Protection Code. Connections shall be UL listed and FM approved.

3. Fire Department connections shall be by Potter-Roemer, Grinnell, Powhatan, Elkhart or Reliable.

PART 3 EXECUTION

3.1 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call in 72 hour utility locate prior to any work commencing, as required by State law and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site at least 72 hours (three business days) prior to construction to verify the location of the existing utilities.

B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

1. Provide the required notice to the utility owners and allow them to locate their facilities according to State law. Field utility locations are valid for only 10 days after original notice. The Contractor shall ensure, at the time of any excavation that a valid utility location exists at the point of excavation.

2. Expose the facility, for a distance of at least 200 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.

3. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.

4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently if required.

C. Conflict with Existing Utilities

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed piping does not permit safe installation of the piping by the use of sheeting, shoring, tieing-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the piping to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the Engineer. Where such relocation of the piping is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed piping does not permit the crossing without immediate or potential future damage to the utility, main, service, or the piping. The Contractor may change the proposed grade of the piping to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the Engineer. Where such relocation of the piping is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

E. Water and Sewer Separation - Shall meet State/County/Municipalities Standard Specifications.

1. Potable water mains should maintain a minimum 10 foot edge-to-edge separation from sewer lines, whether gravity or pressure. If the main cannot be installed providing the 10 foot separation, the separation may be reduced, provided the bottom of the water main is a minimum of 24-inches above the top of the sewer. Should neither of these two separation criteria be possible, the [potable] water main shall be installed below the sewer with a minimum vertical separation of 24-inches and the water main shall be encased in concrete with a minimum depth of 6-inches to 6’ each side of sewer.

2. Where water mains cross the sewer, the pipe joint adjacent to the pipe crossing the sewer shall be cut to provide maximum separation of the pipe joints from the sewer.

3. No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

3.2 LOCATION AND GRADE

A. The Drawings show the alignment and grade of the piping and the location of other appurtenances.

B. Construction Staking

1 The location of principal components of the work is shown on the Drawings. The Contractor shall be responsible for performing all survey work required for construction, including the establishment of base lines and any detailed surveys and benchmarks adjacent to the work

2 The level of detail of survey required shall be that which the correct location of the site piping can be established for construction.

C. Reference Points: The Contractor shall take all precautions necessary, which includes, but is not necessarily limited to, installing reference points, in order to protect and preserve the centerline or baseline established by the Owner.

D. The Contractor shall be responsible for any damage done to reference points, base lines, center lines and temporary bench marks, and shall be responsible for the cost of re-establishment of reference points, base lines, center lines and temporary bench marks as a result of the operations.

E. Construction Surveying Cash Allowance: The survey cash allowance is solely for the use of the Engineer for verification of the Contractor's reference points, centerlines and work performed. The presence of this cash allowance in no way relieves the Contractor of the responsibility of installing reference points, centerlines, temporary bench marks or verifying that the work has been performed accurately.

3.3 LAYING AND PIPE ASSEMBLY

A. Installation

1. Proper implements, tools and facilities shall be provided for the safe performance of the work. All pipe, fittings, valves and hydrants shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to piping materials and protective coatings and linings. Under no circumstances shall piping materials be dropped or dumped into the trench.

2. All pipe, fittings, valves, [hydrants,] and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.

3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.

4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.

5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

6. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade, shall not be permitted.

7. Provide detection tape for all non-metallic pressure pipe. Detection tape shall be buried 4 to 10-inches deep. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finish grade surface.

B. Alignment and Gradient

1 Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.

2 Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

3 The Contractor shall check the invert elevation for gravity sewer or drain pipe and storm drains at each manhole at least three times daily, start, mid-day and end of day. Elevations shall be checked more frequently if more than 100 feet of pipe is installed in a day or if the pipe is being constructed at minimum slope.

4 The Contractor shall check the horizontal alignment of the pipeline at the same schedule as for invert elevations.

C. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the Engineer.

D. Joint Assembly

1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.

2. Each restrained joint shall be inspected by the Contractor to ensure that it has been “homed” 100 percent.

3. The Contractor shall internally inspect each pipe joint to insure proper assembly for pipe 24-inches in diameter and larger after the pipe has been brought to final alignment.

4. Field welding of steel pipe joints shall conform to the requirements of AWWA C206. All welding shall be performed by persons meeting the qualification requirements of ANSI/AWS D1.1.

E. Cutting Pipe: Cut ductile iron pipe using an abrasive wheel saw. Cut PVC pipe using a suitable saw; remove all burrs and smooth the end before jointing. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.

F. Lining Repair: Repair polyethylene or polyurethane linings and recoat spigot ends of cut pipe with a product equal to Protecto 101 or Madewell 1104 coal tar epoxy in accordance with the manufacturer's recommendations and as specified below:

1 Remove all burrs and areas of loose lining materials by sanding or scraping to bare metal.

2 Remove oil and lubricants used during field cutting.

3 Lining shall be stripped back a minimum of 1-inch from the spigot end into well adhered lined areas.

4 Roughen 1 to 2-inches of good lining with a rough grade (40 grit) emery paper, rasp or small chisel, to allow an overlap between new and existing lining.

5 Apply lining repair material in the number of coats required to match the thickness requirements as specified in Part 2 of this Section and in accordance with the manufacturer's recommendations.

G. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the Engineer.

3.4 CONNECTIONS TO EXISTING PIPING

A. Make connections to existing pipe lines as shown on the Drawings.

B. Location: Before laying pipe, locate the points of connection to existing piping and uncover as necessary for the Engineer to confirm the nature of the connection to be made.

C. Interruption of Services: Make connections to existing piping only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the Owner.

D. Tapping Saddles and Tapping Sleeves

1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted.

2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.

3. Before performing field machine cut, the watertightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached, which will induce a test pressure as specified in this Section. No leakage shall be permitted for a period of five minutes.

4. After attaching the saddle or sleeve to existing piping, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.

E. Connections Using Solid Sleeves: Where solid sleeves are shown on the Drawings, the Contractor shall furnish materials and labor necessary to make the connection using a solid sleeve to the existing pipe line.

F. Connections Using Flange Filler: Flange filler shall be used only where shown on the Drawings or approved by the Engineer to make up minor differences in pipe length less than 3-inches. Joint bolt length shall be increased by the thickness of the flange filler.

G. Connections Using Mechanical Pipe Couplings: Where pipe couplings are shown on the Drawings, the Contractor shall furnish materials and labor necessary to make the connection using a pipe coupling to the existing pipe line, including all necessary cutting, plugging and backfill.

H. Connections to Pressure Mains

1 Connections to ductile iron pipe pressure mains shall be by the direct tap method or service clamp, as detailed on the Drawings in full accordance with AWWA requirements.

2 Connections to polyvinyl chloride pipe shall be made using a full body service clamp.

3 Pressure ratings for connections shall be the same as the pressure rating for the pipe.

I. Hydrants: Hydrants shall be attached to the water main by the following method:

1 For mains 12-inches and smaller, the isolation valve shall be attached to the main by connecting the valve to the hydrant tee.

2 For mains larger than 12-inches, the isolation valve shall be attached to the main by providing an anchor coupling between the valve and tapping saddle.

3 The isolation valve shall be attached to the hydrant by providing an anchor coupling between the valve and hydrant.

3.5 THRUST RESTRAINT

A. Provide restraint at all points where hydraulic thrust may develop.

B. Retainer Glands: Provide retainer glands where shown on the Drawings and on fire hydrants and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.

C. Harnessing

1 Provide harness rods only where specifically shown on the Drawings or directed by the Engineer.

2 Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90 degree bend eye bolts.

D. Concrete Thrust Collars: Collars shall be constructed as shown on the Drawings. Concrete shall be as shown on the Drawings. Reinforcing steel shall be as shown on the Drawings. The thrust collar shall be a weld on collar as specified in this Section. Weld-on collar shall be continuously welded to the pipe by the pipe manufacturer.

E. Concrete Blocking

1 Where shown on the Drawings, provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings.

2 Concrete shall be Class “B” as specified in Section Cast-In-Place Concrete of these Specifications.

3 Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the Engineer. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.

3.6 CONSTRUCTION WITHIN STRUCTURES

A. Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Care shall be taken to prevent the pipe coating from being damaged, particularly cement linings on the inside of the pipes and fittings. Any damage shall be remedied as directed by the Engineer.

B. All pipe and fittings shall be carefully examined by the Contractor for defects just before installing and no pipe or fitting shall be installed if it is defective. If any defective pipe or fitting is discovered after having been installed, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at Contractor's own expense.

C. All pipes and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.

D. All elbows, tees, brackets, crosses, and reducers in pressure piping systems shall be adequately restrained against thrust. Underground pressure piping containing unrestrained push-on or mechanical joints or expansion joints shall be restrained by thrust blocks. Thrust blocks shall consist of Class “B” concrete conforming to the requirements of Section Cast-In-Place Concrete of these Specifications and shall be of the size and shape as shown on the Drawings. The Contractor may use forms or undisturbed earth walls to mold the thrust blocks. When earth walls are used, they shall be cut true to shape and all excess earth shall be removed. The work shall be conducted so that no loose earth will become mixed with the concrete. At the end of 24 hours, damp earth may be placed over the concrete to retain moisture.

E. All pipes entering structures shall be adequately supported between the structure and undisturbed earth to prevent damage resulting from settlement of backfill around the structure.

F. All pipe installed under structures shall be encased in Class “C” concrete as specified in Section Cast-In-Place Concrete of these Specifications. The size of the encasement concrete shall be a minimum of 6-inches larger than the outside diameter of the pipe and shall include the area between the top of the pipe and the bottom of the structure.

G. Wall pipe and wall sleeves shall be accurately located and securely fastened in place before concrete is poured. All wall pipe and sleeves shall have wall collars properly located to be in the center of the wall where the respective pipes are to be installed.

H. Wall pipe and wall sleeves shall be installed when the wall or slab is constructed. Blocking out or breaking of the wall for later installation shall not be permitted.

I. Cutting or weakening of structural members to facilitate pipe installation will not be permitted. All piping shall be installed in place without springing or forcing.

3.7 INSTALLATION OF POLYETHYLENE PIPE FOR GAS SERVICE

A. Pipe shall be installed in accordance with the requirements of 49 CFR 192 and ASTM D 2774.

B. Workmanship: Pipe shall be cut accurately to measurements established at the job site and worked into place without springing or forcing. Pipes shall be installed to permit free expansion and contraction without damage to joints, hangers, or the building.

C. Changes in direction shall be made with fittings.

D. Pitch/Grade: All piping shall be installed with sufficient pitch to ensure drainage and venting.

E. Joints: All joints shall be made by persons qualified in accordance with the requirements of 49 CFR 192.

F. Welded Connections

1 Welded connections shall be made in accordance with ASTM D 2567 and the manufacturer's recommendations.

2 Mitering or notching pipe to form elbows and tees will not be permitted. Field and shop bevels shall be in accordance with the recognized standards and shall be performed by mechanical means. Flanges and branches shall be set true. This alignment shall be preserved during the welding operations.

3 Defective welds shall be removed and replaced at no additional cost to the Owner. Repairing of defective welds by adding new material over the defects or by peening will not be permitted.

G. Pipe Supports: Where pipe is exposed, supports shall be provided at intervals recommended by the manufacturer for the maximum anticipated operating temperature.

H. Install AWG #12 copper trace tape in the same trench as the polyethylene pipe with one foot of cover between the pipe and tape. Tape shall be positioned directly over the pipe to be located.

I. All pipe shall be tested in accordance with the requirements of Section Pipe Testing and Acceptance of these Specifications. If inspection or test shows defects, such defective work or material shall be replaced. All repairs to piping systems shall be made with new material. No caulking on screwed joints, cracks or holes will be acceptable. Failed welds must be cut out and replaced. Where it becomes necessary to replace pieces of pipe, such replacements shall be in the same length as the defective piece. Tests shall be repeated after all defects have been corrected.

3.8 INSPECTION AND TESTING

A. All pressure and leakage testing shall be performed in accordance with the requirements of Section Pipe Testing and Acceptance of these Specifications.

3.9 INSULATION AND HEAT TRACING

A. Provide insulation and heat tracing in accordance with Section Thermal and Sound Attenuation Insulation of these Specifications.

3.10 DISINFECTION

A. All potable water lines shall be disinfected in accordance with Section Disinfection of Potable Water Facilities of these Specifications.

END OF SECTION

SECTION 02631 – PIPING TESTING AND ACCEPTANCE

PART 1 GENERAL

1.1 SCOPE

A. Furnish all labor, materials, tools, equipment and related items required to perform tests of gravity pipelines and perform integrity and leakage tests of pressure and vacuum piping.

B. The testing requirements covered under this Section shall apply to all piping systems covered under Site Piping Section of these Specifications and comply with State DOT, State Environmental Protection Agency, State/County/Municipalities Standard Specifications.

C. In a situation where these Specifications differ from requirements of the local issuing authority, the requirement of the local issuing authority shall govern.

1.2 SUBMITTALS

A. Submittals shall conform to the requirements of Shop Drawing, Product Data, and Samples Section of these Specifications and shall include a description of the testing procedures to be employed and the report form to be furnished.

PART 2 PRODUCTS

2.1 TEST MEDIUMS

A. The Owner will provide the necessary water required for testing the work. The Contractor shall furnish all other test mediums. The Contractor shall furnish all equipment, necessary piping and required labor to transport water from its source to the test location for use in testing.

2.2 TEST EQUIPMENT

A. The Contractor shall furnish all labor and equipment, including required pumps with regulated bypass meters and gauges, for conducting of the piping tests.

PART 3 EXECUTION

3.1 GENERAL

A. The entire length of all pressurized piping and gravity lines shall be field tested for tightness by a test as described in this Section.

B. The timing and sequence of testing shall be scheduled by the Contractor, subject to the approval of the Engineer. The Contractor shall provide the Engineer with a minimum of 24 hours notice prior to the start of any test. All tests must be observed by the Engineer.

C. The Contractor shall repair any leaks discovered during the initial filling of the piping and during the testing sequence. All known and visible leaks shall be repaired, whether or not the leakage rate is within allowable limits.

3.2 MAJOR PIPING

A. All piping not listed under Article 3.03 shall be tested in accordance with Article 3.04. This shall include gravity and pressure sewer and sludge lines; potable and non-potable water lines, whether cast iron, ductile iron, steel, copper or PVC. Storm drains shall be exempted from testing required by this Section.

B. Clean and test lines before requesting final acceptance. Where any obstruction is met, clean the lines by means of rods, swabs, or other instruments. When requested by the Engineer, flush out lines and manholes before final inspection.

C. Gravity Piping

1. Pipe lines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.

2. Infiltration Tests: Use only when groundwater is two feet above the top of the pipe.

a. Install suitable weirs in manholes selected by the Engineer to determine the leakage of ground water into the sewer. Measure leakage only when all visible leaks have been repaired and the ground water is two feet above the top of the pipe. If leakage in any section of the pipeline exceeds 25 gpd/inch/diameter/mile, locate and repair leaks. Repair methods must be approved by the Engineer. After repairs are completed, re-test for leakage.

b. Furnish, install and remove the necessary weirs, plugs and bulkheads required to perform the leakage tests. Where continuous monitoring of flow level is required, the Contractor shall provide and operate monitoring equipment.

3. Exfiltration Tests: Choose one of the following when groundwater is not two feet above the top of the pipe.

a. Hydrostatic Test

1) Test pipe between manholes or structures with a minimum of 10 feet hydrostatic pressure, measured at the center of the pipe at the upstream manhole or structure.

2) The ends of the pipe in the test section shall be closed with suitable watertight bulkheads. Inserted into the top of each bulkhead shall be a 2-inch pipe nipple with an elbow. At the upper end of the test section, a 12-inch riser pipe shall be connected to the 2-inch nipple. The test section of pipe shall be filled through the pipe connection in the lower bulkhead which shall be fitted with a valve, until all air is exhausted and until water overflows the riser pipe at the upper end. Water may be introduced into the pipe 24 hours prior to the test period to allow complete saturation. House service lines, if installed, shall also be fitted with suitable bulkheads having provisions for the release of air while the test section is being filled with water.

3) During the test period, which shall extend over a period of 2 hours, water shall be introduced into the riser pipe from measured containers at such intervals as are necessary to maintain the water level at the top of the riser pipe. The total volume of water added during the test period shall not exceed that specified for infiltration.

b. Low-Pressure Air Test: Only sewer diameters less than or equal to 24-inches.

1) Prior to air testing, the section of pipeline between manholes or structures shall be thoroughly cleaned and wetted. Immediately after cleaning or while the pipe is water soaked, the sewer shall be tested with low-pressure air. At the Contractor's option, pipelines may be tested in lengths between manholes or in short sections (25 feet or less) using Air-Lock balls pulled through the line from manhole to manhole. Air shall be slowly supplied to the plugged sewer section until internal air pressure reaches approximately 4.0 psi. After this pressure is reached and the pressure allowed to stabilize (approximately two to five minutes), the pressure may be reduced to 3.5 psi before starting the test. If a 1.0 psi drop does not occur within the test time, then the line has passed the test. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test, and the Contractor will be required to locate the failure, make necessary repairs and retest the line.

Minimum test time for various pipe sizes and types is as follows:

Nominal Pipe Size,	T (Time Min/100) feet	
inches	VCP, RCP1	DIP, PVC2
6	0.7	5.7
8	1.2	7.6
10	1.5	9.4
12	1.8	11.3
15	2.1	14.2
18	2.4	17.0
21	3.0	19.8
24	3.6	22.8

2) Required test equipment, including Air-Lock balls, braces, air hose, air source, timer, rotameter as applicable, cut-off valves, pressure reducing valve, 0-15 psi pressure gauge, 0-5 psi pressure gauge with gradations in 0.1 psi and accuracy of + two percent, shall be provided by the Contractor. Testing equipment shall be equal to Cherne Air-Loc Testing Systems.

3) The Contractor shall keep records of all tests made. Copy of such records will be given to the Engineer or the Owner. Such records shall show date, line number and stations, operator and such pertinent information as required by the Engineer.

4) The Contractor is cautioned to observe proper safety precautions in performance of the air testing. It is imperative that plugs be properly secured and that care be exercised in their removal. Every precaution shall be taken to avoid the possibility of over-pressurizing the sewer line.

4. Deflection Test

a. Test PVC gravity sewer for excessive deflection by passing a mandrel through the pipe. Deflection of the pipe shall not exceed the following:

Nominal Pipe Diameter	Maximum Allowable Deflection
≤ 12-inches	5%
15 to 30-inches	4%
> 30-inches	3%

b. The mandrel size shall be based upon the maximum possible inside diameter for the type of pipe being tested, taking into account the allowable manufacturing tolerances of the pipe. The mandrel shall have an odd number of legs, or vanes, with a quantity of such equal to or greater than nine. The legs of the mandrel shall be permanently attached to the mandrel. A mandrel with variable sizes shall not be allowed. The mandrel shall be constructed of steel aluminum or other material approved by the Engineer, and shall have sufficient rigidity so the legs of the mandrel will not deform when pulling through a pipe. The mandrel dimensions shall be checked by the Engineer before use by the Contractor.

c. Excavate and install properly any section of pipe not passing this test. Re-test until results are satisfactory.

d. This test shall be performed within the first 30 days of installation and during final inspection, at the completion of this Contract.

D. Pressure Piping

1. All sections of pipeline subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of line will be considered ready for testing after completion of all thrust restraint and backfilling.

2. Each segment of pipeline between line valves shall be tested individually.

3. Test Preparation

a. For pipelines less than 24-inches in diameter, flush pipeline section thoroughly at flow velocities greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats. For pipelines 24-inches in diameter and larger, the main shall be carefully swept clean and mopped, if directed by the Engineer. Partially operate valves and hydrants to clean out seats. Provide correctly sized temporary outlets in number adequate to achieve flushing velocities.

b. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.

c. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Unless permanent air vents are in place, insert temporary corporation stops at highpoints to expel air as line is filled with water.

d. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure. Differential pressure at valves and hydrants shall equal the maximum possible, but shall not exceed manufacturer's pressure rating. Where necessary, provide temporary back pressure to meet the differential pressure restrictions.

e. Valves and hydrants shall not be operated in either the opening or closing direction at differential pressures above their rated pressure.

4. The test pressure shall be measured at the lowest point in the test segment and shall be maintained for a minimum of two hours.

5. Maintain the test pressure within 5 psi of the specified test pressure for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gage with graduation not less than 5 psi.

6. Leakage: Leakage shall be defined as the quantity of water that must be pumped into the test section equal to the sum of the water, to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter.

7. The Owner assumes no responsibility for leakage occurring through existing valves.

8. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD\,(P)^{1/2}}{133{,}200}$$

Where: L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds Per square inch (gauge)

As determined under Section 4 of AWWA C600.

If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

9. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.

3.3 POLYETHYLENE PIPING FOR GAS SERVICE

A. Upon completion of the gas piping system, blow lines free of dirt and debris and test in the presence of the Engineer.

B. All tests shall be made before the piping is covered, concealed or backfilled.

C. The testing requirements for the respective systems shall include all those of the applicable governing codes, such as state, local, and insurance, and those specified herein. The Contractor shall furnish all code-required inspection certificates to the Engineer.

D. Systems receiving hydrostatic tests shall be filled, vented, and charged to test pressure. Exterior surfaces of the pipe shall show no cracks or leaks, and shall be completely drop dry.

E. The minimum test pressure shall be 50 psi. The minimum test duration shall be one hour.

F. The pipeline shall fail the test if a measurable pressure drop is observed or if any leakage is detected.

3.4 MANHOLES

A. Prior to testing manholes for watertightness, all liftholes shall be plugged with a non -shrink grout, all joints between precast sections shall be properly sealed and all pipe openings shall be temporarily plugged and properly braced. Each manhole shall pass one of the following tests:

1. Exfiltration Tests: The manhole, after proper preparation as noted above, shall be filled with water. The maximum allowable leakage shall be 0.1 gallon per hour per foot of diameter per foot of depth. Tests shall last a minimum of eight hours. The manholes may be backfilled prior to testing.

2. Vacuum Tests: The manhole, after proper preparation as noted above, shall be vacuum tested prior to backfilling. The test head shall be placed at the inside of the top of the cone section and the compression head inflated to 40 psi to affect a seal between the vacuum base and the manhole structure. Connect the vacuum pump to the outlet port with the valve open. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9-inches. The manhole shall pass if the time is greater than 60 seconds for 48-inch diameter manholes. If the manhole fails the initial test, necessary repairs shall be made with non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained. Vacuum testing equipment shall be equal to that as manufactured by P.A. Glazier, Inc.

3.5 REPAIRS

A. If the leakage exceeds the specified allowable limits, the point or points of leakage shall be sought out and remedied by the Contractor at no additional cost to the Owner. Repair methods must be approved by the Engineer.

3.6 FLUSHING AND CLEANING

A. The systems shall not be used, except for chemical cleaning, until the Engineer has been assured that cleaning has been accomplished.

3.7 FINAL ACCEPTANCE

A. No pipeline installation shall be accepted until all known and visible leaks have been repaired, whether or not the leakage is within the maximum allowable limits.

B. The Contractor will certify that all required tests have been successfully completed before the work is accepted.

END OF SECTION

SECTION 02760 – ASPHALT CONCRETE PAVEMENT

PART 1 -GENERAL

1.1 SCOPE

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to construct asphalt concrete pavements to the grades and cross-sections shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. Use only materials which are furnished by a bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete.

B. Comply with applicable requirements of the State Department of Transportation Standard Specifications.

1.3 SUBMITTALS

A. Certificates: Provide certificates stating that materials supplied comply with State DOT Standard Specifications & Project Specifications. Certificates shall be signed by the asphalt producer and the Contractor.

B. Mix Design: Submit mix design in accordance with State DOT Specifications for each course to the Engineer for acceptance.

C. Asphalt spreader equipment shall be approved by the Engineer and meet State DOT standards. Submit design and operational data.

D. Traffic paint manufacturer's application instructions and a description and other data relative to the Contractor's application equipment and methods shall be submitted in accordance with State DOT Standard Specifications to the Engineer for approval.

1.4 CONDITIONS

A. Weather Limitations

1. Apply bituminous prime and tack coats only when the ambient temperature in the shade is at least 40 degrees F.
2. Do not conduct paving operations when surface is wet, frozen or contains excess moisture which would prevent uniform distribution and required penetration.
3. Construct asphaltic courses only when atmospheric temperature in the shade meets the following conditions, and when the underlying base is dry and when weather is not rainy.
   a. Less than 1” pavement layer (55 degrees and rising).
   b. 1” to 2” pavement layer (50 degrees and rising).
   c. 2” -thicker pavement layer (40 degrees and rising).
4. Place base course when air temperature is above 35 degrees F and rising. No base course shall be placed on a frozen or muddy subgrade.

B. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.

1.5 INSPECTION AND TESTING

A. Pavement and base testing will be performed by an independent testing laboratory selected by the Owner.

B. The testing agency shall test in-place courses for compliance with specified compaction, thickness and surface smoothness requirements.

C. The testing agency shall take one 4-inch diameter core per 2,500 square yards of paved surface at locations selected by the Engineer for density and thickness tests. Repair holes resulting from coring to match existing paving.

D. Compaction

1 Graded Aggregate Base: All compaction requirements shall meet State DOT and Geotechnical Report requirements for Site, whichever is most stringent.

2 Asphaltic Concrete: All compaction requirements shall meet State DOT and Geotechnical Report requirements for Site, whichever is most stringent.

E. Pavement Thickness: Inspect the cores of the base, and surface courses to determine the average thickness of the course. If the average thickness exceeds the allowable variation below, additional cores shall be made at the Contractor's expense to determine the area of deficient thickness. The deficient area shall be corrected by overlay with the same type mix to the limits as determined by the Engineer.

1 Base Course: +1/2-inch.

2 Binder Course: + 1/4-inch.

3 Surface Course: + 1/4-inch.

F. Surface Smoothness: Test finished surface of each asphalt course for smoothness using a 12 foot straightedge. Intervals of tests shall be as directed by the Engineer. Surfaces will not be acceptable if exceeding the following:

1 Base Course: 1/4-inch in 12 feet.

2 Binder Course: 1/4-inch in 12 feet.

3 Surface Course: 1/8-inch in 12 feet.

G. Contractor's Duties Relative to Testing

1 Notifying laboratory of conditions requiring testing.

2 Coordinating with laboratory for field testing.

3 Paying costs for additional testing performed beyond the scope of that required and for retesting where initial tests reveal non-conformance with specified requirements.

4 Paying the cost of overlays or pavement removal and replacement which does not comply with the specified testing limits.

PART 2 -PRODUCTS

2.1 MATERIALS

A. Graded Aggregate Base Course: Graded aggregate base course shall be of uniform quality throughout and shall meet the requirements of the State Department of Transportation Standard Specifications.

B. Black Base: Black base course shall be of uniform quality throughout and shall meet the requirements of the State Department of Transportation Standard Specifications.

C. Binder Course: Binder course shall be of uniform quality throughout and shall conform to the requirements of the State Department of Transportation Standard Specifications

D. Surface Course: Surface course shall be of uniform quality throughout and shall conform to the requirements of the State Department of Transportation Standard Specifications.

E. Prime Coat: Prime coat shall conform to the requirements of the State Department of Transportation Standard Specifications.

F. Tack coat shall conform to the requirements of the State Department of Transportation Standard Specifications.

PART 3 -EXECUTION

3.1 SURFACE PREPARATION

A. Graded Aggregate Base Course

1 Check subgrade for conformity with elevations and section immediately before placing aggregate base material.

2 Place aggregate base material in compacted layers not more than 6-inches thick, unless continuing tests indicate that the required results are being contained with thicker layers.

3 In no case shall more than 8-inches of compacted base be placed in one lift.

4 Spread, shape, and compact all aggregate base material deposited on the subgrade during the same day.

5 The compacted base shall have sufficient stability to support construction traffic without pumping.

6 If compacted base becomes unstable as a result of too much moisture, the base material and underlying subgrade, if necessary, shall be dried and reworked to a moisture content that can be recompacted.

B. Loose and Foreign Material

1 Remove loose and foreign material from surface immediately before application of paving.

2 Use power brooms or blowers, and hand brooming as required.

3 Do not displace surface material.

C. Prime Coat

1 Uniformly apply at a rate of 0.20 to 0.50 gallon per square yard over compacted and cleaned subbase surface.

2 Apply enough material to penetrate and seal, but not flood the surface.

3 Allow to cure and dry as long as required to attain penetration and evaporation of volatile, and in no case less than 24 hours unless otherwise acceptable to the Engineer.

4 Blot excess asphalt with just enough sand to prevent pick-up under traffic.

5 Remove loose sand before paving.

D. Tack Coat

1 Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphalt concrete or Portland cement concrete and similar surfaces.

2 Apply at a rate of 0.05 to 0.15 gallon per square yard of surface.

3 Apply tack coat by brush to contact surfaces of curbs, gutters, manholes, and other structures projecting into or abutting asphalt concrete pavement.

4 Allow surfaces to dry until material is at condition of tackiness to receive pavement.

EQUIPMENT

A. Provide size and quantity of equipment to complete the work specified within the Project time schedule.

B. Bituminous pavers shall be self-propelled that spread hot asphalt concrete mixtures without tearing, shoving or gouging surfaces, and control pavement edges to true lines without use of stationary forms.

C. Rolling equipment shall be self-propelled, steel-wheeled and pneumatic-tired rollers that can reverse direction without backlash.

D. Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools to complete the work specified.

ASPHALTIC CONCRETE PLACEMENT

A. Place asphalt concrete mix on prepared surface, spread and strike-off using paving machine.

B. Spread mixture at the minimum temperature requirements of the State Department of Transportation Standard Specifications.

C. Inaccessible and small areas may be placed by hand.

D. Place each course at a thickness such that when compacted it will conform to the indicated grade, cross-section, finish thickness, and density indicated.

E. Pavement Placing

1 Unless otherwise directed, begin placing along centerline of areas to be paved on crowned section, and at high side of sections on one-way slope, and in direction of traffic flow.

2 After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.

3 Complete base courses for a section before placing surface courses.

4 Place mixture in as continuous an operation as practical.

F. Hand Placing

1 Spread, tamp, and finish mixture using hand tools in areas where machine spreading is not possible, as acceptable to Engineer.

2 Place mixture at a rate that will ensure handling and compaction before mixture becomes cooler than acceptable working temperature.

G. Joints

1 Carefully make joints between old and new pavements, or between successive days work, to ensure a continuous bond between adjoining work.

2 Construct joints to have same texture, density and smoothness as adjacent sections of asphalt concrete course.

3 Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.

4 Offset transverse joints in succeeding courses not less than 24-inches.

5 Cut back edge of previously placed course to expose an even, vertical surface for full course thickness.

6 Offset longitudinal joints in succeeding courses not less than 6-inches.

7 When the edges of longitudinal joints are irregular, honeycombed, or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness.

ASPHALTIC CONRETE COMPACTION

A. Provide sufficient rollers to obtain the required pavement density.

B. Begin rolling operations as soon after placing as the mixture will bear weight of roller without excessive displacement.

C. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set.

D. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

E. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.

F. Do not roll centers of sections first under any circumstances.

G. Breakdown Rolling

1 Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.

2 Operate rollers as close as possible to paver without causing pavement displacement.

3 Check crown, grade, and smoothness after breakdown rolling.

4 Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.

H. Second Rolling

1 Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction.

2 Continue second rolling until mixture has been thoroughly compacted.

I. Finish Rolling

1 Perform finish rolling while mixture is still warm enough for removal of roller marks.

2 Continue rolling until roller marks are eliminated and course has attained specified density.

J. Patching

1 Remove and replace defective areas.
2 Cut-out and fill with fresh, hot asphalt concrete.
3 Compact by rolling to specified surface density and smoothness.
4 Remove deficient areas for full depth of course.
5 Cut sides perpendicular and parallel to direction of traffic with edges vertical.
6 Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

3.5 CLEANING AND PROTECTION

A. Cleaning: After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of the Engineer.

B. Protection

1 After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case no sooner than six hours.

2 Provide barricades and warning devices as required to protect pavement and the general public.

C. Maintenance: The Contractor shall maintain the surfaces of pavements until the acceptance of the Project. Maintenance shall include replacement, overlay, milling and reshaping as necessary to prevent raveling of the road material, the preservation of smooth surfaces and the repair of damaged or unsatisfactory surfaces, to the satisfaction of the Engineer.

3.6 SUPERVISION AND APPROVAL

A. Pavement shall meet the requirements of the regulatory agency responsible for the maintenance of pavement. Obtain agency approval of pavement before requesting final payment.

B. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the Contract, including the bonded period, promptly restore or repair defects.

END OF SECTION

SECTION 02770 – CONCRETE CURBS PART

1 -GENERAL

1.1 SCOPE

A. This work shall consist of furnishing all labor, materials and equipment necessary for the construction of concrete curb, concrete gutter and concrete combined curb and gutter which shall consist of detached curb, detached gutter and monolithic curb and gutter respectively, all constructed of Portland cement concrete, at the locations, and to the lines, grades, cross-section, form and dimensions indicated on the Drawings or as directed by the Engineer and in conformity with the provisions and requirements set out in these Specifications. All work to be in accordance with State DOT Standard Specifications.

B. Cement concrete curb, gutter and combined curb and gutter shall include all necessary excavation, unless otherwise indicated, and subgrade preparation; backfilling, and final clearing up; and completion of all incidentals thereto, as indicated on the Drawings or as directed by the Engineer.

1.2 PRODUCT HANDLING

A. Protection: Use all means necessary to protect concrete materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer at no additional cost to the Owner.

PART 2 -PRODUCTS

2.1 CONCRETE REINFORCEMENT

A. Concrete reinforcement shall conform to the requirements of State DOT Standard Specifications and the Concrete Reinforcement Section of these Specifications.

2.2 CONCRETE AND RELATED MATERIALS

A. General: Concrete and related materials including, but not necessarily limited to, joint materials, membranes and curing compounds shall conform to State DOT Standard Specifications Section 03 30 Cast-In-Place Concrete Class: All concrete shall be Class “B” or type II Portland cement.

C. Water used in mixing concrete shall be fresh, clean, potable water free from injurious amounts of oil, acid, alkali, vegetable, wastewater and/or organic matter. Water shall be considered as weighing 8.33 pounds per gallon.

D. dmixtures shall meet the following requirements:

1. Except as herein specified, no curative or hardening admixtures shall be used.
2. An air entrainment agent capable of providing three to six percent air shall be used. Air entraining admixtures which are added to concrete mixtures shall conform to ASTM C 260 for Air Entraining Admixtures for Concrete.

E. Sub-base shall be constructed of durable material such as crushed stone, bank -run gravel, blast furnace slag or steam-boiler cinders, in accordance with State DOT Standard Specifications.

F. Joint filler shall be a non-extruding joint material conforming to ASTM D1751, ½ inch, Bituminous type for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (non-extruding and resilient bituminous types). The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint unless otherwise specified by the Engineer.

2.3 OTHER MATERIALS

A. All other materials, not specifically described, but required for complete and proper installation of the work of this Section shall be as selected by the Contractor subject to the approval of the Engineer.

PART 3 -EXECUTION

3.1 EARTHWORK

A. General: All earthwork shall be performed in accordance with Section Earthwork of these Specifications and as specified in this Section.

B. Backfilling

1. After the concrete has set sufficiently, the spaces on both sides of the curb, gutter, and combined curb and gutter shall be backfilled, and the materials compacted and left in a neat condition.

2. Curbs to be used in the construction of asphalt pavements shall be backfilled prior to placement of base material.

3.2 INSTALLATION - All construction methods shall conform to State DOT Standard Specifications.

A. Concrete Reinforcement: All concrete reinforcement shall be installed in accordance with Section Concrete Reinforcing of these Specifications and as indicated on the Drawings.

B. Forming

1 Forms shall be metal and of an approved section. They shall be straight, free from distortions, and shall show no vertical variation greater than 1/8-inch in 12 feet, and shall show no lateral variation greater than 1/4-inch in 12 feet from the true plane surface on the vertical face of the form.

2 Forms shall be of the full depth of the structure and be so constructed as to permit the inside forms to be securely fastened to the outside forms.

3 Securely hold forms in place true to the lines and grades indicated on the Drawings.

4 Wood forms may be used on sharp turns and for special sections as approved by the Engineer.

5 Where wooden forms are used, they shall be free from warp and the nominal depth of the structure.

6 All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.

7 The supply of forms shall be sufficient to permit their remaining in place at least 12 hours after the concrete has been placed.

C. Concrete: Concrete shall be placed in accordance with Section Cast-In-Place Concrete of these Specifications.

D. Joints

1 Joints shall be constructed as indicated on the Drawings and as specified.

2 Construct joints true to line with their faces perpendicular to the surface of the structure and within 1/4-inch of their designated position.

3 Thoroughly spade and compact the concrete at the faces of all joints to fill all voids.

4 Install expansion joint materials at the point of curve at all street returns.

5 Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.

6 Place contraction joints every 10 feet along the length of the curbs and gutters.

7 Form contraction joints using steel templates or division plates which conform to the cross section of the structure. Leave the templates in place until the concrete has set sufficiently to hold its shape, but remove them while the forms are still in place.

8 Contraction joint templates or plates shall not extend below the top of the steel reinforcement or shall be notched to permit the reinforcement to be continuous through the joint.

9 Contraction joints shall be a minimum of 1-1/2-inches deep.

E. Finishing

1 Strike off the surface with a template and finish the surface with a wood float using heavy pressure, after which contraction joints shall be made and the surface finished with a wood float or steel trowel.

2 Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius indicated on the Drawings.

3 Finish edges with an approved finishing tool having a 1/4-inch radius.

4 Provide a final broom finish by lightly combing with a stiff broom after troweling is complete.

5 The finished surface shall not vary more than 1/8-inch in 12 feet from the established grade.

F. Concrete Curing

1 After finishing operations have been completed and immediately after the free water has left the surface, the surface of the structure shall be completely coated and sealed with a uniform layer of curing compound.

2 The compound shall be applied in one or two applications as directed by the Engineer. When the compound is applied in two increments, the second application shall follow the first application within 30 minutes.

3 The compound shall be applied continuously by means of an automatic self-propelled, pressure sprayer as approved by the Engineer at the rate directed by the Engineer, but not less than one gallon per 200 square feet of surface.

4 The equipment shall provide adequate stirring of the compound during application.

5 Should the method of applying the compound not produce uniform coverage, its use shall be discontinued, and the curing shall be by another method approved by the Engineer.

G. Protection

1 Provide and use sufficient coverings for the protection of the concrete in case of rain or breakdown of curing equipment.

2 Provide necessary barricades and lights to protect the work and rebuild or repair to the approval of the Engineer. All damage caused by people, vehicles, animals, rain, the Contractor's operations and the like shall be repaired by the Contractor at no additional expense to the Owner.

H. Driveway and Sidewalk Ramp Openings

1 Provide driveway openings of the widths and at locations as indicated on the Drawings and directed by the Engineer.

2 Provide sidewalk ramp openings as indicated on the Drawings in conformance with the applicable regulations and as directed by the Engineer.

3.3 PATCHING

A. Inspect, patch and repair all concrete in accordance with the requirements of the Cast-In-Place Concrete Section of these Specifications.

3.4 CLEARING AND GRUBBING

A. Clearing and grubbing shall be performed in accordance with the requirements of the Earthwork Section of these Specifications.

3.5 ROAD AND DRAINAGE EXCAVATION

A. Site excavation, as indicated on the Drawings or as directed by the Engineer, shall be performed in accordance with the requirements of the Earthwork Section of these Specifications.

3.6 EMBANKMENT CONSTRUCTION

A. Embankment construction, as indicated on the Drawings or as directed by the Engineer, shall be performed in accordance with the requirements of the Earthwork Section of these Specifications.

3.7 SUBGRADE PREPARATION

A. The subgrade shall be formed by excavating to the required depth below the finished surface of the respective types, in accordance with the dimensions and designs indicated on the Drawings or as directed by the Engineer, and shall be of such width as to permit the proper installation and bracing of forms. The subgrade shall be compacted by hand tamping and all soft, yielding or unsuitable material shall be removed and backfilled with satisfactory material and again compacted thoroughly and finished to a smooth and unyielding surface. The finished grade shall be to the dimensions and design indicated on the Drawings or as directed by the Engineer for the bottom of the proposed construction.

3.8 CLEANING

A. All excess or unsuitable material shall be disposed of in a manner satisfactory to the Engineer.

B. Final clean-up shall be performed in accordance with the requirements of Section Cleaning of these Specifications.

C. All material becoming the property of the Owner shall be stored in a manner and at locations near or on the Project as directed by the Engineer.

END OF SECTION

SECTION 02775 – CONCRETE SIDEWALK AND DRIVEWAY

PART 1 -GENERAL

1.1 SCOPE

A. Concrete sidewalk shall be constructed of Portland cement concrete, at the locations and to the dimensions, lines, grades and cross section indicated on the Drawings or as directed by the Engineer and in conformity with the provisions and requirements set out in State DOT Standard Specifications and these Specifications.

B. Concrete driveways shall be constructed of Portland cement concrete, at the locations and to the dimensions, lines, grades and cross section indicated on the Drawings or as directed by the Engineer, and in conformity with the provisions and requirements set out in these Specifications.

C. Concrete sidewalk and driveway shall include all the necessary excavation, unless otherwise indicated, subgrade and subbase preparation, backfilling, final clearing up and completing all incidentals thereto, as indicated on the Drawings or as directed by the Engineer.

PART 2 -PRODUCTS

2.1 MATERIALS

A. Materials used in the construction of sidewalks and driveways, in addition to the general requirements of these Specifications, shall conform, unless otherwise stipulated, to the following:

1 Concrete shall be manufactured of the materials meeting the requirements of and in accordance with the provisions and requirements for Class “B” concrete as set out in the Cast-In-Place Concrete Section of these Specifications.

2 Crushed stone for base shall meet the gradation requirements per State DOT Standard Specifications.

2.2 FORM MATERIAL

A. Forms may be constructed of wood or metal.

B. The lumber to be used in the construction of wood forms shall be free of bulge or warp, of uniform width, not less than 2-inches (commercial) in thickness, except that 1-inch thickness may be used on curves and shall be sound and free from loose knots. Stakes shall be not less than 2 x 4-inch lumber of sufficient length that, when driven, they will hold the forms rigidly in place.

C. Metal forms shall be of approved sections and shall have a flat surface on top. They shall present a smooth surface of the desired contour, sufficiently thick and braced to withstand the weight of the concrete without bulging or becoming displaced.

PART 3 -EXECUTION

3.1 LABOR

A. For finishing, competent and skilled finishers shall be provided.

3.2 EQUIPMENT

A. All equipment necessary and required for the construction of concrete sidewalks and driveways must be on the Project, proven to be in first class working condition and approved by the Engineer, before construction will be permitted to begin.

B. A one bag mixer will be permitted when the total output of concrete, per 10 hour day, does not exceed 25 cubic yards.

C. Satisfactory floats, edgers, spades and tamps shall be furnished. Tamps of not over 8 -inch diameter and weighing not less than 25 pounds shall be provided for tamping subgrade. A 10 foot longitudinal float of the inverted T-type with plough handles attached for manipulation, and a rigid float not less than 18-inches longer than the width of the walk being constructed, shall be provided.

3.3 CLEARING AND GRUBBING

A. Clearing and grubbing shall be performed in accordance with the requirements of the Site Preparation Section of these Specifications.

3.4 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

A. Unless otherwise indicated or stipulated, the removal of structures, obstructions, etc., will be performed in accordance with the requirements of the Demolition of Existing Facilities Section of these Specifications.

3.5 ROAD AND DRAINAGE EXCAVATION

A. Road and drainage excavation, as indicated on the Drawings or as directed by the Engineer, shall be performed in accordance with the requirements of the Demolition of Existing Facilities Section of these Specifications.

3.6 EMBANKMENT CONSTRUCTION

A. Embankment construction, as indicated on the Drawings or as directed by the Engineer, shall be performed in accordance with the provisions of the Earthwork Section of these Specifications.

3.7 SUBGRADE PREPARATION

A. The subgrade for sidewalks and driveways shall be formed by excavation to a depth equal to the thickness per State DOT Standard Specifications.

B. All subgrade shall be of such width as to permit the proper installation and bracing of the forms.

C. Yielding, or unsuitable material shall be removed and backfilled with satisfactory material. Place 6-inches of graded aggregate base under commercial/industrial driveways, compacted thoroughly and finished to a smooth, unyielding surface and proper line, grade and cross section of the proposed construction.

3.8 FORMS

A. All forms shall be set upon the prepared subgrade, true to lines and grade, and held rigidly in place so as not to be disturbed or displaced during the placing of the concrete. The top of the form shall be set to exact grade and the height shall be equal to not less than the thickness of the proposed concrete.

B. All forms shall be so constructed as to form the cross section, contour, etc., of the proposed construction.

C. Immediately before placing the concrete, the forms shall be given a coat of light oil and where being removed and used again, the forms shall be thoroughly cleaned and oiled each time.

D. Forms shall be removed within 24 hours after placing concrete and no pressure shall be exerted upon the concrete in removing forms.

E. When the sidewalk is to be joined to an existing sidewalk, the existing sidewalk, if not in proper condition for the junction, shall be cut to a neat line perpendicular to both the centerline and the surface, or as indicated by the Engineer.

3.9 EXPANSION JOINTS

A. Unless otherwise indicated on the Drawings or as directed by the Engineer, premoulded expansion joint filler, 1/2-inch in thickness, shall be placed at the locations and in line with expansion joints in the adjoining pavement, gutter or curb. When expansion joints are not required in the adjoining pavement or gutter, and not otherwise indicated on the Drawings, a 1/2-inch premoulded expansion joint filler shall be placed at intervals of not over 50 feet apart. All premoulded expansion joint filler must be cut to full width or length of the proposed construction and shall extend to within 1/2-inch of the top or finished surface. All longitudinal expansion joints shall be placed in accordance with State DOT Standard Specifications.

B. All expansion joints shall be true, even and present a satisfactory appearance.

C. All expansion joint material protruding after the concrete has been finished shall be trimmed as directed by the Engineer.

3.10 MANUFACTURING AND PLACING CONCRETE

A. Immediately before placing concrete, the depth of the proposed concrete shall be checked by means of a template cut true to the cross section of the proposed construction and any irregularities shall be corrected.

B. Immediately before placing concrete, all subgrade shall be thoroughly sprinkled or wetted.

C. Concrete shall not be placed upon a frozen subgrade or subbase.

D. Construction joints will be permitted only at grooves or at expansion joints, unless otherwise approved by the Engineer.

E. The concrete shall be manufactured and placed in accordance with the requirements of Section Cast-In-Place Concrete of these Specifications.

F. The concrete shall be placed immediately after mixing; the edges, sides, etc., shall be thoroughly spaded and the surfaces tamped sufficiently to thoroughly compact the concrete and bring the mortar to the surface. The concrete shall be deposited and compacted in a single layer.

3.11 FINISHING

A. The concrete shall be struck-off with a transverse template resting upon the side forms and then shall be floated with a 10 foot longitudinal float working the float transversely across the concrete with a sawing motion, always maintaining it parallel to the edges of the sidewalk, or driveway, where practicable, and in such a manner that all surplus water, laitance and inert material shall be removed from the surface. This operation shall be continued until the surface of the concrete shows no variation from a 10 foot straightedge. If necessary, additional concrete shall be added to fill depressions, and the longitudinal float used again. The longitudinal float shall not be moved ahead more than one-half its length at any time.

B. When the surface of the concrete is free from water and just before the concrete obtains its initial set, it shall be gone over and finished with a wooden float so as to produce a sandy texture. The longitudinal surface variations shall be not more than 1/4-inch under a 12 foot straightedge, nor more than 1/8-inch on a five foot transverse section. The surface of the concrete must be finished so as to drain completely at all times.

C. The edges of the sidewalks or driveways shall be carefully finished and rounded with an edging tool having a radius of 1/2-inch.

D. The surface of sidewalks shall be divided into blocks by use of a grooving tool. Grooves shall be placed so as to cause contraction joints to be placed at a groove line, where practical. The grooves shall be spaced approximately five feet apart and the blocks shall be rectangular unless otherwise ordered by the Engineer. The grooves shall be cut to a depth of not less than 1-inch. The edges of the groves shall be edged with an edging tool having a radius of 1/4-inch, and any marks caused by edging or otherwise shall be removed with a wetted brush or wooden float so as to give the surface an uniform texture and finish.

E. The edges of the concrete at contraction joints shall be rounded with an edging tool having a radius of 1/4-inch. The top and ends, where practicable, of expansion joint material shall be cleaned of all concrete and the expansion joint material shall be trimmed so as to be slightly below the surface of the concrete. All marks caused by edging shall be removed with a wetted brush or wooden float.

3.12 PROTECTION AND CURING

A. Immediately after finishing the concrete, it shall be covered and cured in accordance with the requirements of Section Cast-In-Place Concrete of these Specifications. If the temperature falls to below freezing, satisfactory heating devices shall be placed under suitable covers to keep the temperature around the concrete at above 45 degrees F.

B. Pedestrians will not be allowed upon concrete sidewalks or driveways until 12 hours after finishing concrete, and no vehicles or loads shall be permitted upon any sidewalk or driveway until the concrete has attained sufficient strength for such traffic.

C. The Contractor shall construct such barricades and protection devices as are necessary to keep pedestrians and traffic off the sidewalks or driveways.

D. If any sidewalk or driveway is damaged at any time previous to final acceptance of the Project, it shall be repaired by removing all concrete within the limits of the grooves, and be replaced, at the Contractor's expense, with concrete of the type, kind and finish in the original construction.

3.13 BACKFILLING

A. Immediately after the concrete has set sufficiently, the spaces along the sides or edges of the sidewalk or driveway shall be refilled with suitable material, this material shall be compacted in layers of not over 4-inches each, until firm and solid.

3.14 CLEANING

A. All excess or unsuitable material shall be removed and disposed of in accordance with requirements of the Waste Material Disposal Section of these Specifications.

B. Final clean-up shall be performed in accordance with the requirements of Section Cleaning of these Specifications.

C. All material becoming the property of the Owner shall be stored in a manner and at locations near or on the Project as directed by the Engineer.

END OF SECTION

SECTION 02920 TURF AND GRASSES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. All work to be in accordance with State DOT and County/Municipalities Standard Specifications.

1.2 SUMMARY

A. Section Includes:

1 Fine grading and preparing lawn areas.

2 Furnishing and applying soil amendments.

3 Furnishing and applying fertilizers.

4 Sodding new lawns.

5 Seeding.

6 Meadow grasses and wildflowers.

7 Erosion-control material(s).

8 Replanting unsatisfactory or damaged lawns.

B. Related Sections:

1 Section "Site Preparation" for topsoil stripping and stockpiling.

2 Section "Earthwork" for excavation, filling and backfilling, and rough grading.

3 Section "Plants" for border edgings.

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or

backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

J. Laser Grading: Laser Grading shall include the use of a land leveler that is equipped with a laser controlled hydraulic system that automatically raises and lowers the implement.

K. Rootzone: The combination of topsoil, subsurface soil, sand, lime and fertilizer lightly blended into a loose homogenous mixture, the sand being approximately 85% of the mixture.

L. Warrantied Sod: The specific area(s) of sod harvested and installed during the dormant season that later does not demonstrate reasonable regrowth of stolens to sufficiently re-establish an acceptable playing surface, therefore, is subsequently replaced by the Contractor at no cost to the Owner.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections. Submit planting schedule indicating anticipated dates and locations for each type of planting.

B. Product Data: For each type of product indicated.

   a. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

C. Certification:

   a. Sod Certification: From grassing contractor stating the botanical and common name of the Certified Sod to be installed.

   b. Grass Seed Certification: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

D. Qualification Data: For qualified landscape Installer.

E. Product Certificates: For soil amendments and fertilizers, from manufacturer.

   a. Lime Certification from grassing contractor stating type of lime (pelletized or powdered), lime supplier and rate of application.

   b. Fertilizer Certification from grassing contractor stating composition of fertilizer and rate of application.

F. Material Test Reports: For existing in-place surface soil and imported or manufactured topsoil. Soil Analysis Report giving soil analysis and amendment recommendations. Alter fertilizer and lime requirements as dictated by the soil analysis data.

G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf and meadows during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and meadow establishment.

1. Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing turf and grasses similar in type and scope to that required for this project.

2. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

a. Certified Landscape Technician -Exterior, with installation and maintenance specialty area(s), designated CLT-Exterior.

b. Certified Turfgrass Professional, designated CTP.

c. Certified Turfgrass Professional of Cool Season Lawns, designated CTP-CSL.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.

2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Landscape Architect. A minimum of four (4) representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.

3. Report suitability of tested soil for turf growth.

a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.

b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

D. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to the requirements of the American Sod Producers Association's (ASPA) "Specifications for Turfgrass Sod Materials and Transplanting/Installing."

B. Fertilizer & Lime: Deliver in original sealed, labeled, and undamaged containers.

C. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

D. Bulk Materials:

1 Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing

turf areas or plants.

2 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.

3 Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

A. Planting Restrictions: Sow lawn seed and install sod during normal planting seasons for type of lawn work required. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of substantial completion.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.8 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

    a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

B. Initial Meadow Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable meadow is established, but for not less than 40 days from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOD

A. Sod: (For lawns) Certified turfgrass sod complying with ASPA specifications for machine-cut thickness, size, strength, moisture content, and mowed height, and free of weeds and undesirable native grasses. Provide viable sod of uniform density, color, and texture of the following turfgrass species, strongly rooted, and capable of vigorous growth and development when planted.

2.2 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Grass Seed Mix: Proprietary seed mix as follows:

1. Refer to Vegetative Plan as shown on the Erosion Control Plans, unless otherwise directed.

2.3 MEADOW GRASSES AND WILDFLOWERS

A. Native Grass Seed: Fresh, clean, and dry new seed, of mixed species as follows:

1. Native American Seed: Per local USDA recommendations

B. Seed Carrier: Inert material, sharp clean sand or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed.

2.4 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Perlite: Horticultural perlite, soil amendment grade.

D. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

E. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

2.5 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

C. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.6 FERTILIZERS

A. Slow-Release Fertilizer: Commercial grade Granular or pelleted complete fertilizer of neutral character consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.7 PLANTING SOILS

A. Planting Soil: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful

to plant growth. Mix surface soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

1. Ratio of Loose Compost to Surface Soil by Volume: According to soil analysis recommendations.

2. Ratio of Loose Muck Peat to Surface Soil by Volume: According to soil analysis recommendations.

3. Ratio of Loose Wood Derivatives to Surface Soil by Volume: According to soil analysis recommendations.

4. Weight of Lime per 1000 Sq. Ft.: According to soil analysis recommendations.

5. Weight of Sulfur per 1000 Sq. Ft.: According to soil analysis recommendations.

6. Weight of Agricultural Gypsum per 1000 Sq. Ft.: According to soil analysis recommendations.

7. Volume of Sand Plus 10 Percent per 1000 Sq. Ft.: According to soil analysis recommendations.

8. Weight of Slow-Release Fertilizer per 1000 Sq. Ft.: According to soil analysis recommendations.

B. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes, grubs, other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled, pore-space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis. Provide soil with a pH range of 6.5 to 7. Contractor shall provide sample and soil test analysis to the Landscape Architect prior to delivery of topsoil to site.

2. Mix imported topsoil or manufactured topsoil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

a. Ratio of Loose Compost to Topsoil by Volume: According to soil analysis recommendations.

b. Ratio of Loose Muck Peat to Topsoil by Volume: According to soil analysis recommendations.

c. Ratio of Loose Wood Derivatives to Topsoil by Volume: According to soil analysis recommendations.

d. Weight of Lime per 1000 Sq. Ft.: According to soil analysis recommendations

e. Weight of Sulfur per 1000 Sq. Ft.: According to soil analysis recommendations

f. Weight of Agricultural Gypsum per 1000 Sq. Ft.: According to soil analysis recommendations.

g. Volume of Sand Plus 10 Percent per 1000 Sq. Ft.: According to soil analysis recommendations.

h. Weight of Slow-Release Fertilizer per 1000 Sq. Ft.: According to soil analysis recommendations.

2.8 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew-and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

2.9 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.10 EROSION CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Invisible Structures, Inc.; Slopetame 2.

b. Presto Products Company, a business of Alcoa; Geoweb.

c. Tenax Corporation -USA; Tenweb.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove

the soil and contamination as directed by Landscape Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

   1. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

   1. Apply fertilizer directly to subgrade before loosening.

   2. Thoroughly blend planting soil off-site before spreading.

      a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.

      b. Mix lime with dry soil before mixing fertilizer.

   3. Spread planting soil to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

      a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

   1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.

   2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.

      a. Apply fertilizer directly to surface soil before loosening.

   3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.

   4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before

planting. Do not create muddy soil.

F. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SODDING NEW LAWNS

A. Lay sod within 24 hours of stripping. Do not lay sod if ground is frozen or overly wet.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

C. Lay sod across angle of slopes exceeding 3:1.
   1. Anchor sod on slopes exceeding 6:1 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

D. Saturate sod with fine water spray within 2 hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below the sod.

3.5 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.6 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

   1. Do not use wet seed or seed that is moldy or otherwise damaged.

   2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate as recommended for proprietary seed mix specified/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.7 TURF MAINTENANCE

A. Sodded lawns will be satisfactory provided requirements, including maintenance, have been met and

healthy, well-rooted, even-colored, viable lawn is established, free of weeds, open joints, bare areas, and surface irregularities.

B. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1 Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.

2 In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

3 Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

C. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1 Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2 Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

D. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow Native Sun Turfgrass Seedmix to a height of 1-1/2 to 2 inches.

E. Turf Post-fertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of amount recommended for proprietary seed mixture/1000 sq. ft. to turf area.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.9 MEADOW

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at a total rate as recommended for proprietary seed mix specified/1000 sq. ft.

C. Brush seed into top 1/16 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

E. Water newly planted areas and keep moist until meadow is established.

3.10 MEADOW MAINTENANCE

A. Maintain and establish meadow by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable meadow. Roll, regrade, and replant bare or eroded areas and remulch. Provide materials and installation the same as those used in the original installation.

1 Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and meadow damaged or lost in areas of subsidence.

2 In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

3 Apply treatments as required to keep meadow and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and meadow-watering equipment to convey water from sources and to keep meadow uniformly moist.

1 Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2 Water meadow with fine spray at a minimum rate of 1/2 inch per week for eight weeks after planting unless rainfall precipitation is adequate.

3.11 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.12 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION

SECTION 02980 – REMOVING AND REPLACING PAVEMENT

PART 1 -GENERAL

1.1 SCOPE

A. The work to be performed under this Section shall consist of removing and replacing existing pavement, sidewalks and curbs in paved areas where such have been removed for construction of water mains, fire hydrants, sewers, manholes and all other water and sewer appurtenances and structures. All work to be completed in accordance with State DOT and County/Municipalities Standard Specifications.

1.2 SUBMITTALS

A. Certificates: Provide certificates stating that materials supplied comply with State DOT, State Environmental Protection Agency and County/Municipalities Standard Specifications and Project Specifications. Certificates shall be signed by the asphalt producer and the Contractor.

B. Traffic paint manufacturer's application instructions and a description and other data relative to the Contractor's application equipment and methods shall be submitted to the Engineer for approval.

1.3 CONDITIONS

A. Weather Limitations

1 See Project Asphalt Concrete Pavement Specifications Section.

PART 2 -PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

A. See Project Asphalt Concrete Pavement Specifications Section

B. Special Surfaces: Where driveways or roadways are disturbed or damaged which are constructed of specialty type surfaces, e.g., brick or stone, these driveways and roadways shall be restored utilizing similar, if not original, materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

2.2 TYPES OF PAVEMENT

A. General: All existing pavement removed, destroyed or damaged by construction shall be replaced with the same type and thickness of pavement as that existing prior to construction, unless otherwise directed by the Engineer. Materials, equipment and construction methods used for paving work shall conform to the State Department of Transportation specifications applicable to the particular type required for replacement, repair or new pavements.

B. Aggregate Base: Aggregate base shall be constructed in accordance with the requirements of the State Department of Transportation Standard Specifications.

C. Concrete Pavement: Concrete pavement or base courses shall be replaced with concrete. The surface finish of the replaced concrete pavement shall conform to that of the existing pavement. The surface of the replaced concrete base course shall be left rough. The slab depth shall be equivalent to the existing concrete pavement or base course, but in no case less than 6-inches thick. Transverse and longitudinal joints removed from concrete pavement shall be replaced at the same locations and to the same types and dimensions as those removed. Concrete pavements or concrete base courses shall be reinforced.

D. Asphaltic Concrete Base, Binder and Surface Course: Asphaltic concrete base, binder and surface course construction shall conform to State Department of Transportation Standard Specifications. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, firm, properly cured, dry and the tack coat has been applied. Apply and compact the base in maximum layer thickness by asphalt spreader equipment of design and operation approved by the Engineer. After compaction, the black base shall be smooth and true to established profiles and sections. Apply and compact the surface course in a manner approved by the Engineer. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.

E. Surface Treatment Pavement: Bituminous penetration surface treatment pavement shall be replaced with a minimum thickness of 1-inch conforming to State Department of Transportation Standard Specifications.

F. Gravel Surfaces: Existing gravel road, drive and parking area replacement shall meet the requirements of graded aggregate base course. This surfacing may be authorized by the Engineer as a temporary surface for paved streets until replacement of hard surfaced pavement is authorized.

G. Temporary Measures: During the time period between pavement removal and complete replacement of permanent pavement, maintain highways, streets and roadways by the use of steel running plates anchored to prevent movement. The backfill above the pipe shall be compacted, as specified in Section of these Specifications, up to the existing pavement surface to provide support for the steel running plates. All pavement shall be replaced within seven calendar days of its removal.

PART 3 -EXECUTION

3.1 REMOVING PAVEMENT

A. General: Remove existing pavement as necessary for installing the pipe line and appurtenances.

B. Marking: Before removing any pavement, mark the pavement neatly paralleling pipe lines and existing street lines. Space the marks the width of the trench.

C. Breaking: Break asphalt pavement along the marks using pavement shearing equipment, jack hammers or other suitable tools. Break concrete pavement along the marks by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.

D. Machine Pulling: Do not pull pavement with machines until the pavement is completely broken and separated from pavement to remain.

E. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

F. Sidewalk: Remove and replace any sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.

G. Curbs: Tunnel under or remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.2 REPLACING PAVEMENT

A. Preparation of Subgrade: Upon completion of backfilling and compaction of the backfill, arrange to have the compaction tested by an independent testing laboratory approved by the Engineer. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks and curbs removed.

1 The existing street pavement or surface shall be removed along the lines of the work for the allowable width specified for the trench or structure. After the installation of the sewerage or water works facilities and after the backfill has been compacted suitably, the additional width of pavement to be removed, as shown on the Drawings, shall be done immediately prior to replacing the pavement.

2 Trench backfill shall be compacted for the full depth of the trench as specified in Section of these Specifications.

3 Temporary trench backfill along streets and driveways shall include 6-inches of crushed stone or cherty clay as a temporary surfacing of the trenches. This temporary surface shall be maintained carefully at grade and dust-free by the Contractor until the backfill of the trench has thoroughly compacted in the opinion of the Engineer and permission is granted to replace the street pavement.

4 When temporary crushed stone or chert surface is considered by the Engineer to be sufficient surface for gravel pavement, the surface shall be graded smooth and to an elevation that will make the final permanent surfacing level with the adjacent surfacing that was undisturbed.

B. Pavement Replacement

1 Prior to replacing pavement, make a final cut in concrete pavement 12-inches back from the edge of the damaged pavement with a concrete saw. Remove asphalt pavement 12-inches back from the edge of the damaged pavement using pavement shearing equipment, jack hammers or other suitable tools.

2 Replace all street and roadway pavement as shown on the Drawings. Replace driveways, sidewalks and curbs with the same material, to nearest existing undisturbed construction joint and to the same dimensions as those existing.

3 If the temporary crushed stone or chert surface is to be replaced, the top 6-inches shall be removed and the crushed stone surfacing for unpaved streets or the base for the bituminous surface shall be placed.

4 Following this preparation, the chert or crushed stone base shall be primed with a suitable bituminous material and surfaced with the proper type of bituminous surface treatment.

5 Where the paved surface is to be replaced with asphaltic concrete pavement, concrete pavement or with a concrete base and a surface course, the temporary chert or crushed stone surface and any necessary backfill material, additional existing paving and new excavation shall be removed to the depth and width shown on the Drawings. All edges of the existing pavement shall be cut to a straight, vertical edge. Care shall be used to get a smooth joint between the old and new pavement and to produce an even surface on the completed street. Concrete base slabs and crushed stone bases, if required, shall be placed and allowed to cure for three days before bituminous concrete surface courses are applied. Expansion joints, where applicable, shall be replaced in a manner equal to the original joint.

6 Where driveways or roadways, constructed of specialty type surfaces, e.g., brick or stone are disturbed or damaged, these driveways and roadways shall be restored utilizing similar materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

C. Pavement Resurfacing

1 Certain areas to be resurfaced are specified or noted on the Drawings. Where pavement to be resurfaced has been damaged with potholes, the Contractor shall remove all existing loose pavement material and fill the hole with black base, as specified, to the level of the existing pavement. After all pipe line installations are complete and existing pavement has been removed and replaced along the trench route, apply tack coat and surface course as specified.

2 Resurfacing limits shall be perpendicular to the road centerline. The limits of resurfacing shall be 10 feet beyond the edge of the pavement replacement on the main road being resurfaced, and to the point of tangency of the pavement on the side streets.

D. Pavement Striping: Pavement striping removed or paved over shall be replaced with the same type, dimension and material as original unless directed otherwise by the Engineer.

3.3 SIDEWALK AND CURB REPLACEMENT

A. Construction

1 All concrete sidewalks and curbs shall be replaced with concrete.

2 Preformed joints shall be 1/2-inch thick, conforming to the latest edition of AASHTO M59 for sidewalks and AASHTO M 123 for curbs.

3 Forms for sidewalks shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength, when in place, to hold the concrete true to line and grade without springing or distorting.

4 Forms for curbs shall be metal and of an approved section. They shall be straight and free from distortions, showing no vertical variation greater than 1/8-inch in 10 feet and no lateral variation greater than 1/4-inch in 10 feet from the true plain surface on the vertical face of the form. Forms shall be of the full depth of the structure and constructed such to permit the inside forms to be securely fastened to the outside forms.

5 Securely hold forms in place true to the lines and grades indicated on the Drawings.

6 Wood forms may be used on sharp turns and for special sections, as approved by the Engineer. Where wooden forms are used, they shall be free from warp and shall be the nominal depth of the structure.

7 All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.

B. When a section is removed, the existing sidewalk or curb shall be cut to a neat line, perpendicular to both the centerline and the surface of the concrete slab. Existing concrete shall be cut along the nearest existing construction joints; if such joints do not exist, the cut shall be made at minimum distances shown on the Drawings.

C. Existing concrete sidewalks and curbs that have been cut and removed for construction purposes shall be replaced with the same width and surface as the portion removed. Sidewalks shall have a minimum uniform thickness of per State DOT and County/Municipalities Standard Specifications or Drawings, whichever is more stringent. The new work shall be neatly jointed to the existing concrete so that the surface of the new work shall form an even, unbroken plane with the existing surfaces.

