

**Technical Specifications  
for  
The Replacement and Renovation  
Of the  
South Mills Reclaimed Water Irrigation Storage Lagoon Liner**

Camden County, North Carolina

***Prepared for:***

The County of Camden  
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### EXISTING FACILITY PERMIT

THE COUNTY EXPRESSLY DISCLAIMS ANY AND ALL IMPLIED WARRANTIES ASSOCIATED WITH THIS CONTRACT AND IN PARTICULAR ANY SUCH WARRANTIES RELATED TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR THAT THE DESIGN SPECIFICATIONS AND PLANS PROVIDED FOR THE PROJECT ARE SUITABLE AND ADEQUATE TO PRODUCE THE INTENDED PRODUCT. BY BIDDING ON AND ENTERING INTO THIS CONTRACT, CONTRACTOR EXPRESSLY WARRANTS THAT IT HAS CONSIDERED THE DESIGN SPECIFICATIONS AND PLANS FOR THE PROJECT, THAT THE CONTRACTOR CAN PERFORM THE PROJECT PURSUANT TO THE DESIGN SPECIFICATIONS AND PLANS IN A MANNER CONSISTENT WITH THE REQUIREMENTS OF THIS CONTRACT, THAT THE DESIGN SPECIFICATIONS AND PLANS ARE SUITABLE AND ADEQUATE, AND THAT THE COUNTY SHALL HAVE NO LIABILITY TO THE CONTRACTOR FOR ANY ALLEGED OR ACTUAL DEFECTS IN THE DESIGN SPECIFICATIONS OR PROJECT PLANS.

# Division 1

STANDARD CONSTRUCTION SPECIFICATIONS  
DIVISION I

## GENERAL REQUIREMENTS

## 1. DEFINITIONS AND ABBREVIATIONS

Unless otherwise defined in the Contract Documents, the following definitions and abbreviations shall apply whenever used. The words directed, required, permitted, ordered, requested, constructed, designated, considered, necessary, prescribed, approved, acceptable, satisfactory, or words of like import, refer to actions, expressions and prerogatives of the Engineer.

## 1.01 Definitions

**Acceptance of Work** - All work required by the Contract Documents will be considered accepted upon official action by the Camden County Board of Commissioners of the Camden County. In order to qualify for acceptance, all work specified in the Contract Documents must be completed unless specifically deleted by Contract change orders.

**Acts of God** - An act of God is to be construed to mean an earthquake, flood, cloudburst, tornado, hurricane or other phenomenon of nature of catastrophic proportions or intensity.

**Addenda** - Supplemental written specifications or drawings issued prior to execution of the Contract which modify or interpret the Contract Documents by addition, deletion, clarification or correction.

**Advertisement** - The public announcement inviting bids for work to be performed or materials to be furnished.

**Approved Equal** - A product, component or process whose use in or on a particular project is specified as a standard for comparison purposes only. The "equal" product, component, or process, shall be the same or better than that named in function, performance, reliability, quality, and general configuration. Determination of equality in reference to the project design requirements will be made by the Engineer, pursuant to Subsection 6.07. Whenever a manufacturer's name brand or model is mentioned, it is to be understood that the phrase "approved equal" is assumed to follow thereafter, whether it does in fact or not.

**Attorney** - The County Attorney of the Camden County, North Carolina.

**Bid** - A Proposal.

**Bid Bond** - The bond required to be submitted with each Proposal, as described in the Proposal Form as a Proposal Guaranty, which assures that the Bidder will enter into a Contract if his Proposal is accepted.

**Bidder** - Any individual, firm, co-partnership, corporation, or combination thereof, submitting a Proposal in response to the advertisement calling for Bids on the work contemplated either directly or through a duly authorized representative.

**Change Order** - A written order, issued by Engineer to the Contractor, covering changes in either the Plans, specifications or quantities within the scope of the Contract after award and as further described in Subsections 4.05 and 4.06.

**Contract** - The written agreement covering the performance of the work and the furnishing of labor, materials, tools and equipment and construction of the work for the Project. The Contract shall include the Contract Documents, , certificates of insurance (as specified in Section 7.06 below), and Performance Bond and Payment Bond (as specified in the Proposal Form); also any and all supplemental agreements amending or extending the work completed which may be required to complete the work in a substantial and acceptable manner. Supplemental agreements are written agreements covering alterations or amendments or extensions to the Contract and include Contract change orders.

**Contract Documents** – Those documents identified in Section 4.03.A.

**Contract Item** - A specific unit of work for which a price or basis of payment is provided in the Contract.

**Contract Form** – That certain document entitled “Contract for South Mills Reclaimed Water Storage Lagoon Membrane Replacement Project” to be executed by and between the County and Contractor after the award of the Contract to the Contractor but before work under the Contract begins.

**Contract Price** - Either the unit prices or lump sum price or prices named in the Proposal or in properly executed change orders.

**Contract Time** – This term is defined in Section 8.04, below.

**Contract Review Board** - The Camden County Camden County Board of Commissioners is the Contract Review Board.

**Contract Time** - The number of days stated in the Contract Documents for the completion of the work.

**Contractor** - Any individual, firm, co-partnership, corporation or any combination thereof, who has or have entered into a Contract with the County for a particular project. Unless context clearly requires otherwise, the term Contractor shall be deemed to refer to the Contractor who entered into the Contract to perform work under the Project.

**County** - The County of Camden, North Carolina, acting through its legally constituted Camden County Board of Commissioners or, when so delegated or authorized, through its Owner. The term Owner is synonymous with the term County.

**Day** - Unless otherwise designated, days as used in these Standard Specifications will be understood to mean working days. A working day is any and every day shown on the calendar, excluding Saturdays, Sundays and legal holidays.

**Department of Public Works** - The Department of Public Works of the Camden County, North Carolina, acting directly or through properly authorized officials, employees and agents limited to the particular duties entrusted to them.

**Easements** - The right to use the property of another for a specific purpose or purposes as set forth in a document.

**Engineer** - The engineer or Environmental Permitting Consultant who represents the Owner, who shall perform his work under the direction of the Owner and, with the approval of the County, may perform such work through properly authorized officials, employees and agents limited to the particular duties entrusted to them.

**Equipment** - The machinery, accessories, appurtenances, and manufactured articles to be furnished and/or installed under the Contract.

**Improvement** - General term encompassing all phases of work to be performed under the Contract and is synonymous to the term project.

**Inspector** - The authorized representative of the Engineer whose instructions and decisions shall be limited to the particular duties and responsibilities entrusted to him and making detailed inspections of any or all portions of the work or materials therefore.

**Lump Sum** - A method of payment providing for one all-inclusive payment for the work described to be done, complete and accepted without further measurement, as such work is covered under the applicable lump sum pay item.

**Notice** - A written communication delivered by hand or by mail to the authorized individual, member of the firm, or officer of the corporation for which it is intended. If delivered or sent by mail, it shall be addressed to the last known business address of the individual firm or corporation. In the case of a Contract with two or more persons, firms, or corporations performing work under such Contract, notice to one shall be deemed notice to all.

**NCDOT Standard Specifications** - The latest addition of the Specification Document published by the State of North Carolina entitled Standard Specifications for Roads and Structures - North Carolina Department of Transportation. This document is available from the North Carolina Department of Transportation, Raleigh, North Carolina.

**Owner** - The County of Camden, North Carolina, acting through its legally constituted Camden County Board of Commissioners. The term Owner is synonymous with the term County.

**Pavement** - The uppermost layer of material placed on the traveled way or shoulders. This term is used interchangeably with surfacing.

**Performance Bond and Payment Bond** - The Bonds submitted by the Contractor and his surety, as specified in the Contract and as more fully described in the Proposal Form.

**Plans** - The official Project Plans and Standard Plans, profiles, cross-sections, elevations, details and other working supplementary detail drawings or reproductions thereof approved by the Engineer which show the location, character, dimensions, and details of the work to be performed.

Plans may either be bound in the same book as the balance of the Contract Documents or bound in separate sets and all are a part of the Contract Documents regardless of the method of binding.

In the above definitions, the following terms are defined:

A) **Standard Plans** - Details of structures, devices or instructions adopted by County as a standard and referred to in the Contract Documents.

B) **Project Plans** - Specific details and dimensions peculiar to the work and are supplemented by the Standard Plans insofar as the same may apply.

**Project** - General term encompassing all phases of the Work to be performed under the Contract and is synonymous to the term improvement.

**Proposal** - The offer of a Bidder, submitted on Owner's official Proposal Form, to perform stated work at the prices quoted in such Proposal. The term Bid is synonymous with the term Proposal.

**Proposal Form** - That certain document entitled "Proposal", which describes the procedures for bidding on the "North Dune Loop Drainage and Street Repair Project" and the possible awarding of a contract for said project, as said document is considered prior to completion by a Bidder.

**Proposal Guaranty (Bid Bond)** - The security furnished with a Proposal to ensure that the Bidder will enter into the Contract if his Proposal is accepted.

**Provide** - When related to an item of work, the word 'provide' shall be understood to mean furnish and install the work complete in place.

**Reference Specifications** - Bulletins, standards, rules, methods of analysis or test, codes and specifications of other agencies, engineering societies or industrial associations referred to in the Contract Documents. All such references specified herein refer to the latest edition thereof, including any amendments thereto which are in effect and published at the time of advertising for Bids, or of issuing the permit for the project.

**Right-of-Way** - A general term denoting public land, property or interest therein acquired for or devoted to a public street, public access or public use.

**Roadway** - That portion of the street and its appurtenances between curbs, gutters, or ditches primarily used for vehicular traffic.

**Scheduled Closing Time** - The time and date as set forth in the Request for Bids or any extensions thereof provided by addenda.

**Shop Drawings** - Supplementary plans or data which the Contract requires the Contractor to submit to the Engineer explaining equipment, methods and materials proposed for use.

**Shown** - As used herein, the word shown, or as shown, shall be understood to refer to work shown on the Plans in the Contract Documents.

**Special Provisions** - Requirements peculiar to the project and changes and modifications to the Standard Specifications.

**Specifications** – the Standard Specifications.

**Specified** - As used herein, the word specified or as specified means as required by the Contract Documents.

**Standard Specifications** - The terms, directions, provisions and requirements set forth herein.

**Station** - A distance of 100 feet measured horizontally along the established centerline of the street, sewer, waterway, canal or other work, unless specified otherwise.

**Street** - Any street, avenue, boulevard, alley, lane, bridge, bicycle path, road, public thoroughfare or public way and any land over which a right-of-way has been obtained or granted for the purpose of public travel.

**Subcontractor** - An individual, partnership, firm, corporation or any combination thereof to whom the Contractor sublets part of the Contract.

**Surety** - Any firm or corporation authorized in the State of North Carolina executing a surety bond or bonds payable to the County securing the performance of the Contract either in whole or in part.

**Ton** - A short ton of 2000 lbs.

**Unit Price** - A Contract item of work providing for payment based on an existing unit of measurement; e.g. linear foot or cubic yard.

**Use of Pronoun** - As used herein, the singular shall include the plural, and the plural the singular; any masculine pronoun shall include the feminine or neuter gender; and the term 'person' includes natural person or persons, firms, co-partnerships, corporations, or associations or combinations thereof.

**Utility** - Tracks, overhead or underground wires, pipelines, conduits, ducts, or structures owned, operated or maintained in or across the public right-of-way or easement.

**Work** - All material, labor, tools, plant, vessels, equipment and all appliances, machinery, transportation or appurtenances necessary to perform and complete the Contract and such additional items not specifically indicated or described which can be reasonably inferred as belonging to the item described or indicated and as required by good practice to provide a complete and satisfactory system or structure.

## 1.02 ABBREVIATIONS

AAN American Association of Nurserymen

AASHTO American Association of State Highway and Transportation Officials

ACI American Concrete Institute

AGA American Gas Association

AED Associated Equipment Distributors

AGC Associated General Contractors of America

AIA American Institute of Architects

AISC American Institute of Steel Construction

AISI American Iron and Steel Institute

ANSI American National Standards Institute, Inc.  
APWA American Public Works Association  
ASCE American Society of Civil Engineers  
ASLA American Society of Landscape Architects  
ASME American Society of Mechanical Engineers  
ASTM American Society for Testing and Materials  
AWPA American Wood Preservers Association  
AWS American Welding Society  
AWWA American Water Works Association  
CRSI Concrete Reinforced Steel Institute  
DCM Division of Coastal Management NCDENR  
DWQ Division of Water Quality NCDENR  
EPA Environmental Protection Agency  
FHWA Federal Highway Administration, US Department of Transportation  
FSS Federal Specification and Standards, General Services Administration  
GS General Statutes of North Carolina  
ITE Institute of Traffic Engineers  
NEC National Electrical Code  
NEMA National Electrical Manufacturer's Association  
NLMA National Lumber Manufacturer's Association  
NCAC North Carolina Administrative Code  
NCDENR North Carolina Department of Environment and Natural Resources  
NCDOT North Carolina Department of Transportation  
OSHA Occupational Safety and Health Administration  
PCA Portland Cement Association  
UL Underwriter's Laboratories, Inc.  
USASI United States of America Standards Institute  
USACE United States Army Corp of Engineers

## 2. PROPOSAL REQUIREMENTS

The proposal requirements are contained the Proposal Form.

## 3. AWARD AND EXECUTION OF CONTRACT

Provisions relating to the award and execution of the Contract are provided in the Proposal Form.

## 4. SCOPE OF WORK

### 4.01 Scope of Work

A. Reclaim Water Storage Irrigation Lagoon Membrane Liner Replacement and Renovation in accordance with the following plan sheets:

1. Plan sheet entitled "Wastewater Treatment Facilities, Camden Village Core Project, South Mills Township, Camden County, North Carolina, Contract #2 WWTP, 59-day Storage Pond" as prepared by Hobbs, Upchurch & Associates, P.A., sealed by James H. Bowen, PE, plan sheet number CII.2C, G-2, dated February 2006 with a record drawing stamp date of 1/24/2008.

2. Plan sheet entitled “Wastewater Treatment Facilities, Camden Village Core Project, South Mills Township, Camden County, North Carolina, Contract #2 WWTP, 59-day Storage Lagoon Details” as prepared by Hobbs, Upchurch & Associates, P.A., sealed by James H. Bowen, PE, plan sheet number CII.2C, G-3, dated February 2006 with a record drawing stamp date of 1/24/2008.
3. Plan sheet entitled “Wastewater Treatment Facilities, Camden Village Core Project, South Mills Township, Camden County, North Carolina, Contract #2 WWTP, Storage Lagoon Details” as prepared by Hobbs, Upchurch & Associates, P.A., sealed by James H. Bowen, PE, plan sheet number CII.2C, G-4, dated February 2006 with a record drawing stamp date of 1/24/2008.

#### 4.02 Plans and Specifications

- A. Plans, Specifications and other Contract Documents will govern the work to be done. Anything mentioned in the Specifications and not shown on the Plans and detailed drawings, or anything shown on the Plans and not mentioned in the Specifications, shall be of like effect as though shown or mentioned in both. Specifications and Plans referred to in any of the Contract Documents shall be considered as being included in the document in which such reference is made. When a particular standard or specification is referred to in the Contract Documents, such reference shall be to the standard or specification including officially adopted revisions or amendments thereto which are in force at the time of advertising for Bids, unless otherwise provided, in writing, by the Town.

#### 4.03 Precedence of Contract Documents

- A. The Contract shall be composed of each and every one of the following listed component parts and all approved revisions thereto (collectively, the “Contract Documents”):
  1. Change Orders
  2. Contract Form
  3. Addenda to the Special Provisions
  4. Special Provisions
  5. Addenda to Standard Specifications
  6. Standard Specifications
  7. Plans
  8. Drawings
  9. Instructions to Bidders contained in the Proposal Form.
  10. Proposal

#### 4.04 Conflict of Provisions

- A. In the event of any conflicting provisions or requirements between the component parts of this Contract, the component part having the lowest number, as established in Subsection 4.04 above, shall govern.

- B. Conflicting provisions or requirements in the Contract Documents shall in no way relieve the performance bond and public liability insurance of their respective and specific protection to the Contractor, provided, however, that the sequence provided in Section 4.04 does not conflict with the intent of or harm the product or work in any way. In case of such conflict which would alter the intent of or harm the product or work, the requirement which, in the opinion of the Engineer or County, will result in the best product or work will govern. It is hereby agreed that the entire project shall be completed in accordance with the full intent of the Contract, regardless of conflicting statements, omissions, or errors. The intent of the drawings and Specifications is to outline and control the work in a manner necessary to result in the best completely finished product practicable, at a minimum cost, incorporating all items. Any omissions in the Plans and Specifications pertinent to the requirements of the specified items are unintentional. If such are found, the Contractor will be required to perform the work in a customary workmanlike manner to achieve the intent as stated above, and the Engineer or County will make his or its decisions to be equitable to all concerned. To accomplish the intent of this Contract, the Contractor will be required to maintain adequate competent supervisory personnel on the project at all times, to be responsible for all work being done in accordance with the intent of the Plans and Specifications, whether or not the Engineer is, or is not, present. Should the Engineer or his authorized representative find faulty work on any item at any time in the Contract, he shall so inform the Contractor and the Contractor will be required to correct such work by completely removing and replacing, if necessary, all to the satisfaction of the Engineer or County, and at no cost to the Owner.
- C. It shall be definitely understood that omissions of one or more of the documents comprising the Contract Documents shall not be construed as conflicting provisions. Any requirement given in one documents comprising the Contract Document shall be known to be binding as though it is repeated in all Documents alike. The intent of the Contract is to combine all requirements of all documents comprising the Contract Documents into one.

#### 4.05 Shop Drawings

- A. Plans furnished and included with Specifications show details necessary to comprehensively indicate the work proposed and the results that are intended to be accomplished. The Contractor shall supply and bear the cost of any shop drawing required in connection with the prosecution or construction of any part of such work.
- B. The Contractor shall furnish the specified number of copies of all layout detail, shop and working drawings, requested by the Engineer. Shop drawings shall be of sufficient size and scale to clearly show details. After review and approval by the Engineer, two copies will be returned to the Contractor.
- C. The approval by the Engineer of the Contractor's shop drawings is a general approval relating only to compliance with the intent of the Contract Documents, and shall not constitute a waiver of errors or omissions.

- D. No materials shall be furnished or work done on items requiring shop drawings prior to approval of those drawings.

#### 4.06 Changes in the Work

- A. The Engineer at the direction of the Owner may at any time, by written order, make changes in the Plans and/or Specifications and within the general scope thereof. These changes may be in the Contract or result in addition to or deduction from the work to be performed, or the materials to be furnished pursuant to the Contract. Estimated quantities in the Proposal are primarily for bid purposes. No employee, agent, or representative of the County, with the exception of the Owner, has any power to approve any change in the Contract, and it is the responsibility of the Contractor, before proceeding with any change, to satisfy himself that the change has been properly authorized by the Engineer. No change for any extra work, or any other change in the Contract, will be allowed unless the extra work or change has been authorized in writing by the Owner and the price, therefore, is stated in such a written authority, provided however, that the Engineer may, in the case of an emergency, authorize changes in the field. In no case shall any payment be made for any changes without first the written change order being agreed to and signed by both the Contractor and the Owner. Nothing provided herein shall excuse the Contractor from proceeding with the prosecution of the work as changed. Except as otherwise herein provided, no charge for extra work or materials will be allowed.
- B. The estimate of quantities of work to be done is tabulated in the Proposal and, although stated with as much accuracy as possible, is approximate only and is assumed solely for the basis of calculation upon which the award of Contract shall be made. Payment to the Contractor will be made on the measurement of the work actually performed by the Contractor as specified in the Contract Documents. The Owner reserves the right to increase or diminish the amount of any class of work as may be deemed necessary.
- C. If the actual quantity of any unit item as stated in the Proposal increases or decreases by 25 percent or less, payment for the actual quantity shall be made at the unit price stated in the Proposal. If the actual quantity of any unit item is less than 75 percent of the quantity stated in the Proposal, the Contractor may request, with appropriate documentation, a negotiation of the unit price for that item. Such negotiation shall be at the sole discretion of the Owner. If the actual quantity of any unit item is more than 125 percent of the quantity stated in the Proposal, the Owner may require an equitable reduction of the unit price for that item and the Contract shall be modified accordingly.

#### 4.07 Changed Conditions

- A. The Contractor shall notify the Engineer of changed work site conditions upon their discovery and before they are disturbed. If the Engineer is not given written notice, the Contractor will be deemed to have waived any claim or claims for extra

compensation in any manner arising out of the changed or unusual conditions. Changed conditions are as follows:

- 1) Subsurface or latent physical conditions differing materially from those represented in the contract; or,
  - 2) Unknown physical conditions of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in the work.
- B. The Engineer will promptly investigate all changed conditions. If the Engineer determines that the changed conditions will materially increase or decrease the costs of any portion of the work, the Owner will make an equitable adjustment in the amount of compensation to be paid for the performance of that part of the work involved, the time required, or both. If the Engineer determines that the changed conditions do not justify an adjustment in compensation, and the contractor disagrees with the Engineer's determination, the contractor may submit a written notice of dispute to the Engineer.
- C. In any event, the Contractor shall not be relieved from his obligations to resume construction operations pending a decision as to the validity of a claim, or pending the execution of negotiated agreement to cover additional costs of a claim recognized under the provisions of this section, unless permitted to do so by Owner.

#### 4.08 Disputed Work

- A. If the Contractor considers that a part of the required work is outside the scope of the Contract, or considers any decision of the Engineer to be unfair, or otherwise has a dispute with regard to the performance under the Contract, the contractor shall:
- 1) immediately give oral notice to the Engineer and Owner;
  - 2) before performing the work at issue, obtain a written order from the Owner;
  - 3) within 24 hours of receiving the written order, confirm the notice of dispute in writing; and
  - 4) within ten calendar days after receipt of the written order, file a written protest with the Owner stating clearly and in detail the basis of dispute, and include an itemized statement of any extra costs which have resulted or would result from the disputed work.
- B. If the Contractor fails to comply with the above procedure, the Owner's ruling shall be final and conclusive and the Contractor shall have no claim for additional compensation or time.
- C. Although not to be construed as proceeding under extra work provisions, the Contractor shall keep and furnish records of all disputed work.
- D. Resolution of claims shall be per specification section 7.10 DISPUTE SETTLEMENT.

