

DOCUMENTS AND SPECIFICATIONS
TED HARVEY CONSERVATION AREA
ENHANCEMENT PROJECT
CONTRACT NO. NAT201502/TED.HARVEY

FOR

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
AND ENVIRONMENTAL CONTROL (DNREC)

Division of Fish and Wildlife
89 Kings Highway
Dover, Delaware 19901
(302) 739-9921



Date: April 8, 2016

Job No. 8482-03

Moffatt & Nichol
2700 Lighthouse Point East
Suite 501
Baltimore, Maryland 21224
(410) 563-7300

BIDS WILL BE RECEIVED AT THE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL **UNTIL 2:00 P.M. May 11, 2016** AND WILL BE PUBLICLY OPENED AND READ ALOUD AT THAT TIME. PROPOSALS RECEIVED AFTER THAT DATE AND TIME SET FOR THE OPENING WILL BE RETURNED UNOPENED.

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INVITATION TO BID

Sealed bids for Contract No. NAT201502/TED.HARVEY, will be received by the State of Delaware, Department of Natural Resources and Environmental Control, Division of Fish and Wildlife, at the Richardson & Robbins Building, 89 Kings Highway, Dover, Delaware 19901 until 2:00 p.m. local time on May 11, 2016, at which time they will be publicly opened and read aloud in the Auditorium. Bidder bears the risk of late delivery. Any bids received after the stated time will be returned unopened.

Project involves performing earthwork to raise the elevation of the existing levee and installation of new Water Control Structures within the levee at two locations to improve management of the water elevations within the Conservation Area.

Sealed bids shall be addressed to the Department of Natural Resources and Environmental Control (DNREC) Division of Fish and Wildlife, 89 Kings Highway, Dover, Delaware 19901, ATTN: Mr. Jeremey Ashe. The outer envelope should clearly indicate: **"DNREC CONTRACT NO. NAT201502/TED.HARVEY- SEALED BID - DO NOT OPEN."**

Contract documents may be printed from the following web address www.bids.delaware.gov. or a CD containing contract documents can be obtained at the office of the Department of Natural Resources And Environmental Control, Division of Fish & Wildlife, 89 Kings Highway, Dover, DE 19901.

Construction documents will be available for review at the following locations: Delaware Contractors Association; Associated Builders and Contractors.

Bidders will not be subject to discrimination on the basis of race, creed, color, sex, sexual orientation, gender identity or national origin in consideration of this award, and Minority Business Enterprises, Disadvantaged Business Enterprises, Women-Owned Business Enterprises and Veteran-Owned Business Enterprises will be afforded full opportunity to submit bids on this contract. Each bid must be accompanied by a bid security equivalent to ten percent of the bid amount and all additive alternates. The successful bidder must post a performance bond and payment bond in a sum equal to 100 percent of the contract price upon execution of the contract. The Owner reserves the right to reject any or all bids and to waive any informalities therein. The Owner may extend the time and place for the opening of the bids from that described in the advertisement, with not less than two calendar days notice by certified delivery, facsimile machine or other electronic means to those bidders receiving plans.

END OF ADVERTISEMENT FOR BIDS

SECTION 1A

DEFINITION OF TERMS

DEFINITIONS Wherever used in these Administrative Specifications or in the other Contract Documents, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof.

Application for Payment - The invoice sent to the Department by the Contractor, imprinted with the name and address of the firm in requesting progress payments.

Bid - The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the work to be performed.

Bidder - Any persons, firm or corporation submitting a bid for the work.

Bonds - Bid, performance and payment bonds and other instruments of security, furnished by the Contractor and his surety in accordance with the Contract Documents.

By Others - Refers to all persons or firms other than the contractor to whom this contract is awarded.

Change Order - A written order to the Contractor, issued after execution of the Contract, signed by the Director and Engineer, authorizing an addition, deletion or revision in the work, and if required, adjustment in the Contract Price or Contract Time.

Contract - The written agreement between the Department and the Contractor covering the work to be performed, including the Contractor's bid and the Bonds.

Contract Documents - The Contract, Specifications, Drawings, Addenda (whether issued prior to opening of bids or execution of the Contract) and Modifications.

Contract Price - The total moneys payable to the Contractor under the Contract Documents.

Contract Time - The total number of calendar or working days, and any completion dates for phases or segments of the contract work shown on the Construction Schedule or stated in the specifications or Contract.

Contractor - The person, firm or corporation with whom the Department has executed the Contract.

Department - The legally appointed body known as the Department of Natural Resources and Environmental Control.

Drawings - The drawings and plans which show the character and scope of the work to be performed and which have been prepared or approved by the Engineer and/or Architect and are referred to in the Contract Documents.

Engineer and/or Architect - Refer to Special Provisions, Section 1J.

Field Work Order - A written order to the Contractor, authorized by the Engineer or Inspector, for minor changes or alterations in the work, not involving extra cost and not inconsistent with the overall intent of the Contract Documents.