D. The subgrade shall be formed by excavating to a depth equal to the thickness of the concrete, plus 2-inches. Subgrade shall be of such width as to permit the proper installation and bracing of the forms. Subgrades shall be compacted by hand tamping or rolling. Soft, yielding or unstable material shall be removed and backfilled with satisfactory material. Place 2-inches of porous crushed stone under all sidewalks and curbs and compacted thoroughly, then finish to a smooth, unyielding surface at proper line, grade and cross section.

E. Joint for Curbs

1 Joints shall be constructed as indicated on the Drawings and as specified. Construct joints true to line with their faces perpendicular to the surface of the structure and within 1/4-inch of their designated position.

2 Thoroughly spade and compact the concrete at the faces of all joints filling all voids.

3 Install expansion joint materials at the point of curve at all street returns. Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.

4 Place contraction joints every 10 feet along the length of the curbs and gutters. Form contraction joints using steel templates or division plates which conform to the cross section of the structure. Leave the templates in place until the concrete has set sufficiently to hold its shape, but remove them while the forms are still in place. Contraction joint templates or plates shall not extend below the top of the steel reinforcement or they shall be notched to permit the reinforcement to be continuous through the joint. Contraction joints shall be a minimum of 1-1/2-inches deep.

F. Expansion joints shall be required to replace any removed expansion joints or in new construction wherever shown on the Drawings. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within 1/2-inch of the top of finished concrete surface.

G. Finishing

1 Strike off the surface with a template and finish the surface with a wood float using heavy pressure, after which, contraction joints shall be made and the surface finished with a wood float or steel trowel.

2 Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius indicated on the Drawings.

3 Finish edges with an approved finishing tool having a 1/4-inch radius.

4 Provide a final broom finish by lightly combing with a stiff broom after troweling is

complete.

5 The finished surface shall not vary more than 1/8-inch in 10 feet from the established grade.

H. Driveway and Sidewalk Ramp Openings

1 Provide driveway openings of the widths and at the locations indicated on the Drawings and as directed by the Engineer.

2 Provide sidewalk ramp openings as indicated on the Drawings, in conformance with the applicable regulations and as directed by the Engineer.

I. Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured. Provide necessary barricades to protect the work. All damage caused by people, vehicles, animals, rain, the Contractor's operations and the like shall be repaired by the Contractor, at no additional expense to the Owner.

3.4 MAINTENANCE

A. The Contractor shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the Project. Maintenance shall include replacement, scraping, reshaping, wetting and rerolling as necessary to prevent raveling of the road material, the preservation of reasonably smooth surfaces and the repair of damaged or unsatisfactory surfaces, to the satisfaction of the Engineer. Maintenance shall include sprinkling as may be necessary to abate dust from the gravel surfaces.

3.5 SUPERVISION AND APPROVAL

A. Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment.

B. Obtain the Engineer's approval of restoration of pavement, such as private roads and drives that are not the responsibility of a regulatory agency.

C. Complete pavement restoration as soon as possible after backfilling.

D. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the Contract, including the bonded period, promptly restore or repair defects.

3.6 CLEANING

A. The Contractor shall remove all surplus excavation materials and debris from the street surfaces and rights-of-way and shall restore street, roadway or sidewalk surfacing to its original condition.

END OF SECTION

SECTION 03100 – CONCRETE FORMING AND ACCESSORIES

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division -01 Specification sections, apply to work of this section.

B. State Department of Transportation and County/Municipalities Standard Specifications and Details.

1.2 DESCRIPTION OF WORK

A. The work of this section includes all labor, materials and equipment required to form all cast-in-place concrete shown on the drawings including but not limited to all slabs, joists, beams, columns, walls, stairs, and equipment pads.

1.3 CODES AND STANDARDS

A. Comply with the provision of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1 ACI 301 "Specifications for Structural Concrete for Buildings"

2 ACI 318 "Building Code Requirements for Reinforced Concrete"

3 ACI 117 "Specifications for Tolerances for Concrete Construction and Materials".

4 Concrete Reinforcing Steel Institute " Manual of Standard Practice"

5 Arizona Department of Transportation Standard Specifications

6 Maricopa Association of Governments Standard Specifications

1.4 RESPONSIBILITY

A. The design, construction and safety of all formwork shall be the responsibility of the General Contractor. All forms, shores, backshores, falsework, bracing, and other temporary supports shall be engineered to support all loads imposed including the wet weight of concrete, construction equipment, live loads, lateral loads due to wind and wet concrete imbalance. The Contractor shall also be responsible for determining when temporary supports, shores, backshores, and other bracing may be safely removed.

1.5 DESIGN RESPONSIBILITY

A. The design of all concrete formwork, formwork removal, shoring, and backshoring requirements shall be performed by a registered professional engineer in the state where the project is located and experienced in the design of concrete formwork. The Contractor shall employ the formwork engineer. Calculations, sealed by the registered professional engineer, shall be issued for Owner's record but will not be reviewed or returned.

1.6 SUBMITTALS

A. Design Calculations: Submit for record calculations of all concrete formwork and the shoring plan sealed by a registered engineer in the state where the project is located.

B. Formwork Drawings: Formwork Drawings, prepared under the supervision and sealed by a registered professional engineer in the state where the project is located, shall be submitted for Owners record and shall be reviewed by the Engineer for conformance to structural layout only. Such shop drawings shall indicate types of materials, sizes, lengths, connection details, design allowance for construction loads, anchors, form ties, shores, braces, construction joints, reveals, camber, openings, formwork coatings and all other pertinent information.

C. Pan Form Shop Drawings: The Contractor shall submit pan shop drawings for Engineer's review and approval. Approval will be for conformance to structural layout only.

D. Shoring Plan: Submit drawings to indicate the number of levels of shoring, proposed time and sequence of formwork and shore removal, minimum concrete strength for stripping of forms and shore removal, assumed construction loads, amount and layout of shores (specify whether backshores or reshores), and length of time shores are to be left in place. This plan shall be strictly followed by the Contractor. Shoring plans are to be submitted for Owner's record only and will not be reviewed or returned.

PART 2 -PRODUCTS

2.1 PAN FORMS

A. Specification: Unless specified otherwise, concrete joist construction shall conform to Manual of Standard Practice, Chapter 10, as published by CRSI.

B. Material and Pan Type:

1 Material: Pans shall be fabricated either of steel that is free of dents, irregularities, sag and rust or of glass-fiber reinforced plastic that is molded under pressure with matched dies. Pan forms allowing warped surfaces, leakage of concrete at joints, and uneven surfaces beyond tolerance levels will not be acceptable.

2 New or Reconditioned Pans. Subject to pan tolerance and surface finish requirements below, pan joist forms may be either new pans or reconditioned pans at Contractor's option. Forms may be "long forms", "flange forms", "long flange forms", or "adjustable forms" at Contractor's option. Pan splices may be lapped, reinforced butt jointed, or semi-butt jointed (using end caps welded back to-back with 2" maximum distance between pan ends). The use of flange forms with lapped or semi-butt splice joints shall be limited to Class D and C surface finishes only. The maximum number of joints in any bay shall be four located at approximately the one-fifth points in each bay.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Unless otherwise specified, formwork for exposed concrete surfaces as noted on the drawings, shall consist of plywood, metal, metal framed plywood, or other acceptable surface. Formwork shall provide a continuous straight and smooth surface conforming to the joint system as specified on the Architect's drawings. Form material shall have sufficient thickness to withstand pressure of concrete without bow or deflection. Plywood shall be exterior grade plywood panels, suitable for concrete forms, complying with U.S. Product Standard PS-1, each piece bearing a legible inspection trademark, and as follows:

1. Phenolic Surface Film Overlay over Hardwood Face, Class 1 or better.
2. High Density Overlay (100/30 min. rating) on Hardwood Face, Class 1or better.

3. High Density Overlay (100/30 min. rating) on Softwood Face, Class 1 or better
4. Medium Density Overlay on Hardwood Face, Class 1 or better, mill-release agent treated and edge sealed.
5. Medium Density Overlay on Softwood Face, Class 1 or better, mill-release agent treated and edge sealed.
6. Structural 1, B-B, or better, mill oiled and edged sealed.
7. "B-B (Concrete Form) Plywood", Class 1, or better, mill-oiled and edge sealed.

B. Rough-formed finished concrete: Unless otherwise specified, the default finish for formed surfaces shall be rough-form finish constructed with plywood, lumber, metal or other acceptable material. Lumber shall be dressed on at least two edges and one side for tight fit. The minimum grade shall be B-C, exterior grade.

C. Textured-form finished concrete: For exposed surfaces as noted on the drawings provide units of form face design, size, arrangement and configuration that matches Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners. See Architect's drawings, specifications and control sample for special form textured finish concrete.

2.3 CYLINDRICAL COLUMNS AND SUPPORTS

A. Round section members shall be formed with metal, fiberglass, reinforced plastic, paper or fiber tubes, unless otherwise specified. Paper or fiber tubes shall be constructed of laminated plies using water-resistant adhesive with wax impregnated exterior for weather and moisture protection. Units shall have sufficient wall thickness to resist loads imposed by wet concrete without detrimental deformation.

2.4 FORMWORK COATINGS

A. Formwork coatings shall be a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces or impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede curing with water or curing compounds. Provide a product that has a maximum VOC (Volatile Organic Compounds) of 50 g/l but not greater than that permitted by the local government agency having jurisdiction in the area where the project is located.

Products: Subject to compliance with requirements, provide one of the following:

"Enviroform", Conspec Marketing and Manufacturing Co., Inc. "Cast-Off WB", Sonneborn Building Products “Farm Fresh”, Unitex "Formshield WB"; Tamms Industries “Form-Eze Natural”, The Euclid Chemical Company, Inc. “Bio-Form”, Universal Form Clamp “Aqua Blue”, US Spec

2.5 NAILS AND FASTENERS

A. Use only galvanized nails and fasteners for securing formwork in structures exposed to weather or unconditioned spaces such as garages, canopies and porte-cocheres.

2.6 FORM TIES

A. Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to minimize spalling of concrete on removal.

1 Exposed Surfaces: For surfaces designated with Class A and B finish tolerances, furnish units that will leave no portion of the tie closer than 3/4 inch to the plane of the concrete surface and that will leave holes not larger than 1 inch in diameter in concrete surface when the ends or end-fasteners have been removed.

2 Dampproofed Surfaces: Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

3 Exposed to Weather or Unconditioned Space: Provide removable, glass-fiberreinforced plastic, stainless steel, or galvanized form ties that will leave no corrodible metal closer than 1 1/2 inches in surfaces that will be exposed to weather or in an unconditioned space in the final structure. The ties shall leave holes no larger than 1 inch in diameter in concrete surfaces when the ends or end-fasteners are removed.

2.7 CHAMFER STRIPS

A. Provide wood, metal, PVC, or rubber strips, ¾ by ¾ inch, minimum.

PART 3 -EXECUTION

3.1 FABRICATION AND CONSTRUCTION

A. Design, erect, support, brace and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic construction loads that might be applied until the concrete structure can support such loads.

B. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

D. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and patch forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges as indicated, using specified chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

H. Pan Form Fabrication and Construction:

1. Factory fabricate pan form units to specified sizes and shapes as indicated on the drawings. Units shall be designed for easy removal without damaging placed concrete. Units shall be properly shored and adjoining pan units shall be blocked if required to prevent lateral or vertical deflection of formwork during concrete placement.
2. Load Distribution Ribs: Provide load distribution ribs at least 5" wide for all pans 30" wide and narrower and elsewhere where indicated on the drawings. Minimum rib spacing shall be:
   a. None in spans less than 20 feet.
   b. One near the center of spans 20 to 30 feet.
   c. Two near the third points of spans over 30 feet.

   Discontinue ribs between two adjacent joists that have differences in span larger than 33%, between a joist and an adjacent parallel wall, and between a joist and an adjacent parallel beam that is 1 ½ or more times wider than the joist.

3.2 CLEANING AND TIGHTENING

A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and all other debris just prior to concrete placement. Retighten forms and bracing prior to concrete placement as required to prevent mortar leaks and maintain proper alignment.

3.3 CLEANING AND RE-USE OF FORMS

A. Forms reused in the work shall be repaired and cleaned. Split, frayed, delaminated, or otherwise damaged facing material will not be acceptable for exposed surfaces. Forms intended for successive concrete placement shall have surfaces cleaned, fins and laitance removed, and joints tightened to avoid surface offsets. New form coating compound shall be applied to reused forms. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.4 TOLERANCES

A. Unless specified otherwise, all tolerances for concrete formwork shall conform to ACI Standard 117, "Standard Tolerances for Concrete Construction and Materials". Before concrete placement the Contractor shall check lines and levels of erected formwork and make any corrections and adjustments as required to ensure proper size and location of concrete members and stability of forming systems. During concrete placement the Contractor shall check formwork and supports to ensure that forms have not displaced and that completed work will be within specified tolerances.

B. Construct forms so as to limit the offset between adjacent pieces of formwork facing material in accordance with the following classifications as defined in ACI 117. The offset limits shall apply to both abrupt and gradual variations in the surface.

1 Surfaces prominently exposed to public view in the completed structure where appearance is of special importance or architecturally exposed concrete as identified on the drawings -Class A, 1/8 inch.

2 Surfaces scheduled to receive plaster, stucco, or wainscoting -Class B, 1/4 inch.

3 Other surfaces that are exposed to view but not scheduled to receive other finishes, except those formed by pans -Class C, 1/2 inch.

4 Surfaces that are permanently concealed from public view in the completed structure – Class D, 1 inch.

C. Pan Construction Surface Tolerance – Discontinuities in the concrete surface:

1 At typical pan construction unless noted otherwise (with lapped splice or semi-butt joint splices, new or reconditioned pans): Class D, 1 inch.

2 At pan construction exposed to view but not scheduled to receive other finishes (with lapped splice or semi-butt joint splice, new pans only) – Class C, 1/2 inch.

3 At pan construction prominently exposed to view where appearance is of special importance, (no splice or reinforced butt-joint splices, new pans only): Class B, 1/4 inch.

4 At pan construction scheduled to receive plaster, stucco, or wainscoting (no splice or reinforced butt-joint splice, new pans only): -Class B, 1/4 inch

D. Prior to each concrete pour, the Contractor shall engage a qualified surveyor to verify that work is within specified tolerances. The surveyor shall report in writing to the Architect, Engineer and Contractor certifying that the work is acceptable or indicating any deviations from allowable tolerances.

3.5 SHORES AND SUPPORTS

A. Definitions

1 Shores: Vertical or inclined support members designed to carry the weight of formwork, concrete, and construction loads above.

2 Reshores: Shores placed snugly under a stripped concrete structural member after the original forms and shores have been removed from the member, thus requiring the member to carry its own weight and superimposed construction loads at the time of installation. Reshores are assumed to carry no load at the time of installation. After the installation of reshores, superimposed construction loads are assumed to be distributed among all members connected by reshores.

3 Backshores: Shores placed snugly under a stripped concrete structural member after the original formwork and shores have been removed from a small area without allowing the structural member to deflect or support its own weight or superimposed construction loads. It is assumed that backshores carry the same load as that carried by the original shores they replace.

Comply with requirements of ACI 301 for shoring, reshoring and backshoring in concrete construction and as herein specified where more stringent.

B. Design: Shores and reshores or backshores must be designed to carry all loads transmitted to them. A rational analysis should be used to determine the number of floors to be shored, reshored, or backshored, subject to the minimums stated in the following paragraph, and to determine the loads transmitted to the floors, shores and reshores or backshores as a result of the construction sequence. The analysis should consider, but should not necessarily be limited to, the following:

1. Structural design load of the slab or member including live load, partition loads, and other loads for which the engineer designed the slab. The live load reduction factors for the design of certain members are shown on the structural drawings. The reduced live load and an allowance for construction loads shall be taken into consideration when performing the analysis.

2. Dead load weight of the concrete and formwork.

3. Construction live loads, such as placing crews and equipment or stored materials.

4. Design strength of concrete specified.

5. Cycle time between placement of successive floors.

6. Strength of concrete at time it is required to support shoring loads from above.

7. The distribution of loads between floors, shores, and reshores or backshores at the time of placing concrete, stripping formwork, and removal of reshoring or backshoring.

8. Span of slab or structural member between permanent supports.

9. Type of formwork systems, i.e., span of horizontal formwork components, individual shore loads, etc.

10. Minimum age where appropriate.

11. Alignment of shores. Where possible, Shores for any floor shall be placed directly above previously placed shores so that load will be transferred directly to such shores.

3.6 REMOVAL OF FORMS AND SUPPORTS

A. Determination by Contractor's Registered Engineer: The Contractor's registered engineer shall determine and submit for Owner's record the time and sequence of formwork and shore removal subject to the criteria as specified below. The submittal shall clearly distinguish between reshoring and backshoring procedures.

B. Determining *in situ* Strength of Concrete: The General Contractor shall be responsible for making and curing concrete cylinders, cured under field conditions, for the purpose of determining concrete strength at time of form and shore removal. Such cylinders shall be made by the Contractor and tested by his testing laboratory. Alternatively, the *in situ* strength of concrete may be determined by the Maturity Method following the requirements of ASTM C 1074. An acceptable system for this method is the "*intelli*Rock" system manufactured and supplied by Engius Constructive Intelligence of Stillwater, OK.

C. Records of Weather Conditions: The General Contractor shall be responsible for keeping records of weather conditions to be used in the decision on when to remove forms.

D. Formwork Not Supporting Concrete: Formwork not supporting concrete such as sides of beams, walls, columns and similar parts of the structure, may be removed after cumulatively (not necessarily consecutively) curing at not less than 50°F for 12 hours after placing concrete, provided the concrete is sufficiently hard so as not to be damaged by form removal operations and provided curing and protection operations are maintained. If ambient air temperatures remain below 50°F, if retarding agents are used, or if Type II and Type V portland cement is used, then this specified minimum period should be increased as required to safely remove the forms without damage to the concrete. Where such forms also support formwork for slab or beam soffits, the removal times of the latter shall govern.

E. Formwork Supporting Weight of Concrete: Formwork supporting weight of concrete such as beam soffits, joists, slabs and other structural elements shall not be removed until concrete has attained at least the following percentages of the design minimum 28 day compressive strength:

Joists, Beam Bottoms -75%, but not less than 2800 psi Slabs - 75%, but not less than 2800 psi

F. Placing Reshores and Backshores:

1 All shoring operations shall be carried out in accordance with a planned sequence as determined by the Contractor's shoring engineer.

2 Shoring operations shall be performed so that at no time will areas of new construction be required to support combined dead and construction loads in excess of the available strength as determined by the design loads (as specified in the General Notes) and the developed concrete strength (as determined by field cured cylinders) at the time of stripping and reshoring or backshoring.

3 Shores (backshores or reshores) shall not be removed until the structural member supported has sufficient strength to support all applied loads.

4 For backshoring operations, the forms shall be removed in such a manner that individual structural members are not allowed to deflect and carry load.

5 Reshoring operations require that the structural members be strong enough to safely support their own weight before stripping of formwork.

6 For reshoring operations, no structural member shall be overstressed under its own dead weight plus the weight of the floors above and construction loads assigned to the structural member by a rational analysis that accounts for the relative stiffness of each floor with due consideration of concrete age and strength. While reshoring is underway, no construction loads shall be permitted on the new construction unless it can safely support the construction loads.

7 Where possible, shores shall be located in the same position on each floor so that they will be continuous in their support from floor to floor.

G. Post Tension Construction: Formwork supporting post-tensioned floor construction, including shores, reshores and backshores shall be designed to support any additional loads produced by the stressing operation.

END OF SECTION 03100

SECTION 03200– CONCRETE REINFORCING

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The work of this section includes labor, materials, hardware, equipment, transportation and services required to fabricate and place all reinforcement for cast-in-place concrete including bars, welded wire fabric, ties and supports shown on the drawings and as specified. Prestressing reinforcement is specified in Post-Tensioned Concrete and/or Precast Concrete sections of the specifications.

1.3 QUALITY CONTROL

A. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

B. Codes and Standards: Comply with all provisions of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1 ACI 301 -"Specifications for Structural Concrete for Buildings".

2 ACI 117 -'Specifications for Tolerances for Concrete Construction and Materials."

3 Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

4 ANSI/AWS D1.4 “Structural Welding Code – Reinforcing Steel”

5 State Department of Transportation Standard Specifications

1.4 SUBMITTALS

A. Shop Drawings: Submit shop drawings for all reinforcing steel and related accessories for the Engineer's approval. Shop drawings shall show arrangement and layout, bending and assembly diagrams, bar schedules, stirrup spacing, splicing and laps of bars and shall be prepared in accordance with CRSI Standards.

B. Mill Certificates: Submit, for record, mill certificates and/or test results signed by Contractor and Producer, for all reinforcement.

C. Product Data: Submit manufacturer’s product data with application and installation instructions for proprietary materials and items, including mechanical splices, hooked anchorage systems, large-headed stud punching shear reinforcement, dowel bar substitute systems, and dowel bar sleeves.

D. International Code Council (ICC) Evaluation Service Reports: Submit evaluation service reports of approval from ICC Evaluation Service, Inc. for mechanical splice, hooked anchorage systems, large-headed stud punching shear reinforcement and dowel bar substitute systems.

1.5 PREINSTALLATION CONFERENCE

A. The Reinforcing-Placing subcontractor shall attend the Pre-Concrete Conference conducted by the Concrete Contractor as described in Specification Section “Cast-in-Place Concrete”.

1.6 TESTING AND INSPECTION

A. Perform all tests and inspections of reinforcing steel as specified herein.

B. Any testing laboratory retained to run tests required by this specification shall meet the basic requirements of ASTM E 329.

PART 2 -PRODUCTS

2.1 MATERIALS

A. Reinforcement:

1. Reinforcing materials shall be delivered from the mill in bundles that are identified as to heat number and manufacturer and accompanied with mill and analysis test reports and an affidavit from the supplier stating that the material conforms to the requirements of the governing ASTM specification listed herein.

2. Deformed bar material that is not identifiable according to the criteria listed above shall be tested for tensile strength and bend tests according to ASTM A 615 on a sample of 2 bars for each ten tons or fraction thereof of unidentified material for each bar size. The bars shall be a minimum of 24 inches long. Bend tests are not required for #14 and # 18 bars. Submit the results of such tests for record.

3. Reinforcing Bars: Reinforcing bars shall conform to ASTM A 615 Grade 60 as noted on the drawings.

4. Weldable Reinforcing Bars: All reinforcing bars noted on the drawings as being required to be welded shall conform to ASTM A 706.

5. Use Reinforcing steel made from 100% recycled material, 2/3 of which shall be post-consumer material. A minimum of 50% of the material in the reinforcement must have been extracted, harvested, or recovered as well as manufactured, within 500 miles of the project site.

6. Deformed Bar Anchors: ASTM A 496 with a minimum yield strength of 70,000 PSI. Standard ASTM A 615 Grade 60 or Grade 40 reinforcing bars may not be substituted for deformed bar anchors.

7. Plain Steel Welded Wire Reinforcement: ASTM A 185 with a yield strength of 65,000 PSI. Provide in flat sheets only.

8. Strands: Uncoated seven wire, one half inch diameter, stress relieved 270 ksi strand low relaxation type, ASTM A 416 "Specification for Uncoated Seven Wire Stress Relieved Strand for Prestressed Concrete" and "Specification for Unbonded Single Strand Tendons” as published by the Post-Tensioning Institute.

9. Wire: Smooth wire for spiral reinforcement shall conform to ASTM A 82 with a minimum yield strength of 70,000 PSI.

10. Joint Dowel Bars: Smooth bars used to dowel across slab-on-grade construction joints shall conform to ASTM A 615, Grade 40 or ASTM A 36, plain-steel bars. Cut bars true to length with ends square and free of burrs

11. Dowel Bar Sleeves: Plastic or gage metal (26 ga. min.) sleeves with an inside diameter of 1/16 inch greater than the dowel bar that it encases, that have the strength, durability, and design to provide free movement of the dowel relative to the concrete slab and that are specifically manufactured for this purpose.

12. Alternate Slab-on-Grade Joint Load Transfer Systems: A system that consists of flat, ASTM A 36 plate that is saw cut into a square or rectangular shape and is embedded into or encased by a plastic sleeve that allows movement in both lateral directions but not in the vertical direction. Acceptable systems are manufactured by PNA Construction Technologies with products known by the names “Diamond Dowel System” and “PD3 Basket” and Greenstreak Group Inc. with products known as “Speed Plate’ and “Double-Tapered Basket”.

13. Tie Wire: Tie wire shall be annealed steel tie wire, minimum 16 gauge.

a. Tie wire in architecturally exposed concrete shall be plastic coated or stainless steel.

14. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations.

a. Slabs-on-Grade: Use precast concrete bar supports (dobies) or supports with sand plates or horizontal runners designed for use on ground.

b. Spread Footing Bottom Reinforcement: Use precast concrete bar supports (dobies) or chairs designed for soil-supported slabs.

c. Exposed to View Concrete: Provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

B. Coating Repair Materials: Repair damaged areas of epoxy-coated or galvanized reinforcement using the following products.

1. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc shall be used to repair damaged areas of galvanized reinforcement.

2.2 SPLICES

A. End Bearing Compression Splices: Members with end bearing compression splices shall have vertical bars saw cut or otherwise finished for true bearing. Bar ends shall terminate in flat surfaces within 1 1/2 degrees of a right angle to the axis of the bars and shall be fitted within 3 degrees of full bearing after assembly. Splice bars shall be held in concentric contact by a suitable device. The following are acceptable end bearing compression devices:

"Speed Sleeve", Erico Products, Inc. "G-Loc", BarSplice Products, Inc. or other Engineer-approved product.

B. Mechanical Tension Splices:

1. Mechanical splices shall conform to Type 1 and Type 2 splices.

a. Type 1 splice shall develop 1.25 times the specified yield strength of the splice bar.
b. Type 2 splice shall meet the requirements of Type 1 splice and, in addition, develop the full tensile strength of the splice bar.

2. The bar ends that are to attach to the splice shall be prepared and installed in accordance with the manufacturer's requirements. Splices shall be approved by the ICC-Evaluation Service, Inc and shall have the Evaluation Report submitted for Engineer review. The following are acceptable mechanical tension splices (splices qualified for use with grade 75 bars are parenthetically noted):

"ZAP Screwlok", BarSplice Products, Inc. (qualified for use with grade 75 bars)
"BPI Grip XL System", Barsplice Products, Inc. "Taper Threaded Grip Twist System", Barsplice Products, Inc. "Lenton Coupler", Erico Products, Inc. (for grade 75 bars, use only "Standard Coupler") "NMB Splice Sleeve", Splice Sleeve North America" (qualified for grade 75 #7 bars and higher) "BarLock, L-Series", Dayton Superior "Taperlok Couplers", Dayton Superior "Lenton Interlok", Erico Products, Inc. "Griptec", Dextra Manufacturing Co.
or other Engineer-approved product.

C. Dowel Bar Replacement: All grade 60 reinforcing steel dowel bars shown on the drawings crossing concrete construction joint surfaces with inserts cast flush against the form and having reinforcing bars connected to the insert in a subsequent concrete pour shall conform to the following:

1 Splice connection to the insert shall develop the 1.25 times the specified yield strength and the full tensile strength of the spliced bar.

2 Splices shall be approved by the ICC Evaluation Service, Inc. as expressed in an ICC Evaluation Service Report.

3 The following are acceptable products (for use only with grade 60 bars):

"Lenton Form Saver", , Erico Products, Inc. "DB-SAE Dowel Bar Splicer", Dayton/Richmond, Inc. or other Engineer-approved product.

D. Hooked Anchorage Replacement: Reinforcing bar terminations shall be manufactured out of ASTM A 576 material and shall develop the full tensile strength of the bar when installed at the manufacturer's recommended depth. The Anchorage shall be approved by the ICC Evaluation Service Inc. as expressed in an ICC Evaluation Service Report. The following are acceptable products (for use only with grade 60 bars):

"Lenton Terminator", Erico Products, Inc. or other Engineer-approved product.

PART 3 -EXECUTION

3.1 FABRICATION AND DELIVERY

A. Bending and Forming: Fabricate bars of indicated sizes and accurately form to shapes and lengths indicated and required, by methods not injurious to materials. Do not heat reinforcement for bending. Bars shall be free from injurious defects, have a workmanlike finish with no excessive rust and/or pitting and have no unusual kinks or bends.

B. Marking and Shipping: Bundle reinforcement and tag in accordance with Section 7.4.5 of the CRSI “Manual of Standard Practice”. Transport and store at site so as not to damage material. Keep sufficient supply of tested, approved and proper reinforcement at the site to avoid delays. Maintain reinforcing bars free of mud, dirt, grease, or other coating.

3.2 PLACING REINFORCEMENT

A. Comply with CRSI recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified.

B. Before placing reinforcement and again before concrete is placed, clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by chairs, runners, bolsters, spacers and hangers, as required. Exercise particular care to maintain proper distance and clearance between parallel bars and between bars and forms. Provide spreaders and spacers to hold steel in position. Support steel at proper height upon approved chairs.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set tie wires so ends are directed into concrete, not toward exposed concrete surfaces.

E. Support of Spread Footing Reinforcing Steel

1 Bottom Steel: Support bottom reinforcing mat to provide the specified clearance to the bars. Spacing between supports shall not exceed 4'-0" centers each way.

2 Top Steel: Support top reinforcing on steel angle frames braced in both directions or on special standee support bars. Spacing between supports shall not exceed 4'-0" centers each way. The depth of the supports shall provide the specified clearance from the bars to the top of the concrete. The design of the support steel shall be the responsibility of the Contractor.

F. Install welded wire reinforcement in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus two inches and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

G. Coordinate with other trades and expedite materials and labor to avoid omissions and delay.

H. Install waterproof membrane or vapor barrier as specified prior to placing steel for concrete slabs-on-grade.

I. Extend reinforcement continuous through construction joints unless otherwise shown on the drawings.

J. Slab-on-Grade Joint Dowel Bars: Support slab-on-grade joint dowel bars independently of support for slab reinforcement on soil supported slab bolsters or specially manufactured cradles such that dowel bar remains parallel to slab surface and at right angles to joint during concreting operations. Lightly coat the exposed end of the dowel with a paraffin-base lubricant, asphalt emulsion, form oil, or grease or use a dowel bar sleeve.

K. Alternate Slab-on-Grade Joint Load Transfer Systems: Install the alternate load transfer system in accordance with the manufacturer's instructions such that the largest plane of the flat plate is parallel to the plane of the subgrade on which the slab is bearing.

L. Provide and place additional reinforcing steel at all sleeves and openings in beams, slabs and walls as specified on the drawings. Where sleeves or openings not shown on the drawings interrupt the reinforcement, consult with Engineer for instructions for placing and splicing of bars. Provide required additional reinforcing steel at no additional cost to the Owner.

3.3 SPLICING REINFORCING STEEL

A. Provide splice as indicated on the drawings. Splice reinforcing bars only at locations shown on the structural drawings and approved shop drawings. Unauthorized or unscheduled splices not approved by the Engineer in writing will not be accepted.

B. All lap splices in reinforcing steel shall be contact lap splices unless detailed otherwise on the drawings.

C. Maintain proper cover between reinforcing bars at splices.

D. Lap unscheduled reinforcing bars not otherwise specified a minimum of 30 bar diameters at splices. Lap welded wire fabric a minimum of one full wire mesh plus two inches.

E. Manufacturer of mechanical tension splice shall be present for first day's installation.

3.4 WELDING REINFORCING STEEL

A. Welding reinforcing steel is permitted only where specifically shown on the drawings. All welding shall conform to AWS D1.4. Only weldable reinforcing steel conforming to ASTM A 706 or deformed bar anchors conforming to ASTM A 496 shall be permitted. ASTM A 615 bars may not be welded for structural use.

B. Tack welding of reinforcement shall only be allowed for preassembled mats and cages.

3.5 SHRINKAGE AND TEMPERATURE REINFORCEMENT

A. Provide shrinkage and temperature reinforcement as indicated on the drawings at right angles to main top and bottom bars for all structural slabs unless detailed otherwise on the drawings.

3.6 PLACEMENT OF WELDED WIRE REINFORCEMENT

A. Wherever welded wire reinforcement is specified as reinforcement in pan-formed beams or slabs, it shall be continuous and properly lapped one full wire spacing plus 2" across the entire concrete surface and not interrupted by beam or girders.

3.7 REINFORCEMENT IN JOIST DISTRIBUTION RIBS

A. Provide reinforcement in ribs, minimum one -#5 continuous top and bottom unless indicated otherwise on the drawings.

3.8 REINFORCEMENT IN PAN-FORMED BEAM SLABS

A. Reinforcement: Provide reinforcing in pan-formed beam slabs as shown on the drawings.

B. Placement of Slab Reinforcement: Provide required bar supports and additional reinforcing as shown in details on the drawings to support slab reinforcing with the clear cover shown on the drawings.

3.9 REINFORCEMENT IN GRADE BEAMS

A. Provide reinforcing in grade beams as shown on the drawings.

B. Bar Support for Grade Beam Cages: Grade beam bottom steel shall be supported at 5'0" maximum centers using beam bolsters that provide 3" bottom cover to the reinforcing steel. Beam bolsters used shall be designed and manufactured for support on soil.

3.10 REINFORCEMENT IN TOPPING SLABS

A. Provide welded smooth wire reinforcement minimum 6 x 6 W1.4 x W1.4 in all topping slabs unless specified otherwise on the drawings.

3.11 REINFORCEMENT IN HOUSEKEEPING PADS

A. Provide welded smooth wire reinforcement 6 x 6 W2.9 x W2.9 minimum in all housekeeping pads supporting mechanical equipment unless detailed otherwise on the drawings.

3.12 REINFORCEMENT IN SIDEWALKS

A. Provide welded smooth wire reinforcement minimum 6 x 6 W1.4 x W1.4 in all sidewalks unless detailed otherwise on the Architectural, Civil, or Structural Drawings.

3.13 MECHANICAL AND PLUMBING REQUIREMENTS

A. Refer to Mechanical and Plumbing Drawings for concrete requiring reinforcing steel. Such reinforcement shall be furnished as part of the work of this section.

3.14 QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

A. See Testing Laboratory Services section of these Specifications for reinforcing inspection and testing requirements.

END OF SECTION 03200

SECTION 03300 – CAST-IN-PLACE CONCRETE

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section. All work shall be performed in accordance with State DOT Standard Specifications and Details.

1.2 DESCRIPTION OF WORK

A. Extent of concrete work is shown on drawings, including schedules, notes and details which show size and location of members and type of concrete to be poured. Furnish all labor, materials, services, equipment and hardware required in conjunction with or related to the forming, delivery and pouring of all poured-in-place concrete work.

B. Concrete paving and walks are specified in Division 02.

C. Concrete Formwork, Reinforcement, Architectural Concrete, Precast Concrete, Post-Tensioned Concrete are specified in other Division-03 sections.

1.3 QUALIFICATIONS

A. The concrete supplier shall have a minimum of five years experience in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment. The supplier must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

B. The concrete contractor shall have a minimum of five years experience with installation of concrete similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful –service performance.

C. Any testing laboratory retained to run tests required by this specification shall meet the basic requirements of ASTM E 329.

1.4 QUALITY CONTROL

A. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

B. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. ACI 301 – "Specifications for Structural Concrete for Buildings".
2. ACI 117 – 'Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 318 – "Building Code Requirements for Reinforced Concrete".
4. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

C. Document Conflict and Precedence: In case of conflict among documents, including architectural and structural drawings and specifications, notify the Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.

D. Inspection and Testing of the Work: Materials and installed work may require testing and retesting, as directed by the governing building code or the Architect/Engineer, at any time during progress of work. The Contractor shall provide adequate notification to the Owner's Testing Agency of construction operations including the project schedule to allow the Testing Agency to schedule inspections. The Contractor shall make adequate arrangement with the Owner's Testing Agency for inspection of

material stockpiles and facilities. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents.

E. Acceptance Criteria for Concrete Strength: The strength level of an individual class of concrete shall be considered satisfactory if both the following requirements are met:

1. The average of all sets of three consecutive strength tests equal or exceed the required f'c.

2. No individual strength test falls below the required f'c by more than 500 psi.

3. A strength test is defined as the average strength of two 6" x 12" cylinder breaks or three 4" x 8" cylinder breaks tested at the strength age indicated on the drawings for that class of concrete.

F. Responsibility for Selection and Use of Concrete Admixtures and Chemical Treatments: The Contractor shall be responsible for selecting admixtures and surface treatments that are compatible with the intended use of the concrete including all final surface treatments called for within this or other specifications or on the structural or architectural drawings. The Contractor is responsible for following the manufacturer's instructions for the use of their product including abiding by any limitations placed by the manufacturer on the use of any of its products.

G. Survey for Anchor Rods and Reinforcing Steel Dowels: The Contractor shall use a qualified surveyor to lay out the proper location of all embedded anchor rods and reinforcing steel dowels for columns above before they are encased in concrete. The surveyed locations of such elements shall be submitted to the Architect/Engineer for record.

1.5 PREINSTALLATION CONFERENCES

A. Mix Design Conference: At least 30 days prior to submittal of concrete design mixes, the Contractor shall hold a meeting or telephone conference to review the detailed requirements for preparing the concrete mix designs. Participants shall include representatives from the Contractor, Owner's Testing Laboratory, Concrete Supplier, Architect, and Engineer.

B. Pre-Concrete Conference:

1. At least 7 days prior to beginning concrete work, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss required methods and procedures to produce concrete construction of the required quality. Also review requirements for submittals, status of coordinating work and availability of materials. Establish work progress schedule and procedures for materials inspection, testing and certifications. The contractor shall send a pre-concrete conference agenda to all attendees 7 days prior to the scheduled date of the conference.

2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

   Contractor's Superintendent
   Laboratory responsible for the concrete design mix
   Laboratory responsible for field quality control
   Concrete Subcontractor
   Ready-Mix Concrete Producer
   Admixture Supplier
   Concrete Pumping Contractor
   Owner's and Architect's/Engineer's Representative

3. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:

   Owner's Representative
   Architect
   Engineer-of-Record

4. The Engineer shall be present at the conference. The Contractor shall notify the Engineer at least 7 days prior to the scheduled date of the conference.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including admixtures, patching compounds, epoxies, grouts, waterstops, joint systems, curing compounds, dry-shake finish materials, hardeners, sealers mechanical splices, hooked anchorage systems, dowel bar substitute systems, dowel bar sleeves, and others as requested by Architect/Engineer.

B. Samples: Submit samples of materials specified if requested by Architect/Engineer, including names, sources and descriptions.

C. Mix Designs: Submit mix designs as specified herein.

D. Material and Mill Certificates: Provide material and mill certificates as specified herein and in the Testing Laboratory section of the Specifications. The Manufacturer and Contractor shall sign the material and mill certificates certifying that each material item complies with specified requirements. Provide certification from admixture manufacturers that chloride ion content complies with specified requirements.

E. Construction Joints: Submit drawing of proposed construction joint locations in concrete for slab on grade, mat foundations, structural floors, roofs and walls. Submit any additional or changed reinforcing that is required at construction joints that differs from that shown on the drawings.

F. Minutes of preconstruction conference.

G. Surveys: Submit report certifying that all anchor rods and reinforcing dowels into columns above are in their proper location prior to placing of concrete.

1.7 PROVISION FOR OTHER WORK

A. Provide for installation of inserts, hangers, metal ties, anchors, bolts, angle guards, dowels, thimbles, slots, nailing strips, blocking, grounds and other fastening devices required for attachment of work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Do not install sleeves in any concrete slabs, beams or columns except where shown on the drawings or upon written approval of the Architect/Engineer.

B. Protect adjacent finish materials against damage and spatter during concrete placement.

PART 2 -PRODUCTS

2.1 CONCRETE MATERIALS

Refer to the drawings for classes and strengths of concrete required.

A. Portland Cement: ASTM C 150, Type I or Type III, or ASTM C 1157, Type GU or HE unless otherwise approved by the Architect/Engineer. For concrete exposed to salt air or salt water, provide Type II or Type V cement.

1. Use one brand of cement, for each class of concrete, throughout the project, unless approved otherwise by the Architect/Engineer and the Owner's Testing Laboratory. Submit mill certificates certifying conformance to this specification for each brand and type of cement.

2. Testing of cement in lieu of mill certificate submittal will be required if:

   a. The cement has been in storage at the mixing site for over 30 days

   b. It is suspected by the Owner, Architect, Engineer or Owner's Testing Laboratory that the cement has been damaged in storage or in transit or is in any way defective.

B. Fly Ash: ASTM C 618, Class C or F.

C. Silica Fume: ASTM C 1240, Amorphous Silica.

D. Slag Cement: ASTM C 989, Grade 100 or 120 or ASTM C 595, Type IS or Type S.

E. Normalweight Aggregates: ASTM C 33, and as herein specified. Submit material certificates from aggregate supplier or test results from an independent testing agency certifying conformance to this specification for each source of aggregate.

1. 1. Submit certification that aggregate does not contain any deleterious materials that react with alkalis in the concrete mix to cause excessive expansion of the concrete for concrete that is exposed to wetting, has extended exposure to humid atmosphere, or is in contact with moist ground.

F. Lightweight Aggregates: ASTM C 330. Submit material certificates from aggregate supplier or test results from an independent testing agency certifying conformance to this specification for each source of aggregate.

G. Water: Comply with the requirements of ASTM C 1602

H. Cementitious materials, aggregate, and water must be extracted or recovered as well as manufactured within 500 miles of the project site.

I. Air-Entraining Admixture: ASTM C 260. Provide air entrainment as specified in Table 4.2.2.4.of ACI 301-05 in all concrete exposed to freezing and thawing. Interior steel troweled surfaces subjected to vehicular traffic shall not have more than 3% entrained air. Surfaces scheduled to receive hardeners shall not have more than 3% entrained air.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Darex" or "Daravair" series; W. R. Grace & Co.
"MBAE90" or "Micro-Air"; BASF Admixtures, Inc
"Sika AER"; Sika Corporation
"Air Mix" or "AEA-92"; The Euclid Chemical Company, Inc.
“Eucon Air 30” or “Eucon Air 40”, The Euclid Chemical Co., Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

J. Water-Reducing Admixture: ASTM C 494, Type A. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Pozzolith 322N" or "Polyheed 997"; BASF Admixtures, Inc.
"Plastocrete 161"; Sika Chemical Corp.
"Eucon WR-75 or WR-91"; The Euclid Chemical Company, Inc.
"WRDA ";series W.R. Grace & Co.
“Eucon NW” or “Eucon LW”, The Euclid Chemical Company, Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

K. Mid-Range Water-Reducing Admixture: ASTM C 494, Type A and Type F. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

“Polyheed 997”, BASF Admixtures, Inc.

"Eucon MR", The Euclid Chemical Company, Inc.
"Sikament HP", Sika Chemical Corp.
"Daracem" or "Mira " series, W.R. Grace & Co.
"Eucon X15" or "Eucon X20", The Euclid Chemical Company, Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

L. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"ADVA" or "Daracem" Series; W.R. Grace & Co.
"Rheobuild 1000" or "Glenium 30/30"; BASF Admixtures, Inc.
"Sikament"; Sika Chemical Corp.
"Eucon 37/1037" or "Plastol" series; The Euclid Chemical Company, Inc.
"Euconl SP" or "Eucon RD", The Euclid Chemical Company, Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

M. Water-Reducing, Accelerator Admixture (Non-Corrosive, Non-Chloride): ASTM C 494, Type C or E. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Polarset";"Gilco", "Lubricon NCA" or "DCI", W.R. Grace & Co.
"Pozzutec 20+"; BASF Admixtures, Inc.
"Accelguard 80/90"; "NCA", or "AcN", The Euclid Chemical Company, Inc.
"Plastocrete 161FL", Sika Chemical Co.
"Eucon AcN", The Euclid Chemical Company, Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

N. Water-Reducing, Retarding Admixture: ASTM C 494, Type D. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Daratard" series, W.R. Grace & Co.
"Pozzolith 100XR" or "Pozzolith 300R; BASF Admixtures, Inc.
"Plastiment"; Sika Chemical Co.
"Eucon Retarder", Series, The Euclid Chemical Company, Inc.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

O. Viscosity Modifying Admixture: Used to enhance plastic concrete properties such as workability, pumpability, and stability for "self-consolidating concrete".

"Rheomac VMA" series, BASF Building Systems
"Eucon SL" or "Visctrol", The Euclid Chemical Co.
"VisoCrete" series, Sika Chemical Co.
"VMAR" series, W.R. Grace & Co.

P. Shrinkage Reducing Admixture: An admixture that reduces drying shrinkage by reducing the capillary tension of pore water.

Subject to compliance with requirements, provide one of the following products and manufacturers:

For Air-Entrained Concrete:

"Eclipse Plus"'; Grace Construction Products
"Eucon SRA"; The Euclid Chemical Company, Inc.

For Non Air-Entrained Concrete

“Eclipse Floor”, Grace Construction
Products “Tetraguard AS20”, BASF Admixtures, Inc.

Q. Crystalline-forming Waterproofing Admixture: An powder admixture capable of producing concrete that is water tight under hydrostatic pressure up to 7 atmospheres when tested in accordance with Corps of Engineers test CRD-C48 and capable of sealing cracks up to 0.4mm.

Products: Subject to compliance with requirements, provide the following at dosage rates per manufacturer’s recommendation:

“Penetron Admix”, ICS/Penetron International/Ltd.
”Krystol Internal Membrane”, Kryton International, Inc.
“Xypex C series”, Xypex Chemical Corporation

R. Calcium Chloride and Chloride Ion Content:

1. Calcium chloride or admixtures containing more than 0.5% chloride ions by weight of the admixture are not permitted.

2. The maximum water soluble chloride ion concentration in hardened concrete at ages from 28 to 42 days contributed from all ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the limits specified in ACI 301-05 Table 4.2.2.6. Water-soluble chloride ion tests shall conform to ASTM C 1218. One test shall be run for each class of concrete before the mix design submittal and each time a change is made to the mix design (such as change in aggregate type or source).

3. The Concrete Supplier shall certify on the Mix Design Submittal Form that the chloride ion content in all concrete mix designs used on the project does not exceed the limits stated above.

S. Certification: Written conformance to all the above mentioned requirements and the chloride ion content of the admixture as tested by an accredited laboratory will be required from the admixture manufacturer at the time of mix design review by the Engineer.

2.2 RELATED MATERIALS

A. Waterstops: Provide waterstops at all construction joints and other joints in all foundation walls below grade and where shown on the drawings. Size to suit joints. Provide flat, dumbbell type or centerbulb type.

1. Polyvinyl chloride (PVC) waterstops: Corps of Engineers CRD-C 572.

2. Preformed Plastic Waterstops: Federal Specifications SS-S-210A "Sealing Compound for Expansion Joints". Manufacturers: Synko-Flex Products, Inc.

3. Bentonite Waterstop RX manufactured by American Volclay Products.

B. Vapor Barrier: Provide vapor barrier cover chosen from products specified below over prepared base material where indicated.

1. Plastic Vapor Barrier: Provide a flexible, preformed sheet membrane conforming to ASTM E 1745 with the following properties.

    a. Class A material

    b. Minimum of 15 mils thick

    c. c. Maximum water vapor permeance rating of 0.02 as tested by ASTM E 96

    d. Acceptable products include the following:

        "Stego Wrap Vapor Barrier (15 mil)", Stego Industries, LLC

        “Griffolyn Vaporguard”, Reef Industries

        "Perminator (15 mil)", W.R. Meadows

        “Viper Vaporcheck (16 mil)”, Insulation Solutions, Inc.

2. Tape for Plastic Moisture Retarders: High-density polyethylene tape with pressure sensitive adhesive having a minimum width of 4 inches.

C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171:

1. Waterproof paper.

2. Polyethylene film.

3. Polyethylene-coated burlap.

4. Polyethylene-coated natural cellulose fabric such as “Aquacure” by Greenstreak Group, Inc.

E. Slip-resistive Emery Aggregate or Aluminum Granule Finish: Provide fused aluminum-oxide granules, or crushed emery, as abrasive aggregate for slip-resistive finish. The emery aggregate shall contain not less than 50% aluminum oxide and not less than 20% ferric oxide. The aluminum aggregate material shall contain not less than 95% fused aluminum-oxide granules. Use material that is factory-graded, packaged, rust-proof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.

Subject to compliance with requirements, provide one of the following:

"Emery Tuff Non-Slip", Dayton-Superior

"Grip-It" or “Grip-It AO”, L&M Construction Chemicals, Inc

“Frictex NS”, Sonneborn-ChemRex

F. Colored, Mineral Aggregate, Dry Shake Surface Hardener: Packaged, dry, combination of materials, consisting of portland cement, graded quartz aggregate, coloring pigments (if required) and plasticizing admixtures. Use coloring pigments that are finely ground, non-fading mineral oxides, interground with cement. Color, as selected by Architect, unless otherwise indicated.

Products: Subject to compliance with requirements, provide one of the following:

"Surflex"; Euclid Chemical Co.

"Quartz Plate"; L & M Const. Chemical Co.

“Lithochrome”, LM Scofield Construction Chemical Co.

"Mastercron"; BASF Building Systems

"Quartz-Tuff“, Dayton Superior

"US Spec Dense Top", US Mix Co.

Submit manufacturer's certification that product conforms to the requirements specified.

G. Non-Oxidizing Metallic Floor Hardener: Packaged dry, combination of materials consisting of Portland Cement, non-rusting aggregate and plasticizing admixtures.

"Diamond Plate," Euclid Chemical Company "Lumiplate," BASF Building Systems

H. Liquid Membrane-Forming Curing and Curing and Sealing Compounds:

1. High-Solids, Solvent-Based Curing and Sealing Compound with Moderate Yellowing Characteristics: Liquid type membrane-forming curing and sealing compound, clear styrene acrylate type, complying with ASTM C 1315, Type I, Class B. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile, resilient flooring, vinyl-backed carpet, wood, terrazzo, epoxy overlays or adhesives, or other coating or finishing products. Subject to compliance with requirements, provide one of the following products:

"Kure-N-Seal 30,' BASF Building Systems

"Super Rez-Seal," Euclid Chemical Co.

"Masterkure N-Seal-HS," ChemRex, Inc., MBT Protection and Repair Division

"Dress & Seal 30", L & M Construction Chemicals, Inc.

Submit manufacturers certification that product conforms to the requirements specified and is compatible with all subsequent surface treatments. Submit any instructions that must be followed prior to any subsequent surface treatments.

2. High-Solids, Solvent-Based, Non-Yellowing Curing and Sealing Compound: Liquid type membrane-forming curing compound, acrylic type, complying with ASTM C 1315, Type 1, Class A. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile, resilient flooring, vinyl-backed carpet, wood, terrazzo, epoxy overlays or adhesives, or other coating or finishing products.

Products: Subject to compliance with requirements, provide the following product or equivalent products:

"Lumiseal Plus"; L.M. Construction Chemicals

"Super Diamond Clear"; Euclid Chemical Co.

"Solvent Seal 30" or "Solvent Seal 1315", Unitex

"Vocomp 25", W.R. Meadows

"US Spec CS-30-1315", US Mix Co.

Submit manufacturers certification that product conforms to the requirements specified and is compatible with all subsequent surface treatments. Submit any instructions that must be followed prior to any subsequent surface treatments.

3. Water-Based Dissipating Resin Type Curing Compound: Curing Compound shall be a dissipating resin type, which chemically breaks down after approximately 4 weeks. Membrane forming compound shall meet ASTM C 309, Types 1 or 1D, Class B.

Products: Subject to compliance with requirements, provide one of the following:

"Kurez DR Vox" or "Kurez W Vox", Euclid Chemical Company

"L&M Cure R", L&M Construction Chemicals

“Horncure WB 30”, Tamms Industries

“Hydro Cure 309”, Unitex “Sealtight 1100-Clear”, W. R. Meadows

“US Spec Maxcure Resin Clear”, US Mix Co.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments and floor coverings.

4. High Solids, Water-Based Acrylic Curing and Sealing Compound with Moderate Yellowing Characteristics: Water-Based membrane-forming curing and sealing compound conforming to ASTM C 1315, Type 1, Class B, classified as low odor. Product shall provide a maximum moisture loss of 0.030 Kg/m^2 in 72 hours when applied at a coverage rate of 300 sf/gallon. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile, resilient flooring, vinyl-backed carpet, wood, or terrazzo, epoxy overlays or adhesives, or other coating or finishing products.

   Products: Subject to compliance with above requirements, provide one of the following products or equivalent products:

   "Safe Cure and Seal (J-19)"; Dayton Superior Corp.

   "Super Aqua-Cure VOX"; Euclid Chemical Co.

   "Dress & Seal, 30 WB"; L & M Construction Chemicals, Inc.

   "Masterkure 200W"; BASF Building Systems

   “Hydro 18”, Unitex

   Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

5. High Solids, Water-Based, Non-Yellowing Curing and Sealing Compound: Water based membrane-forming curing and sealing compound, acrylic type, complying with ASTM C 1315, Type 1, Class A classified as low odor. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile resilient flooring, vinyl-backed carpet, wood, terrazzo, epoxy overlays or adhesives, or other coating or finishing products.

   Products: Subject to compliance with requirements, provide one of the following:

   "Super Diamond Clear Vox", Euclid Chemical Company

   "Lumiseal 30 WB", L&M Construction Chemicals

   “Kure 1315”, BASF Building Systems

   “Hydro Seal 30”, Unitex

   “Vocomp 30”, W. R. Meadows

   “US Spec Radiance UV-25”, US Mix Co.

   “Luster Seal WB 300”, Tamms Industries

   Submit manufacturer's certification that product conforms to the requirements specified and is

compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

I. Evaporation Control: Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss in hot weather conditions.

Products: Subject to compliance with requirements, provide one of the following:

"Eucobar"; Euclid Chemical Company

"E-Con"; L & M Construction Chemical, Inc.

"Confilm"; BASF Building Systems

"Sure Film (J-74)", Dayton Superior

"SikaFilm", Sika Chemical Co.

“Pro-Film”, Unitex

“Sealtight Evapre”, W. R. Meadows

“US Spec Monofilm ER”, US Mix Co.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all coverings and surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

J. Chemical Curing/Floor Hardener Compound: Sodium silicate based compound which reacts with concrete constituents to harden the surface, resulting in a surface having a maximum abrasion coefficient of 0.25 cm3/cm2 when tested in accordance with ASTM C 418.

Products: Subject to compliance with requirements, provide one of the following:

"Eucosil," Euclid Chemical Co.

"Sonosil," BASF Building Systems

"Day-Chem S.1-Cure (J-13), Dayton Superior

"Chem Hard;" L & M Construction Co.

“Uni Cure HD”, Unitex

“Med-Cure”, W. R. Meadows

“US Spec Permasil”, US Mix Co.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all coverings and surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

K. Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicates per gal.

Products: Subject to compliance with requirements, provide one of the following:

"Surfhard"; Euclid Chemical Co.

"Lapidolith"; BASF Building Systems

"Day-Chem Hardener (J-15)," Dayton Superior

“Fluohard”, L & M Construction Chemical, Inc.

"Penalith", W. R. Meadows

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all coverings or surface treatments to be received. Submit any instructions that must be followed prior to any subsequent surface treatments.

L. Liquid Sealer/Densifier: High performance, deeply penetrating concrete densifier that is an odorless, colorless, VOC-compliant, non-yellowing siliconate-based solution containing a minimum solids content of 20%, 50% of which is siliconate.

"Euco Diamond Hard", Euclid Chemical Co.

"Seal Hard", L & M Construction Chemical, Inc.

"Luqui-Hard", W.R. Meadows

M. Water and Chloride Ion Repelling Penetrating Sealer: Clear, solvent based Silane or Siloxane penetrating sealer which reacts chemically with the concrete surface to function as a Chloride Ion screen with a minimum 90% factor when tested in accordance with NCHRP #244, Series II, and applied in accordance with the manufacturer's recommendation.

Products: Subject to compliance with requirements, provide one of the following:

1. 40% Solids, Low VOC (< 600 g/l)
   a. "Hydrozo Silane 40 VOC", BASF Building Systems
   b. "Iso-flex 618-40 VOC", Lymtal International, Inc.
   c. "Protectosil Chem-Trete 40 VOC", Evonik Industries
2. 100% solids
   a. "Hydrozo 100", BASF Building Systems.
   b. "Iso-flex 618-100 CRS", Lymtal International, Inc.
   c. cProtectosil Chem-Trete BSM-400", Evonik Industries

N. Water and Chloride Ion Repelling Penetrating Sealer: Clear, solvent free, Silane penetrating sealer which reacts chemically with the concrete surface to function as a Chloride Ion screen with a minimum 83% factor when tested in accordance with NCHRP #244, Series II and applied in accordance with the manufacturer's recommendation.

Products: Subject to compliance with requirements, provide one of the following:

1. 40% solids:
   a. "Enviroseal 40" –BASF Building Systems
   b. "Iso-flex 618-40 WB", Lymtal International, Inc.
2. 100% solids:
   a. "Protectosil BH-N", Evonik Industries

O. Bonding Compound: Polyvinyl acetate or acrylic base, for use in cosmetic and/or nonstructural repairs.

Products: Subject to compliance with requirements, provide one of the following:

1. Acrylic or Styrene Butadiene:

"Day-Chem Ad Bond (J-40)"; Dayton Superior

"SBR Latex"; Euclid Chemical Co.

"Daraweld C"; W. R. Grace

"Acrylic Additive" BASF Building Systems

"SikaLatex", Sika Chemical Co.

“Intralok”, W. R. Meadows

“US Spec Acrylcoat”, US Mix Co.

“Akkro 7-T”, Tamms Industries

2. Polyvinyl Acetate (Interior Use Only)

"Euco Weld"; Euclid Chemical Co.

"Everweld"; L & M Construction Chemicals, Inc.

"Superior Concrete Bonder (J-41)," Dayton Superior

“US Spec Bondcoat”, US Mix Co.

P. Epoxy Products: Two component material suitable for use on dry or damp surface, complying with ASTM C 881.

1. Products for Crack Repair:

"Sikadur 35 Hi Mod LV"; Sika Chemical Company – injection type

"Sikadur 52", Sika Chemical Company – injection type

"Sikadur 55 SLV", Sika Chemical Company – gravity feed

"Eucopoxy Injection Resin," Euclid Chemical Company

"Sure-Inject (J-56)," Dayton Superior

“Epofil SLV”, BASF Building Systems

“ETI-LV” or “ETI-GV”, Simpson Strong-Tie Co., Inc. – injection type

“Pro-Poxy 100 LV” or “Pro-Poxy 50”, Unitex

“Crackbond”, U.S. Anchor Corp.

“Rezi-Weld LV”, W. R. Meadows

“US Spec Maxibond” US Mix Co. – injection or gravity feed

“US Spec Eposeal LVS”, US Mix Co. – gravity feed

“Duralcrete LV”, Tamms Industries

2. Products for Epoxy Mortar Patches:

"Sikadur Lo-Mod LV"; Sika Chemical Corporation

"Euco 352 LV," Euclid Chemical Company

"Sure Grip Epoxy Grout (J-54)," Dayton-Superior

“Epofil”, BASF Building Systems

“Pro-Poxy 2500”, Unitex

“Rezi-Weld 1000”, W. R. Meadows

“US Spec EPM 3000”, US Mix Co.

"Duralcrete LV", Tamms Industries

3. Products for Epoxying Steel Plates to Concrete: Conform to ASTM C 881-90, Type IV, Grade 3, Class A, B, & C except gel times.

   "Sikadur 31 Hi-Mod Gel"; Sika Corporation

   "Euclid 452 Gel," Euclid Chemical Company

   "Sure Anchor I (J-S1)," Dayton Superior

   "Epo Gel" or "Rapid Gel", BASF Building Systems

   "Pro-Poxy 300", Unitex

   "US Spec Gelbond NS" US Mix Co.

   "Duralcrete Gel", Tamms Industries

4. Products for Adhesive Anchors or Reinforcing Steel in Normalweight Concrete: Product that conforms to ASTM C 881-02, Type IV, Grade 3, Class A, B, & C except gel times, and that is dispensed from a two-component cartridge system through a mixing nozzle that thoroughly mixes the two components as it is injected into the hole. The product must show certification by the ICC Evaluation Service of having passed Acceptance Criteria 308 as evidenced by an Evaluation Service Report (ESR). Consult with the manufacturer for the minimum temperature of the concrete surface allowed.

   a. Normal weight Concrete:

      "HIT-RE 500-SD", Hilti Fastening Systems

      "SET-XP" Adhesive", Simpson Strong-tie

      "PE 1000+", Powers Fasteners, Inc.

   b. Lightweight Concrete:

      No approved products

   c. These products may not be used in concrete cast over corrugated deck.

5. Substitutions for products noted in the drawings may be considered provided complete technical information and job references are furnished to the Engineer for approval prior to commencement of work. Failure to obtain approval for anchor substitutions will render the contractor liable for the design and performance of the anchor.

Q. Self-Leveling Mortars, Underlayment Compound: Freeflowing, self-leveling, pumpable cementitious base compound. Follow manufacturer's instruction regarding the use of a bonding agent.

   Products: Unless specified otherwise, provide one of the following:

   "Sonoflow," BASF Building Systems

   "Sikatop 111"; Sika Chemical Co.

   "Flo-Top" or "Flo-Top 90"; Euclid Chemical Co.

   "Levelayer I," Dayton Superior

   "US Spec Self-leveling Underlayment" US Mix Co.

   "Level Magic", Tamms Industries

R. Polymer Patching Mortar: Polymer and microsilica modified cementitious based compounds.

Products:

Horizontal Application

"Thin Top Supreme, Concrete Top Supreme," Euclid Chemical

"Sikatop 121 or 122," Sika Chemical

"Emaco R310 CI," BASF Building Systems

“Sonopatch 100 or 200”, BASF Building Systems

“US Spec H2 or NuTop” US Mix Co.

“Speed Crete PM”, Tamms Industries

Vertical or Overhead Application

"Verticoat/Verticoat Supreme," Euclid Chemical

"Sikatop 123," Sika Chemical

"Emaco R350 CI," BASF Building Systems

“Sonopatch 200”, BASF Building Systems

“US Spec V/O Patch”, US Mix Co.

“Speed Crete PM”, Tamms Industries

S. High Strength Flowing Repair Mortar: For forming and pouring structural members, or large horizontal repairs, provide flowable one-part, high strength microsilica polymer modified repair mortar with 3/8" aggregate. The product shall achieve 9000 psi @ 28days at a 9-inch slump.

Products:

“Road Patch”, BASF Building Systems

“US Spec STR Mortar”, US Mix Co.

“Eucocrete”, Euclid Chemical Co.

“Form and Pour”, Tamms Industries

T. Anti-Corrosive Epoxy/Cementitious Adhesive: Water-based epoxy/cementitious compound for adhesion and corrosion protection or reinforcing members (20 hour maximum open time).

Products:

"Corr-Bond," Euclid Chemical Co.

"Armatec 110," Sika Chemical Co.

“Sonoprep Plus”, BASF Building Systems

U. Expansion Anchors in Concrete:

1. ICC Approval: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published Evaluation Report showing having passed Acceptance Criteria 193 and approval for use in cracked concrete and resisting wind and seismic loads shall be approved for use.
2. Type: All expansion anchors in concrete shall be only wedge type expansion, sleeve-type expansion, or undercut type anchors.

3. Interior Use: All expansion anchors, nuts and washers for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.

4. Exterior or Exposed Use: All expansion anchors, nuts and washers for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors, nuts and washers shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel and nuts and washers from 300 series or Type 18-8 stainless steel.

5. Nuts and Washers: Nuts and washers shall be furnished from the manufacturer and used with the anchors.

6. Acceptable Products and Manufacturers – Normal and Lightweight Concrete:

   "Kwik Bolt TZ", "HDA Undercut Anchor" and "HSL-3 Heavy Duty Sleeve

   Anchor", Hilti Fastening Systems

   "Strong-Bolt Wedge Anchor", Simpson Strong-Tie, Co., Inc

   "Red Head Trubolt + Wedge Anchor", ITW Red Head

   "DUC Undercut Anchor", USP Structural Connectors

   "Power Stud + SD2", Powers Fasteners, Inc

   "SRS TZ Carbon Steel Anchor", MKT Metall-Kunststoff-Technik

   "Torq-Cut Self Undercutting Anchor", Simpson Strong-Tie, Co. Inc. (ESR Pending)

7. Acceptable Products and Manufacturers – Normal and Light Weight Concrete on Corrugated Deck:

   "Kwik Bolt TZ", Hilti Fastening System

   Strong-Bolt Wedge-Anchor", Simpson Strong-Tie, Co, Inc.

   Power Stud + SD2", Powers Fasteners, Inc.

8. Substitutions for products noted in the drawings may be considered provided complete technical information and job references are furnished to the Engineer for approval prior to commencement of work. Failure to obtain approval for anchor substitutions will render the contractor liable for the design and performance of the anchor.

V. VScrew Anchors in Concrete

1. Approvals: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICCES) with a published Evaluation Report showing having passed Acceptance Criteria 193 and approved for use in cracked concrete and resisting wind and seismic loads shall be approved for use.

2. Interior Use: All screw anchors for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3

3. Exterior or Exposed Use: All screw anchors for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel.

4. Acceptable Products and Manufacturers – All Conditions: "Titen HD", Simpson Strong-Tie Co., Inc "Snake+Anchor" Powers Fasteners, Inc. "Wedge-Bolt+", Powers Fasteners, Inc. (greater than ¼ in. diameter)

5. Substitutions for products noted in the drawings may be considered provided complete technical information and job references are furnished to the Engineer for approval prior to commencement of work. Failure to obtain approval for anchor substitutions will render the contractor liable for the design and performance of the anchor.

W. Threaded Rods Chemically Anchored in Concrete

1. Type; Threaded rods installed in holes using a chemical anchoring process shall have a 45º chiseled end on one end.

2. Interior Application; Meet the requirements of ASTM A 307, A 36 or A 193, grade B7.

3. Exterior Application: Meet the requirements of ASTM A 153 galvanized steel, or F 593, Group 1 or 2, condition CW stainless steel.

X. Anchor Rods:

1. All anchor rods shall conform to ASTM F 1554 unless noted otherwise on the drawings and shall be of the yield strength as specified below as appropriate for the types and at the locations as specified on the drawings:

   a. ASTM F 1554, Grade 36 (1/4 inch to 4 inches in diameter).

2. Anchor rods used with galvanized baseplates shall be galvanized.

3. 3Nuts: All nuts with anchor rods shall be heavy hex head conforming to ASTM A 563.

4. Washers: Unless noted otherwise on the drawings, washer size and thickness for all anchor rods shall conform to Table 14-2 of AISC “Steel Construction Manual” with holes 1/16” greater than the anchor rod diameter. Washers shall conform to ASTM A 36 steel.

Y. Reglets: Where resilient or elastomeric sheet flashing or bituminous membrane are terminated in reglets, provide reglets of not less than 26 gage galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

Z. Contraction and Construction Joint-Filler Material for Slabs-on-Grade: Provide a 2component semi-rigid, 100% solids epoxy having a minimum shore A hardness of 80 when tested in accordance with ASTM D 2240. Subject to compliance with requirements, provide one of the following:

"Euco 700", Euclid Chemical Co., Inc.

"Spec-Joint CJ"; Conspec Marketing and Manufacturing Co., Inc.

"Masterfill 300 I", BASF Building Systems

“MM-80”, Metzger/McGuire Co.

“Rezi-Weld Flex”, W. R. Meadows

“US Spec SR-50 EJF”, US Mix Co.