#### 4.09 Extra Work

- A. The Owner shall have the right to require, and the Contractor agrees to do, extra work over and above that which is indicated by the Contract Documents and covered by the unit prices of the Contract or negotiated price or prices, which logically forms a part of the Contract, arising from reasonably unforeseeable conditions, changed requirements or new information. Such additional work shall be undertaken only upon written instructions from the Owner. Payment for extra work will be made pursuant to Subsection 9.07.

#### 4.10 Force Account Work

- A. Force account work is extra work that is not covered under unit price or lump sum money items in the Contract Documents and where negotiated price or prices have not been agreed upon. Payment for force account work will be made pursuant to Subsection 9.08.
- B. The Contractor shall maintain records in such a manner as to provide a clear distinction between direct cost of extra work paid for on force account basis and cost of other operations performed in connection with the Contract Documents.
- C. Signed, daily reports in duplicate of the extra work to be paid for on a force account basis shall be furnished to the Owner by the Contractor. Materials used will be itemized and direct cost of labor and charges for equipment rental will be furnished by the Contractor or Subcontractor. The Contractor will provide names, identifications, and classifications of workmen, the hourly rate of pay and hours of work, and the size, type, and identification number of equipment and hours of equipment operation.
- D. Material charges shall be substantiated by vendors' invoices with copies of such invoices submitted with the reports, or, if not available, submitted with subsequent reports. In the event said vendors' invoices are not submitted within 15 days after completion of the work, Owner reserves right to establish the cost of such materials at the lowest current price at which said materials are available in the quantities concerned, delivered to the location of the work. The Owner will compare his records with the reports furnished by the Contractor, make any necessary adjustments, and compile the cost of extra work paid for on a force account basis on forms furnished by the Owner. When these extra work reports are agreed upon and signed by both parties, they shall become the basis of payment for the work performed.

#### 4.11 Salvage

- A. When shown or specified, the Contractor shall carefully salvage and stockpile within the construction area all castings, pipe, and any discarded facilities to be disposed of by the Owner.

## 4.12 General Items of Work

- A. In all Contracts the following items of work are understood to be included as described in Division 2 general technical requirements:

**Section Item of Work**

Section 02110 - SITE CLEARING

Section 02190 - EROSION &amp; SEDIMENTATION CONTROL

Section 02220 – EARTHWORK

HDPE Geomembrane Specification

- B. If no pay item is shown in the Proposal for the above items of work, payment shall be considered to be incidental to, or included in, the other items for work in the Contract.

## 5. CONTROL OF WORK

## 5.01 Authority of and Coordination between the Owner and Engineer

- A. The Contractor shall perform all work to the satisfaction of the Engineer and Owner. The Contract and Specifications give the Owner authority over the work. For the purpose of determining the Contractor's duties, liabilities or entitlement to compensation or liability for damages, the decision of the Owner will be final on all questions including, but not limited to, the following:
- 1) Quality and acceptability of materials and work;
  - 2) Classification and measurement of unit price work;
  - 3) Acceptability of rates of progress on the work;
  - 4) Interpretation of plans and specifications;
  - 5) Fulfillment of the Contract by the Contractor; and,
  - 6) Payments under the Contract.
- B. The Contractor shall at all times carry out and fulfill the instructions and directions of the Engineer or Owner, as applicable, relative to the work.
- C. Upon failure on the part of the Contractor to comply with any reasonable order made under the provisions of Contract, the Owner shall have the authority to cause unacceptable work to be remedied or removed and replaced, and unauthorized work to be removed and to deduct the cost thereof from any monies due or to become due the Contractor.
- D. The Owner has the authority to suspend work for causes set forth in Section 8, particularly Subsection 8.05.
- E. The work will not be considered complete until it has passed final inspection by the Engineer and is accepted by the Owner and met warranty requirements. Interim approval of the work by the Engineer during progress of the work signifies favorable opinion and qualified consent; it does not carry with it certification, assurance of completeness, assurance of quality, or assurance of accuracy

concerning details, dimensions, and quantities. Such approval will not relieve the Contractor from responsibility for errors, for improper fabrication, for failure to conform to requirements, or for other deficiencies.

- F. The Engineer shall have authority to make decisions with regard to the Project to the extent that those decisions relate to the technical aspects of the work to be performed under the Contract. Notwithstanding the foregoing, the County hereby reserves the right to review and revise any decision made by the Engineer with regard to the Project, the Contract, or the Contract Documents.
- G. Notwithstanding any other provision contained in these Specifications, the County shall retain authority to make decisions with regard to the Project, the Contract, or the Contract Documents, including, without limitation, the interpretation of conflicting provisions in the Contract Documents, the decision as to whether to enforce provisions of the Contract Documents, and whether to make payment to the Contractor. In making any decision related to the Project, the Contract, or the Contract Documents, the County may, in its sole discretion, consult with the Engineer or any other person or entity.

#### 5.02 Authority and Duties of Inspectors

- A. Inspectors have the authority to:
  - 1) Inspect all work done and materials furnished including preparation, fabrication, or manufacture of materials to be used;
  - 2) Report to the Engineer or Owner about the progress of the work and the manner it is performed;
  - 3) Report to the Engineer or Owner and notify the Contractor when materials furnished or work performed by the Contractor fail to meet the requirements of the plans and specifications; and
  - 4) Perform such other tasks that may be delegated by the Owner or Owner.
- B. Inspectors are not authorized to:
  - 1) Accept work; or,
  - 2) Alter or waive the provisions of the Contract.
- C. Failure of the Inspector or Engineer to call the attention of the Contractor to faulty work or infringements upon Plans or Specifications shall not constitute acceptance of said work.

#### 5.03 Inspection

- A. The Contractor shall allow the Engineer or Owner every reasonable facility necessary to obtain information about type and quality of materials used in the work, methods used to complete the work, and progress of the work. The Engineer and the inspector shall be allowed access to all parts of the work to ascertain whether or not the work is performed in accordance with the requirements and intent of the Contract.

- B. The Contractor shall furnish, at no expense to the Owner, samples required for testing purposes. The Contractor shall, at any time before final acceptance of the work, remove or uncover portions of the work as directed by the Engineer or Owner. The Contractor shall restore the portions of the work to the standard required by the Contract. If the exposed work is acceptable, the uncovering and restoring of the work will be paid for as extra work. If the exposed work is unacceptable, the uncovering and restoring of the work shall be at the expense of the Contractor. Any work done or materials used without approval of the Engineer or Owner may be ordered removed and replaced at no expense to the Owner.
- C. When the work affects or may affect property of any other unit of government, political subdivision, utility, or railroad corporation, representatives of that organization shall have the right to inspect the work. Such inspection shall not make any other unit of government, political subdivision, utility, or any railroad corporation a party to the Contract and shall not interfere with the rights of the parties of the Contract.

#### 5.04 Authority of Contractor

- A. The Contractor shall notify the Owner, Owner and Engineer in writing of the name, address and telephone number (day and night) of his superintendent who will act as the Contractor's representative and who shall have the authority to act in all matters relating to this Contract. The superintendent shall have full authority to carry out all the provisions of the Contract and to supply materials, equipment, tools and labor without delay for the performance of the work. The Contractor shall also submit in writing to the Owner a résumé of the superintendent's qualifications, years of experience and names of other projects on which he worked in a supervisory capacity. The Contractor shall not remove or replace the superintendent without two weeks prior notice thereof to the Engineer and Owner. The Contractor will supervise and direct the work. He has the authority to determine the means, methods, techniques, sequences and procedures of construction, except in those instances where Owner specifies in the Contract, a means, method, technique, sequence or procedure for construction of that item of work.
- B. Subcontractors will not be recognized as having a direct relationship with the Owner. All persons engaged in the work including employees of subcontractors and suppliers will be considered as employees of the Contractor and their work shall be subject to the provisions of the Contract. References in the Contract Documents to actions required of subcontractors, manufacturers, suppliers or any person other than the Contractor, the Owner or the Engineer shall be interpreted as requiring that the Contractor shall cause such subcontractor, manufacturer, supplier or person to perform the specified action.

#### 5.05 Responsibility of the Contractor

- A. It is the responsibility of the Contractor to do all work and furnish all labor, materials, equipment, tools, and machines necessary for the performance and completion of the project in accordance with Contract Documents within the

specified time. Materials and construction details built by the Contractor but not a part of the permanent project, shall meet approval of the Engineer, but such approval shall not relieve the Contractor from responsibility for their safety and efficiency.

- B. The Owner shall not be liable or responsible for any accident, loss, or damage happening to work referred to in the Contract Documents prior to completion and acceptance thereof.
- C. The Contractor shall at all times be responsible for the adequacy, efficiency and sufficiency of subcontractors, manufacturers, suppliers and their employees. All subcontractors, manufacturers and suppliers must have sufficient knowledge, skill and experience to perform properly the work awarded to them.
- D. The Contractor shall at all times be responsible for the adequacy, efficiency and sufficiency of his employees. All workers must have sufficient knowledge, skill and experience to perform properly the work assigned to them.
- E. The Contractor, acting through his superintendent, shall give personal attention to and shall manage the work to the end that it shall be prosecuted faithfully. When the superintendent is not personally present at the job site, his previously designated representative shall be available and shall have the authority to act on the Contract.
- F. The Contractor alone shall at all times be responsible for the safety of his and his subcontractor's employees. The Contractor shall maintain the job site and perform the work in a manner which meets the Owner's and Contractor's responsibility under statutory and common law for the provision of a safe place to work.
- G. The Contractor shall at all times conduct his work so as to insure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work and to insure the protection of persons and property. No road or street shall be closed to the public except with the permission of the Engineer, Owner and proper governmental authority. Fire hydrants on or adjacent to the work shall be kept accessible to firefighting equipment at all times. Temporary provisions shall be made by the Contractor to insure the use of sidewalks, private and public driveways and proper functioning of all gutters, sewer inlets, drainage ditches and culverts, irrigation ditches and natural water courses.
- H. The Contractor shall adopt a written safety program complying with the requirements for employee and public safety set forth herein above. Four (4) copies of the Contractor's safety program shall be submitted to the Engineer and Owner. Adoption of and compliance with such program and submission of the copies thereof to the Engineer and Owner shall be a condition precedent to the Contractor's right to receive progress payments.
- I. The Contractor shall maintain books, records (including but not limited to financial records), and other evidence and documents pertinent to the performance of the

work under this Contract in accordance with generally accepted principles and practices.

- J. The Contractor will provide proper facilities to the Owner for access, inspection, and copying at all times. The books, records documents, etc. to be maintained under this paragraph shall be maintained and made available during performance of the Contract and for three (3) years after completion of the work, or settlement of any claims arising thereon, whichever is later.
- K. The Owner's access to such records is not limited to the required retention periods. The Owner and its authorized representative shall have access to such records at any reasonable time for as long as the records are maintained.
- L. The Contractor shall perform the work in accordance with currently approved methods and practice in the Contractor's professional capacity and in accordance with the standards of applicable professional organizations and licensing agencies.
- M. The Contractor shall act as an independent contractor and is not an employee, subcontractor, agent, servant, partner nor joint venture of the County. The Contractor has the right to use its best judgment and efforts to fulfill the terms and obligations of the Contract Documents. Contractor shall further agree and acknowledge the following:
  - (1) Contractor will receive no compensation other than that agreed to by the parties as bid by the Contractor plus any compensation agreed to in subsequent change orders and the Contractor, its agents, employees and subcontractors are not subject to nor eligible for any benefits which may be offered by the County to its employees, such as vacation pay, sick leave, insurance coverage or retirement plan participation. Any such benefits offered by the Contractor shall be the Contractor's sole responsibility.
  - (2) The services to be provided by the Contractor are an independent calling or occupation.
  - (3) The Contractor is expected to use its own skill, judgment and expertise to fulfill its obligations, and is not supervised, directed or controlled by the County as to the means or methods it should employ except that the Contractor follow the Contract Documents.
  - (4) The Contractor is not required to perform tasks in particular order or sequence, except as provided in the Contract Documents.
  - (5) The Contractor needs no training from the County as to how to fulfill its duties and responsibilities.
  - (6) The Contractor may determine its own daily schedule and those of its own employees or servants without prior approval of the County.

(7) The Contractor is not required to devote any particular percentage of its time or resources to perform the services required hereunder.

(8) The Contractor shall furnish its own equipment and supplies.

(9) Although the Contractor may be provided the use of the County's facilities, such use is provided merely to facilitate the Contractor's coordination with the County's staff and communication with vendors, other contractors engaged on the project, and members of the community.

(10) To the extent the Contractor must procure or maintain any insurance, license, certification or trade membership, it must do so at its own cost.

(11) The Contractor shall not be prevented from performing other services for other parties. Contractor may engage in other business endeavors or projects of any kind as long as such activities do not conflict with the Contractor's relationship with the County as defined hereunder.

N. The Contractor shall read and review all plans, specifications and supporting documents attached to these specifications within the Appendix.

#### 5.06 Notifications Relative to Contractor's Activities

- A. The Contractor shall take special notice of Subsection 5.05. The Contractor shall obtain prior approval from the Owner for closing or partial closing of any street. The Contractor shall, without exception, notify the Fire Department, Police Department, ambulance services, U. S. Postal Service, garbage services, and Camden County Schools when closing any street, or portion thereof, in the County of Southern Shores for any purpose.
- B. Said notice shall include the limits and approximate duration of the closure. The Contractor shall promptly notify said departments when the streets are again passable for emergency vehicles.
- C. The Contractor shall also cause the least inconvenience possible to businesses, property owners and residents. Each business and residence shall be given an approved, printed notice of a pending closure. Ample time shall be allowed for the movement of vehicles away from the project. In emergencies, Contractor shall notify businesses and residents directly and assist them in leaving the area as needed.
- D. The Contractor shall leave his night emergency telephone number or numbers with the Chief of Police so that contact may be made easily at all times in case of barricade trouble or other emergencies.
- E. Contractors shall request on-site utility locations in accordance with the laws governing utility locations prior to the commencement of work.

- F. When performing work in streets and easements, whether inside or outside Owner's legal boundaries, the Contractor shall notify all of the affected local agencies about the operations so as to properly coordinate and expedite the work in such a manner as to cause the least amount of conflict and interference between the operations and those of other agencies.
- G. Notifications shall include, but not be limited to, the time of commencement and completion of work, names of streets or locations of alleys to be closed, schedule of operations and routes of detours where possible.
- H. Any or all damages or claims resulting from improper or insufficient notification of the affected agencies shall be the responsibility of the Contractor.
- I. Subject to the provisions of Section 5.07, Owner shall relocate or cause to be relocated all privately or publicly owned utility conduits, lines, poles, mains, pipes and such other facilities within the jurisdiction and control of Owner where such relocation is necessary in order to conform said utility and other facilities to the plans and ultimate requirements of the project.

#### 5.07 Utilities and Existing Improvements

- A. Information shown as to location of the existing water courses, drains, sewer lines or utility lines which cross or are adjacent to the project is not guaranteed to be accurate.
- B. The Contractor shall provide for the flow of sewers, drains, or water courses as approved by the Engineer.
- C. It shall be the responsibility of the Contractor to determine the exact location of all utilities and service connections thereto. The Contractor shall make his own investigations, including contacting the owners of appropriate utilities and making exploratory excavations to determine the locations and type of existing utilities, including service connections, prior to commencing work which could result in damage to such utilities. Excavation in the vicinity of existing structures and utilities shall be carefully done by Contractor by hand. The Contractor shall immediately notify the Engineer of any utility discovered by the Contractor which is not shown on the drawings or which is in a different position than shown on the drawings.
- D. In case it should be necessary to remove, relocate, or temporarily maintain a utility because of interference with the work, the work on the utility shall be performed and paid for as follows:
  - 1) If the Work can be accomplished by bracing, shoring, using temporarily holding poles, hand-digging underground cables and setting them to the side of the trench, making slight adjustments to lines and structures, and taking similar measures to work with and around existing utilities, Contractor shall take such measures, as necessary, to accomplish the Work, and such measures shall be taken

without separate or additional compensation to the Contractor. Any such methods and measures shall be approved in advance by the owning utility and the Engineer.

2) If the Contractor cannot work with and around existing utilities as provided in Section 5.07.D.1), and if it is then necessary to remove, relocate, or temporarily maintain a utility, the Owner may either: (A) make arrangements with the owner of the utility or with any other person or entity for such work to be done at no cost to the Contractor; or (B) require the Contractor to do such work in accordance with specification Sections 9.07 and/or 9.08; or (C) terminate this Contract if, in the Owner's sole discretion, the Owner deems the cost of removing, relocating, or temporarily maintaining the utility too great, in which case such termination shall be deemed to have satisfied and been made pursuant to the provisions of Section 8.11.B.

3) Notwithstanding the provisions of this Section 5.07.D. to the contrary, the Contractor shall be responsible for, and shall pay the cost of, removing, relocating, or temporarily maintaining a utility if such removal, relocation, or temporary maintenance is shown in the Contract Documents. Any such methods and measures shall be approved in advance by the owning utility and the Engineer.

- E. No representations are made that the obligations to move or temporarily maintain any utility and to pay the cost thereof is or is not required to be borne by the owner of such utility.
- F. The right is reserved to governmental agencies and to owners of utilities to enter at any time upon any street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the work and for the purpose of maintaining and making repairs to their property.
- G. The Contractor shall make excavations and borings ahead of work, as necessary, to determine the exact location of interfering utilities or underground structures.
- H. Ordinarily, utility companies responsible for facilities located within the right-of-way will be required to complete any installation, relocation, repair, or replacement prior to the commencement of work by the Contractor. However, when this is not feasible or practicable or the need for such work was not foreseen, such utility owners or Owner shall have the right to enter the right-of-way and upon any structure therein for the purpose of making new installations, changes or repairs. Operations shall be conducted so as to provide the time needed for such work to be accomplished during the progress of the improvement, and at no additional cost to Owner.
- I. While performing the Work, the Contractor shall be held responsible for: any damage by Contractor or its subcontractor(s) or agent(s) to, maintenance for, and protection of existing utilities and structures.

#### 5.08 Cooperation Between Contractors

- A. The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this Contract.
- B. When separate contracts are let within the work area, each contractor involved will submit a realistic progress schedule for the Owner's approval. Each party shall have the right to review all schedules. After consultations with the contractors, the Owner will determine acceptable schedules.
- C. Each contractor involved shall assume all liability in connection with the Contract and shall protect and save harmless the Owner from any and all damages or claims that may arise because of inconvenience, delay, or loss experienced by the Contractor due to the presence and operations of other contractors working on or near the same project.
- D. The contractor shall arrange the work and shall place and dispose of the materials being used so as not to interfere with the operations of other contractors on or near the same project.
- E. When a dispute arises between two or more contractors engaged on work in the same or adjacent areas as to the respective rights of each, the Owner, or, if directed by the Owner, the Engineer will determine the matters at issue and define the respective rights of the various interests involved. The Owner's decision shall be final and binding on all parties concerned.
- F. If the contract gives notice of other work that may affect the work of this Contract, the coordination of the work shall be taken into account by the Contractor, and any resulting costs shall be considered incidental work.
- G. In an emergency, the contractor that is immediately accessible may make repairs to a facility or utility of another contractor.

#### 5.09 Survey Service

- A. Construction related surveying services will be the responsibility of the Contractor.

#### 5.10 Protection of Survey Markers

- A. Permanent Survey Markers
  - 1. The Contractor shall take necessary measures to insure the preservation of survey monuments, stakes, lot stakes and bench marks. The Contractor shall not disturb permanent survey monuments, stakes, lot stakes or bench marks and shall bear the expense of replacing any that may be disturbed.
  - 2. When a change is made in the finished elevation of the pavement of any roadway in which a permanent survey monument is located, the monument cover shall be adjusted to the new grade without disturbing the underlying monument.

## B. Lines and Grades

1. The Contractor shall preserve construction survey stakes and marks for the duration of their usefulness during construction. The cost of replacement shall be an expense of the Contractor

## 5.11 Protection of Property

- A. The Contractor shall protect all public and private property insofar as it may be endangered by operations and take every reasonable precaution to avoid damage to such property.
- B. The Contractor shall restore and bear the cost of any public or private improvement, facility or structure within the right-of-way or easement which is damaged or injured directly or indirectly by or on account of any act, omission, or neglect in the execution of the work which is not designated for removal but visibly evident or correctly shown on the Plans. The Contractor shall restore any damaged public or private improvement to a condition as good or better than that existing before such damage or injury occurred by repairing, rebuilding, or otherwise effecting restoration thereof, or if this is not feasible, makes a suitable settlement with the Owner of the damaged property, all at no expense to the Owner.
- C. The Contractor shall give reasonable notice to occupants of buildings on property adjacent to the work to permit occupants to remove vehicles, boats, trailers, and other possessions, as well as salvage or relocate plants, trees, fences, sprinkler systems, or other improvements in the right-of-way, which are designated for removal or which may be destroyed or damaged by work operations.
- D. The Contractor shall protect all designated trees and planted areas within the right-of-way or easements. He shall also exercise care and conduct operations so as to minimize damage to new planted areas.

## 5.12 Protection of Work

- A. Until acceptance of the project, the Contractor shall at all times protect from damage and preserve all materials, supplies, equipment of any description, and all work already performed, from the nature of the work, the action of the elements, and damage by any person or persons or from any other cause whatsoever.

## 5.13 Use of Improvement During Construction

- A. Upon request and with approval of the Owner, or upon order of Owner, Contractor will be relieved of the duty of maintaining and protecting certain portions of work which are approved to be placed in service and which have been completed in accordance with the Contract Documents, including cleanup.
- B. Owner shall have the right to take possession of and use any completed or partially completed portions of the improvement. Such use shall not be considered as final acceptance of the improvement or portions thereof.

- C. In addition, such action by Owner will relieve the Contractor of responsibility for injury or damage to said completed portions of work resulting from use by public traffic or from the action of the elements or from any other cause, except injury or damage resulting from Contractor's own operations or from his negligence. Contractor will not be required to again clean up such portions of the improvement prior to field acceptance, excepting for such items of work as result from his operations. However, nothing in this section shall be construed as relieving Contractor from full responsibility for making good work or materials found to be defective.