Furnish - To obtain and deliver on the job for installation by other trades.

Inspector - An authorized representative of the Department assigned to on-site inspection of any feature of materials or work entering into the Contract.

Installation - In addition to actual installation, includes all unloading, handling, rigging and hoisting, and the furnishing of all tools, equipment and materials required to handle and install the work, except as otherwise specified in the Contract Documents.

Job Site - The site upon which the Contract work is to be performed.

Modification - Any written amendments of any of the Contract Documents (including Change Orders and Field Work Orders) duly executed and delivered after execution of the Contract.

Owner - Same as Department.

Property - The metes and bounds of lands administered by the Department, and containing the project to be constructed.

Project - The entire construction to be performed as provided in the Contract Documents.

Provide - Furnish and install.

Secretary - The Secretary of the Department acting either directly or through authorized Agents.

Shop Drawings - All drawings, diagrams, illustrations, brochures, schedules and other data which illustrate the equipment, material and work to be furnished by the Contractor.

Specifications - The Administrative Specifications and the Technical Specifications.

State - State of Delaware.

Subcontractor - An individual, firm or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the work at the site.

Superintendent - The Contractor's representative at the site, and shall have authority to act on behalf of the Contractor.

Testing Laboratory - A materials testing laboratory approved by the Secretary.

Work - Any and all obligations, duties and responsibilities necessary to the successful completion of the Project assigned to or undertaken by the Contractor under the Contract Documents, including the furnishing of all labor, materials, equipment and other incidentals.

SECTION 1B

INSTRUCTIONS TO BIDDERS

1B.01 PROPOSALS

(a) Refer to Special Provisions, Section 1J, for instructions for submitting proposal and bid opening date and time, Section 1J.05.

(b) Shall be on the furnished proposal forms. All blank spaces in the form shall be filled, signed in ink in longhand where designated, and all numbers shall be stated in words and in figures. The completed forms shall be without interlineations, alterations, or erasures. All attachments to the specifications and proposal are a necessary part thereof, and shall not be detached or altered.

(c) Shall not contain any recapitulation of the work to be done. No changes shall be made in the phraseology of the form. Nor partial bids nor any alternative bids not provided for in the form will be considered. Where proposal provides for quoting either addition or deduction for an "Alternate" item, indicate whether the sum named is an addition or deduction by ruling out the words not wanted.

1B.02 DRAWINGS AND SPECIFICATIONS

(a) Will be issued by the Department. Refer to Special Provisions, Section 1J.

(b) Prospective Bidders may obtain contract documents at the Department of Natural Resources and Environmental Control, Division of Fish and Wildlife, 89 Kings Highway, Dover, DE 19901.

1B.03 THE BIDDER

(a) Shall carefully examine the documents, the drawings and the specifications, shall visit the site and fully inform himself as to all existing and controlling conditions and limitations including availability of materials and labor. The submission of a bid shall be a representation that he has inspected the site and has familiarized himself with all of the controlling conditions. Failure to conduct these thorough examinations shall in no way relieve the successful bidder of his responsibility for the complete and satisfactory performance of all required work.

(b) Shall notify the Project Manager and/or Engineer in writing within seven working days following the pre-bid meeting if he finds discrepancies in, or omissions from, the drawings and/or specifications, or is in doubt as to their meanings. If explanation is necessary, a reply will be made by an addendum issued to all bidders. No oral statement shall change the requirements of the specifications or drawings unless confirmed in writing.

Addenda will be mailed or delivered to all who are known by the Agency to have received a complete set of the Bidding Documents.

Copies of the Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

No Addenda will be issued later than 5 calendar days prior to the date for receipt of bids except an Addendum withdrawing the request for Bids or one which extends the time or changes the location for the opening of bids.

Each bidder shall ascertain prior to submitting his bid that he has received all Addenda issued, and shall acknowledge their receipt in his bid in the appropriate space. Not acknowledging an issued Addendum could be grounds for determining a bid to be non-responsive.

(c) Shall state the lump sum price for which he will execute and complete base bid items in accordance with the drawings, specifications, and the requirements of the Contract. Prices quoted shall include federal or state taxes, if such are applicable.

(d) For Public Works Contracts, the contractor shall not subcontract, sublet, sell, transfer, assign, purchase work or materials from an organization other than his/her own, or otherwise dispose of the contract or contracts or any portion thereof, or of his/her right, title or interest therein, without written permission from the State. In case such permission is given, the contractor will be permitted to subcontract or sublet a portion thereof but shall perform with his/her own organization, work amounting to not less than fifty percent (50%) of the total contract bid price, exclusive of General Condition Items, Overhead, and Profit.

(e) Shall submit with his proposal a guarantee in accordance with Section 1B.05 below.

(f) Shall submit with his proposal a properly executed Non-Collusion statement in accordance with Section 1B.06 below.

(g) Shall submit with his proposal a properly executed Sub-Contractors List in accordance with Section 1B.07 below.

(h) Shall submit with his proposal a copy of their Delaware Business License.