AA. Bondbreaker for Construction Joints in Slabs-on-Grade: A dissipating bondbreaking compound containing no silicones, resins, or waxes, and that conforms to ASTM C 309. Subject to compliance with requirements, acceptable manufacturers include the following:

“Sure-Lift”, Dayton Superior Corporation, Inc.

“Tilt-Eez”, Conspec Marketing and Manufacturing Co., Inc.

BB. Joint-Filler Strips for Isolation Joints in Slabs-on-Grade: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork

CC. Rigid-Cellular-Polystyrene Boards use as Fill under Topping Slabs or Slabs-on-Grade: Provide rigid, expanded (EPS) or extruded (XPS) cellular polystyrene boards that conform to ASTM D 6817 or ASTM C 578 with a minimum density of 19 kg/m^3. Subject to compliance with requirements, acceptable manufacturers include the following:

"STYROFOAM Brand" Dow Chemical Company

"R-Control EPS Geofoam" - All grades, R-Control Building Systems

"EPS Geofoam", Carpenter Co.

"Knauf Geofoam", Knauf Polystyrene

"Insulfill", Premier Industries

2.3 PROPORTIONING AND DESIGN OF CONCRETE MIXES

A. The Contractor shall submit concrete mix designs and the Concrete Mix Design Submittal Form located at the end of this specification section for each class of concrete indicated on the structural drawings and in the Specifications for approval by the Engineer and Owner's Testing Laboratory at least 15 working days prior to the start of construction,. If required, the Contractor shall engage the services of an independent Testing Laboratory to assist in preparing the mix design. The Contractor shall not begin work with a particular mix until that mix design has been approved.

B. Mix Design Conference: See the PREINSTALLATION CONFERENCES section of this specification.

C. The Contractor, acting in conjunction with his Concrete Supplier and his Testing Laboratory, shall submit in writing, with his mix designs, the method used to select mix proportions. Either of the following methods, as outlined in ACI 301, may be used.

1. Field Experience Method
2. Laboratory Trial Mixture Method

D. Required types of concrete and compressive strengths shall be as indicated on the Structural Drawings.

E. All mix designs shall state the following information:

1. Mix design number or code designation by which the Contractor shall order the concrete from the Supplier.
2. Structural slab or member for which the concrete is designed (i.e., columns, shear walls, footings, slab on grade, etc.).
3. Wet and dry unit weight.
4. 28 day compressive strength.
5. Aggregate type, source, size, gradation, fineness modulus.
6. Cement type and brand.
7. Fly ash or other pozzolan type and brand (if any).
8. Admixtures including air entrainment, water reducers, high-range water reducers, accelerators, and retarders.
9. Design Slump or Slump/Flow.
10. Proportions of each material used.
11. Water/cementitious ratio and maximum allowable water content.

12. Method by which the concrete is intended to be placed (bucket, chute, or pump).

13. Required average strength qualification calculations per ACI 301 4.2.3.3a and 4.2.3.3b. Submit separate qualification calculations for each production facility that will supply concrete to the project.

14. Documentation of Average strength (trial mix data or field test data) per ACI 301: When field test data is used to qualify average strength, submit separate documentation for each production facility that will supply concrete to the project.

15. Field test data submitted for qualification of average strength under ACI 301 shall include copies of the Concrete Testing Agency's reports from which the data was compiled.

16. All other information requested in the Concrete Mix Design Submittal Form located at the end of this specification section.

F. Supplementary Cementitious Materials: Fly ash replacement of Portland cement shall not exceed 25% unless otherwise approved. If fly ash is used, it must be at a minimum fly ash replacement level of 15%. Slag cement replacement of Portland cement shall not exceed 50% unless otherwise approved. Approval for higher levels will be based on showing experience of satisfactory performance on other projects using materials from identical sources as proposed for this project. Submit evidence of such experience on other projects.

G. Aggregate: Comply with the following special requirements:

1. For exposed concrete, provide aggregates from a single source.

2. For exterior exposed surfaces, do not use aggregates containing spallingcausing deleterious substances.

H. Admixtures:

1. Admixtures to be used in concrete shall be subject to the approval of the Engineer and Owner's Testing Laboratory and shall be used for the purpose intended by the manufacturer to produce concrete to meet the specified requirements.

2. Quantities of admixtures to be used shall be in strict accordance with the manufacturer’s instructions.

I. Lightweight Structural Concrete:

1. Comply with the requirements of ACI 211 and ACI 301.

2. Provide concrete with a dry unit weight of not more than 116 pounds per cubic foot and not less than 110 pounds per cubic foot. Design mix to produce strengths as indicated on the drawings with a split cylinder strength factor $(fct/(f'c)^{0.5})$ of not less than 5.7.

J. Adjustments of Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such mix design adjustments shall be provided at no additional cost to the Owner. Any adjustments in approved mix designs including changes in admixtures shall be submitted in writing with the specified Concrete Mix Design Submittal Form to the Engineer and Owner's Testing Laboratory for approval prior to field use.

K. Chloride Ion Content: A written submittal shall be made with each mix design proposed for use on the project that the chloride ion content from all ingredients including admixtures will not exceed the limits specified in this section of the Specifications.

2.4 CONCRETE MIXES

A. Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94, "Ready Mixed Concrete" and this specification.

PART 3 -EXECUTION

3.1 SLUMP LIMIT

A. The slump, as measured in the field where concrete cylinders are taken, shall be within plus or minus 1 inch of the design slump noted on the Mix Design Submittal Form. Self-consolidating concrete shall have a slump/flow of plus or minus 2 inches of the design slump noted on the Mix Design Submittal Form. Water may be added to the concrete in the field only to the extent that the prescribed water/cementitious ratio noted in the Mix Design Submittal Form is not exceeded.

3.2 VAPOR BARRIER INSTALLATION

A. Install vapor barrier in accordance with ASTM E 1643 and manufacturer’s instructions.

B. Seal all joints in the field with the specified pressure sensitive tape. Heat-welded joints done in a shop prior to delivery is an acceptable method to minimize the number of field joints.

C. Seal all pipe penetrations through the moisture retarder with a boot made from the moisture retarder material and tape.

3.3 JOINTS IN CONCRETE

A. Construction Joints: Locate and install construction joints as indicated on the drawings or if not shown on drawings, located so as not to impair strength and appearance of the structure, as acceptable to Architect/Engineer.

1. Keyways: Provide keyways with a depth of one tenth of the member thickness (1 1/2" minimum or as shown on the drawings) in construction joints only where shown on the drawings.

2. Joint Construction: Place construction joints in the center one third of suspended spans and grade beams and as shown on the drawings for slabs-ongrade and walls unless shown otherwise. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise shown on the drawings. Dowels that cross construction joints shall be supported during concreting operations so as to remain parallel with the slab or wall surface and at right angles to the joint. Submit all construction joint locations as a shop drawing submittal.

3. Waterstops: Provide waterstops in construction joints as indicated on the Architectural and Structural Drawings. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

4. Isolation Joints in Slabs-on-Ground: Construct isolation joints (without dowels) in slabs-on-ground at points of contact between slabs on ground and vertical surfaces only where specifically detailed on the drawings. Install joint-filler strips at joints where indicated. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated on the drawings. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together. Provide construction joints with dowels at all locations unless isolation joints are detailed.

5. Contraction (Control) Joints in Slabs-on-Ground: Maximum joint spacing shall be 36 times the slab thickness or 20 feet, whichever is less and at a minimum on column lines unless otherwise noted on the drawings. Use one of the two following methods (sawed or formed) to create the joints. Do not use the formed joint in areas subject to vehicular traffic.

    a. Sawed Joints

1) Primary Method: Early-Entry, dry-cut method, by Soff-Cut International, Corona, CA (800) 776-3328. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within 1 to 4 hours, depending on air temperature, after final finish as soon as the concrete surface is firm enough to not be torn or damaged by the blade at each saw cut location. Use 1/8 inch thick blade, cutting 1 1/4” inch into the slab.

2) Optional Method (where Soff-Cut System method equipment is not available, subject to limitations): This method may not be used when there is no dowel passing through the contraction joint. Use a conventional saw to cut joints within 4 to 12 hours after finishing as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use 1/8 inch thick blade, cutting to a depth of 1/4 of the slab thickness but not less than 1 inch. Cut to a depth of 1/3 slab thickness for slabs reinforced with steel fibers.

b. Formed Joints: Form contraction joints by inserting premolded plastic hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. The depth is to be 1/4 the slab thickness, but not less than 1 inch. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

c. Joint Filler: Provide in both contraction and saw-cut construction joints when specified.

3) Remove dirt and debris from the joint by vacuuming immediately prior to filling joint. Clean the joint of curing compounds and sealers.

4) Filler material shall be applied to the joints when the building is under permanent temperature control, but no less than 90 days after slab construction.

5) Follow the manufacturer's recommended procedure for installing filler material. The joint filler must be flush with the adjacent concrete. A concave profile on the top of the joint filler is unacceptable and will be grounds for removal and replacement.

d. The Contractor shall protect the joints from damage caused by wheeled traffic or other sources during construction until a joint-filler material (if specified) has been installed.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto unless directed otherwise by these specifications. Install reglets to receive top edge of foundation sheet waterproofing where specified by the Architect, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles and other conditions.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

C. Do not install sleeves in concrete slabs, pier caps, footings or walls except where shown on the structural drawings or approved by the Architect and Engineer.

D. Securely fasten embedded plates, angles, anchor rods and other items to be built into the concrete to the formwork or hold in place with templates. Insertion of these items into concrete after casting is prohibited.

3.5 CONCRETE PLACEMENT

A. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

C. Comply with ACI 301 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation. Spread concrete using short-handled, square-ended shovels, or come-alongs.

2. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

3. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use internal vibrators of the largest size and power that can properly be used in the work as described in the table entitled “Range of characteristics, performance, and applications of internal vibrators” found in ACI 301.

4. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

5. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for slabs. Do not place concrete over columns and walls until concrete in columns and walls is no longer plastic and has been in place at least one hour.

6. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners of forms, eliminating air and stone pockets that may cause honeycombing, pitting, or planes of weakness.

7. Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedges, bull floats or darbies to smooth surface free of humps or hollows before excess moisture or bleedwater appears on the surface. Do not disturb slab surfaces prior to beginning finishing operations.

8. Maintain reinforcing in proper position during concrete placement operations.

9. Placing Concrete by Pump: If concrete is placed by using a pump, the grout used for pump priming must not become a part of the completed structure unless an engineered grout design mix and grout location are approved in advance by the Engineer.

3.6 FINISH OF FORMED SURFACES

A. Rough Form Finish: Provide rough form finish for formed concrete surfaces not otherwise scheduled on the drawings to receive a smooth-form finish. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish: Provide smooth form finish for formed concrete surfaces as scheduled on the drawings, which may include those exposed-to-view, or that are to be covered with a coating or covering material applied directly to concrete such as waterproofing, dampproofing, painting, veneer plaster or other similar system, or to a surface that is to receive a smooth rubbed finish or grout cleaned finish. This is an as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections exceeding 1/8 inch in height removed and smoothed.

C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled or specified concrete surfaces, which have received smooth-form finish treatment, not later than one day after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

D. Grout Cleaned Finish: Provide grout cleaned finish to scheduled or specified concrete surfaces that have received smooth-form finish treatment.

1. Combine one part portland cement to 1-1/2 parts fine sand by volume, and 50:50 mixture of acrylic or styrene butadiene based bonding admixture and water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

2. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Self-Consolidating Concrete Architectural Finish: Use self-consolidating concrete where shown on the plans to produce a smooth, uniform finish upon form removal with no patching, stoning, rubbing or other form of repair, except washing, permitted. The surface shall match the approved jobsite test panel.

F. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.7 MONOLITHIC SLAB FINISHES

Place, consolidate, strike off, and level concrete, eliminating high spots and low spots, before proceeding with any other finish operation. Do not add water to the surface of the concrete during finishing operation.

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerance specified below. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using a hand float, a bladed power float equipped with float shoes, or a powered disk float, when the bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit the operation. Check and level surface plane to a tolerance as specified below. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating

system. After floating, begin first trowel finish operation by hand or power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface to a tolerance as specified below. Grind smooth surface defects which would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply initial trowel finish as specified above, then immediately follow with slightly scarifying surface by fine brooming.

E. Slip-Resistive Broom Finish: Apply slip-resistive broom finish to garage floors and ramps less than 6% slope, exterior concrete platforms, steps and ramps and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Roller-Bug Finish: Provide a roller-bug finish with a minimum ¼" amplitude to all ramps exceeding a 6% slope. Extend the finish as least 12 feet beyond the beginning and ending of the greater-than-6% ramp. The finish shall be imprinted on the concrete by the use of a roller-bug tamper.

G. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Apply proprietary chemical hardeners, in strict accordance with manufacturer's printed instructions.

After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

H. Liquid Sealer/Densifier Finish: Apply liquid sealer/densifier finish to exposed interior concrete floors where indicated. Apply liquid liquid sealer/densifier after complete curing and drying of the concrete surface and in strict accordance with manufacturer's printed instructions.

I. Penetrating Sealer Finish: Apply a chloride-and-water-repelling-penetrating-sealer finish to surfaces as described below and where indicated on the drawings. Apply liquid penetrating sealer after complete curing and drying of the concrete surface. Apply proprietary sealers in strict accordance with manufacturer's printed instructions. The Contractor shall verify the compatibility of the sealer product with the paint used to stripe parking decks and coordinate the sequencing of the sealing and striping operations. Apply to the following surfaces:

1. Sloping and horizontal surfaces of parking garages
2. Top surfaces of exposed exterior balconies

J. Slip-Resistive Aggregate Finish: Apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps and elsewhere as indicated on the Architect's or Structural Drawings.

After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened slip-resistive aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose slip-resistive aggregate.

K. Colored, Mineral Aggregate Surface Hardener: Provide colored, mineral aggregate surface hardener to monolithic slab surface indicated.

Apply dry shake materials for colored wear-resistant finish at rate of not less than 100 lbs. per 100 sq. ft., unle`ss greater amount is recommended by material manufacturer.

Cast a trial slab approximately 20 feet square to determine actual application rate, color and finish as

acceptable to Architect/Engineer.

Immediately following first floating operation, uniformly distribute approximately 2/3 of required weight of dry shake material over concrete surface, and embed by means of power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material at right angles to first application, and embed by power floating.

After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by dry shake hardener manufacturer. Apply curing compound immediately after final finishing.

L. Non-Oxidizing Metallic Floor Hardener: Slabs in areas noted on the drawings shall receive an application of the non-oxidizing, metallic floor hardener applied at the rate of 150 lbs. Per 100 sq. ft. Immediately following the first floating operation, uniformly distribute approximately 2/3 of the required weight of the hardener over the concrete surface by mechanical spreader and embedded by means of power floating. The hardener shall be floated in and the second application made. The surface shall be floated again to properly bond the hardener to the base concrete slab. The surface shall then be troweled at least twice to a smooth dense finish.

M. Finish of Top of Spread Footings:

1. Top Surface below Finished Slab: The top of the footing shall be screeded level and smooth with a flatness F-number, F_F15 (overall), F_F10 (minimum local) and a levelness F-number, F_L12 (overall), F_L10 (minimum local).

2. Top Surface as Finished Slab: The top surface of a footing that is to serve as the finished slab in the building shall be leveled, cured, and surface prepared as specified for the finished floor construction appropriate to the space usage as defined in the Architectural Drawings.

3.8 CONCRETE FINISH MEASUREMENT AND TOLERANCES

A. Testing Procedure: ASTM E 1155

B. Tolerance on Floor Elevations: Construction tolerance on absolute floor elevation from the specified elevation as shown on the drawings shall be as specified below, taken from ACI 117:

1. Slab-on-Grade Construction -+ 3/4".

2. Top surfaces of formed slabs measured prior to removal of supporting shores + 3/4".

3. Top surfaces of all other slabs -+ 3/4".

C. Random Traffic Floor Finish Tolerances:

1. Specified overall values for flatness (SOFF) and levelness (SOFL) shall conform to the values listed below for the floor surface classification noted for each slab category noted.

Floor Surface Classification	SOFF	SOFL
Conventional	20	15
Moderately Flat	25	20
Flat	35	25
Very Flat	45	35
Super Flat	60	40

2. Minimum local values for flatness (MLF$_F$) and levelness (MLF$_L$) shall equal 3/5 of the SOFF and SOFL values, respectively, unless noted otherwise. The MLFF and MLFL values shall apply to the minimum areas bounded by the column lines and half-column lines, or the minimum areas bounded by the construction and contraction joints, whichever are the smaller areas.

3. The SOF$_L$ and MFL$_{LL}$ tolerance values shall apply only to level slabs-on-ground or to level, uncambered suspended slabs that are shored such that it cannot deflect from the time the floor is placed to the time it is measured.

4. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10 feet at any point.

D. Construction Requirements to Achieve Specified Floor Finish Tolerances:

1. Forms shall be properly leveled, in good condition and securely anchored including special attention to ends and transitions.

2. Bearing surfaces for straightedges such as form edges or previously poured slabs shall be kept clean of laitance, sand, gravel, or other foreign elements.

3. Screeds shall be maintained in good condition with true round rolling wheels and level cutting edges. The use of optical sighting equipment such as lasers is recommended for checking levelness and straightness. The Contractor shall promptly adjust or replace equipment when test results indicate substandard work.

4. Highway straightedges are recommended for use in lieu of bullfloats for all slab placement and finishing operations.

E. Contractor Responsibility for Concrete Floor Finish Requirements: Floor finish requirements shown below (flatness and levelness tolerances) are minimum requirements that apply unless stricter requirements are contained in instructions for installation of applied floor products in which case the Contractor is responsible for attaining the values prescribed by the manufacturer of such products.

F. Concrete Floor Finish Tolerance for Slab-on-Grade Construction:

1. Concrete Placement: Concrete shall be placed and screeded to predetermined marks set to elevations prescribed on the drawings.

2. Finish Tolerances of Random Traffic Floor Surfaces:

a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional

b. Carpeted Areas: Moderately Flat

c. Exposed slabs in public spaces, slabs to receive thin-set flooring: Flat

d. Ice or Roller rinks: Very Flat

e. Movie or Television studios: Super Flat

f. Gymnasium Floors Scheduled to Receive Wood Playing Floor: Very Flat

G. Concrete Floor Finish Tolerance for Shored, Cast-in-Place Suspended Slab Construction:

1. Concrete Placement: Formwork shall be set and securely braced so that soffits are positioned to allow scheduled concrete member sizes and thicknesses within tolerances specified in ACI 117. Concrete shall be placed and screeded to predetermined marks on the form surface conforming to elevations prescribed on the drawings.

2. Camber: Formwork camber, as indicated on the drawings, shall be set to provide a uniform, smooth soffit profile in each direction. Minimum slab thickness, as specified on the drawings, shall be maintained throughout the slab surface to a tolerance as specified in ACI 117. Tolerance on camber shall be $\pm$ 1/4". Levelness F-Number tolerances specified below do not apply to areas of the floor where camber or intentional slope is shown.

3. Finish Tolerances of Random Traffic Floor Surfaces:

   a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional

   b. Carpeted Areas: Moderately Flat

   c. Exposed slabs in public spaces, slabs to receive thin-set flooring: Flat

   d. Movie or Television studios: Super Flat

4. Extra Concrete: The contractor shall include in his bid any additional concrete required to achieve the specified slab surface finish tolerance.

5. Concrete Placement at Column Bays Supported by Unshored Transfer Girders: Concrete in floor areas supported by transfer girders or trusses shall be placed and screeded to predetermined marks placed over the metal deck slab conforming to elevations as specified on the drawings. At least the minimum slab thickness, as specified on the drawings, shall be maintained throughout the slab surface. The Contractor shall conform to the F_F values specified above.

H. Concrete Floor Finish Tolerance -Unshored Metal Deck on Shored or Unshored Steel Beam or Open-Web Joist Floor Construction:

1. Concrete Placement: Concrete over metal deck shall be placed and screeded level and flat to the tolerance specified below, maintaining at least the minimum slab thickness at all locations as specified on the drawings. The Contractor shall increase the slab thickness as required to compensate for metal deck deflection, and in unshored beam construction, residual beam camber and beam deflection in order to achieve a level and flat floor within specified tolerances.

2. Finish Tolerance of Random Traffic Floor Surfaces:

   a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional

   b. Carpeted Areas: Moderately Flat

   c. Exposed slabs in public spaces, slabs to receive thin-set flooring: Flat

   d. Movie or Television studios: Super Flat

   e. Eighty percent (80%) of the final floor surface shall fall within an envelope of 0.75" centered about the mean elevation of all the readings. (± 0.375 about mean). The mean elevation of all readings shall not deviate from the specified design grade by more than ± 0.375".

3. Extra Concrete: The contractor shall include in his bid any additional concrete required to achieve the specified slab surface finish tolerance and to compensate for metal deck deflection, beam camber and beam deflection.

4. Concrete Placement at Column Bays Supported on Transfer Girders or Trusses: Concrete in floor areas supported by transfer girders or trusses shall be placed and screeded to predetermined marks placed over the metal deck slab conforming to elevations as specified on the drawings. At least the minimum slab thickness, as specified on the drawings, shall be maintained throughout the slab surface. The Contractor shall conform to the F_F values specified above.

I. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:

1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:

   a. The composite overall values of F_F or F_L of the entire floor installation measure less than specified values.

   b. Any individual test section measures less than the specified absolute minimum F_F or F_L value.

2. Modification of Existing Surface:

   a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately undertake the approved repair method.

   b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair and time to affect the repair.

   c. Repair method(s), at the sole discretion of the Architect/Engineer or Owner's Representative, may include grinding (floor stoning), planing, retopping with self leveling underlayment compound or repair topping, or any combination of the above.

   d. The Architect/Engineer or Owner's Representative maintains the right to require a test repair section using the approved method of repair for review and approval to demonstrate a satisfactory end product. If, in the opinion of the Architect/Engineer or Owner's Representative, the repair is not satisfactory an alternate method of repair shall be submitted or the defective area shall be replaced.

   e. The judgment of the Architect/Engineer or Owner's Representative on the appropriateness of a repair method and its ability to achieve the desired end product shall be final.

   f. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3. Removal and Replacement:

   a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately commence to remove and replace the defective work.

   b. Replacement section boundaries shall be made to coincide with the test section boundaries as previously defined.

   c. Sections requiring replacement shall be removed by sawcutting along the section boundary lines to provide a neat clean joint between new replacement floor and existing floor.

d. The new section shall be reinforced the same as the removed section and doweled into the existing floor as required by the Engineer. No existing removed reinforcing steel may be used. All reinforcing steel shall be new steel.

e. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or Owner's Representative.

f. The judgment of the Architect/Engineer or Owner's Representative on the need for replacement shall be final.

g. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3.9 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of concrete. Apply evaporation retarder if hot, dry and windy weather causes moisture loss exceeding 0.2 lb./sq. ft. x hr before and during finishing operations.. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be 7 days for all concrete except high early strength concrete which shall be cured for 3 days minimum.

   Alternatively, curing times may be reduced if either of the following provisions is complied with:

   a. If tests are made of cylinders kept adjacent to the structure and cured by the same methods, curing measures may be terminated when the average compressive strength has reached 70% of the specified 28 day compressive strength.

   b. If the temperature of the concrete is maintained at a minimum of 50°F for the same length of time required for laboratory cured cylinders of the same concrete to reach 85% of the 28 day compressive strength, then curing may be terminated thereafter.

3. Curing shall be in accordance with ACI 301 procedures. Avoid rapid drying at the end of the curing period.

B. Curing Formed Surfaces: Where wooden forms are used, cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. When forms are removed, continue curing by one or a combination of the methods specified below, as applicable.

1. Columns and Shearwalls Not Exposed to View: Moist cure in forms or by one or a combination of methods 1, 2, or 3 specified below. Use a high –solids, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, type I, Class A or B for method 3.

2. Columns and Shearwalls Exposed to View: Moist cure in forms or by one or a combination of methods 1, 2 or 3 specified below. Use a high-solids, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, type 1, class A for method 3.

3. Sides and Soffits of Beams and Pan-Joist Ribs, Soffits of Slabs: Moist cure in forms or by one or a combination of methods 1, 2 or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

4. Basement Walls, Sides of Exterior Retaining Walls: Moist cure in forms or by one or a combination of methods 1, 2 or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

C. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping and other flat surfaces by one or a combination of the methods specified below, as applicable. The Contractor shall choose a curing method that is compatible with the requirements for subsequent material usage on the concrete surface.

1. Ramps and Horizontal Surfaces of Parking Areas, Exposed Exterior Balconies: Cure using only methods 1 or 2 as specified below.

2. Floors Directly Exposed to Vehicular or Foot Traffic not in Parking Areas and not otherwise receiving a chemical hardener or penetrating sealer finish: Apply two coats of a high-solids, water-based, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, type 1, Class A in accordance with method 3 as specified below.

3. Floors in Non-Public spaces that are left exposed to view and not receiving sealers or hardeners, floors involved in under-floor air distribution systems: Apply one coat of a high-solids, water-based, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, type 1, Class A or B in accordance with method 3 as specified below.

4. Floors that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile, acrylic terrazzo, vinyl composition tile, sheet vinyl, linoleum, vinyl-backed carpet, rubber, athletic flooring, synthetic turf, wood, epoxy overlay or adhesive, or other coating or finishing products: Cure using methods 2 or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

5. All Other Surfaces: Cure using methods 1,2 or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

D. Curing Methods:

1. Method 1 -Moisture Curing: Provide moisture curing by one of the following methods:

   a. Keep concrete surface continuously wet by covering with water.

   b. Continuous water-fog spray.

   c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Method 2 -Moisture-Cover Curing: Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Water may be added to concrete surface to prevent drying before the cover is installed, but the surface shall not be flooded with water if a non-absorptive cover is used.

3. Method 3 – Curing or Curing and Sealing Compound: Provide curing, curing/hardener, liquid membrane-forming curing, or curing and sealing compound as follows:

Apply specified compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Do not allow to puddle. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period. Apply second coat for sealing 2 to 3 hours after the first coat was applied.

Do not use membrane-forming curing and sealing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glued-down carpet, vinyl composition tile, linoleum, sheet vinyl, rubber, athletic flooring, synthetic turf, or wood), paint or other coatings and finish materials. Dissipating resin type cures are acceptable in these locations.

3.10 HOT OR OTHER ADVERSE WEATHER CONCRETING

A. Definition:

1. Conditions warranting hot weather concreting practices are defined as any combination of high air temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties. If conditions cause an evaporation rate of 0.2 lb./sq. ft./hr. as calculated by Figure 2.1.5 in ACI 305R-99, then precautions shall be taken to prevent plastic shrinkage cracks from occurring.

2. The maximum acceptable concrete temperature at the truck discharge point shall be 95°F.

B. Specification: Follow hot weather concreting practices specified below when required to limit the concrete temperature at the truck discharge point to the stated maximum acceptable temperature.

C. Records: Under hot weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature at truck discharge and general weather conditions.

D. Hot Weather Concreting Requirements: The following items, all or in part as required, shall be followed to limit the concrete temperature to the stated maximum acceptable temperature and to minimize the possibility of plastic shrinkage cracks from developing.

1. Design the concrete mixes specifically for hot weather conditions replacing some cement with fly ash or other pozzolan and using a water reducing retarding admixture (ASTM C 494 Type D).

2. Use the largest size and amount of coarse aggregate compatible with the job.

3. Use sunshades and/or windbreaks.

4. Delay construction of indoor slabs-on-grade until the walls and roof are constructed.

5. Cool and shade aggregate stockpiles.

6. Use ice as part of the mixing water or cool the water with liquid nitrogen.

7. Limit the number of revolutions at mixing speed to 125 maximum.

8. Reduce time between mixing and placing as much as possible.

9. Do not add water to ready-mixed concrete at the job site unless it is part of the amount required initially for the specified water-cement ratio and the specified slump.

10. Schedule concrete placement for early morning, late afternoon, or night.

11. Have all forms, equipment and workers ready to receive and handle concrete.

12. Maintain one standby vibrator for every three vibrators used.

13. Keep all equipment and material cool by spraying with water including exteriors of forms, reinforcing steel, subgrade, chutes, conveyors, pump lines, tremies, and buggies.

14. Protect slab concrete at all stages against undue evaporation by applying a fog spray or mist above the surface or applying a monomolecular film. Where high temperatures and/or placing conditions dictate, use water-reducing retarding admixture (Type D) in lieu of the water-reducing admixture (Type A) as directed by the Owner's Testing Laboratory.

15. Provide continuous curing, preferably with water, during the first 24 hours using wet burlap, cotton mats, continuous spray mist, or by applying a curing compound meeting ASTM C 1315. Continue curing for 3 days minimum.

16. Cover reinforcing steel with water soaked burlap so that steel temperature will not exceed ambient air temperature immediately before placement of concrete.

17. As soon as possible, loosen forms and run water down the inside. When forms are removed, provide a wet cover to newly exposed surfaces.

3.11 COLD OR OTHER ADVERSE WEATHER CONCRETING

A. Definition:

1. Concrete shall not be placed when the outside air temperature is 40°F or less unless cold weather concreting practices are followed as specified below.

2. Cold weather concreting practices should also be followed whenever the average daily air temperature is less than 40°F for more than three successive days. The average daily air temperature is the average of the highest and lowest temperature occurring during the period from midnight to midnight. The requirement for adhering to these cold-weather concreting practices may be terminated when the air temperature is above 50º F for more than half of any 24h duration.

3. The temperature of the concrete immediately after placing shall be no less than and no more than 20º greater than the following temperature:.

   a. 55º F for sections less than 12 in. in the least dimension

   b. 50º F for sections 12 to 36 in. in the least dimension

   c. 45º F for sections 36 to 72 in. in the least dimension

   d. 40º F for sections greater than 72 in. in the least dimension

4. Protect the concrete immediately after placing and during the curing period such that the concrete does not freeze nor fall below the temperature levels stated in the above paragraph. When removing protection, the maximum decrease in temperature measured at the surface of the concrete in a 24 hour period shall not exceed the following:

   a. 50º F for sections less than 12 in. in the least dimension

   b. 40º F for sections 12 to 36 in. in the least dimension

   c. 30º F for sections 36 to 72 in. in the least dimension

   d. 20º F for sections greater than 72 in. in the least dimension

5. The maximum concrete temperature heated by artificial means at point of placement shall not exceed 90°F.

B. Records: Under cold weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature as placed and general weather conditions.

C. Cold Weather Concreting Requirements: The following items, all or in part as required, should be followed to assure acceptable concrete in cold weather conditions:

1. Design the concrete mix suitable for cold weather. Use air entrainment (where not prohibited) and obtain high early strength by using a higher cement content, a high early strength cement (Type III), or a specified non-chloride accelerator (ASTM C 494 Type C or E).

2. Protect the concrete during curing period using insulating blankets, insulated forms, enclosures and/or heaters.

3. Concrete cured in heated enclosures shall have heaters vented to prevent exposure of concrete and workmen to noxious gases.

4. Frozen subgrade shall be thawed prior to concrete placement and snow and ice shall be removed from forms.

5. Concrete shall be protected and cured at 50°F for seven days minimum if normal concrete (Type I cement) is used and for three days minimum if high early strength concrete (concrete with Type III cement, 100 pounds cement added per cubic yard concrete, or a non-chloride accelerator added).

6. Concrete not loaded during construction shall be protected a minimum of 3 days for normal concrete and 2 days for high early strength concrete to obtain safe form stripping strength. Concrete fully loaded during construction shall be protected for whatever time period is required to obtain the required strength as determined by nondestructive strength tests (Windsor probe, Swiss Hammer Test) on the in-place concrete.

7. Heat the mixing water and then blend hot and cold water to obtain concrete no more than 10°F above the required temperature.

8. Heat the aggregates by circulating steam in pipes placed in the storage bins for air temperatures consistently below 32°F. When either water or aggregate is heated to over 140°F combine them in the mixer first to obtain a maximum temperature of the mixture not to exceed 140°F in order to prevent flash set of the concrete.

9. Uniformly thaw aggregates far in advance of batching to prevent moisture variations in the stockpile.

10. Cover warmed stockpiles with tarps to retain heat.

11. Place air entraining admixture in the batch after the water temperature has been reduced by mixing with cooler solid materials.

12. Use wind screens to protect concrete from rapid cooling.

13. Place vertical pump lines inside the building, if possible, for concrete being pumped.

14. Maintain artificial heat as low as possible to reduce temperature stresses during cooling.

15. Avoid water curing of concrete except for parking garage structures. Apply the required curing compound to unformed surfaces as soon as possible to prevent drying of concrete from heated enclosures.

16. Delay form stripping as long as possible to help prevent drying from heated enclosures and to reduce damage to formed surfaces caused by premature stripping.

17. Provide triple thickness of insulating materials at corners and edges vulnerable to freezing.

18. Wrap protruding reinforcing bars with insulation to avoid heat drain from the warm concrete.

19. Gradually reduce the heat at the end of the heating period to reduce likelihood of thermal shock.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor rods for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp and finish concrete surfaces as scheduled.

E. Installation of Adhesive Anchors Using Injectable Epoxy or Adhesive: A representative of the adhesive manufacturer shall be present for the first three holes that are drilled and filled with adhesive. After drilling the hole to the diameter and depth recommended by the manufacturer, clean the hole with a wire or nylon brush. Blow the dust out of the hole using compressed air with a nozzle that reaches to the bottom of the hole. When using adhesive from a new pack, the adhesive that is discharged from the mixing nozzle should be a uniform gray color before any adhesive is installed in the hole. Fill the hole with adhesive starting from the very bottom of the hole until the hole is about 2/3 full. Do not leave an air pocket at the bottom of the hole. Insert the anchor rod or dowel by slowly twisting it into the hole.

3.13 CONCRETE SURFACE REPAIRS

A. Definition -Defective Areas:

1. Formed Surfaces: Concrete surfaces requiring repairs shall include all honeycombs, rock pockets and voids exceeding 1/4" in any dimension, holes left by tie rods or bolts, cracks in excess of 0.01" and any other defects that affect the durability or structural integrity of the concrete.

2. Unformed Surfaces: Concrete surfaces requiring repair shall include all surface defects such as crazing, cracks in excess of 0.01" wide or cracks which penetrate to reinforcement or through the member, popouts, spalling and honeycombs.

B. Classification:

1. Structural Concrete Repair: Major defective areas in concrete members that are load carrying (such as shear walls, beams, joists and slabs), are highly stressed, and are vital to the structural integrity of the structure shall require structural repairs. Structural concrete repairs shall be made using a two-part epoxy bonder, epoxy mortar or specified polymer repair mortar. The Engineer shall determine the locations of required structural concrete repairs.

2. Cosmetic Concrete Repair: Defective areas in concrete members that are non-load carrying and minor defective areas in load carrying concrete members shall require cosmetic concrete repair when exposed to view and not covered up by architectural finishes. Cosmetic concrete repairs may be made using a polymer repair mortar and compatible bonding agent. The Architect/Engineer shall determine the locations of required cosmetic concrete repairs. Stains and other discolorations that cannot be removed by cleaning and are exposed to view will require cosmetic repair. Cosmetic concrete repair in exposed-to-view surfaces will require Architect's approval prior to patching operation.

3. Slab Repairs: High and low areas in concrete slabs shall be repaired by removing and replacing defective slab areas unless an alternate method, such as grinding and/or filling with self-leveling underlayment compound or repair mortar is approved by the Architect/Engineer. Repair of slab spalls and other surface defects shall be made using epoxy products as specified above and as determined by the Engineer. The high strength flowing repair mortar may be used for areas greater than 1 inch in depth.

3.14 QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

A. See Testing Laboratory Services section of these Specifications for concrete materials and cast-in-place concrete inspection and test requirements.

3.15 INVESTIGATION OF LOW CONCRETE STRENGTH TEST RESULTS

A. Contractor Responsibility for Low Strength Concrete:

1. If the average of any three consecutive strength tests falls below the required f'c for a class of concrete but no individual strength test is more than 500 psi below f'c, the Contractor shall immediately notify the Engineer by telephone or e-mail and take immediate steps to increase the average of subsequent strength tests.

2. If any individual strength test falls more than 500 psi below the required f'c, the Contractor shall immediately notify the Engineer by telephone or e-mail and take immediate steps to assure that the load-carrying capacity of the structure is not jeopardized.

B. Additional Field Tests to Confirm Low Concrete Strengths:

1. The cost of all investigations of low-strength concrete, as defined by any individual strength test being more than 500 psi below the required f'c, shall be borne by the Contractor.

2. Code-Prescribed Acceptance: The only accepted field-test methods of determining actual in-situ concrete strength is by the way of core tests as prescribed below.

3. Non-Destructive Tests: If any individual strength test falls more than 500 psi below the required f'c, the Engineer may request that non-destructive field tests be performed on the concrete in question using Swiss Hammer, Windsor Probe, or other appropriate methods as approved by the Engineer. Report the comparative test results of the suspect concrete under consideration with identical tests done on concrete of known strength and of the same class. The Engineer considers these test results as only approximate indicators of strength and may not necessarily, by themselves, resolve the low concrete strength issue. These test results will be considered as additional information by which to make an informed judgment. The Engineer reserves the right to accept the concrete based on the results of these approximate tests or order that core tests be taken as prescribed below. At the Contractor's option, the approximate nondestructive field-tests may be waived and core tests immediately initiated.

4. Core Tests: If, in the opinion of the Engineer, the likelihood of low-strength concrete is confirmed and it has been determined that the load-carrying capacity of the structure is significantly reduced as a result, the Engineer may request that core tests be taken from the area in question as directed by the Engineer. There shall be a minimum of three cores taken for each strength test more than 500 psi below the required f'c and tested in accordance with ASTM C 42. If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60°to 80°F, relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 48 hours and tested wet. The Contractor shall fill all holes made by drilling cores with an approved drypack concrete.

5. Acceptance Criteria for Core Test: Concrete in an area represented by core tests shall be considered adequate if the average of three cores is equal to at least 85% of the required f'c and no single core is less than 75% of the required f'c. If approved by the Engineer, locations of erratic core strengths may be retested to check testing accuracy.

6. Load Test: If the concrete strength is not considered adequate based on core tests and the structural adequacy remains in doubt, the Engineer may order a load test as specified in ACI 318 be conducted for the questionable portion of the structure.

7. Strengthening or Demolition of the Structure: If the structural adequacy of the affected portion of the structure remains in doubt following the load test, the Engineer may order the structure to be strengthened by an appropriate means or demolished and rebuilt at the Contractor's expense.

END OF SECTION 03300

CONCRETE PREPLACEMENT SIGN-OFF CARD

Project: _____

Inspection Date: _____ Concrete Placement Date: _____

Expected Time of Concrete Placement: _____

Estimated Quantity: _____

Mix Design Strength: _____

Location of Structure: _____

Member (walls, beams, etc.): _____

Weather Conditions: _____

Method of Pour: Chute _____ Bucket _____ Pump _____

Conveyor _____ Other _____

Work	Status		Signature	Date
	Ready	N/A		
Formwork				
Reinforcing				
Mechanical				
Electrical				
Instrumentation				
Plumbing				
Process				
Metal Embeds				
Miscellaneous Specialties				
Clean-Up/OK to Place				

The Contractor certifies that the above work to be cast is prepared in accordance with the Contract Documents.

By: Contractor (Superintendent) _____

Date: _____

1. Description

   1.1. Type This work shall consist of furnishing and constructing a CON/SPAN® O-SERIES bridge system in accordance with these specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on the plans or as established by the Engineer. In situations where two or more specifications apply to this work, the most stringent requirements shall govern.

   1.2. Designation Precast reinforced concrete CON/SPAN® O-SERIES bridge units manufactured in accordance with this specification shall be designated by span and rise. Precast reinforced concrete wingwalls and headwalls manufactured in accordance with this specification shall be designated by length, height, and deflection angle. Precast Reinforced Concrete Express™ foundation units manufactured in accordance with this specification shall be designated by length, height and width.

   1.3. Alternates Precast reinforced concrete CON/SPAN® O-SERIES Bridge System as supplied by CONTECH Engineered Solutions is the basis of this design. Proposed alternates must be of equal or greater span and must provide the documentation listed below at least 20 days prior to bid. Any approved alternate shall be designated via addenda 10 days prior to bid. Alternates will not be evaluated after the bid.

   - Bridge drawings including a plan view showing total bridge length and end treatment wall length and angles, upstream and downstream end elevations showing precast span, clear span, clear distance between foundations, precast rise, clear rise, headwall height and wall thickness dimensions of bridge members and bridge end treatments. Structures must maintain minimum precast span AND minimum distance between the inside edges of the foundations as shown on the plans.

   - Product specific foundation design detailing foundation width, thickness, required reinforcement and concrete compressive strength.

   - Design calculations for precast concrete elements and foundations sealed by a registered professional engineer in the State of Georgia. The Professional engineer signing the shop drawings and calculations MUST have at least 5 years' experience designing Soil Interactive structures utilizing a PUBLIC domain software.

   - Hydraulic analysis demonstrating no increase in headwater elevation, tailwater elevation or velocity. Contact engineer for acceptable hydraulic software list.

2. Design

   2.1. Specifications The precast elements are designed in accordance with the "AASHTO LRFD Bridge Specification" 4th Edition, adopted by the American Association of State Highway and Transportation Officials, 2002. A minimum of one foot of cover above the crown of the bridge units is required in the installed condition. (Unless noted otherwise on the shop drawings and designed accordingly.)

3. Materials

   3.1. Concrete The concrete for the precast elements shall be air-entrained when installed in areas subject to freeze-thaw conditions, composed of Portland cement,

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fine and coarse aggregates, admixtures and water. Air-entrained concrete shall contain 6 ± 2 percent air. The air-entraining admixture shall conform to AASHT0 M154. The minimum concrete compressive strength shall be as shown on the shop drawings.

3.1.1. Portland Cement - Shall conform to the requirements of ASTM Specifications C150-Type I, Type II, or Type III cement.

3.1.2. Coarse Aggregate - Shall consist of stone having a maximum size of 1 inch. Aggregate shall meet requirements for ASTM C33.

3.1.3. Water Reducing Admixture - The manufacturer may submit, for approval by the Engineer, a water-reducing admixture for the purpose of increasing workability and reducing the water requirement for the concrete.

3.1.4. Calcium Chloride - The addition to the mix of calcium chloride or admixtures containing calcium chloride will not be permitted.

3.1.5. Mixture The aggregates, cement and water shall be proportioned and mixed in a batch mixer to produce a homogeneous concrete meeting the strength requirements of this specification. The proportion of Portland cement in the mixture shall not be less than 564 pounds (6 sacks) per cubic yard of concrete.

3.2. Steel Reinforcement

3.2.1. The minimum steel yield strength shall be 60,000 psi, unless otherwise noted on the shop drawings.

3.2.2. All reinforcing steel for the precast elements shall be fabricated and placed in accordance with the detailed shop drawings submitted by the manufacturer.

3.2.3. Reinforcement shall consist of welded wire fabric conforming to ASTM Specification A 185 or A 497, or deformed billet steel bars conforming to ASTM Specification A 615, Grade 60. Longitudinal distribution reinforcement may consist of welded wire fabric or deformed billet-steel bars.

3.3. Steel Hardware

3.3.1. Bolts and threaded rods for wingwall connections shall conform to ASTM A 307. Nuts shall conform to AASHTO M292 (ASTM A194) Grade 2H. All bolts, threaded rods and nuts used in wingwall connections shall be mechanically zinc coated in accordance with ASTM B695 Class 50.

3.3.2. Structural Steel for wingwall connection plates and plate washers shall conform to AASHTO M 270 (ASTM A 709) Grade 36 and shall be hot dip galvanized as per AASHTO M111 (ASTM A123).

3.3.3. Inserts for wingwalls shall be 1" diameter Two-Bolt Preset Wingwall Anchors as manufactured by Dayton Superior Concrete Accessories, Miamisburg, Ohio, (800) 745-3700 and shall be mechanically zinc coated in accordance with ASTM B695 Class 50.

3.3.4. Ferrule Loop Inserts shall be F-64 Ferrule Loop Inserts as manufactured by Dayton Superior Concrete Accessories, Miamisburg, Ohio, (800) 745-3700.

3.3.5. Hook Bolts used in attached headwall connections shall be ASTM A307.

3.3.6. Inserts for detached headwall connections shall be AISI Type 304 stainless steel, F-58 Expanded Coil inserts as manufactured by Dayton

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Superior Concrete Accessories, Miamisburg, Ohio, (800) 745-3700. Coil rods and nuts used in headwall connections shall be AISI Type 304 stainless steel. Washers used in headwall connections shall be either AISI Type 304 stainless steel plate washers or AASHTO M270 (ASTM A709) Grade 36 plate washers hot dip galvanized as per AASHTO M111 (ASTM A123).

3.3.7. Reinforcing bar splices shall be made using the Dowel Bar Splicer System as manufactured by Dayton Superior Concrete Accessories, Miamisburg, Ohio, (800) 745-3700, and shall consist of the Dowel Bar Splicer (DB-SAE) and Dowel-In (DI).

4. Manufacture of Precast Elements Subject to the provisions of Section 5, below, the precast element dimension and reinforcement details shall be as prescribed in the plan and shop drawings provided by the manufacturer.

4.1. Forms The forms used in manufacture shall be sufficiently rigid and accurate to maintain the required precast element dimensions within the permissible variations given in Section 5 of these specifications. All casting surfaces shall be of a smooth material.

4.2. Placement of Reinforcement

4.2.1. Placement of Reinforcement in Precast Bridge Units - The cover of concrete over the outside circumferential reinforcement shall be 2 inches minimum. The cover of concrete over the inside circumferential reinforcement shall be 1 1/2 inches minimum, unless otherwise noted on the shop drawings. The clear distance of the end circumferential wires shall not be less than one inch nor more than two inches from the ends of each section. Reinforcement shall be assembled utilizing single or multiple layers of welded wire fabric (not to exceed 3 layers), supplemented with a single layer of deformed billet-steel bars, when necessary. Welded wire fabric shall be composed of circumferential and longitudinal wires meeting the spacing requirements of 4.3, below, and shall contain sufficient longitudinal wires extending through the bridge unit to maintain the shape and position of the reinforcement. Longitudinal distribution reinforcement may be welded wire fabric or deformed billet-steel bars and shall meet the spacing requirements of 4.3, below. The ends of the longitudinal distribution reinforcement shall be not more than 3 inches and not less than 1 1/2 inches from the ends of the bridge unit.

4.2.2. Bending of Reinforcement for Precast Bridge Units – The outside and inside circumferential reinforcing steel for the corners of the bridge shall be bent to such an angle that is approximately equal to the configuration of the bridge's outside corner.

4.2.3. Placement of Reinforcement for Precast Wingwalls and Headwalls - The cover of concrete over the longitudinal and transverse reinforcement shall be 2 inches minimum. The clear distance from the end of each precast element to the end of reinforcing steel shall not be less than ½ inch nor more than 3 inches. Reinforcement shall be assembled utilizing a single layer of welded wire fabric, or a single layer of deformed billet-steel bars. Welded wire fabric shall be composed of transverse and longitudinal wires meeting the spacing requirements of 4.3, below, and shall contain sufficient longitudinal wires extending through the element to maintain the shape and position of the reinforcement. Longitudinal reinforcement may be welded wire fabric or deformed billet-steel bars and shall meet the spacing requirements of 4.3, below.

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4.2.4. Placement of Reinforcement for Precast Foundation Units – The cover of concrete over the bottom reinforcement shall be 3 inches minimum. The cover of concrete for all other reinforcement shall be 2 inches minimum. The clear distance from the end of each precast element to the end of reinforcing steel shall not be less than 2 inches nor more than 3 inches. Reinforcement shall be assembled utilizing a single layer of welded wire fabric or a single layer of deforemed billet-steel bars. Welded wire fabric shall be composed of transverse and longitudinal wires meeting the spacing requirements of 4.3, below, and shall contain sufficient longitudinal wires extending trhough the element to maintain the shape and position of the reinforcement. Longitudinal reinforcement may be welded wire fabric or deformed billet-steel bars and shall meet the spacing requirements of 4.3, below.

4.3. Laps, Welds, Spacing

4.3.1. Laps, Welds, and Spacing for Precast Bridge Units - Tension splices in the circumferential reinforcement shall be made by lapping. Laps may be tack welded together for assembly purposes. For smooth welded wire fabric, the overlap shall meet the requirements of AASHTO 8.30.2 and 8.32.6. For deformed welded wire fabric, the overlap shall meet the requirements of AASHTO 8.30.1 and 8.32.5. The overlap of welded wire fabric shall be measured between the outer-most longitudinal wires of each fabric sheet. For deformed billet-steel bars, the overlap shall meet the requirements of AASHTO 8.25. For splices other than tension splices, the overlap shall be a minimum of 12" for welded wire fabric or deformed billet-steel bars. The spacing center to center of the circumferential wires in a wire fabric sheet shall be not less than 2 inches nor more than 4 inches. The spacing center to center of the longitudinal wires shall not be more than 8 inches. The spacing center to center of the longitudinal distribution steel for either line of reinforcing in the top slab shall be not more than 1 foot 4 inches.

4.3.2. Laps, Welds, and Spacing for Precast Wingwalls, Headwalls and Foundations - Splices in the reinforcement shall be made by lapping. Laps may be tack welded together for assembly purposes. For smooth welded wire fabric, the overlap shall meet the requirements of AASHTO 8.30.2 and 8.32.6. For deformed welded wire fabric, the overlap shall meet the requirements of AASHTO 8.30.1 and 8.32.5. For deformed billet-steel bars, the overlap shall meet the requirements of AASHTO 8.25. The spacing center-to-center of the wires in a wire fabric sheet shall be not less than 2 inches nor more than 8 inches.

4.4. Curing The precast concrete elements shall be cured for a sufficient length of time so that the concrete will develop the specified compressive strength in 28 days or less. Any one of the following methods of curing or combinations thereof shall be used:

4.4.1. Steam Curing - The precast elements may be low-pressure steam cured by a system that will maintain a moist atmosphere.

4.4.2. Water Curing - The precast elements may be water cured by any method that will keep the sections moist.

4.4.3. Membrane Curing - A sealing membrane conforming to the requirements of ASTM Specification C309 may be applied and shall be left intact until the required concrete compressive strength is attained. The concrete temperature at the time of application shall be within +/- 10 degrees F of the atmospheric temperature. All surfaces shall be kept moist prior to the

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application of the compounds and shall be damp when the compound is applied.

4.5. Storage, Handling & Delivery

4.5.1. Storage

Precast concrete bridge elements shall be lifted and stored in “as-cast” position.

Precast concrete headwall and wingwall units are cast, stored and shipped in a flat position.

The precast elements shall be stored in such a manner to prevent cracking or damage. Store elements using timber supports as appropriate. The units shall not be moved until the concrete compressive strength has reached a minimum of 2500 psi, and they shall not be stored in an upright position.

4.5.2. Handling

Handling devices shall be permitted in each precast element for the purpose of handling and setting.

Spreader beams may be required for the lifting of precast concrete bridge elements to preclude damage from bending or torsion forces.

4.5.3. Delivery

Precast concrete elements must not be shipped until the concrete has attained the specified design compressive strength, or as directed by the design Engineer.

Precast concrete elements may be unloaded and placed on the ground at the site until installed. Store elements using timber supports as appropriate.

4.6. Quality Assurance The Precaster shall demonstrate adherence to the standards set forth in the NPCA Quality Control Manual. The Precaster shall meet either Section 4.6.1 or 4.6.2

4.6.1. Certification: The Precaster shall be certified by the Precast/Prestressed Concrete Institute Plant Certification Program or the National Precast Concrete Association's Plant Certification Program prior to and during production of the products covered by this specification.

4.6.2. Qualifications, Testing and Inspection

4.6.2.1. The Precaster shall have been in the business of producing precast concrete products similar to those specified for a minimum of three years. He shall maintain a permanent quality control department or retain an independent testing agency on a continuing basis. The agency shall issue a report, certified by a licensed engineer, detailing the ability of the Precaster to produce quality products consistent with industry standards.

4.6.2.2. The Precaster shall show that the following tests are performed in accordance with the ASTM standards indicated. Tests shall be performed as indicated in Section 6 of these specifications.

4.6.2.2.1. Air Content: C231 or C173

4.6.2.2.2. Compressive Strength: C31, C39, C497

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4.6.2.3. The Precaster shall provide documentation demonstrating compliance with this section to CONTECH® Engineered Solutions at regular intervals or upon request.

4.6.2.4. The Owner may place an inspector in the plant when the products covered by this specification are being manufactured.

4.6.3. Documentation - The Precaster shall submit Precast Production Reports to CONTECH® Engineered Solutions as required.

5. Permissible Variations

5.1. Bridge Units

5.1.1. Internal Dimensions - The internal dimension shall vary not more than 1% from the design dimensions nor more than 1-1/2 inches whichever is less.

5.1.2. Slab and Wall Thickness - The slab and wall thickness shall not be less than that shown in the design by more than 1/4 inch. A thickness more than that required in the design shall not be cause for rejection.

5.1.3. Length of Opposite Surfaces - Variations in laying lengths of two opposite surfaces of the bridge unit shall not be more than 1/2 inch in any section, except where beveled ends for laying of curves are specified by the purchaser.

5.1.4. Length of Section - The underrun in length of a section shall not be more than 1/2 inch in any bridge unit.

5.1.5. Position of Reinforcement - The maximum variation in position of the reinforcement shall be ± 1/2 inch. In no case shall the cover over the reinforcement be less than 1 1/2 inches for the outside circumferential steel or be less than 1 inch for the inside circumferential steel as measured to the external or internal surface of the bridge. These tolerances or cover requirements do not apply to mating surfaces of the joints.

5.1.6. Area of Reinforcement - The areas of steel reinforcement shall be the design steel areas as shown in the manufacturer's shop drawings. Steel areas greater than those required shall not be cause for rejection. The permissible variation in diameter of any reinforcement shall conform to the tolerances prescribed in the ASTM Specification for that type of reinforcement.

5.2. Wingwalls & Headwalls

5.2.1. Wall Thickness - The wall thickness shall not vary from that shown in the design by more than 1/2 inch.

5.2.2. Length/ Height of Wall sections - The length and height of the wall shall not vary from that shown in the design by more than 1/2 inch.

5.2.3. Position of Reinforcement - The maximum variation in the position of the reinforcement shall be ± 1/2 inch. In no case shall the cover over the reinforcement be less than 1 1/2 inches.

5.2.4. Size of Reinforcement - The permissible variation in diameter of any reinforcing shall conform to the tolerances prescribed in the ASTM Specification for that type of reinforcing. Steel area greater than that required shall not be cause for rejection.

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5.3. Foundation Units

5.3.1. Wall Thickness - The wall thickness shall not vary from that shown in the design by more than 1/2 inch.

5.3.2. Length/ Height/Width of Foundation sections - The length, height and width of the foundation units shall not vary from that shown in the design by more than 1/2 inch.

5.3.3. Position of Reinforcement - The maximum variation in the position of the reinforcement shall be ± 1/2 inch. In no case shall the cover over the reinforcement be less than 1 1/2 inches.

5.3.4. Size of Reinforcement - The permissible variation in diameter of any reinforcing shall conform to the tolerances prescribed in the ASTM Specification for that type of reinforcing. Steel area greater than that required shall not be cause for rejection.

6. Testing/ Inspection

6.1. Testing

6.1.1. Type of Test Specimen - Concrete compressive strength shall be determined from compression tests made on cylinders or cores. For cylinder testing, a minimum of 4 cylinders shall be taken for each bridge element. Each element shall be considered separately for the purpose of testing and acceptance.

6.1.2. Compression Testing - Cylinders shall be made and tested as prescribed by the ASTM C 39 Specification. Cylinders shall be cured in the same environment as the bridge elements. Cores shall be obtained and tested for compressive strength in accordance with the provisions of the ASTM C42 specification.

6.1.3. Acceptability of Cylinder Tests - When the average compressive strength of all cylinders tested is equal to or greater than the design compressive strength, and not more than 10% of the cylinders tested have a compressive strength less than the design concrete strength, and no cylinder tested has a compressive strength less than 80% of the design compressive strength, then the element shall be accepted. When the compressive strength of the cylinders tested does not conform to these acceptance criteria, the acceptability of the element may be determined as described in section 6.1.4, below.

6.1.4. Acceptability of Core Tests - The compressive strength of the concrete in a bridge element is acceptable when the average core test strength is equal to or greater than the design concrete strength. When the compressive strength of a core tested is less than the design concrete strength, the precast element from which that core was taken may be re-cored. When the compressive strength of the re-core is equal to or greater than the design concrete strength, the compressive strength of the concrete in that bridge element is acceptable.

6.1.4.1. When the compressive strength of any recore is less than the design concrete strength, the precast element from which that core was taken shall be rejected.

6.1.4.2. Plugging Core Holes - The core holes shall be plugged and sealed by the manufacturer in a manner such that the elements will meet all of the test requirements of this specification. Precast elements so sealed shall be considered satisfactory for use.

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6.1.4.3. Test Equipment - Every manufacturer furnishing precast elements under this specification shall furnish all facilities and personnel necessary to carry out the test required.

6.2. Inspection The quality of materials, the process of manufacture, and the finished precast elements shall be subject to inspection by the purchaser.

7. Joints The bridge units shall be produced with flat butt ends. The ends of the bridge units shall be such that when the sections are laid together they will make a continuous line with a smooth interior free of appreciable irregularities, all compatible with the permissible variations in section 5, above. The joint width between adjacent precast units shall not exceed 3/4 inches.

8. Workmanship/ Finish The bridge units, wingwalls, headwalls and foundation units shall be substantially free of fractures. The ends of the bridge units shall be normal to the walls and centerline of the bridge section, within the limits of the variations given in section 5, above, except where beveled ends are specified. The faces of the wingwalls and headwalls shall be parallel to each other, within the limits of variations given in section 5, above. The surface of the precast elements shall be a smooth steel form or troweled surface. Trapped air pockets causing surface defects shall be considered as part of a smooth, steel form finish.

9. Repairs Precast elements may be repaired, if necessary, because of imperfections in manufacture or handling damage and will be acceptable if, in the opinion of the purchaser, the repairs are sound, properly finished and cured, and the repaired section conforms to the requirements of this specification.

10. Rejection The precast elements shall be subject to rejection on account of any of the specification requirements. Individual precast elements may be rejected because of any of the following:

    10.1. Fractures or cracks passing through the wall, except for a single end crack that does not exceed one half the thickness of the wall.

    10.2. Defects that indicate proportioning, mixing, and molding not in compliance with section 4 of these specifications.

    10.3. Honeycombed or open texture.

    10.4. Damaged ends, where such damage would prevent making a satisfactory joint.

11. Marking Each bridge unit shall be clearly marked by waterproof paint. The following shall be shown on the inside of the vertical leg of the bridge section:
    Bridge Span X Bridge Rise
    Date of Manufacture
    Name or trademark of the manufacturer

12. Installation Preparation To ensure correct installation of the precast concrete bridge system, care and caution must be exercised in forming the support areas for bridge units, headwall, and wingwall elements. Exercising special care will facilitate the rapid installation of the precast components.

    12.1. Footings

    Do not over excavate foundations unless directed by site soil engineer to remove unsuitable soil.

    The site soils engineer shall certify that the bearing capacity meets or exceeds the footing design requirements, prior to the contractor pouring of the footings.

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The bridge units and wingwalls shall be installed on either precast or cast-in-place concrete footings. The size and elevation of the footings shall be as designed by the Engineer. A keyway shall be formed in the top surface of the bridge footing as specified on the plans. No keyway is required in the wingwall footings, unless otherwise specified on the plans.

The footings shall be given a smooth float finish and shall reach a compressive strength of 2,000 psi before placement of the bridge and wingwall elements. Backfilling shall not begin until the footing has reached the full design compressive strength.

The footing surface shall be constructed in accordance with grades shown on the plans. When tested with a 10-foot straight edge, the surface shall not vary more than 1/4 inch in 10 feet.

If a precast concrete footing is used, the contractor shall prepare a 4-inch thick base layer of compacted granular material the full width of the footing prior to placing the precast footing.

The foundations for precast concrete bridge elements and wingwalls must be connected by reinforcement to form one monolithic body. Expansion joints shall not be used.

The contractor shall be responsible for the construction of the foundations per the plans and specifications.

13. Installation

13.1. General The installation of the precast concrete elements shall be as explained in the publication *CON/SPAN Bridge Systems Installation Handbook*.

13.1.1. Lifting It is the responsibility of the contractor to ensure that a crane of the correct lifting capacity is available to handle the precast concrete units. This can be accomplished by using the weights given for the precast concrete components and by determining the lifting reach for each crane unit. Site conditions must be checked well in advance of shipping to ensure proper crane location and to avoid any lifting restrictions. The lift anchors or holes provided in each unit are the only means to be used to lift the elements. The precast concrete elements must not be supported or raised by other means than those given in the manuals and drawings without written approval from CONTECH® Engineered Solutions.

13.1.2. Construction equipment weight restrictions: In no case shall equipment operating in excess of the design load (HL-93) be permitted over the bridge units unless approved by CONTECH® Engineered Solutions.

13.1.2.1. In the immediate area of the bridge units, the following restrictions for the use of heavy construction machinery during backfilling operations apply:

- No construction equipment shall cross the bare precast concrete bridge unit.
- After the compacted fill level has reached a minimum of 4 inches over the crown of the bridge, construction equipment with a weight of less than 10 tons may cross the bridge.

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- After the compacted fill level has reached a minimum of 1 foot over the crown of the bridge, construction equipment with a weight of less than 30 tons may cross the bridge.
- After the compacted fill level has reached the design cover, or 2 feet minimum, over the crown of the precast concrete bridge, construction equipment within the design load limits for the road may cross the precast concrete bridge.

13.2. Leveling Pad/ Shims The bridge units and wingwalls shall be set on hardboard shims conforming to ASTM D1037 or plastic shims (Dayton Superior P-80, P-81 or approved equal) measuring 5" x 5", minimum, unless shown otherwise on the plans. A minimum gap of 1/2 inch shall be provided between the footing and the bottom of the bridge's vertical legs or the bottom of the wingwall. Also, a supply of 1/4 inch, 1/2 inch & 1/8 inch thick hardboard or plastic shims for various shimming purposes shall be on site.

13.3. Placement of Bridge Units

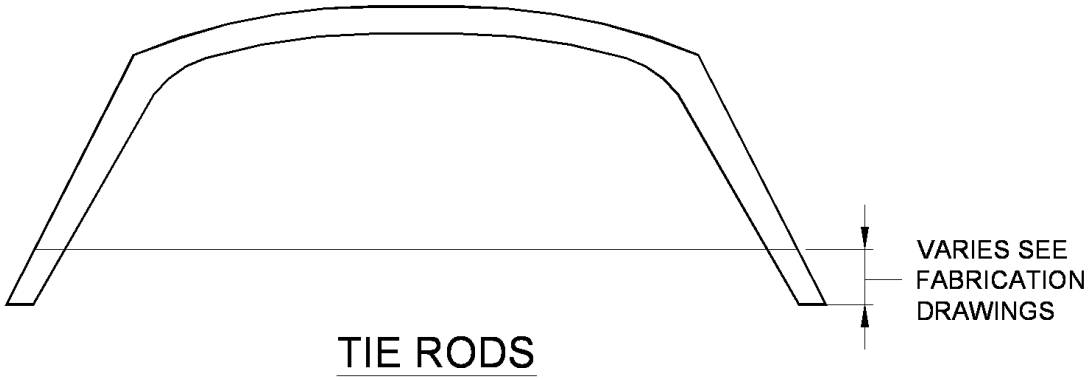
The bridge units shall be placed as shown on the Engineer's plan drawings. Special care shall be taken in setting the elements to the true line and grade. The joint width between adjacent precast units shall not exceed 3/4 inches.

13.4. It is the contractor's responsibility to maintain the structure span during all phases of installation. Due to the arch shape, bridge elements will tend to spread under self-weight. It is imperative that any lateral spreading of the bridge elements be avoided during and after their placement. Generally, horizontal tie rods are shipped in the larger bridge elements to assist in preventing this spreading. Tie rods shall not be removed until bridge units are grouted and grout has cured. It is recommended that temporary hardwood blocks be used in conjunction with the cable/tie rods to maintain span. If, however, due to site restrictions, these cable ties/tie rods must be removed prior to placement of the bridge elements, the contractor must notify CONTECH (manufacturer) and request a suggested installation procedure.

In addition, if the cable ties/tie rods must be removed prior to setting arch units, the following quality control procedure must be followed:

1) Find "measured span" upon arch unit's delivery to site, prior to lifting from truck and removing cable ties/tie rods. "Measured span" shall be the average of (3) span measurements along the lay length of the arch unit.
2) After setting of bridge unit on the foundation, verify the span. This "installed span measurement" shall not exceed the maximum of
   A) The nominal span + ½" OR
   B) The "measured span".

If the "installed span measurement" exceeds this amount, the arch unit shall be lifted and re-set until the "installed span measurement" meets the limits.



TIE RODS

13.5. Placement of Wingwalls, Headwalls & Foundation Units

The wingwalls, headwalls and foundations shall be placed as shown on the plan drawings. Special care shall be taken in setting the elements to the true line and grade.

13.6. Waterproofing/ Joint protection and Subsurface Drainage

13.6.1. External Protection of Joints - The butt joint made by two adjoining bridge units shall be covered with a 7/8" x 1 3/8" preformed bituminous joint sealant and a minimum of a 9-inch wide joint wrap. The surface shall be free of dirt before applying the joint material. A primer compatible with the joint wrap to be used shall be applied for a minimum width of nine inches on each side of the joint. The external wrap shall be either EZ-WRAP RUBBER by PRESS-SEAL GASKET CORPORATION, SEAL WRAP by MAR MAC MANUFACTURING CO. INC. or approved equal. The joint shall be covered continuously from the bottom of one bridge section leg, across the top of the bridge and to the opposite bridge section leg. Any laps that result in the joint wrap shall be a minimum of six inches long with the overlap running downhill.

13.6.2. In addition to the joints between bridge units, the joint between the end bridge unit and the headwall shall also be sealed as described above. If precast wingwalls are used, the joint between the end bridge unit and the wingwall shall be sealed with a 2'-0" strip of filter fabric. Also, if lift holes are formed in the bridge units, they shall be primed and covered with a 9" x 9" square of joint wrap.

13.6.3. During the backfilling operation, care shall be taken to keep the joint wrap in its proper location over the joint.

13.6.4. Subsoil drainage shall be as directed by the engineer.

13.7. Grouting

13.7.1. Grouting shall not be performed when temperatures are expected to go below 35° for a period of 72 hours.

Fill the bridge-foundation keyway with cement grout (Portland cement and water or cement mortar composed of Portland cement, sand and water) with a minimum 28-day compressive strength of 3000 psi. Vibrate as required to ensure that the entire key around the bridge element is completely filled. If bridge elements have been set with temporary ties

(cables, bars, etc.) grout must attain a minimum compressive strength of 1500 psi before ties may be removed.