#### 5.14 Use of Light, Power and Water

- A. The Contractor shall furnish temporary light, power and water complete with connecting piping, wiring, lamps, and similar equipment necessary for the work as approved. The Contractor shall install, maintain and remove temporary lines upon completion of work. The Contractor shall obtain all permits and bear all costs in connection with temporary services and facilities at no expense to Owner. The Contractor shall conform to applicable rules and codes in the use of these facilities.

#### 5.15 Subsurface Data

- A. All information obtained by Engineer regarding subsurface information and groundwater elevations will be available for inspection at the office of the Engineer upon request.
- B. Known utilities and structures expected to be adjacent to or encountered in the work are shown on the Plans. Such information is offered as supplementary information only.
- C. Neither the Engineer nor Owner assumes any responsibility for the completeness or interpretation of such supplementary information.
- D. Logs of test holes, test pits, soil reports, ground-water levels and other supplementary subsurface information are offered as the best available information of underlying materials and conditions at the locations actually tested. Owner will not be liable for any loss sustained by the Contractor as a result of any variance between conditions contained in or interpretations of test reports and the actual conditions encountered during progress of the work.
- E. The Contractor shall examine the site and available records, as set forth in Proposal Form. The submission of a Proposal shall be conclusive evidence that the Bidder has investigated and is satisfied as to the subsurface conditions to be encountered, as to the character, quality and quantities of work to be performed and materials to be furnished, and as to the requirements of the Contract Documents.

#### 5.16 Verbal Agreements

- A. No verbal agreement or conversation with any officer, agent or employee of the Owner, either before or after execution of the Contract, shall affect or modify any of the terms or obligations contained in any of the documents comprising the Contract. Any such verbal agreement or conversation shall be considered as unofficial information and in no way binding upon Owner.

#### 5.17 Dust, Noise and Pollution Control

- A. The Contractor shall conduct the work in accordance with local laws and ordinances and all regulations of the NCDENR other agencies of the state, and with all laws and regulations of the federal government and in accordance with subsection 7.01. All practicable means shall be exercised to prevent, control and abate the pollution of waters and to maintain reasonable purity of the air. The Contractor shall abate dust nuisance by cleaning up, sweeping, sprinkling with water, or other means as necessary to accomplish the suppression of dust.
- B. The Contractor shall conduct the work in conformity to all applicable laws and regulations governing construction noise.

#### 5.18 Temporary Traffic Control

- A. The Contractor shall provide and be responsible at all times for such flag persons, signs and other devices not otherwise specified to be furnished by the Owner, in conformance with the language below:
  - 1. The Contractor shall maintain traffic flow during construction and shall provide, install, and maintain all traffic control devices in accordance with these project guidelines, the Project Special Provisions, North Carolina Department of Transportation Standard Specifications for Roads and Structures 2012, and the current edition of the Manual of Uniform Traffic Control Devices (MUTCD).
  - 2. The Contractor shall utilize complete and proper traffic controls and traffic control devices during all operations. All traffic control and traffic control devices required for any operation shall be functional and in place prior to the commencement of that operation. Signs for temporary operations shall be removed during periods of inactivity. The Contractor is required to leave the project in a manner that will be safe to the traveling public and which will not impede motorists. All traffic control devices shall be provided and maintained by the Contractor as in Section 1105 of the Standard Specifications.
  - 3. Traffic movements through lane closures on roads with two way traffic shall be controlled by flaggers stationed at each end of the work zone. In situations where sight distance is limited, the Contractor shall provide additional means of controlling traffic, including, but not limited to, two-way radios, pilot vehicles, temporary traffic signals, or additional

flaggers. Flaggers shall be competent personnel, adequately trained in flagging procedures, and furnished with proper safety devices and equipment, including, but not limited to, safety vests and stop/slow paddles.

4. All personnel when working in traffic areas or areas in close proximity to traffic shall wear an approved safety vest, or shirt or jacket which meets the color requirements of the Manual 21 Uniform Traffic Control Devices. (MUTCD).
  5. The Contractor shall comply with all applicable regulations including, but not limited to, Federal, State, and local laws, ordinances, and regulations governing safety, health, and sanitation, and shall provide all safeguards, safety devices, and protective equipment, and shall take any other needed actions, on his own responsibility that are reasonably necessary to protect the life and health of employees on the job and the safety of the public, and to protect property in connection with the performance of the work covered by the contract. Failure to comply with any of the requirements for safety and traffic control of this contract shall result in suspension of work as provided in sub article 108-7(2) of the Standard Specifications.
- B. Upon failure to immediately provide the necessary flag persons, or to provide, erect, maintain, and remove barricades, lights, and standard signs when so ordered, Engineer or Owner shall be at liberty, without further notice to Contractor or his Surety, to do so and deduct all of the costs thereof from any payments due or coming due to Contractor.

#### 5.19 Removal of Unacceptable or Unauthorized Work

- A. If the Engineer or Owner finds the work performed is not in conformance with the Contract, the Engineer or Owner may:
  - 1) Reject the work and have it replaced or otherwise corrected by the Contractor at no expense to the Owner, or;
  - 2) Accept the work as suitable for the intended purpose, document the basis of acceptance, and adjust the amount paid to the Contractor.
- B. The Owner's judgment concerning acceptability of work will be final. Unacceptable work found before final acceptance of the work shall be corrected or removed as directed by the Owner and replaced by work and materials conforming to the requirements of the Contract.
- C. Unauthorized work will not be paid for and may be ordered removed at the Contractor's expense.
  1. Unauthorized work is:
    - a) Work done beyond lines shown on the Plans or established by the Engineer or Contract Documents;
    - b) Work done contrary to the Engineer's or Owner's instructions; or,

- c) Work done without the Engineer's or Owner's written authorization.
- D. If, when ordered by the Engineer or Owner, the Contractor fails to correct or remove unacceptable work or to remove unauthorized work, the Engineer or Owner may have the correction or removal and replacement done by others. The cost shall be borne by the Contractor and may be deducted from payments due or to become due to the Contractor.

#### 5.20 Restoration and Cleanup

- A. Periodically, or as directed by Engineer or Owner, as the work progresses, and immediately after completion of the work, Contractor shall clean up and remove all refuse, debris, equipment and unused materials of any kind resulting from the work. Upon failure to do so within twenty-four hours after directed, the work may be done by Owner or third party and the cost thereof be deducted from any payment due Contractor.
- C. As a condition precedent to final acceptance of the project, all equipment and temporary structures, and all rubbish and waste shall be removed and the right-of-way and premises shall be generally cleaned up to conform substantially to conditions as they existed before the commencement of work, as approved.

#### 5.21 Final Inspection

- A. When all on-site construction work on the project is completed, the Contractor shall notify the Engineer and Owner in writing that the project is ready for final inspection. The Engineer and Owner will make an inspection within 15 calendar days of receiving notification. The Engineer or Owner will notify the Contractor, in writing, within ten calendar days thereafter. If all construction work required by the Contract is found complete and satisfactory, this inspection will constitute the final inspection.
- B. If any work is found incomplete or unsatisfactory, the Engineer will give written instructions, at the direction of the Owner, as to what shall be done to satisfactorily complete the work. After complying with such instructions, the Contractor shall follow the above procedures of notification, requesting a final inspection.
- C. The Engineer will issue a notice to the Contractor when all the following work is satisfactorily completed.
  - 1) All work required under the contract;
  - 2) All change order work;
  - 3) The final trimming and cleanup work; and,
  - 4) All required certifications, bills, forms, and other documents are received from the Contractor including:
    - Consent of Surety
    - Lien Waivers
    - Warrantee

#### 5.22 Final Acceptance

- A. After final inspection of all work is made, and the work is found acceptable, the Owner will make final acceptance of the work under the Contract.
- B. The Contractor will be notified, in writing, within ten calendar days after final acceptance of the work.

## 6. CONTROL OF MATERIALS

### 6.01 Quality of Materials

- A. Only new materials, parts, products and equipment which conform to specified requirements shall be used in the work, unless directed by the Engineer or Owner, the Proposal and Special Provisions to salvage and reuse existing materials. Materials and products which after approval have become unsuitable or unacceptable for use, regardless of cause, will be rejected by the Engineer or Owner and shall not be used.

### 6.02 Sampling and Testing

- A. Tests of materials will be made by Contractor in accordance with methods described or designated in the applicable Specifications, and at any time during the production, fabrication, preparation and use of the materials.
- B. Owner reserves the right to require samples and to test products for compliance with pertinent requirements irrespective of prior certification of the products by the manufacturer thereof as set forth in Subsection 6.03.
- C. When tests of materials are necessary, as determined by the Engineer, such tests will be made by and at the expense of Owner unless otherwise specified. The Contractor shall afford such facilities as required for collecting and forwarding samples where practical and withhold from use the materials represented by the samples until tests have been made and materials found equal to requirements of the Specifications or to approved samples. In all cases the required samples shall be furnished without charge and in ample time to permit testing of materials prior to use. No claim will be allowed for any delay caused by awaiting test results. Safety measures and devices to protect those who take the samples shall be provided.
- D. In the absence of any reference Specification, it shall be understood that such materials shall meet the specifications and requirements of the American Society for Testing and Materials (ASTM), or the American Association of State Highway and Transportation Officials (AASHTO), as directed by the Engineer. When there is no pertinent coverage under ASTM or AASHTO, the material concerned shall meet specifications and requirements of applicable commercial standards of the Commodity Standards Division of the U.S. Department of Commerce. Lacking such coverage, materials shall meet requirements established by reputable industry for a high-quality product of the kind involved.

- E. All testing shall be performed by or handled through a testing laboratory as directed by the Engineer and Owner.
- F. In the event Owner requests tests and the materials fail, the Contractor shall bear all costs for all subsequent testing necessary to meet specified requirements.
- G. It shall be the responsibility of the Contractor to notify the County's testing consultant when construction milestones are met and materials are ready to be tested. The Contractor shall coordinate directly with the County's testing company and notify the Engineer and Public Works Director of scheduled testing.

#### 6.03 Certification

- A. For commercial products inclusive of industry standardized products, in lieu of normal sampling and testing procedures by the Contractor and Owner, the Engineer may accept from Contractor two copies of the manufacturer's certification with respect to the product involved, under conditions set forth as follows:
  - 1. Certification shall state that the named product conforms to Owner's requirements and that representative samples thereof have been sampled and tested as specified.
  - 2. Certification shall either be accompanied with a certified copy of test results, or certify that such test results are on file with the manufacturer and will be furnished to Engineer upon request.
  - 3. Certification shall give the name and address of the manufacturer, the testing agency and the date of tests; and shall set forth the means of identification which will permit field determination of the product delivered to the project as being the product covered by the certification.
  - 4. Owner will not be responsible for any costs of certification or for any costs of the sampling and testing of products in connection therewith.

#### 6.04 Inspection Requirements

- A. Access to Engineer, Owner or his representatives shall be allowed to all parts of the work and to plants of manufacturers at all times. The Contractor shall furnish them with every reasonable facility for ascertaining if the work meets requirements and intent of the Contract Documents. All samples required for testing purposes shall be furnished at no expense to Owner.

#### 6.05 Inspection By Others

- A. Inspection of work by persons other than representatives of the Owner will not constitute inspection by Owner, except as set forth in Section 6.03.

#### 6.06 Storage and Protection of Materials

- A. Materials shall be stored to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the right-of-way may be used for storage purposes, including Contractor's equipment, but any additional space required therefore shall be provided by Contractor at his expense. Private property shall not be used for storage purposes without written permission of the property owner or lessee. When requested, copies of such written permission shall be furnished to the Engineer and Owner.

#### 6.07 Trade Names, Approved Equals or Substitutions

- A. In order to establish a basis of quality, certain processes, types of machinery or equipment or kinds of materials may be specified either by description of process or by designating a manufacturer by name and referring to his brand or product designation, or by specifying a kind of material. It is not the intent of these Specifications to exclude other processes, equipment or materials of equal value, utility or merit.
- B. Whenever a process is designated or a manufacturer's name, brand, or item designation is given or whenever a process or material covered by patent is designated or described it shall be understood that the words 'or approved equal' follow such name, designation or description, whether in fact they do so or not.
- C. If it is desirable to furnish items of equipment by manufacturers other than those specified as a substitute after the Contract is executed, approval shall be secured prior to placing a purchase order or furnishing same.
- D. If the Proposal includes a list of equipment, materials or articles for which Contractor must name the manufacturer at time of submission of the Bid, no substitutions therefore will be permitted after a Proposal has been accepted, without the express consent of Owner.
- E. The Contractor shall assume full responsibility for all expenses involved in making any required changes in the Contract Documents to accommodate a substitution approved by the Engineer and Owner for the convenience of Contractor, or to circumvent any unforeseen difficulty in obtaining a specified article.

#### 6.08 Owner Furnished Equipment and Materials

- A. Equipment and materials furnished by the Owner will be delivered or made available to the Contractor at the locations specified. An inspection of the Owner-furnished equipment and materials shall be made at the time of delivery to the Contractor to satisfy the Owner and the Contractor that the quantity and quality of the equipment and material is satisfactory for use in the work. Thereafter, the Contractor will be responsible for the equipment and material. Deductions will be made from payments due or to become due to the Contractor for any shortages,

deficiencies, or damages which may occur after such delivery, and for any demurrage charges.

## 7. LEGAL RELATIONS AND RESPONSIBILITIES

### 7.01 Laws and Regulations

#### A. General

1. The Contractor shall keep fully informed of all Federal and State laws, ordinances and regulations, and all orders and decrees or 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 work. All such laws, ordinances, regulations, orders and decrees shall be observed and complied with. The Contractor shall protect and indemnify Owner and his representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by Contractor, his Subcontractors, suppliers of materials or services, or others engaged by the Contractor, or their employees.
2. Attention is directed to the General Statutes of the State of North Carolina for public contracts and public works contracts.

#### B. Protection of the Environment

1. The Contractor's attention is directed to GS, NCAC and all project permits for dealing with the prevention of environmental pollution and the preservation of natural resources that affect the performance of the work. Any unforeseen work relating to the prevention of environmental pollution or the preservation of natural resources shall be considered the responsibility of the contractor.
2. The Contractor shall conduct operations in conformity to the applicable sections of NCAC, laws amendatory thereto, and all pertinent regulations of the NCDENR and other agencies of the state and the federal government, as well as ordinances or resolutions enacted or adopted by local authorities.
3. It is public policy that all practicable means be exercised to prevent, control, and abate the pollution of waters of the state, and to maintain reasonable purity of the air by the control or abatement of air pollution.
4. The Contractor shall exercise every reasonable precaution throughout the life of the Contract to safeguard the air resources of the state by controlling or abating air pollution.
5. Federal, state, and local agencies having a responsibility and/or jurisdiction relating to the environment include, but are not limited to, the following agencies:

U.S. Department of Agriculture  
U.S. Department of Health and Human Services

U.S. Environmental Protection Agency  
U.S. Corps of Engineers  
U.S. Coast Guard  
U.S. Department of Labor  
North Carolina Department of Environment and Natural Resources  
    Division of Land Quality  
    Division of Water Quality  
    Division of Coastal Management  
    Division of Air Quality  
    Division of Marine Fisheries  
    Division of Waste Management  
North Carolina Department of Health and Human Services  
North Carolina Department of Transportation  
North Carolina Wildlife Resources Commission  
NOAA – National Marine Fisheries Service  
Albemarle Regional Health Services  
Local County Courts and Board of Commissioners  
Local County Councils and Commissions  
Local Planning Commissions

#### 7.02 Subcontractors

- A. The Contractor agrees not to assign, transfer, convey or otherwise dispose of the Contract or the right, title or interest therein either in whole or in part, or the power to execute such contract, to any person, firm or corporation without the written consent of the Owner. No portion of the contract shall be sublet, subcontracted or performed by other than the Contractor's own organization except with the written consent of the owner. Requests for permission to sublet or subcontract any portion of the Contract or to have any of the work performed by another organization shall be in writing and accompanied by a demonstration that the organization which will perform the work is experienced and equipped for such work.
- B. Written consent to assign, transfer, convey, sublet, subcontract or otherwise dispose of any portion of the Contract or to have portions of the work performed by other than the contractor's own organization shall not relieve the Contractor of any responsibility under the Contract or for the fulfillment of the Contract.
- C. The Contractor shall perform with the Contractor's own organization Contract work amounting to not less than 40 percent of the amount of the Contract as awarded, except that any items designated in the Contract as specialty items may be performed by subcontract. The cost of any such specialty items may be deducted from the amount of the Contract before computing the amount of work required to be performed by the Contractor's own organization. The term "own organization" refers only to workers employed and paid directly by the Contractor and equipment owned or rented by the Contractor.
- D. The Contractor shall make payment for subcontract work; performance of specialty items and other Contract work performed by others in the same units and on the same basis of measurement as apply under the Contract.

- E. In making payment to subcontractors and to others by whom work under the Contract is performed, the Contractor shall protect against the possibility of overpayment, and shall assume losses that result from overpayment. While the Engineer may estimate the quantities of work performed and of materials on hand for inclusion in progress payments, there is no guarantee of the correctness of such estimates. No incorrect estimate, regardless of by whom or when given, will be binding upon the Owner in final settlement.
- F. The Contractor shall direct and coordinate the operations of subcontractors and others performing the work and shall insure that the orders of the Engineer and or Owner are promptly carried out. Failure of the Contractor to control the work of subcontractors and other employees may result in the issuance of orders requiring the cancellation of the subcontracts and the removal of the subcontractors and other employees from the work site.

#### 7.03 No Waiver of Legal Rights

- A. Owner shall not be precluded or stopped by any measurement, estimate or certificate made either before or after completion and acceptance of work or payment therefore, from showing the true amount of character of work performed and materials furnished by the Contractor, or from showing that any such measurement, estimate or certificate is untrue or incorrectly made, or that work or materials do not conform in fact to the Contract.
- B. Owner shall not be precluded or stopped, notwithstanding any such measurement, estimate or certificate, or payment in accordance therewith, from recovering from the Contractor and his Sureties such damages as it may sustain by reason of his failure to comply with terms of the Contract, or from enforcing compliance with the Contract.
- C. Neither acceptance by Owner or by any representative or agent of the Owner of the whole or any part of the work, nor any extension of time, nor any possession taken by Owner, nor any payment for all or any part of the project, shall operate as a waiver of any portion of the Contract or of any power herein reserved, or any right to damages herein provided. A waiver of any breach of the Contract shall not be held to be a waiver of any other subsequent breach.

#### 7.04 Other Contracts

- A. Owner shall have the right to let other contracts to be coordinated with this Contract. The Contractor shall cooperate with and afford such other contractors reasonable opportunity for introduction and storage of materials and for execution of their work. Any matter of dispute shall be decided by the Owner, and his decision shall be binding.
- B. If any part of the work depends for its proper execution upon work of any such other Contractor, the Contractor shall inspect and promptly report to the Engineer and Owner any defects that affect subsequent work. Failure to do so shall constitute

an acceptance of such other Contractor's work as fit and proper for the reception and attachment of his own work and equipment.

#### 7.05 Hold Harmless

- A. Contractor shall defend, indemnify and hold harmless Owner from and against all liability or loss and against all claims or actions based upon or arising out of damage or injury to persons or property caused by or sustained in connection with the performance of this Contract by Contractor except, for losses, claims, or actions resulting from the sole negligence of Owner.
- B. The Contractor shall assume all responsibilities for the work, and bear all losses and damages directly or indirectly resulting to the Contractor, the Owner, or to others on account of the character or performance of the work, unforeseen difficulties, accidents, or any other cause whatsoever.
- C. The Contractor shall assume defense of, indemnify and save harmless the Owner, its officers, and employees from all claims, liability, loss, damage and injury of every kind, nature and description, directly or indirectly resulting from activities in the performance of the Contract, the ownership, maintenance or use of motor vehicles in connection therewith, or the acts, omissions, operations, or conduct of the Contractor or any Subcontractor under the Contract or any way arising out of the Contract, irrespective of whether any act, omission or conduct of the Owner connected with the Contract is a condition or contributory cause of the claim, liability loss, damage or injury and irrespective of whether act, omission, or conduct of the Contractor or Subcontractor is merely a condition rather than a cause of a claim, liability, loss, damage or injury.
- D. The Contractor shall not be liable for nor be required to defend or indemnify, the Owner relative to claims for damage or damages resulting solely from acts or omissions of the Owner, its officers, agents, or employees.

#### 7.06 Insurance

- A. The Contractor shall provide and maintain general liability, auto liability, property, and workers' compensation insurance for life of this Contract.
  - 1. General Liability Insurance

The Contractor shall maintain an ISO Commercial General Liability insurance policy (or an equivalent policy approved by Owner) with combined single limits of at least \$1,000,000 per occurrence for bodily injury, personal injury, and property damage and an aggregate limit of a least \$2,000,000. The policy shall include coverage for contractual liabilities.
  - 2. Comprehensive Automobile Liability Insurance

The Contractor shall maintain an automobile liability insurance policy with combined single limits of a least \$1,000,000 per occurrence for bodily injury, personal injury, and property damage.

3. Additional Insured Endorsement

The general and automobile insurance policies specified above shall include endorsements naming as an additional insured "the Camden County, its agents, employees and officials all while acting within their official capacity as such."

4. Property Insurance

Depending on the nature of the construction contemplated under this contract, Owner may require Contractor to provide property insurance. Refer to Special Provisions section of this Contract.

5. Workers' Compensation Insurance

Contractor, its subcontractors, if any, and all employers working under this agreement are subject employers under the North Carolina Workers' Compensation Law which requires them to provide workers' compensation coverage for all their subject workers.

Contractor is responsible for maintaining workers' compensation insurance for his employees and assuring that his subcontractors, if any, also maintain workers' compensation insurance. Contractor shall defend, indemnify, and hold Owner harmless from any liability for any workers' compensation claims costs, fines, or costs whatsoever arising from Contractor's or his subcontractors' failure to comply.