13.7.2. All grout shall have a maximum aggregate size of ¼ inch.

13.7.3. Lifting and erection anchor recesses shall be filled with grout.

13.8. Backfill

13.8.1. Do not perform backfilling during wet or freezing weather.

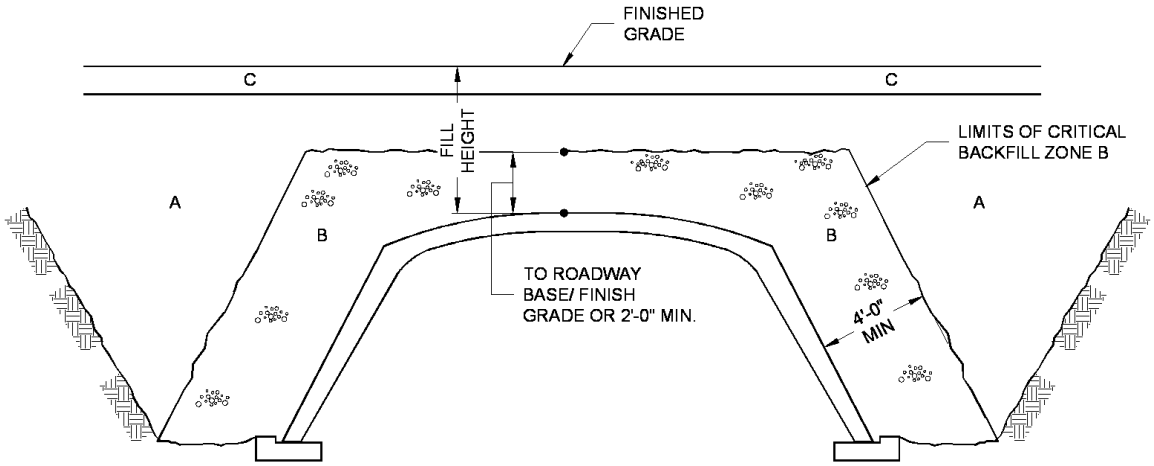
13.8.2. No backfill shall be placed against any structural elements until they have been approved by the Engineer.

13.8.3. Backfill shall be considered as all replaced excavation and new embankment adjacent to the precast concrete elements. The project construction and material specifications, which include the specifications for excavation for structures and roadway excavation and embankment construction, shall apply except as modified in this section.

13.8.4. Backfill Zones

- In-situ soil
- Zone A: constructed embankment or overfill.
- Zone B: fill that is directly associated with precast concrete bridge installation.
- Zone C: road structure.

13.8.5. Required Backfill Properties



SPAN	FILL HEIGHT	ACCEPTABLE MATERIAL INSIDE ZONE B
≤ 24'-0"	≥ 12'-0"	A1, A3
≤ 24'-0"	< 12'-0"	A1, A2, A3, A4
> 24'-0"	all	A1, A3

13.8.5.1. In-situ soil

Natural ground is to be sufficiently stable to allow effective support to the precast concrete bridge units. As a guide, the existing natural ground should be of similar quality and density

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to Zone B material for minimum lateral dimension of one bridge span outside of the bridge footing.

13.8.5.2. Zone A

Zone A requires fill material with specifications and compacting procedures equal to that for normal road embankments.

13.8.5.3. Zone B

Generally, soils shall be reasonably free of organic matter, and, near concrete surfaces, free of stones larger than 3 inches in diameter. See charts for detailed descriptions of acceptable soils.

Acceptable Soils for use in Zone B Backfill

Typical USCS Materials	AASHTO Group	AASHTO Subgroup	Percent passing US Sieve No.			Character of Fraction passing No. 40 Sieve		Soil Description
			#10	#40	#200	Liquid Limit	Plasticity Index	
GW, GP, SP	A-1	A-1a	50 max	30 max	15 max		6 max	Largely gravel but can include sand and fines
GM, SW, SP, SM		A-1b		50 max	25 max		6 max	Gravelly sand or graded sand, may include fines
GM, SM, ML, SP, GP	A-2	A-2-4			35 max	40 max	10 max	Sands, gravels with low-plasticity silt fines
SC, GC, GM		A-2-5			35 max	41 min	10 max	Sands, gravels with plastic silt fines
SP, SM, SW	A-3			51 min	10 max		non-plastic	Fine sands
ML, SM, SC	A-4				36 min	40 max	10 max	Low-compressibility silts

13.8.5.4. Zone C

Zone C is the road section of gravel, asphalt or concrete built in compliance with local engineering practices.

13.8.5.5. Geotechnical engineer shall review gradations of all interfacing materials and, if necessary, recommend geotextile filter fabric (provided by contractor).

13.8.6. Placing and Compacting Backfill

Dumping for backfilling is not allowed any nearer than 3 ft from the bridge leg.

The fill must be placed and compacted in layers not exceeding 8 inches. The maximum difference in the surface levels of the fill on opposite sides of the bridge must not exceed 2 feet.

The fill behind wingwalls must be placed at the same time as that of the bridge fill. It must be placed in progressively placed horizontal layers not exceeding 8 inches per layer.

The backfill of Zone B shall be compacted to a minimum density of 95% of the Standard Proctor, as required by AASHTO T-99.

Soil within 1 foot of concrete surfaces shall be hand-compacted. Elsewhere, use of rollers is acceptable. If vibrating roller-compactors are used, they shall not be started or stopped within Zone B and the vibration frequency should be at least 30 revolutions per second.

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The backfill material and compacting behind wingwalls shall satisfy the criteria for the bridge backfill, Zone B.

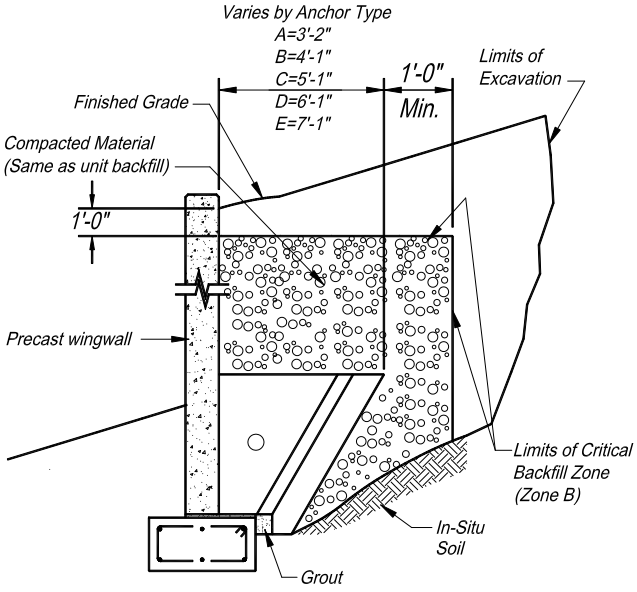
Backfill against a waterproofed surface shall be placed carefully to avoid damage to the waterproofing material.

13.8.7. Bridge Units

For fill heights over 12 feet (as measured from top crown of bridge to finished grade), no backfilling may begin until a backfill compaction testing plan has been coordinated with and approved by CONTECH® Engineered Solutions.

13.8.8. Wingwalls

Backfill in front of wingwalls shall be carried to ground lines shown in the plans.



13.8.9. Monitoring

The contractor shall check settlements and horizontal displacement of foundation to ensure that they are within the allowable limit provided by the engineer. These measurements should give an indication of the settlements and deformations along the length of the foundations.

The first measurement should take place after the erection of all precast bridge system elements, a second after completion of backfilling, and a third before opening of the bridge to traffic. Further measurements may be made according to local conditions.

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ARTICULATING CONCRETE BLOCK (ACB) SYSTEM SPECIFICATIONS - ARMORFLEX®

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The contractor shall furnish all labor, materials, equipment, and incidentals required for, and perform all operations in connection with, the installation of the ArmorFlex® Articulating Concrete Block (ACB) system in accordance with the lines, grades, design and dimensions shown on the Contract Drawings and as specified herein.

1.2 RELATED SECTIONS

A. Reserved

1.3 SUBMITTALS

A. Submit under provisions of Related Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Certification of successful completion of full-scale laboratory testing in accordance with the current version of ASTM D 7277, *Standard Test Method for Performance Testing of Articulating Concrete Block (ACB) Revetment Systems for Hydraulic Stability in Open Channel Flow*. This certification shall comprise a final test report from the testing facility, or a summary test report from the testing facility providing the test procedure and the obtained Critical Shear Stress parameters of the tested block. Third-party testimonies of compliance shall not be sufficient to satisfy this requirement.
2. Certified analysis and interpretation of the test data shall conform to the guidance contained in the current version of ASTM D 7276, *Standard Guide for Analysis and Interpretation of Test Data for Articulating Concrete Block (ACB) Revetment Systems in Open Channel Flow*.
3. The following information obtained from the above testing, analysis, and interpretation:
    a. Tested bed slope
    b. Maximum discharge attained prior to failure
    c. Measured water surface elevation
    d. Calculated energy grade line (EGL)
    e. Plot of the applied shear and velocity by station
    f. An illustration of the selected control volume on a profile of the test slope
    g. Calculated design Manning’s n
    h. Calculated block system coefficient of Lift
    i. Characteristic block properties including weight and moment arms
    j. Extrapolation of tested values to thicker block (if required)

C. Factor of Safety (FoS) calculations in support of the proposed ACB system

1. In accordance with the Factor-of-Safety design methodology as described in *“Moment Stability Analysis Method for Determining Safety Factors for Articulated Concrete Blocks”*, by Amanda L. Cox, 2010.
2. Stamped and signed by a Professional Engineer licensed to practice in the state where the project is located.
3. The following project specific hydraulic requirements are to be utilized:

Property	Value
Channel Bottom Width (ft)	
Channel Side Slopes (_H:1V)	

Channel Bed Slope (ft/ft)	
Design Volumetric Flow Rate (cfs)	

4. The analysis shall be performed based upon the stability of the ACBs due to gravity alone, conservatively neglecting any stabilizing forces potentially provided by cabling, mechanical anchorage, contact with adjacent blocks, or other restraints not attributable to gravity alone.
5. The analysis must account for a 0.5-inch block projection, in accordance with *ASTM D 6884, Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems,* Section 6.3.3. Site grading requirements may not be used to omit this requirement for standard (non-tapered) block. For block that is tapered (i.e., the block thickness is greater on the downstream edge than on the upstream edge, by at least 0.5"), this block projection value may be 0 inches for analysis purposes.

D. An appropriate geotextile, selected for the site being protected on the basis of the gradation and permeability of the surface soils.

E. Manufacturer's certificates of compliance for ACB/mats, revetment cable, geotextile, and any revetment cable fittings and connectors in accordance with the current version of ASTM D 6884, *Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems*.

F. Shop Drawings for the layout of the mats, installation, and safety instructions, and any recommendations, if applicable, that are specifically related to the project.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Suppliers must own and operate their own manufacturing facility.
2. Suppliers shall directly employ a minimum of five (5) registered Professional Engineers.
3. A list of five (5) comparable projects, in terms of size and applications, in the United States, where the satisfactory performance of the specific ACB system can be verified after a minimum of five (5) years of service life.
4. The names and contact information (phone numbers and e-mail addresses, at a minimum) for the suppliers' representatives, for technical, production or logistics questions, at least one of whom must reside in the state where the project is located.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

1.5 PRE-INSTALLATION MEETINGS

A. Supplier's representative shall be available for pre-installation meeting a minimum two weeks prior to starting work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Materials delivered to the site shall be inspected for damage, unloaded and stored with the minimum of handling. Material shall be kept free of dirt and debris.

B. Storage shall be in accordance with manufacturer's requirements.

C. Handling: Materials shall be handled in such a manner as to ensure delivery to the site in sound, undamaged condition.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

ArmorFlex® as manufactured and sold by:
ARMORTEC, a Contech Company
9025 Centre Pointe Dr., Suite 400
West Chester, OH 45069
P: 800-645-7000
F: 513-645-7993
www.conteches.com/Products/Erosion-Control/Hard-Armor/ArmorFlex

B. Substitutions: Not permitted.

2.2 MATERIALS

A. Articulating Concrete Blocks

1. Manufacturing shall conform to the current version of ASTM D-6684, *Standard Specification for Materials and Manufacture of Articulating Concrete Block (ACB) Revetment Systems*.
2. Cementitious Materials - Materials shall conform to the following applicable ASTM specifications:
   a. Portland Cements - Specification C 150, for Portland Cement.
   b. Blended Cements - Specification C 595, for Blended Hydraulic Cements.
   c. Hydrated Lime Types - Specification C 207, for Hydrated Lime Types.
   d. Pozzolans - Specification C 618, for Fly Ash and Raw or Calcined Natural Pozzolans for use in Portland Cement Concrete.
   e. Aggregates – Specification C 33, for Concrete Aggregates, except that grading requirements shall not necessarily apply.
3. Casting: The ACB units shall be produced using a dry cast method. Dry cast units obtain strength more quickly than wet cast blocks, and will also achieve a greater uniformity of quality and greater durability.
4. Physical Requirements: At the time of delivery to the work site, the ACB units shall conform to the physical requirements prescribed in Table listed below.

PHYSICAL REQUIREMENTS

Compressive Strength Net Area Min. p.s.i (mPa)		Water Absorption Max. lb/ft^3 (kg/m^3)	
Avg. of 3 units	Individual Unit	Avg. of 3 units	Individual Unit
4,000 (27.6)	3,500 (24.1)	9.1 (160)	11.7 (192)

5. Visual Inspection
   a. All units shall be sound and free of defects which would interfere with the proper placement of the unit, or which would impair the performance of the system. Surface cracks incidental to the usual methods of manufacture, or surface chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection.
   b. Cracks exceeding 0.25 inches (.635 cm) in width and/or 1.0 inch (2.54 cm) in depth shall be deemed grounds for rejection. Chipping resulting in a weight loss exceeding 10% of the average weight of a concrete unit shall be deemed grounds for rejection.
   c. Blocks rejected prior to delivery from the point of manufacture shall be replaced at the manufacturer's expense. Blocks rejected at the job site shall be repaired with structural grout or replaced upon request at the expense of the contractor.
6. Sampling and Testing
   a. The purchaser (or their authorized representative) shall be afforded access to the relevant manufacturing facility or facilities, if desired, in order to inspect and/or sample the ACB units from lots ready for delivery prior to release for

delivery to the job site. Such inspections are at the sole expense of the requesting entity.

b. Purchaser may request additional testing other than that provided by the manufacturer as needed. Such requested testing will extend any stated lead times for manufacturing and delivery, if the results of such testing are a prerequisite to approval (i.e., approval for release to manufacturing). Costs associated with such testing shall be borne by the purchaser.

B. Revetment Cables and Fittings

1. Option 1. Polyester Revetment Cable and Fittings
   a. Revetment cable shall be constructed of high tenacity, low elongating, and continuous filament polyester fibers. Cable shall consist of a core construction comprised of parallel fibers contained within an outer jacket or cover.
   b. The size of the revetment cable shall be selected such that the minimum acceptable strength is at least five (5) times that required for lifting of the mats, in accordance with ASTM D-6684 paragraph 5.5.2. This design shall include a reduction factor for splicing of 60%, unless a larger factor can be substantiated by laboratory testing.
   c. The revetment cable shall exhibit resistance to most concentrated acids, alkalis and solvents. Cable shall be impervious to rot, mildew and degradation associated with marine organisms. The materials used in the construction of the cable shall not be affected by continuous immersion in fresh or salt water.
   d. Selection of cable and fittings shall be made in a manner that ensures a safe design factor for mats being lifted from both ends, thereby forming a catenary. Consideration shall be taken for the bending of the cables around hooks or pins during lifting. Fittings such as sleeves and stops shall be aluminum and washers shall be plastic unless otherwise shown on the Contract Drawings.
2. Option 2. Galvanized Steel Revetment Cable and Fittings
   a. Revetment cable shall be constructed of preformed galvanized aircraft cable (GAC). The cables shall be made from individual wires and strands that have been formed during the manufacture into the shape they have in finished cable.
   b. Cable shall consist of a core construction comprised of seven (7) wires wrapped within seven (7) or nineteen (19) wire strands.
   c. The size of the revetment cable shall be selected such that the minimum acceptable strength is at least five (5) times that required for lifting of the mats, in accordance with ASTM D-6684 paragraph 5.5.2. This design shall include a reduction factor for splicing of 75%, unless a larger factor can be substantiated by laboratory testing.
   d. The revetment cable shall exhibit resistance to mild concentrations of acids, alkalis, and solvents. Fittings such as sleeves and stops shall be aluminum, and the washers shall be galvanized steel or plastic. Furthermore, depending on material availability, the cable type (7x7 or 7x19) can be interchanged while always ensuring the required factor of safety for the cable.
   e. Selection of cable and fittings shall be made in a manner that insures a safe design factor for mats being lifted from both ends, thereby forming a catenary. Consideration shall be taken for the bending of the cables around hooks or pins during lifting. Fittings such as sleeves and stops shall be aluminum and washers shall be plastic unless otherwise shown on the Contract Drawings.

C. Filter Fabric

1. The standard for sizing geotextile for these applications is AASHTO M-288, Permanent Erosion Control, Class 2. Either woven monofilament or non-woven geotextile are acceptable; woven slit-film geotextiles are not acceptable.
2. Geotextile shall be sized for the soil subgrade permeability per Section 31 35 19.16 – Geotextile Slope Protection.
3. Under no circumstances shall the filter fabric be permanently affixed or otherwise

adhered to the blocks or mats; i.e., the filter fabric shall be independent of the block system.

4. During all periods of shipment and storage, the filter fabric shall be protected from direct sunlight, UV radiation, and temperatures greater than 140°F. To the extent possible, the fabric shall be maintained wrapped in its protective covering. Geotextile exposure to sunlight or UV radiation shall be minimized to the greatest extent possible until the installation process begins.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

A. All subgrade preparation shall be performed in accordance with the current version of ASTM D 6884, *Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems*.

B. The slope shall be graded to a smooth plane surface to ensure that intimate contact is achieved between the slope face and the geotextile (filter fabric), and between the geotextile and the entire bottom surface of the individual ACBs. All slope deformities, roots, grade stakes, and stones which project normal to the local slope face must be re-graded or removed. No holes, "pockmarks", slope board teeth marks, footprints, or other voids greater than 0.5 inch in depth normal to the local slope face shall be permitted. No grooves or depressions greater than 0.5 inches in depth normal to the local slope face with a dimension exceeding 1.0 foot in any direction shall be permitted. Where such areas are evident, they shall be brought to grade by placing compacted homogeneous material. The slope and slope face shall be uniformly compacted, and the depth of layers, homogeneity of soil, and amount of compaction shall be as required by the EOR.

C. Excavation and preparation for all termination trenches or aprons shall be done in accordance to the lines, grades and dimensions shown in the Contract Drawings. The termination trench hinge-point at the top of the slope shall be uniformly graded so that no dips or bumps greater than 0.5 inches over or under the local grade occur. The width of the termination trench hinge-point shall also be graded uniformly to assure intimate contact between all ACBs and the underlying grade at the hinge-point.

D. Immediately prior to placing the filter fabric and ACB mats, the prepared subgrade shall be inspected by the EOR as well as the owner's representative. No fabric or blocks shall be placed thereon until that area has been approved by each of these parties.

3.2 PLACEMENT OF GEOTEXTILE FILTER FABRIC

A. All placement and preparation should be performed in accordance with the current version of ASTM D 6884, *Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems*. Filter Fabric, or filtration geotextile, as specified elsewhere, will be placed within the limits of ACBs shown on the Contract Drawings.

B. The filtration geotextile will be placed directly on the prepared area, in intimate contact with the subgrade, and free of folds or wrinkles. The geotextile will not be walked on or disturbed when the result is a loss of intimate contact between the ACB and the geotextile or between the geotextile and the subgrade. The geotextile filter fabric will be placed so that the upstream strip of fabric overlaps the downstream strip. The longitudinal and transverse joints will be overlapped at least one and a half (1.5) feet for dry installations and at least three (3) feet for below-water installations. The geotextile will extend at least one (1) foot beyond the top and bottom revetment termination points, or as required by the EOR. If ACBs are assembled and placed as large mattresses, the top lap edge of the geotextile should not occur in the same location as a space between ACB mats unless the space is concrete filled.

3.3 PLACEMENT OF THE ACBs/MATS

A. ACB placement and preparation should be performed in accordance with the current version of ASTM D 6884, *Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems*. ACB block/mats, as specified in Part 2:A of these Specifications, will be constructed within the specified lines and grades shown on the Contract Drawings.

B. Field installation shall be consistent with the way the system was installed in preparation for hydraulic testing pursuant to the current version of ASTM D 7277, *Standard Test Method for Performance Testing of Articulating Concrete Block (ACB) Revetment Systems for Hydraulic Stability in Open Channel Flow*. Any external restraints, anchors, or other ancillary components (such as synthetic drainage mediums) shall be employed as they were during testing; e.g., if the hydraulic testing installation utilized a drainage layer, then the field installation must also utilize a drainage layer. This does not preclude the use of other section components for other purposes, e.g., a geogrid for strengthening the subgrade for vehicular loading, or an intermediate filter layer of sand to protect very fine-grained native soils.

C. The subgrade shall be prepared in such a manner as to produce a smooth plane surface prior to placement of the ACBs or mats. No individual block within the plane of placed ACBs will protrude more than 0.5 inches or as otherwise specified by the EOR. ACBs should be flush and develop intimate contact with the subgrade section, as approved by the EOR. Proposed hand placing is only to be used in limited areas, specifically identified by the EOR or manufacturers' mat layout drawings, as approved by the EOR.

D. If assembled and placed as large mattresses, the ACB mats will be attached to a spreader bar or other approved device to aid in the lifting and placing of the mats in their proper position by the use of a crane or other approved equipment. The equipment used should have adequate capacity to place the mats without bumping, dragging, tearing or otherwise damaging the underlying fabric. The mats will be placed side-by-side, so that the mats abut each other, and/or end-to-end. Mat seams or openings between mats greater than two (2) inches will be backfilled with 4000 p.s.i. non-shrink grout, concrete or other material approved by the EOR. Whether placed by hand or in large mattresses, distinct changes in grade that results in a discontinuous revetment surface in the direction of flow will require backfill at the grade change location so as to produce a continuous surface.

E. Termination trenches will be backfilled and compacted flush with the top of the blocks. The integrity of the trench backfill must be maintained so as to ensure a surface that is flush with the top surface of the ACBs for its entire service life. Termination trenches will be backfilled as shown on the Contract Drawings. Backfilling and compaction of trenches will be completed in a timely fashion. No more than 500 linear feet of placed ACBs with non-completed termination trenches will be permitted at any time.

F. The cells or openings in the ACBs will be backfilled and compacted with suitable material, as specified by the EOR. Backfilling and compaction will be completed in a timely manner so that no more than 500 feet of exposed mats exist at any time. Finishing requirements are explicitly at the discretion of the EOR.

G. The manufacturer of the ACBs/mats shall provide design and construction advice during the design and initial installation phases of the project when required or as necessary, at the discretion of the EOR. The ACB supplier shall provide, at a minimum, one full day or two half-days of on-site project support upon request.

END OF SECTION

A-JACKS® CONCRETE ARMOR UNIT SPECIFICATION

24 in. A-Jacks Units

PART 1: GENERAL

A. Scope of Work

The Contractor shall furnish all labor, materials, equipment, and incidentals required and perform all operations in connection with the installation of A-JACKS® concrete armor units in accordance with the lines, grades, design and dimensions shown on the Contract Drawings and as specified herein.

B. Submittal

The Contractor shall submit to the Engineer all manufacturers' hydraulic testing and calculations in support of the proposed hard armor unit and geotextile.

The Contractor shall furnish the manufacturer's certificates of compliance for the concrete hard armor units. The Contractor shall also furnish the manufacturer's specifications, literature, shop drawings for the layout of the A-JACKS®, and any recommendations, if applicable, that are specifically related to the project.

Alternative materials may be considered. Such materials must be pre-approved in writing by the Engineer prior to bid date. Alternative material packages must be submitted to the Engineer a minimum of thirty (30) days prior to bid date. Submittal packages must include, as a minimum, the following:

1. Full-scale laboratory testing and associated engineered calculations quantifying the hydraulic capacity of the proposed hard armor system in similar conditions to the specific project.

PART 2: PRODUCTS

A. General

The geometry of an A-JACKS® concrete armor unit consists of six arms extending from a central hub. A complete unit is made up of two identical halves, with each half consisting of a central core with three legs radiating outward at equal spacing. On each half, two fillets are located between adjacent arms. These fillets provide additional structural strength and aid in the proper placement of the armor units.

When the symmetrical halves are interlocked, the resultant unit will have geometry, which exhibits six equally spaced arms, with each arm spaced at 90 degrees from the four

adjacent arms. When placed in the most stable configuration, each unit will rest on three of the six arms.

B. Concrete Armor Units

1. Scope

1.1 This specification covers concrete armor units for erosion control used for coastal applications (shoreline, breakwaters, jetties, and other harbor structures), along with toe-protection and slope protection for streambank applications.

2. Materials

The 2 ft. (AJ-24) A-Jacks® units will be produced on a pre-determined concrete block machine and will conform to ASTM D 6684-04, Standard Specification for Materials and Manufacture of Articulating Concrete Block (ACB) Revetment Systems.

2.1 Cementitious Materials - Materials shall conform to the following applicable ASTM specifications:

2.1.1 Portland Cements - Specification C 150, for Portland Cement.

2.1.2 Blended Cements - Specification C 595, for Blended Hydraulic Cements.

2.1.3 Hydrated Lime Types - Specification C 207, for Hydrated Lime Types.

2.1.4 Pozzolans - Specification C 618, for Fly Ash and Raw or Calcined Natural Pozzolans for use in Portland Cement Concrete.

2.2 Aggregates shall conform to the following ASTM specifications, except that grading requirements shall not necessarily apply:

2.2.1 Normal Weight - Specification C 33, for Concrete Aggregates.

3. Casting

The concrete units will be produced by a dry cast method. The dry cast units obtain strength in a shorter duration as well as an increase in the durability and overall quality of product. Material and manufacture standards will be compliant with ASTM D6684-04.

4. Physical Requirements

4.1 At the time of delivery to the work site, the units shall conform to the physical requirements prescribed in Table 1 below.

TABLE 1. A-JACKS® PHYSICAL REQUIREMENTS

Compressive Strength Net Area Min. psi		**Water Absorption Max., lb/ft^3**	
Avg. of 3 units	Individual Unit (min. required)	Avg. of 3 units	Individual Unit
4000	3,500	9.1	11.7

4.2 Units shall be sampled and tested in accordance with ASTM C 140, Standard Test Methods of Sampling and Testing Concrete Masonry Units.

5. Visual Inspection

5.1 All units shall be sound and free of defects that would interfere with either the proper placement of the unit or impair the performance of the system. Surface cracks incidental to the usual methods of manufacture, or surface chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection.

5.2 Cracks exceeding 0.25 inches (.635 cm) in width and/or 1.0 inch (2.54 cm) in depth shall be deemed grounds for rejection.

5.3 Chipping resulting in a weight loss exceeding 10% of the average weight of a concrete unit shall be deemed grounds for rejection.

5.4 A-Jacks® rejected prior to delivery from the point of manufacture shall be replaced at the manufacturer's expense. A-Jacks® rejected at the job site shall be repaired with structural grout or replaced at the expense of the contractor.

6. Sampling and Testing

6.1 The purchaser or their authorized representative shall be accorded proper access to facilities to inspect and sample the units at the place of manufacture from lots ready for delivery.

6.2 Field installation procedures shall comply with the procedures utilized during the hydraulic testing procedures of the recommended system. All system restraints and ancillary components (such as synthetic drainage mediums) shall be employed as they

were during testing. For example, if the hydraulic testing installations utilize a drainage layer then the field installation must utilize a drainage layer; an installation without the drainage layer would not be permitted.

6.3 Additional testing, other than that provided by the manufacturer, shall be borne by the purchaser.

7. Manufacturer

The A-JACKS® concrete system shall have the following nominal characteristics:

TABLE 2. STANDARD SIZES OF A-JACKS®

A-JACK Model	Total Length (in)	Arm Length (in)	Fillet Length (in)	Arm Width (in)	Volume (ft^3)	Weight (lbs)
AJ-24	24	8.30	1.85	4.00	0.59	76-82

The Armor unit shall be A-JACKS® as manufactured by:

ARMORTEC, A Contech Company
9025 Centre Pointe Dr., Suite 400
West Chester, OH 45269
Phone: 1-800-645-7000
Fax: 1-513-645-7993

C. Filter Fabric

The geotextile will meet the minimum physical requirements listed in Table No. 3 of these Specifications. Consultation with the manufacturer is recommended.

The geotextile must be permitted to function properly by allowing relief of hydrostatic pressure; therefore fine soil particles will not be allowed to clog the filter fabric.

During all periods of shipment and storage, the filter fabric will be protected from direct sunlight, ultraviolet rays and temperatures greater than 140 degrees Fahrenheit. To the extent possible, the fabric will be maintained wrapped in its protective covering. The geotextile will not be exposed to sunlight, ultraviolet rays until the installation process begins.

TABLE 3: PHYSICAL REQUIREMENTS

Physical Property	Test Procedure	Minimum Value
Grab Tensile Strength	ASTM D4632	280 Lbs.

		(in any principal direction)
Breaking Elongation	ASTM D4632	50% max.
		(in any principal direction)
Trapezoidal Tear	ASTM D4533	112 Lbs.
CBR Puncture Strength	ASTM D6241	800 Lbs.
A.O.S.	ASTM D4751	Soil Specific

Soil characteristics such as grain size distribution and plasticity will be determined for every 200,000 square feet of geotextile installed or for each source of borrow material used during construction. Significant differences in soil characteristics will require further inspection at the discretion of the Engineer. The locations for which the material to be tested is extracted will be approved by the Engineer. The Contractor will provide the site-specific soil and modified proctor curves for the site-soil, at no expense to the manufacturer. Also, the contractor will be responsible for the performance of the test by a certified independent laboratory experienced in performing such test. The test will be performed under the actual field soil conditions or as otherwise required by the Engineer.

The need and frequency of soil testing is explicitly at the discretion of the Engineer Record.

At the time of installation, the filter fabric will be rejected if it has been removed from its protective cover for over 72 hours or has defects, tears, punctures, flow deterioration, or damage incurred during manufacture, transportation or storage. With the acceptance of the Engineer, placing a filter fabric patch over the damaged area prior to placing the mats will repair a torn or punctured section of fabric. The patch will be large enough to overlap a minimum of three (3) feet in all directions.

D. Cabling

Termination or transition of the A-Jacks armoring, as identified in the submittal and contract drawings will require additional field cabling. Cable type will be minimum 1/4" galvanized or polyester, as approved by the Engineer.

Field cabling is done to mitigate unexpected local toe scour or to add redundancy at the termination and transition points. Cable will be placed around the mid-section of the selected units (recommended 3-unit minimum), hand tightened and connected using standard cable hardware supplied by the manufacturer.

Cable orientation of the recommended 3-unit minimum (i.e. perpendicular or parallel to a slope) will be identified and agreed upon in the field by the Contractor and Engineer's representative. Ensure practical placement of additional cabling to minimize unreasonable effort by Contractor. Prior to field cabling work means and methods will be discussed to establish a typical configuration for the previously identified areas.

Ultimately, the number of units to be cabled as well as orientation is at the discretion of

D. Armor Unit Performance Specifications –Channel Bed and Bank Protection

D.1 The armor unit should provide sufficient hydraulic stability under the design conditions specified above.

D.2 The Factor-of-Safety (FOS) Method should be used in evaluating the hydraulic stability of the chosen armor units.

D.3 The FOS for shear stress, SF_τ, should be greater than 2, where SF_τ is defined in the following:

$$SF_\tau = \tau_p/\tau_o$$

where τ_p is the permissible stress for the armor unit accounting for the appropriate side slope correction factor, and τ_o is the maximum bed shear stress corresponding to the design condition.

D.4 The FOS for velocity, SF_v, should be greater that *2*, where SF_v is defined in the following:

$$SF_v = V_p/V$$

where V_p is the permissible velocity for the armor unit accounting for the appropriate side slope correction factor, and V is the design velocity.

PART 3: FOUNDATION, GEOTEXTILE AND A-JACKS PREPARATION & PLACEMENT

A. Foundation Preparation

General. All subgrade preparation should be performed in accordance with *ASTMD6884-03, Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems*.

Areas on which filter fabric and the Hard Armor Units are to be placed will be constructed to the lines and grades shown on the Contract Drawings and to the tolerances specified in the Contract Documents, and approved by the Engineer.

Grading. The slope will be graded to a smooth plane surface to ensure that intimate contact is achieved between the slope face and the geotextile (filter fabric). All slope deformities, roots, grade stakes, and stones which project normal to the local slope face must be re-graded or removed. Where such areas are evident, they will be brought to

grade by placing compacted homogeneous material. The slope and slope face will be uniformly compacted, and the depth of layers, homogeneity of soil and amount of compaction will be as required by the Engineer.

Inspection. Immediately prior to placing the filter fabric and remaining subgrade components, the prepared subgrade will be inspected by the Engineer as well as the owner's representative. No fabric, subgrade section or Hard Armor Unit will be placed thereon until that area has been approved by each of these parties. "Rules of thumb" to be established in initial inspection of each product type with regard to foundation preparation to facilitate efficiency in future project preparation areas.

B. Placement of Geotextile Filter Fabric

General.
All placement and preparation should be performed in accordance with *ASTM D6884-03, Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems*. Filter Fabric, or filtration geotextile, as specified elsewhere, will be placed within the limits shown on the Contract Drawings.

Placement. The filtration geotextile will be placed directly on the prepared area, in intimate contact with the subgrade, and free of folds or wrinkles. The geotextile will not be walked on or disturbed when the result is a loss of intimate contact between the geotextile and the subgrade. The geotextile filter fabric will be placed so that the upstream strip of fabric overlaps the downstream strip. The longitudinal and transverse joints will be overlapped at least two (2) feet. The geotextile will extend at least one (1) foot beyond the top and bottom revetment termination points, or as required by the Engineer.

C. Placement of A-Jacks System

The proposed A-Jacks units, as specified in Part 2A of these specifications, will be constructed within the specified lines and grades shown on the Contract Drawings.

Placement (No. 57 Stone) – 24" A-Jacks
If applicable, to mitigate subgrade inconsistencies, a minimum thickness of 4" of No. 57 stone is required prior to installing the 24" units. The stone and desired thickness will be placed directly on the specified geotextile as directed and accepted by the Engineer of Record or representative.

Bedding – 24" A-Jacks
For both A-Jack sizes, a bedding layer of clean stone is to be placed in conjunction with the subgrade section for backfilling purposes to achieve necessary bearing and/or setback tolerances. Recommended bedding layer sizes for each size unit are listed below:

A-Jacks Size (in.)	D_{50} Size Bedding Layer (in.)
24"	2-3"

Alternate D^{50} sizes for bedding layers will be defined by local aggregate availability, approved by the Design Engineer.

Placement – 24" A-Jacks
A-Jacks can be installed individually or in bundles at the discretion of the Contractor.

Placed individually, A-Jacks will be placed with uniform spacing. For a specified area receiving the 24" units, standard spacing between unit center in both the x and y dimension is 12", which represents a 0.5 packing ratio. Tighter placement tolerances are possible, such as a 0.4 packing ratio, but may become difficult to achieve while placing successive rows in a matrix. Standard installation includes placing the units in a consistent repeatable fashion to aid in efficiency. Recommended in-place orientation of the unit(s) emphasizes pointing exposed projecting unit arm (vertical or horizontal) downstream whenever practical during construction.

Placed in bundles, A-Jacks are placed into a pre-determined matrix, spacing them as closely as possible, approximating the maximum packing ratio of 0.4 (9.6" center spacing in x and y directions). Cable will be placed around the pre-determined matrix (around mid-section) with cable; hand tightened and connected using standard cable hardware supplied by the manufacturer. Bundles are to be placed as closely as possible, with recommended tolerance requirement of 4" between bundles. If the bundling method is employed by the Contractor, tolerances between bundles will be discussed and agreed upon prior to commencing work. Spacing will be measured from center of bundle to middle of installed bundle, in the horizontal plane, before additional (stacked) units are placed.

Bedding stone material can be utilized for bridging interior voids and establishing consistent bedding layer for additional lifts of unit(s), whether hand placed or bundles. Vertical fluctuations occurring from unit to unit or bundle to bundle will be compensated for by utilizing bedding.

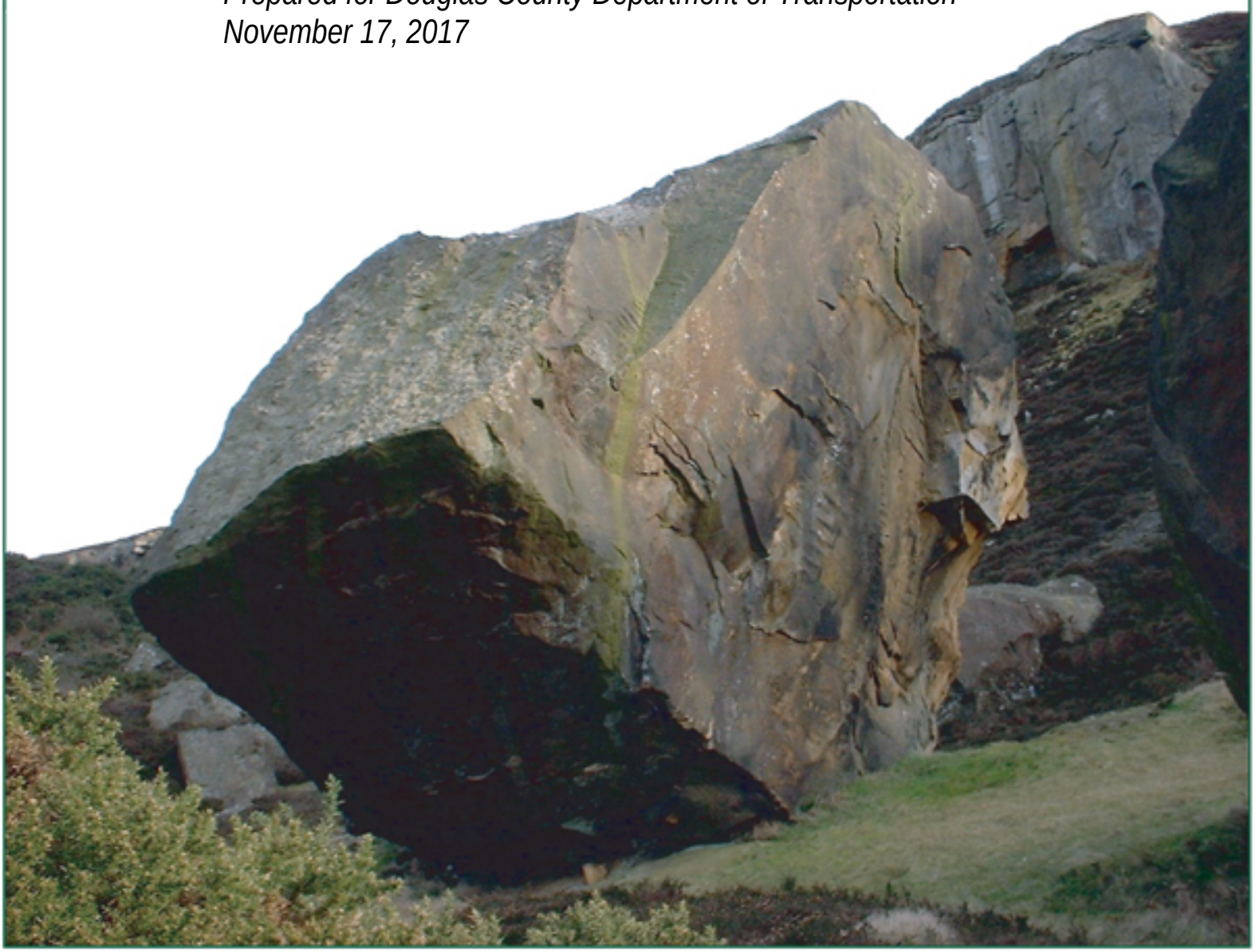
Consultation. The manufacturer of the hard armor units will provide design and construction advice during the design and initial installation phases of the project as necessary, by the discretion of the Engineer.

GEO HYDRO ENGINEERS

Report of Subsurface Exploration and Geotechnical Engineering Evaluation

Whitestone Boulevard Culvert Replacement
Douglas County, Georgia
Geo-Hydro Project Number 171061.20

Prepared for Douglas County Department of Transportation
November 17, 2017



Mr. Miguel Valentin
Douglas County Department of Transportation
8700 Hospital Drive
Douglasville, Georgia 30134

November 17, 2017

Report of Subsurface Exploration
and Geotechnical Engineering Evaluation
Whitestone Boulevard Culvert Replacement
Douglas County, Georgia
Geo-Hydro Project Number 171061.20

Dear Mr. Valentin:

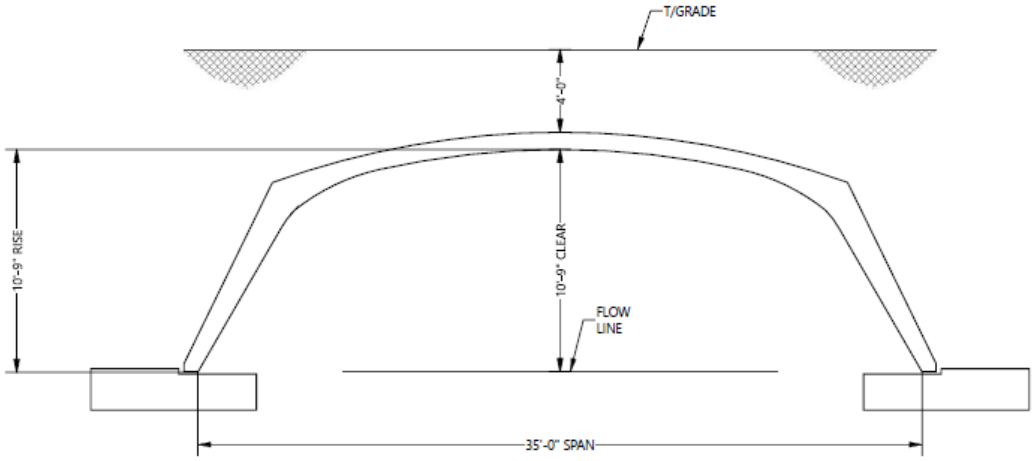
Geo-Hydro Engineers, Inc. has completed the authorized subsurface exploration for the above referenced project. The scope of services for this project was outlined in proposal number 20570.2 dated Mary 31, 2017.

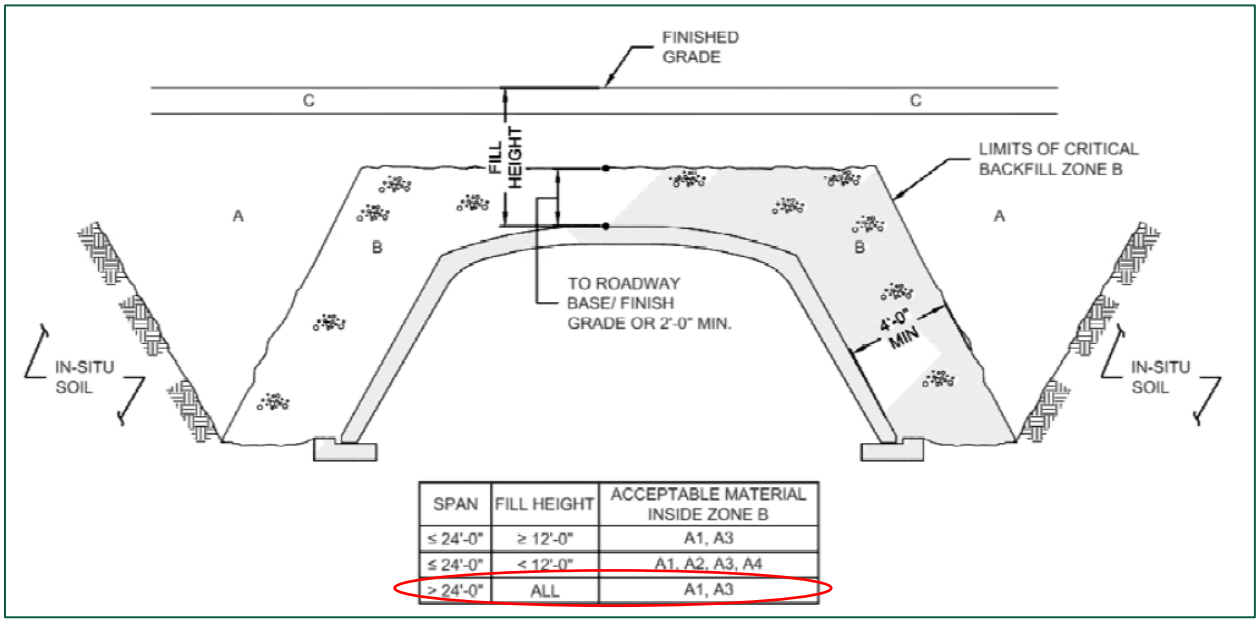
Project Information

The project involves the replacement of an existing failed culvert along Whitestone Boulevard crossing an unnamed tributary of Hurricane Creek in Doulgas County, Georgia. We understand that current plans call for replacing the existing culvert with a Con/Span O-535 culvert by Contech. The new structure will have a length of 66 feet, a span of 35 feet, and almost 11 feet of clear space within the culvert. The plan excerpt below shows the proposed culvert configuration.

Based on the information provided by Contech, maximum reactions at the culvert foundations will be about 25 and 10 kips per lineal foot for vertical and horizontal reactions, respectively. Additionally, the working plans provided to us identify a critical backfill zone extending 2 to 4 feet from the outside of the culvert. The plan excerpt and table on the following page identifiy the critical backfill zone and the requirements for the material used within the critical backfill zone.

Original plans for the project called for a precast triple box culvert with an invert elevation of 951. We have assumed that the invert elevation for the Con/Span culvert will be similar.





SPAN	FILL HEIGHT	ACCEPTABLE MATERIAL INSIDE ZONE B
≤ 24'-0"	≥ 12'-0"	A1, A3
≤ 24'-0"	< 12'-0"	A1, A2, A3, A4
> 24'-0"	ALL	A1, A3

ACCEPTABLE SOILS FOR USE IN ZONE B BACKFILL

TYPICAL USCS MATERIALS	AASHTO GROUP	AASHTO SUBGROUP	PERCENT PASSING US SIEVE NO.			CHARACTER OF FRACTION PASSING NO. 40 SIEVE		SOIL DESRIPTION
			#10	#40	#200	LIQUID LIMIT	PLASTICITY INDEX	
GW, GP, SP	A1	A-1a	50 MAX	30 MAX	15 MAX		6 MAX	LARGELY GRAVEL BUT CAN INCLUDE SAND AND FINES
GM, SW, SP, SM		A-1b		50 MAX	25 MAX		6 MAX	GRAVELLY SAND OR GRADED SAND, MAY INCLUDE FINES
GM, SM, ML, SP, GP	A2	A-2-4			35 MAX	40 MAX	10 MAX	SANDS, GRAVELS WITH LOW-PLASTICITY SILT FINES
SC, GC, GM		A-2-5			35 MAX	41 MIN	10 MAX	SANDS, GRAVELS WITH PLASTIC SILT FINES
SP, SM, SW	A3			51 MIN	10 MAX		NON-PLASTIC	FINE SANDS
ML, SM, SC	A4				36 MIN	40 MAX	10 MAX	LOW-COMPRESSIBILTY SILTS

Exploratory Procedures

Test Borings

The subsurface exploration consisted of two machine-drilled soil test borings and two hand auger borings performed at the approximate locations shown on Figure 2 included in the Appendix. The test borings were located in the field by Geo-Hydro by measuring angles and distances from existing site features. Elevations shown on the test boring records were interpolated from the topographic site plan provided to us and have been rounded to the nearest foot. In general, the boring locations and elevations should be considered approximate.

Standard penetration testing, as provided for in ASTM Dl586, was performed at select depth intervals in the machine-drilled soil test borings. Dynamic cone penetrometer testing (ASTM STP-399) was performed at select depths in the hand auger boring. Soil samples obtained from the drilling operation were examined and classified in general accordance with ASTM D2488 (Visual-Manual Procedure for Description of Soils). Soil classifications include the use of the Unified Soil Classification System described in ASTM D2487 (Classification of Soils for Engineering Purposes). The soil classifications also include our evaluation of the geologic origin of the soils. Evaluations of geologic origin are based on our experience and interpretation and may be subject to some degree of error.

Descriptions of the soils encountered, groundwater conditions, standard penetration resistances, and other pertinent information are provided in the test boring records and hand auger log included in the Appendix.

Laboratory Testing

Three bulk soil samples were collected for laboratory testing from borings B-1 and B-2. Laboratory testing included two particle size analyses (ASTM D422), two Atterberg Limits tests (ASTM 4318), one Resistivity test (ASTM G187), and one pH test (ASTM G51).

Regional Geology

The project site is located in the Northern Piedmont Geologic Province of Georgia. Soils in this area have been formed by the in-place weathering of the underlying crystalline rock, which accounts for their classification as “residual” soils. Residual soils near the ground surface that have experienced advanced weathering frequently consist of red brown clayey silt (ML) or silty clay (CL). The thickness of this surficial clayey zone may range up to roughly 6 feet. For various reasons, such as erosion or local variation of mineralization, the upper clayey zone is not always present.

With increased depth, the soil becomes less weathered, coarser grained, and the structural character of the underlying parent rock becomes more evident. These residual soils are typically classified as sandy micaceous silt (ML) or silty micaceous sand (SM). With a further increase in depth, the soils eventually become quite hard and take on an increasing resemblance to the underlying parent rock. When these materials have a standard penetration resistance of l00 blows per foot or greater, they are referred to as partially weathered rock. The transition from soil to partially weathered rock is usually a gradual one, and may occur at a wide range of depths. Lenses or layers of partially weathered rock are not unusual in the soil profile.

Partially weathered rock represents the zone of transition between the soil and the indurated metamorphic rocks from which the soils are derived. The subsurface profile is, in fact, a history of the weathering process that the crystalline rock has undergone. The degree of weathering is most advanced at the ground surface, where fine-grained soil may be present. Conversely, the weathering process is in its early stages immediately above the surface of relatively sound rock, where partially weathered rock may be found.

The thickness of the zone of partially weathered rock and the depth to the rock surface have both been found to vary considerably over relatively short distances. The depth to the rock surface may frequently

range from the ground surface to 80 feet or more. The thickness of partially weathered rock, which overlies the rock surface, may vary from only a few inches to as much as 40 feet or more.

Stream valleys in the Piedmont Region may contain alluvial (water-deposited) soils, depending on ground surface topography, stream flow characteristics, and other factors. By nature, alluvial soils can be highly variable depending upon the energy regime at the time of deposition. Coarse materials such as sand or gravel are deposited in higher energy environments, while fine grained materials such as silt and clay are deposited in low energy environments. Alluvial soils may also contain significant organic materials, and are frequently in a loose, saturated condition. In many cases, fine grained alluvial soils will be highly compressible and have relatively low shear strength.

Near surface geologic conditions at the site have been modified by previous roadway construction activities.

Soil Test Boring Summary

Machine-Drilled Borings

Both borings performed within the travel lanes of Whitestone Boulevard encountered about 3 inches of asphalt underlain by 14 inches of graded aggregate base and about 8 inches of a larger crushed stone.

Beneath the pavement structure, borings B-1 and B-2 encountered fill materials extending to depths of about 12 and 18 feet, respectively. The fill was classified as silty sand and clayey sand with varying amounts or mica and rock fragments. Standard penetration resistances recorded in the fill ranged from 7 to 22 blows per foot. It is important to note that rock fragments and other hard inclusions will typically amplify standard penetration resistances. Such artificially inflated values should not be considered representative of the consistency of fill materials.

Beneath fill materials, borings B-1 encountered alluvial (water-deposited) soil extending to a depth of about 18 feet. The alluvium was classified as silty sand with rock fragments. A standard penetration resistance of 12 blows per foot was recorded in the alluvium.

Beneath the fill materials or alluvial soils, both borings encountered residual soils or partially weathered rock typical of the Piedmont region. The residual soils were classified as micaceous silty sand. Standard penetration resistances of 20 and 36 blows per foot were recorded in the residual soils.

Borings B-1 and B-2 encountered partially weathered rock at depths of about 23 and 18 feet, respctively. Partially weathered rock is locally defined as residual material having standard penetration resistance values greater than 100 blows per foot.

Borings B-1 and B-2 encountered conditions causing auger refusal at approximate depths of 30 and 25 feet, respectively. Auger refusal is the condition that prevents further advancement of the boring using conventional soil drilling techniques. Auger refusal may be indicative of a boulder, a lens or layer of rock, a rock pinnacle, or a larger rock mass.

At the time of drilling, groundwater was encountered in borings B-1 and B-2 at depths of 16 and 14 feet, respectively. The borings were backfilled with soil cuttings after the groundwater check and patched with asphalt. It should be noted that groundwater levels will fluctuate depending on yearly and seasonal rainfall variations, the creek level, and other factors, and may rise in the future.

Hand Auger Borings

Starting at the ground surface, both hand auger borings encountered alluvial (water-deposited) soils classified as silty sand, clayey sand, and sandy clay with varying amounts of rock fragments. Dynamic cone penetration resistances recorded in the alluvial soils ranged from 0 to 4 blows per foot. Borings HA-1 and HA-2 encountered conditions causing auger refusal at depths of about 4 and 5½ feet, respectively, without fully penetrating the alluvial soils.

For more detailed descriptions of subsurface conditions, please refer to the test boring records and hand auger logs included in the Appendix.

Soil Test Boring Summary

Boring	Approx. Ground Elevation	Approx. Invert Elevation	Groundwater		Bottom of Fill/ Alluvial Materials		Top of PWR		Auger Refusal	
			Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation
B-1	969	951	16	953	18	951	28	941	30	939
B-2	969	951	14	955	18	951	18	951	25	944

All Depths and Elevations in this Summary Table are Approximate
NE: Not Encountered
PWR: Partially Weathered Rock

LABORATORY TEST RESULTS

Atterberg Limits (ASTM D4318)

Sample	Liquid Limit	Plastic Limit	Plasticity Index	Natural Moisture %
B-1 (-12 feet)	46	29	17	20
B-2 (-22 feet)	31	22	9	21

Sieve Analysis with Hydrometer (ASTM D422)

Sample	%Gravel	%Sand	%Silt	%Clay
B-1 (-12 feet)	2.5	53.3	16.6	27.6
B-2 (-22 feet)	0.9	60.8	17.4	20.9

pH (ASTM G51) and Resistivity (ASTM G187)

Sample	pH	Resisitvity (ohm-cm)
B-2 (-12 feet)	5.5	28,000

USCS Classification (ASTM D2487)

Sample	Classification
B-1 (-12 feet)	SM
B-2 (-22 feet)	SC

Evaluations and Recommendations

The following evaluations and recommendations are based on the information available on the proposed construction, the data obtained from the test borings and laboratory testing, and our experience with soils and subsurface conditions similar to those encountered at this site. Because the test borings represent a statistically small sampling of subsurface conditions, it is possible that conditions may be encountered during supplemental exploration or during construction that are substantially different from those indicated by the test borings. In these instances, adjustments to the design and construction may be necessary.

Geotechnical Considerations

The following geotechnical characteristics of the site should be considered for planning and design:

- Borings B-1 and B-2 encountered fill materials extending to depths of about 12 and 18 feet. Standard penetration resistances recorded in the fill indicate variable compactive effort at the time of fill placement. We expect the fill materials will be removed during excavation to reach the culvert foundation bearing elevation. Alluvial soils will be encountered at lower elevations immediately adjacent to the creek and may extend below the foundation bearing areas.

- Based on the results of the laboratory testing, the on-site soils do not meet the requirements for backfill within the critical backfill zone as outlined on the project drawings. We recommend identifying a borrow source with acceptable backfill materials prior to construction.

- Boring B-2 encountered partially weathered rock at a depth of 18 feet (approximate elevation 951). Based on an assumed invert elevation of 951, we expect removal of partially weathered rock to be necessary to reach the culvert foundation bearing elevation. It is important to note that the depth to partially weathered rock and rock can vary drastically over relatively short distances. Where encountered, removal of partially weathered rock will require the use of impact hammers.

- At the time of drilling, groundwater was encountered in borings B-1 and B-2 at depths of 16 and 14 feet, respectively; corresponding to approximate elevations of 953 and 955, respectively. However, we expect that the stabilized groundwater level will be at the approximate creek elevation. The contractor must be prepared to implement temporary dewatering as necessary to advance the work. We expect that a temporary creek diversion in conjunction with direct pumping from excavations and sumps may be sufficient to provide adequate temporary dewatering. However, temporary dewatering is typically a means-and-methods item left to the contractor. We recommend providing a performance specification for dewatering in the construction documents rather than any specific way to accomplish temporary dewatering.

- Based on the results of the test borings and contingent on proper site preparation and thorough evaluation of foundation excavations, it is our opinion that the proposed replacement culvert can be supported using conventional shallow foundations bearing at an elevation of approximately 948 or below. We recommend an allowable bearing pressure of 3,000 psf for design purposes.

The following sections provide recommendations regarding these issues and other geotechnical aspects of the project.

Construction Dewatering

Dewatering should be performed to maintain the groundwater level at least 2 feet below the lowest prevailing excavation depth. We recommend that the project specifications require the use of dewatering as necessary, and dictate the result of the dewatering operation. The contractor may then implement a technique or combination of techniques appropriate for the actual field conditions encountered. The following represents a minimum guide specification for dewatering.

Minimum Guide Specification for Dewatering

****

NOTE: The following specifications are for use as a guide for development of actual specifications. The guide is not intended for direct use as a construction specification without modifications to reflect specific project conditions.

****

Control of groundwater shall be accomplished in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation slopes, and will not result in damage to existing structures. Where necessary to these purposes, the water level shall be lowered in advance of excavation, utilizing trenches, sumps, wells, well points or similar methods. The water level, as measured in piezometers, shall be maintained a minimum of 3 feet below the prevailing excavation level. Open pumping from sumps and ditches, if it results in boils, loss of soil fines, softening of the ground or instability of slopes, will not be permitted. Wells and well points shall be installed with suitable screens and filters so that continuous pumping of soil fines does not occur. The discharge shall be arranged to facilitate collection of samples by the Engineer.

Adapted from Construction Dewatering - A Guide to Theory and Practice, John Wiley and Sons.

Excavation Characteristics

Boring B-2 encountered partially weathered rock a depth of about 18 feet (approximate elevation 951). Based on an assumed invert elevation of 951, we expect removal of partially weathered rock to be necessary to reach the culvert foundation bearing elevation. We expect ripping of partially weathered rock to be impractical for this project due to the size of equipment necessary to operate within the relatively small site. We expect the use of impact hammers to be necessary to remove partially weathered rock where encountered.

For planning purposes, we recommend assuming that blasting will be necessary to remove material below the depth of auger refusal (machine-drilled borings). It would not be unusual for rock or partially weathered rock to occur at higher elevations between or around some of the soil test borings.

For construction bidding and field verification purposes it is common to provide a verifiable definition of rock in the project specifications. The following are typical definitions of mass rock and trench rock:

- Mass Rock: Material that cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at 56,000 pounds (Caterpillar D-8K or equivalent), and occupying an original volume of at least one cubic yard.

- Trench Rock: Material occupying an original volume of at least one-half cubic yard which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as a Caterpillar 322C L, John Deere 230C LC, or a Komatsu PC220LC-7; equipped with a short tip radius bucket not wider than 42 inches.

Blasting

In most cases rock excavation is performed by blasting. Standard blasting procedures include drilling through the materials to be blasted to introduce the explosives and covering up the area to be blasted to prevent flying debris. The area to be blasted is typically covered with several feet of soil or a blast mat. Alternatively, the existing soil overburden can be left in place, which in most cases will eliminate the need for a soil cover or a blast mat.

Blasting generates ground vibrations that can be detrimental to adjacent structures. Research by the United States Bureau of Mines and other organizations provides limits for safeguarding adjacent structures during blasting operations. A peak particle velocity of 2 inches per second is generally recognized as a conservative limit, and is the maximum peak particle velocity allowed by the Georgia Blasting Standards Act of 1978.

State and local laws require that precondition surveys of neighboring properties be performed prior to conducting blasting activities. Typical requirements are to conduct a precondition survey of structures and facilities within a 1,000-foot radius of the blast site. Vibration monitoring is also required in all four compass directions at the nearest structure not owned by the developer/owner. Some municipalities have variations of these requirements, and the local requirements should be reviewed prior to beginning blasting activities.

Reuse of Excavated Materials

Based on the results of test borings and our observations, residual soils, and existing fill materials appear to be suitable for reuse as structural fill after moisture adjustment. For planning purposes, we recommend assuming that alluvial soils will not be suitable for reuse as structural fill. Geo-Hydro should observe the excavation of existing fill materials and alluvial soils to evaluate their suitability for reuse.

It is important to establish as part of the construction contract whether soils having elevated moisture content will be considered suitable for reuse. We often find this issue to be a point of contention and a source of delays and change orders. From a technical standpoint, soils with moisture contents wet of optimum as determined by the standard Proctor test (ASTM D698) can be reused provided that the moisture is properly adjusted to within the workable range. From a practical standpoint, wet soils can be very difficult to dry in small or congested sites and such difficulties should be considered during planning and budgeting. A clear understanding by the general contractor and grading subcontractor regarding the reuse of excavated soils will be important to avoid delays and unexpected cost overruns.

Partially weathered rock materials will be suitable for reuse as structural fill only if they break down into a reasonably well-graded material that can be satisfactorily compacted. The presence of cobble size or boulder size material, which does not break down under the action of compaction equipment, will limit the suitability of partially weathered rock materials. Engineering judgment will be required in the field to evaluate the acceptability of partially weathered rock materials for reuse as structural fill.

For planning purposes, blast rock should be considered unsuitable for reuse as structural fill.

Structural Fill

We recommend that materials selected for use as structural fill be free of organic debris, waste construction debris, and other deleterious materials. The material should not contain rocks having a diameter over 4 inches. It is our opinion that the following soils represented by their USCS group symbols will typically be suitable for use as structural fill and are usually found in abundance in the Piedmont: (SM), (ML), and (CL). The following soil types are typically suitable but are not abundant in the Piedmont: (SW), (SP), (SC), (SP-SM), and (SP-SC). The following soil types are considered unsuitable: (MH), (CH), (OL), (OH), and (Pt). *Special or more stringent requirements regarding the nature and gradation of fill and backfill materials may prevail if a Contech structure is selected.*

Laboratory Proctor compaction tests and classification tests should be performed on representative samples obtained from the proposed borrow material to provide data necessary to determine acceptability and for quality control. The moisture content of suitable borrow soils should generally be no more than 3 percentage points below or above optimum at the time of compaction. Tighter moisture limits may be necessary with certain soils.

It is possible that highly micaceous soils could be utilized as structural fill material. The use of such materials will require very close attention to quality control of moisture content and density. Additionally, it is our experience that highly micaceous soils tend to rut under rubber-tired vehicle traffic. Continuous maintenance of areas subjected to construction traffic is typically required until construction is completed.

Suitable fill material should be placed in thin lifts. Lift thickness depends on the type of compaction equipment, but a maximum loose-lift thickness of 8 inches is generally recommended. The soil should be compacted by a self-propelled sheepsfoot roller. Within small excavations such as in utility trenches, around manholes, above foundations, or behind retaining walls, we recommend the use of “wacker packers”

or “Rammax” compactors to achieve the specified compaction. Loose lift thicknesses of 4 to 6 inches are recommended in small area fills.

We recommend that structural fill be compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D698). The upper 12 inches of pavement subgrades should be compacted in accordance with Georgia DOT requirements to at least 100 percent of the standard Proctor maximum dry density (ASTM D698). Additionally, the maximum dry density of structural fill should be no less than 90 pcf. Geo-Hydro should perform density tests during fill placement.

Earth Slopes

Temporary construction slopes should be designed in strict compliance with OSHA regulations. The exploratory borings indicate that most soils at the site are Type C as defined in 29 CFR 1926 Subpart P. This dictates that temporary construction slopes be no steeper than 1.5H:1V for excavation depths of 20 feet or less. Temporary construction slopes should be closely observed on a daily basis by the contractor’s “competent person” for signs of mass movement: tension cracks near the crest, bulging at the toe of the slope, etc. The responsibility for excavation safety and stability of construction slopes should lie solely with the contractor.

We recommend that extreme caution be observed in trench excavations. Several cases of loss of life due to trench collapses in Georgia point out the lack of attention given to excavation safety on some projects. We recommend that applicable local and federal regulations regarding temporary slopes, and shoring and bracing of trench excavations be closely followed.

Earth Pressure (Cast-in-Place Structures)

Three earth pressure conditions are generally considered for retaining wall design: "at rest", "active", and "passive" stress conditions. Retaining walls which are rigidly restrained at the top and will be essentially unable to rotate under the action of earth pressure (such as basement or foundation walls) should be designed for "at rest" conditions. Retaining walls which can move outward at the top as much as 0.5 percent of the wall height (such as free-standing walls) should be designed for "active" conditions. For the evaluation of the resistance of soil to lateral loads the "passive" earth pressure must be calculated. It should be noted that full development of passive pressure requires deflections toward the soil mass on the order of l.0 percent to 4.0 percent of total wall height.

Earth pressure may be evaluated using the following equation:

$$p_h = K\,(D_w Z + q_s) + W_w(Z-d)$$

where: p_h = horizontal earth pressure at any depth below the ground surface (Z).
W_w = unit weight of water
Z = depth to any point below the ground surface
d = depth to groundwater surface

D_w = wet unit weight of the soil backfill (depending on borrow sources). The wet unit weight of most residual soils may be expected to range from approximately 115 to 125 pcf. Below the groundwater level, D_w must be the buoyant weight.

q_s = uniform surcharge load (add equivalent uniform surcharge to account for construction equipment loads)

K = earth pressure coefficient as follows:

Earth Pressure Condition	Coefficient
At Rest (K_o)	0.5
Active (K_a)	0.33
Passive (K_p)	3.0

The groundwater term, $W_w(Z-d)$, should be used if no drainage system is incorporated behind retaining walls. If a drainage system is included which will not allow the development of any water pressure behind the wall, then the groundwater term may be omitted. The development of excessive water pressure is a common cause of retaining wall failures. Drainage systems should be carefully designed to ensure that long term permanent drainage is accomplished.

The above design recommendations are based on the following assumptions:

- Horizontal backfill
- 95 percent standard Proctor compactive effort on backfill (ASTM D698)
- No safety factor is included

For convenience, equivalent fluid densities are frequently used for the calculation of lateral earth pressures. For "at rest" stress conditions, an equivalent fluid density of 63 pcf may be used. For the "active" state of stress an equivalent fluid density of 42 pcf may be used. These equivalent fluid densities are based on the assumptions that drainage behind the retaining wall will allow *no* development of hydrostatic pressure; that native sandy silts or silty sands will be used as backfill; that the backfill soils will be compacted to 95 percent of standard Proctor maximum dry density; that backfill will be horizontal; and that no surcharge loads will be applied.

For analysis of sliding resistance of the base of a retaining wall, the coefficient of friction may be taken as 0.4 for the soils at the project site. This is an ultimate value, and an adequate factor of safety should be used in design. The force which resists base sliding is calculated by multiplying the normal force on the base by the coefficient of friction. Full development of the frictional force could require deflection of the base of roughly 0.l to 0.3 inches.

Foundation Design

Based on the results of the test borings, we expect that the proposed replacement culvert foundations will be underlain by residual soil and partially weathered rock. For planning purposes, we recommend a foundation bearing elevation of 948. Typically, the construction of a bottomless culvert in an existing creek

channel requires the temporary diversion of the creek and the removal of some of the existing loose materials located at culvert bearing elevation.