6. Additional Policies and Special Coverage

B. Refer to the Special Provisions section of this Contract for additional coverage that may be required.

C. Certificates of Insurance

1. Certificates of insurance evidencing all policies required by this Contract shall be delivered to the Owner prior to the commencement of any work. All certificates shall include a 30-day notice of cancellation clause and required additional insured endorsements. The Owner has the right to reject any certificate for unacceptable coverage and/or companies.

7.07 Royalties and Patents

A. The Contractor shall pay all royalties and license fees. The Contractor shall see the Owner free, indemnify and defend Owner, from all loss or damage that may result from the wrongful or unauthorized use of any patented article or process.

## 7.08 Permits &amp; Reference Documents

- A. The following Permits and Supporting Data apply to this project:
1. Permit No.: WQ0029894 Camden County WWTP
- B. The Following Plan Sets apply to this project:
1. Plan sheet entitled “Wastewater Treatment Facilities, Camden Village Core Project, South Mills Township, Camden County, North Carolina, Contract #2 WWTP, 59-day Storage Pond” as prepared by Hobbs, Upchurch & Associates, P.A., sealed by James H. Bowen, PE, plan sheet number CII.2C, G-2, dated February 2006 with a record drawing stamp date of 1/24/2008.
  2. Plan sheet entitled “Wastewater Treatment Facilities, Camden Village Core Project, South Mills Township, Camden County, North Carolina, Contract #2 WWTP, 59-day Storage Lagoon Details” as prepared by Hobbs, Upchurch & Associates, P.A., sealed by James H. Bowen, PE, plan sheet number CII.2C, G-3, dated February 2006 with a record drawing stamp date of 1/24/2008.
  3. Plan sheet entitled “Wastewater Treatment Facilities, Camden Village Core Project, South Mills Township, Camden County, North Carolina, Contract #2 WWTP, Storage Lagoon Details” as prepared by Hobbs, Upchurch & Associates, P.A., sealed by James H. Bowen, PE, plan sheet number CII.2C, G-4, dated February 2006 with a record drawing stamp date of 1/24/2008.

## 7.09 Payment of Obligations

- A. Contractor shall: (1) Make payment promptly as due, to all persons supplying to such contractor labor or material for the prosecution of the work provided in this contract. (2) Pay all contributions or amounts to the Industrial Accident Fund from the contractor or subcontractor incurred in the performance of the contract. (3) Not permit any lien or claim to be filed or prosecute against the state, county, school district, municipality, municipal corporation, or subdivision thereof on account of any labor or material furnished. (4) Pay to the Department of Revenue all sums withheld from employees.
- B. If Contractor fails, neglects or refuses to make prompt payment of any claim for labor or services furnished to the contract or subcontractor by any person in connection with this contract as such claim becomes due, the proper officer or employees representing Owner may pay such claim to the person furnishing the labor or services and charge the amount of the payment against the funds due or to become due the Contractor by reason of this contract.
- C. The payment of a claim in the manner authorized above shall not relieve the Contractor or the Contractor's surety from obligation with respect to any unpaid claims.

### 7.10 Dispute Settlement

- A. In the event the Contractor has filed a written protest in accordance with Section 4.09 Disputed Work, the Owner shall review the written protest and related documents and perform such investigations as the Owner deems appropriate and will try to transmit its decision in writing to the Contractor within 30 days from the date of receipt of the written protest.
- B. In the event the Owner elects to do so, the Owner may establish a "Claims Review Board" either to assist in reviewing appeals hereunder or to consider Contractor appeals directly.
- C. Subject to the provisions of Section 7.10.E. below, during the pendency of a written protest any related work performed by the Contractor shall be done at the Contractor's risk unless authorized by the Owner.
- D. [reserved]
- E. Where a written protest relates to only a portion of the work to be performed under this Contract, the Contractor shall not delay that portion of the work to which the written protest does not relate, unless the Contractor shall have written permission or written direction from the Owner to do so.
- F. [reserved]
- G. The parties hereby stipulate and consent that jurisdiction and venue shall be exclusively for all matters arising under this agreement in the courts of the State of North Carolina.
- H. All terms and provisions of this agreement shall be construed according to North Carolina law, it being agreed by the parties that the agreement was entered into in the State of North Carolina.

### 7.11 Protection of Other Governmental Authorities

- A. Whenever work under the Contract affects or may affect public property owned by or under the jurisdiction of any governmental authority, agency or district, including governmental subdivision other than the Owner, the Contractor shall indemnify and save harmless such governmental authority, its officers, agents and employees, from loss damage or claim of loss or damage to such property or the use thereof, arising from work under the Contract. Any bond or insurance and any special guarantee deposit required by such governmental authority, shall be supplied before beginning any portion of the work which affects or may affect the property of such governmental authority or the use thereof.

### 7.12 Public Safety and Convenience

- A. The Contractor shall conduct the project with proper regard for the safety and convenience of the public. When the project involves use of public ways, flag

persons shall be provided when directed, and means of free access to all fire hydrants, service stations, warehouses, stores, houses, garages and other property shall be maintained.

- B. When access to a business or businesses may be confusing for the traveling public due to operations of the contractor, the Contractor shall provide adequate signage to clarify alternate or existing access to the business(s). Private residential driveways shall be closed only with approval of the Owner or specific permission of the property owner.
- C. Normal operation of public transit vehicles shall not be interfered with unless otherwise authorized. The contractor shall not obstruct or interfere with travel over any public street or sidewalk without approval. Open trenches and excavations shall be provided with adequate barricades of an approved type which can be seen from a reasonable distance. At night, all open work and obstructions shall be marked by lights. The Contractor shall install and maintain all necessary signs, lights, flares, barricades, railings, runways, stairs, bridges and facilities. The Contractor shall observe all safety instructions received from Engineer, Owner or governmental authorities, but following of such instructions shall not relieve Contractor from his responsibility or liability for accidents to workmen or damage or injury to person or property.
- D. Emergency traffic such as police, fire and disaster units shall be provided reasonable access to the work area at all times.
- E. The Contractor shall be liable for any damages which may result from failure to provide such reasonable access or failure to notify the appropriate authority.

#### 7.13 Personnel Safety

- A. The Contractor shall be responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. Safety provisions shall conform to the applicable federal, state, county, and local laws, ordinances and codes.
- B. Where any of these are in conflict, the more stringent requirement shall be followed. The duty of the Engineer to conduct construction review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site.

#### 7.14 Detours

- A. All detours caused by work operations, or for convenience of the Contractor, shall be constructed and maintained at no expense to Owner. Plans for such detours shall be submitted to Engineer and Owner for approval.

- B. The Contractor shall construct and maintain temporary detours to provide adequate passage of public traffic and protection of the work at all times. If a detour established by the Contractor causes or may cause difficulty or confusion regarding access to a business, the Contractor shall provide signs to direct the traveling public to the business.
- C. Detours within the limits of the project such as side street crossings, temporary bridges over freshly placed concrete, or utilization of one or more lanes of the construction area for maintenance of traffic shall be the responsibility of the Contractor.
- D. If, in the judgment of the Engineer, one-way piloted traffic is necessary, it shall be provided for as set forth in Section 02105 - Temporary Traffic Control. The Engineer may recommend if flagging and piloting can be dispensed with after working hours. In the event that flagging and piloting are required after working hours as a result of carelessness or negligence on the part of the Contractor to properly condition work at the end of the day, such piloting and flagging shall be provided by Contractor at no expense to Owner.
- E. Upon failure to immediately provide, maintain, or remove suitable detours or detour bridges when ordered to do so by Engineer or Owner, Owner may without notice to Contractor or his Surety provide, maintain, or remove the detour and deduct costs thereof from any payments due or coming due to Contractor.

#### 7.15 Labor

- A. Upon notification in writing from the Owner, the Contractor shall remove immediately from the job for its duration any laborer, workman, mechanic, foreman, superintendent, or other person employed who is found to be incompetent, intemperate, troublesome, disorderly or otherwise objectionable, or who fails or refuses to perform his work properly and acceptably.
- B. Attention is directed to the North Carolina General Statutes relative to unlawful employment practices or discrimination by employers against any employee or applicant for employment because of race, religion, color, sex, or national origin. It is an unlawful employment practice for an employer, because of the race, religion, color, sex, or national origin of any individual, to refuse to hire or employ or to bar or discharge from employment such individual or to discriminate against such individual in compensation or in terms, conditions or privileges of employment.
- C. In the event the Contract is funded in whole or in part by federal funds, the Contractor shall comply with all provisions of Executive Order No. 11246 and of the rules, regulations, and relevant orders of the Secretary of Labor.
- D. In the event of the Contractor's noncompliance with the nondiscrimination clauses of a Contract so funded, or with any such rules, regulations, or orders, the Contract may be canceled, terminated, or suspended in whole or in part, and the Contractor may be declared ineligible for future government contracts or federally assisted

construction contracts, in accordance with procedures authorized in Executive Order No. 11246, and such other sanction may be imposed and remedies invoked as provided in Executive Order No. 11246, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

- E. If it is necessary to perform construction work on Saturdays, Sundays or legal holidays, or outside the eight (8) hour regular working day, Owner shall be notified of intent to do so one day prior to commencing such overtime work. In any event, all work shall be subject to Camden County Board of Commissioners approval. Prior to the start of such work, the Contractor shall arrange with the Engineer and/or Owner for continuous or periodic inspection of the work, surveys, and tests of materials, when necessary. Contractor shall be responsible for any additional costs incurred for inspection of work, surveys, and tests of materials necessitated by such overtime work.

#### 7.16 Use of Explosives

- A. The use of explosives is prohibited.

#### 7.17 Rights-of-Way, Easements and Premises

- A. Construction activities shall be confined within property lines, limits of easements and limits of construction permits as shown or specified in the Contract Documents, unless arrangements are made with owner(s) of adjacent private property. Prior to the use of any private property outside these specified boundaries, written permission of the property owner(s) shall be filed with the Owner; upon terminating such usage, a release from all damages, signed by the property owner(s), shall be filed with the Owner. Contractor shall save and hold harmless Owner from any loss or claim for damages resulting from unauthorized use of private property.
- B. The specified work areas shall not be unreasonably encumbered with materials and equipment, and permits for special occupancy and use of the specified work areas shall be obtained from the proper agencies and all associated costs borne by the Contractor. The Engineer's directions regarding signs, advertisements, fires, and smoking will be followed.

#### 7.18 Waste Sites

- A. Shall be permitted through the NCDENR, NCDOT or other local, state or federal agency having jurisdiction of the type and nature of the waste.
- B. Either type of waste site shall be operated in such a manner as to meet all safety and health requirements of state and local agencies. Sites, operations, or the result of such operations, which create a nuisance problem, or which result in damage to public or private properties will not be permitted.
- C. Permits for dumping on sites designated in the Contract Documents or by the Engineer will be provided by Owner. The Contractor shall obtain any necessary

permits for other sites at no expense to Owner. In selecting and obtaining fill sites for excess materials, the Contractor shall be aware of restrictions and regulations related to fill of wetlands, floodways, floodplains, drainage ways, erosion control, etc., and shall obtain all necessary approvals and permits related to the fill. Copies of issued permits will be furnished to Engineer prior to commencing filling operations. Materials shall not be deposited on an unimproved dedicated street without permission of the Engineer.

- D. Where waste sites are designated in the Contract Documents, the operations shall be performed as directed; and upon completion, the Contractor shall uniformly clean and shape the area as directed.
- E. Where there is additional waste excavation in excess of that needed for the project or for predesignated sites, this material shall be disposed by securing and operating a waste site in conformance with the general requirements hereinbefore described. Contractor may accept any reimbursement that can be secured from the sale of such material.

#### 7.19 Vermin Control

- A. At the time of occupancy by Owner, any structure or structures entirely constructed under the Contract shall be free of rodents, insects, vermin or pests. The Contractor shall arrange and pay for extermination work as may be necessary as part of the Contract work within the Contract time. Work shall be performed by a licensed agency in accordance with the requirements of governing authorities. The Contractor shall assume responsibility for any injury to persons or property resulting from extermination work for the elimination of any offensive odors resulting from extermination operations.

### 8. PROSECUTION AND PROGRESS OF WORK

#### 8.01 Contractor's Construction Schedule

- A. Before starting work, the Contractor shall submit a proposed construction schedule to the Engineer and Owner. If it is desirable to carry on operations in more than one location simultaneously, a schedule shall be submitted for each location two weeks in advance of beginning such operations. In the event that the Contractor's proposed construction schedule does not meet the necessary construction program schedule as determined by Owner, the Contractor shall resubmit a schedule that conforms as approved.
- B. The schedule shall show the proposed order of work and indicate the time required for completion of the major items of work. This working schedule shall take into account the passage or handling of traffic with the least practicable interference therewith and the orderly, timely and efficient prosecution of work. It will also be used as an indication of the sequence of the major construction operations and as a check on the progress of work, but does not become a part of the Contract.

- C. If requested by the Engineer or Owner, the Contractor shall provide weekly progress schedules of expected project activities. The progress schedules shall indicate the Contractor's plan of prosecution of the work in sufficient detail to enable the Contractor, the County, and the Engineer to plan, coordinate, appraise, document, and control their respective Contract responsibilities. The schedule of work, and the work forces and equipment supplied by the Contractor, shall be adjusted periodically as necessary to allow for the completion of the Contract within the Contract Time.

#### 8.02 Preconstruction Conference

- A. A pre-construction conference with the Owner, Engineer, and Contractor will be provided. A Contractor's attendance at the said preconstruction conference is mandatory.

#### 8.03 Notice To Proceed

- A. A written "Notice to Proceed" will be given after the Contract has been executed and the Performance Bond and Payment Bond, and all required insurance certificates have been filed with and approved by the Owner. No work shall commence under the Contract until such written notice has been given.
- B. Notice to Proceed for the project may be delayed by Owner until required utility relocation, construction, or reconstruction has been completed or has progressed to a satisfactory degree of conformance which will allow initial contract work to commence.
- C. Work shall commence within ten days after the date of the Notice to Proceed, or by such other date or time period specified in the Notice to Proceed. The actual date of commencement of work, or the last allowable date for commencement as specified in the Notice to Proceed, whichever is earlier, shall establish the date for commencement of the Contract time. The Contractor shall notify the Owner forty-eight (48) hours in advance of the actual time and place work will be started.

#### 8.04 Contract Time

- A. Except as otherwise agreed by the County and Contractor in writing, the Contract Time shall be from August 1, 2018 to October 1, 2018.
- B. Time shall be considered the essence of the Contract.
- C. If, in the judgment of the Owner, insufficient forces are being employed, or inadequate equipment and methods are used, or if progress is for any reason unduly delayed, he may instruct the Contractor in writing to increase his force or equipment, or adopt improved methods to expedite the work, and the Contractor shall heed and follow such instructions, but conformity to the Owner's instructions shall not relieve the Contractor of any of his responsibilities under the Contract.

- D. If the Contractor at any time falls behind its proposed schedule of work, the Owner may request and the Contractor shall supply a new schedule of work along with a statement regarding the increased forces or equipment or new construction methods to be employed on the work in order to complete the work within the Contract Time. Failure to supply a schedule of work and sufficient forces and equipment to complete the work within the Contract Time may be declared a breach of contract by the Owner.
- D. The Contractor shall complete the work called for under the Contract within the Contract Time or adjusted Contract Time.

#### 8.05 Suspensions Of Work

- A. Suspension by Owner
  - 1. The Contractor shall immediately suspend work on the project wholly or in part as directed by the Owner for good and sufficient reason. In the event of such suspension, Owner shall, except in emergency, and except as hereinafter provided, give Contractor three days' notice and work shall be resumed within five days after notice has been given by Owner to Contractor to do so. Owner shall allow Contractor an extension of time for completion corresponding to the total period of temporary suspension, and shall reimburse him for necessary rental of unused equipment, services of watchpersons and other unavoidable expenses by reason of the suspension without fault of Contractor.
  - 2. Contractor shall not be entitled to damages, intangible or overhead costs or anticipated profits from such temporary suspension.
- B. Suspension by Engineer or Owner
  - 1. The Contractor shall immediately suspend work on the project wholly or in part as directed by the Owner or, with the Owner's written authority, the Engineer, pursuant to Subsections 5.01 and 5.02 due to: (1) failure to correct unsafe conditions for working personnel, the general public or Owner's employees, (2) failure to carry out provisions of the Contract Documents, or (3) failure to carry out orders or directions, for such periods as the Engineer or Owner may deem necessary due to conditions considered unsuitable for the performance of the work or for any reason deemed to be in the public interest.
  - 2. The Contractor shall immediately suspend work on the project wholly or in part as directed by the Owner or, with the Owner's written authority, the Engineer, for such periods as the Engineer may deem necessary, pursuant to Subsection 5.19 for failure to immediately correct defective and unacceptable work.
- C. Suspension by Contractor

1. Suspending operations because of seasonal conditions or other unsuitable conditions pursuant to Subsection 8.06 shall require the concurrence of the Owner.

D. Responsibility of Contractor

1. Voluntary or involuntary suspension or slowdown, with or without the approval of the Owner or Engineer, and suspension of work ordered by the Owner or Engineer will not be grounds for claims or damages, idle equipment or labor, or extra compensation. No allowance or compensation will be made on account of such suspensions of work except as provided hereinbefore and as provided in Subsection 8.06.
2. At the commencement of, and during any suspensions of work, the Contractor shall be responsible for the care of work performed and take every precaution to prevent any damage or deterioration of the work. The Contractor shall be responsible for work, including temporary protection devices to warn, safeguard, protect, guide and inform traffic during suspension, the same as though its performance had been continuous and without interferences.
3. The Contractor shall be responsible and bear all costs for providing suitable provisions for traffic control and for maintenance and protection of the work during suspension for cause. If the Contractor fails to provide for temporary traffic control and to maintain the work, the Engineer or Owner may immediately proceed to maintain the work. The cost of such maintenance shall be deducted from payments due or to become due to the Contractor.

E. Resumption of Work

1. In all cases of suspension, work will be resumed only upon written order of the Engineer or Owner.

8.06 Delays and Extensions

- A. Contract completion time may be subject to adjustment during the progress of the work at the written request of the Contractor, for causes beyond the control of Contractor and which the Owner, with the advice of the Engineer, determines actually affected the time necessary for completion of work under the Contract.
- B. The Owner or Engineer will not consider adjustment of Contract Time based on shortage or inadequacy of labor and equipment, negligence or fault of Contractor and other deficiencies or lacks which are within the province of Contractor's control or responsibility. Causes which will be given consideration in justifying adjustment of Contract time will include, but are not limited to, the following:
  1. Errors, changes, or omissions in the Contract Documents.

2. Failure of Owner, its representatives and its other contractors to act promptly in carrying out obligations and duties.
3. Failure of Owner to submit the Contract Documents, or a part thereof, to the Contractor for execution within the specified time contained in Subsection 3.01 of the Proposal Form.
4. Performance of extra work under Subsection 4.10.
5. Court orders enjoining the prosecution of the project, strikes, acts of God which shall include action of the elements not reasonably foreseeable by the Contractor, or act of Owner not authorized by the Contract or permitted by law.

- C. A Contract time extension will be considered only if the Contractor has given written notice to Owner and Engineer of the cause of delay within ten days after the beginning thereof and notice to Owner or Engineer of the termination thereof within five days after such termination, and make claim for such extension prior to the Contract completion date. The decision by the Owner, with advice from the Engineer, of the reasonable term of any extension or denial thereof shall be final.
- D. An adjustment of Contract time, as herein provided, shall be Contractor's sole remedy for any delay in completion of the project arising from causes beyond the control of Contractor, and in no event shall Contractor be entitled to collect or recover any damages, loss or expense incurred by reason of such delay.

#### 8.07 Liquidated Damages

- A. The Contractor agrees to pay \$500 per calendar day for damages for delay sustained by the County by reason of the Contractor's failure to timely perform its obligations under the Contract. Such damages include, but are not limited to, the cost of prolonged administration, supervision and inspection and resolution of traffic and public relations issues surrounding the delayed completion. In submitting a Bid, Contractor the amount of liquidated damages as stated above is a reasonably accurate forecast of the probable damages for delay that would be sustained by County in the event of a delay in completion. Such liquidated damages shall not be the exclusive remedy of County, but shall be in addition to any other remedies County may have for breach of the Contract and shall be in addition to any actual provable damages, other than for delay, sustained by County by reason of a breach of the Contract by Contractor.
- B. When the Contractor believes that all work on the project has been completed, the Contractor will set up a walk-through inspection with the Engineer and Owner, unless the Owner elects not to participate in such inspection. A "punch list" of all unfinished or unacceptable items will be made. The Contractor will finish all punch list work before the end of time allowed for the project. If work has not been completed by the end of the time allowed for the project, liquidated damages shall be charged for such delayed completion as provide above and shall be in addition to any other remedies the County may have for breach of the Contract.

#### 8.08 Contractor's Representative

- A. Before starting work an authorized representative shall be designated who shall have complete authority to represent and to act for Contractor, in his absence from the work site, in all directions given him by the Owner or Engineer. Contractor, or his authorized representative, shall supervise the work, and shall be present on site continually during its progress, including such times as only Subcontractors may be actively working on the project. If called for in the Contract Documents, an office shall be maintained on or adjacent to the project site. The Contractor shall keep a complete copy of the Plans, Permits and Specifications on or near the site at all times. If Contractor and his authorized representative are not present on any part of the work where it may be necessary to give instructions, directions may be given by Engineer or Owner to the superintendent or foreman who may have charge of that particular part of the project, and such order shall be received and followed. Such directions shall not be deemed to change the status of Contractor or Subcontractor, not to make Owner an employer, nor to give Owner direct responsibility for the methods and manner of the work. Such directions of major importance will be confirmed in writing. Any direction will be so confirmed in each case on written request from the Contractor.

#### 8.09 Conflicts, Errors, Omissions, and Additional Drawings

- A. All plans shall be checked and compared prior to construction and Engineer notified of any discrepancies or omissions in order to permit correction by Engineer. Coordination of Plans and Specifications is intended. Labor and materials required for the work shall be furnished if indicated on one and not the other as fully as if mentioned or indicated on both; and should any work or materials be reasonably required or intended for carrying the project to completion which are inadvertently omitted on the Plans and Specifications, the same shall be furnished as fully as if particularly delineated or described. The intent of the Plans and Specifications is to show and describe a complete project within the limits stated. Dimensions shown on Plans shall be followed rather than scale measurements. Whenever it appears that the Contract plans are not sufficiently detailed or explicit, the Engineer may furnish additional detailed drawings or written instructions.
- B. In case of conflict between requirements set forth in the Contract Documents the provisions for order of precedence in Subsection 4.04.A shall apply.

#### 8.10 Owner's Right To Do Work

- A. Neglecting to prosecute the project properly, or failing or refusing to perform any of the terms or conditions of the Contract, will permit Owner to supply or correct any deficiency or defect without prejudice to any other remedy. Such action by Owner shall be taken only after three days' notice by Engineer or Owner to Contractor and his Surety, unless in the judgment of the Owner, an emergency or danger to the work or to the public exists, in which event action of Owner, as set forth above, may be taken without any notice whatsoever. The cost of such action by owner shall be deducted from the payment then or thereafter due Contractor. The Contractor shall pay Owner any costs in excess of such payment due.

### 8.11 Termination of Contract

- A. All terms and conditions of the Contract are considered material, and failure by Contractor to comply with any of said terms or conditions shall, at Owner's option, be deemed a breach of contract. Upon such failure, Owner shall have the right, whether an alternative right is provided or not, to declare the Contract terminated. Issuance by Owner of an order stating that the Contract is terminated, and service of a copy of said order upon Contractor and his Surety, shall be deemed a complete termination of the Contract. Upon the Contract being so terminated, Owner may retain all sums due under the Contract and both the Contractor and his Sureties shall be liable under his bond for all losses, expenses and damages caused to Owner by reason of his failure to complete the Contract, and Surety shall be required, at Owner's option, to complete the project. Notwithstanding such termination, Contractor and his Sureties shall remain liable under the terms of the Contract for work performed prior to such termination. The Engineer will recommend to the County the payment due Contractor for work performed prior to the date of Contract termination.
- B. County and Contractor may agree to terminate the contract: (1) If work under the contract is suspended by an order of a public agency for any reason considered to be in the public interest other than by a labor dispute or by reason of a third party judicial proceeding relating to the work other than a suit or action filed in regards to a labor dispute; and (2) If the circumstances or conditions are such that it is impracticable within a reasonable time to proceed with a substantial portion of the public works.
- C. Reimbursement for mobilization expenses, when not included in the contract as a separate pay item, including moving equipment to and from the work, will be considered where the volume of work completed is too small to compensate the Contractor for these expenses under the Contract prices. When an item for mobilization appears in the Contract as a separate pay item, the amount to be paid the Contractor will be the mobilization amount earned in accordance with Section 02100.
- D. Acceptable materials obtained by the Contractor and not incorporated in the work may be purchased from the Contractor at actual cost as shown by receipted bills.

### 8.12 Default By Contractor

- A. The Owner may, without prejudice to any other right or remedy and after giving the Contractor and Contractor's surety seven days' written notice, terminate the employment of the Contractor if the Contractor should:
  - 1) Be adjudged bankrupt or experience dissolution, termination of existence, insolvency, business failure or discontinuance as a going business, appointment of a receiver of any property of, for the benefit of creditors by, or the commencement of any proceeding under any bankruptcy or insolvency laws by or against contractor.
  - 2) Make a general assignment for the benefit of the Contractor's creditors;

- 3) Have a receiver appointed on account of contractor's insolvency;
- 4) Fail to supply enough properly skilled workers, proper materials, or adequate equipment for the efficient prosecution of the work;
- 5) Fail to make prompt payment to subcontractors or suppliers;
- 6) Disregard laws, ordinances, or the instructions of the Engineer, Owner, or County; or
- 7) Fail to comply with any term, obligation, or covenant or condition contained in this contract or the associated permits, within seven (7) days after receipt of written notice from Owner demanding such compliance.

- B. The Owner will take possession of the premises and all materials, tools, and appliances as well as all other materials on which the Contractor has received partial payment. The Owner may finish the work by any method the Owner deems expedient.
- C. The Contractor shall not be entitled to receive any further payment until the work is completed. On completion of the work, determination shall be made by the County, with the advice of the Engineer, of the total amount the Contractor would have been entitled to receive for the work had the Contractor completed the work. The difference between the total amount and the amounts previously paid to the Contractor shall be called the unpaid balance and if the unpaid balance exceeds the expense incurred by the Owner in completing the work, including expense for additional managerial and administrative services, the excess will be paid to the Contractor, with the consent of the surety. If the expense incurred by the Owner exceeds the unpaid balance, the amount of the excess shall be paid to Owner by the Contractor or the surety.
- D. Upon completion of the project by others, Contractor will be entitled to the return of all material which has not been used in the work or which has not been paid for, and for all plant, tools, equipment and other property, provided, however, that no claim will be allowed because of usual and ordinary depreciation, loss, wear and tear. None of the foregoing provisions, or the provisions in Subsection 8.11, shall be construed to require Owner to complete the work, nor to waive or in any way limit or modify the provisions of the Contract relating to the fixed and liquidated damages suffered by Owner on account of failure of Contractor to complete the project within the time prescribed.

#### 8.13 Completion and Acceptance

- A. After completion of the work specified in the Contract, and completion of the final inspection, the Engineer will recommend to the Owner that the work be accepted and payment be made.
- B. No payment made under the Contract except the final payment shall be evidence of the performance of the Contract, either wholly or in part, and no payment shall constitute an acceptance of unauthorized or defective work or improper material.
- C. A certificate of completion or letter of acceptance of the project, submitted by the Engineer or other officer of the Owner, shall constitute final acceptance of the

work on the date of the certificate or letter. Such certificate or letter of acceptance shall not constitute an acceptance of any unauthorized work.

- D. The acceptance of the work shall not prevent the Owner from making claim against the Contractor for defective work.

#### 8.14 Final Warranty

- A. The work is guaranteed by the Contractor for a specified period from the date of final acceptance by the owner. If no warranty period is specified, the work shall be guaranteed for one year from the date of final acceptance by the owner. The Contractor's performance bond shall remain in effect during the warranty period. If, within the warranty period, repairs or changes are required in connection with the work, the Contractor shall promptly, without expense to the Owner:
  - 1) Place in satisfactory condition all guaranteed work;
  - 2) Correct all damage to the building site, equipment or contents which is the result of the use of materials, equipment or workmanship with are inferior, defective, or not in accordance with the terms of the contract; and,
  - 3) Correct any work, material, equipment, or contents of building, structure or site disturbed in fulfilling the guarantee.
- B. Repairs, replacements or changes made under the warranty requirements shall be warranted for the specified warranty period, or for one year, beginning on the date of the acceptance of the repairs, replacements or changes.
- C. If the Contractor fails within ten days to proceed to comply with the terms of this warranty, the owner may have the defects corrected. The Contractor and Contractor's surety shall be liable for all expense incurred. In case of an emergency where delay would cause serious loss or damage, repairs may be made without notice to the Contractor and the Contractor or Contractor's surety shall pay the cost.

### 9. MEASUREMENT AND PAYMENT

#### 9.01 Measurement of Quantities

- A. Payments shall be based on measurements of completed work in accordance with the United States Standard Measures. Units of measurement for payment shall be shown or specified. In calculating quantities, all lengths and areas will be based on horizontal and vertical measurement, unless otherwise specified.
- B. Basis is defined as the particular standard unit of measurement which will be applied to a particular item of work as shown on the Proposal for a specific Contract. Each basis of measurement herein set forth is generally applicable and will be in effect; however, in case of conflict, the order of precedence will conform to Subsection 4.04.A.

#### 9.02 Scope of Payment

- A. Quantities listed in the proposal do not govern final payment. These quantities are estimates only for purposes of obtaining competitive bids. Payments to the Contractor will be made only for actual quantities of Contract items performed in accordance with terms of the Contract and for items of work actually performed as Extra Work or under supplemental agreement in accordance with the terms of the Contract.
- B. The Contractor shall accept the compensation, as herein provided, in full payment for furnishing all materials, labor, tools, equipment and incidentals, excluding those specified in Subsection 4.09, necessary for performing all work under the Contract, also for all loss, damage or liability arising from the nature of the work, or from the action of the elements, subject to provisions of Subsection 6.06 or from any unforeseen difficulties which may be encountered during prosecution of the work, until final acceptance by Owner.

#### 9.03 Payment Schedule

- A. The Contractor may submit a request for partial payment on a monthly basis (every 30 days), or other interval as approved by the Owner. The amount of partial payments will be based on the work accomplished and accepted as the last day of the approved pay period. All requests for payment shall be made on the form furnished to the Contractor by the Camden County. The form shall be completely and legibly filled out with all appropriate information supplied and shall be signed by an authorized representative of the Contractor. Minority Business (MB) and Women's Business (WB) participation shall be listed in the appropriate spaces on all requests for payment. If there is no participation the word "None" or the figure "0" shall be entered. One hundred percent (100%) payment shall be made after successful completion of the work as verified by the final inspection. Final payment will be released upon the receipt of a written statement from the Contractor to the County indicating that all subcontractors have been paid in full.

#### 9.04 Verification of Work

- A. Reserved

#### 9.05 Compensation for Alteration of Contract

- A. Unless changes and alterations in Plans or Quantities, Contract Documents, or details of construction materially change the character of work to be performed or unit costs thereof, Contractor shall accept as payment in full, so far as Contract items are concerned, payment at the same unit prices as are provided under the Contract for accepted quantities of work done. If the work involved is measured on a lump sum basis, the adjustment of the lump sum for the increases or decreases shall be as specifically set forth in the applicable section of these Standard Specifications.
- B. If, however, the character of work or unit costs thereof are materially changed, pursuant to Subsection 4.07, compensation for such work will be made on such basis as may have been agreed to in advance of the performance of work, or in case

no such basis has been previously agreed upon, then an allowance may be made, either for or against the Contractor, in such amount as the County, with the advice of the Engineer, may determine to be fair and equitable.

#### 9.06 Eliminated Items

- A. Owner shall have the right to eliminate, omit or cancel (herein collectively termed elimination) portions of the Contract Documents relating to construction of any items or part of any item by payment to the Contractor of a fair and equitable amount covering all items of actual costs incurred directly in connection with eliminated work and prior to the date of elimination of work by order of the County. Where practicable, work completed before elimination shall be paid for at unit prices, otherwise Contractor will be allowed a profit percentage on materials used and construction work actually performed at rates as provided in Section 4.11 for force account work, but no allowance will be made for anticipated profits. Acceptable materials ordered by Contractor, delivered to the work site, or properly stored at sites approved by the Engineer Or Owner prior to date of elimination of work by order of the County may be purchased from Contractor by Owner at actual cost, and thereupon shall become the property of Owner.

#### 9.07 Payment for Extra Work

- A. Extra work shall be paid at prices agreed upon between Contractor and Owner, but in no event exceeding unit prices established in the Contract.
- B. When such order pertains to work of a class or classes for which no unit prices are established, then the agreed adjustment shall be based either on unit prices decided on fair and equitable grounds or shall be a lump sum similarly decided, as Owner may determine, or such work may be done as Extra Work at force account. In no case shall any claim for Extra Work be made unless ordered as such.

#### 9.08 Payment for Force Account Work

- A. Whenever the Contractor is directed by written notice from the Engineer as the Owner's representative, to perform extra work on a time and material basis, the Contractor shall furnish labor, equipment, and materials necessary to complete the work in a satisfactory manner and within a reasonable period of time. For the work performed, payment will be made for the documented actual necessary expense of the following:
  - 1) Field and office labor, including estimating and procurement personnel and foremen, who are directly assigned to the time and materials work (actual payroll cost, including wages, fringe benefits as established by law). The cost of labor shall include any employer payments to or on behalf of the worker for health and welfare, pension, vacation and similar purposes. Where subsistence and travel allowances are required for performance of extra work, the charges shall consist of the actual amount paid to each worker. No other fixed labor burdens will be considered unless approved in writing by the Owner.

2) Material delivered and used on the designated work, including sales tax, if paid by the Contractor or his subcontractor.

3) Rental, or equivalent rental cost of equipment, including necessary transportation, for items having a value in excess of \$100. When equipment is not rented, the equivalent rental cost of equipment shall be based on the standard rental rates for Contractor-owned equipment, but in no event shall exceed the rental rates set forth in the "Rental Rate Blue Book for Construction Equipment" and the "Rental Rate Blue Book for Older Construction Equipment" which are published by the Equipment Guidebook Company, P.O. Box 10113, Palo Alto, CA 94303. For equipment not listed in said document, the rental rate shall be as listed by the local section of the Associated General Contractors. If the equipment is not listed by the Associated General Contractors, the rental rate will be mutually agreed upon in writing between the Contractor and Owner prior to the use of said unlisted equipment. The reasonable cost of moving equipment onto and off the job site shall be included, but equipment rental shall not be paid when the equipment is inoperative due to breakdowns. Individual pieces of equipment or small tools having a replacement value of \$100 or less shall be considered as included in the overhead allowance and no additional payment therefore shall be made.

a. When equipment is used on the extra work for less than five (5) days, hourly rates shall be used. Less than thirty (30) minutes of operation shall be considered ½ hour of operation. When equipment is used on the extra work for more than five (5) days, weekly rates shall apply. In this case, less than four (4) hours of operation shall be considered to be ½ day of operation.

b. Rental or equivalent rental costs will be allowed for only those days or hours during which the equipment is in actual use. Rental and transportation allowances shall not exceed the current rental rates prevailing in the locality. The rentals allowed for equipment shall be understood to cover all fuel, supplies, repairs, and renewals.

c. The Owner reserves the right to furnish such materials and equipment as he deems expedient, and the Contractor shall have no claim for profit or added fees on the cost of such materials and equipment.

4) One percent (1%) for additional bond, when required and approved by the Owner.

5) Additional insurance (other than labor insurance) as required and approved by the Owner.

6) Professional services shall be included in "actual necessary expense" only when the Owner has determined that such services are necessary and the provision of such services has been authorized in advance in writing by the Engineer.

a. To the preceding actual necessary expenses, there shall be added the following fixed fees for either the Contractor or subcontractor actually executing the work:

- A fixed fee of 20 percent (20%) of the cost of Item a
- A fixed fee of 15 percent (15%) added to the cost of Items b and c
- A fixed fee of 6 percent (6%) added to the cost of Items d and e
- A fixed fee of 10 percent (10%) added to the cost of Item f

- B. An additional fixed fee of 10 percent (10%) shall be allowed the Contractor for the administrative handling of portions of the work that are executed by an approved subcontractor. No additional fixed fee will be allowed for the administrative handling of work executed by a subcontractor of a subcontractor, unless by written permission from the Owner.
- C. The added fixed fees shall be full compensation for the cost of general supervision, overhead, profit, and any other general expense.
- D. If a dispute occurs over payment for work provided on a time and material basis, the dispute shall not be cause for stopping work.
- E. The Contractor shall maintain accurate records for all work performed on a time and material basis. These records will reflect all the actual necessary expenses pertaining to the extra work and shall at all times be available for audit by the Owner.
- F. The Contractor's records shall make clear distinction between the direct costs of work paid for on a time and materials basis and the costs of other work. The Contractor shall furnish the Engineer report sheets in duplicate of each day's work. The daily report sheets shall itemize the labor, materials and equipment used. The daily report sheets shall provide names or identifications and classifications of workers, the hours worked, the sizes, types, and identification numbers of equipment, and hours operated. Daily report sheets shall be signed by the Contractor or his authorized agent and verified by the Engineer.
- G. To receive partial payments and final payment for time and materials work, the Contractor shall submit to the Engineer and Owner in a manner approved by the Engineer, detailed and complete documented verification of the Contractor's and any of his subcontractor's actual costs incurred. Material and rental charges shall be substantiated by copies of vendors' invoices. Such costs shall be submitted within thirty (30) days after said work has been satisfactorily completed.

#### 9.09 Progress Payments and Retainage

- A. Payments for all work under the Contract will be made at the price or prices bid therefore, and those prices shall include full compensation for all incidental work.
- B. Progress estimate of work performed in any calendar month will be made by the Engineer before the last week of that month. These estimates shall include value of labor performed and materials incorporated in the work since commencing work under the Contract. Such estimates need not be made by strict measurements and may be approximate only, may relate to the cost schedule mentioned herein, and

shall be based upon the whole amount of money that will become due according to terms of the Contract when project has been completed. The Engineer may in special circumstances include in progress estimates up to eighty-five percent of the cost of Contractor of materials delivered to the site, properly stored, protected from damage and insured, provided that after any such payment such materials must be used in the particular project; Engineer may require receipted invoices prior to payment.

- C. If the Contract price is determined, in whole or in part, on a lump sum basis, Contractor shall prepare an estimated cost schedule relating thereto and have Engineer approve same before commencing work; progress estimates based on said estimated cost schedule shall be the basis for progress payments.
- D. Progress payment will be made by Owner on a monthly basis no later than the 20th day of the subsequent month of work performed, except that, additional days may be required when a payment is accompanied by one or more of the following: an extension of completion time, change order or extra bill. Payment may be made via use of checks or warrants at the option of Owner for the amount of the approved estimate. Notwithstanding any other payment provision herein, the Owner may retain up to ten percent (10%) retainage on payments made pursuant to this Contract, but only after the Owner has made a determination that such retainage made be withheld pursuant to GS 143-134.1.
- F. Monies retained will be released to Contractor following official acceptance of the project by the Camden County Board of Commissioners of the Camden County. The County Engineer may recommend early release of partial retainage, if any, if all work is completed.
- G. If Contractor fails to complete the project within the time limit fixed in the Contract or any extension thereof, no estimate may be accepted for progress or other payments allowed thereafter until the project is completed.
- H. The making of progress payments shall under no circumstances be construed as an acceptance of any of the work or materials under the Contract.

#### 9.10 Deferment of Payments

- A. No partial or final payment will be made until all orders made by Engineer to Contractor in accordance with the Specifications are compiled with, or until all claims or liens filed or prosecuted against Owner, its officer or employees contrary to provisions of the Contract are satisfied.
- B. In the event a complaint or charge of unlawful employment practices is filed against the Contractor by anyone, including the Owner, no further payments will be made on the Contract until such time as the issue is resolved.

#### 9.11 Final Estimate and Payment

- A. The Engineer, Project Inspector, and Owner shall be notified when work is considered complete and Owner, with the advice of the Engineer, shall, within fifteen (15) days after receiving notice, either accept the work or notify Contractor of work yet to be performed on the Contract. If accepted, Engineer shall so notify Contractor, and will make a final estimate and recommend acceptance of the work as of a certain date. Upon approval and acceptance by Owner, Contractor will be paid a total payment equal to the amount due under the Contract including all retainage, if any.
- B. As a further prerequisite to final payment, Contractor shall execute and deliver to Owner, in form approved by the Attorney, a receipt for all amounts paid or payable to Contractor under the Contract, and a release and waiver of all claim against Owner growing out of, or connected with, the Contract and furnish satisfactory evidence that all amounts due for labor, materials and other obligations under the Contract have been fully and finally settled or are fully covered by insurance protecting Owner, its officers, agents and employees as well as Contractor.
- C. If Owner declares a default of the Contract, and Surety completes said Contract, all payments after declaration of default and retainage held by Owner, if any, shall be paid to Surety and not to Contractor in accordance with terms of the Contract.

#### 9.12 Acceptance of Final Payment

- A. Acceptance by Contractor of final payment shall release Owner and Engineer as agent of Owner from all claims and all liability to Contractor for all things done or furnished in connection with the work, and every act of Owner and others relating to or arising out of the work. No payment, however, final or otherwise, shall operate to release Contractor or his Sureties from obligations under the Contract and the performance, payment, and other bonds and warranties, as herein provided.

# Division 2

SECTION 02110 - SITE CLEARING

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes, but is not limited to the following:
  - 1. Protection of existing vegetation.
  - 2. Removal of vegetation.
  - 3. Topsoil stripping.
  - 4. Clearing and grubbing.
  - 5. Removing above-grade improvements.
  - 6. Removing below-grade improvements.

1.03 PROJECT CONDITIONS

- A. Traffic:
  - 1. Conduct site clearing operations to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Owners or NCDOT.
- B. Protection of Existing Improvements:
  - 1. Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
  - 2. Restore damaged improvements to their original condition, as acceptable to property owners.
- C. Protection of Existing Trees and Vegetation:
  - 1. Protect existing vegetation indicated to remain in place during preconstruction meeting, or outside the limits of grading, against unnecessary cutting, breaking or skinning of roots. Provide adequate temporary guards to protect trees and vegetation to be left standing.

2. Repair or replace vegetation damaged by construction operations, in a manner acceptable to the Owner.
3. Replace vegetation which cannot be repaired and restored to full-growth status, as determined by Owner.

## PART 2- PRODUCTS

Not Applicable to this Section

## PART 3- EXECUTION

### 3.01 SITE CLEARING

#### A. General

1. Remove trees, shrubs, grass and other vegetation, improvements, or other obstructions as required to permit installation of new construction.
2. Remove similar items elsewhere on site or premises as specifically indicated. "Removal" includes digging out and off-site disposing of stumps and roots.
3. Cut minor roots and branches of trees indicated to remain in a clean and careful manner, where such roots and branches obstruct installation of new construction.

#### B. Topsoil

1. Topsoil is defined as soil found in a depth of not more than 18 inches from existing ground surface. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.
2. Under new pavement areas outside of existing pavement areas strip topsoil encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Topsoil stripping shall extend (2) feet beyond all paving limits.
3. Remove growths of grass or other vegetation from areas before stripping.
4. Dispose of unsuitable or excess topsoil same as specified for disposal of waste material.

#### C. Clearing & Grubbing

1. Clear site of trees, shrubs and other vegetation, except for those indicated to remain during preconstruction meeting and those outside clearing limits.

2. Completely remove stumps, roots and other debris protruding through ground surface.
3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated. Place fill material in horizontal layers in accordance with Section 02200 Earthwork, 3.07 B.

D. Removal of Improvements

1. Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction. For the specified sections of roadways to be rebuilt or otherwise improved, remove all existing asphalt pavement. The asphalt pavement removed from this street section may be milled and utilized as reclaimed material to be used in combination with aggregate base materials. Reclaimed asphalt shall be submitted for testing of gradation and materials and satisfactorily pass test prior to use as subbase.