Based on our experience with similar projects and the results of the test borings, we expect conventional shallow foundations to be suitable for support of the new culvert. Due to a maximum vertical load of 25 kips per lineal foot, it will be critical to thoroughly evaluate any soil present at the bearing elevation. All fill materials and alluvial soils at the bearing elevations should be completely removed and replaced with concrete or Georgia DOT Type II foundation backfill completely wrapped in a non-woven, needle-punched filter fabric with a rated weight of 8 ounces per square yard. Additionally, some residual soils may be soft, loose, or otherwise unable to provide the design bearing capacity. Such materials should also be excavated and replaced with fully wrapped and compacted crushed stone or concrete as outlined above. For planning purposes, we recommend assuming that 50 percent of the culvert foundations will require excavation and replacement extending to a depth of 3 feet. This is intended as a budgetary allowance. The actual amount of excavation and replacement performed should be based on actual conditions at the time of construction and may exceed this recommended allowance.

Contingent upon proper site preparation and thorough evaluation of the foundation excavation, it is our opinion that the proposed culvert can be supported using conventional foundations as planned. We recommend an allowable bearing pressure of 3,000 psf for design. Based on the results of the test borings, we anticipate that settlement of the box culvert will be no greater than about ¾-inch. Most of the settlement should occur shortly after construction of the culvert, therefore having little or no influence on the finished pavement.

Seismic Design

Based on the results of the test borings and following the calculation procedure in the 2012 International Building Code (Chapter 20, ASCE 7-10), the *Site Class* for the site is *D*. The mapped and design spectral response accelerations are as follows: S_S=0.183, S_1=0.089, S_{DS}=0.196, S_{D1}=0.143.

Based on the information obtained from the soil test borings, it is our opinion that the potential for liquefaction of the residual soils at the site due to earthquake activity is relatively low.

* * * * *

We appreciate the opportunity to serve as your geotechnical consultant for this project, and are prepared to provide any additional services you may require. If you have any questions concerning this report or any of our services, please call us.

Sincerely,

GEO-HYDRO ENGINEERS, INC.



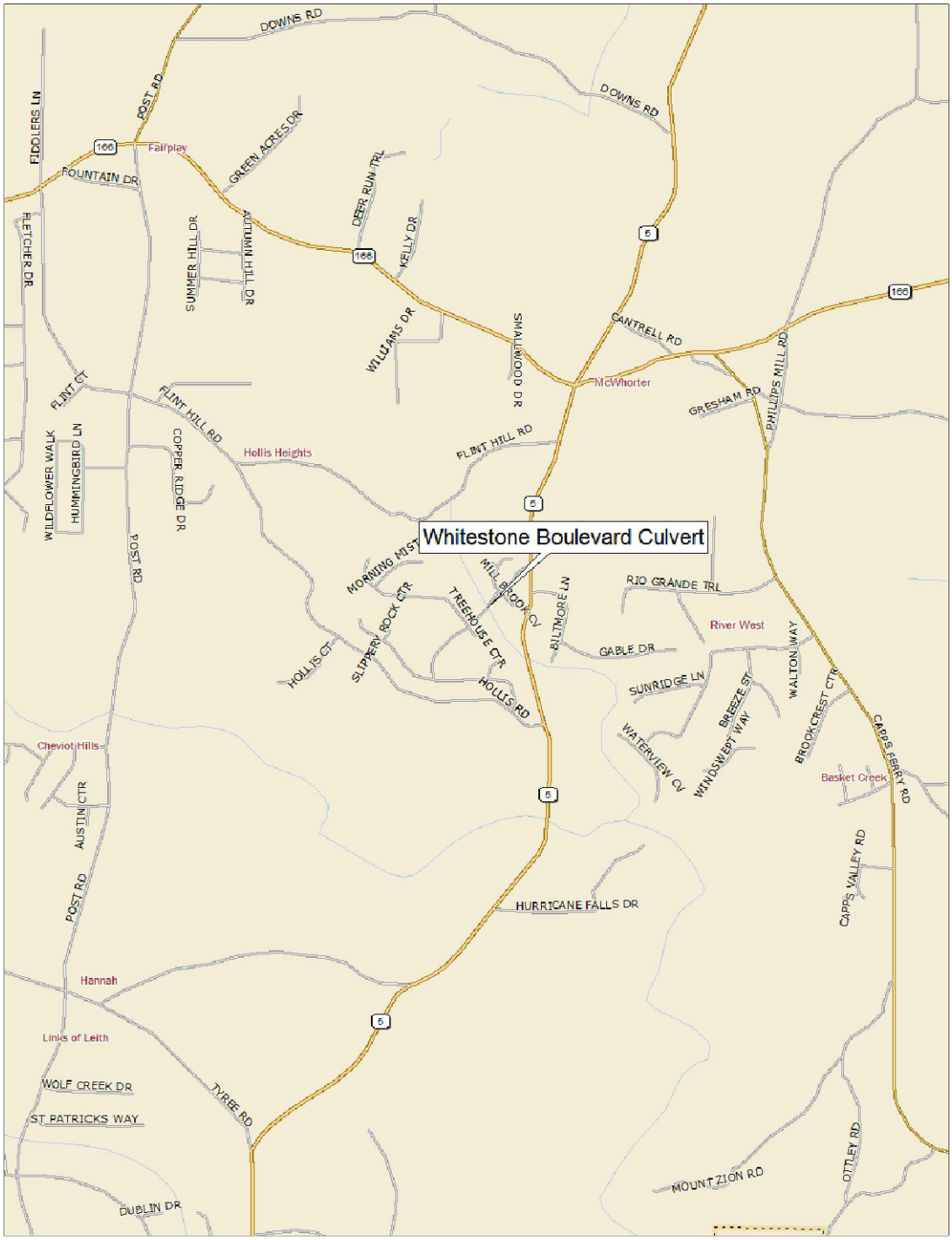


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Chief Engineer
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AMP/LEB/171061.20 - Whitestone Boulevard Culvert Replacement - Geotechnical Report

APPENDIX



0 0.25 0.5 1 1.5

Approximate Scale, Miles

Figure 1: Site Location Plan

Whitestone Boulevard Culvert Replacement
Douglasville, Georgia
Geo-Hydro Project Number 171061.20

GEO HYDRO ENGINEERS



0 15 30 60 90

Approximate Scale: 1"=30'

LEGEND: Soil Test Boring
Hand Auger Boring

Figure 2: Boring Location Plan

Whitestone Boulevard Culvert Replacement
Douglasville, Georgia
Geo-Hydro Project Number 171061.20

Symbols and Nomenclature

Symbols

▌	Thin-walled tube (TWT) sample recovered
▯	Thin-walled tube (TWT) sample not recovered
●	Standard penetration resistance (ASTM D1586)
50/2”	Number of blows (50) to drive the split-spoon a number of inches (2)
65%	Percentage of rock core recovered
RQD	Rock quality designation - % of recovered core sample which is 4 or more inches long
GW	Groundwater
	Water level at least 24 hours after drilling
	Water level one hour or less after drilling
ALLUV	Alluvium
TOP	Topsoil
PM	Pavement Materials
CONC	Concrete
FILL	Fill Material
RES	Residual Soil
PWR	Partially Weathered Rock
SPT	Standard Penetration Testing

Penetration Resistance Results	Number of Blows, N	Approximate Relative Density
Sands	0-4	very loose
	5-10	loose
	11-20	firm
	21-30	very firm
	31-50	dense
	Over 50	very dense

	Number of Blows, N	Approximate Consistency
Silts and	0-1	very soft
Clays	2-4	soft
	5-8	firm
	9-15	stiff
	16-30	very stiff
	31-50	hard
	Over 50	very hard

Drilling Procedures

Soil sampling and standard penetration testing performed in accordance with ASTM D 1586. The standard penetration resistance is the number of blows of a 140-pound hammer falling 30 inches to drive a 2-inch O.D., 1.4-inch I.D. split-spoon sampler one foot. Rock coring is performed in accordance with ASTM D 2113. Thin-walled tube sampling is performed in accordance with ASTM D 1587.

GEO HYDRO ENGINEERS

B-1

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Whitestone Boulevard Culvert Replacement**		Project No: **171061.20**
Location: **Douglasville, Georgia**		Date: **11/7/17**
Method: **HSA- ASTM D1586**	GWT at Drilling: **16 feet**	G.S. Elev: **969**
Driller: **GCD (Rope & Cathead)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **EM**

Elev. (Ft)	Depth (Ft)	GWT	Description	N
969	0		Asphalt (Approximately 3 inches)	
			Graded Aggregate Base (Approximately 14 inches)	
			Crushed Stone (Approximately 8 inches)	
965	5		Firm to very firm brown slightly micaceous silty fine to coarse sand (SM) (FILL)	21
				22
				15
960	10			16
			Firm brown silty fine to coarse sand (SM) with rock fragments (ALLUVIUM)	
955	15	▽		12
			Firm gray highly micaceous silty fine to coarse sand (SM) (RESIDUUM)	
950	20			20
			Dark brown highly micaceous silty fine to coarse sand (SM)	
945	25			36
			Partially weathered rock - No sample recovered	
940	30		Auger Refusal at 30 feet	50/0"
935	35			

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD SOIL TEST BORINGS.GPJ GEO HYDRO.GDT 11/17/17

B-2

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Whitestone Boulevard Culvert Replacement**		Project No: **171061.20**
Location: **Douglasville, Georgia**		Date: **11/7/17**
Method: **HSA- ASTM D1586**	GWT at Drilling: **14 feet**	G.S. Elev: **969**
Driller: **GCD (Rope & Cathead)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **EM**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
969	0			Asphalt (Approximately 3 inches)	
				Graded Aggregate Base (Approximately 14 inches)	19
				Crushed Stone (Approximately 8 inches)	
965	5			Loose to firm brown micaceous silty fine to coarse sand (SM) with rock fragments (FILL)	20
					9
960	10				9
		▽		Loose gray-brown clayey fine to medium sand (SC) (FILL)	
955	15				7
950	20			Partially weathered rock sampled as gray highly micaceous silty fine to coarse sand (SM)	50/2"
				No sample recovered at 25 feet	
945	25			Auger Refusal at 25 feet	50/0"
940	30				
935	35				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD SOIL TEST BORINGS.GPJ GEO HYDRO.GDT 11/17/17

HAND AUGER LOG HA-1

Date Performed: 11/1/17 Logged by: EM

Equipment: Hand Auger Elevation(ft): 960

GEO HYDRO ENGINEERS

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Tan to brown stilty fine to coarse sand (SM) (ALLUVIUM)					
2				4			
3		Gray fine to coarse sandy clay (CL) with rock fragments (ALLUVIUM)					
4		Auger refusal at 3 feet 10 inches		1			
5		Initial boring encountered auger refusal at 1 foot. Boring offset 5 feet and encountered auger refusal at 1 foot. Boring offset 4 feet and encountered auger refusal at 1 foot. Boring offset 5 feet and encountered auger refusal at 8 inches. Boring offset 5 feet and encountered auger refusal at 3 feet 10 inches.					
6							
7							
8		No groundwater encountered					
9							

HAND AUGER LOG HA-2

Date Performed: 11/1/17 Logged by: EM

Equipment: Hand Auger Elevation(ft): 960

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Brown silty fine to medium sand (SM) (ALLUVIUM)					
2		Brown clayey fine to medium sand (SC) (ALLUVIUM)					
3		Brown fine sandy clay (CH) (ALLUVIUM)		2			
4							
5				0			
6		Auger Refusal at 5 feet 6 inches					
7		Initial boring encountered auger refusal at 3 feet 10 inches. Boring offset 5 feet and encountered auger refusal at 5 feet 6 inches.					
8		Groundwater encountered at 4 feet					
9							

Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

Whitestone Boulevard Culvert Replacement
Douglasville, Georgia
171061.20

HAND AUGER HAND AUGER LOG.GPJ LOG A GNNN07.GDT 11/17/17

LABORATORY TEST RESULTS

GEO HYDRO ENGINEERS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	NK
Date	11/09/17
Checked By	

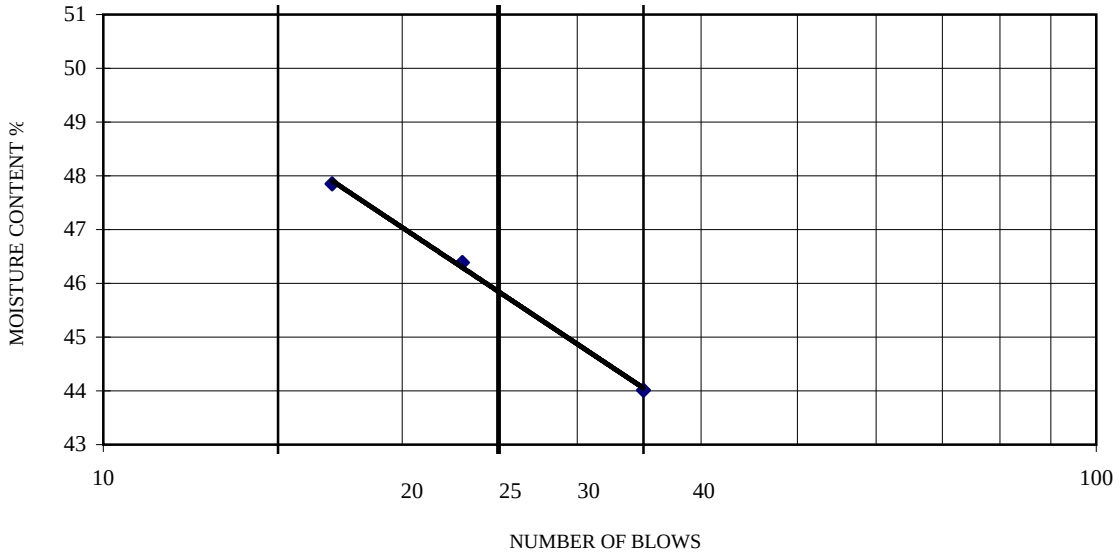
Client Pr. #	171061.20	Lab. PR. #	1707A-37-1
Pr. Name	Whitestone Blvd Culvert Replacement	S. Type	Bag
Sample ID	26208/B-1	Depth/Elev.	-12'
Location	-	Add. Info	-

ASTM D 4318/AASHTO T 88, T 89
Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

LIQUID LIMIT

Number of Blows	35	23	17
Mass of Wet Sample & Tare, g	41.96	42.41	44.37
Mass of Dry Sample & Tare, g	36.67	36.95	38.58
Mass of Tare, g	24.65	25.18	26.48
Moisture Content, %	44.01	46.39	47.85

Oven ID #	15/496/610
Balance ID #	139/563
Liquid Limit Device ID #	451/569



PLASTIC LIMIT

Mass of Wet Sample & Tare, g	37.71	30.54
Mass of Dry Sample & Tare, g	34.48	29.05
Mass of Tare, g	23.37	23.89
Moisture Content, %	29.07	28.88

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

Mass of Wet Sample & Tare, g	350.30
Mass of Dry Sample & Tare, g	308.30
Mass of Tare, g	99.30
Moisture Content, %	20.10

LIQUID LIMIT (LL)	46
PLASTIC LIMIT (PL)	29
PLASTICITY INDEX (PI)	17
LIQUIDITY INDEX (LI)	-0.52

DESCRIPTION: Red Silty Sand

USCS (ASTM D2487; D2488): SM

AASHTO (M 145): NA

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Web: www.test-llc.com

Tested By	EB
Date	11/10/17
Checked By	LB

Client Pr. #	171061.20	Lab. PR. #	1707A-37-1
Pr. Name	Whitestone Blvd Culvert Replacement	S. Type	Bag
Sample ID	26208/B-1	Depth/Elev.	-12'
Location	-	Add. Info	-

ASTM D 422/AASHTO T 88
Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

As-Received Moisture Content

Mass of Wet Sample & Tare, g	350.30
Mass of Dry Sample & Tare, g	308.30
Mass of Tare, g	99.30
Moisture Content, %	20.1

Moisture Content of Material Used for Hydrometer Analysis

Mass of Wet Sample & Tare, g	458.50
Mass of Dry Sample & Tare, g	397.50
Mass of Tare, g	103.90
Moisture Content, %	20.8

Mass of Total Sample before separation on #4 sieve & Tare, g	2335.00
Mass of Tare, g	0.00
Total Mass of Dry Sample, g	1933.32

Mass of Sample used for hydrometer analysis, g	70.70
Dry Mass, g	58.54
% of Total Sample passing #4 sieve	97.5

SIEVE ANALYSIS

PORTION OF SAMPLE RETAINED ON #4 SIEVE

Mass of Tare, g: 0.00

Sieve Size		Sample & Tare, g	% RETAINED	%PASSING
12"	COBBLES		0.0	100.0
3"			0.0	100.0
2.5"	COARSE		0.0	100.0
2"	GRAVEL		0.0	100.0
1.5"			0.0	100.0
1"			0.0	100.0
.75"		0.00	0.0	100.0
.5"	FINE GRAVEL	14.20	0.7	99.3
.375"		24.80	1.3	98.7
#4	COARSE SAND	48.30	2.5	97.5

PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)

Sieve Size		Cumulative Mass retained, g	% PASSING
#10	MEDIUM	1.56	94.9
#20	SAND	5.04	89.1
#40		9.19	82.2
#60	FINE SAND	16.96	69.3
#100		24.61	56.5
#200	FINES	32.01	44.2

Remarks

HYDROMETER ANALYSIS

Length of Dispersion Period	1 Minute
Mechanical Dispersion Device ID #	61
Amount of Dispersing Agent (ml)	125.0
Specific Gravity (assumed)	2.700
Specific Gravity (tested)	
Starting time	14:00

PARTICLE-SIZE ANALYSIS

% COBBLES	0.0	% MEDIUM SAND	12.7
% COARSE GRAVEL	0.0	% FINE SAND	38.0
% FINE GRAVEL	2.5	% FINES	44.2
% COARSE SAND	2.6	% TOTAL SAMPLE	100.0
% CLAY(<0.005mm)	27.6	% CLAY(<0.002mm)	21.8

Date	Time	Testing time (min)	Reading	Temp (°C)	K	Composite Correction	Actual Reading	Effective Depth (cm)	a	Particle Diam. (mm)	Percent Passing
10/10/17	14:02	2	31.0	19.1	0.01361	6.5	24.5	12.3	0.99	0.0338	40.4
10/10/17	14:05	5	29.0	19.1	0.01361	6.5	22.5	12.6	0.99	0.0216	37.1
10/10/17	14:15	15	27.0	19.1	0.01361	6.5	20.5	13.0	0.99	0.0127	33.8
10/10/17	14:30	30	26.0	19.1	0.01361	6.5	19.5	13.1	0.99	0.0090	32.2
10/10/17	15:00	60	25.0	19.1	0.01361	6.5	18.5	13.3	0.99	0.0064	30.5
10/10/17	18:10	250	21.0	19.1	0.01361	6.5	14.5	14.0	0.99	0.0032	23.9
10/11/17	14:00	1440	19.0	19.1	0.01361	6.5	12.5	14.3	0.99	0.0014	20.6

Hydrometer 152H ID #	305527	Oven ID #	15/496/610
Sieve Shaker ID #	555	Balance ID#	139/142/700

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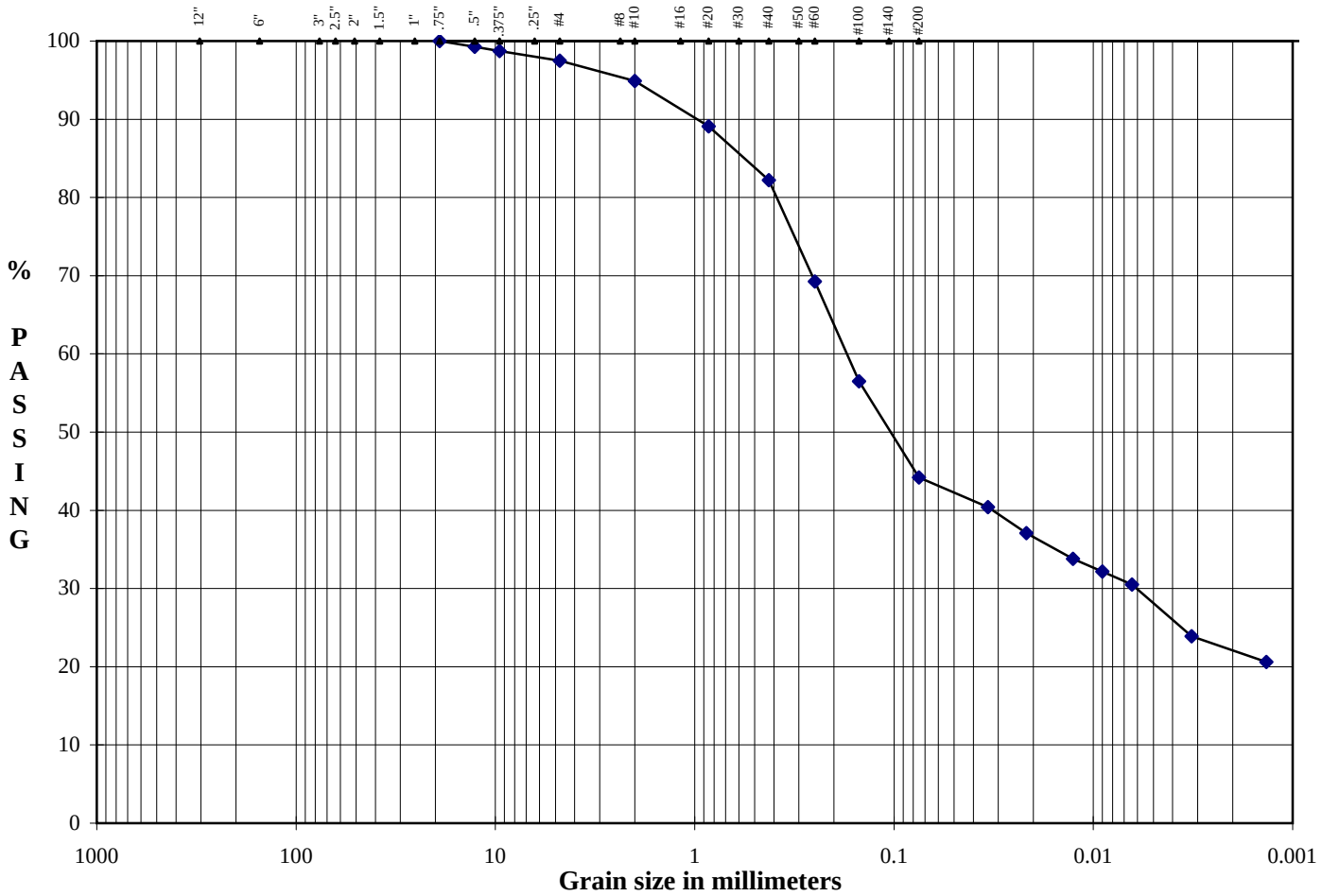
Tested By	EB
Date	11/10/17
Checked By	

Client Pr. #	171061.20	Lab. PR. #	1707A-37-1
Pr. Name	Whitestone Blvd Culvert Replacement	S. Type	Bag
Sample ID	26208/B-1	Depth/Elev.	-12'
Location	-	Add. Info	-

ASTM D 422/AASHTO T 88

Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

Particle-Size Analysis



Boulders	Cobbles	Gravel: Coarse	Gravel: Fine	Sand: Coarse	Sand: Medium	Sand: Fine	Fines: Silt or Clay

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	NA	mm
Cu	NA	
Cc	NA	

DESCRIPTION: Red Silty Sand

USCS (ASTM D2487; D2488): SM

Project's Specific % Passing: NA

Project's Specific Particle Size, mm: NA

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Fax: 770-923-8973
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Tested By	NK
Date	11/09/17
Checked By	

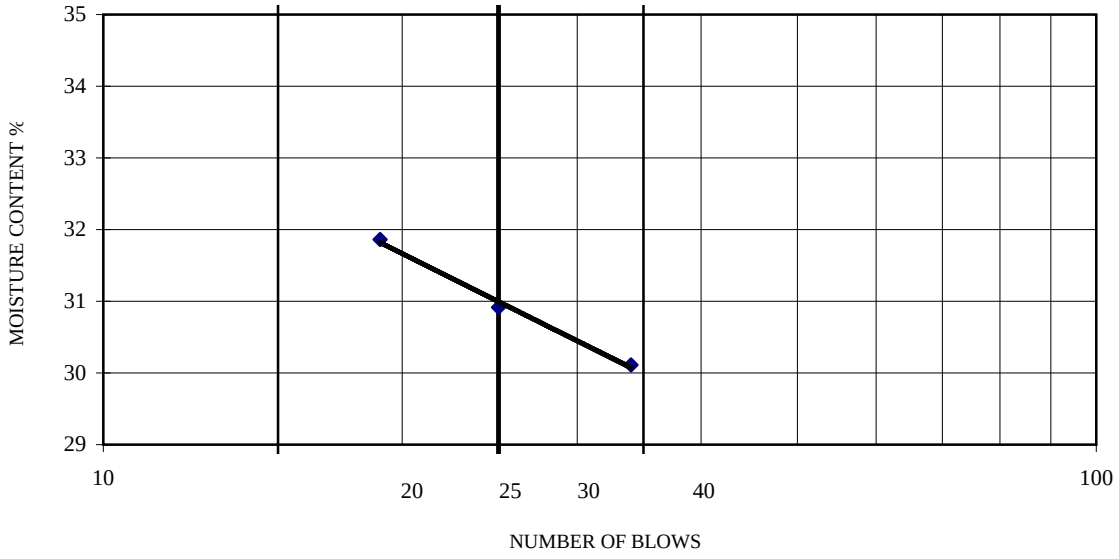
Client Pr. #	171061.20	Lab. PR. #	1707A-37-1
Pr. Name	Whitestone Blvd Culvert Replacement	S. Type	Bag
Sample ID	26211/B-2	Depth/Elev.	-22'
Location	-	Add. Info	-

ASTM D 4318/AASHTO T 88, T 89
Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

LIQUID LIMIT

Number of Blows	34	25	19
Mass of Wet Sample & Tare, g	40.96	40.94	47.80
Mass of Dry Sample & Tare, g	37.16	37.02	43.18
Mass of Tare, g	24.54	24.34	28.68
Moisture Content, %	30.11	30.91	31.86

Oven ID #	15/496/610
Balance ID #	139/563
Liquid Limit Device ID #	451/569



PLASTIC LIMIT

Mass of Wet Sample & Tare, g	35.52	35.38
Mass of Dry Sample & Tare, g	33.56	33.39
Mass of Tare, g	24.87	24.47
Moisture Content, %	22.55	22.31

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

Mass of Wet Sample & Tare, g	421.70
Mass of Dry Sample & Tare, g	366.20
Mass of Tare, g	96.70
Moisture Content, %	20.59

LIQUID LIMIT (LL)	31
PLASTIC LIMIT (PL)	22
PLASTICITY INDEX (PI)	9
LIQUIDITY INDEX (LI)	-0.16

DESCRIPTION: Yellow Clayey Sand

USCS (ASTM D2487; D2488): SC

AASHTO (M 145): NA

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Tested By	EB
Date	10/09/17
Checked By	LB

Client Pr. #	171061.20	Lab. PR. #	1707A-37-1
Pr. Name	Whitestone Blvd Culvert Replacement	S. Type	Bag
Sample ID	26211/B-2	Depth/Elev.	-22'
Location	-	Add. Info	-

ASTM D 422/AASHTO T 88
Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

As-Received Moisture Content

Mass of Wet Sample & Tare, g	421.70
Mass of Dry Sample & Tare, g	366.20
Mass of Tare, g	96.70
Moisture Content, %	20.6

Moisture Content of Material Used for Hydrometer Analysis

Mass of Wet Sample & Tare, g	470.90
Mass of Dry Sample & Tare, g	413.50
Mass of Tare, g	130.10
Moisture Content, %	20.3

Mass of Total Sample before separation on #4 sieve & Tare, g	2242.00
Mass of Tare, g	0.00
Total Mass of Dry Sample, g	1864.39

Mass of Sample used for hydrometer analysis, g	70.60
Dry Mass, g	58.71
% of Total Sample passing #4 sieve	99.1

SIEVE ANALYSIS

PORTION OF SAMPLE RETAINED ON #4 SIEVE

Mass of Tare, g: 0.00

Sieve Size		Sample & Tare, g	% RETAINED	%PASSING
12"	COBBLES		0.0	100.0
3"			0.0	100.0
2.5"	COARSE		0.0	100.0
2"	GRAVEL		0.0	100.0
1.5"			0.0	100.0
1"			0.0	100.0
.75"		0.00	0.0	100.0
.5"	FINE GRAVEL	4.10	0.2	99.8
.375"		5.10	0.3	99.7
#4	COARSE SAND	17.40	0.9	99.1

PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)

Sieve Size		Cumulative Mass retained, g	% PASSING
#10	MEDIUM	0.48	98.3
#20	SAND	2.66	94.6
#40		6.93	87.4
#60	FINE SAND	17.76	69.1
#100		28.73	50.6
#200	FINES	36.02	38.3

Remarks

HYDROMETER ANALYSIS

Length of Dispersion Period	1 Minute
Mechanical Dispersion Device ID #	61
Amount of Dispersing Agent (ml)	125.0
Specific Gravity (assumed)	2.700
Specific Gravity (tested)	
Starting time	14:02

PARTICLE-SIZE ANALYSIS

% COBBLES	0.0	% MEDIUM SAND	10.9
% COARSE GRAVEL	0.0	% FINE SAND	49.1
% FINE GRAVEL	0.9	% FINES	38.3
% COARSE SAND	0.8	% TOTAL SAMPLE	100.0
% CLAY(<0.005mm)	20.9	% CLAY(<0.002mm)	17.0

Date	Time	Testing time (min)	Reading	Temp (°C)	K	Composite Correction	Actual Reading	Effective Depth (cm)	a	Particle Diam. (mm)	Percent Passing
10/10/17	14:04	2	28.0	19.1	0.01361	6.5	21.5	12.8	0.99	0.0344	35.9
10/10/17	14:07	5	26.0	19.1	0.01361	6.5	19.5	13.1	0.99	0.0221	32.6
10/10/17	14:17	15	24.0	19.1	0.01361	6.5	17.5	13.5	0.99	0.0129	29.2
10/10/17	14:32	30	22.0	19.1	0.01361	6.5	15.5	13.8	0.99	0.0092	25.9
10/10/17	15:02	60	20.0	19.1	0.01361	6.5	13.5	14.1	0.99	0.0066	22.6
10/10/17	18:12	250	18.0	19.1	0.01361	6.5	11.5	14.5	0.99	0.0033	19.2
10/11/17	14:02	1440	16.0	19.1	0.01361	6.5	9.5	14.8	0.99	0.0014	15.9

Hydrometer 152H ID #	305527	Oven ID #	15/496/610
Sieve Shaker ID #	555	Balance ID#	139/142/700

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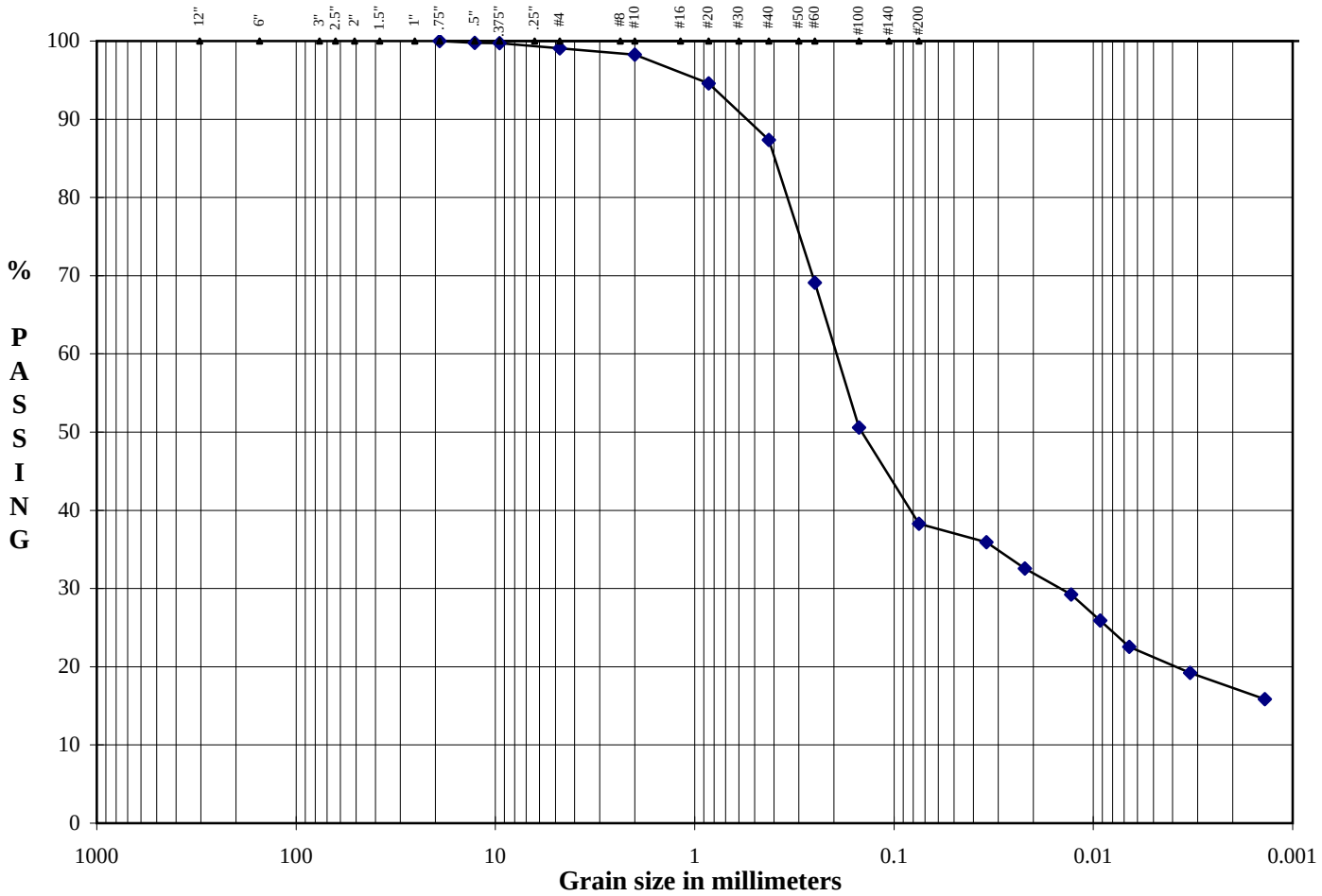
Tested By	EB
Date	10/09/17
Checked By	

Client Pr. #	171061.20	Lab. PR. #	1707A-37-1
Pr. Name	Whitestone Blvd Culvert Replacement	S. Type	Bag
Sample ID	26211/B-2	Depth/Elev.	-22'
Location	-	Add. Info	-

ASTM D 422/AASHTO T 88

Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

Particle-Size Analysis



Boulders	Cobbles	Gravel: Coarse	Gravel: Fine	Sand: Coarse	Sand: Medium	Sand: Fine	Fines: Silt or Clay

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	NA	mm
Cu	NA	
Cc	NA	

DESCRIPTION: Yellow Clayey Sand

USCS (ASTM D2487; D2488): SC

Project's Specific % Passing	NA
Project's Specific Particle Size, mm	NA

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Tested By	ED
Date	11/09/17
Checked By	

Client Pr. #	171061.20	Lab. PR. #	1707A-37-1
Pr. Name	Whitestone Blvd Culvert Replacement	S. Type	Basg
Sample ID	26210/B-2	Depth/Elev.	-12'
Location	-	Add. Info	-

ASTM G 57/G187/AASHTO T 288

Standard Test Method for Determining Minimum Laboratory Soil Resistivity

Determination of Resistivity at as-received moisture content

As-received Moisture Content	
Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	NA

Remarks

TEST DATA

Mass of Soil Box, g	-	Meter Dial Reading, ohms	-
Mass of Soil Box + Soil, g	-	Reading of Meter Range Multiplier	-
Mass of Soil, g	-	Measured Resistance, ohms	-
Calibrated Volume of Soil Box, ft^3	0.0027	Calibrated Soil Box Multiplier, cm	1.0
Wet Density of as-placed Soil, pcf	-		
Dry Density of as-placed Soil, pcf	-	**Reported Soil Resistivity, ohms-cm**	**NA**

Determination of Minimum Soil Resistivity

TEST DATA

	Trials at Various Moisture Content								
TRIAL #	1	2	3	4	5	6	7	8	9
Meter Dial Reading, ohms	33.6	34.1	32.8	30.1	28	28			
Reading of Meter Range Multiplier	K	K	K	K	K	K			
Measured Resistance, ohms	33600	34100	32800	30100	28000	28000			
Calibrated Soil Box Multiplier, cm	1.0	1.0	1.0	1.0	1.0	1.0			
Measured Resistivity, ohms-cm	33600	34100	32800	30100	28000	28000			

Reported Soil Minimum Resistivity, ohms-cm **28000**

Note: Material passed # 10 sieve used for testing

Oven ID #	496/610
Balance ID #	563/700
Soil Box ID #	612/613/707
Resistivity Meter ID #	706

Description

NA

USCS (D2487; D2488)	NA
AASHTO (M145)	NA

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Web: www.test-llc.com

Tested By	EB
Date	11/09/17
Checked By	

Client Pr. #	171061.20	Lab. PR. #	1707A-37-1
Pr. Name	Whitestone Blvd Culvert Replacement	S. Type	Basg
Sample ID	26210/B-2	Depth/Elev.	-12'
Location	-	Add. Info	-

ASTM G51

Standard Test Method for Determining pH of Soil for Use in Corrosion Testing

SAMPLE PREPARATION

Roots, Stones, Gravel and other deleterious material was removed prior to testing

Measurements performed ar room temperature condition: 21.9 °C

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	pH meter Reading #1	pH meter Reading #2	pH meter Reading #3	**Reported pH value**
26210	See Above	5.52	5.50	5.46	**5.5**

REMARKS

NIST TRACEABLE BUFFER SOLUTIONS (4.0; 7.0; 10.0 pH) were used for CALIBRATION of pH METER prior to testing.

pH Meter ID 375/732/733

CONSTRUCTION DRAWINGS
OF
WHITESTONE BLVD.
CULVERT REPLACEMENT

Primary Permittee:

1. *"I certify that the receiving water(s) or outfall(s) or a combination of receiving water(s) and outfall(s) will be monitored in accordance with the Erosion, Sedimentation and Pollution Control Plan."*
2. *"I certify that the Erosion, Sedimentation and Pollution Control Plan (Plan) has been prepared in accordance with Part IV of the General NPDES Permit No. GAR 100001, No. GAR 100002 or No. GAR 100003, the Plan will be implemented, and that such Plan will provide for compliance with this permit."*
3. *"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that certified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is , to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."*

Primary Permittee Signature

The Primary Permittee shall provide the applicable portion of the ES&PC Plan to each Secondary Permittee prior to the Secondary conducting any construction activity and have each Secondary Permittee sign the Plan or portion of the Plan applicable to their site.

SECONDARY PERMITTEE

A written acknowledgement of receipt of the Plan or amendments to the Plan must be made by the secondary permittee and a copy of such be retained in the new primary permittee's records in accordance with Part IV.E.3. of this permit

SECONDARY PERMITTEE	COMPANY NAME	CONTACT #
SECONDARY PERMITTEE	COMPANY NAME	CONTACT #
SECONDARY PERMITTEE	COMPANY NAME	CONTACT #
SECONDARY PERMITTEE	COMPANY NAME	CONTACT #
SECONDARY PERMITTEE	COMPANY NAME	CONTACT #
SECONDARY PERMITTEE	COMPANY NAME	CONTACT #

LOCATION

L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER/DEVELOPER/PRIMARY PERMITTEE

DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134
24 hr. CONTACT: MIGUEL VALENTIN
PH: 770.920.7325

TOTAL PROJECT AREA: 0.60 ac
TOTAL DISTURBED AREA: 0.56 ac.

GPS LOCATION OF BEGINNING & END OF PROJECT

BEGINNING	END
(INT. OF HWY 5 & WHITESTONE BLVD)	(INT. OF BIG CREEK DR. & WHITESTONE BLVD)
LATITUDE: 33.605491	LATITUDE: 33.602900
LONGITUDE: 84.839559	LONGITUDE: 84.842765

WSA NOTES

1. *STORMWATER MANAGEMENT STRUCTURES ON PRIVATE PROPERTY MUST BE MAINTAINED BY THE PROPERTY OWNER. ALL SUBSEQUENT OWNERS MUST BE INFORMED OF OPERATIONS AND MAINTENANCE REQUIREMENTS. FAILURE TO MAINTAIN STORMWATER INFRASTRUCTURE MAY RESULT IN ENFORCEMENT ACTION. CHANGES AND MODIFICATIONS TO STORMWATER INFRASTRUCTURE (PUBLIC AND PRIVATE) MUST BE APPROVED BY THE DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY.*
2. *DOWNSTREAM IMPACTS OF DEVELOPMENT ARE THE RESPONSIBILITY OF THE OWNER. DEVELOPMENT MAY NOT CAUSE DOWNSTREAM IMPACTS SUCH AS INCREASED FLOOD HAZARD, EROSION OF OFF-SITE SOILS AND STREAM CHANNELS, OR IMPAIRMENT OF WATER QUALITY OF RECEIVING WATERS.*
3. *APPROVAL IS BASED ON INFORMATION SUPPLIED ON THESE DRAWINGS. IF UNKNOWN CONDITIONS ARE ENCOUNTERED, OR SITE CONDITIONS CHANGE OR THESE PLANS ARE OTHERWISE FOUND TO BE NOT REPRESENTATIVE OF SITE CONDITIONS, CONTACT THE DOUGLASVILLE - DOUGLAS COUNTY WATER AND SEWER AUTHORITY ENGINEERING DEPARTMENT. DESIGN REVISION AND RE-SUBMITTAL MAY BE REQUIRED.*
4. *CONSTRUCTION, WHICH IMPACTS STREAMS, WETLANDS, OR OTHER ENVIRONMENTALLY SENSITIVE AREAS, SHALL COMPLY WITH APPLICABLE LOCAL, STATE, AND FEDERAL LAWS. PLAN APPROVAL BY WSA DOES NOT RELIEVE THE OWNER, DEVELOPER, AND CONTRACTOR OF THE OBLIGATION TO APPLY FOR AND OBTAIN REQUIRED PERMITS AND COMPLY WITH CURRENT REGULATIONS.*
5. *DEVELOPMENT MAY NOT OCCUR IN FLOOD PRONE AREAS AS DEFINED BY THE DOUGLASVILLE - DOUGLAS COUNTY WATER AND SEWER AUTHORITY. UNAUTHORIZED DEVELOPMENT WILL BE ORDERED REMOVED AND RESTORATION OF THE SITE REQUIRED, BOTH AT THE EXPENSE OF THE DEVELOPER.*
6. *APPROVAL OF THESE PLANS IS BASED ON SUBMITTED INFORMATION REGARDING EXTENTS OF SOIL DISTURBANCE, SCHEDULE OF ACTIVITIES, AND PROPOSED MEASURES TO CONTROL EROSION AND SEDIMENT CONTROL. SIGNIFICANT CHANGES TO PROJECT DESIGN OR SCHEDULE ELEMENTS MUST BE APPROVED BY THE AUTHORITY.*
7. *PLAN APPROVAL DOES NOT RELEASE ANY PARTY FROM DUTY TO COMPLY WITH LOCAL, STATE, AND FEDERAL LAW. IT IS UNLAWFUL TO INCREASE TURBIDITY IN RECEIVING WATERS MORE THAN 25 NTU.*
8. *THE DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY REQUIRES THAT EVERY SERVICE CONNECTION BE EQUIPPED WITH A BACKFLOW PREVENTION DEVICE. FACILITIES THAT, IN THE OPINION OF THE AUTHORITY, MAY POTENTIALLY INTRODUCE HAZARDOUS OR TOXIC SUBSTANCES INTO THE WATER SUPPLY WILL BE REQUIRED TO INSTALL A REDUCED PRESSURE ASSEMBLY THAT VENTS TO THE ATMOSPHERE.*
9. *DOUGLASVILLE-DOUGLAS COUNTY WSA APPROVAL OF THESE PLANS DOES NOT CONSTITUTE A GUARANTEE OF WATER OR SEWERAGE CAPACITY. CAPACITY IS NOT ALLOCATED UNTIL IT IS PURCHASED THROUGH THE SALE OF A WATER METER.*
10. *ANY MODIFICATIONS/CHANGES TO AN EXISTING OR ADDITIONS TO A PORTION OF THE WATER, SEWER, OR STORMWATER SYSTEMS IS REQUIRED TO BE INSPECTED AND OR REVIEWED BY WSA (WSA ENG. DEPT. PH# 770-949-7617).*
11. *PLAN APPROVAL DOES NOT RELEASE THE OWNER, DEVELOPER, OR CONTRACTOR FROM RESPONSIBILITY FOR ENVIRONMENTAL DAMAGE, PROPERTY DAMAGE, OR ENDANGERMENT OF PUBLIC HEALTH, RESPONSIBLE PARTIES SHALL MITIGATE IMPACTS, REPAIR DAMAGE, AND COMPENSATE AFFECTED PARTIES AS REQUIRED BY LOCAL AND STATE LAW.*
12. *ALL CONSTRUCTION AND MATERIALS SHALL BE IN FULL ACCORDANCE WITH CURRENT RULES AND REGULATIONS AND DESIGN STANDARDS AND SPECIFICATIONS PUBLISHED BY THE DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY. IT IS THE RESPONSIBILITY OF EACH DEVELOPER AND CONTRACTOR TO FAMILIARIZE HIMSELF WITH ALL CURRENT WSA RULES AND STANDARDS.*
13. *THE DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY WILL OBTAIN ROAD BORE PERMITS AND ROAD CUT PERMITS AT THE COUNTY AND STATE LEVELS FOR ALL APPROVED PROJECTS. ROAD BORE/CUT WORK SHALL NOT BEGIN UNTIL PERMITS ARE OBTAINED.*
14. *PLEASE NOTIFY WSA ENGINEERING DEPT. 72 HOURS BEFORE CONSTRUCTION AT 770-949-7617.*

811 Know what's **below.**
Call before you dig.
Dial 811.
or call 800-282-7411

IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL UNDERGROUND UTILITIES BEFORE BEGINNING CONSTRUCTION AND ADVISE ENGINEERING OF ANY CONFLICTS. ALL LOCATION OF UTILITIES SHOWN ON THESE DRAWINGS IS APPROXIMATE AND MAY NOT BE A COMPLETE LOCATION OF ALL UTILITIES. CERTIFICATION TO THE LOCATION OF ALL UTILITIES IS WITHHELD.



INDEX OF DRAWINGS

SHEET	DESCRIPTION
GN1	GENERAL NOTES
EC1	NPDES NOTES
EC2	NPDES NOTES
EC3	INITIAL PHASE EROSION CONTROL PLAN
EC4	INTERMEDIATE PHASE EROSION CONTROL PLAN
EC5	FINAL PHASE EROSION CONTROL PLAN
EC6	EROSION CONTROL DETAILS
EC7	NPDES CHECKLIST
DEM1	DEMOLITION PLAN
SP1	SITE PLAN
GP1	GRADING PLAN
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CD2	STANDARD CONSTRUCTION DETAILS
CD3	STANDARD CONSTRUCTION DETAILS
CD4	STANDARD CONSTRUCTION DETAILS
CD5	STANDARD CONSTRUCTION DETAILS

JOB#: **H15166**

WHITESTONE BLVD CULVERT REPLACEMENT

DATE: MAY 11, 2018

No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

HUGHES-RAY COMPANY, INC.
ENGINEERS | SURVEYORS | LANDSCAPE ARCHITECTS
6554 EAST CHURCH STREET
DOUGLASVILLE, GEORGIA 30134
p 770.942.0196
f 770.942.0152
www.HughesRay.com

NRCS NOTES

EROSION & SEDIMENT CONTROL NOTES

1. **THE ESCAPE OF SEDIMENT FROM THE SITE SHALL BE PREVENTED BY THE INSTALLATION OF EROSION AND SEDIMENT CONTROL MEASURES AND PRACTICES PRIOR TO LAND DISTURBING ACTIVITIES.**
2. **EROSION CONTROL MEASURES WILL BE MAINTAINED AT ALL TIMES. IF FULL IMPLEMENTATION OF THE APPROVED PLAN DOES NOT PROVIDE FOR EFFECTIVE EROSION CONTROL, ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IMPLEMENTED TO CONTROL OR TREAT THE SEDIMENT SOURCE.**
3. **ANY DISTURBED AREA LEFT EXPOSED FOR A PERIOD OF 14 DAYS SHALL BE STABILIZED WITH MULCH OR TEMPORARY SEEDING.**
4. NOTIFY THE DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY AT LEAST 72 HOURS PRIOR TO COMMENCEMENT OF LAND DISTURBING ACTIVITIES. AN INSPECTOR WILL BE ASSIGNED AND A PRE-CONSTRUCTION MEETING HELD PRIOR TO COMMENCEMENT OF LAND DISTURBANCE.
5. ALL CONTRACTORS FOR EROSION SEDIMENTATION AND POLLUTION CONTROL SHALL BE APPROVED BY THE AUTHORITY.
6. THE CONTRACTOR MUST NOTIFY THE UTILITIES PROTECTION CENTER AT 1-800-282-7411 AT LEAST 72 HOURS PRIOR TO COMMENCEMENT OF LAND-DISTURBING ACTIVITIES.
7. STRIPPING OF VEGETATION, REGRADING, AND OTHER DEVELOPMENT ACTIVITIES SHALL BE CONDUCTED IN SUCH A MANNER SO AS TO MINIMIZE EROSION.
8. CUT AND FILL OPERATIONS SHALL BE KEPT TO A MINIMUM.
9. DEVELOPMENT PLANS MUST CONFORM TO TOPOGRAPHY AND SOIL TYPE, SO AS TO CREATE THE LOWEST PRACTICABLE EROSION POTENTIAL.
10. WHENEVER FEASIBLE, NATURAL VEGETATION SHALL BE RETAINED, PROTECTED, AND SUPPLEMENTED.
11. DISTURBED AREAS AND THEIR DURATION OF EXPOSURE TO EROSIVE ELEMENTS SHALL BE KEPT TO A PRACTICABLE MINIMUM.
12. DISTURBED SOIL SHALL BE STABILIZED AS QUICKLY AS PRACTICABLE.
13. TEMPORARY VEGETATION OR MULCHING SHALL BE EMPLOYED TO PROTECT EXPOSED CRITICAL AREAS DURING DEVELOPMENT.
14. PERMANENT VEGETATION AND STRUCTURAL EROSION CONTROL MEASURES SHALL BE INSTALLED AS SOON AS PRACTICABLE.
15. TO THE EXTENT NECESSARY, SEDIMENT IN RUN-OFF WATER SHALL BE TRAPPED BY THE USE OF DEBRIS BASINS, SEDIMENT BASINS, SILT TRAPS, OR SIMILAR MEASURES UNTIL THE DISTRBED AREA IS STABILIZED.
16. ADEQUATE PROVISIONS SHALL BE PROVIDED TO MINIMIZE DAMAGE FROM SURFACE WATER TO THE CUT FACE OF EXCAVATIONS OR THE SLOPING SURFACES OF FILLS.
17. CUTS AND FILLS SHALL NOT ENDANGER ADJOINING PROPERTY.
18. FILLS SHALL NOT ENCROACH UPON NATURAL WATERCOURSES OR CONSTRUCTED CHANNELS IN A MANNER THAT WOULD ADVERSELY AFFECT OTHER PROPERTY OWNERS.
19. GRADING EQUIPMENT MUST CROSS FLOWING STREAMS BY THE MEANS OF BRIDGES OR CULVERTS, EXCEPT WHEN SUCH METHODS ARE NOT FEASIBLE, PROVIDED IN ANY CASE THAT SUCH CROSSINGS SHALL BE KEPT TO A MINIMUM AND THAT A PROPERLY TEMPORARY STREAM CROSSING IS CONSTRUCTED IN ACCORDACE WITH STATE AND LOCAL REGULATIONS.
20. PROVISIONS SHALL BE PROVIDED FOR TREATMENT OR CONTROL OF ANY SOURCE OF SEDIMENTS AND ADEQUATE SEDIMENTATION CONTROL FACILITIES TO RETAIN SEDIMENTS ON SITE OR PRECLUDE SEDIMENTATION OF ADJACENT WATERS BEYOND THE LEVELS SPECIFIED IN THIS PERMIT.
21. NO CONSTRUCTION ACTIVITIES SHALL BE CONDUCTED WITHIN A 50-FOOT BUFFER ALONG THE BANKS OF ALL STATE WATERS (AS MEASURED HORIZONTALLY FROM THE POINT WHERE VEGETATION HAS BEEN WRESTED BY NORMAL STREAM FLOW OR WAVE ACTION) UNLESS A FORMAL WAIVER HAS BEEN GRANTED BY THE AUTHORITY.
22. WHERE THE AUTHORITY GRANTS A WAIVER, NO CONSTRUCTION ACTIVITIES SHALL BE CONDUCTED WITHIN A 50-FOOT BUFFER STATE BUFFER WITHOUT FULL COMPLIANCE OF STATE REGULATIONS AND OBTAINING A VARIANCE IF APPLICABLE.
23. EXCEPT AS PROVIDED ABOVE, FOR REQUIRED BUFFERS NO CONSTRUCTION ACTIVITIES SHALL BE CONDUCTED WITHIN A BUFFER AND A BUFFER SHALL REMAIN IN ITS NATURAL, UNDISTURBED, STATE OF VEGETATION.
24. BETWEEN THE TIME FINAL STABILIZATION OF THE SITE IS ACHIEVED AND UPON THE SUBMITTAL OF A NOTICE OF TERMINATION, A BUFFER MAY BE THINNED OR TRIMMED OF VEGETATION. A PROTECTIVE VEGETATIVE COVER MUST REMAIN TO PROTECT WATER QUALITY AND AQUATIC HABITAT AND A NATURAL CANOPY MUST BE LEFT IN SUFFICIENT QUANTITY TO KEEP SHADE ON THE STREAMBED.

Ss EROSION CONTROL BLANKET IS REQUIRED ON ALL SLOPES 2.5:1 OR STEEPER & GREATER THAN 10 FEET.

- PERSON RESPONSIBLE FOR THE INSTALLATION AND MAINTENANCE OF EROSION CONTROL DEVICES AND MEASURES IS;

DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134
24 hr. CONTACT: MIGUEL VALENTIN
PH: 770.920.7325

- ALL DRAINAGE EASEMENTS MUST BE GRASSED AND RIP-RAPPED AS REQUIRED TO CONTROL EROSION.
- ALL CONSTRUCTION MUST CONFORM TO LOCAL DOUGLAS COUNTY GA. CONSTRUCTION STANDARDS.
- ALL BUILDING SITES SHALL BE A MINIMUM OF 4' ABOVE HIGH WATER ELEVATION AND/OR THE 100-YEAR FLOOD ELEVATION.
- CLEARING AND GRADING SHALL BE LIMITED TO AREAS DESIGNATED AS RIGHT-OF-WAY AND THOSE AREAS REQUIRED FOR STORM DRAINAGE, DETENTION FACILITIES, AND UTILITIES.
- ALL SIDEWALKS ARE REQUIRED TO BE INSTALLED PRIOR TO EXPIRATION OF BONDS.

- CONSTRUCTION SCHEDULE:
  1. NOTIFICATION OF LOCAL GOVERNING AUTHORITY: MAY 2018
  2. CONSTRUCTION OF SEDIMENT CONTROL DEVICES: JULY 2018
  3. CULVERT REPLACEMENT: JULY 2018-JUNE 2019
  4. LAND STABILIZATION: WITHIN 14 DAYS OF ACHIEVING FINAL GRADE.

- THE DEVELOPER IS RESPONSIBLE FOR OBTAINING ANY PERMITS THAT MAY BE REQUIRED FOR LAND DISTURBANCES AND/OR BUFFER REQUIREMENTS.
- THERE IS ESTABLISHED A 50 FOOT BUFFER ALONG THE BANKS OF ALL STATE WATERS, AS MEASURED HORIZONTALLY FROM THE POINT WHERE VEGETATION HAS BEEN WRESTED BY NORMAL STREAM FLOW OR WAVE ACTION.
- ALL STATE WATERS HAVE BEEN DELINEATED ON THIS SITE AND ARE SHOWN WITHIN A 50 FT. UNDISTURBED CREEK/D.E. BUFFER.

EROSION AND SEDIMENT CONTROL SCHEDULE

1. PLACE CONSTRUCTION EXIT.
2. PLACE EROSION AND SEDIMENT CONTROL DEVICES AND "SILT FENCE".
3. PLACE TREE PROTECTION FENCE IN CRITICAL ROOT ZONE & CALL FOR INSPECTION.
4. TEMPORARY SEDIMENT POND FEATURES AND SILT CONTROL FENCE ARE TO BE CONSTRUCTED AND FULLY FUNCTIONAL PRIOR TO ANY GRADING.
5. GRADE TEMPORARY CONSTRUCTION SWALES TO ON-SITE SEDIMENT CONTROL PONDS, DETENTION PONDS, AND DR2 INLETS.
6. CLEAR, STRIP & PROVIDE TEMPORARY SWALES TO SILT COLLECTION POINTS.
7. GRADE ROADS AND BUILDINGS-- SLOPE ROADS TO SD2 INLETS.
8. CONSTRUCT UNDERGROUND UTILITIES-- CONSTRUCT SD2 INLETS AS SOON AS POSSIBLE.
9. ROADWAY CURBING AND BASE PAVING WILL BE INSTALLED AFTER UTILITY INSTALLATION HAS BEEN COMPLETED.
10. RETAIN ALL NATURAL VEGETATION, SAVE AREAS NOTED ON STAKING PLANS.
11. LANDSCAPING WILL BE PERFORMED AS SOON AS PRACTICAL AFTER BUILDING CONSTRUCTION IS COMPLETE. APPROPRIATE PLANT MATERIAL SHALL BE INSTALLED AREA BY AREA AS SITE WORK PERMITS.
12. SEDIMENT BASINS AND CONTROL DEVICES WILL REMAIN IN PLACE AND IN WORKING ORDER UNTIL CONSTRUCTION IS COMPLETE AND THEY BECOME UNNECESSARY.
13. CLEAN PONDS AS REQUIRED TO MAINTAIN DESIGN VOLUME OR BEFORE ONE-HALF FULL.

GRADING PLAN

1. HAULING TO AND FROM SITE IS/IS NOT REQUIRED.(IF HAULING TO AND FROM SITE IS REQUIRED, SUBMIT A PROPOSED HAUL ROUTE TO BE REVIEWED AND APPROVED BY DC DOT.)
2. ALL BUILDINGS SHALL BE A MIN. OF 40' FROM AN OPEN DRAINAGE EASEMENT.
3. ALL BUILDING SITES SHALL BE A MIN. OF 4' ABOVE HIGH WATER ELEV. AND OR THE 100 YR. FLOOD ELEVATION.
4. PROJECTS REQUIRING MASS GRADING WILL REQUIRE REPORTS FROM AN INDEPENDENT GEOTECHNICAL ENGINEER TO BE SUBMITTED TO THE DEVELOPMENT CONTROL DIVISION VERIFYING MATERIAL TYPE AND THAT PROPER COMPACTION WAS ACHIEVED.

WATER NOTES

- PIPE MATERIAL (WATER MAINS) 4" OR GREATER MAIN WILL BE: D.I.P. CLASS 50.
- GATE VALVES (4" & GREATER) SHALL BE MUELLER, U.S., OR M & H.
- FIRE HYDRANTS SHALL BE MANUFACTURED BY: MUELLER, M.& H., OR AMERICAN.
- WATER MAIN TO HAVE 48" COVER.
- PLACE METER BOXES AT PROPERTY LINE APPROXIMATELY 11 FEET BEHIND CURBING. METER BOXES MUST BE ON ROAD RIGHT-OF-WAY.
- ALL METER BOXES MUST BE ON LOT BEING SERVED.
- MARK CURB AT METER SERVICE LINES- "W".
- MARK CURB AT VALVE LOCATIONS- "V".
- ALL SERVICES WILL BE RUN BY THE CONTRACTOR, LONG AND SHORT SIDE. (COPPER TUBING TYPE 'K').
- THRUST BLOCKS AT ALL BENDS, TEES, AND HYDRANTS.
- LINE SIZING IS PER DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY REQUIREMENTS.
- CONTRACTOR TO CONTACT OWNER(S) OF ALL UTILITIES AND HAVE UTILITIES MARKED PRIOR TO ANY CONSTRUCTION.
- LOCATION AND SIZE OF EXISTING WATER LINES AND APPURTENANCES WAS OBTAINED FROM DOUGLASVILLE- DOUGLAS COUNTY WATER AND SEWER AUTHORITY FROM BEST INFORMATION AVAILABLE.
- METER BOXES AND CURB STOPS ARE TO BE THE RESPONSIBILITY OF THE DEVELOPER/CONTRACTOR. BOXES ARE TO BE INSTALLED WITH PROPER LIDS AND ADJUSTED TO COINCIDE WITH SURROUNDING TOPO AS PER DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY RULES AND REGULATIONS.
- ALL VALVE BOXES, FIRE HYDRANTS AND MAIN LINES MUST BE ADJUSTED SO AS TO COINCIDE WITH SURROUNDING TOPO. ALL VALVE BOXES WILL BE ENCASED WITH 2'x 2'x 4" CONCRETE PAD.
- WATER SERVICE PLACED UNDER PAVEMENT SHALL BE ENCASED IN 2" P.V.C. PIPE.

STORM WATER NOTES:

1. ALL STORM WATER CONSTRUCTION SHALL CONFORM TO DOUGLASVILLE- DOUGLAS COUNTY WATER & SEWER AUTHORITY DESIGN & CONSTRUCTION STANDARDS. & SPECIFICATIONS, LATEST EDITION.
2. NOTIFY THE DOUGLASVILLE-DOUGLAS COUNTY WATER & SEWER AUTHORITY ENGINEERING DEPARTMENT AT LEAST 72 HOURS PRIOR TO BEGINNING OF LAND DISTURBANCE. AN INSPECTOR WILL BE ASSIGNED & A PRE-CONSTRUCTION MEETING SCHEDULED AT THIS TIME.
3. "AS-BUILT" DRAWINGS SHALL BE FIELD VERIFIED & STAMPED BY A STATE OF GEORGIA LICENSED P.E. OR L.S.
4. ALL CONTRACTORS FOR GRADING, EROSION CONTROL, & STORM WATER SYSTEM CONSTRUCTION SHALL BE APPROVED BY THE AUTHORITY.
5. CONTRACTORS HAVE THE RESPONSIBILITY TO COMPLY WITH EROSION CONTROL REQUIREMENTS OF THE LOCAL LAND DISTURBANCE PERMIT & NPDES GENERAL PERMIT IF APPLICABLE.
6. THE CONTRACTOR SHALL COMPLY WITH ALL UTILITIES PROTECTION CENTER REQUIREMENTS.
7. RIP RAP WILL BE REQ'D WHEN CREEK OR DRAINAGE SWALES CROSS SAN. SEWER SYSTEM. DURING CONSTRUCTION OF SAN. SEWER SYSTEM ADDITIONAL EROSION CONTROL MEASURES WILL BE REQ'D WHERE/IF EROSION BEGINS TO OCCUR.
8. RCP TO BE DELIVERED IN SECTIONS NOT TO EXCEED 8 FT. IN
9. CMP TO MEET MIN. GAUGE OF GA.DOT 1030D, EXCEPT THAT CMP 42" OR GREATER SHALL BE AT LEAST 14 GAUGE.
- ALL BUILDINGS SHOULD BE A MINIMUM OF 40' FROM AN OPEN DRAINAGE EASEMENT.
- ALL DRAINAGE EASEMENTS MUST BE GRASSED AND RIP RAPPED AS REQUIRED TO CONTROL EROSION
- ALL BUILDINGS SITES SHALL BE A MINIMUM OF 4' ABOVE HIGH WATER ELEVATION AND/OR THE 100-YEAR FLOOD ELEVATION.

DOUGLASVILE-DOUGLAS COUNTY WATER SEWER AUTHORITY

WATER & SEWER NOTES

A. ALL WATER MAINS AND SANITARY SEWER CONSTRUCTION SHALL CONFORM TO THE DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY'S DESIGN AND CONSTRUCTION STANDARDS, LATEST EDITION.

B. NOTIFY THE WSA ENGINEERING DEPARTMENT AT LEAST 72 HOURS PRIOR TO BEGINNING OF CONSTRUCTION ON WATER AND SEWER. AN INSPECTOR WILL BE ASSIGNED AND A PRE-CONSTRUCTION MEETING SCHEDULED AT THIS TIME.

C. "AS-BUILT" DRAWINGS SHALL BE FIELD VERIFIED AND STAMPED BY A REGISTERED PROFESSIONAL ENGINEER OR LAND SURVEYOR, LICENSED IN THE STATE OF GEORGIA.

D. ALL CONTRACTORS FOR WATER AND SEWER CONSTRUCTION SHALL BE ON THE WSA APPROVED CONTRACTORS LIST. CONTACT THE WSA ENGINEERING DEPARTMENT FOR A COPY OF THE LIST AND/OR APPLICATIONS.

E. CONTRACTORS HAVE THE RESPONSIBILITY TO ASSURE EROSION CONTROL OF ALL AUTHORITY EASEMENTS, PARTICULARLY WHEN THESE EASEMENTS ARE IN CLOSE PROXIMITY OF DRAINAGE EASEMENTS. SEE THE ASSIGNED DOUGLASVILLE-DOUGLAS COUNTY WSA INSPECTOR FOR DETAILS.

F. THE CONTRACTOR SHALL COMPLY WITH ALL UTILITIES PROTECTION CENTER REQUIREMENTS.

UTILITIES PROTECTION CENTER OF GEORGIA

overhead / underground

BEFORE ANY EXCAVATION WORK BEGINS OR ANY WORK BEGINS WITHIN TEN(10') FT. OF OVERHEAD POWER LINES OF 750 VOLTS OR MORE, NOTIFICATION MUST BE MADE TO THE UTILITIES PROTECTION CENTER (UPC) AT 1-800-282-7411 (770-623-4344 IN METRO ATLANTA).

IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL UNDERGROUND UTILITIES BEFORE BEGINNING CONSTRUCTION AND ADVISE ENGINEERING OF ANY CONFLICTS. ALL LOCATION OF UTILITIES SHOWN ON THESE DRAWINGS IS APPROXIMATE AND MAY NOT BE A COMPLETE LOCATION OF ALL UTILITIES. CERTIFICATION TO THE LOCATION OF ALL UTILITIES IS WITHHELD.

STREET PLAN &PROFILE NOTES:

- ALL CONSTRUCTION MUST CONFORM TO DOUGLAS COUNTY, GEORGIA STANDARDS
- ALL DRAINAGE EASEMENTS MUST BE GRASSED AND RIP RAPPED AS REQUIRED TO CONTROL EROSION.
- ALL BUILDING SITES SHALL BE A MINIMUM OF 4' ABOVE HIGH WATER ELEVATION AND/OR THE 100-YEAR FLOOD ELEVATION.
- ALL BUILDINGS SHOULD BE A MINIMUM OF 40' FROM AN OPEN DRAINAGE EASEMENT.
- CLEARING AND GRADING SHALL BE LIMITED TO AREAS DESIGNATED AS RIGHT-OF-WAY AND THOSE AREAS REQUIRED FOR STORM DRAINAGE, DETENTION FACILITIES, AND ULILITIES.
- ALL SIDEWALKS ARE REQUIRED TO BE INSTALLED PRIOR TO EXPIRATION OF BONDS.
- PROJECTS REQUIRING MASS GRADING WILL REQUIRE REPORTS FROM AN INDEPENDENT GEOTECHNICAL ENGINEER TO BE SUBMITTED TO THE DEVELOPMENT CONTROL DIVISION VERIFYING MATERIAL TYPE AND THAT PROPER COMPACTION WAS ACHIEVED.
- IT IS THE DEVELOPERS RESPONSIBILITY TO COORDINATE WORK WITH ADJACENT PROPERTY OWNERS IMPACTED BY WORK APPROVED UNDER THIS PLAN.
- HAULING TO AND FROM SITE IS NOT REQUIRED.(IF HAULING TO AND FROM SITE IS REQUIRED, SUBMIT A PROPOSED HAUL ROUTE TO BE REVIEWED AND APPROVED BY DC DOT.)
- UTILITIES AND DRAIN PIPES SHALL BE RELOCATED OUTSIDE THE DECELERATION LANE.
- ALL UTILITY CONNECTIONS OR INSTALLATIONS WITHIN THE PUBLIC RIGHTS-OF-WAY REQUIRE A SEPARATE UTILITY PERMIT.
- ALL ROADWAY DRAINAGE STRUCTURES SHALL BE IN ACCORDANCE WITH GA. DOT STANDARDS
- THE TOPPING SHALL NOT BE INSTALLED UNTIL ONE (1) YEAR AFTER FINAL PLAT APPROVAL OR BUILDING CONSTRUCTION ON 75% OF ALL LOTS HAS BEEN COMPLETED, WHICHEVER COMES FIRST.
- ALL EXTERIOR MAINLINE ROADWAY IMPROVEMENTS SHALL BE COMPLETED PRIOR TO FINAL PLAT APPROVAL.
- SIDEWALKS REQIURED ON BOTH SIDES OF ALL STREETS PER UDC

DOUGLAS COUNTY DOT NOTES

1. APPLICANT OR APPLICANT'S CONTRACTOR MUST CONTACT THE DOUGLAS COUNTY DOT INSPECTOR, PRIOR TO BEGINNING ANY WORK AUTHORIZED UNDER THIS PLAN, FOR THE PURPOSE OF SCHEDULING A PRECONSTRUCTION CONFERENCE TO REVIEW THE APPROVED PLANS AND DISCUSS MATTERS PERTAINING TO THE ORDER OF WORK, TRAFFIC CONTROL, UTILITY ADJUSTMENTS OR OTHER ITEMS THAT MAY AFFECT THE COMPLETION OF THE PROJECT.
2. DOUGLAS COUNTY DOT INSPECTOR MR. TODD PERKINS - PH # 678-626-5643
3. IT IS APPLICANT'S RESPONSIBILITY TO COORDINATE WITH ADJACENT / AFFECTED PROPERTY OWNERS, ALL WORK OUT SIDE THE LIMITS OF APPLICANTS' PROPERTY BOUNDARIES OR EXISTING RIGHT-OF-WAY WHICH AFFECTS OR IMPACTS THOSE PROPERTIES.
4. ALL REQUIRED ROADWAY IMPROVEMENTS MUST BE COMPLETE PRIOR TO ISSUANCE OF ANY CERTIFICATE OF OCCUPANCY AND RELEASE OF BONDS.
5. ALL UTILITY CONNECTIONS OR INSTALLATIONS WITHIN PUBLIC RIGHTS-OF-WAY REQUIRE A SEPARATE UTILITY PERMIT.
6. APPLICANT SHALL REMOVE, PROTECT, AND RESET ANY EXISTING ROADSIDE SIGNS AS REQUIRED TO PERFORM ALL APPROVED ROAD WIDENING AND CONSTRUCTION.
7. CONTRACTOR SHALL INSTALL AND MAINTAIN WORK ZONE TRAFFIC CONTROL IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).
8. TRAFFIC ALONG PUBLIC ROADWAYS SHALL BE MAINTAINED AT ALL TIMES.
9. INGRESS / EGRESS TO ALL ADJACENT OR AFFECTED PROPERTY OWNERS SHALL BE MAINTAINED AT ALL TIMES.
10. CONTRACTOR MUST OBTAIN APPROVAL FROM THE DOUGLAS COUNTY DOT PRIOR TO IMPLEMENTATION OF ANY LANE CLOSURE. HOWEVER, NO LANE CLOSURES WILL BE ALLOWED FROM 6:00 AM - 9:00 AM OR 3:00 PM - 6:00 PM MONDAY THRU FRIDAY.
11. ROADWAY SIGNS AND PAVEMENT MARKINGS SHALL CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), LATEST EDITION, AND ANY APPLICABLE DOUGLAS COUNTY DOT STANDARDS.
12. ALL PAVEMENT MARKINGS WITHIN THE RIGHT-OF-WAY SHALL BE THERMOPLASTIC UNLESS OTHERWISE NOTED.
13. ALL REGULATORY SIGNS SHALL HAVE HIGH INTENSITY GRADE SHEETING. ALL OTHER SIGNS ENGINEER GRADE SHEETING. ALL SIGNS SHALL BE ON 5052-H38 FLAT ALUMINUM ALLOY (0.080 GAUGE THICKNESS) MEETING FHWA SPECIFICATIONS FOR CORNER RADII. ALL SIGNS SHALL MEET OR EXCEED GEORGIA DEPARTMENT OF TRANSPORTATION SPECIFICATIONS FOR RETRO-REFLECTIVITY AND COLOR.
14. ALL SIGNS, UNLESS OTHERWISE NOTED, SHALL BE INSTALLED ON 12' - 3#/FT "U" - CHANNEL POSTS. THESE POSTS SHALL BE DARK GREEN (WEATHER RESISTANT, RUST INHIBITIVE, HIGH QUALITY ENAMEL), STANDARD INSTALLATION DEPTH IS 2 FT.
15. RAISED PAVEMENT MARKERS (RPM'S) SHALL BE PROVIDED ON ALL COLLECTOR AND ARTERIAL STREETS PER GADOT STANDARD DETAILS.

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No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

GENERAL NOTES OF

WHITESTONE BLVD. CULVERT REPLACEMENT

L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

HOWARD B. RAY
No. 24019
PROFESSIONAL ENGINEER
7-10-18

DATE:	5/11/18
DRAWN BY:	JJT
CHECKED BY:	HBR

JOB#: H15166

GN1

EROSION & SEDIMENT CONTROL NOTES

1. **THE ESCAPE OF SEDIMENT FROM THE SITE SHALL BE PREVENTED BY THE INSTALLATION OF EROSION AND SEDIMENT CONTROL MEASURES AND PRACTICES PRIOR TO LAND DISTURBING ACTIVITIES.**
2. **EROSION CONTROL MEASURES WILL BE MAINTAINED AT ALL TIMES. IF FULL IMPLEMENTATION OF THE APPROVED PLAN DOES NOT PROVIDE FOR EFFECTIVE EROSION CONTROL, ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IMPLEMENTED TO CONTROL OR TREAT THE SEDIMENT SOURCE.**
3. **ANY DISTURBED AREA LEFT EXPOSED FOR A PERIOD GREATER THAN 14 DAYS SHALL BE STABILIZED WITH MULCH OR TEMPORARY SEEDING.**
4. **NON EXEMPT ACTIVITIES SHALL NOT BE CONDUCTED WITHIN THE 25 OR 50-FOOT UNDISTURBED STREAM BUFFERS AS MEASURED FROM THE POINT OF WRESTED VEGETATION WITHOUT FIRST ACQUIRING THE NECESSARY VARIANCES AND PERMITS.**

DESCRIPTION OF CONSTRUCTION ACTIVITY

THE PROPOSED PROJECT OF **WHITESTONE BLVD CULVERT REPLACEMENT** WILL INCLUDE THE DEMOLITION OF EXISTING FEATURES IN THE PROPOSED WORK AREA, AND THE REPLACEMENT OF ROADWAY, CURB AND GUTTER, SIDEWALKS, AND BRIDGE STRUCTURE. THE EXISTING SITE IS A PREVIOUSLY WASHED OUT STORM CULVERT, AND ROADWAY THAT CROSSES HARRIS CREEK.
THE SITE DRAINS TO HOLLIS CREEK
THIS SITE IS NOT WITHIN 1 MILE UPSTREAM OF A 305(b) OR 303(d) IMPAIRED STREAM.
THE PROPOSED CONSTRUCTION IS ACCOMPANIED BY A VERY RIGOROUS EROSION CONTROL PROGRAM TO ENSURE THAT STORMWATER ASSOCIATED WITH THE CONSTRUCTION DOES NOT CAUSE EROSION, SEDIMENTATION AND POLLUTION WITHIN THE RECEIVING WATERS OF THIS DRAINAGE AREA.

THE TOTAL AREA FOR THIS PROJECT IS 0.60 ACRES AND WILL HAVE APPROXIMATELY 0.56 ACRES DISTURBED. THE DISTURBED ACREAGE IS FOR PRIMARY & SECONDARY PERMITTEE'S.

RUNOFF COEFFICIENT STATEMENT:

THE EXISTING SITE IS A RELATIVELY FLAT CREEK CROSSING (C=0.57) FOR THE PROPOSED DEVELOPMENT. FINAL RUNOFF COEFFICIENT WILL BE APPROXIMATELY C=0.57.

CRITICAL AREAS

1. HOLLIS CREEK
2. 2 ROWS OF SILT FENCE TYPE S

WETLANDS CERTIFICATION:
THE DESIGN PROFESSIONAL WHOSE SEAL APPEARS HEREIN CERTIFIES THE FOLLOWING:

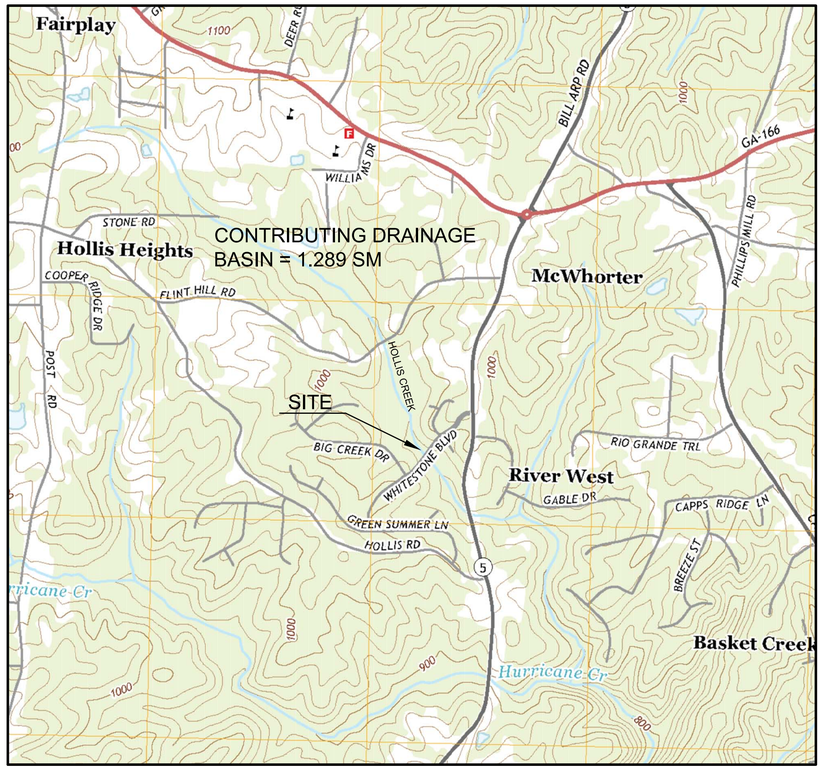
- THE NATIONAL WETLANDS INVENTORY MAP HAS BEEN CONSULTED;
- THE APPROPRIATE PLAN SHEET DOES NOT INDICATE WETLANDS AS SHOWN ON THE MAP; AND
- IF WETLANDS ARE INDICATED THE LANDOWNER OR DEVELOPER HAS BEEN ADVISED THAT LAND DISTURBANCE OF PROTECTED WETLANDS SHALL NOT OCCUR UNLESS THE APPROPRIATE SECTION 404 PERMIT OR LETTER OF PERMISSION HAS BEEN OBTAINED.

- STATE WATERS OR WETLANDS ARE LOCATED ON OR WITHIN 200 FEET OF THIS PROJECT.

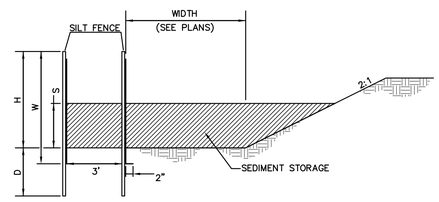
AS PER OFFICIAL F.I.A, MAP 13097C0227D
DATED MARCH 4, 2013. THIS PROPERTY IS LOCATED
IN A DESIGNATED FLOOD HAZARD AREA.

SEDIMENT STORAGE CALCULATIONS
TOTAL ACREAGE = 0.60 ACRES TOTAL DISTURBED AREA = 0.56 ACRES
SEDIMENT STORAGE PROVIDED BY: INITIAL PHASE TOTAL AREA DISTURBED = 0.39 ACRE TOTAL SEDIMENT STORAGE REQUIRED: 0.39 AC * 67 CY/AC = 27 CY REQUIRED 330 LF Sd1-S (DOUBLE ROW) * 0.224 (2' WIDTH) = 74 CY PROVIDED
74 CY PROVIDED > 27 CY REQUIRED
INTERMEDIATE PHASE TOTAL AREA DISTURBED = 0.47ACRE TOTAL SEDIMENT STORAGE REQUIRED: 0.47 AC * 67 CY/AC = 32 CY REQUIRED 423 LF Sd1-S (DOUBLE ROW) * 0.224 (2' WIDTH) = 95 CY PROVIDED
95 CY PROVIDED > 32 CY REQUIRED

ANTICIPATED CONSTRUCTION SCHEDULE					
DESCRIPTION	JULY 2018	OCTOBER 2018	JANUARY 2018	APRIL 2018	JUNE 2019
INSTALLATION OF SEDIMENT CONTROL MEASURES					
INSTALL TREE PROTECTION DEVICES & SIGNAGE / CLEARING & GRUBBING					
DEMOLITION AND REMOVAL OF EXISTING STRUCTURES					
ROADWAY & UTILITY CONSTRUCTION					
GRADING OPERATIONS					
PAVING OPERATION					
GRASSING INCLUDE TEMPORARY & PERMANENT VEGETATION					
MAINTENANCE OF EROSION & SEDIMENT CONTROL MEASURES					
FINAL LANDSCAPING					
REMOVAL OF EROSION CONTROL					



USGS MAP



ELEVATION
N.T.S.

FENCE TYPE	POST LENGTH	H	D	W	S	WIDTH (FT)	STORAGE (CY/LF)	
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	0	0.181	
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	1	0.224	*
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	2	0.267	
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	3	0.311	
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	4	0.354	
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	5	0.392	
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	6	0.441	
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	7	0.483	
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	8	0.528	
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	9	0.571	
TYPE "S"	4 FT	2'-4"	1'-6"	2'-10"	1'-2"	10	0.614	

DOUBLE ROW TEMPORARY SILT FENCE
STORAGE DETAIL
N.T.S.
E-DTL-53

Clearing Phase Erosion Control Notes:

- *Prior to the Land Disturbing Construction, the Contractor shall schedule a pre-construction meeting with the area site development inspector.*
- *The contractor shall observe the project sequence shown on the plans. The contractor shall maintain careful scheduling and performance to insure that land stripped of it's natural cover is exposed only in small quantities.*
- *The owner agrees to provide and maintain off-street parking on the subject property during the entire construction period.*
- *No staging areas, material storage, concrete wash out areas, or debris burn and burial holes shall be located within 500 feet of designated tree protection areas.*
- *A copy of the approved land disturbance plan and permit shall be present on the site at all times.*
- *The escape of sediment from the site shall be prevented by the installation of erosion and sediment control measures and practices prior to, or concurrent with, land disturbing activities.*
- *Prior to commencing land disturbance activity, the limits of land disturbance shall be clearly and accurately demarcated with stakes, ribbons, or other appropriate means. The location and extent of all authorized land disturbance activity shall be demarcated for the duration of the construction activity. No land disturbance shall occur outside the approved limits indicated on the approved plans.*

The following initial erosion control measures shall be implemented prior to any other construction activity.

1. *The construction exit, consisting of a minimum pad size of 20 feet by 50 feet with a minimum of 6" thick stone, shall be placed as shown on the plan. The stone size should consist of course aggregate between 1-1/2" & 3-1/2" in diameter and overlaid on a geotextile underliner. The geotextile underliner shall meet the requirements of AASHTO M288-96, Section 7.3 separation requirements.*
2. *Immediately after the establishment of construction entrance/exits, all perimeter erosion control and storm water management devices shall be installed as shown on the clearing phase erosion control plan.*
3. *Type "C" silt fence should be installed at the perimeter of the disturbed area as shown on the plan. The silt fence should be placed in accordance with the manual for erosion control in Georgia, Table 6-20.2. The silt fence should be kept erect at all times and repaired when requested by the site inspector or the project design professional of record. Silt should be removed when accumulation reaches ½ height of the barrier. The perimeter silt fence should be inspected daily for any failures. any failures of said fencing should be repaired immediately.*
4. *Inlet sediment protection measures shall be installed on all existing storm structures as shown on the plan. See separate details for specifics on type of inlet protection specified.*
5. *Stone check dams shall be installed in areas of concentrated flows as shown on the plan.*
6. *Tree protection fencing should be installed prior to the start of any land disturbance activity and maintained until final landscape is installed. The tree protection fencing should be inspected daily. Any failures of said fencing should be repaired immediately.*

- ***After installation of initial erosion control measures the site contractor shall schedule an inspection by the project design professional. The design professional shall inspect the installation of initial sediment storage requirements and perimeter control BMP's within seven (7) days after installation. No other construction activities shall occur until the project design professional approves the installation of said erosion control measures. If unforeseen conditions exist in the field that warrant additional erosion control measures, the contractor must construct any additional erosion control devices deemed necessary by the site inspection within two (2) buisness days after receiving the report (unless additional time is needed due to adverse weather).***
- *After approval of the initial erosion control installation, the contractor may proceed with clearing and grubbing activities. As clearing permits, the contractor shall construct temporary sediment ponds and diversion dikes as shown on the clearing phase plan to control erosion and storm water run off.*
- *The contractor can utilize cleared trees as barrier brush sediment control in areas shown on plan where initial grading activities will not occur.*
- *No burn or bury pits shall be permitted on the construction site without written permission by the owner and/or the engineer of record.*
- *Additional silt barriers must be placed as shown on the plan as access is obtained during clearing. No grading shall take place until silt barrier installation and sediment ponds are constructed as shown on the clearing phase erosion control plan.*
- *All silt fence must meet the requirements of section 171-temporary silt fence for the Department of Transportation, State of Georgia, Standard Specifications, 1983 Edition.*
- *All items in this section of the specifications shall meet the requirements as set forth in Section 161, 162, 163, and 164, of the Georgia D.O.T. Standard Specifications, for roads and bridges.*
- *Mulch or temporary grassing shall be applied to all exposed areas within 7 days of land disturbance.*
- *All disturbed areas left mulched after 14 days shall be stabilized with temporary vegetation.*
- *Sediment and erosion control measures should be checked after each rain event. Each device is to be maintained or replaced if sediment accumulation has reached one half the capacity of the device. Additional devices must be installed if new channels have developed.*
- *The construction exist shall be maintained in a condition which will prevent track or flow of mud onto public right-of-way. This may require periodic top dressing with 1-3" of stone, as conditions demand. All materials spilled, dropped, washed, or tracked from vehicle onto public roadway or into storm drain must be removed immediately.*
- *Contractor shall inspect control measures at the end of each working day to ensure measures are functioning properly.*
- *Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source as directed by the on site inspector or the civil engineer.*
- *Failure to install, operate, or maintain all erosion control measures will result in all construction being stopped on the job until such measures are corrected back to the approved erosion control plans.*

Grading Phase Erosion Control Notes:

- *During construction, the contractor shall maintain careful scheduling and performance to ensure that land stripped of it's natural ground cover is exposed only in small quantities and therefore limited durations, before permanent erosion protection is established. Note sub phases shown on plans.*
- *Earthwork operations in the vicinity of stream buffers shall be carefully controlled to avoid dumping or sloughing into the buffer areas.*
- *The following erosion control measures shall be implemented during the preliminary grading phase of construction.*
- *Sediment shall not be washed into inlets. It shall be removed from the sediment traps and disposed of and stabilized so that it will not enter the inlets again.*
- *Erosion control devices shall be installed immediately after ground disturbance occurs. The location of some of the erosion control devices may have to be altered from that shown on the approved plans if drainage patterns during construction are different from the proposed drainage patterns. It is the contractor's responsibility to accomplish erosion control for all drainage patterns created at various stages during construction. Any difficulty in controlling erosion during any phase of construction shall be reported to the design professional immediately.*
- *The contractor shall furnish and maintain all necessary barricades while roadway frontage improvements are being made.*
- *Type "A" silt fence should be installed at the toe of all fill slopes 10 feet or greater in height. The silt fence should be placed in accordance with the manual for erosion control in Georgia, Table 6-20.2. The silt fence shall be maintained until permanent ground cover is established on the slope. Silt shall be removed when accumulation reaches ½ height of the barrier. Additionally, diversion dikes shall be constructed along the top of all said fill slopes with the use of temporary down drains to control storm water run off as shown on the plans. See separate details for additional information.*
- *The contractor shall be responsible for establishing barriers at the toe of slopes under construction. These barriers shall be as shown in the plans. These barriers may be relocated and reused after permanent slope stabilization becomes fully established. As they are relocated, any defective materials in the barrier shall be replaced. In addition, all debris and silt at the previous location shall be removed.*
- *Cut and fill slopes are not to exceed "2H:1V"*
- *All slopes steeper than 2.5:1 and with a height of ten feet or greater, and cuts and fills within stream buffers, shall be stabilized with appropriate erosion control matting or blankets. See separate details for additional information.*
- *Type "A" silt fence shall be placed at the toe of all dirt stock pile areas. See separate details for additional information.*
- *Inlet sediment protection measures shall be installed on all storm structures as they are constructed. See plan view for specific type and separate details for additional information on type of inlet protection specified.*
- *Storm drain outlet protection shall be placed at all outlet headwalls as soon as the headwall is constructed. See separate details for additional information.*
- *Stone check dams shall be installed in areas of concentrated flows as shown on the plan. See separate detail for additional information.*
- *All drainage swales shall be applied with vegetative cover as soon as final grade is achieved.*
- *All graded areas shall be applied with vegetative cover as soon as final grade is achieved.*
- *Mulch or temporary grassing shall be applied to all exposed areas within 7 days of land disturbance.*
- *All disturbed areas left mulched after 30 days shall be stabilized with temporary grassing.*
- *After preliminary grading activities, the contractor shall construct temporary sediment basins and diversion dikes as shown on the plan. The contractor shall maintain the sediment pond until permanent ground cover is established. Sediment shall be cleaned out of the ponds when it reaches the 1/3 depth of basin. See separate details for additional information.*
- *Sediment and erosion control measures should be checked after each rain event. Each device is to be maintained or replaced if sediment accumulation has reached one half the capacity of the device. Additional devices must be installed if new channels have developed.*
- *The construction exit shall be maintained in a condition which will prevent track or flow of mud onto public right-of-way. This may require periodic top dressing with 1-3" of stone, as conditions demand. All materials spilled, dropped, washed, or tracked from vehicle onto public roadway or into storm drain must be removed immediately.*
- *Contractor shall inspect control measures at the end of each working day to ensure measures are functioning properly.*
- *Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source as directed by the on site inspector or the civil engineer.*
- *Failure to install, operate, or maintain all erosion control measures will result in all construction being stopped on the job until such measures are corrected back to the approved erosion control plans.*

Final Phase Erosion Control Notes:

- *The following erosion control measures shall be implemented during the final erosion control phase of construction.*
- *Sediment shall not be washed into inlets. It shall be removed from the sediment traps and disposed of and stabilized so that it will not enter the inlets again.*
- *mulch or temporary grassing shall be applied to all exposed areas within 7 days of land disturbance.*
- *all disturbed areas left mulched after 30 days shall be stabilized with temporary grassing.*
- *The contractor shall maintain all sediment ponds and erosion control measures until permanent ground cover is established. Sediment shall be cleaned out of the ponds when it reaches the half way point on the riser.*
- *After curbing, graded aggregate base, and pavement has been installed, all inlet sediment traps on single and double wing catch basins along with any curb inlets shall be removed and replaced with curb filter inlet protection. See separate detail for additional information.*
- *All roadway and parking shoulders should be applied with vegetative cover as soon as final grade is achieved behind curbs.*
- *Sediment and erosion control measures should be checked after each rain event. Each device is to be maintained of replaced if sediment accumulation has reached one half the capacity of the device. Additional devices must be installed if new channels have developed.*
- *The construction exit shall be maintained in a condition which will prevent track or flow of mud onto public right-of-way. This may require periodic top dressing with 1 - 3" of stone, as conditions demand. All materials spilled, dropped, washed, or tracked from vehicle onto public roadway or into storm drain must be removed immediately.*
- *Contractor shall inspect control measures at the end of each working day to ensure measures are functioning properly.*
- *Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source as directed by the on site inspector or the Civil Engineer.*
- *Failure to install, operate, or maintain all erosion control measures will result in all construction being stopped on the job until such measures are corrected back to the approved erosion control plans.*
- *Upon completion of the project and receipt of certificate of occupancy, the contractor shall remove all temporary erosion control measures and dispose of them unless noted on plans.*

(NOTES CONTINUED ON SHEET EC2)

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NPDES NOTES
OF

WHITESTONE BLVD. CULVERT REPLACEMENT

L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
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8700 HOSPITAL DRIVE
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SAME AS ABOVE

24 HR. CONTACT:
MIGUEL VALENTIN
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GEORGIA REGISTERED PROFESSIONAL ENGINEER
No. 24019
HOWARD B. RAY
7-10-18

Certification # 0000004500	
DATE:	5/11/18
DRAWN BY:	JJT
CHECKED BY:	HBR
JOB#: H15166	

EC1

(NOTES CONTINUED FROM SHEET EC1)

Permit Coverage:

This plan has been prepared to meet the requirements under the State of Georgia, Department of Natural Resources, Environmental Protection Division (EPD), General Permit No. GAR 100002 for Authorization To Discharge Under The National Pollution Discharge Elimination System (NPDES), Storm Water Discharges Associated With Construction Activity For Infrastructure Construction Projects.

PART I. COVERAGE UNDER THIS PERMIT

A. Permit Area.
This permit regulates point source discharges of storm water to the waters of the State of Georgia from construction activities, as defined in this permit.

PART I.C. ELIGIBILITY.

1. Construction Activities. This permit authorizes, subject to the conditions of this permit:

A. All discharges of storm water associated with infrastructure construction projects that will result in land disturbance equal to or greater than one (1) acre occurring on or before, and continuing after, the effective date of this permit, (henceforth referred to as existing storm water discharges from construction activities) except for discharges identified under Part I.C.3.;
B. All discharges of storm water associated with infrastructure construction projects that will result in land disturbances equal to or greater than one (1) acre occurring after the effective date of this permit, (henceforth referred to as storm water discharges from construction activities), except for discharges identified under Part I.C.3.;

2. Mixed Storm Water Discharges. This permit may only authorize a storm water discharge from a construction site or construction activities that is mixed with a storm water discharge from an industrial source or activity other than construction where:

A. The industrial source or activity other than construction is located on the same site as the construction activity and is an integral part of the construction activity;
B. The storm water discharges associated with industrial activity from the areas of the site where construction activities are occurring are in compliance with the terms of this permit; and
C. Storm water discharges associated with industrial activity from the areas of the site where industrial activity other than construction are occurring are covered by a different NPDES general permit or individual permit authorizing such discharges and the discharges are in compliance with a different NPDES permit.

3. Limitations on Coverage. The following storm water discharges from construction sites are not authorized by this permit:

A. storm water discharges associated with an industrial activity that originate from the site after construction activities have been completed and the site has undergone final stabilization;
B. discharges that are mixed with sources of non-storm water other than discharges which are identified in Part III.A.2. of this permit and which are in compliance with Part IV.D.6. (non-storm water discharges) of this permit;
C. storm water discharges associated with industrial activity that are subject to an existing NPDES individual or general permit. Such discharges may be authorized under this permit after an existing permit expires provided the existing permit did not establish numeric limitations for such discharges; and
D. storm water discharges from construction sites that the Director (EPD) has determined to be or may reasonably be expected to be contributing to a violation of a water quality standard.

4. Compliance with Water Quality Standards. No discharges authorized by this permit shall cause violations of Georgia's in-stream water quality standards as provided by the Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03.

PART III. SPECIAL CONDITIONS, MANAGEMENT PRACTICES, PERMIT VIOLATIONS AND OTHER LIMITATIONS

A. Prohibition on Non-Storm Water Discharges.

1. Except as provided in Part I.C.2. and III.A.2., all discharges covered by this permit shall be composed entirely of storm water.
2. The following non-storm water discharges may be authorized by this permit provided the non-storm water component of the discharge is explicitly listed in the Erosion, Sedimentation and Pollution Control Plan and is in compliance with Part IV.D.6.: discharges from fire fighting activities; fire hydrant flushing; potable water sources including water line flushing; irrigation drainage; air conditioning condensate; springs; uncontaminated ground water; and foundation or footing drains where flows are not contaminated with process materials or pollutants.

B. Releases in Excess of Reportable Quantities.

1. The discharge of hazardous substances or oil in the storm water discharge(s) from a site shall be prevented. This permit does not relieve the permittee of the reporting requirements of Georgia's Oil or Hazardous Material Spills or Releases Act (O.C.G.A. §§12-14-2, et seq.). 40 CFR Part 117 and 40 CFR Part 302. Where a release containing a hazardous substance in an amount equal to or in excess of a reporting quantity established under either Georgia's Oil or Hazardous Material Spills or Releases Act (O.C.G.A. §§12-14-2, et seq.), 40 CFR 117 or 40 CFR 302 occurs during a 24 hour period, the permittee is required to notify EPD at (404) 656-4863 or (800) 241-4113 and the National Response Center (NRC) at (800) 424-8802 in accordance with the requirements of Georgia's Oil or Hazardous Material Spills or Releases Act (O.C.G.A. §§12-14-2, et seq.), 40 CFR 117 and 40 CFR 302 as soon as he/she has knowledge of the discharge.

   This permit does not authorize the discharge of hazardous substances or oil resulting from an on-site spill.

PART IV. EROSION, SEDIMENTATION AND POLLUTION CONTROL PLAN

(i). Except as provided in Part IV.(ii), below, no construction activities shall be conducted within a 25 foot buffer along the banks of all state waters, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, except where the Director has determined to allow a variance that is at least as protective of natural resources and the environment in accordance with the provisions of O.C.G.A. 12-7-6, or where a drainage structure or a roadway drainage structure must be constructed, provided that adequate erosion control measures are incorporated in the project plans and specifications and are implemented. The buffer shall not apply to the following land-disturbing activities, provided that they occur at an angle, as measured from the point of crossing, within 25 degrees of perpendicular to the stream; cause a width of disturbance of not more than 50 feet within the buffer; and adequate erosion control measures are incorporated into the project plans and specifications and are implemented: (1) stream crossings for water lines or (2) stream crossings for sewer lines;

(ii). No construction activities shall be conducted within a 50 foot buffer, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, along the banks of any state waters classified as 'trout streams' except when approval is granted by the Director for alternate buffer requirements in accordance with the provisions of O.C.G.A. 12-7-6, or where a roadway drainage structure must be constructed; provided, however, that small springs and streams classified as 'trout streams' which discharge an average annual flow of 25 gallons per minute or less shall have a 25 foot buffer or they may be piped, at the discretion of the permittee, pursuant to the terms of a rule providing for a general variance promulgated by the Board of Natural Resources including notification of such to EPD and the local issuing authority of the location and extent of the piping and prescribed methodology for minimizing the impact of such piping and for measuring the volume of water discharged by the stream. Any such pipe must stop short of the downstream permittee's property, and the permittee must comply with the buffer requirement for any adjacent trout streams. The buffer shall not apply to the following land-disturbing activities, provided that they occur at an angle, as measured from the point of crossing, within 25 degrees of perpendicular to the stream; cause a width of disturbance of not more than 50 feet within the buffer; and adequate erosion control measures are incorporated into the project plans and specifications and are implemented: (1) stream crossings for water lines or (2) stream crossings for sewer lines; and

(iii). Except as provided above, for buffers required pursuant to Part IV.(i). and (ii)., no construction activities shall be conducted within a buffer and a buffer shall remain in its natural, undisturbed, state of vegetation until all landdisturbing activities on the construction site are completed. Between the time final stabilization of the site is achieved and upon the submittal of a Notice of Termination, a buffer may be thinned or trimmed of vegetation as long as a protective vegetative cover remains to protect water quality and aquatic habitat and a natural canopy is left in sufficient quantity to keep shade on the stream bed.

3. INSPECTIONS.
A. PERMITTEE REQUIREMENTS.

(1). Each day when any type of construction activity has taken place at a primary permittee's site, certified personnel provided by the primary permittee shall inspect: (a) all areas at the primary permittee's site where petroleum products are stored, used, or handled for spills and leaks from vehicles and equipment; (b) all locations at the primary permittee's site where vehicles enter or exit the site for evidence of off-site sediment tracking; and (c) measure rainfall once each 24 hour period at the site. These inspections must be conducted until a Notice of Termination is submitted.

(2). Certified personnel (provided by the primary permittee) shall inspect the following at least once every seven (7) calendar days and within 24 hours of the end of a storm that is 0.5 inches rainfall or greater (unless such storm ends after 5:00 PM on any Friday or on any non-working Saturday, non-working Sunday or any non-working Federal holiday in which case the inspection shall be completed by the end of the next business day and/or working day, whichever occurs first): (a) disturbed areas of the primary permittee's construction site that have not undergone final stabilization; (b) areas used by the primary permittee for storage of materials that are exposed to precipitation that have not undergone final stabilization; and (c) structural control measures. Erosion and sediment control measures identified in the Plan applicable to the primary permittee's site shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s). For areas of a site that have undergone final stabilization, the permittee must comply with Part IV.D.4.a.(3). These inspections must be conducted until a Notice of Termination is submitted.

(3). Certified personnel (provided by the primary permittee) shall inspect at least once per month during the term of this permit (i.e., until a Notice of Termination is received by EPD) the areas of the site that have undergone final stabilization. These areas shall be inspected for evidence of, or the potential for, pollutants entering the drainage system and the receiving water(s). Erosion and sediment control measures identified in the Plan shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s).

(4). Based on the results of each inspection, the site description and the pollution prevention and control measures identified in the Erosion, Sedimentation and Pollution Control Plan, the Plan shall be revised as appropriate not later than seven (7) calendar days following each inspection. Implementation of such changes shall be made as soon as practical but in no case later than seven (7) calendar days following each inspection.

(5). A report of each inspection that includes the name(s) of personnel making each inspection, the date(s) of each inspection, major observations relating to the implementation of the Erosion, Sedimentation and Pollution Control Plan, and actions taken in accordance with Part IV.D.4.a.(4). of the permit shall be made and retained at the site or be readily available at a designated alternate location until the entire site or that portion of a construction project that has been phased has undergone final stabilization and a Notice of Termination is submitted to EPD. Such reports shall identify any incidents of non-compliance. Where the report does not identify any incidents of non-compliance, the report shall contain a certification that the construction site is in compliance with the Erosion, Sedimentation and Pollution Control Plan and this permit. The report shall be signed in accordance with Part V.G. of this permit.

5. Sampling Requirements. This permit requires the monitoring of nephelometric turbidity in receiving water(s) or outfalls in accordance with this permit. The following procedures constitute EPD's guidelines for sampling turbidity.

B. SAMPLE TYPE. All sampling shall be collected by "grab samples" and the analysis of these samples must be conducted in accordance with methodology and test procedures established by 40 CFR Part 136 (unless other test procedures have been approved); the guidance document titled "NPDES Storm Water Sampling Guidance Document, EPA 833-B-92-001" and guidance documents that may be prepared by the EPD.
(1). Sample containers should be labeled prior to collecting the samples.
(2). Samples should be well mixed before transferring to a secondary container.
(3). Large mouth, well cleaned and rinsed glass or plastic jars should be used for collecting samples. The jars should be cleaned thoroughly to avoid contamination.
(4). Manual, automatic or rising stage sampling may be utilized. Samples required by this permit should be analyzed immediately, but in no case later than 48 hours after collection. However, samples from automatic samplers must be collected no later than the next business day after their accumulation, unless flow through automated analysis is utilized. Dilution of samples is not required. Samples may be analyzed directly with a properly calibrated turbidimeter. Samples are not required to be cooled.
(5). Sampling and analysis of the receiving water(s) or outfalls beyond the minimum frequency stated in this permit must be reported to EPD as specified in Part IV.E.

C. SAMPLING POINTS.
(1). For construction activities the primary permittee must sample all perennial and intermittent streams and other water bodies shown on the USGS topographic map and all other field verified perennial and intermittent streams and other water bodies, or all outfalls into such streams and other water bodies, or a combination thereof. However, provided for in and in accordance with Part IV.D.5.c.(2) of this permit, primary permittees on an infrastructure construction project may sample the representative perennial and intermittent streams, other water bodies or outfalls, or a combination thereof. Samples taken for the purpose of compliance with this permit shall be representative of the monitored activity and representative of the water quality of the receiving water(s) and/or the storm water outfalls using the following minimum guidelines:
(A). The upstream sample for each receiving water(s) must be taken immediately upstream of the confluence of the first storm water discharge from the permitted activity (i.e., the discharge farthest upstream at the site) but downstream of any other storm water discharges not associated with the permitted activity. Where appropriate, several upstream samples from across the receiving water(s) may need to be taken and the arithmetic average of the turbidity of these samples used for the upstream turbidity value.
(B). The downstream sample for each receiving water(s) must be taken downstream of the confluence of the last storm water discharge from the permitted activity (i.e., the discharge farthest downstream at the site) but upstream of any other storm water discharge not associated with the permitted activity. Where appropriate, several downstream samples from across the receiving water(s) may need to be taken and the arithmetic average of the turbidity of these samples used for the downstream turbidity value.
(C). Ideally the samples should be taken from the horizontal and vertical center of the receiving water(s) or the storm water outfall channel(s).
(D). Care should be taken to avoid stirring the bottom sediments in the receiving water(s) or in the outfall storm water channel.
(E). The sampling container should be held so that the opening faces upstream.
(F). The samples should be kept free from floating debris.
(G). Permittees do not have to sample sheetflow that flows onto undisturbed natural areas or areas stabilized by the project. For purposes of this section, stabilized shall mean, for unpaved areas and areas not covered by permanent structures, 100% of the soil surface is uniformly covered in permanent vegetation with a density of 70% or greater, or equivalent permanent stabilization measures (such as the use of rip rap, gabions, permanent mulches or geotextiles) have been used. Permanent vegetation shall consist of: planted trees, shrubs, perennial vines; a crop of perennial vegetation appropriate for the time of year and region; or a crop of annual vegetation and a seeding of target crop perennials appropriate for the region. For infrastructure construction projects on land used for agricultural or silvicultural purposes, final stabilization may be accomplished by stabilizing the disturbed land for its agricultural or silvicultural use. Final stabilization applies to each phase of construction.
(H). All sampling pursuant to this permit must be done in such a way (including generally accepted sampling methods, locations, timing, and frequency) as to accurately reflect whether storm water runoff from the facility/site is in compliance with the standard set forth in Parts III.C.3. or III.C.4., whichever is applicable.

D. SAMPLING FREQUENCY.
1. The primary permittee must sample in accordance with the Plan at least once for each rainfall event described below. For a qualifying event, samples must be taken within forty-five (45) minutes of:

   A. The accumulation of the minimum amount of rainfall for the qualifying event, if the storm water discharge to a monitored receiving water or from a monitored outfall has begun at or prior to the accumulation, or
   B. The beginning of any storm water discharge to a monitored receiving water or from a monitored outfall, if the discharge begins after the accumulation of the minimum amount of rainfall for the qualifying event.
2. However, where manual and automatic sampling are impossible (as defined in this permit), or are beyond the permittee's control, the permittee shall take samples as soon as possible, but in no case more than twelve (12) hours after the beginning of the storm water discharge.
3. Sampling by the permittee shall occur for the following events:

   A. For each area of the site that discharges to a receiving stream, the first rain event that reaches or exceeds 0.5 inch and allows for monitoring during normal business hours* (Monday thru Friday, 8:00 AM to 5:00 PM and Saturday 8:00 AM to 5:00 PM when construction activity is being conducted by the Primary permittee) that occurs after all clearing and grubbing operations have been completed in the drainage area of the location selected as the representative sampling location;
   B. In addition to (a) above, for each area of the site that discharges to a receiving stream, the first rain event that reaches or exceeds 0.5 inch and allows for monitoring during normal business hours* that occurs either 90 days after the first sampling event or after all mass grading operations have been completed in the drainage area of the location selected as the representative sampling location, whichever comes first;
   C. At the time of sampling performed pursuant to (a) and (b) above, if BMPs are found to be properly designed, installed and maintained, no further action is required. If BMPs in any area of the site that discharges to a receiving stream are not properly designed, installed and maintained, corrective action shall be defined and implemented within 2 business days, and turbidity samples shall be taken from discharges from that area of the site for each subsequent rain event that reaches or exceeds 0.5 inch during normal business hours* until the selected turbidity standard is attained, or until post-storm event inspections determine that BMPs are properly designed, installed and maintained; and
   D. Existing construction activities, i.e., those that are occurring on or before the effective date of this permit, that have met the sampling required by (a) above shall sample in accordance with (b). Those existing construction activities that have met the sampling required by (b) above shall not be required to conduct additional sampling other than as required by (c) above.

***Note:** That the Permittee may choose to meet the requirements of (a) and (b) above by collecting turbidity samples from any rain event that reaches or exceeds 0.5 inch and allows for monitoring at any time of the day or week.

E. REPORTING.
1. The applicable permittees are required to submit a summary of the monitoring results to the EPD at the address shown in Part II.C. by the fifteenth day of the month following the reporting period. Reporting periods are months during which samples are taken in accordance with this permit. Sampling results shall be in a clearly legible format. Upon written notification, EPD may require the applicable permittee to submit the sampling results on a more frequent basis. Sampling and analysis of any storm water discharge(s) or the receiving water(s) beyond the minimum frequency stated in this permit must be reported in a similar manner to the EPD. The sampling reports must be signed inaccordance with Part V.G. Sampling reports must be submitted to EPD until such time as a NOT is submitted in accordance with Part VI.

2. Each permittee must retain copies of all monitoring results reported by that permittee in accordance with this Part. In addition to other record keeping requirements, the monitoring information shall include:
   a. The date, exact place, and time of sampling or measurements;
   b. The name(s) of the individual(s) who performed the sampling and measurements;
   c. The date(s) analyses were performed;
   d. The time(s) analyses were initiated;
   e. The name(s) of the individual(s) who performed the analyses;
   f. References and written procedures, when available, for the analytical techniques or methods used.;
   g. The results of such analyses, including the bench sheets, instrument readouts, computer disks or tapes, etc., used to determine these results; and
   h. Results which exceed 1000 NTU shall be reported as "exceeds 1000 NTU."

F. RETENTION OF RECORDS
1. The primary permittee shall retain the following records at the construction site or the records shall be readily available at a designated alternate location from commencement of construction until such time as a NOT is submitted in accordance with Part VI:

   a. A copy of all Notices of Intent submitted to EPD;
   b. A copy of the Erosion, Sedimentation and Pollution Control Plan required by this permit;
   c. The design professional's report of the results of the inspection conducted in accordance with Part IV.A.5. of this permit;
   d. A copy of all monitoring information, results, and reports required by this permit;
   e. A copy of all inspection reports generated in accordance with Part IV.D.4.a of this permit;
   f. A copy of all violation summaries and violation summary reports generated in accordance with Part III.D.2. of this permit; and
   g. Daily rainfall information collected in accordance with Part IV.D.4.a.(1)(c) of this permit.

2. Copies of all Notices of Intent, Notices of Termination, reports, plans, monitoring reports, monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, Erosion, Sedimentation and Pollution Control Plans, records of all data used to complete the Notice of Intent to be covered by this permit and all other records required by this permit shall be retained by the permittee who either produced or used it for a period of at least three years from the date that the NOT is submitted in accordance with Part VI of this permit. These records must be maintained at the permittee's primary place of business or at a designated alternative location once the construction activity has ceased at the permitted site. This period may be extended by request of the EPD at any time upon written notification to the permittee.

INVENTORY FOR POLLUTION PREVENTION PLAN

The materials or substances listed below are expected to be present onsite during construction:
* Concrete
* Paints (enamel)
* Wood and wood products
* PVC pipe
* Petroleum based products
* Asphalt
* Detergents
* Metal Columns and roofs
* Fertilizers
* Cleaning solvents
* Sand and limestone rock

Spill Prevention
Material Management Practices
The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff.
Good Housekeeping:
The following good housekeeping practices will be followed onsite during the construction project.
* An effort will be made to store only enough product required to do the job.
* All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
* Products will be kept in their original containers with the original manufacture label.
* Substances will not be mixed with one another unless recommended by the manufacturer.
* Manufactures recommendations for proper use and disposal will be followed.
* The site superintendent will inspect daily to ensure proper use and disposal of materials onsite.

Hazardous Products:
These practices are used to reduce the risks associated with hazardous materials.
* Products will be kept in original containers unless they are not re-sealable.
* Original labels and material safety data will be retained; they contain important product information.
* If surplus product must be disposed of, manufacturers or local and state recommended methods for proper disposal will be followed.

Spill Prevention:
The following product specific practices will be followed onsite:
Petroleum Products:
All onsite vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers, which are clearly labeled. Any asphalt substances used onsite will be applied according to the manufacture recommendations.
Fertilizers:
Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.
Paints:
All containers will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewer system but will be properly disposed of according to manufacturers instructions of state and local regulations.
Concrete Trucks:
The contractor will establish a single wash-out basin for concrete trucks. Concrete trucks will only be allowed to wash out or discharge surplus concrete from the chute, on the site at this location. Wash out of the concrete trucks drum at the construction site is prohibited. When the project is completed, and as a part of the final clean-up, the contractor will be responsible for removing all concrete spoils and waste in the basin to an off-site location. The basin area will be filled with dirt, compacted, graded, grassed and restored to original condition or better.
Spill Control Practices:
In addition to the good housekeeping and material management practices discussed in the previous sections of this plan. The following practices will be followed for spill prevention and clean-up.
* Manufacturer recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
* Materials and equipment necessary for spill cleanup will be kept in the material storage area onsite. Equipment and material will include but not be limited to brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand sawdust, and plastic and metal trash containers specifically for this purpose.
* All spills will be cleaned up immediately after discovery.
* The spill area will be kept well ventilated and personnel will appropriate protective clothing to prevent injury from contact with a hazardous substance.
* Spills of toxic or hazardous material will be reported to the appropriate state or local government agency regardless of the size.
* The spill prevention plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.
* The contractors site superintendent responsible for the day-to-day site operations, will be the spill prevention and cleanup coordinator, he will designate at least one other site person who will receive spill prevention and cleanup training. This individual will become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the material storage area and in the office trailer onsite (or designated onsite job location).

OTHER CONTROLS THE CONTRACTOR IS RESPONSIBLE FOR:

Waste Materials:
All waste materials will be collected and stored in a secured, laded, metal Dumpster, rented from a licensed solid waste disposal company, **no waste materials shall be discharged to water of the State, except as authorized by section 404 Permit.** The materials shall be placed in dumpsite which meets all State and local regulations. All trash and construction debris from the site will be placed in the dumpster or transported to the authorized disposal area. All construction waste shall be hauled off-site a minimum of once a week or as needed to keep site safe during and after working hours. No large piles of debris shall be left that would allow children or adults to climb to a height over five feet about the existing grade on site. No construction waste materials will be buried on-site. All personnel will be instructed regarding the correct procedure(s) for waste disposal. Notices and information regarding these procedures will be posted and/or provided to appropriate personnel by the contractor or the person responsible for the day-to-day construction activities and operations at this site. The contractor is responsible for the implementation of these procedures throughout his contract for construction.
Hazardous Waste:
All hazardous waste material will be disposed of in a manner specified by state or local regulation or by the manufacturer. Site personnel will be instructed in any special procedures and/or practices by the contractors day-to-day manager of site operations.
Sanitary Waste:
All sanitary waste will be collected from the portable restroom units a minimum of once per week by a sanitary waste contractor and hauled to a location approved for disposal by state and local regulations.
Offsite Vehicle Tracking:
A stabilized construction exit is required (more than one if needed) to reduce vehicle tracking of sediments. Dump trucks hauling material from the construction site will be covered with a tarpaulin.
Timing of Controls/Measures
The sequence of major activities gives the general timing for the completion of construction activities. Sediment and erosion controls identified in the plan will be installed immediately upon commencement of land disturbance activities being initiated. Grading and stabilization of the site shall commence as soon as other improvements have been completed. Permanent grassing of the areas indicated will take place as soon as finish grading has been completed. Temporary controls and measures will be removed when project has been final inspected and approved by the building department.
Maintenance / Inspection Procedures
Erosion and Sediment control inspection and Maintenance practices
These are the inspection and maintenance practices contractor will use to maintain erosion and sediment controls.
* All control measures will be inspected at least once each week and following any storm event of 0.5 inches or greater.
* All measures will maintained in good working order, if a repair is necessary, it will be initiated within 24 hours of report.
* Built up sediment will be removed from silt fence when it has reached one-third the height of the fence.
* Silt fence will be inspected for depth of sediment, tears, to see if the fabric is securely attached to the fence posts, and to see that the fence posts are firmly in the ground.
* Temporary and permanent seeding and planting will be inspected for bare spots, washouts, and healthy growth.
* A maintenance inspection report will be made after each inspection. A copy of the report-form to be completed by the inspector shall be in accordance with guidelines of EPD.
* Contractors site superintendent will be responsible for filling out inspection and maintenance reports. Another individual will be selected as an alternate to be responsible for inspections, maintenance and repair activities, and filling out the inspection and maintenance report should the superintendent be unavailable.
* Personnel selected for inspection and maintenance responsibilities will receive training from contractor. They will be trained in all the inspection and maintenance practices necessary for keeping the erosion and sediment controls used onsite in good working order.

Non-Storm Water Discharges;
It is expected that the following non-storm water discharges will occur from site during the construction period:
* Pavement wash waters (where no spills or leaks of toxic of hazardous materials have occurred).

Erosion, Sedimentation and Pollution Control Certification In Accordance with Section V.G.d of this permit:

1. *I certify that the Permittees erosion, sedimentation and pollution control plan provides for an appropriate and comprehensive system of best management practices required by the Georgia Water Quality Control Act and the document "Manual for Erosion and Sediment Control in Georgia" (manual) published by the State Soil and Water Conservation Commission as of January 1 of the year in which the land disturbing activity was permitted, provides for the sampling of the receiving water(s) or the sampling of the storm water outfalls and that the designed system of best management practices and sampling methods is expected to meet the requirements contained in the General NPDES Permit No. **GAR 100002.***

2. *"I certify under penalty of law that this plan was prepared after a site visit to the locations described herein by myself or my authorized agent, under my direct supervision."*

The primary, secondary or tertiary permittees, as applicable, who began construction on or before the effective date of this permit shall amend their Plan or TEC plan whenever there is a change in design, construction, operation, or maintenance, which has a significant effect on BMP's with a hydraulic component. These revisions must be certified by the design professional. Amendments/revisions to the ES&PC Plan which have a significant effect on BMP's with a hydraulic component must be certified by the design professional.

3. *I certify that Georgia's 2008 or subsequent 305(B)/303(D) List Documents (Final) have been consulted to determine if the project site is or is not applicable to the requirements for proximity of an Impaired Stream Segment.*

Design Professional: _____
Certification # 0006[illegible]

PREPARED BY:
HRC
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www.HughesRay.com

No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

NPDES NOTES OF
WHITESTONE BLVD. CULVERT REPLACEMENT
L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

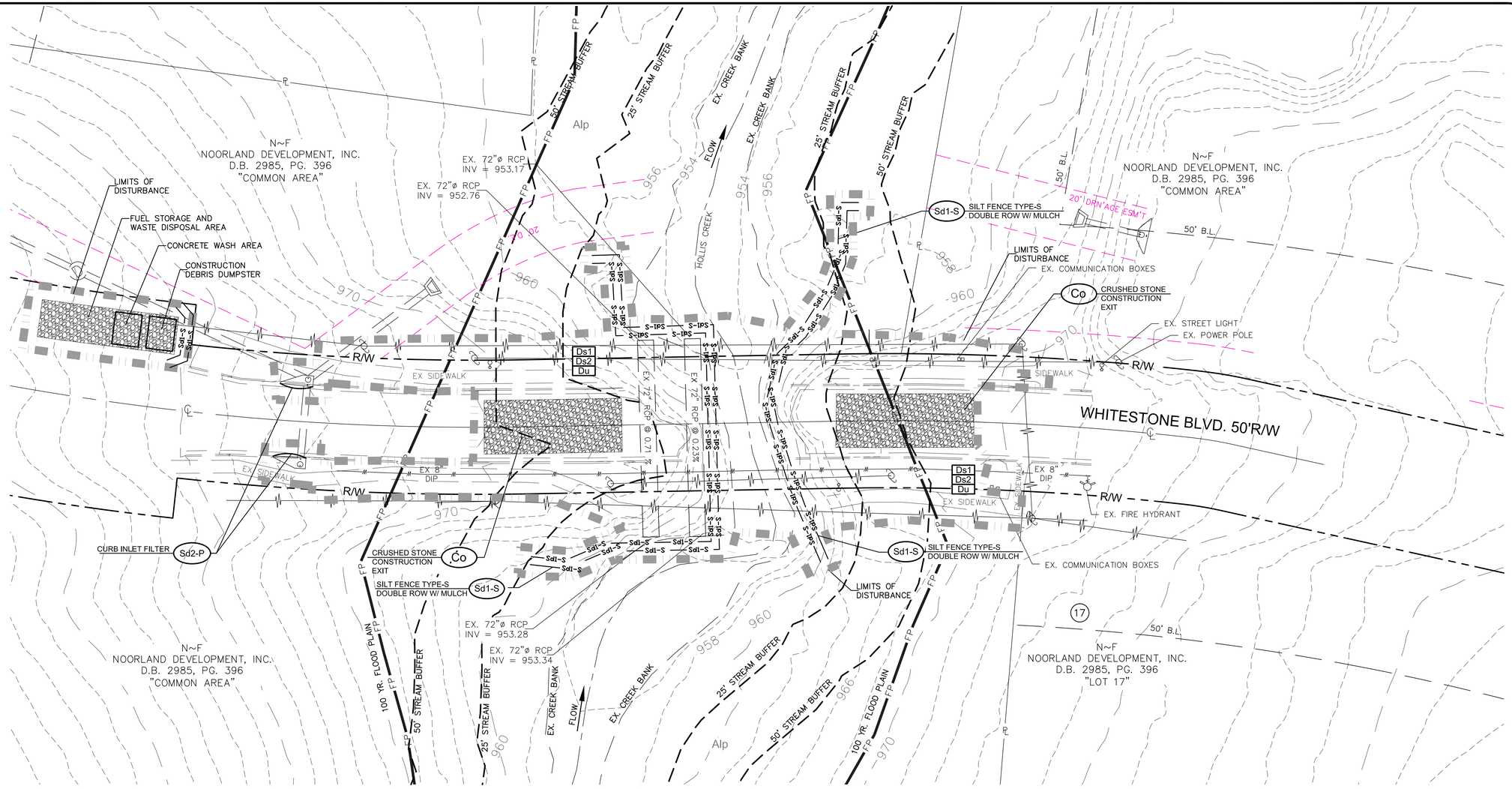
GEORGIA REGISTERED PROFESSIONAL ENGINEER HOWARD B. RAY No. 24019 — 10-18

Certification # 0000004500

DATE:	5/11/18
DRAWN BY:	JJT
CHECKED BY:	HBR

JOB#: H15166

EC2



EROSION CONTROL LEGEND

Co	CRUSHED STONE CONSTRUCTION EXIT
Sd1-S	SILT FENCE TYPE-S
Sd2-P	CURB INLET FILTER
Ch2	CHANNEL PROTECTION
Bf	BUFFER ZONE
Ss	SLOPE STABILIZATION
Ds1	DISTURBED AREA STABILIZATION (WITH MULCHING ONLY)
Ds2	DISTURBED AREA STABILIZATION (WITH TEMPORARY SEEDING)
Ds3	DISTURBED AREA STABILIZATION (WITH PERMANENT VEGETATION)
Ds4	DISTURBED AREA STABILIZATION (WITH SODDING)
Du	DUST CONTROL ON DISTURBED AREAS

SOILS LEGEND
Alp – Alluvial land, somewhat poorly drained

GPS LOCATION OF BEGINNING & END OF PROJECT

BEGINNING
(INT. OF HWY 5 & WHITESTONE BLVD)
LATITUDE: 33.605491
LONGITUDE: 84.839559

END
(INT. OF BIG CREEK DR. & WHITESTONE BLVD)
LATITUDE: 33.602900
LONGITUDE: 84.842765

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

PREPARED BY:
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No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

INITIAL PHASE EROSION CONTROL PLAN
OF
WHITESTONE BLVD. CULVERT REPLACEMENT
L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

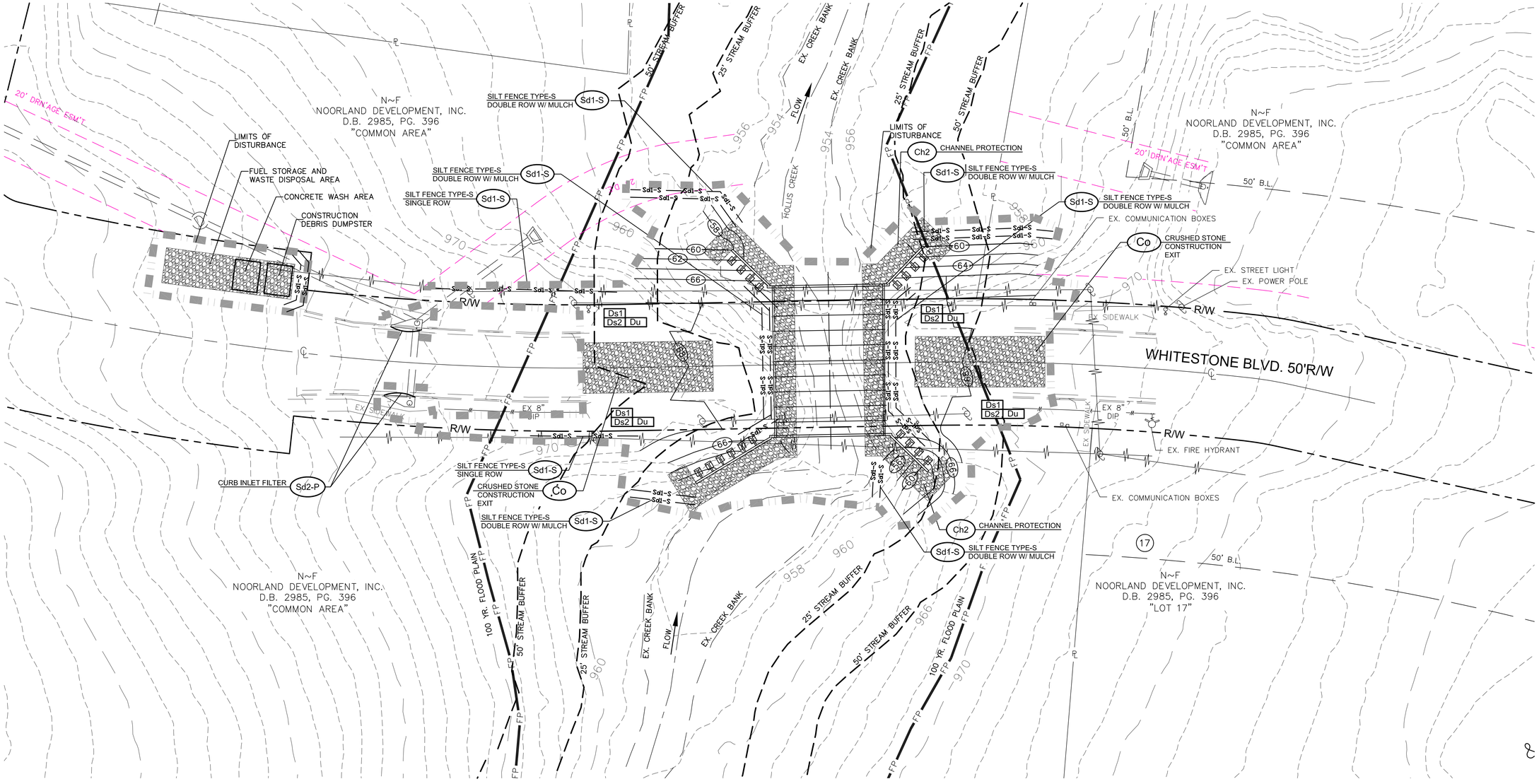
24 HR. CONTACT:
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GEORGIA REGISTERED PROFESSIONAL ENGINEER HOWARD B. RAY No. 24019 7-10-18

Certification # 0000004500
DATE: 5/11/18
DRAWN BY: JJT
CHECKED BY: HBR

JOB#: H15166

EC3



CONTRACTOR IS RESPONSIBLE FOR DEWATERING DURING ALL PHASES OF CONSTRUCTION WHETHER IT IS SHOWN ON THESE PLANS OR NOT.

EROSION CONTROL LEGEND

Co	CRUSHED STONE CONSTRUCTION EXIT
Sd1-S	SILT FENCE TYPE-S
Sd2-P	CURB INLET FILTER
St	OUTLET PROTECTION
Bf	BUFFER ZONE
Ss	SLOPE STABILIZATION
Ds1	DISTURBED AREA STABILIZATION (WITH MULCHING ONLY)
Ds2	DISTURBED AREA STABILIZATION (WITH TEMPORARY SEEDING)
Ds3	DISTURBED AREA STABILIZATION (WITH PERMANENT VEGETATION)
Ds4	DISTURBED AREA STABILIZATION (WITH SODDING)
Du	DUST CONTROL ON DISTURBED AREAS

GPS LOCATION OF BEGINNING & END OF PROJECT

BEGINNING
(INT. OF HWY 5 & WHITESTONE BLVD)
LATITUDE: 33.605491
LONGITUDE: 84.839559

END
(INT. OF BIG CREEK DR. & WHITESTONE BLVD)
LATITUDE: 33.602900
LONGITUDE: 84.842765

NORTH
MAGNETIC

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

PREPARED BY:
HRC
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No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

INTERMEDIATE PHASE EROSION CONTROL PLAN OF WHITESTONE BLVD. CULVERT REPLACEMENT

L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

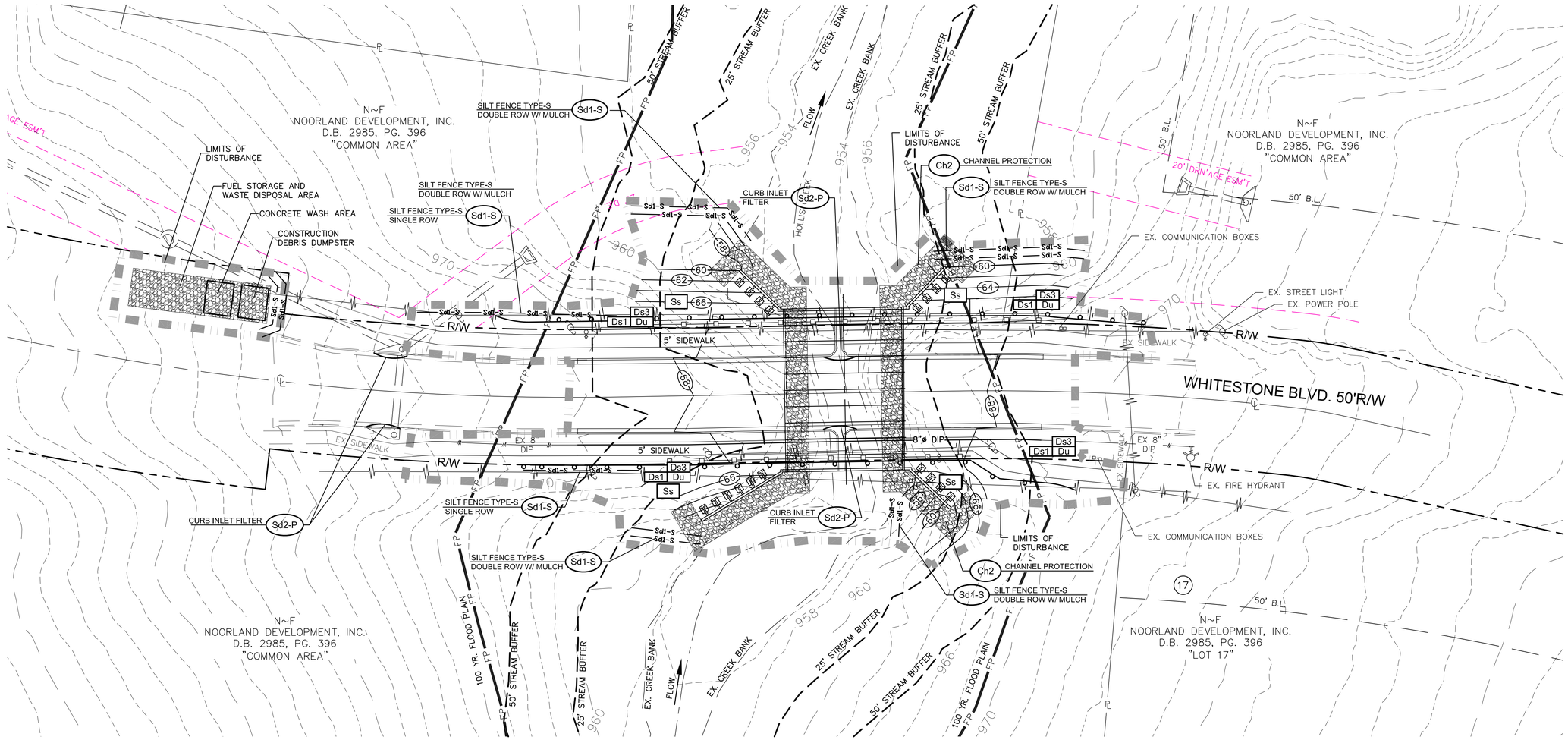
24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

STATE OF GEORGIA
No. 24019
PROFESSIONAL
ENGINEER
HOWARD B. RAY
7-10-18

Certification # 0000004500
DATE: 5/11/18
DRAWN BY: JJT
CHECKED BY: HBR

JOB#: H15166

EC4



CONTRACTOR SHALL SPREAD ANY EXCESS RIPRAP IN FRONT OF CULVERT ON THE UPSTREAM SIDE WITHIN THE LIMITS OF THE WING WALLS

EROSION CONTROL LEGEND

Co	CRUSHED STONE CONSTRUCTION EXIT
Sd1-S	SILT FENCE TYPE-S
Sd2-P	CURB INLET FILTER
St	OUTLET PROTECTION
Bf	BUFFER ZONE
Ss	SLOPE STABILIZATION
Ds1	DISTURBED AREA STABILIZATION (WITH MULCHING ONLY)
Ds2	DISTURBED AREA STABILIZATION (WITH TEMPORARY SEEDING)
Ds3	DISTURBED AREA STABILIZATION (WITH PERMANENT VEGETATION)
Ds4	DISTURBED AREA STABILIZATION (WITH SODDING)
Du	DUST CONTROL ON DISTURBED AREAS

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

PREPARED BY:
HRC
HUGHES-RAY COMPANY, INC.
ENGINEERS | SURVEYORS | LANDSCAPE ARCHITECTS
6554 EAST CHURCH STREET
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No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

FINAL PHASE EROSION CONTROL PLAN OF WHITESTONE BLVD. CULVERT REPLACEMENT

L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

REGISTERED PROFESSIONAL ENGINEER No. 24019 PROFESSIONAL ENGINEER HOWARD B. RAY
7/10-18

Certification # 0000004500

DATE:	5/11/18
DRAWN BY:	JJT
CHECKED BY:	HBR

JOB#: H15166

EC5

GEORGIA
UNIFORM CODING SYSTEM
FOR SOIL EROSION AND SEDIMENT CONTROL PRACTICES
GEORGIA SOIL AND WATER CONSERVATION COMMISSION

STRUCTURAL PRACTICES

CODE	PRACTICE	DETAIL	MAP SYMBOL	DESCRIPTION
Cd	CHECKDAM			A small temporary barrier or dam constructed across a swale, drainage ditch or area of concentrated flow.
Ch	CHANNEL STABILIZATION			Improving, constructing or stabilizing an open channel, existing stream, or ditch.
Co	CONSTRUCTION EXIT		Co	A crushed stone pad located at the construction site exit to provide a place for removing mud from tires thereby protecting public streets.
Cr	CONSTRUCTION ROAD STABILIZATION		Cr	A travelway constructed as part of a construction plan including access roads, subdivision roads, parking areas and other on-site vehicle transportation routes.
Dc	STREAM DIVERSION CHANNEL			A temporary channel constructed to convey flow around a construction site while a permanent structure is being constructed.
Di	DIVERSION			An earth channel or dike located above, below, or across a slope to divert runoff. This may be a temporary or permanent structure.
Dn1	TEMPORARY DOWNDRAIN STRUCTURE		Dn1	A flexible conduit of heavy-duty fabric or other material designed to safely conduct surface runoff down a slope. This is temporary and inexpensive.
Dn2	PERMANENT DOWNDRAIN STRUCTURE		Dn2	A paved chute, pipe, sectional conduit or similar material designed to safely conduct surface runoff down a slope.
Fr	FILTER RING			A temporary stone barrier constructed at storm drain inlets and pond outlets.
Ga	GABION			Rock filter baskets which are hand-placed into position forming soil stabilizing structures.
Gr	GRADE STABILIZATION STRUCTURE		Gr	Permanent structures installed to protect channels or waterways where otherwise the slope would be sufficient for the running water to form gullies.
Lv	LEVEL SPREADER			A structure to convert concentrated flow of water into less erosive sheet flow. This should be constructed only on undisturbed soils.
Rd	ROCK FILTER DAM			A permanent or temporary stone filter dam installed across small streams or drainageways.
Re	RETAINING WALL		Re	A wall installed to stabilize cut and fill slopes where maximum permissible slopes are not obtainable. Each situation will require special design.
Rt	RETRO FITTING		Rt	A device or structure placed in front of a permanent stormwater detention pond outlet structure to serve as a temporary sediment filter.
Sd1	SEDIMENT BARRIER		(SILT FENCE TYPE)	A barrier to prevent sediment from leaving the construction site. It may be sandbags, bales of straw or hay, brush, logs and poles, gravel, or a silt fence.
Sd2	INLET SEDIMENT TRAP			An impounding area created by excavating around a storm drain drop inlet. The excavated area will be filled and stabilized on completion of construction activities.
Sd3	TEMPORARY SEDIMENT BASIN		Sb	A basin created by excavation or a dam across a waterway. The surface water runoff is temporarily stored allowing the bulk of the sediment to drop out.
Sd4	TEMPORARY SEDIMENT TRAP			A small temporary pond that drains a disturbed area so that sediment can settle out. The principle feature distinguishing a temporary sediment trap from a temporary sediment basin is the lack of a pipe or riser.
Sk	FLOATING SURFACE SKIMMER		Sk	A buoyant device that releases/drains water from the surface of sediment ponds, traps, or basins at a controlled rate of flow.
Spb	SEEP BERM		Spb	Linear control device constructed as a diversion perpendicular to the direction of runoff to enhance dissipation and infiltration, while creating multiple sedimentation chambers with the employment of intermediate dikes.