E. Site Drainage

1. Contractor to maintain positive drainage throughout the Site Clearing operation so as to avoid standing water on work surfaces.

3.02 DISPOSAL OF WASTE MATERIALS

- A. Burning is permitted if allowed by local authorities. Contractor is responsible for obtaining any local burning permits.
- B. Remove waste materials and unsuitable or excess topsoil from property and dispose of in a legal manner.

END OF SECTION 02110

SECTION 02190 - EROSION & SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. The extent of the work required under this section is that required to minimize water, air, and soil erosion and siltation.
- B. Temporary erosion control measures which may be necessary include, but are not limited to, temporary berms, dikes, dams, drainage ditches, silt basins, silt ditches, perimeter swales, slope drains, structures, vegetation, mulches, mats, netting, gravel or any other methods or devices that are necessary to control or restrict erosion. Temporary erosion control measures may include work outside the right-of-way or construction limits where such work is necessary as a result of construction such as borrow pit operations, haul roads, plant sites, equipment storage sites, and disposal of waste or debris. The Contractor shall be liable for all damages to public or private property caused by silting or slides originating in waste areas furnished by the Contractor.

1.03 SUBMITTALS

- A. Silt Fence

1.04 QUALITY ASSURANCE

- A. Furnish certification from supplier that materials are as specified.
- B. Applicable Codes and Standards:
  - 1. North Carolina Sedimentation Pollution Control Act of 1973, as amended and revised, and the Rules and Regulations promulgated pursuant to the provisions of said act.
  - 2. North Carolina Department of Environment and Natural Resources - EROSION AND SEDIMENT CONTROL PLANNING & DESIGN MANUAL, latest edition, herein referred to in this Section as the Practice Standards and Specifications.

3. North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures latest edition.
4. Contractor is encouraged to contact the County Soil and Water Extension Service for site specific seeding recommendations.
5. In the event of conflict between the regulations listed above and the requirements of these specifications, the more restrictive requirement shall apply.

#### 1.05 SANCTIONS

- A. Failure on the part of the Contractor to perform the necessary measures to control erosion, siltations, and pollution will result in the Engineer notifying the Contractor to take such measures. In the event that the Contractor fails to perform such measures within 24 hours after receipt of such notice, the Engineer may suspend the work as provided above, or may proceed to have such measures performed with other forces and equipment, or both. The cost of such work performed by other forces will be deducted from monies due the Contractor on his contract.

### PART 2- PRODUCTS

#### 2.01 SEEDING

- A. Seeding grasses and legumes shall meet the requirements of Section 6.11 of the Practice Standards and Specifications.
- B. Use certified seed for permanent seeding. This seed shall meet published North Carolina Standards and should bear an official "Certified Seed" label.

#### 2.02 SILT FENCE

- A. Silt fence shall be a synthetic filter fabric of at least 95% by weight of polyolefins or polyester, which is certified by the manufacturer or supplier as conforming to the requirements of ASTM D 6461.
- B. Steel posts shall be a minimum of five (5) feet long made of 1.33 lb / linear foot steel. Posts shall be secured to fabric in a manner that does not affect the structural integrity of the fabric.

#### 2.03 SOD

- A. Plant Material: Sod shall have a plant material that is high-quality, healthy and vigorous. The contractor shall select a variety that is well-adapted to the region

- and expected level of maintenance.
- B. Soil Amendments: lime and complete fertilizer, incorporated to a depth of 4-6 inches.
- C. Surface: smooth and firm; not compacted clay or pesticide treated soil.
- D. Irrigation: contractor shall water the sod until properly established.

### PART 3- EXECUTION

#### 3.01 GENERAL

- A. The Contractor shall take whatever measures are necessary to minimize soil erosion and siltation, and water, air and noise pollution caused by his operations. The Contractor shall also comply with the applicable regulations of all legally constituted authorities relating to pollution prevention and control. The Contractor shall keep himself fully informed of all such regulations which in any manner affect the conduct of the work, and shall at all times observe and comply with all such regulations. In the event of conflict between such regulations and the requirements of the specifications, the more restrictive requirements shall apply.
- B. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces, or other property. All disturbed areas not to be paved and left exposed will, within 30 working days of completion of any phase of grading, be planted or otherwise provided with either temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.
- C. Prior to suspension of operations on the project or any portion thereof, the Contractor shall take all necessary measures to protect the construction areas, including but not limited to borrow sources, soil type base course sources, and waste areas, from erosion during the period of suspension.
- D. Provide diversion ditches and berms as necessary to prevent concentrated flow of water across disturbed areas.
- E. Stockpile excavated material on the opposite side of the utility trenches from the watercourses to the extent that is possible.
- F. In the event that stockpiles are placed on the watercourse side of the trench, provide silt fence or silt berms with stone filter outlets along the entire length of the

stockpile that is on the watercourse side of the trench. Upon the completion of backfilling, the measures shall be removed and the site graded to its natural grade or as shown on plans.

- G. Maintain natural buffer zones along all watercourses sufficient to retain all visible siltation within the first 25 percent of the buffer width.
- H. Provide a settling basin with a gravel filter outlet for all water pumped from trenches or de-watering equipment. Pumping of that water directly into any stream, pond, or watercourse is prohibited.
- I. Tamp, fertilize, seed and mulch the disturbed areas as soon as practicable after line is installed and, in all cases, no later than 30 days after completion of the line segment or work at a particular site.
- J. When construction operations are suspended for more than 30 days, provide temporary seeding and mulching of all disturbed areas including those areas in which further construction is necessary.
- K. Erosion control measures installed by the Contractor shall be acceptably maintained by the Contractor.

### 3.02 SEEDING

- A. See Drawings for seeding mixture.
- B. Seeding for erosion control shall be performed in accordance with the recommended outlined in the Practice Standards and Specifications.
- C. Soil Amendments: Apply lime and fertilizer according to soil test, or apply 3,000 - 5,000 lb/acre ground agricultural limestone and 1,000 lb/acre 10-10-10 fertilizer.
- D. Mulch: Apply 4,000 lb/acre grain straw or equivalent cover of another suitable mulch. Anchor straw by tacking with asphalt, netting, or roving or by crimping with a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool. Anchor netting and erosion control fabric at the edge of pavement with a 2 foot wide ribbon of ABC Stone (“crusher run”).
- E. All seeded areas will be fertilized, re seeded as necessary, and mulched according to these specifications to maintain a vigorous, dense vegetative cover.

### 3.03 SODDING

- A. Install sod within 36 hours of harvest.
- B. Store rolls or pallets of sod in the shade during installation.
- C. Rake soil surface to break crust just prior to laying sod, or irrigate soil lightly if the weather is hot. Do not install on hot, dry soil, compacted clay, frozen soil, gravel, or soil that has been treated with pesticides.
- D. Install strips of sod with their longest dimension perpendicular to the slope and stagger in a brick-like pattern. Do not stretch or overlap. All joints should butt tightly against each other. Match angled ends correctly to prevent voids. Use a knife or masons trowel to trim and fit irregular shaped areas.
- E. Roll sod lightly after placement to ensure a firm soil contact.
- F. Irrigate soil until soil is wet to a depth of 4 inches and keep moist until the grass takes root.

### 3.04 WATER AND AIR POLLUTION

- A. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent pollution of rivers, streams, and water impoundments. Pollutants such as chemicals, fuels, lubricants, bitumens, raw sewage, and other harmful waste shall not be discharged into or alongside of rivers, streams, or EROSION & SEDIMENTATION CONTROL 02190-4 impoundments, or into natural or man made channels leading thereto.
- B. The Contractor shall comply with all State or local air pollution regulations throughout the life of the project.

### 3.05 DUST CONTROL

- A. The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project, including, but not specifically limited to, unpaved secondary roads, haul roads, access roads, disposal sites, borrow and material sources, and production sites. Dust control shall not be considered effective condition, public nuisance, or condition endangering the value, utility, or appearance of any property.

3.06 NOISE CONTROL

- A. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent excessive and unnecessary noise. The Contractor shall choose his methods so as to minimize the disturbance of area residents.

3.07 SILT FENCE

- A. Silt fence shall be installed in locations shown on Drawings and in accordance with details shown on Drawings.

END OF SECTION 02190

SECTION 02200 - EARTHWORK

---

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the preparation of the subgrade for placement of 60 mil textured HDPE membrane liner.

1.03 DEFINITIONS

- A. Excavation: Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.
- B. Unauthorized Excavation: Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation shall be at Contractor's expense.
- C. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.
- D. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.
- E. Topsoil: Topsoil is defined as soil found in a depth of not more than 18 inches from existing ground surface.
- F. Undercut: Soil excavation deeper than 18 inches below existing ground surface.

1.04 QUALITY ASSURANCE

- A. Applicable Codes and Standards:
  - 1. North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures latest edition.
- B. Testing and Inspection Service: The Owner will, at their discretion, employ and

pay for a qualified independent geotechnical testing and inspection laboratory EARTHWORK 02200-1 (Geotech) to perform soil testing and inspection services during the work. Contractor to schedule Geotech at applicable phases of the work.

- C. Finish Subgrade Elevation: Final subgrade elevation shall be within 0.05' of plan elevations.

#### 1.05 SITE CONDITIONS

- A. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicted to remain in place, provide adequate means of support and protection during earthwork operations. Call North Carolina One Call 800-632-4949.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
2. Do not interrupt existing utilities serving facilities occupied by others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.
3. Provide minimum of 48-hour notice to Engineer, Owner, and User and receive written notice to proceed before interrupting any utility.
4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

- B. Use of Explosives:

1. Use of explosives is not permitted.

- C. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights.
2. Operate warning lights as recommended by authorities having jurisdiction.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
4. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dry-out to the greatest extent possible.

Maintain moist condition for root system and cover exposed roots with moistened burlap.

5. Contractor to establish and maintain positive drainage throughout the work area to prevent deterioration of subgrade within pavement, sidewalk, driveways, and any building areas.

## PART 2- PRODUCTS

### 2.01 SOIL MATERIALS

- A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups SW, SP, SP-SM, and SM, unless otherwise approved by Owner's Geotech.
- B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups SC, CL, ML, OL, CH, MH, OH, and PT.
- C. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, and natural or crushed sand.
- D. Backfill and Fill Materials: Satisfactory soil materials free of plastic clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

## PART 3- EXECUTION

### 3.01 EXCAVATION

- A. Excavation is unclassified and includes excavation of all muck, rock, and other materials required to obtain subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- B. Earth excavation includes excavation of pavements and other obstructions visible on 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.
- C. Proof-roll subgrades before filling with satisfactory soils and I or aggregate base course materials. Proof-rolling shall be done under the observation of the Owner's Geotech and / or Owner's Engineer. Proof-rolling shall be done with a fully loaded tandem dump truck to identify soft pockets and / or areas of excessive yielding.

- D. If unsuitable bearing materials are encountered, at the required subgrade elevations, the Contractor shall notify the Engineer. The Engineer and/or the Geotech shall make the determination as to the delineation and management of the unsuitable bearing materials. If a detailed delineation of the extent of the unsuitable bearing material is required, the Contractor, at the direction of the Engineer and/or the Geotech, shall prepare a topographic survey of the area with unsuitable bearing materials. The topographic survey shall consist of topographic shots taken on an appropriate scale grid pattern that encompasses the entire area in EARTHWORK 02200-3 question. Grid pattern shall be approved by Engineer and survey work shall be done under the observation of the Owner's Geotech and/or Engineer. After removal of unsuitable material, and before placement of suitable fill, the Contractor shall conduct a second topographical survey with shots taken on a like scale grid pattern. These surveys will be used as the basis for determining the amount of under-excavation and basis for payment for additional fill material. The surveys to be prepared for determining the quantity of under-excavation shall be at the Contractor's expense and shall be prepared by a North Carolina Registered Land Surveyor. No action shall be taken without authorization by the Owner, Engineer, and Geotech.
- E. Earth excavation includes excavation under building footings, slabs on grade, and or driveways.

### 3.02 STABILITY OF EXCAVATIONS

- A. General: Comply with Federal, State and local codes, ordinances and requirements of agencies having jurisdiction.
- B. Slope sides of excavations to comply with Federal, State and local codes, ordinances and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses. Contractor shall be responsible for reviewing OSHA and other applicable regulations for shoring and bracing and submit drawings in accordance with the regulations to the Engineer prior to commencement of work. When required by OSHA, drawings shall be sealed by a properly licensed professional engineer.

- D. Provide permanent steel sheet piling or properly treated timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2 ft.-6-inches below final grade and leave permanently in place.

### 3.03 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
  - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of excavation areas and any undercut areas that may cause soil changes detrimental to stability of subgrade and other excavated areas. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to EARTHWORK 02200-4 convey water away from excavations.
  - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey ground water, rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

### 3.04 STORAGE OF EXCAVATED MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.
  - 1. Locate and retain soil materials away from edge of excavations.
  - 2. Slope all temporary and /or permanent stockpiled materials to prevent slope failures.
- B. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill in legal disposal area.

### 3.05 EXCAVATION FOR PAVEMENTS

- A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

### 3.06 BACKFILL AND FILL

- A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under grassed areas, use satisfactory excavated or borrow material.
2. Under walks and pavements, use subbase material, satisfactory excavated or borrow material, or a combination.

### 3.07 SUBGRADE PREPARATION AND COMPACTION

#### A. Surface Preparation Recommendations:

1. Remove all vegetation, topsoil, organic and unsuitable materials. Proof-roll subgrades before filling with satisfactory soils and/or aggregate base course materials. Proof-rolling shall be done under the observation of the Owner's Geotech and/or Owner's Engineer. Proof-rolling shall be done with a fully loaded tandem dump truck to identify soft pockets and I or areas of excessive yielding.
2. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal to a depth of 6" ± so that fill material will bond with existing surface.
3. 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.

B. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Owner provided Geotech if soil density tests indicate inadequate compaction.

F. Compaction:

1. Natural soils shall be compacted to a dry density of at least 95% of the modified Proctor maximum dry density (ASTM D1557).
  2. Fill material shall be compacted to a dry density of at least 95% of the modified Proctor maximum dry density (ASTM D1557).
- G. Moisture Control: 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. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
- H. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
- I. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

### 3.08 GRADING

- A. 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.
- B. Finish surfaces free from irregular surface changes and as follows:
1. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
- C. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

### 3.09 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction:
1. All stripping of topsoil, excavation, proof-rolling, selection and compaction of fill shall be under the direct control of the Geotech hired by, retained and paid for by the Owner and approved by the Engineer. The Contractor,

Geotech, and Engineer shall establish a program that provides the necessary field supervision, field or laboratory testing and other quality control monitoring and testing which may be required in order to meet the requirements of all site work.

2. Perform field density tests in accordance with ASTM D 1556.
  3. Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.
  4. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Owner's Geotech.
  5. Percent of Maximum Dry Density Requirements: As described in 3.07 F of this Section.
- B. Paved Areas: Perform at least one field density test of subgrade for every 6,000 sq.ft. of paved area, but in no case fewer than three (3) tests per area of work tested per event.
- C. Compacted Fill for Paved Areas: In each compacted fill layer, perform one field density test for every 6,000 sq.ft. every other lift of overlaying paved area, but in no case fewer than three (3) tests per area of work tested per event.

### 3.10 EROSION CONTROL

- A. Provide erosion control methods in accordance with Section 02190- Erosion and Sediment Control and the North Carolina Department of Environment & Natural Resources, Land Quality Section.

### 3.11 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic, standing water, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape,

and compact to required density prior to further construction.

- D. 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.

### 3.12 DISPOSAL OF EXCESS AND 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 in a legal manner.

END OF SECTION 02200

# Supplemental Specifications

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**SPECIFICATIONS AND TECHNICAL REQUIREMENTS FOR THE MANUFACTURING AND  
INSTALLATION  
OF POLYETHYLENE GEOMEMBRANES**

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*The following specification constitutes a guideline for the preparation of site specific geomembrane manufacturing and installation specification requirements.*

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## **1. General**

### **1.1 Scope**

This Technical Specification defines the minimum requirements for the supply and installation of the Premium High Density Polyethylene (HDPE) geomembranes for the [Project Name] project. This Technical Specification also defines the minimum requirements for finished surfaces to be lined, material quality, placing, seaming and testing.

### **1.2 Operational Conditions**

The Premium HDPE geomembranes will be subjected to operating temperatures of up to 60°C (140°F). The physical properties of the proposed geomembrane shall be thoroughly reviewed to ensure long-term performance.

### **1.3 Definitions & Abbreviations**

#### **1.3.1 Definitions**

**Table 1 - Definitions**

<b>Term</b>	<b>Definition</b>
Owner	Project Owner.
Engineer	Representative appointed by the Owner to assess and monitor that the Contractor is performing the Work in accordance with the contract Documents. The Engineer is responsible for the release of Hold Points and Witness Points.
Contractor	The individual, firm, partnership, or corporation which is determined to be the successful bidder.
Geomembrane Installer	Contractor responsible for the installation of the geomembrane.
Manufacturer	Responsible party for the manufacturing of geomembranes.
Lot	A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.
Subgrade	The prepared surface of the earth on which geomembranes, footings, pavements, slabs, fill and embankments are constructed.

#### **1.3.2 Abbreviations**

**Table 2 - Abbreviations**

<b>Abbreviation</b>	<b>Description</b>
ASTM	American Society for Testing and Material
ATV	All-Terrain Vehicle
c/c	Center to Center
CQA	Construction Quality Assurance
DT	Destructive Testing
GRI	Geosynthetic Research Institute
HDPE	High Density Polyethylene
LLDPE	Linear Low Density Polyethylene
NDT	Non-Destructive Testing
PE	Polyethylene
QC	Quality Control

## HDPE Geomembrane Specification

### 1.3.3 Document References

In addition to the requirements of this Technical Specification, the Contractor shall also comply with the requirements of the documents referenced in Table 3 (below).

**Table 3 - Associated Document References**

Document Number	Title
Plan sheet number CII.2C, G-2	Plan sheet entitled "Wastewater Treatment Facilities, Camden Village Core Project, South Mills Township, Camden County, North Carolina, Contract #2 WWTP, 59-day Storage Pond" as prepared by Hobbs, Upchurch & Associates, P.A., sealed by James H. Bowen, PE, dated February 2006 with a record drawing stamp date of 1/24/2008.
Plan sheet number CII.2C, G-3	Plan sheet entitled "Wastewater Treatment Facilities, Camden Village Core Project, South Mills Township, Camden County, North Carolina, Contract #2 WWTP, 59-day Storage Lagoon Details" as prepared by Hobbs, Upchurch & Associates, P.A., sealed by James H. Bowen, PE, dated February 2006 with a record drawing stamp date of 1/24/2008.
Plan sheet number CII.2C, G-4	Plan sheet entitled "Wastewater Treatment Facilities, Camden Village Core Project, South Mills Township, Camden County, North Carolina, Contract #2 WWTP, Storage Lagoon Details" as prepared by Hobbs, Upchurch & Associates, P.A., sealed by James H. Bowen, PE, dated February 2006 with a record drawing stamp date of 1/24/2008.

### 1.4 Standards & Codes

Unless otherwise specified, workmanship and materials for the construction of the earthworks and associated geomembranes work shall be in accordance with the requirements of the relevant Federal, State and Local Regulations and other Regulatory Authority requirements, as applicable.

Latest editions of published Codes & Standard, including any other standards referenced therein, shall apply as of the date of issue of this Technical Specification. Where any conflict occurs between mandatory regulations, standards and codes, and other regulatory authority requirements, the most stringent requirement shall apply.

#### 1.4.1 Standard & Codes

**Table 4 - Standards**

Standard	Description
ASTM D792	Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
ASTM D1004	Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
ASTM D1238	Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.

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ASTM D1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique.
ASTM D1603	Standard Test Method for Carbon Black Content in Olefin Plastics.
ASTM D3895	Standard Test Method for Oxidation Induction Time of Polyolefin by Differential Scanning Calorimetry.
ASTM D4218	Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique.
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
ASTM D5199	Standard Test Method for Measuring Nominal Thickness of Geosynthetics.
ASTM D5397	Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembrane Using Notched Constant Tensile Load.
ASTM D5596	Standard Test Method for Microscopic evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
ASTM D5721	Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
ASTM D5820	Standard Practice for Pressurized Air Channel Evaluation Testing of Dual Seamed Geomembranes.
ASTM D5885	Test Method for Oxidation Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry.

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ASTM D5994	Standard Test Method for Measuring the Core Thickness of Textured Geomembranes.
ASTM D6392	Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
ASTM D6693	Standard Test Method for Determining Tensile Properties of Non-Reinforced Polyethylene and Non-Reinforced Flexible Polypropylene Geomembranes
ASTM D7240	Standard Practice for Leak Location using Geomembranes with an insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test).
ASTM D7466	Standard Test Method for Measuring the Asperity Height of Textured Geomembrane.
GRI GM6	Pressurized Air Channel Test for Dual Seamed Geomembranes.
GRI GM9	Cold weather Seaming of Geomembranes.
GRI GM11	Accelerated Weathering of Geomembranes Using a Fluorescent UVA Condensation Exposure Device.
GRI GM13	Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.
GRI GM14	Selecting Variable Intervals for Taking Geomembrane Destructive Seam samples Using the Method of Attributes.
GRI GM19	Standard Specification for Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.

### **1.5 Quality System Requirements**

The Engineer reserves the right to inspect the materials and workmanship at any time. Materials or workmanship found not conform to this Specification may be rejected during the execution of the work. The Contractor shall be responsible for the removal and replacement of any work that is rejected, including any other work damaged as a result.

### **1.6 Submittals**

#### **1.6.1 Construction Procedure**

A Construction Procedure for the installation of the HDPE geomembrane shall be submitted to the Engineer prior to the commencement of works.

The Construction Procedure shall include, but is not limited, the following:

- Certification of Welding Technicians;
- Subgrade acceptance;
- Placement of Geomembrane;
- Placement of temporary liner ballasting;
- Geomembrane Panel Layout Drawing;
- Panel Seaming;
- Liner Anchorage;
- Geomembrane NDT;
- Geomembrane DT;
- Storage of Materials On Site;
- Handling of Materials;

## **HDPE Geomembrane Specification**

- Disposal of Excess Materials;
- Product Identification and Traceability;
- Inspection and Test Plans.