STRUCTURAL PRACTICES

CODE	PRACTICE	DETAIL	MAP SYMBOL	DESCRIPTION
Sr	TEMPORARY STREAM CROSSING		Sr	A temporary bridge or culvert-type structure protecting a stream or watercourse from damage by crossing construction equipment.
St	STORMDRAIN OUTLET PROTECTION		St	A paved or short section of riprap channel at the outlet of a storm drain system preventing erosion from the concentrated runoff.
Su	SURFACE ROUGHENING		Su	A rough soil surface with horizontal depressions on a contour or slopes left in a roughened condition after grading.
Tc	TURBIDITY CURTAIN		Tc	A floating or staked barrier installed within the water (it may also be referred to as a floating boom, silt barrier, or silt curtain).
Tp	TOPSOILING		Tp	The practice of stripping off the more fertile soil, storing it, then spreading it over the disturbed area after completion of construction activities.
Tr	TREE PROTECTION		Tr	To protect desirable trees from injury during construction activity.
Wt	VEGETATED WATERWAY OR STORMWATER CONVEYANCE CHANNEL			Paved or vegetative water outlets for diversions, terraces, berms, dikes or similar structures.

VEGETATIVE PRACTICES

CODE	PRACTICE	DETAIL	MAP SYMBOL	DESCRIPTION
Bf	BUFFER ZONE		Bf	Strip of undisturbed original vegetation, enhanced or restored existing vegetation or the reestablishment of vegetation surrounding an area of disturbance or bordering streams.
Cs	COASTAL DUNE STABILIZATION (WITH VEGETATION)		Cs	Planting vegetation on dunes that are denuded artificially constructed, or re-nourished.
Ds1	DISTURBED AREA STABILIZATION (WITH MULCHING ONLY)		Ds1	Establishing temporary protection for disturbed areas where seedlings may not have a suitable growing season to produce an erosion retarding cover.
Ds2	DISTURBED AREA STABILIZATION (WITH TEMP SEEDING)		Ds2	Establishing a temporary vegetative cover with fast growing seedings on disturbed areas.
Ds3	DISTURBED AREA STABILIZATION (WITH PERM SEEDING)		Ds3	Establishing a permanent vegetative cover such as trees, shrubs, vines, grasses, or legumes on disturbed areas.
Ds4	DISTURBED AREA STABILIZATION (SODDING)		Ds4	A permanent vegetative cover using sods on highly erodable or critically eroded lands.
Du	DUST CONTROL ON DISTURBED AREAS		Du	Controlling surface and air movement of dust on construction site, roadways and similar sites.
Fl-Co	FLOCCULANTS AND COAGULANTS		Fl-Co	Substance formulated to assist in the solids/liquid separation of suspended particles in solution.
Sb	STREAMBANK STABILIZATION (USING PERM VEGETATION)		Sb	The use of readily available native plant materials to maintain and enhance streambanks, or to prevent, or restore and repair small streambank erosion problems.
Ss	SLOPE STABILIZATION		Ss	A protective covering used to prevent erosion and establish temporary or permanent vegetation on steep slopes, shore lines, or channels.
Tac	TACKIFIERS AND BINDERS		Tac	Substance used to anchor straw or hay mulch by causing the organic material to bind together.

GaSWCC (Amended – 2013)

VEGETATIVE PLAN

SEEDING RATES FOR TEMPORARY SEEDINGS **Ds2 | Du**

Species	Rate Per 1,000 sq. ft.	Rate Per Acre	Planting Dates Mts–L'stone Piedmont	Coastal
Winter Rye (Secale cereale)	0.6 lbs.	28 lbs.	9/15–4/15	10/1–3/15 10/15–2/15
Mix when appropriate with: Unhulled Common Bermudagrass (Cynodon dactylon)	0.2 lbs.	6–8 lbs.	10/1–4/15	9/15–3/15 10/15–2/15
Lespedeza (Lespedeza striata)	0.2 lbs.	8–10 lbs.	9/15–4/15	10/1–3/15 10/15–2/15
Mix when appropriate with: Common Bermudagrass (Cynodon dactylon)	0.2 lbs.	8–10 lbs.	4/15–10/1	3/15–9/15 2/15–10/15

Unusual site conditions may require heavier seeding rates.
Seeding dates may need to be altered to fit temperature variations and local conditions.
The above application rates are for erosion control purposes only.
See Landscape Plan for FINAL vegetation.
ADD 1 TON OF LIME PER DISTURBED ACRE unless soil test indicate otherwise.
ADD 1000 lbs. OF 6–12–12 FERTILIZER PER GRASSED ACRE unless soil test indicate otherwise.

SEEDING RATES FOR PERMANENT SEEDINGS **Ds3 | Du**

Species	Rate Per 1,000 sq. ft.	Rate Per Acre	Planting Dates Mts–L'stone Piedmont	Coastal
Unhulled Common Bermudagrass (Cynodon dactylon) Mixed with: Winter Rye (Secale cereale)	0.2 lbs. 0.6 lbs.	6–8 lbs. 28 lbs.	9/15–4/15	9/15–3/15 10/15–2/15
Common Bermudagrass (Cynodon dactylon)	0.23 lbs.	8–10 lbs.	4/15–10/1	3/15–9/15 2/15–10/15
Mix when appropriate with: Lespedeza (Lespedeza striata)	0.2 lbs.	8–10 lbs.	9/15–4/15	10/1–3/15 10/15–2/15

Unusual site conditions may require heavier seeding rates.
Seeding dates may need to be altered to fit temperature variations and local conditions.
The above application rates are for erosion control purposes only.
See Landscape Plan for FINAL vegetation.
ADD 2 TON OF LIME PER DISTURBED ACRE unless soil test indicate otherwise.
ADD 1500 lbs. OF 6–12–12 FERTILIZER PER GRASSED ACRE unless soil test indicate otherwise.

MULCHING RATES: **Ds1 | Du** ALTERNATIVE = **Tb**

Mulching with permanent vegetation:
Mulch is required for all permanent vegetation applications.
Mulch applied to seeded areas shall achieve 75% soil cover.
Dry straw mulch shall be applied at a rate of 2 tons per acre.
Dry hay mulch shall be applied at a rate of 2.5 tons per acre.

Mulching Only:
Straw/Hay Shall be applied at 2–4 Inches depth providing complete soil coverage.

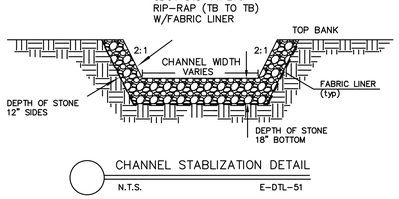
ALTERNATIVE **Tb**

IF ABOVE TREATMENT IS INEFFECTIVE USE APPROVED TACKIFIERS AND BINDERS

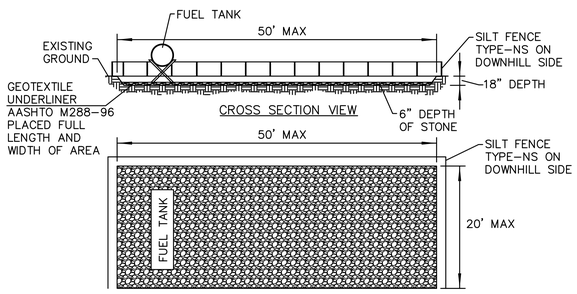
Product or Trade Name	Recommended Application Rate
A500 HYDRO–STIK	40 lb./ac.
Agro Tack MP	PMR
CONWED CON–TAC	40 lb./ac.
EcoTak–OP/EcoTAk–SATII	PMR
Emulsified Asphalt	100 gal. of SS–1h or CSS–1h and 100 gal. of water per ton of mulch
Hercules Soilloc–E	PMR
HYDRO–BOND	35 lb./ac.
RMB–plus	80–120 lb./ac.
TACPAC GT	PMR
TERRA–MULCH	
TACKING AGENT III	PMR

ANTICIPATED SEEDING SCHEDULE
PIEDMONT REGION

TEMPORARY SEEDING Ds2	J	F	M	A	M	J	J	A	S	O	N	D
WINTER RYE (Secale cereale)	■	■								■	■	■
WINTER RYE mixed w/ UNHULLED COMMON BERMUDA (Cynodon dactylon)	■	■								■	■	■
ANNUAL LESEDEZA (Lesedeza striata)	■	■								■	■	■
ANNUAL LESEDZA mixed w/ HULLED COMMON BERMUDA (Cynodon dactylon)			■	■	■	■	■	■				
PERMANENT SEEDING Ds3	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
UNHULLED COMMON BERMUDA (Cynodon dactylon) mixed w/ WINTER RYE (Secale cereale)	■	■								■	■	■
HULLED COMMON BERMUDA (Cynodon dactylon)			■	■	■	■	■	■				
COMMON BERMUDA mixed w/ ANNUAL LESEDEZA (Lesedeza striata)	■	■								■	■	■



CHANNEL STABLIZATION DETAIL
N.T.S. E–DTL–51

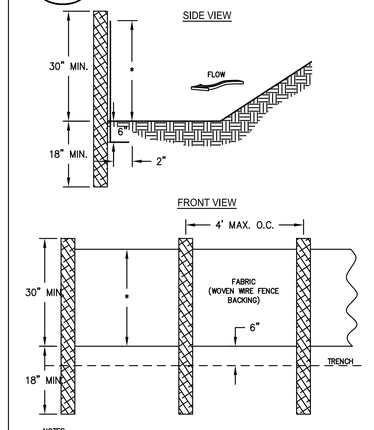


PLAN VIEW

NOTE:
DISPOSAL AREA DESIGNATED FOR FUEL STORAGE AND CONCRETE TRUCKS TO DUMP EXCESS CONCRETE.

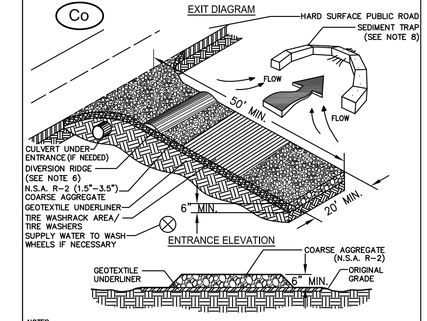
FUEL STORAGE AND WASTE DISPOSAL AREA
NTS E–DTL–34B

Sd1-S SILT FENCE - TYPE SENSITIVE

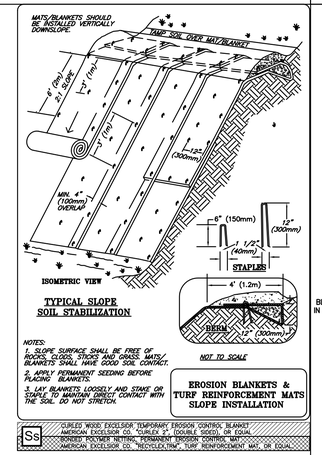


NOTES:
1. USE STEEL OR WOOD POSTS OR AS SPECIFIED BY THE EROSION, SEDIMENTATION, AND POLLUTION CONTROL PLAN.
2. HEIGHT (*) IS TO BE SHOWN ON THE EROSION, SEDIMENTATION, AND POLLUTION CONTROL PLAN.

CRUSHED STONE CONSTRUCTION EXIT



NOTES:
1. AVOID LOCATING ON STEEP SLOPES OR AT CURVES ON PUBLIC ROADS.
2. REMOVE ALL VEGETATION AND OTHER UNSUITABLE MATERIAL FROM THE FOUNDATION AREA, GRADE, AND CROWN FOR POSITIVE DRAINAGE.
3. AGGREGATE SIZE SHALL BE IN ACCORDANCE WITH NATIONAL STONE ASSOCIATION R–2 (1.5"–3.5" STONE).
4. GRAVEL PAD SHALL HAVE A MINIMUM THICKNESS OF 6".
5. PAD WIDTH SHALL BE EQUAL FULL WIDTH AT ALL POINTS OF VEHICULAR EGRESS, BUT NO LESS THAN 20'.
6. A DIVERSION RIDGE SHOULD BE CONSTRUCTED WHEN GRADE TOWARD PAVED AREA IS GREATER THAN 2%.
7. INSTALL PIPE UNDER THE ENTRANCE IF NEEDED TO MAINTAIN DRAINAGE DITCHES.
8. WHEN WASHING IS REQUIRED, IT SHOULD BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN (DIVERT ALL SURFACE RUNOFF AND DRAINAGE FROM THE ENTRANCE TO A SEDIMENT CONTROL DEVICE).
9. WASHRACKS AND/OR TIRE WASHERS MAY BE REQUIRED DEPENDING ON SCALE AND CIRCUMSTANCE. IF NECESSARY, WASHRACK DESIGN MAY CONSIST OF ANY MATERIAL SUITABLE FOR TRUCK TRAFFIC THAT REMOVE MUD AND DIRT.
10. MAINTAIN AREA IN A WAY THAT PREVENTS TRACKING AND/OR FLOW OF MUD ONTO PUBLIC RIGHTS–OF–WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.

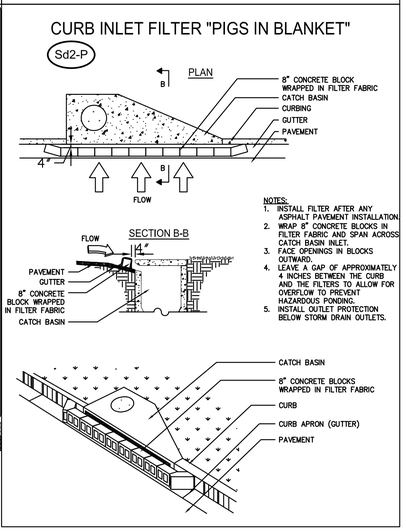


NOTES:
1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS MATS/ BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.

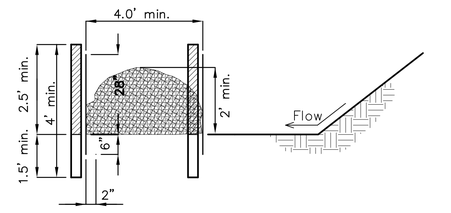
Ss SINGLE WIRE EXCELSIOR "TEMPORARY EROSION CONTROL BLANKET" AMERICAN EXCELSIOR CO. "CURLEX I" (SINGLE SIDED), OR EQUAL
BIODEGRADABLE POLYMER NETTING, PERMANENT EROSION CONTROL MATTING AMERICAN EXCELSIOR CO. "RECYCLEX/TRM", TURF REINFORCEMENT MAT, OR EQUAL

CURB INLET FILTER "PIGS IN BLANKET"

Sd2-P



NOTES:
1. INSTALL FILTER AFTER ANY ASPHALT PAVEMENT INSTALLATION
2. WRAP 8" CONCRETE BLOCKS IN FILTER FABRIC AND SPAN ACROSS CATCH BASIN INLET.
3. FACE OPENINGS IN BLOCKS OUTWARD.
4. LEAVE A GAP OF APPROXIMATELY 4 INCHES BETWEEN THE CURB AND THE FILTERS TO ALLOW FOR OVERFLOW TO PREVENT HAZARDOUS PONDING.
5. INSTALL OUTLET PROTECTION BELOW STORM DRAIN OUTLETS.



SIDE VIEW

Sd1-S SILT FENCE DOUBLE ROW TYPE "S" WITH MULCH BETWEEN ROWS. N.T.S E–DTL–27

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No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
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EROSION CONTROL DETAILS
OF
WHITESTONE BLVD. CULVERT REPLACEMENT
L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
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GEORGIA REGISTERED No. 24019 PROFESSIONAL ENGINEER HOWARD B. RAY
7-10-18

Certification # 0000004500
DATE: 5/11/18
DRAWN BY: JJT
CHECKED BY: HBR

JOB#: H15166

EC6

EROSION, SEDIMENTATION & POLLUTION CONTROL PLAN CHECKLIST
INFRASTRUCTURE CONSTRUCTION PROJECTS

SWCD:_____

Project Name: WHITESTONE BLVD CULVERT REPLACEMENT **Address:** WHITESTONE BOULEVARD

City/County: DOUGLAS COUNTY **Date on Plans:** MAY 11, 2018

Name &email of person filling out checklist: JONATHAN TILENIS jtilenis@hughesray.com

TO BE SHOWN ON ES&PC PLAN

Plan Page #	Included Y/N		
EC7	Y	1	The applicable Erosion, Sedimentation and Pollution Control Plan Checklist established by the Commission as of January 1 of the year in which the land-disturbing activity was permitted. (The completed Checklist must be submitted with the ES&PC Plan or the Plan will not be reviewed)
EC1–7	Y	2	Level II certification number issued by the Commission, signature and seal of the certified design professional. (Signature, seal and Level II number must be on each sheet pertaining to ES&PC Plan or the Plan will not be reviewed)
EC1–7	Y	3	The name and phone number of the 24-hour local contact responsible for erosion, sedimentation and pollution controls.
CVR	Y	4	Provide the name, address and phone number of primary permittee.
CVR	Y	5	Note total and disturbed acreage of the project or phase under construction.
EC3–4	Y	6	Provide the GPS locations of the beginning and end of the Infrastructure project. Give the Latitude and Longitude in decimal degrees.
EC1–7	Y	7	Initial date of the Plan and the dates of any revisions made to the Plan including the entity who requested the revisions.
EC1	Y	8	Description of the nature of construction activity.
EC1	Y	9	Provide vicinity map showing site's relation to surrounding areas. Include designation of specific phase, if necessary.
EC1	Y	10	Identify the project receiving waters and describe all sensitive adjacent areas including streams, lakes, residential areas, wetlands, marshlancs, etc. which may be affected.
EC2	Y	11	Design professional's certification statement and signature that the site was visited prior to development of the ES&PC Plan as stated on page 15 of the permit.
EC2	Y	12	Design professional's certification statement and signature that the permittee's ES&PC Plan provides for an appropriate and comprehensive system of BMPs and sampling to meet permit requirements as stated on page 15 of the permit.*
EC2	Y	13	Design professional certification statement and signature that the permittee's ES&PC Plan provides for representative sampling as stated on page 26 of permit as applicable.*
EC1	Y	14	Clearly note the statement that "The design professional who prepared the ES&PC Plan is to inspect the installation of the initial sediment storage requirements, perimeter control BMPs, and sediment basins in accordance with part IV.A.5. within 7 days after installation."*
EC1	Y	15	Clearly note the statement that "Non-exempt activities shall not be conducted within the 25 or 50-foot undisturbed stream buffers as measured from the point of wrested vegetation or within 25-feet of the coastal marshland buffer as measured from the Jurisdictional Determination Line without first acquiring the necessary variances and permits."
	N/A	16	Provide a description of any buffer encroachments and indicate whether a buffer variance is required.
EC2	N/A	17	Clearly note the statement that "Amendments/revisions to the ES&PC Plan which have a significant effect on BMPs with a hydraulic component must be certified by the design professional."*
EC2	Y	18	Clearly note the statement that "Waste materials shall not be discharged to waters of the State, except as authorized by a section 404 permit."*
EC1	Y	19	Clearly note statement that "The escape of sediment from the site shall be prevented by the installation of erosion and sediment control measures and practices prior to land disturbing activities."
EC1	Y	20	Clearly note statement that "Erosion control measures will be maintained at all times. If full implementation of the approved Plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source."
EC1	Y	21	Clearly note the statement "Any disturbed area left exposed for a period greater than 14 days shall be stabilized with mulch or temporary seeding."
EC1	Y	22	Any construction activity which discharges storm water into an Impaired Stream Segment, or within 1 linear mile upstream of and within the same watershed as, any portion of an Biota Impaired Stream Segment must comply with Part III. C. of the Permit. Include the completed Appendix 1 listing all the BMPs that will be used for those areas of the site which discharge to the Impaired Stream Segment.*
	N/A	23	If a TMDL Implementation Plan for sediment has been finalized for the Impaired Stream Segment (identified in item 22 above) at least six months prior to submittal of NOI, the ES&PC Plan must address any site-specific conditions or requirements included in the TMDL Implementation Plan.*
EC2	Y	24	BMPs for concrete washdown of tools, concrete mixer chutes, hoppers and the rear of the vehicles. Washout of the drum at the construction site is prohibited.*
EC2	Y	25	Provide BMPs for the remediation of all petroleum spills and leaks.
	N/A		
EC2	Y	26	Description of the measures that will be installed during the construction process to control pollutants in storm water that will occur after construction operations have been completed.*
EC2	Y	27	Description of the practices that will be used to reduce the pollutants in storm water discharges.*
EC1	Y	28	Description and chart or timeline of the intended sequence of major activities which disturb soils for the major portions of the site (i.e., initial perimeter and sediment storage BMPs, clearing and grubbing activities, excavation activities, utility activities, temporary and final stabilization).
EC2	Y	29	Provide complete requirements of inspections and record keeping by the primary permittee.*
EC2	Y	30	Provide complete requirements of sampling frequency and reporting of sampling results.*
EC2	Y	31	Provide complete details for retention of records as per Part IV.F. of the permit.*
EC2	Y	32	Description of analytical methods to be used to collect and analyze the samples from each location.*
EC1	Y	33	Appendix B rationale for NTU values at all outfall sampling points where applicable.*
EC1	Y	34	Delineate all sampling locations, perennial and intermittent streams and other water bodies into which storm water is discharged also provide a summary chart of the justification and analysis for the representative sampling as applicable.*
EC1	Y	35	A description of appropriate controls and measures that will be implemented at the construction site including: (1) initial sediment storage requirements and perimeter control BMPs, (2) intermediate grading and drainage BMPs, and (3) final BMPs. For construction sites where there will be no mass grading and the initial perimeter control BMPs, intermediate grading and drainage BMPs, and final BMPs are the same, the plan may combine all of the BMPs into a single phase.*
EC3–5	Y	36	Graphic scale and North arrow.
EC3–5	Y	37	Existing and proposed contour lines with contour lines drawn at an interval in accordance with the following:

Existing Contours	USGS 1": 2000' Topographical Sheets
Proposed Contours	1" : 400' Centerline Profile

EC6	Y	38	Use of alternative BMPs whose performance has been documented to be equivalent to or superior to conventional BMPs as certified by a Design Professional (unless disapproved by EPD or the Georgia Soil and Water Conservation Commission). Please refer to the Alternative BMP Guidance Document found at www.gaswcc.org.
	N/A	39	Use of alternative BMP for application to the Equivalent BMP List. Please refer to Appendix A-2 of the Manual for Erosion & Sediment Control in Georgia 2016 Edition.*
EC3–5	Y	40	Delineation of the applicable 25-foot or 50-foot undisturbed buffers adjacent to State waters and any additional buffers required by the Local Issuing Authority. Clearly note and delineate all areas of impact.
EC1	Y	41	Delineation of on-site wetlands and all State waters located on and within 200 feet of the project site.
EC1	Y	42	Delineation and acreage of contributing drainage basins on the project site.
EC1	Y	43	Delineate on-site drainage and off-site watersheds using USGS 1" :2000' topographical sheets.
EC1	Y	44	An estimate of the runoff coefficient or peak discharge flow of the site prior to and after construction activities are completed.
	N/A	45	Storm-drain pipe and weir velocities with appropriate outlet protection to accommodate discharges without erosion. Identify/Delineate all storm water discharge points.
EC3	Y	46	Soil series for the project site and their delineation.
EC3–5	Y	47	The limits of disturbance for each phase of construction.
EC1	Y	48	Provide a minimum of 67 cubic yards of sediment storage per acre drained using a temporary sediment basin, retrofitted detention pond, and/or excavated inlet sediment traps for each common drainage location. Sediment storage volume must be in place prior to and during all land disturbance activities until final stabilization of the site has been achieved. A written justification explaining the decision to use equivalent controls when a sediment basin is not attainable must be included in the plan for each common drainage location in which a sediment basin is not provided. A written justification as to why 67 cubic yards of storage is not attainable must also be given. Worksheets from the Manual must be included for structural BMPs and all calculations used by the design professional to obtain the required sediment storage when using equivalent controls. When discharging from sediment basins and impoundments, permittees are required to utilize outlet structures that withdraw water from the surface, unless infeasible. If outlet structures that withdraw water from the surface are not feasible, a written justification explaining this decision must be included in the plan.
EC3–5	Y	49	Location of Best Management Practices that are consistent with and no less stringent than the Manual for Erosion and Sediment Control in Georgia. Use uniform coding symbols from the Manual, Chapter 6, with legend.
EC6	Y	50	Provide detailed drawings for all structural practices. Specifications must, at a minimum, meet the guidelines set forth in the Manual for Erosion and Sediment Control in Georgia.
EC6	Y	51	Provide vegetative plan, noting all temporary and permanent vegetative practices. Include species, planting dates and seeding, fertilizer, lime and mulching rates. Vegetative plan shall be site specific for appropriate time of year that seeding will take place and for the appropriate geographic region of Georgia.

*If using this checklist for a project that is less than 1 acre and not part of a common development but within 200 ft of a perennial stream the * checklist items would be N/A.

Effective January 1, 2018

PREPARED BY:
HUGHES-RAY COMPANY, INC.
ENGINEERS | SURVEYORS | LANDSCAPE ARCHITECTS
6554 EAST CHURCH STREET
DOUGLASVILLE, GEORGIA 30134
p 770.942.0196
f 770.942.0152
www.HughesRay.com

No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

NPDES CHECKLIST
OF
WHITESTONE BLVD. CULVERT REPLACEMENT
L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

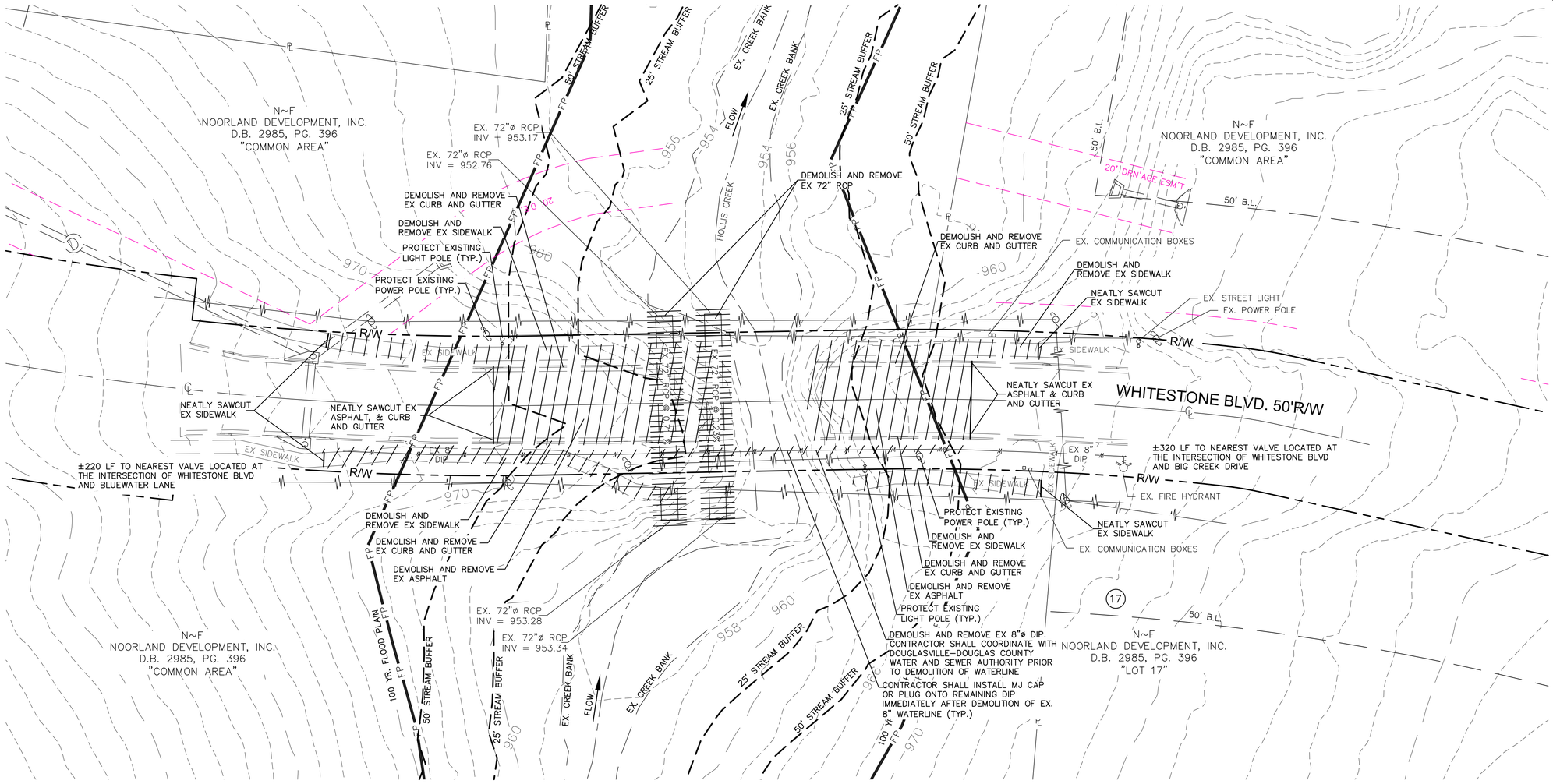
GEORGIA REGISTERED No. 24019 PROFESSIONAL ENGINEER HOWARD B. RAY
7-10-18

Certification # 0000004500

DATE:	5/11/18
DRAWN BY:	JJT
CHECKED BY:	HBR

JOB#: H15166

EC7



CONTRACTOR IS RESPONSIBLE FOR DEMOLITION AND REMOVAL
OF ALL EXISTING STORM STRUCTURES AND DEBRIS
CONTRACTOR SHALL REMOVE ROADWAY WASHOUT FROM CREEK

811

Know what's below.

Call before you dig.

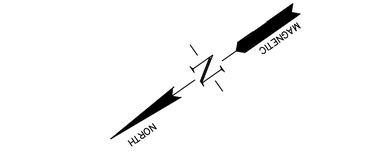
Dial 811.

or call 800-282-7411

IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL UNDERGROUND UTILITIES BEFORE BEGINNING CONSTRUCTION AND ADVISE ENGINEERING OF ANY CONFLICTS. ALL LOCATION OF UTILITIES SHOWN ON THESE DRAWINGS IS APPROXIMATE AND MAY NOT BE A COMPLETE LOCATION OF ALL UTILITIES. CERTIFICATION TO THE LOCATION OF ALL UTILITIES IS WITHHELD.

DEMOLITION NOTES:

1. THIS SHEET FOR DEMOLITION PURPOSES ONLY.
2. ALL NECESSARY PERMITS FOR DEMOLITION SHALL BE OBTAINED BY THE CONTRACTOR PRIOR TO BEGINNING WORK.
3. CONTRACTOR SHALL PROTECT ALL ADJACENT LANDS FROM DAMAGE DURING DEMOLITION WORK. ANY OFF-SITE AREAS DISTURBED SHALL BE RETURNED TO A CONDITION EQUAL TO OR BETTER THAN THE EXISTING CONDITION.
4. NO DEMOLITION MATERIALS SHALL BE DISPOSED OF ON-SITE. ALL DEBRIS SHALL BE HAULED OFF-SITE TO A DISPOSAL AREA APPROVED BY THE STATE OF GEORGIA FOR THE HANDLING OF DEMOLITION DEBRIS.
5. ALL STRUCTURES NOT LABELED FOR DEMOLITION SHALL BE PROTECTED FROM DAMAGE DURING ALL PHASES OF CONSTRUCTION. ANY STRUCTURES THAT ARE TO REMAIN THAT ARE DAMAGED SHALL BE REPAIRED BY THE CONTRACTOR TO A CONDITION EQUAL TO OR BETTER THAN THE EXISTING CONDITION AT NO ADDITIONAL COST.
6. CONSTRUCTION ENTRANCE AND SILT FENCE SHALL BE IN PLACE PRIOR TO DEMOLITION OPERATIONS.
7. NECESSARY BARRICADES, SUFFICIENT LIGHTS, SIGNS AND OTHER TRAFFIC CONTROL METHODS AS MAY BE NECESSARY FOR THE PROTECTION AND SAFETY OF THE PUBLIC SHALL BE PROVIDED AND MAINTAINED THROUGHOUT THE LIFE OF THE PROJECT.
8. UTILITIES ARE SHOWN FOR THE CONVENIENCE OF THE CONTRACTOR. OWNER & ENGINEER ARE NOT RESPONSIBLE FOR UTILITY LOCATIONS. CONTRACTOR SHALL CONTACT THE UTILITIES PROTECTION CENTER @ 811 OR 1-800-282-7411, 72 HOURS PRIOR TO CONSTRUCTION TO HAVE UTILITIES LOCATED.
9. CONTRACTOR SHALL NOTIFY ENGINEER OF DISCREPANCIES BETWEEN THESE PLANS AND FIELD CONDITIONS.
10. CONTRACTOR SHALL REMOVE ALL EXISTING CONSTRUCTION NECESSARY TO CONSTRUCT THE PROPOSED PROJECT, INCLUDING BUT NOT LIMITED TO, EXISTING FOUNDATIONS, BELOW GRADE PIPING, TREES/VEGETATION, ETC.
11. CONTRACTOR SHALL REPAIR TO ORIGINAL CONDITION ANY DAMAGE TO EXISTING CONSTRUCTION THAT IS TO REMAIN.



PREPARED BY:
HRC
HUGHES-RAY COMPANY, INC.
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f 770.942.0152
www.HughesRay.com

No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

DEMOLITION PLAN
OF
WHITESTONE BLVD. CULVERT REPLACEMENT
L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

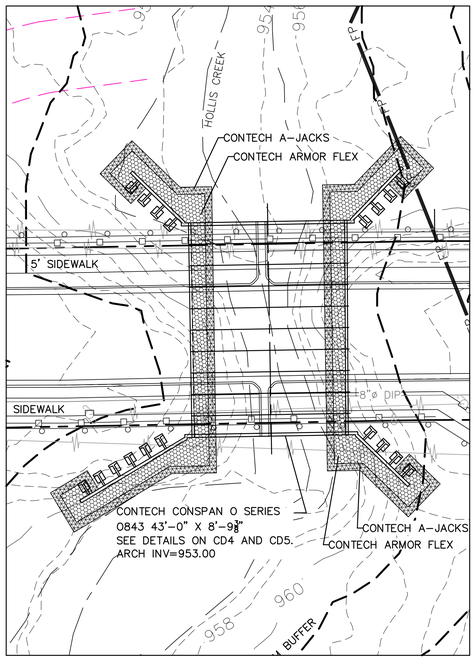
DEVELOPER:
SAME AS ABOVE

24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

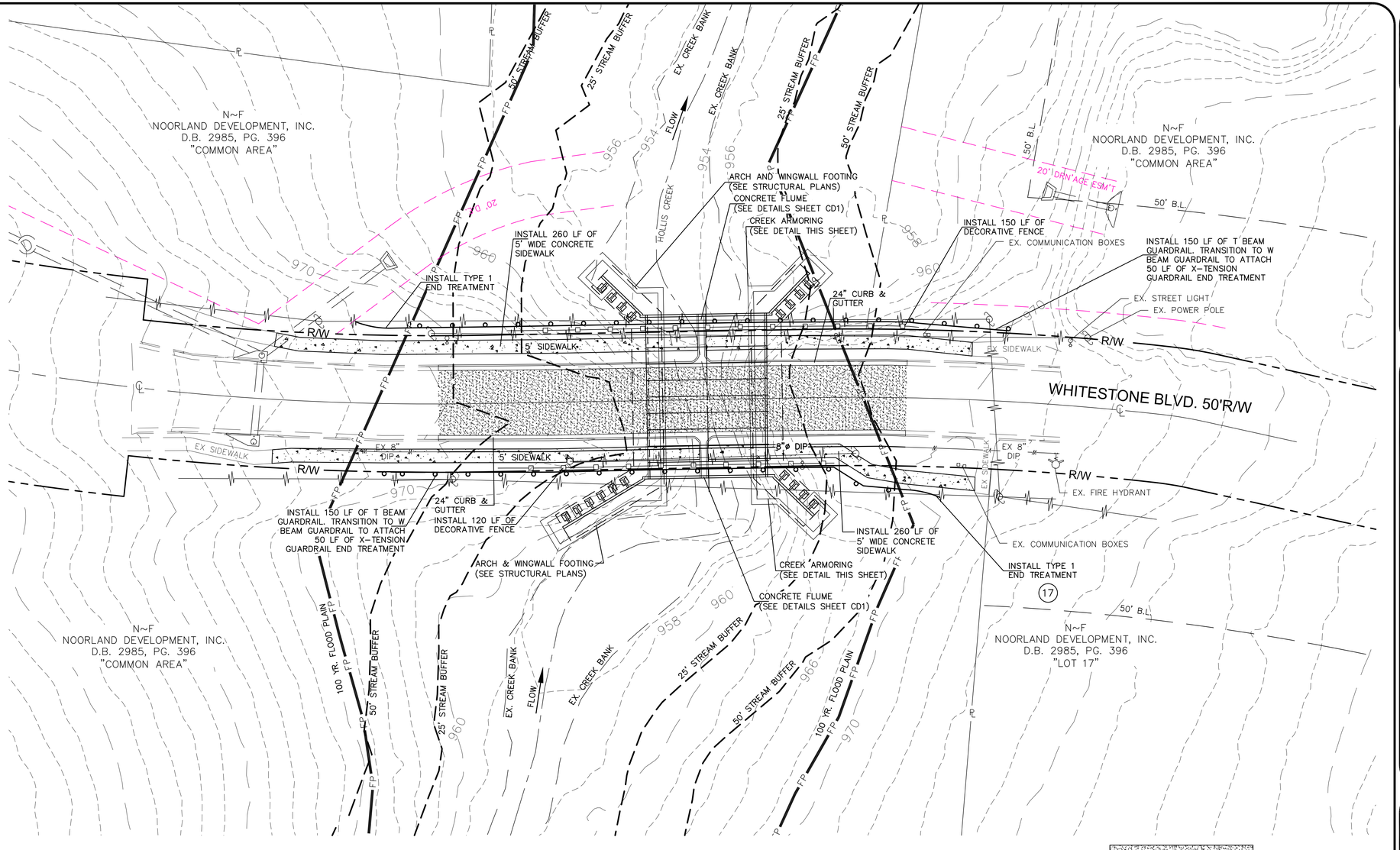
GEORGIA
No. 24019
PROFESSIONAL
ENGINEER
HOWARD B. RAY
7-10-18

DATE:	5/11/18
DRAWN BY:	JJT
CHECKED BY:	HBR
JOB#: H15166	

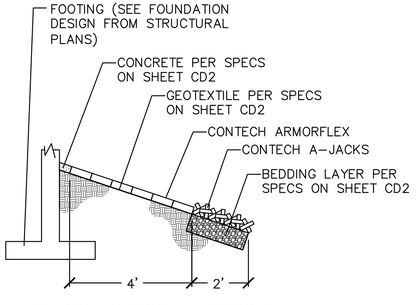
DEM1



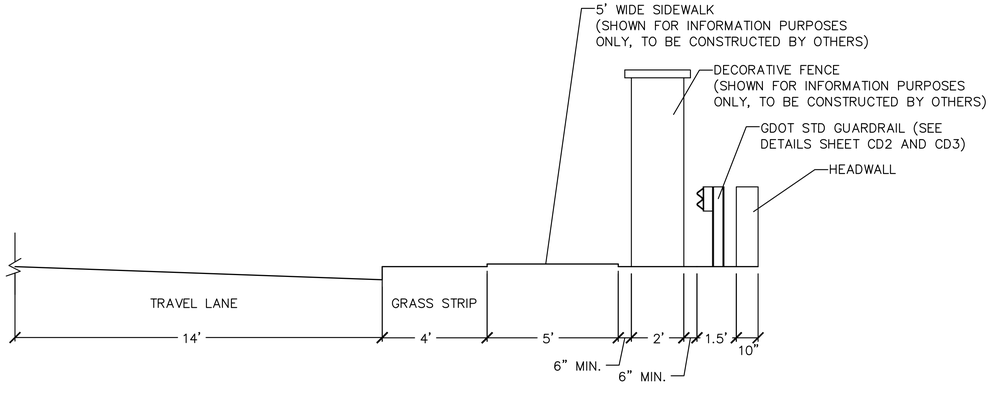
CREEK ARMORING DETAIL PLAN
SCALE: 1"=20'



NEW ASPHALT
SEE DCDOT DETAIL
ON SHEET CD1



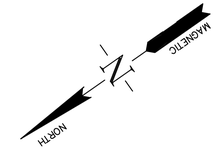
CREEK ARMORING DETAIL SECTION
SCALE: N.T.S.



ROAD SECTION
SCALE: N.T.S.

GUARDRAIL CONTACT INFORMATION

FOR MORE INFORMATION ON X-TENSION END TREATMENT SYSTEM CONTACT:
STEVEN GARREN
PHONE: 678-237-1109
EMAIL: STEVEN.GARREN@LINDSAY.COM



GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

PREPARED BY:
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No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
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SITE PLAN
OF
WHITESTONE BLVD. CULVERT REPLACEMENT
L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

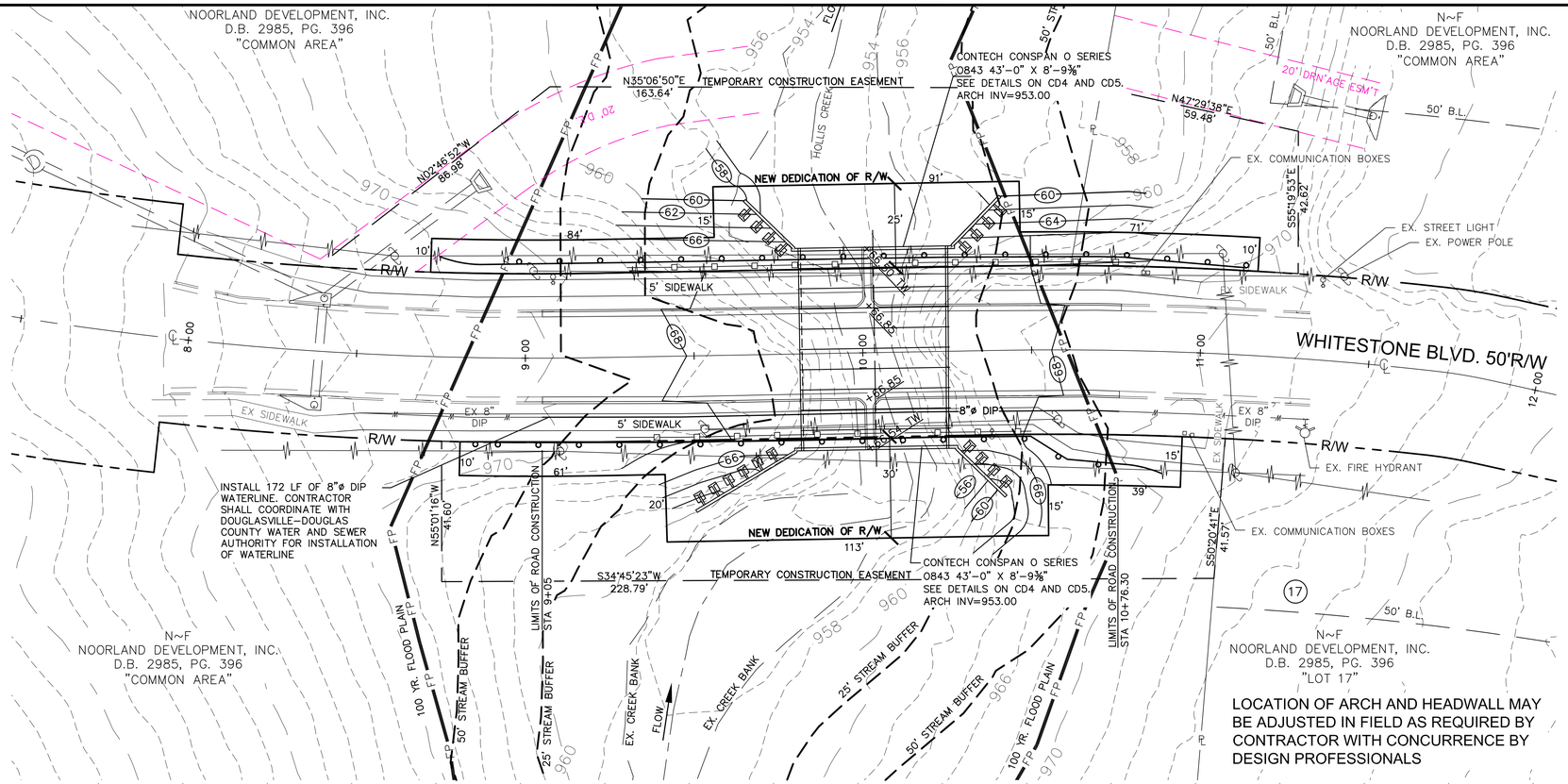
24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

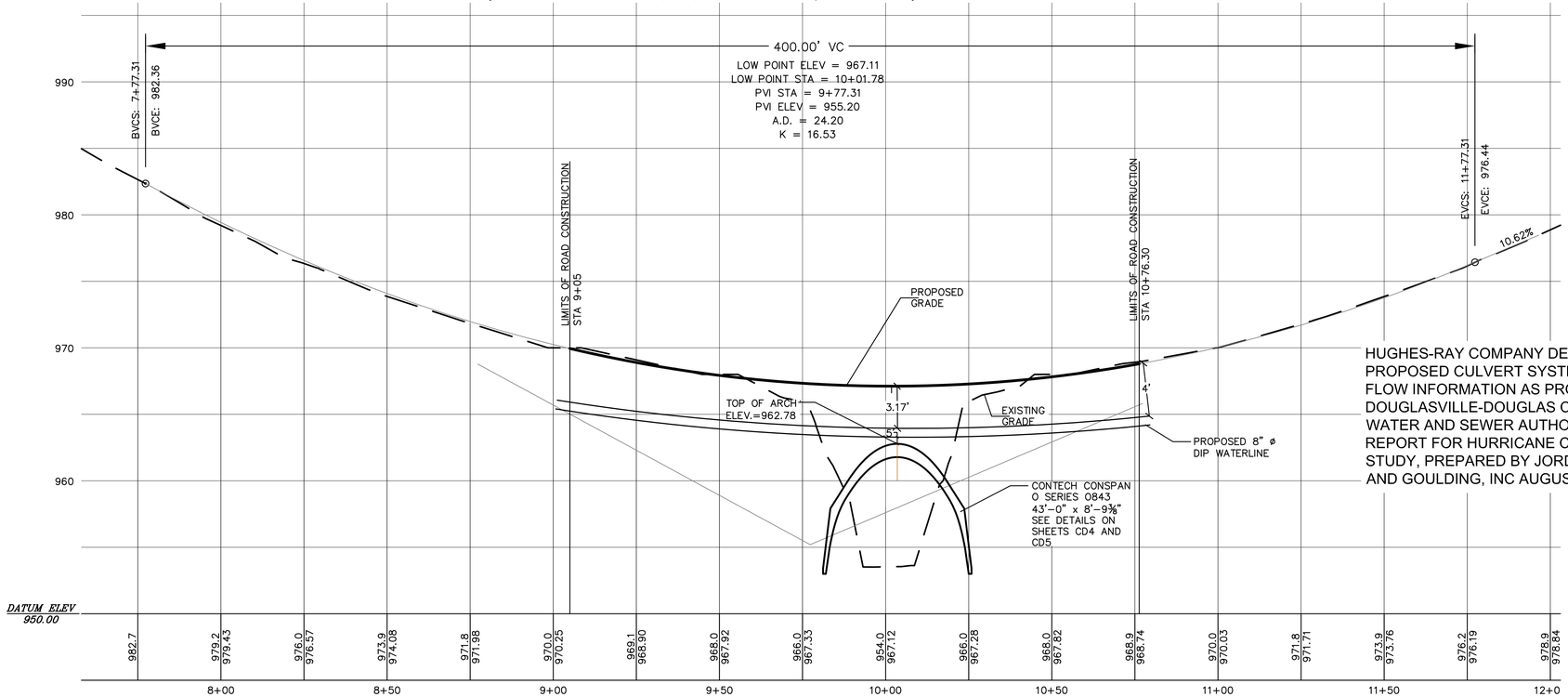
STATE OF GEORGIA
No. 24019
PROFESSIONAL ENGINEER
HOWARD B. RAY
7-10-18

DATE:	5/11/18
DRAWN BY:	JJT
CHECKED BY:	HBR

JOB#: H15166

SP1

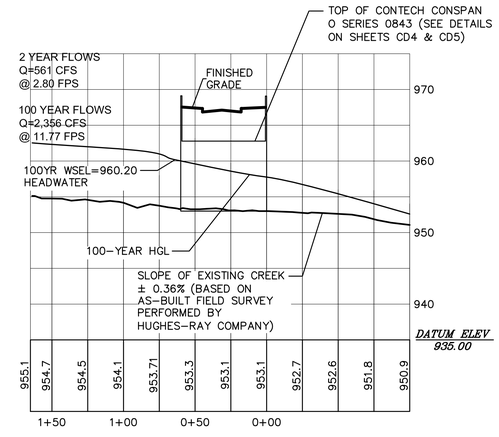




WHITESTONE BLVD ROADWAY PROFILE

VERT. SCALE 1"=5'
HORIZ. SCALE 1"=25'

HUGHES-RAY COMPANY DESIGNED THE PROPOSED CULVERT SYSTEM BASED ON FLOW INFORMATION AS PROVIDED BY DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY'S REPORT FOR HURRICANE CREEK FLOOD STUDY, PREPARED BY JORDAN, JONES AND GOULDING, INC AUGUST 2009



CONTECH CONSPAN
O SERIES O843
43'-0" x 8'-9 3/8"

VERT. SCALE 1"=10'
HORIZ. SCALE 1"=50'

MAGNETIC NORTH

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

PREPARED BY:
HRC
HUGHES-RAY COMPANY, INC.
ENGINEERS | SURVEYORS | LANDSCAPE ARCHITECTS
6554 EAST CHURCH STREET
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T 770.942.0196
F 770.942.0152
www.HughesRay.com

No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

GRADING PLAN
OF
WHITESTONE BLVD. CULVERT REPLACEMENT
L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

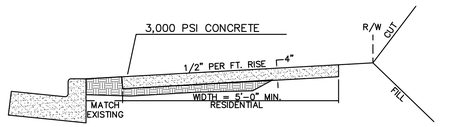
24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

HOWARD B. RAY
No. 24019
PROFESSIONAL ENGINEER
7-10-18

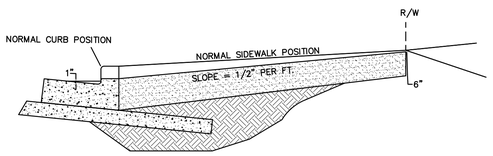
DATE:	5/11/18
DRAWN BY:	JJT
CHECKED BY:	HBR

JOB#: H15166

GP1



TYPICAL SECTION OF SIDEWALK



SIDEWALK SECTION AT DRIVEWAY

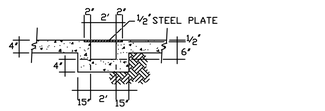
NOTE:

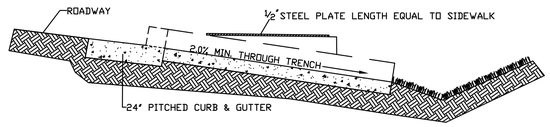
1. CONCRETE TO BE PLACED 4" THICK AND FINISHED WITH TAMPS, WOOD FLOATS & STIFF-BRISTLE BROOMS.
2. TRANSVERSE CONTRACTION JOINTS SHALL BE PLACED AT 10 FT. INTERVALS, NO CONTRACTION JOINT TO BE PLACED IN SIDEWALKS IN DRIVEWAYS. ALL EDGES TO BE ROUNDED TO 1/4" RADIUS.
3. 1/2" EXPANSION JOINTS SHALL BE PLACED WHERE SIDEWALKS TIE INTO A STRUCTURE OR TERMINATE AT CURB, RAMPS OR DRIVEWAYS OR A MAXIMUM OF 150 FEET APART.

TYPICAL SIDEWALK SECTION

N.T.S.

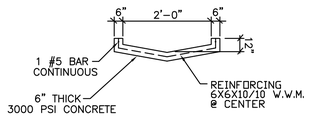
SIDEWALK NOT IN CONTRACT.
SHOWN FOR INFORMATION PURPOSES ONLY.
TO BE CONSTRUCTED BY OTHERS.

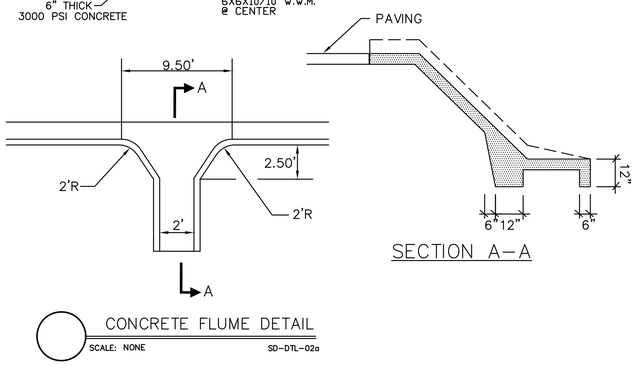




FLUME UNDER SIDEWALK DETAIL

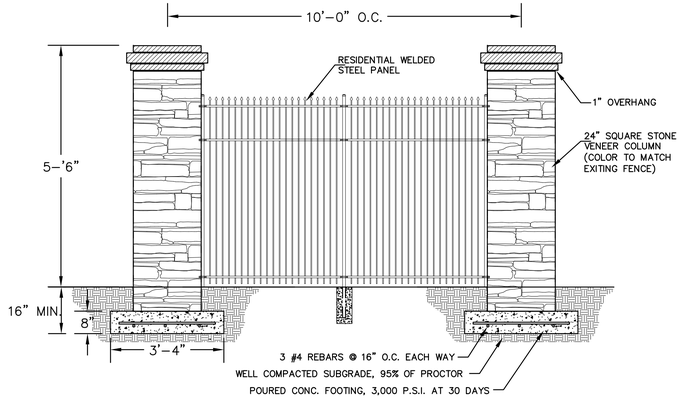
NTS SD-DTL-36





CONCRETE FLUME DETAIL

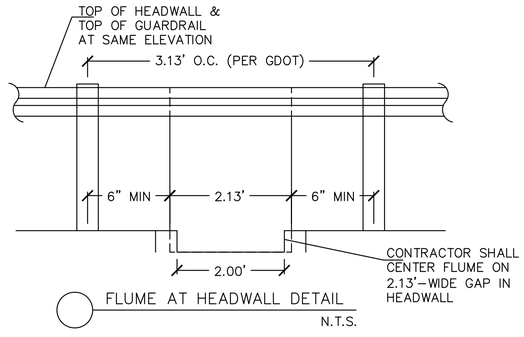
SCALE: NONE SD-DTL-02a



DECORATIVE FENCE WITH STONE COLUMN DETAIL

NTS LA-DTL-27

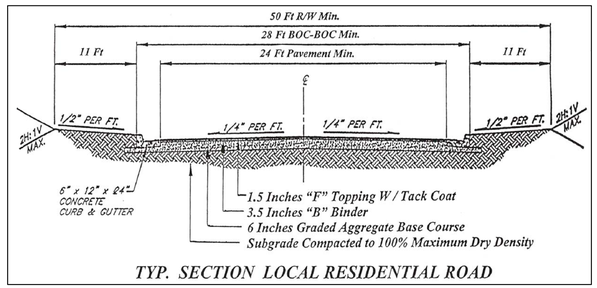
DECORATIVE FENCE NOT IN CONTRACT.
SHOWN FOR INFORMATION PURPOSES ONLY.
TO BE CONSTRUCTED BY OTHERS.



FLUME AT HEADWALL DETAIL

N.T.S.

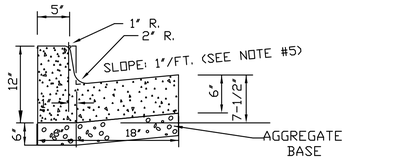
NOTE:
ASPHALT TOPPING LAYER TO BE DONE BY OTHERS. NOT INCLUDED IN CONTRACTOR'S SCOPE OF WORK.



TYP. SECTION LOCAL RESIDENTIAL ROAD

NOTES:

1. 1/2" PREFORMED EXPANSION JOINTS REQUIRED AT ALL STRUCTURES & RETURNS.
2. MAX. OF 400' DISTANCE BETWEEN EXPANSION JOINTS.
3. 10' DISTANCE BETWEEN DUMMY JOINTS.
4. CONCRETE STRENGTH = 3000 PSI, SLUMP = 2", FINISH SHALL BE SMOOTH & EVENED WITH A WOODEN FLOAT.
5. MATCH PAVEMENT CROSS SLOPE WHERE GUTTER SPILLS.

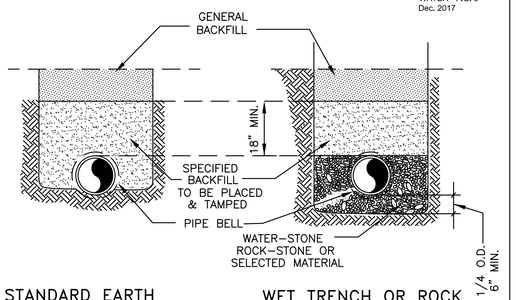


CONCRETE CURB & GUTTER DETAIL IN DCDOT R/W

SCALE: NONE S-DTL-01d

DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY

WATER - FIG. 3
Dec. 2017

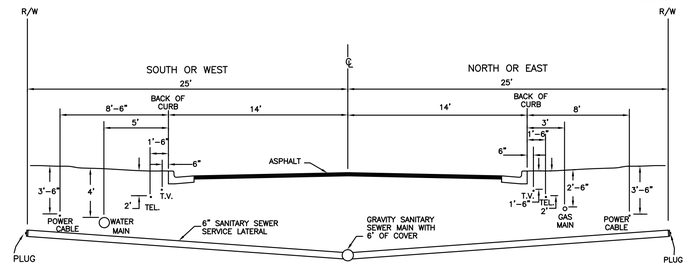


STANDARD EARTH C-1 WET TRENCH OR ROCK C-2

BEDDING DETAILS

DOUGLASVILLE-DOUGLAS COUNTY WATER AND SEWER AUTHORITY

WATER - FIG. 1
Dec. 2017



NOTES:

1. ON ALL UNCURBED TWO LANE STREETS, UTILITY LOCATIONS SHALL BE AT THE SAME DISTANCES FROM THE CENTER LINE AS SHOWN ABOVE.
2. POLES FOR OVERHEAD UTILITIES SHALL BE LOCATED A MINIMUM OF 20' FROM THE CENTER LINE OF THE ROAD ON TWO LANE STREETS.

UTILITIES PROTECTION CENTER, INC.
404-623-4344 OR 1-800-282-7411

STANDARD LOCATIONS FOR UNDERGROUND UTILITIES

PREPARED BY:
HUGHES-RAY COMPANY, INC.
ENGINEERS | SURVEYORS | LANDSCAPE ARCHITECTS
6554 EAST CHURCH STREET
DOUGLASVILLE, GEORGIA 30134
p 770.942.0196
f 770.942.0152
www.HughesRay.com

No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

STANDARD CONSTRUCTION DETAILS
OF

WHITESTONE BLVD. CULVERT REPLACEMENT

L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

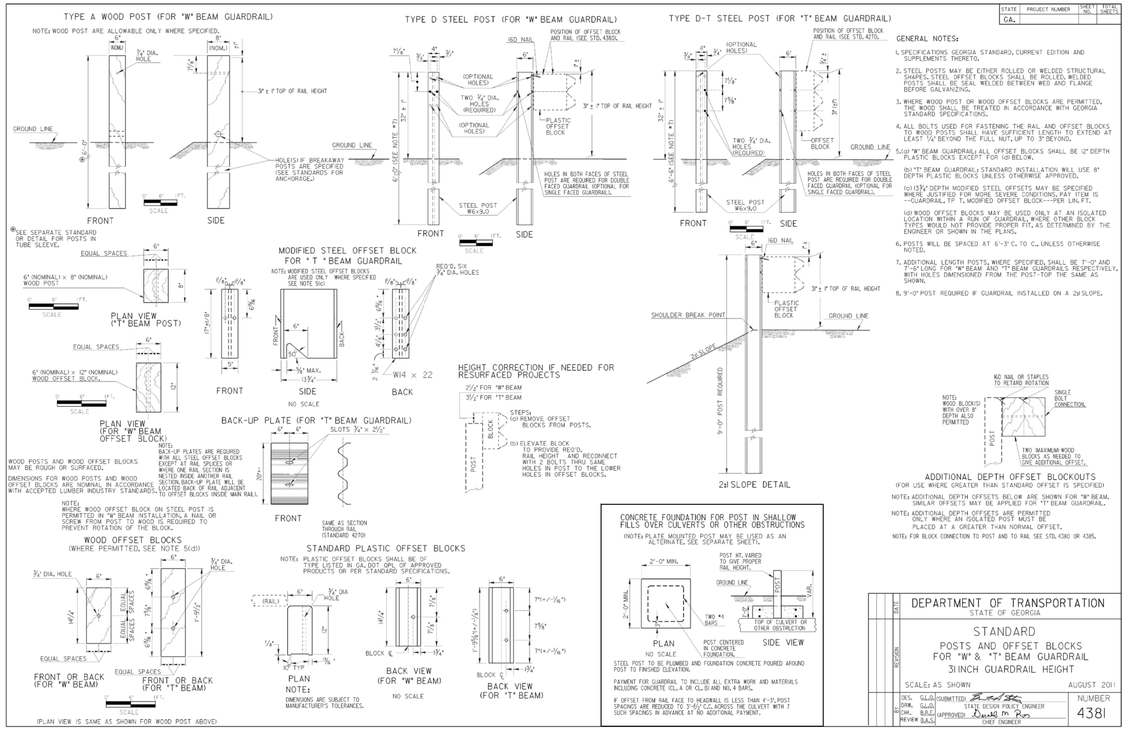
24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

GEORGIA REGISTERED PROFESSIONAL ENGINEER HOWARD B. RAY No. 24019 7-10-18

DATE:	5/11/18
DRAWN BY:	JJT
CHECKED BY:	HBR

JOB#: H15166

CD1



STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.			