### **1.6.2 Panel Layout Drawing**

The Geomembrane Installer shall prepare geomembrane panel layout drawings allocating a logical sequence of numbers to panel and seams. Three copies shall be submitted to the Engineer as part of the overall Construction Procedure for review and approval.

The panel layout should minimize the number of panels and the length of seams. Seams shall be oriented perpendicular to the batter slopes and not across the batter slopes wherever practical. No horizontal seam should be located within 1.5m of a batter toe line. Horizontal seams should be staggered across each width of roll. The panel layout may be varied in the field from that shown on the drawings only with the approval of the Engineer in writing.

In accordance with the Construction Procedure (**Section 1.6.1: Construction Procedure**), the following shall be included in the panel layout drawings:

- Proposed Starting Position for the placement of the HDPE Geomembrane;
- Panel Numbering System;
- Panel Diagram (of Suitable Scale);
  - Panel Layout
  - Panel Dimensions
- Relevant Experience of Geomembrane Installer;

### **1.6.3 Manufacturer QC Documentation**

All materials must strictly comply with the requirements of this Specification. For all materials, a Manufacturer QC documentation shall be provided to the Engineer before the materials are to be installed.

The Manufacturer QC documentation shall include, but is not limited to, the following:

- Roll Number;
- Resin Lot;
- Product Code;
- Manufacturing Date;
- Roll Length;
- Roll Test Data Report;
  - Average Thickness (ASTM D5994)
  - Minimum Thickness (ASTM D5994)
  - Asperity Height (ASTM D7466)
  - Tensile Properties (ASTM D6693)
  - Tear Resistance (ASTM D1004)
  - Puncture Resistance (ASTM D4833)
  - Density (ASTM D1505)
  - Carbon Black Content (ASTM D4218)
  - Standard Oxidative Induction Time (ASTM D3895) or
  - High Pressure Oxidative Induction Time (ASTM D5885)
  - Oven Aging at 85°C, % Retained after 90days (ASTM D3895 / ASTM D5885)
  - UV Resistance, % Retained after 1600hours (GRI GM11 / ASTM D5885)

## ***HDPE Geomembrane Specification***

### **1.7 Qualifications**

#### **1.7.1 Manufacturer Qualifications**

The Geomembrane shall be manufactured by Solmax International Inc. or approved equal.

The Manufacturer shall have manufactured a minimum of 10,000,000 ft<sup>2</sup> of polyethylene geomembranes during the past year.

The Manufacturer shall carry the following certifications:

- ISO 9001
- GAI-LAP

#### **1.7.2 Geomembrane Installer Qualifications**

Installation shall be performed according to IAGI Installation Specification.

The Geomembrane Installer shall have installed a minimum of 10 projects involving a total of 5,000,000 ft<sup>2</sup> of HDPE or similar geomembrane product during the last 3 years.

The Installation Supervisor shall have installed or supervised the installation and seaming of a minimum of 10 projects involving a total of 5,000,000 ft<sup>2</sup> of HDPE or similar geomembrane product. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

The Geomembrane Installer shall provide a minimum of one Master Seamer for work on the project. The Master Seamer must have completed a minimum of 3,000,000 ft<sup>2</sup> of geomembranes seaming work using the type of seaming apparatus proposed for the use on this Project.

## **2. Materials**

### **2.1 General**

All materials must strictly comply with the requirements of this Specification. For all materials, a Technical Data Sheet with the required testing shall be provided to and approved by the Engineer before the materials are to be installed.

The Contractor shall allow sufficient time for the Engineer to review the certified test results provided to not impact the geomembrane delivery schedule.

Materials shall be protected against solar radiation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Materials and equipment damaged prior to, and or during installation shall not be used and must be replaced at the Contractor's expense.

Production samples of materials shall be provided to the Engineer and will be held throughout the period of the contract for the purpose of providing a reference against which all subsequent items may be gauged for compliance with this Specification.

The HDPE geomembrane shall be a new, first-quality product designed specifically for the purpose of hydraulic containment and of the thickness specified. The membrane shall be uniform, free of holes, blisters, bubbles, gels, nicks, cuts, undispersed raw materials, or any sign of contamination by foreign matter.

### **2.2 Geomembrane Material**

The geomembranes shall be comprised of High Density Polyethylene (HDPE) and shall meet the required physical, mechanical and endurance properties shown in the product Technical Data Sheet in Table 5 (a), (b) and (c) (below).

## HDPE Geomembrane Specification

**Table 5(a) – Black Premium HDPE Geomembrane (Smooth) Technical Properties**

Property	Test Method	Frequency <sup>(1)</sup>	Unit	Test Value			
			Imperial	40 mils	60 mils	80 mils	100 mils
<b>Specification</b>							
Thickness (min. avg.)	ASTM D5994	Every roll	mils	40.0	60.0	80.0	100.0
Thickness (min)				36.0	54.0	72.0	90.0
Resin Density	ASTM D1505	1/Batch	g/cc	< 0.940	< 0.940	< 0.940	< 0.940
Melt Index – 190/2.16 (max.)	ASTM D1238	1/Batch	g/10min	1.0	1.0	1.0	1.0
Sheet Density <sup>(8)</sup>	ASTM D792	Every 10 rolls	g/cc	≥ 0.94	≥ 0.94	≥ 0.94	≥ 0.94
Carbon Black Content <sup>(9)</sup>	ASTM D4218	Every 2 rolls	%	2.0 – 3.0	2.0 – 3.0	2.0 – 3.0	2.0 – 3.0
Carbon Black Dispersion	ASTM D5596	Every 6 rolls	Category	Cat. 1 & 2			
OIT – Standard (avg.)	ASTM D3895	Per formulation	min	160	160	160	160
HP-OIT – High Pressure (avg.)	ASTM D5885	Per formulation	min	800	800	800	800
<b>Tensile Properties (min. avg.)<sup>(2)</sup></b>							
Strength at Yield	ASTM D-6693	Every 2 rolls	ppi	84	132	177	212
Elongation at Yield			%	13	13	13	13
Strength at Break			ppi	152	243	327	410
Elongation at Break			%	750	750	750	750
Tear Resistance (min. avg.)	ASTM D1004	Every 5 rolls	lbf	28	42	58	73
Puncture Resistance (min. avg.)	ASTM D4833	Every 5 rolls	lbf	85	125	160	195
Dimensional Stability	ASTM D1204	Certified	%	± 2	± 2	± 2	± 2
Stress Crack Resistance (SP-NCTL) (avg.)	ASTM D5397	1/Batch	hr	1,000	1,000	1,000	1,000
Multi-Axial Tensile (min. avg.)	ASTM D5617	Per Formulation	%	15	15	15	15
Oven Aging - % retained after 90 days	ASTM D5721	Per Formulation					
HP-OIT (min. avg.)	ASTM D5885		%	80	80	80	80
UV Resistance - % retained after 1600 hr	GRI GM11	Per Formulation					
HP-OIT (min. avg.)	ASTM D5885		%	80	80	80	80
<b>Supply Specification (roll dimensions may vary ± 1%)</b>							
Roll Dimension - Width	-		ft	26.2	26.2	26.2	26.2
Roll Dimension - Length	-		ft	689	459	344	279
Area (Surface / Roll)	-		ft <sup>2</sup>	18,052	12,026	9,013	7,310
Color	-		-	Black	Black	Black	Black

\*The Premium HDPE geomembranes roll can be supplied in 22.3 ft Width.

**Notes:**

- (1) Testing Frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar)
- (2) Machine Direction (MD) and Cross Machine Direction (XMD or TD) average value should be on the basis of 5 specimens each direction.
- (8) Correlation table is available for ASTM D792 vs ASTM D1505. Both methods give the same results.
- (9) Correlation table is available for ASTM D1603 vs ASTM D4218. Both methods give the same results.

\*All values are nominal test results, except when specified as minimum or maximum.

\*The information contained herein is provided for reference purposes only and is not intended as a warranty of guarantee. Final determination of suitability for use contemplated is the sole responsibility of the user. SOLMAX assumes no liability in connection with the use of this information.

Solmax is not a design professional and has not performed any design services to determine if Solmax's goods comply with any project plans or specifications, or with the application or use Solmax's goods to any particular system, project, purpose, installation or specification.

\*Please select the suitable and up to date Technical Data Sheet from Solmax's website or refer to Solmax's sales representative.

## HDPE Geomembrane Specification

**Table 5(b) - Premium HDPE Geomembrane (Single Textured) Technical Properties**

Property	Test Method	Frequency <sup>(1)</sup>	Unit	Test Value			
				40 mils	60 mils	80 mils	100 mils
Thickness (min. avg.)	ASTM D5994	Every roll	mils	40.0	60.0	80.0	100.0
Thickness (min)				36.0	54.0	72.0	90.0
Asperity Height <sup>(3)</sup> (min. avg.)	ASTM D7466	Every roll	mils	20	20	20	20
Textured side	-	-		Bottom	Bottom	Bottom	Bottom
Resin Density	ASTM D1505	1/Batch	g/cm <sup>3</sup>	< 0.940	< 0.940	< 0.940	< 0.940
Melt Index – 190/2.16 (max.)	ASTM D1238	1/Batch	g/10min	1.0	1.0	1.0	1.0
Sheet Density <sup>(8)</sup>	ASTM D1505	Every 10 rolls	g/cm <sup>3</sup>	≥ 0.94	≥ 0.94	≥ 0.94	≥ 0.94
Carbon Black Content <sup>(9)</sup>	ASTM D4218	Every 2 rolls	%	2.0 – 3.0	2.0 – 3.0	2.0 – 3.0	2.0 – 3.0
Carbon Black Dispersion	ASTM D5596	Every 6 rolls	Category	Cat. 1 & 2			
OIT – Standard (avg.)	ASTM D3895	Per formulation	min	160	160	160	160
HP-OIT – High Pressure (avg.)	ASTM D5885	Per formulation	min	800	800	800	800
Tensile Properties (min. avg.) <sup>(2)</sup>	ASTM D-6693	Every 2 rolls					
Strength at Yield			ppi	90	132	177	225
Elongation at Yield			%	13	13	13	13
Strength at Break			ppi	75	115	155	230
Elongation at Break			%	200	200	200	200
Tear Resistance (min. avg.)	ASTM D1004	Every 5 rolls	lbf	32	45	60	75
Puncture Resistance (min. avg.)	ASTM D4833	Every 5 rolls	lbf	95	130	160	190
Dimensional Stability	ASTM D1204	Certified	%	± 2	± 2	± 2	± 2
Stress Crack Resistance (avg.)	ASTM D5397	1/Batch	hours	1,000	1,000	1,000	1,000
Multi-Axial Tensile (min. avg.)	ASTM D5617	Per Formulation	%	15	15	15	15
Oven Aging - % retained after 90 days	ASTM D5721	Per Formulation					
HP-OIT (min. avg.)	ASTM D5885		%	80	80	80	80
UV Resistance - % retained after 1600 hr	GRI GM11	Per Formulation					
HP-OIT (min. avg.)	ASTM D5885		%	80	80	80	80
Roll Dimension - Width	-		ft	26.2	26.2	26.2	26.2
Roll Dimension - Length	-		ft	656	443	344	279
Area (Surface / Roll)	-		ft <sup>2</sup>	17,187	11,607	9,013	7,310
Color	-		-	Black	Black	Black	Black

\*The Premium HDPE geomembranes roll can be supplied in 22.3 ft Width.

**Notes:**

- (1) Testing Frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar)
- (2) Machine Direction (MD) and Cross Machine Direction (XMD or TD) average value should be on the basis of 5 specimens each direction.
- (3) ASTM D7466 is identical to GRI-GM12.
- (8) Correlation table is available for ASTM D792 vs ASTM D1505. Both methods give the same results.
- (9) Correlation table is available for ASTM D1603 vs ASTM D4218. Both methods give the same results.

\*All values are nominal test results, except when specified as minimum or maximum.

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**\*Please select the suitable and up to date Technical Data Sheet from Solmax's website or refer to Solmax's sales representative.**

## HDPE Geomembrane Specification

**Table 5(c) - Premium HDPE Geomembrane (Textured) Technical Properties**

Property	Test Method	Frequency <sup>(1)</sup>	Unit	Test Value			
				40 mils	60 mils	80 mils	100 mils
Thickness (min. avg.)	ASTM D5994	Every roll	mils	40.0	60.0	80.0	100.0
Thickness (min)				36.0	54.0	72.0	90.0
Asperity Height <sup>(3)</sup> (min. avg.)	ASTM D7466	Every roll	mils	20	20	20	20
Resin Density	ASTM D1505	1/Batch	g/cm <sup>3</sup>	< 0.940	< 0.940	< 0.940	< 0.940
Melt Index – 190/2.16 (max.)	ASTM D1238	1/Batch	g/10min	1.0	1.0	1.0	1.0
Sheet Density <sup>(8)</sup>	ASTM D1505	Every 10 rolls	g/cm <sup>3</sup>	≥ 0.94	≥ 0.94	≥ 0.94	≥ 0.94
Carbon Black Content <sup>(9)</sup>	ASTM D4218	Every 2 rolls	%	2.0 – 3.0	2.0 – 3.0	2.0 – 3.0	2.0 – 3.0
Carbon Black Dispersion	ASTM D5596	Every 6 rolls	Category	Cat. 1 & 2	Cat. 1 & 2	Cat. 1 & 2	Cat. 1 & 2
OIT – Standard (avg.)	ASTM D3895	Per formulation	min	160	160	160	160
HP-OIT – High Pressure (avg.)	ASTM D5885	Per formulation	min	800	800	800	800
<b>Tensile Properties (min. avg.)<sup>(2)</sup></b>							
Strength at Yield	ASTM D-6693	Every 2 rolls	ppi	90	132	177	225
Elongation at Yield			%	13	13	13	13
Strength at Break			ppi	75	115	155	230
Elongation at Break			%	200	200	200	200
Tear Resistance (min. avg.)			ASTM D1004	Every 5 rolls	lbf	32	45
Puncture Resistance (min. avg.)	ASTM D4833	Every 5 rolls	lbf	95	130	160	190
Dimensional Stability	ASTM D1204	Certified	%	± 2	± 2	± 2	± 2
Stress Crack Resistance (avg.)	ASTM D5397	1/Batch	hours	1,000	1,000	1,000	1,000
Multi-Axial Tensile (min. avg.)	ASTM D5617	Per Formulation	%	15	15	15	15
Oven Aging - % retained after 90 days	ASTM D5721	Per Formulation					
HP-OIT (min. avg.)	ASTM D5885		%	80	80	80	80
UV Resistance - % retained after 1600 hr	GRI GM11	Per Formulation					
HP-OIT (min. avg.)	ASTM D5885		%	80	80	80	80
Roll Dimension - Width	-		ft	26.2	26.2	26.2	26.2
Roll Dimension - Length	-		ft	558	443	344	279
Area (Surface / Roll)	-		ft <sup>2</sup>	14,620	11,607	9,013	7,310
Color	-		-	Black	Black	Black	Black

\*The Premium HDPE geomembranes roll can be supplied in 22.3 ft Width.

**Notes:**

- (1) Testing Frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar)
- (2) Machine Direction (MD) and Cross Machine Direction (XMD or TD) average value should be on the basis of 5 specimens each direction.
- (3) ASTM D7466 is identical to GRI-GM12.
- (8) Correlation table is available for ASTM D792 vs ASTM D1505. Both methods give the same results.
- (9) Correlation table is available for ASTM D1603 vs ASTM D4218. Both methods give the same results.

\*All values are nominal test results, except when specified as minimum or maximum.

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**\*Please select the suitable and up to date Technical Data Sheet from Solmax's website or refer to Solmax's sales representative.**

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### 2.3 Geomembrane Manufacturing Quality Control

The geomembrane shall be monitored throughout the manufacturing process for product integrity and consistency. The manufacturer shall test rolls in accordance with Table 5 (a), (b) and (c) (above) with results showing conformance with the required physical properties listed in Table 5 (a), (b) and (c) (above).

Certified test results shall be submitted to and approved by the Engineer before the HDPE geomembrane rolls are to be installed from the manufacturing plant. The Geomembrane Installer shall allow sufficient time for the Engineer to review the certified test results provided to not impact the geomembrane delivery schedule.

The Geomembrane Installer shall submit a list which indicates date of production, resin batch number, manufacturing line number and identification number and square feet of each geomembranes roll. Rolls shall be listed in the order of production with the status of the roll (rejected or approved for shipment). All rolls shall be included in the list whether or not approved for shipment.

Any roll(s) that do not meet the required physical properties or have not been tested at the required frequency (Table 5(a), (b) and (c)) shall be rejected and removed from site.

### 2.4 HDPE Resin

Resin used in the manufacture of HDPE geomembranes shall be first quality single source, compounded polyethylene resin manufactured specifically for the purpose of producing HDPE geomembranes.

Reclaimed polymer shall not be added to the resin. The manufacturer may rework edge trim from the roll being produced. Edge trim shall be returned immediately to the process but shall not exceed 10% of the total resin required. Edge trim which has been stored or sourced from other manufacturing plants shall not be recycled.

The manufacturer shall sample and test for the properties listed in Table 6 (below) per batch resin. Certified test results shall be submitted to and approved by the Engineer before the HDPE geomembrane rolls are to be installed. The Geomembrane Installer shall allow sufficient time for the Engineer to review the certified test results provided to not impact the geomembrane delivery schedule.

**Table 6 - Resin Physical Properties**

Test Property	Test Method	Unit	Requirement
Density <sup>(1)</sup>	ASTM D1505	g/cm <sup>3</sup>	≥ 0.932
Melt Flow Index	ASTM D1238	g/10 min.	≤ 1.00

**Notes:**

(1) Base resin density without carbon black added.

### 2.5 Extrudate Material

The extrudate rod or bead shall be high quality polyethylene and shall be of the same formulation as the resin used to produce the geomembranes. All additives shall be thoroughly dispersed throughout the extrudate rod or bead. There shall be no contamination by foreign matter in the extrudate rod or bead.

### 2.6 Roll Identification

Geomembrane shall be supplied in rolls of width accordance to the product Technical Data Sheet in Table 5(a), (b) and (c). The rolls supplied should not allow any longitudinal seams. As a minimum, each roll shall be labeled as follows:

- Roll Number;
- Name of Manufacturer;

## ***HDPE Geomembrane Specification***

- Batch Number of Raw Material;
- Date of Manufacture;
- Material Thickness;
- Roll Length and Area;
- Product Type and Grade.

Rolls will need to have permanent marking every 16 feet along the smooth edges that include, as a minimum, the following information:

- Roll Number;
- Distance from start of the roll (in feet or meters).

### **2.7 Delivery**

Rolls of geomembrane will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

### **2.8 Storage**

The on-site storage location for geomembrane rolls, provided by the Contractor to protect the geomembranes from puncture, abrasion and excessive dirt and moisture should have the following characteristics:

- Level (no wooden pallets);
- Smooth;
- Dry;
- Protected from theft and vandalism;
- Adjacent to the area to be lined.

The rolls shall be handled and stored with care to prevent any damage to the geomembrane. During the transport of the material from the manufacturing plant to site and storage of the geomembrane rolls on site, the geomembrane shall not be stacked higher than 3 rolls high.

### **2.9 Handling**

Materials are to be handled so as to prevent damage.

### **2.10 Samples**

The Contractor shall submit samples of the geomembrane material and field seams to the Engineer for approval prior to the start of construction. The Contractor shall submit 8.5" x 11" samples of geomembrane materials which have been made in conformance with this Specification.

### **2.11 Geomembrane Warranty**

The Contractor shall provide warranties for the geomembrane manufacturing and geomembrane installation in accordance.

#### **2.11.1 Material Warranty**

The geomembrane manufacturer shall furnish a written geomembrane warranty, which warrants the geomembrane material for a minimum of five (5) years from the date of installation and final acceptance of the geomembrane.

The warranty shall be against manufacturing defects and workmanship. The warranty shall be limited to replacement of material only and shall be pro-rated.

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### **2.11.2 Installer Warranty**

The Geomembrane Installer shall guarantee the geomembranes installation against defects in the installation and workmanship for one (1) year, commencing with the date of final acceptance of the geomembrane. A written geomembrane warranty will be required.

### **3. Geomembrane Subgrade Preparation**

#### **3.1 Subgrade Preparation**

The Geomembrane Installer shall ensure that all surfaces to be lined including corners and around penetrations shall be finished smooth and free of rocks, stones, sticks, roots, sharp objects and debris of any kind or any object which may damage the geomembrane in accordance with Specification Section 02220. The surface is to provide a firm unyielding compacted subgrade for the geomembrane. All desiccation cracking shall be repaired by the Contractor to the satisfaction of the Engineer.

Where a suitable surface cannot be achieved by treatment of in-situ material, an imported smoothing fine course shall be placed. The smoothing fine course shall consist of sandy clay which shall be free of organic matter and coarse or sharp particles. The smoothing course shall be the minimum thickness necessary to maintain 6" minimum cover over irregularities or protrusions in the sub-grade formation unless shown otherwise on the Drawings. The surface shall be watered and rolled with a smooth steel drum roller to obtain a smooth uniform finish.

The Geomembrane Installer shall provide daily written subgrade acceptance certifications to the Engineer for the surface to be covered by the geomembranes in that day's operation. The surface shall be maintained in a manner, during installation, to ensure subgrade stability.

All subgrade damaged by construction equipment and deemed unsuitable for geomembranes deployment, in the opinion of the Engineer, shall be repaired prior to placement of the geomembranes. All repairs shall be approved by the Engineer.

Surfaces to be lined shall be flat on any plane within  $\pm 2''$  vertical tolerance in any area of 100 ft<sup>2</sup>. All intersections between planes shall be made along straight lines.

#### **3.2 Subgrade Maintenance**

Where surface finishing is completed ahead of geomembrane installation, the surface shall be maintained until immediately prior to geomembrane installation. This surface will need to be re-inspected again by the Engineer and approved prior to installation of the geomembrane. Sufficient equipment shall remain on the site until and during installation to enable reinstatement of the surface in the event of damage due to inclement weather or desiccation cracking. Any reinstatement work shall be at the expense of the Contractor. The Engineer reserves the right to instruct the Contractor to perform remedial work to satisfy the criteria.

## **4. Geomembrane Installation**

### **4.1 General**

Geomembrane installation shall be performed in accordance with the International Association of Geosynthetic Installers (IAGI) HDPE Geomembrane Installation Specification. Where there is discrepancy between the IAGI HDPE Geomembrane Installation Specification and this Specification, this Specification shall govern.

Rolls of geomembrane shall be handled and securely stored to prevent damage prior to installation. Geomembrane shall be unrolled in a controlled manner directly into the final position. The method of unrolling shall not cause scratches or crimps in the material, nor shall it disrupt the integrity of the finished sub-grade.

The geomembrane shall be placed in a relaxed state such that the material can respond to thermal changes without excessive buckling, wrinkling or tensioning. Slack shall be included in the geomembrane on the batter side of the tie-in seam along the toe of all internal slopes. The included slack at the tie-in seam will minimize tension on the tie-in seam due to contraction of the geomembrane at temperatures cooler than ambient during installation. This induced slack shall vary in height based on the ambient air temperature as given in Table 7 (below).

**Table 7 - Induced Slack Height at Varying Ambient Temperatures**

<b>Ambient Air Temperature (°F)</b>	<b>Slack Height (inches)</b>
32-40	1
40-50	2
50-60	3
60-70	4
70-80	5
80-90	6
90-100	7
100-110	8

For material temperatures between 5°F and 32°F, the deployment and seaming will be performed in accordance with GRI GM9. No geomembranes material shall be unrolled or deployed if the material temperatures are lower than 5°F, unless otherwise approved in writing by the Engineer. Only the quantity of geomembranes that will be anchored and seamed together in one day shall be deployed.

In general, seams shall be orientated parallel to the line of maximum slope. In corners and odd shaped geometric locations, the total length of the field seam shall be minimized. Seams shall not be located at low points in the subgrade unless geometry requires seaming at such locations as approved by the Engineer.

All HDPE panels that are to be welded together shall be manufactured by the same geomembrane manufacturer, made from the same resin type and made using the same formulation. Adjacent HDPE panels that do not satisfy all of these requirements shall not be welded together. Any panels welded together that violate any of these criteria shall be rejected and removed from site at the Geomembrane Installer’s expense.

The geomembranes shall not be allowed to “bridge” over voids or low areas in the subgrade. The geomembranes shall rest in intimate contact with the subgrade.

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Temporary ballasting such as sand bags or tires shall be placed on the geomembrane to prevent wind damage during and after installation. It should be noted that this temporary ballasting shall be of a suitable construction to prevent against damage of the geomembrane. The Contractor shall be required to ensure that the spacing of these sand bags / tires are appropriately designed (this could include tying the sand bags / tires together in a horizontal and vertical direction) to prevent against uplift and potential damage of the geomembrane. Any geomembrane material that has been damaged as the result of the wind, in the opinion of the Engineer, shall be removed and replaced at the Contractor's expense.

All personnel working on the geomembrane surface shall wear soft-soled shoes, and shall not engage in any activity which may damage the geomembrane.

Machinery, other than seam welding machinery or All-Terrain Vehicles (ATV) approved for use by the Engineer in writing, shall not be operated on the geomembrane.

The use of ATVs for the deployment of the geomembrane will be allowed. For ATVs to be used, the Contractor must demonstrate that the ATV exerts a maximum allowable pressure on the ground surface (or geomembrane surface) of 8 psi. The maximum allowable pressure on the ground surface (or geomembrane surface) is influenced by the tread pattern of the tires on the ATV. The maximum allowable ground surface (or geomembrane surface) pressure is not the reading from a tire pressure gauge. The ATVs shall only be used to deploy rolls of geomembrane and shall not be used to transport personnel, equipment, sandbags or the like.

### **4.2 Seaming**

#### **4.2.1 General**

Seaming of geomembranes shall be carried out strictly in accordance with the manufacturer's written instructions and in accordance with GRI GM19. The contractor shall provide a complete description of the processes to be used, and shall identify the equipment proposed for accomplishing the seaming.

No geomembranes material shall be seamed when the sheet temperature is below 5°F and above 170°F as measured by an infrared thermometer (or surface thermocouple), unless otherwise approved by the Engineer. For material temperatures between 5°F and 32°F, seaming shall be performed in accordance with GRI GM9.

#### **4.2.2 Personnel**

The Contractor shall nominate a Project Seam Welding Supervisor before commencing work and shall demonstrate that the Seam Welding Supervisor has a proven background in installation of lining systems and materials similar to those specified. All personnel employed in welding shall be competent and experienced in the use of the equipment. The Contractor shall ultimately be responsible for ensuring the quality assurance program is followed.

#### **4.2.3 Seam Welding Equipment**

Only specialized purpose-designed equipment approved by the Engineer shall be used. For long-run work, the machine shall be mounted on a carriage to operate at a controlled speed. In all cases, the temperature at the point of fusion shall be monitored and controlled with an interlock to the drive mechanism so that welding is stopped if the temperature falls outside the range at which satisfactory welding can be achieved.

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Where the welding procedure includes provision for heated extrudate to be incorporated in the weld, any degraded extrudate, which has been overheated or heated and cooled in the barrel, shall be purged with fresh material prior to the resumption of welding.

Equipment shall be maintained on a regular basis to ensure efficient performance throughout.

The field tensiometer shall have a current certificate of calibration in accordance with the manufacturer's calibration recommendations.

### **4.2.4 Seam Strength Requirements**

Each test specimen should fail in the parent material and not in the weld as demonstrated by test welds and destructive test samples in accordance with **Section 5: Geomembrane Inspection & Testing**. Breadth and depth of fusion between sheets shall be as required to meet these criteria. Where heated extrudate is included in the weld, the extrudate material after fusion shall be fully compatible physically and chemically with the geomembrane material.

The geomembrane material shall not be overheated during welding such that crystallization, oxidation, perforation or degradation of the geomembrane occurs.

### **4.2.5 Weather Conditions**

Welding shall not be commenced or continued during rain, fog, excessive winds, snowing, sleeting or hailing. Welding shall not be commenced or continued when ambient temperatures (as measure 3' above the seam being welded) is outside the range of 5°F to 100°F. When ambient temperatures are between 5°F and 32°F, seaming shall be performed in accordance with GRI GM9.

The seams adjacent to the corners of the ponds and the toe of the slopes shall be made during the coolest part of the day and shall not be made when the geomembrane is exposed to direct sunlight.

### **4.2.6 Geomembrane Preparation**

The surface of the geomembrane to be welded shall be clean, dry and free from any foreign matter and contaminants, such as clay and sand.

### **4.2.7 Seam Lap**

The minimum lap of adjacent geomembrane sheets shall be 6", unless specified as greater by the geomembrane manufacturer or the welding equipment supplier.

Fishmouths, or excessive wrinkles at the seam overlap, shall be minimized. When necessary, cut along the ridge of the wrinkles back into the panel to create a flat overlap. The cut shall be terminated with a keyhole cut (nominal 0.5" diameter hole) so as to minimize crack/tear propagation. The overlay shall subsequently be seamed. The keyhole cut shall be patched with an oval or round patch, of the same base geomembrane material extending a minimum of 6" beyond the cut in all directions.

### **4.2.8 Fusion Welding (Primary Welds)**

Seam welding of HDPE geomembranes shall be accomplished primarily by fusion welding using either a hot wedge or hot air welder.

Geomembrane surface area to be fusion welded must be cleaned from dust, mud, debris and shall be protected against moisture build-up between sheets.

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The seam shall consist of a double weld produced by surface fusion with an air gap between. Pressure nipping rollers shall press the molten surfaces together immediately behind the hot air or hot wedge welder to complete the weld.

### **4.2.9 Extrusion Welding (Secondary Welds)**

Extrusion welding shall only be used where fusion welding is not possible, such as at pipe penetrations, patches, repairs, and short runs of seams (less than a roll width).

Geomembrane surface area to be extrusion welded must be cleaned by using disc grinder or equivalent to remove the oxidized layers and dirt. The leading edge of the upper geomembrane needs to be beveled or tapered to a 45° angle and the bottom geomembrane grind marks shall be about 5% of the liner thickness.

Extrusion welding shall be achieved by fusion of an extrudate to the top surface of both sheets at the lap. The depth and width of engagement of the extrudate shall be as required to achieve the strength requirements. The means of deposition of the extrudate shall provide for full integration with the surface of the sheets, so that the weld becomes homogeneous with the geomembrane.

### **4.2.10 Connections at Penetration and to Structures**

Connections to geomembrane penetrations and adjoining structures shall be made in accordance with the details shown on the construction drawings. Connections shall be at least equivalent in strength to the normal lap seams and the security of containment shall not be diminished. Local stresses in the geomembrane at connections shall be minimized.

Penetrations shall be constructed from the base geomembranes material, flat stock, prefabricated boots and accessories as shown in the construction drawings.

## **4.3 Geomembrane Anchorage**

Anchor trenches shall be excavated in accordance with the details on the construction drawings. The anchor trenches shall be kept well drained to avoid softening during rain periods and maintained so as to not dry, desiccate and crack.

The Contractor shall seek approval from the Engineer prior to the commencement of anchor trench backfilling. Once the anchor trench is ready to be backfilled, it shall be backfilled in early morning when the geomembrane is at maximum contraction. Backfilling shall be carried out in planned, logical sequence to avoid overstressing of the geomembrane. The front edge of the anchor trench will be rounded, with no sharp stones that might damage the liner.

## **4.4 Cleaning Up**

On completion of the work on site, the Contractor shall clean up and leave the whole area to the satisfaction of the Engineer.

## **5. Geomembrane Inspection, Testing & Repair**

All areas found to be defective shall be repaired at the expense of the Geomembrane Installer. The Engineer shall be notified of defective areas prior to the repair taking place.

The Geomembrane Installer shall ensure a plan is marked up showing the locations of repairs made and the type of repair made. The Geomembrane Installer shall submit a marked up drawing showing the locations of the repairs to the Engineer for review and approval.

### **5.1 Visual Inspections**

The entire surface of every sheet of geomembrane material shall be inspected by the Geomembrane Installer during placing to identify any tears, abrasions, indentations, cracks, thin areas, or other defects.

Any defects such as holes, tears, blisters, lamination, undispersed raw materials or visible non-uniformity or contamination by foreign matter which in the opinion of the Engineer is detrimental to the long service life required of the membrane geomembrane, shall be grounds for rejection of the membrane geomembrane material.

Where additional faults are found, the Engineer reserves the right to reject the roll. The Contractor shall replace any rejected rolls and repair any defects to the Engineer's satisfaction at the Geomembrane Installer's expense.

#### **5.1.1 Geomembrane Visual Inspections**

Following the installation of the geomembrane, a detailed visual inspection of the primary geomembrane surface shall be performed by the Engineer (accompanied by the Geomembrane Installer), to identify any defects in the geomembrane surface caused during installation. Prior to performing the survey, a survey grid shall be determined to ensure that the visual survey is performed across 100% of the geomembrane surface.

### **5.2 Seam Testing**

All geomembrane weld seams shall be subjected to both non-destructive and destructive field testing. Additionally, representative samples of field seams shall be taken for laboratory testing by an independent, appropriately qualified geosynthetic testing laboratory.

The tests in this Section shall be carried out at the specified frequencies.

Testing of each length of seam shall be carried out within 48 hours of its completion.

The acceptance criteria for peel and shear strength testing shall be in accordance with GRI GM19.

#### **5.2.1 Test Welds (In Field)**

Test seams shall be made by each welding technician and tested in accordance with ASTM D6392 at the beginning of each seam period. Test seaming shall be performed under the same conditions and with the same equipment and operator combination as production seams. The test seam shall be approximately 6 feet long for fusion welding and 3 feet long for extrusion welding with the seam centered lengthwise.

At a minimum, trial welds shall be made by each technician as follows:

- Prior to commencement of each shift;
- One time every 4 hour thereafter;

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- Following any break in operation;
- Following any significant adjustment to welder controls.

Additional tests may be required with changes in environmental conditions.

Two 1 inch wide specimens shall be die-cut by the Geomembrane Installer from each end of the test seam. These specimens shall be tested by the Geomembrane Installer using a field tensiometer testing both tracks for peel strength and direct shear strength tests.

The test weld will be considered acceptable if the test piece fails in the un-welded geomembrane away from the seam. If the field test fails then further test welds shall be made after appropriate adjustment of the welder controls, and retested until an acceptable weld is obtained. Field test results shall be recorded and test pieces marked and stored. The Engineer reserves the right to take further test pieces from the test welds for independent tests off-site.

The minimum seam weld strength criteria for peel and shear strength testing are as specified in Table 8 (below). The seam strength testing shall be done in accordance with GRI GM19.

**Table 8 - Weld Strength Requirements**

**Seam Strength and Related Properties of Thermally Bonded Smooth and Textured HDPE Geomembrane**

Geomembrane Nominal Thickness	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
<b>Hot Wedge Seams<sup>(1)</sup></b>							
shear strength <sup>(2)</sup> , lb/in.	57	80	100	120	160	200	240
shear elongation at break <sup>(3)</sup> , %	50	50	50	50	50	50	50
peel strength <sup>(2)</sup> , lb/in.	45	60	76	91	121	151	181
peel separation, %	25	25	25	25	25	25	25
<b>Extrusion Fillet Seams</b>							
shear strength <sup>(2)</sup> , lb/in.	57	80	100	120	160	200	240
shear elongation at break <sup>(3)</sup> , %	50	50	50	50	50	50	50
peel strength <sup>(2)</sup> , lb/in.	39	52	65	78	104	130	156
peel separation, %	25	25	25	25	25	25	25

Notes for Table 8 :

1. Also for hot air and ultrasonic seaming methods
2. Values listed for shear and peel strengths are for 4 out of 5 test specimens; the 5<sub>th</sub> specimen can be as low as 80% of the listed values
3. Elongation measurements should be omitted for field testing

### **5.2.2 Non-Destructive Testing (In Field)**

All seams shall be non-destructively tested in accordance with the following sections.

#### **5.2.2.1 Air Pressure Testing**

Double fusion seams with an enclosed channel shall be air pressure tested by the Geomembrane Installer in accordance with ASTM D5820 and ASTM D4437. Every geomembrane seam shall be subjected to air pressure testing. The testing shall be achieved by inflation of the space between the welds to approximately 30 psi pressure and following the 2 minute “relaxing period” (whereby the air temperature and pressure stabilizes), the air pressure will be monitored 5 minutes and the pressure loss recorded.

If pressure loss does not exceed 4 psi after 5 minutes, the seam shall be considered leak tight and therefore considered to be acceptable.

#### **5.2.2.2 Vacuum Testing**

For single welded seams testing shall be achieved using vacuum testing. Vacuum testing shall be performed by the Geomembrane Installer in accordance with ASTM D4437 and ASTM D5641.

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The Vacuum pump shall be charged and the tank pressure adjusted to approximately 5 psi. If no bubbles appear while the vacuum is held for 5 seconds, then the seam is satisfactory.

### **5.2.3 Destructive Testing (In Field & In Laboratory)**

Samples for destructive testing shall be taken from finished seams at locations as directed by the Engineer. A sampling frequency of one sample per 500 feet of seam length shall be used. The sample shall be taken by the Geomembrane Installer from a location specified by the Engineer.

Each sample shall be 3 feet long, parallel to the seam by 1 foot wide, with the seam central in width. The sample shall be cut into three equal sections distributed as indicated in Table 9 (below).

**Table 9 - Destructive Test Sample Allocation**

<b>Sample Section No.</b>	<b>Sample Allocation</b>	<b>Allocation Description</b>
1	Field Testing	Seam Strength Testing
2	Laboratory	Seam Strength Testing
3	Engineer	Record Section

For field testing, the Geomembrane Installer shall cut 10 identical 1 inch wide replicate specimens from their sample (Table 9, Sample Section No. 1). The Geomembrane Installer shall test five (5) specimens for seam shear strength and five (5) for peel strength. Peel tests shall be performed on both inside and outside weld tracks. To be acceptable, 4 of 5 test specimens must pass the stated criteria in Table 9 (above) with less than 25% separation. If 4 of 5 specimens pass, the sample qualifies for testing by the testing laboratory. The preparation of the sample and field testing by the Geomembrane Installer shall be witnessed by an Independent Construction Quality Assurance (CQA) firm representative.

If any samples fail field testing, additional samples shall be taken to define the extent of sub-standard seam. Destructive testing of the seams must be carried out as the seams are welded together on a continuous basis. Destructive testing shall not be conducted at the end of the geomembrane installation.

For laboratory testing, the laboratory shall cut 10 identical 1 inch wide replicate specimens from their sample (Table 9, Sample Section No. 2). The laboratory shall test five (5) specimens for seam shear strength and five (5) for peel strength. The laboratory shall test the samples in accordance with GRI GM19 and report the results to the Contractor and the Engineer simultaneously.

The third sample section (Table 9, Sample Section No. 3) shall be submitted to the Engineer for record keeping. The third sample section shall not be used by the Geomembrane Installer to confirm marginally failing test results obtained from their sample.

For field seams, if a laboratory test fails, that shall be considered an indicator of the possible inadequacy of the entire seamed length corresponding to the test sample. Additional destructive test portions shall then be taken by the Geomembrane Installer from locations 10 feet on either side of the failed sample (c/c by sample). Field and Laboratory testing shall be conducted on these verification samples. Passing tests shall be an indicator of adequate seams. Failing tests shall be an indicator of non-adequate seams and all seams represented by the destructive test locations shall be repaired with a cap-strip extrusion welded to all sides of the capped area. All cap-strip seams shall be non-destructively vacuum box tested until adequacy of the seams is achieved. Cap strip seams exceeding 165 feet in length shall be destructively tested.

### **5.3 Geomembrane Defects**

#### **5.3.1 Identification of Defects**

Panels and seams shall be inspected by the Geomembrane Installer, Contractor and Engineer during and after panel deployment to identify all defects, including holes, blisters, undispersed raw materials and signs of contamination by foreign matter.

#### **5.3.2 Evaluation of Defects**

Each suspect location on the geomembrane (both in geomembranes seam and non-seam areas) shall be non-destructively tested using one of the methods described in **Section 5.2.2: Non-Destructive Testing**. Each location which fails non-destructive testing shall be marked, numbered, measured and posted on the daily “installation” drawings and subsequently repaired.

If a destructive sample fails the field or laboratory test, the Geomembrane Installer shall repair the seam between the two nearest passed locations on both sides of the failed destructive sample location.

#### **5.3.3 Wrinkles**

Any wrinkles that can fold over shall be repaired either by cutting out excess material or, if possible, allowing the geomembrane to contract as the temperature decreases. In no case shall material be placed over the geomembrane that could result in the geomembrane folding. All folded geomembrane shall be removed. No material shall be placed in areas where the geomembrane is not in contact with the supporting subgrade.

### **5.4 Geomembrane Repair**

#### **5.4.1 Geomembrane Repair Procedures**

Any portion of the geomembrane with a flaw or that fails a non-destructive test shall be repaired by one of the following methods:

- Patching for holes, defects or tears 0.5 inch or larger in diameter or length – used to repair large holes, tears, large panel defects, and destructive sample locations that are less than 20ft<sup>2</sup> (total area);
- Extrusion – used to repair relatively small defects in panels and seams, but not greater than 0.5 inch in length;
- Capping – used to repair failed welds or geomembrane seams where welds cannot be non-destructively tested;
- Removal – used to replace areas with large defects where the preceding methods are not appropriate. Also used to remove excess material (wrinkles) from the installed geomembrane.

Once the repair has been completed, further non-destructive or destructive testing shall be carried out to ensure the repairs are completed to the requirements of this Specification.

#### **5.4.2 Verification of Seam Repairs**

Each repair shall be non-destructively tested using either vacuum box or spark testing methods. Tests which pass the non-destructive test shall be taken as an indication of a successful repair. Failed tests shall be re-seamed and retested until a passing test results. The number, date, location, technician and test outcome of each patch shall be recorded.

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### **5.5 Testing & Inspection Records**

Full records of geomembrane testing and inspection shall be submitted progressively to the Engineer, as the work proceeds. Final completion will not be certified until all records have been submitted and approved by the Engineer.

Records shall include, but not limited to, the following:

- Contractor's panel layout drawing showing panel numbers and seam numbers, to be marked up progressively with the roll number used for each panel, and with the locations of samples taken for destructive testing;
- Manufacturer's roll production test reports for all rolls used in the work;
- Subgrade certification reports;
- Daily vacuum box or seam inflation test reports referenced to seam numbers;
- Daily test weld field test reports referenced to seam numbers, equipment identification, and operator, and including weather and temperature conditions and any adjustments to equipment controls;
- Destructive test field report and record of submission for laboratory testing referenced to seam number;
- Laboratory test reports to be available within two weeks of testing;
- Record drawing indicating geomembrane seam locations, destructive test locations, cap strip locations, patches and all repairs for the geomembrane system.

## **6. Geomembrane Completion**

The Geomembrane Installer shall undertake post installation testing of geomembrane as soon as practical after installation. Installation and material defects detected by post installation testing shall be covered under the Installation warranty and shall be repaired to the satisfaction of the Engineer.

### **6.1 Geomembrane Completion Acceptance Criteria**

Upon completion of the geomembrane completion phase (complete with repair and re-testing of leaks), the geomembrane installation shall be deemed as substantially complete and handover shall be approved by the Engineer.

Following handover, leakage rates shall be monitored by the Owner during first filling for the presence of leakage. If leakage is detected within the first year, the installer shall re-mobilize on-site and locate and repair the leaks per the requirements of **Section 2.11.2: Geomembrane Installer Warranty**.

The Engineer shall release the work as being complete upon receipt and approval of the following:

- Checks on application and final finish;
- The installation of HDPE geomembranes has been completed and signed off;
- Repairs to defects have been completed;
- Site has been left clean with no litter;
- All required documentation has been provided to the Engineer in accordance with **Section 5.5: Testing & Inspection Records**.

**End of Specification**

# Existing Facility Permit