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

STANDARD
POSTS AND OFFSET BLOCKS
FOR "W" & "T" BEAM GUARDRAIL
31INCH GUARDRAIL HEIGHT

SCALE: AS SHOWN — AUGUST 2011

DES. G.L.G. / DRW. G.L.G. / CHK. B.R.C. / REVIEW B.A.S. — SUBMITTED: STATE DESIGN POLICY ENGINEER; APPROVED: CHIEF ENGINEER

NUMBER 4381

No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

PREPARED BY:
HUGHES-RAY COMPANY, INC.
ENGINEERS | SURVEYORS | LANDSCAPE ARCHITECTS
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DOUGLASVILLE, GEORGIA 30134
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STANDARD CONSTRUCTION DETAILS
OF
WHITESTONE BLVD. CULVERT REPLACEMENT
L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

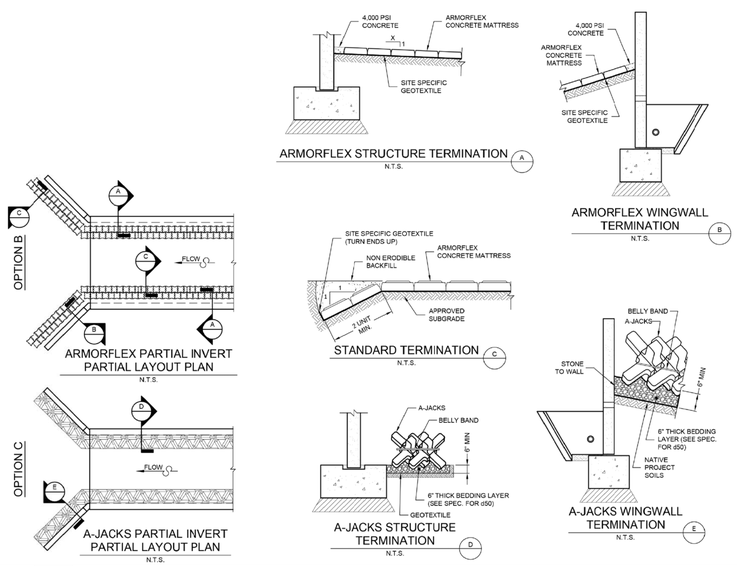
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DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

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7-10-18

DATE:	5/11/18
DRAWN BY:	JJT
CHECKED BY:	HBR
JOB#:	H15166
	CD2



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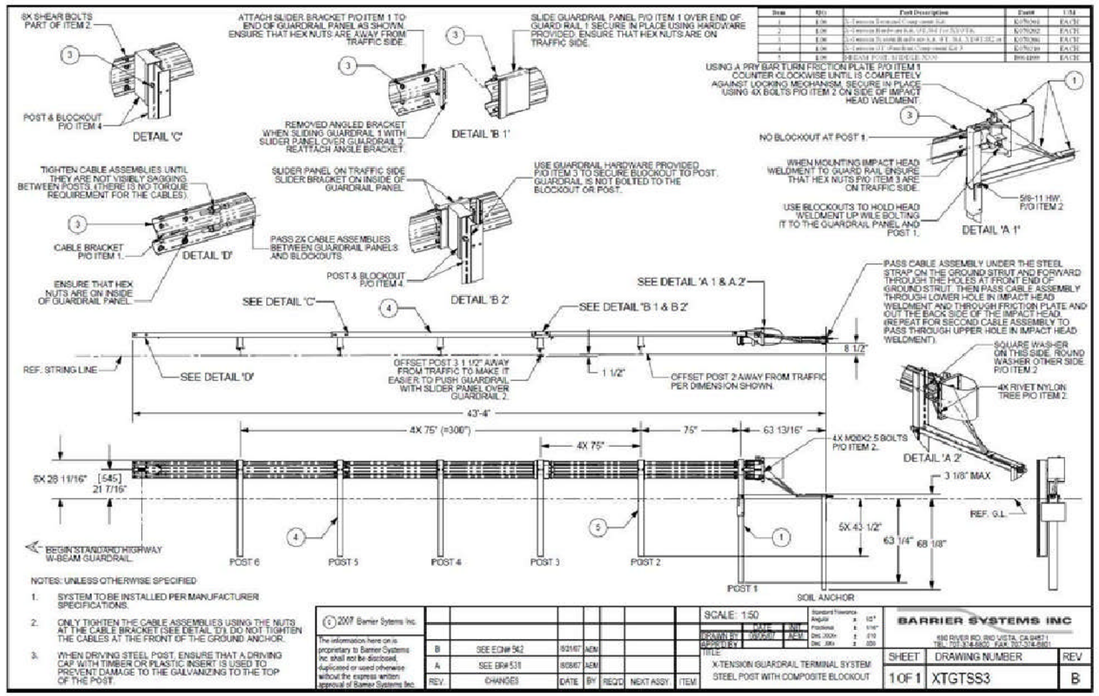
CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH STRUCTURAL PLATE

CONSPAN O SERIES O535 - 35'-0" X 10'-9"
WHITESTONE BOULEVARD CULVERT REPLACEMENT

DOUGLASVILLE, GA

PROJECT No.: 545129	SEQ No.: 000	DATE:
DESIGNED:	DRAWN:	
CHECKED:	APPROVED:	
SHEET NO.: 11 OF 11		



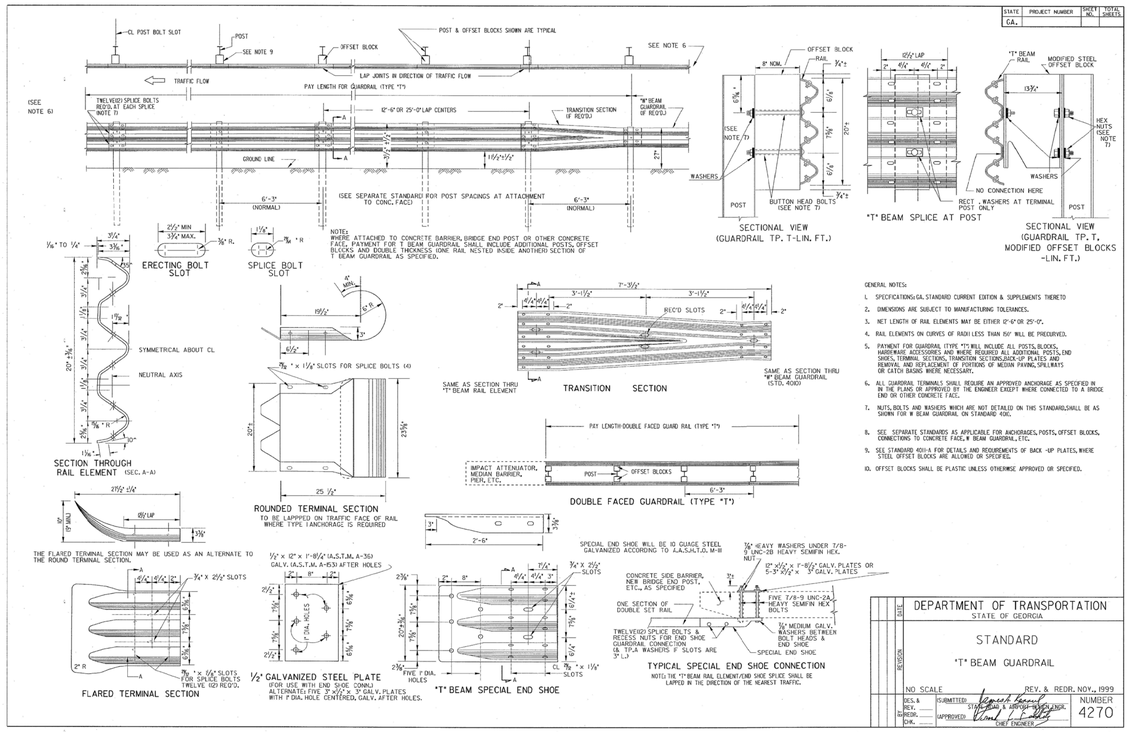
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1	1.00	X-Tension Terminal Component Sub	K979003	EACH
2	1.00	X-Tension Hardware Kit, 31" 3-Strand SYSTEM	K979002	EACH
3	1.00	X-Tension Impact Head Weldment Sub	K979001	EACH
4	1.00	X-Tension 31" Friction Component Sub	K979000	EACH
5	1.00	SYSTEM POST & BRACE SUB	8991899	EACH

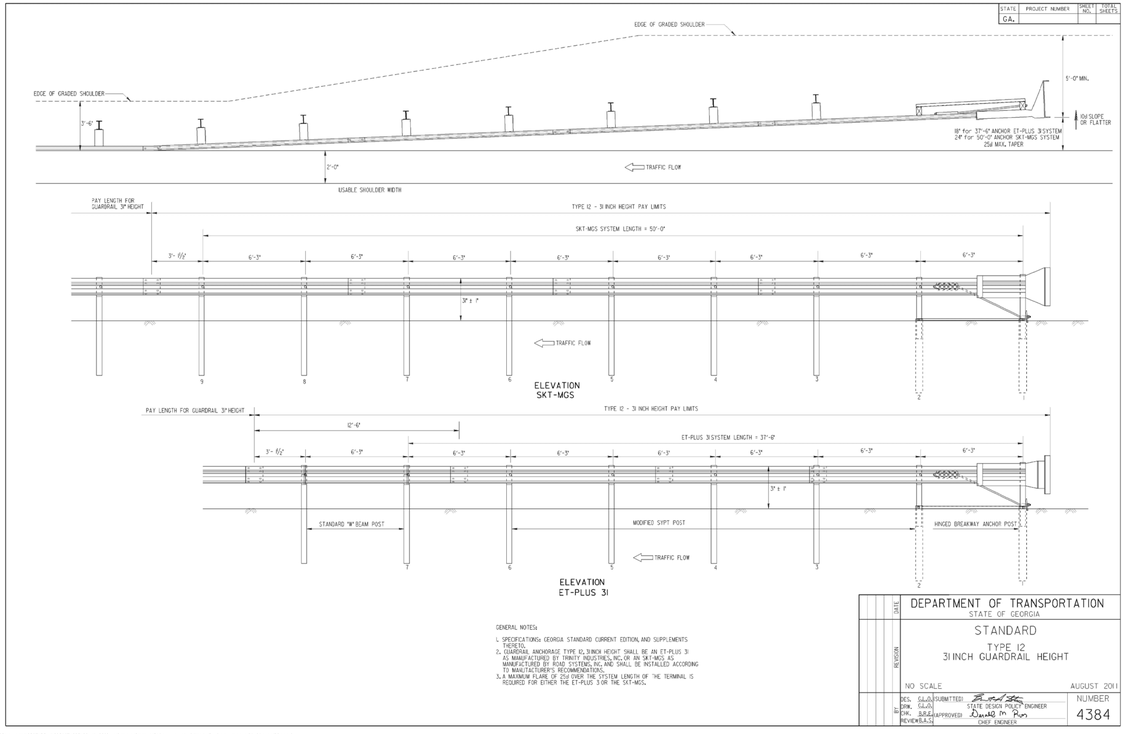
SCALE: 1:50								Standard Tolerance: Angular ± 1/2°	BARRIER SYSTEMS INC
								Fractional ± 1/16"	650 RIVER RD, RIO VISTA, CA 94571
DRAWN BY:	JJT	DATE:	5/11/18					Dec. .XX in ± .010	TEL: (707) 374-6800 FAX: (707) 374-6807
APPROVED BY:	HBR	DATE:	5/11/18					Dec. .XXX ± .005	
TITLE: X-TENSION GUARDRAIL TERMINAL SYSTEM STEEL POST WITH COMPOSITE BLOCKOUT								SHEET: 1 OF 1	DRAWING NUMBER: XTGTSS3	REV: B

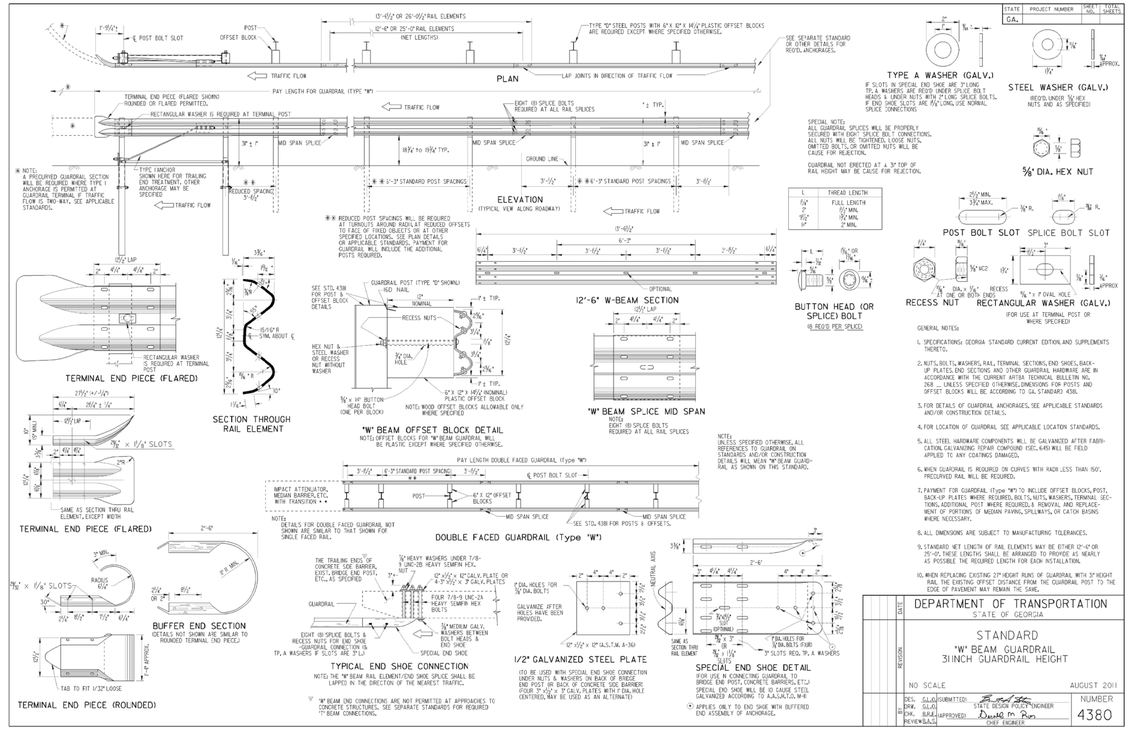
REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY	ITEM
B	SEE ECN# 562	9/21/17	ADM			
A	SEE ER# 531	8/28/17	ADM			

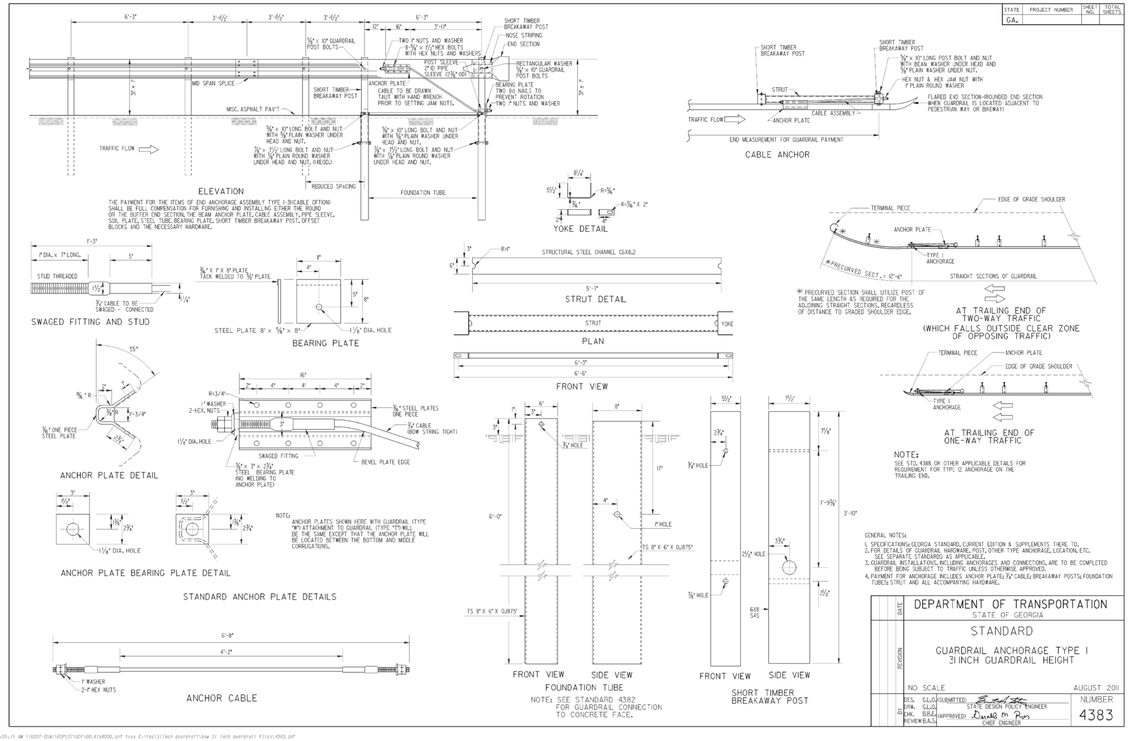
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FOR MORE INFORMATION ON X-TENSION END TREATMENT SYSTEM CONTACT:
STEVEN GARREN
PHONE: 678-237-1109
EMAIL: STEVEN.GARREN@LINDSAY.COM









PREPARED BY:
HUGHES-RAY COMPANY, INC.
ENGINEERS | SURVEYORS | LANDSCAPE ARCHITECTS
6554 EAST CHURCH STREET
DOUGLASVILLE, GEORGIA 30134
p 770.942.0196
f 770.942.0152
www.HughesRay.com

No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

STANDARD CONSTRUCTION DETAILS OF

WHITESTONE BLVD. CULVERT REPLACEMENT

L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

DATE: 5/11/18
DRAWN BY: JJT
CHECKED BY: HBR

JOB#: H15166

CD3

NOTES

GENERAL NOTES:

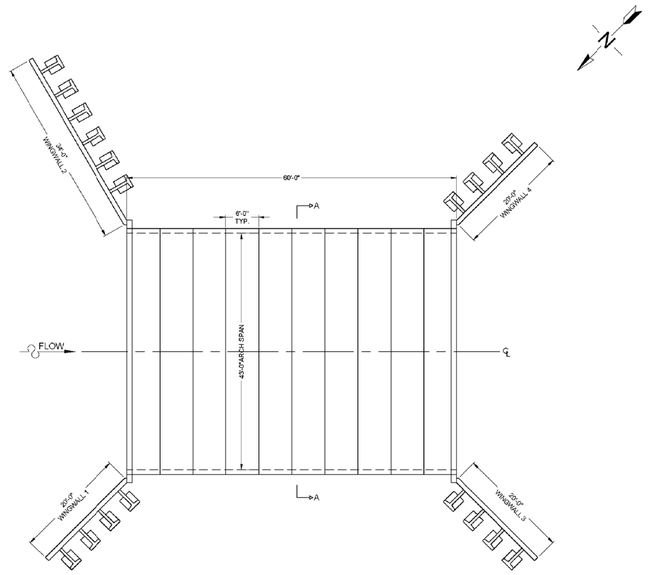
1. THIS BRIDGE HAS BEEN DESIGNED FOR GENERAL SITE CONDITIONS. THE PROJECT ENGINEER SHALL BE RESPONSIBLE FOR THE STRUCTURE'S SUITABILITY TO THE EXISTING SITE CONDITIONS AND FOR THE HYDRAULIC EVALUATION -- INCLUDING SCOUR AND CONFIRMATION OF SOIL CONDITIONS.
2. PRIOR TO CONSTRUCTION, CONTRACTOR MUST VERIFY ALL ELEVATIONS SHOWN THROUGH THE ENGINEER.
3. ONLY CONTECH ENGINEERED SOLUTIONS LLC, THE CONSPAN® APPROVED PRECASTER IN GEORGIA MAY PROVIDE THE STRUCTURE DESIGNED IN ACCORDANCE WITH THESE PLANS.
4. THE USE OF ANOTHER PRECAST STRUCTURE WITH THE DESIGN ASSUMPTIONS USED FOR THE CONSPAN® STRUCTURE MAY LEAD TO SERIOUS DESIGN ERRORS. USE OF ANY OTHER PRECAST STRUCTURE WITH THIS DESIGN AND DRAWINGS VOIDS ANY CERTIFICATION OF THIS DESIGN AND WARRANTY. CONTECH ENGINEERED SOLUTIONS ASSUMES NO LIABILITY FOR DESIGN OF ANY ALTERNATE OR SIMILAR TYPE STRUCTURES.
5. ALTERNATE STRUCTURES MAY BE CONSIDERED, PROVIDED THAT DRAWINGS AND CALCULATIONS SIGNED AND SEALED BY A PROFESSIONAL ENGINEER, REGISTERED IN THE STATE OF GEORGIA , EMPLOYED BY THE PRECAST CONCRETE BRIDGE SUPPLIER, ARE SUBMITTED TO THE ENGINEER 2 WEEKS PRIOR TO THE BID DATE FOR REVIEW AND APPROVAL.
6. ALTERNATE STRUCTURES MAY BE CONSIDERED, PROVIDED THAT THE ALTERNATE DESIGN DOES NOT REDUCE THE HYDRAULIC OPENING OF THE STRUCTURE AS SHOWN ON THE DRAWINGS. AT A MINIMUM THE ALTERNATE STRUCTURE MUST PROVIDE THE SAME OR LARGER SPAN AND RISE AS THE STRUCTURE SHOWN ON THE DRAWINGS.
7. THE PRECAST ARCH SUPPLIER MUST ATTEND THE PRE-BID MEETING, IF ONE IS HELD.
8. SUPPLIER OF PROPOSED ALTERNATES TO A CONSPAN® BRIDGE SYSTEM MUST SUBMIT AT LEAST TWO (2) INDEPENDENTLY VERIFIED FULL SCALE LOAD TESTS THAT CONFIRM THE PROPOSED DESIGN METHODOLOGY OF THE THREE SIDED/ARCH STRUCTURE(S). THE PROPOSED ALTERNATE, UPON SATISFACTORY CONFIRMATION OF DESIGN METHODOLOGY, MAY BE CONSIDERED AN ACCEPTABLE ALTERNATE.
9. PROPOSED ALTERNATE STRUCTURES MAY BE CONSIDERED, PROVIDED THAT THE PRECAST CONCRETE BRIDGE STRUCTURES ARE PROVIDED BY A SUPPLIER THAT HAS A MINIMUM OF TWO (2) REGISTERED PROFESSIONAL ENGINEERS ON STAFF THAT ARE DEDICATED TO THE DESIGN OF THESE TYPES OF STRUCTURES. SUPPLIER MUST PROVIDE THESE NAMES, P.E. LICENSE NUMBERS AND DATES OF HIRE AT TIME OF ALTERNATE SUBMITTAL.
10. CONTECH CONTACT - CHRIS PITTMAN (770) 530-8769

DESIGN DATA

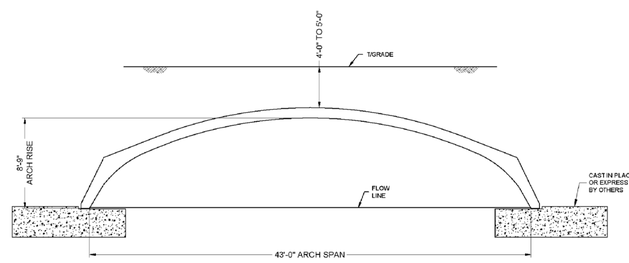
DESIGN LOADING:
BRIDGE UNITS: HL-93
HEADWALLS: EARTH PRESSURE + LL SURCHARGE
WINGWALLS: EARTH PRESSURE + LL SURCHARGE
DESIGN FILL HEIGHT: 4'-0" TO 5'-0"
FROM TOP OF CROWN TO TOP OF PAVEMENT.
DESIGN METHOD: LOAD RESISTANCE FACTOR DESIGN PER AASHTO LRFD SPECIFICATION

MATERIALS

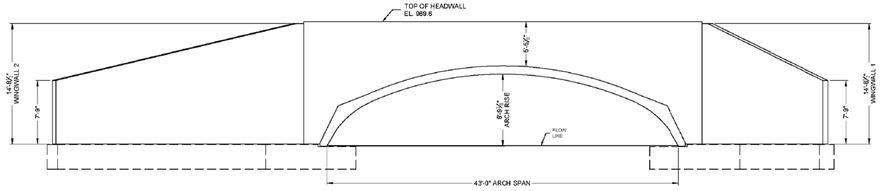
PRECAST UNITS SHALL BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH CONSPAN® SPECIFICATIONS. CONCRETE FOR FOOTINGS SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI. REINFORCING STEEL FOR FOOTINGS SHALL CONFORM TO ASTM A615 OR A996-GRADE 60.



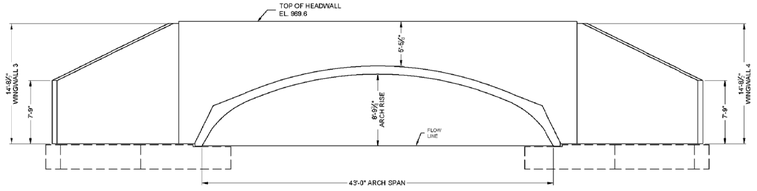
BRIDGE PLAN



CROSS SECTION A-A



INLET END ELEVATION



OUTLET END ELEVATION

The design and information shown on this drawing is provided as a service by the precast concrete structure manufacturer (Contech Engineered Solutions LLC, "Contech"). Contech's sole responsibility is limited to the supply of precast concrete structural components in accordance with these plans and Contech's standard practices. Any use or reliance on the information provided by Contech for any purpose other than that specifically stated in this drawing is at the user's own risk and without liability to Contech. Failure to comply with the above restrictions will be considered misuse of this drawing. Contech assumes no responsibility for the accuracy of dimensions and details on construction drawings not prepared by Contech, unless such dimensions and details are expressly approved in writing by Contech. It is expressly understood that the suggested dimensions upon which Contech's shop drawings are based are subject to verification by the user, engineer of record, or other responsible party to be sure that they are correct and conform to the latest information available for the project. Contech's shop drawings will be prepared in accordance with applicable industry standards. Review and approval of Contech's shop drawings by the user, engineer of record, or other responsible party shall be obtained before any fabrication will be performed. Any errors or omissions noted on the shop drawings by any of the above parties will be corrected before any fabrication will be performed. Contech is responsible only for correcting errors and omissions noted in its shop drawings. Review and approval of Contech's shop drawings shall not include review or approval of any item not fabricated by Contech. Any such review or approval shall not relieve any other party from responsibility for errors or omissions in the plans or other documents it has prepared or approved. Review and approval of Contech's shop drawings by any party shall not relieve any other party of responsibility for complying with applicable requirements, including any requirement to review shop drawings. Contech's bid is based upon the plans, specifications, and other documents made available to Contech at the time of bid. Contech reserves the right to modify its bid after receipt of any changes to the plans, specifications, or other documents. Contech assumes no responsibility for any deficiencies that may appear in such documents that are subsequently corrected by addenda, clarifications, or other written communications issued by the owner or engineer of record prior to Contech's bid. Contech's bid is based upon the scope of work defined by the contract documents available to Contech at the time of bid. Any modifications to the scope of work after award of contract will be subject to negotiation of appropriate adjustments to Contech's contract price and delivery schedule.

NO.	DATE	REVISION DESCRIPTION	BY
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CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONSPAN O-SERIES
PROPOSAL (Shown)

CONSPAN O SERIES O843 - 43'-0" X 8'-9"
WHITESTONE BOULEVARD CULVERT REPLACEMENT
DOUGLASVILLE, GA

PROJECT No.:	BID No.:	DATE:
045129	000	6/8/2017
DESIGNED:	DRAWN:	
	REC	
CHECKED:	APPROVED:	
SHEET NO.: 1 OF 5		

CONSPAN O SERIES O843 - 43'-0" X 8'-9"
WHITESTONE BOULEVARD CULVERT REPLACEMENT
DOUGLASVILLE, GA

PROJECT No.:	BID No.:	DATE:
045129	000	6/8/2017
DESIGNED:	DRAWN:	
	REC	
CHECKED:	APPROVED:	
SHEET NO.: 2 OF 5		

CONSPAN O SERIES O843 - 43'-0" X 8'-9"
WHITESTONE BOULEVARD CULVERT REPLACEMENT
DOUGLASVILLE, GA

PROJECT No.:	BID No.:	DATE:
045129	000	6/8/2017
DESIGNED:	DRAWN:	
	REC	
CHECKED:	APPROVED:	
SHEET NO.: 3 OF 5		

PREPARED BY:
HRC
HUGHES-RAY COMPANY, INC.
ENGINEERS | SURVEYORS | LANDSCAPE ARCHITECTS
6554 EAST CHURCH STREET
DOUGLASVILLE, GEORGIA 30134
p 770.942.0196
f 770.942.0152
www.HughesRay.com

No.	DATE:	REVISION
1	6/22/18	CONSPAN SIZE CHANGE
2	7/10/18	DDCWSA COMMENTS

STANDARD CONSTRUCTION DETAILS
OF
WHITESTONE BLVD. CULVERT REPLACEMENT
L.L. 82, 3rd DISTRICT, 5th SECTION
DOUGLAS COUNTY, GEORGIA

OWNER:
DOUGLAS COUNTY
8700 HOSPITAL DRIVE
DOUGLASVILLE, GA. 30134

DEVELOPER:
SAME AS ABOVE

24 HR. CONTACT:
MIGUEL VALENTIN
770.920.7325

DATE: 5/11/18
DRAWN BY: JJT
CHECKED BY: HBR

JOB#: H15166

CD4

SPECIFICATIONS FOR MANUFACTURE AND INSTALLATION OF CON/SPAN® O-SERIES BRIDGE SYSTEMS

1. DESCRIPTION
   1.1 SCOPE - THIS WORK SHALL CONSIST OF FURNISHING AND CONSTRUCTING A CON/SPAN O-SERIES BRIDGE SYSTEM IN ACCORDANCE WITH THESE SPECIFICATIONS AND IN REASONABLE CLOSE CONFORMITY WITH THE LINES, GRADES, DESIGN AND DIMENSIONS SHOWN ON THE PLANS OR ESTABLISHED BY THE ENGINEER. THE SYSTEM CONSISTS OF TWO OR MORE SPECIFICATIONS APPLY TO THIS WORK, THE MOST STRINGENT REQUIREMENTS SHALL GOVERN.
   1.2 DESIGNATION - PRECAST REINFORCED CONCRETE CON/SPAN O-SERIES BRIDGE UNITS MANUFACTURED IN ACCORDANCE WITH THESE SPECIFICATIONS SHALL BE DESIGNATED AS PRECAST REINFORCED CONCRETE TWINWALLS AND HEADWALLS MANUFACTURED IN ACCORDANCE WITH THIS SPECIFICATION SHALL BE DESIGNATED BY LENGTH, WEIGHT AND WIDTH.

2. DESIGN
   2.1 SPECIFICATIONS - THE PRECAST ELEMENTS ARE DESIGNED IN ACCORDANCE WITH THE "AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS", ADOPTED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, A MINIMUM OF ONE FOOT OF COVER ABOVE THE CROWN OF THE BRIDGE UNITS IS REQUIRED IN THE INSTALLED CONDITION (UNLESS NOTED OTHERWISE ON THE SHOP DRAWINGS AND DESIGNED ACCORDINGLY.)

3. MATERIALS
   3.1 CONCRETE - THE CONCRETE FOR THE PRECAST ELEMENTS SHALL BE AIR-ENTRAINED WHEN INSTALLED IN AREAS SUBJECT TO FREEZING AND THAWING. THE CONCRETE SHALL BE MADE WITH CEMENT, FINE AND COARSE AGGREGATES, ADMIXTURES AND WATER. AIR ENTRAINED CONCRETE SHALL CONTAIN 6 ± 2 PERCENT AIR. THE AIR ENTRAINING ADMIXTURE SHALL CONFORM TO AASHTO M154. THE MINIMUM CONCRETE COMPRESSIVE STRENGTH SHALL BE AS SHOWN ON THE SHOP DRAWINGS.
      3.1.1 PORTLAND CEMENT - SHALL CONFORM TO THE REQUIREMENTS OF ASTM SPECIFICATIONS C150, TYPE I, TYPE II, OR TYPE III CEMENT.
      3.1.2 COARSE AGGREGATE - SHALL CONSIST OF STONE HAVING A MINIMUM DRY ROD WEIGHT OF 90 LBS/CUBIC FOOT AND SHALL BE REGRADED AS PER ASTM C33.
      3.1.3 WATER REDUCING ADMIXTURE - THE MANUFACTURER MAY SUBMIT, FOR APPROVAL BY THE ENGINEER, A WATER REDUCING ADMIXTURE FOR THE PURPOSE OF INCREASING WORKABILITY AND REDUCING THE WATER CONTENT OF THE CONCRETE.
      3.1.4 CALCIUM CHLORIDE - THE ADDITION TO THE MIX OF CALCIUM CHLORIDE OR ADMIXTURES CONTAINING CALCIUM CHLORIDE WILL NOT BE PERMITTED.
      3.1.5 MIXTURE - THE AGGREGATES, CEMENT AND WATER SHALL BE PROPORTIONED AND MIXED IN SUCH A MANNER AS TO PRODUCE A NON-SEGREGATING CONCRETE MEETING THE STRENGTH REQUIREMENTS OF THIS SPECIFICATION. THE PROPORTION OF PORTLAND CEMENT IN THE MIXTURE SHALL NOT BE LESS THAN SIX POUNDS (6 SACKS) PER CUBIC YARD OF CONCRETE.
   3.2 STEEL REINFORCEMENT
      3.2.1 THE MINIMUM STEEL YIELD STRENGTH SHALL BE 60,000 PSI, UNLESS OTHERWISE NOTED ON THE SHOP DRAWINGS.
      3.2.2 ALL REINFORCING STEEL FOR THE PRECAST ELEMENTS SHALL BE FREE FROM LOOSE MILL SCALE AND RUST AND WITH THE EXCEPTION OF DRAWINGS SUBMITTED BY THE MANUFACTURER.
      3.2.3 REINFORCEMENT SHALL CONSIST OF WELDED WIRE REINFORCING CONFORMING TO ASTM SPECIFICATION A 184, DEFORMED BILLET STEEL BARS CONFORMING TO ASTM SPECIFICATION A 615, GRADE 60, CONSTRUCTIONAL STEEL CONFORMING TO ASTM A 36, OR WELDED WIRE FABRIC OF DEFORMED BILLET STEEL BARS.
   3.3 STEEL HARDWARE
      3.3.1 BOLTS AND THREADED RODS FOR WINGWALL CONNECTIONS SHALL CONFORM TO ASTM A 307, NUTS SHALL CONFORM TO ASTM A 563, GRADE A OR GRADE 2H. ALL BOLTS, THREADED RODS AND NUTS USED IN WINGWALL CONNECTIONS SHALL BE MECHANICALLY ZINC COATED IN ACCORDANCE WITH ASTM B695 CLASS 55.
      3.3.2 STRUCTURAL STEEL FOR WINGWALL CONNECTION PLATES SHALL BE HOT DIP GALVANIZED AFTER FABRICATION PER ASTM A 123, GRADE 36 AND SHALL NOT EXCEED 40 PSI AS PER AASHTO M 111 / ASTM A123.
      3.3.3 INSERTS FOR WINGWALLS SHALL BE 1" DIAMETER TWO-BOLT PRESET WINGWALL ANCHORS AS MANUFACTURED BY DAYTON SUPERIOR SPECIALTY CHEMICAL ACCESSORIES, MIAMISBURG, OHIO, (800) 748-3700, AND SHALL BE MECHANICALLY ZINC COATED IN ACCORDANCE WITH ASTM B695 CLASS 55.
      3.3.4 FERRULE LOOP INSERTS SHALL BE F-64 FERRULE LOOP AS MANUFACTURED BY DAYTON SUPERIOR SPECIALTY CHEMICAL ACCESSORIES, MIAMISBURG, OHIO, (800) 748-3700.
      3.3.5 HOOK BOLTS - USED TO ATTACH HEADWALL CONNECTIONS SHALL BE ASTM A307.
      3.3.6 INSERTS FOR CAP-SCAND HEADWALL CONNECTIONS SHALL BE ASTI TYPE 304 STAINLESS STEEL EXPANDED COIL INSERTS AS MANUFACTURED BY DAYTON SUPERIOR CONCRETE ACCESSORIES, MIAMISBURG, OHIO, (800) 748-3700, COIL RODS AND NUTS USED IN HEADWALL CONNECTIONS SHALL BE ASTM 304 STAINLESS STEEL WASHERS USED IN HEADWALL CONNECTIONS SHALL BE EITHER AISI TYPE 304 STAINLESS STEEL PLATE WASHERS OR AASHTO M 270 (ASTM A709) GRADE 36 PLATE WASHERS HOT DIP GALVANIZED AFTER FABRICATION PER ASTM A 123.
      3.3.7 MECHANICAL SPLICES OF REINFORCING BARS SHALL BE MADE USING THE DOWEL BAR SPLICER SYSTEM AS MANUFACTURED BY DAYTON SUPERIOR CONCRETE ACCESSORIES, MIAMISBURG, OHIO, (800) 748-3700, AND SHALL BE IN ACCORDANCE WITH THE CON/SPAN DESIGN AND DETAILS IN GA.

4. MANUFACTURE OF PRECAST ELEMENTS - SUBJECT TO THE PROVISIONS OF SECTION 5, BEGIN THE PRECAST ELEMENT MANUFACTURE TO THE DIMENSIONS, DETAILS, SHALL BE AS PRESCRIBED IN THE PLANS AND SHOP DRAWINGS PROVIDED BY THE MANUFACTURER.
   4.1 FORMS - THE FORMS USED IN THE PRECAST SHALL BE SUFFICIENTLY RIGID AND ACCURATE TO MAINTAIN THE REQUIRED PRECAST ELEMENT DIMENSIONS WITHIN THE TOLERANCES VARYING GIVEN IN SECTION 5 OF THESE SPECIFICATIONS. THE FINAL CASTING SURFACES SHALL BE OF A SMOOTH MATERIAL CAPABLE OF
   4.2 PLACEMENT OF REINFORCEMENT
      4.2.1 PLACEMENT OF REINFORCEMENT IN PRECAST BRIDGE UNITS - THE COVER OF CONCRETE OVER THE OUTSIDE REINFORCEMENT SHALL BE NOT LESS THAN 1" NOR MORE THAN 1-1/2" MINIMUM. THE COVER OF CONCRETE OVER THE CIRCUMFERENTIAL REINFORCEMENT SHALL BE OF SUFFICIENT THICKNESS TO PROVIDE THE MINIMUM COVER SPECIFIED ABOVE FOR THE OUTSIDE REINFORCEMENT. THE CLEAR DISTANCE OF THE END REINFORCEMENT FROM THE ENDS OF THE UNIT SHALL BE NOT LESS THAN 1" NOR MORE THAN 2". THE CLEAR DISTANCE BETWEEN EACH SECTION REINFORCEMENT SHALL BE ASSEMBLED UTILIZING SINGLE OR MULTIPLE LAYERS OF WELDED WIRE FABRIC (NOT TO EXCEED 5 LAYERS), SPIRALLY ORIENTED WITH A SINGLE LAYER OF WELDED WIRE FABRIC OR A COMBINATION OF THE SHOP DRAWINGS.
      4.2.2 BENDING OF REINFORCEMENT - REINFORCEMENT SHALL BE BENT TO SUCH AN ANGLE THAT IS NOT INJURIOUS TO THE MATERIAL. BENDING OF REINFORCEMENT IN PRECAST BRIDGE UNITS - THE OUTSIDE AND INSIDE CIRCUMFERENTIAL REINFORCING STEEL FOR THE CORNERS OF THE BRIDGE SHALL BE BENT TO SUCH AN ANGLE THAT IS CONSISTENT WITH THE SHAPE AND ORIENTATION OF THE REINFORCEMENT.
      4.2.3 PLACEMENT OF REINFORCEMENT IN PRECAST FOOTINGS, WINGWALLS AND HEADWALLS - THE COVER OF CONCRETE OVER THE LONGITUDINAL AND TRANSVERSE REINFORCEMENT SHALL BE NOT LESS THAN THE CLEAR DISTANCE FROM THE END OF EACH PRECAST ELEMENT TO THE END OF REINFORCING STEEL SHALL NOT BE LESS THAN 1½" NOR MORE THAN 2". REINFORCEMENT SHALL BE ASSEMBLED UTILIZING A SINGLE LAYER OF WELDED WIRE FABRIC OR A COMBINATION OF THE SHOP DRAWINGS. THE CLEAR DISTANCE OF THE END REINFORCEMENT SHALL BE NOT LESS THAN 1" NOR MORE THAN 2". THE CLEAR DISTANCE BETWEEN EACH SECTION REINFORCEMENT SHALL BE ASSEMBLED UTILIZING SINGLE OR MULTIPLE LAYERS OF WELDED WIRE FABRIC (NOT TO EXCEED 5 LAYERS), SPIRALLY ORIENTED WITH A SINGLE LAYER OF WELDED WIRE FABRIC OR A COMBINATION OF THE SHOP DRAWINGS.
      4.2.4 PLACEMENT OF REINFORCEMENT IN PRECAST CONCRETE UNITS - TENSION SPLICES - IN THE CIRCUMFERENTIAL REINFORCEMENT SHALL BE MADE BY LAPPING. LAPS MAY BE TACK WELDED TOGETHER FOR ASSEMBLY PURPOSES. FOR SMOOTH WELDED WIRE FABRIC, THE OVERLAP SHALL MEET THE REQUIREMENTS OF AASHTO S1.2.2.5 AND S1.2.6.2. FOR DEFORMED WELDED WIRE FABRIC, THE OVERLAP SHALL MEET THE REQUIREMENTS OF AASHTO S1.2.3.1 AND S1.1.6.1. THE OVERLAP OF WELDED WIRE FABRIC SHALL BE MEASURED BETWEEN THE OUTERMOST LONGITUDINAL WIRES OF EACH FABRIC SHEET. THE OVERLAP OF WELDED WIRE FABRIC SHALL MEET THE REQUIREMENTS OF AASHTO S1.1.2.9 FOR SPLICES OTHER THAN TENSION SPLICES. THE OVERLAP SHALL BE A MINIMUM OF 1½" OR LESS THAN 2" FOR ONE WIRE SPACING CENTER TO CENTER OF THE LONGITUDINAL WIRES PLUS 2" FOR EACH SPACING CENTER TO CENTER OF THE TRANSVERSE WIRES. WELDED WIRE FABRIC SHALL BE NO LESS THAN 2" NOR MORE THAN 4". THE SPACING CENTER TO CENTER OF THE LONGITUDINAL WIRES SHALL BE NO LESS THAN 2" NOR MORE THAN 12". WELDED WIRE FABRIC SHALL BE SUFFICIENTLY RIGID AND ACCURATE TO MAINTAIN THE REQUIRED PRECAST ELEMENT DIMENSIONS WITHIN THE TOLERANCES VARYING GIVEN IN SECTION 5 OF THESE SPECIFICATIONS. THE FINAL CASTING SURFACES SHALL BE OF A SMOOTH MATERIAL CAPABLE OF
   4.3 LAPS, WELDS, AND SPACING FOR PRECAST WINGWALLS, HEADWALLS, FOOTINGS, SPLICES AND OTHER REINFORCEMENT SHALL BE MADE BY LAPPING. LAPS MAY BE TACK WELDED TOGETHER FOR ASSEMBLY PURPOSES. FOR SMOOTH WELDED WIRE FABRIC, THE OVERLAP SHALL MEET THE REQUIREMENTS OF AASHTO S1.2.2.5 AND S1.2.6.2. FOR DEFORMED WELDED WIRE FABRIC, THE OVERLAP SHALL MEET THE REQUIREMENTS OF AASHTO S1.2.3.1 AND S1.1.6.1. THE OVERLAP OF WELDED WIRE FABRIC SHALL BE MEASURED BETWEEN THE OUTERMOST LONGITUDINAL WIRES OF EACH FABRIC SHEET. THE OVERLAP SHALL BE A MINIMUM OF 1½" OR LESS THAN 2" FOR ONE WIRE SPACING CENTER TO CENTER OF THE LONGITUDINAL WIRES PLUS 2" FOR EACH SPACING CENTER TO CENTER OF THE TRANSVERSE WIRES. WELDED WIRE FABRIC SHALL BE NO LESS THAN 2" NOR MORE THAN 4". THE SPACING CENTER TO CENTER OF THE LONGITUDINAL WIRES SHALL BE NO LESS THAN 2" NOR MORE THAN 12". WELDED WIRE FABRIC SHALL BE SUFFICIENTLY RIGID AND ACCURATE TO MAINTAIN THE REQUIRED PRECAST ELEMENT DIMENSIONS WITHIN THE TOLERANCES VARYING GIVEN IN SECTION 5 OF THESE SPECIFICATIONS. THE FINAL CASTING SURFACES SHALL BE OF A SMOOTH MATERIAL CAPABLE OF
   4.4 CURING - THE PRECAST CONCRETE ELEMENTS SHALL BE CURED FOR A SUFFICIENT LENGTH OF TIME BUT THE CONCRETE STRENGTH SHALL NOT BE LESS THAN 70% OF THE SPECIFIED 28 DAYS STRENGTH AT THE TIME OF REMOVAL OF THE ENDS OF CUPRIC OR COMBINATIONS THERE OF SHALL BE USED.
      4.4.1 STEAM CURING - THE PRECAST CONCRETE UNITS MAY BE CURED BY LOW-PRESSURE STEAM CURED BY A SYSTEM THAT WILL PRODUCE A MOIST ATMOSPHERE.
      4.4.2 WATER CURING AND PROTECTION - CONCRETE SHALL BE CURED BY ANY METHOD THAT WILL KEEP THE SECTIONS MOIST.
      4.4.3 MEMBRANE CURING - A CURING MEMBRANE CONFORMING TO THE REQUIREMENTS OF ASTM C309 CLASS B MAY BE USED AS AN ALTERNATIVE METHOD OF CURING. THE MEMBRANE SHALL BE APPLIED TO CONCRETE CONTAINING NO REINFORCEMENT AT A UNIFORM COVERAGE OF NOT LESS THAN ONE GALLON PER 200 SQUARE FEET OF SURFACE AREA. THE TOLERANCES PRESCRIBED IN THIS SPECIFICATION FOR THAT TYPE OF REINFORCEMENT.
   4.5 HANDLING - WINGWALLS AND HEADWALLS SHALL BE CAREFULLY KEPT MOIST PRIOR TO THE APPLICATION OF THE MEMBRANE CURING COMPOUND AND DAMP DURING THE COMPOUND APPLICATION.
   4.6 STORAGE, HANDLING & DELIVERY
      4.6.1 STORAGE - PRECAST CONCRETE BRIDGE ELEMENTS SHALL BE LIFTED AND STORED IN "AS-CAST" POSITION. PRECAST ELEMENTS SHALL BE STORED IN SUCH A MANNER AS TO PREVENT CRACKING AND STAINING. THE UNITS SHALL BE STORED ON SUITABLE SUPPORTS AS APPROPRIATE. THE UNITS SHALL BE STORED WITH THE MARKINGS CLEARLY VISIBLE AND IN SUCH A MANNER THAT THEY MAY BE READILY INSPECTED, AND THEY SHALL NOT BE STORED IN AN UPRIGHT POSITION.
      4.6.2 HANDLING - WINGWALLS AND HEADWALLS SHALL BE LIFTED BY EACH PRECAST ELEMENT FOR THE PURPOSE OF HANDLING THE PRECAST CONCRETE BRIDGE ELEMENTS SHALL BE LIFTED AT THE LIFTING POINTS OF PRECAST CONCRETE BRIDGE UNITS TO PRECLUDE DAMAGE FROM BENDING OR TORSION FORCES.
      4.6.3 DELIVERY - PRECAST CONCRETE ELEMENTS SHALL NOT BE SHIPPED UNTIL THE CONCRETE HAS ATTAINED THE SPECIFIED COMPRESSIVE STRENGTH. THE CONCRETE STRENGTH FOR SHIPMENT OF PRECAST CONCRETE ELEMENTS MAY BE LESS THAN 28 DAYS STRENGTH AS PROVIDED IN THE SPECIFICATIONS.
   4.7 QUALITY ASSURANCE - THE PRECAST PLANT SHALL DEMONSTRATE ADHERENCE TO THIS STANDARDS SET FORTH IN THE NPCA QUALITY CONTROL MANUAL FOR CERTIFIED PLANTS, SECTION 6, "PRODUCTION".
      4.7.1 CERTIFICATION - THE PRECASTER SHALL BE CERTIFIED BY THE PRECAST/PRESTRESSED CONCRETE INSTITUTE PLANT CERTIFICATION PROGRAM OR THE NATIONAL PRECAST CONCRETE ASSOCIATION PLANT CERTIFICATION.
      4.7.2 QUALIFICATIONS, TESTING AND INSPECTION
         4.8.2.1 THE PRECASTER SHALL HAVE BEEN IN THE PRECAST CONCRETE BUSINESS FOR A MINIMUM OF 3 YEARS PRIOR TO THE START OF CONSTRUCTION AND FOR A MINIMUM OF THREE YEARS, HE SHALL MAINTAIN A PERMANENT QUALITY CONTROL DEPARTMENT OR RETAIN AN INDEPENDENT TESTING AGENCY ON A CONTINUING BASIS TO PERFORM QUALITY CONTROL TESTS AND ENGINEERING ANALYSES AND SHALL BE CAPABLE OF DEMAND THE ABILITY OF THE PRECASTER TO PRODUCE QUALITY PRODUCTS CONSISTENT WITH INDUSTRY STANDARDS.
         4.8.2.2 THE PRECASTER SHALL SHOW THAT THE FOLLOWING TESTS ARE PERFORMED IN ACCORDANCE WITH THE PROCEDURES AND METHODS INDICATED. TESTS SHALL BE PERFORMED AS INDICATED IN SECTION 9 OF THESE SPECIFICATIONS
         4.8.2.3 AIR CONTENT, COST OR C173
         4.8.2.2 COMPRESSIVE STRENGTH, C39, C31, C497
         4.8.2.3 THE PRECASTER SHALL PROVIDE DOCUMENTATION DEMONSTRATING COMPLIANCE WITH THIS SECTION
         4.8.2.4 THE PRECASTER SHALL ESTABLISH AND MAINTAIN REGULAR INTERVALS OR UPON REQUEST
         4.8.2.4 THE OWNER MAY PLACE AN INSPECTOR IN THE PLANT WHEN THE PRODUCTS CONFORM TO THIS SPECIFICATION ARE BEING MANUFACTURED.
      4.8.3 DOCUMENTATION - THE PRECASTER SHALL SUBMIT PRECAST ENGINEERED DRAWINGS AND CALCULATIONS ENGINEERED SOLUTIONS AS REQUIRED.

5. REINFORCEMENT
   5.1 DIMENSIONS
      5.1.1 NOMINAL DIMENSIONS - THE NOMINAL DIMENSION SHALL HARY NOT MORE THAN ½ FROM THE DESIGN DIMENSIONS NOR MORE THAN ¼" WHICHEVER IS LESS.
      5.1.2 SLAB LENGTH, THICKNESS - THE SLAB AND WALL THICKNESS SHALL NOT BE LESS THAN THAT SHOWN IN THE DESIGN BY MORE THAN ¼", A DEFICIENCY GREATER THAN THAT REQUIRED IN THE DESIGN SHALL NOT BE CAUSE FOR REJECTION.
      5.1.3 LENGTH OF OPPOSITE SURFACES - VARIATIONS FROM THE LENGTHS OF TWO OPPOSITE SURFACES OF THE BRIDGE UNIT SHALL NOT EXCEED THE VALUES GIVEN IN SECTION 5.1.2 AND 5.1.6.1, EXCEPT DIFFERENCES BEVELED ENDS FOR LAYING OF CURVES SHALL BE EQUAL TO THE BEVEL.
      5.1.4 LENGTH OF SECTION - THE UNDERRUN IN LENGTH OF A SECTION SHALL NOT BE MORE THAN ½" IN ANY BRIDGE UNIT.
      5.1.5 POSITION OF REINFORCEMENT - THE MAXIMUM VARIATION IN POSITION OF THIS REINFORCEMENT SHALL BE ±½". IN NO CASE SHALL THE COVER BE DECREASED BY MORE THAN ½" BELOW THE MINIMUM SPECIFIED. FOR THE OUTSIDE CIRCUMFERENTIAL STEEL AT THE ENDS OF CUPRIC OR COMBINATIONS THERE OF SHALL BE USED.
      4.4.1 STEAM CURING - THE PRECAST CONCRETE UNITS MAY BE CURED BY LOW-PRESSURE STEAM CURED BY A SYSTEM THAT WILL PRODUCE A MOIST ATMOSPHERE.
      4.4.2 WATER CURING AND PROTECTION - CONCRETE SHALL BE CURED BY ANY METHOD THAT WILL KEEP THE SECTIONS MOIST.
      4.4.3 MEMBRANE CURING - A CURING MEMBRANE CONFORMING TO THE REQUIREMENTS OF ASTM C309 CLASS B MAY BE USED AS AN ALTERNATIVE METHOD OF CURING. THE MEMBRANE SHALL BE APPLIED TO CONCRETE CONTAINING NO REINFORCEMENT AT A UNIFORM COVERAGE OF NOT LESS THAN ONE GALLON PER 200 SQUARE FEET OF SURFACE AREA. THE TOLERANCES PRESCRIBED IN THIS SPECIFICATION FOR THAT TYPE OF REINFORCEMENT.
   4.5 HANDLING - WINGWALLS AND HEADWALLS SHALL BE CAREFULLY KEPT MOIST PRIOR TO THE APPLICATION OF THE MEMBRANE CURING COMPOUND AND DAMP DURING THE COMPOUND APPLICATION.
   4.6 STORAGE, HANDLING & DELIVERY
      4.6.1 STORAGE - PRECAST CONCRETE BRIDGE ELEMENTS SHALL BE LIFTED AND STORED IN "AS-CAST" POSITION. PRECAST ELEMENTS SHALL BE STORED IN SUCH A MANNER AS TO PREVENT CRACKING AND STAINING. THE UNITS SHALL BE STORED ON SUITABLE SUPPORTS AS APPROPRIATE. THE UNITS SHALL BE STORED WITH THE MARKINGS CLEARLY VISIBLE AND IN SUCH A MANNER THAT THEY MAY BE READILY INSPECTED, AND THEY SHALL NOT BE STORED IN AN UPRIGHT POSITION.
      4.6.2 HANDLING - WINGWALLS AND HEADWALLS SHALL BE LIFTED BY EACH PRECAST ELEMENT FOR THE PURPOSE OF HANDLING THE PRECAST CONCRETE BRIDGE ELEMENTS SHALL BE LIFTED AT THE LIFTING POINTS OF PRECAST CONCRETE BRIDGE UNITS TO PRECLUDE DAMAGE FROM BENDING OR TORSION FORCES.
      4.6.3 DELIVERY - PRECAST CONCRETE ELEMENTS SHALL NOT BE SHIPPED UNTIL THE CONCRETE HAS ATTAINED THE SPECIFIED COMPRESSIVE STRENGTH. THE CONCRETE STRENGTH FOR SHIPMENT OF PRECAST CONCRETE ELEMENTS MAY BE LESS THAN 28 DAYS STRENGTH AS PROVIDED IN THE SPECIFICATIONS.
   4.7 QUALITY ASSURANCE - THE PRECAST PLANT SHALL DEMONSTRATE ADHERENCE TO THIS STANDARDS SET FORTH IN THE NPCA QUALITY CONTROL MANUAL FOR CERTIFIED PLANTS, SECTION 6, "PRODUCTION".
      4.7.1 CERTIFICATION - THE PRECASTER SHALL BE CERTIFIED BY THE PRECAST/PRESTRESSED CONCRETE INSTITUTE PLANT CERTIFICATION PROGRAM OR THE NATIONAL PRECAST CONCRETE ASSOCIATION PLANT CERTIFICATION.
      4.7.2 QUALIFICATIONS, TESTING AND INSPECTION
         4.8.2.1 THE PRECASTER SHALL HAVE BEEN IN THE PRECAST CONCRETE BUSINESS FOR A MINIMUM OF 3 YEARS PRIOR TO THE START OF CONSTRUCTION AND FOR A MINIMUM OF THREE YEARS, HE SHALL MAINTAIN A PERMANENT QUALITY CONTROL DEPARTMENT OR RETAIN AN INDEPENDENT TESTING AGENCY ON A CONTINUING BASIS TO PERFORM QUALITY CONTROL TESTS AND ENGINEERING ANALYSES AND SHALL BE CAPABLE OF DEMAND THE ABILITY OF THE PRECASTER TO PRODUCE QUALITY PRODUCTS CONSISTENT WITH INDUSTRY STANDARDS.
         4.8.2.2 THE PRECASTER SHALL SHOW THAT THE FOLLOWING TESTS ARE PERFORMED IN ACCORDANCE WITH THE PROCEDURES AND METHODS INDICATED. TESTS SHALL BE PERFORMED AS
         4.8.2.3 AIR CONTENT, COST OR C173
         4.8.2.2 COMPRESSIVE STRENGTH, C39, C31, C497
         4.8.2.3 THE PRECASTER SHALL PROVIDE DOCUMENTATION DEMONSTRATING COMPLIANCE WITH THIS SECTION
         4.8.2.4 THE PRECASTER SHALL ESTABLISH AND MAINTAIN REGULAR INTERVALS OR UPON REQUEST
         4.8.2.4 THE OWNER MAY PLACE AN INSPECTOR IN THE PLANT WHEN THE PRODUCTS CONFORM TO THIS SPECIFICATION ARE BEING MANUFACTURED.
      4.8.3 DOCUMENTATION - THE PRECASTER SHALL SUBMIT PRECAST ENGINEERED DRAWINGS AND CALCULATIONS ENGINEERED SOLUTIONS AS REQUIRED.

6. REINFORCEMENT
   6.1 DIMENSIONS
      6.1.1 NOMINAL DIMENSIONS - THE NOMINAL DIMENSION SHALL HARY NOT MORE THAN ½ FROM THE DESIGN DIMENSIONS NOR MORE THAN ¼" WHICHEVER IS LESS.
      6.1.2 SLAB LENGTH, THICKNESS - THE SLAB AND WALL THICKNESS SHALL NOT BE LESS THAN THAT SHOWN IN THE DESIGN BY MORE THAN ¼", A DEFICIENCY GREATER THAN THAT REQUIRED IN THE DESIGN SHALL NOT BE CAUSE FOR REJECTION.
      6.1.3 LENGTH OF OPPOSITE SURFACES - VARIATIONS FROM THE LENGTHS OF TWO OPPOSITE SURFACES OF THE BRIDGE UNIT SHALL NOT EXCEED THE VALUES GIVEN IN SECTION 6.1.2 AND 6.1.6.1, EXCEPT DIFFERENCES BEVELED ENDS FOR LAYING OF CURVES SHALL BE EQUAL TO THE BEVEL.
      6.1.4 LENGTH OF SECTION - THE UNDERRUN IN LENGTH OF A SECTION SHALL NOT BE MORE THAN ½" IN ANY BRIDGE UNIT.
      6.1.5 POSITION OF REINFORCEMENT - THE MAXIMUM VARIATION IN POSITION OF THIS REINFORCEMENT SHALL BE ±½". IN NO CASE SHALL THE COVER BE DECREASED BY MORE THAN ½" BELOW THE MINIMUM SPECIFIED. FOR THE OUTSIDE CIRCUMFERENTIAL STEEL AT THE ENDS OF CUPRIC OR COMBINATIONS THERE OF SHALL BE USED.
      6.1.6 AREA OF REINFORCEMENT - THE AREAS OF STEEL REINFORCEMENT SHALL BE IN EXCESS OF THE AREAS AS SHOWN IN THE MANUFACTURER'S SHOP DRAWINGS. STEEL AREAS SHALL NOT BE LESS THAN THOSE SHOWN BY MORE THAN 5%. THE DEFICIENCY GREATER THAN THAT REQUIRED CONCRETE COMPRESSIVE STRENGTH IS ATTAINED. TOLERANCES PRESCRIBED IN THIS SECTION FOR THAT TYPE OF REINFORCEMENT.
   6.2 WINGWALLS, HEADWALLS, FOOTINGS
      5.2.1 WALL THICKNESS - THE WALL THICKNESS SHALL NOT VARY MORE THAN ¼" FROM THE DESIGN DIMENSIONS.
      5.2.2 HEIGHT OF WALL SECTIONS - THE LENGTH AND HEIGHT OF THE WALL SHALL NOT VARY FROM THAT SHOWN IN THE DESIGN BY MORE THAN ½".
      5.2.3 POSITION OF REINFORCEMENT - THE MAXIMUM VARIATION IN THE LOCATION OF THE REINFORCEMENT SHALL BE ±½". IN NO CASE SHALL THE COVER BE DECREASED BY MORE THAN ½" BELOW THE MINIMUM SPECIFIED.
      5.2.4 SIZE OF REINFORCEMENT - THE PERMISSIBLE VARIATION IN DIAMETER OF ANY REINFORCING SHALL CONFORM TO THE TOLERANCES GIVEN IN SECTION 5.2.3. DIMENSIONS USING TWIRER SUPPORTS AS APPROPRIATE. THE UNITS SHALL BE STORED WITH THE MARKINGS CLEARLY VISIBLE AND IN SUCH A MANNER THAT THEY MAY BE READILY INSPECTED, AND THEY SHALL NOT BE STORED IN AN UPRIGHT POSITION.
   6.3 HANDLING - WINGWALLS AND HEADWALLS SHALL BE CAREFULLY KEPT MOIST PRIOR TO THE APPLICATION OF THE MEMBRANE CURING COMPOUND AND DAMP DURING THE COMPOUND APPLICATION.
   6.4 STORAGE, HANDLING & DELIVERY
      6.4.1 STORAGE - PRECAST CONCRETE BRIDGE ELEMENTS SHALL BE LIFTED AND STORED IN "AS-CAST" POSITION. PRECAST ELEMENTS SHALL BE STORED IN SUCH A MANNER AS TO PREVENT CRACKING AND STAINING. THE UNITS SHALL BE STORED ON SUITABLE SUPPORTS AS APPROPRIATE. THE UNITS SHALL BE STORED WITH THE MARKINGS CLEARLY VISIBLE AND IN SUCH A MANNER THAT THEY MAY BE READILY INSPECTED, AND THEY SHALL NOT BE STORED IN AN UPRIGHT POSITION.
      6.4.2 HANDLING - WINGWALLS AND HEADWALLS SHALL BE LIFTED BY EACH PRECAST ELEMENT FOR THE PURPOSE OF HANDLING THE PRECAST CONCRETE BRIDGE ELEMENTS SHALL BE LIFTED AT THE LIFTING POINTS OF PRECAST CONCRETE BRIDGE UNITS TO PRECLUDE DAMAGE FROM BENDING OR TORSION FORCES.
      6.4.3 DELIVERY - PRECAST CONCRETE ELEMENTS SHALL NOT BE SHIPPED UNTIL THE CONCRETE HAS ATTAINED THE SPECIFIED COMPRESSIVE STRENGTH. THE CONCRETE STRENGTH FOR SHIPMENT OF PRECAST CONCRETE ELEMENTS MAY BE LESS THAN 28 DAYS STRENGTH AS PROVIDED IN THE SPECIFICATIONS.
   6.5 QUALITY ASSURANCE - THE PRECAST PLANT SHALL DEMONSTRATE ADHERENCE TO THIS STANDARDS SET FORTH IN THE NPCA QUALITY CONTROL MANUAL FOR CERTIFIED PLANTS, SECTION 6, "PRODUCTION".
      6.5.1 CERTIFICATION - THE PRECASTER SHALL BE CERTIFIED BY THE PRECAST/PRESTRESSED CONCRETE INSTITUTE PLANT CERTIFICATION PROGRAM OR THE NATIONAL PRECAST CONCRETE ASSOCIATION PLANT CERTIFICATION.
      6.5.2 QUALIFICATIONS, TESTING AND INSPECTION
         6.8.2.1 THE PRECASTER SHALL HAVE BEEN IN THE PRECAST CONCRETE BUSINESS FOR A MINIMUM OF 3 YEARS PRIOR TO THE START OF CONSTRUCTION AND FOR A MINIMUM OF THREE YEARS, HE SHALL MAINTAIN A PERMANENT QUALITY CONTROL DEPARTMENT OR RETAIN AN INDEPENDENT TESTING AGENCY ON A CONTINUING BASIS TO PERFORM QUALITY CONTROL TESTS AND ENGINEERING ANALYSES AND SHALL BE CAPABLE OF DEMAND THE ABILITY OF THE PRECASTER TO PRODUCE QUALITY PRODUCTS CONSISTENT WITH INDUSTRY STANDARDS.
         6.8.2.2 THE PRECASTER SHALL SHOW THAT THE FOLLOWING TESTS ARE PERFORMED IN ACCORDANCE WITH THE PROCEDURES AND METHODS INDICATED. TESTS SHALL BE PERFORMED AS
         6.8.2.3 AIR CONTENT, COST OR C173
         6.8.2.2 COMPRESSIVE STRENGTH, C39, C31, C497
         6.8.2.3 THE PRECASTER SHALL PROVIDE DOCUMENTATION DEMONSTRATING COMPLIANCE WITH THIS SECTION
         6.8.2.4 THE PRECASTER SHALL ESTABLISH AND MAINTAIN REGULAR INTERVALS OR UPON REQUEST
         6.8.2.4 THE OWNER MAY PLACE AN INSPECTOR IN THE PLANT WHEN THE PRODUCTS CONFORM TO THIS SPECIFICATION ARE BEING MANUFACTURED.
      6.8.3 DOCUMENTATION - THE PRECASTER SHALL SUBMIT PRECAST ENGINEERED DRAWINGS AND CALCULATIONS ENGINEERED SOLUTIONS AS REQUIRED.

7. JOINTS
   7.1 GROUTED JOINTS - THE WALL THICKNESS SHALL NOT VARY MORE THAN ¼" FROM THE DESIGN DIMENSIONS.
   7.2 HEIGHT OF WALL SECTIONS - THE LENGTH AND HEIGHT OF THE WALL SHALL NOT VARY FROM THAT SHOWN IN THE DESIGN BY MORE THAN ½".
   7.3 POSITION OF REINFORCEMENT - THE MAXIMUM VARIATION IN THE LOCATION OF THE REINFORCEMENT SHALL BE ±½". IN NO CASE SHALL THE COVER OVER THE REINFORCEMENT BE LESS THAN ½".
   7.4 SIZE OF REINFORCEMENT - THE PERMISSIBLE VARIATION IN DIAMETER OF ANY REINFORCING SHALL CONFORM TO THE TOLERANCES GIVEN IN SECTION 7.3. DIMENSIONS USING TWIRER SUPPORTS AS APPROPRIATE.
   7.5 HANDLING - WINGWALLS AND HEADWALLS SHALL BE CAREFULLY KEPT MOIST PRIOR TO THE APPLICATION OF THE MEMBRANE CURING COMPOUND AND DAMP DURING THE COMPOUND APPLICATION.
   7.6 STORAGE, HANDLING & DELIVERY
      7.6.1 STORAGE - PRECAST CONCRETE BRIDGE ELEMENTS SHALL BE LIFTED AND STORED IN "AS-CAST" POSITION. PRECAST ELEMENTS SHALL BE STORED IN SUCH A MANNER AS TO PREVENT CRACKING AND STAINING. THE UNITS SHALL BE STORED ON SUITABLE SUPPORTS AS APPROPRIATE. THE UNITS SHALL BE STORED WITH THE MARKINGS CLEARLY VISIBLE AND IN SUCH A MANNER THAT THEY MAY BE READILY INSPECTED, AND THEY SHALL NOT BE STORED IN AN UPRIGHT POSITION.
      7.6.2 HANDLING - WINGWAL