(i) Shall sign his name in the space provided therefore. If the proposal is made by a partnership or corporation, the name and address of the partnership or corporation shall be shown, together with the names of the partners or the officers. A proposal made by a corporation shall be signed by one of the authorized officers thereof.

(j) If awarded the contract, the bidder will be required to furnish copies of Insurance Certificates endorsed to meet the requirements of the contract.

(k) Each bidder shall include signed Affidavit(s) for the Bidder and each listed Subcontractor certifying compliance with OMB Regulation 4104- "Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on "Large Public Works Projects." "Large Public Works" is based upon the current threshold required for bidding Public Works as set by the Purchasing and Contracting Advisory Council.

1B.04 THE SECRETARY OF THE DEPARTMENT OR HIS REPRESENTATIVE

(a) May, during the bidding period, advise the bidders by addenda, of additions, omissions, or alterations in the specifications and drawings. All such changes shall be included in the work covered by the proposal and shall become part of the specifications as if originally included therein.

(b) Reserves the right to waive technicalities, to reject any and all bids, to advertise for new proposals, to proceed to do the work otherwise, or to abandon the work, if, in the judgment of the Secretary, the best interest of the State will be promoted thereby.

(c) Reserves the right to adjust, delete, increase, or reduce any or all items contained in the technical specifications by amounts which will not exceed twenty-five percent (25%) of the total bid price.

(d) Reserves the right to reject bids if any unit or alternate bid prices are obviously unbalanced, either above or below reasonable cost analysis values.

1B.05 PROPOSAL GUARANTEE

Each bidder shall submit with proposal a guarantee in sum equal to ten percent (10%) of the total value of his bid. This guarantee shall be submitted in the form of a good and sufficient bond (sample copy attached) to the State of Delaware for the benefit of the Department; or, a certified check drawn on a reputable banking institution, or payable to the order of the Department of Natural Resources and Environmental Control. Certified check and bond guarantees of all bidders will be returned after the contract has been executed.

1B.06 NON-COLLUSION STATEMENT

The Department requires, as a condition precedent to acceptance of bids, a sworn statement executed by, or on behalf of the persons, firm association or corporation to whom such Contract is to be awarded, certifying that such person, firm, association or corporation has not, either directly or indirectly, entered into an agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with such contract. The form for this sworn statement is included in the proposal and must be properly executed in order to have the bid considered. Failure to execute the Non-Collusion Statement will automatically disqualify the bid.

1B.07 SUB-CONTRACTOR LIST

(a) As required by Delaware Code, Title 29, Section 6962 (d) (10) b, each Bidder shall submit with their Bid a completed List of Sub-Contractors included with the Bid Form. NAME ONLY ONE SUB-CONTRACTOR FOR EACH TRADE. A Bid will be considered non-responsive unless the completed list is included.

(b) Provide the Name and Address for each listed sub-contractor. Addresses by City, Town or Locality, plus State will be acceptable.

(c) It is the responsibility of the Contractor to ensure that their Sub-Contractors are in compliance with the provisions of this law. Also, if a Contractor elects to list themselves as a Sub-Contractor for any category, they must specifically name themselves on the Bid Form and be able to document their capability to act a Sub-Contractor in that category in accordance with this law.

1B.08 PREFERENCE FOR DELAWARE LABOR

As referenced in 29DELC 6962 (d) (4) (b). “In the construction of all public works for the State or any political subdivision thereof or by firms contracting with the State or any political subdivision thereof, preference in employment of labors, workers or mechanics shall be given to bona-fide legal citizens of the State who have established citizenship by residence of at least 90 days in the State.

1B.09 LICENSE AND TAX REQUIREMENTS

(a) Each Contractor and Subcontractor shall be licensed to do business in the State of Delaware and shall pay all fees and taxes due under State laws. In conformance with Section 2503, Chapter 25, Title 30, Delaware Code, the Contractor shall furnish the State Tax Department, within 10 days after award of contract, a statement of the total values of each contract and subcontract, together with the names and addresses of the contracting parties. The Contractor, before the payment of any award or amount payable to any contractor or subcontractor not a resident of Delaware, shall ascertain from said non-resident contractor or Subcontractor and/or State Tax Department, whether they have obtained a license and satisfied their liability paid by the non-resident Contractor or Subcontractor, the Contractor shall deduct from the award the amount payable to said non-resident Contractor or Subcontractor the amount of said license liability and shall pay the same to the State Tax Department within 10 days after final payment and settlement within the non-resident Contractor or Subcontractor.

(b) Taxes: The Contractor shall pay all sales, consumer, use and other taxes required by law.

1B.10 PAYMENTS

The Department may, at the discretion of the Secretary, make partial payments based upon the Contractor's continuous and conscientious performance. The partial payments shall not exceed 95% of the cost of materials and labor incorporated in the work. See Section 1D General Conditions Part II Sections 1D.21; 1D.22; and 1D.23 for additional information and clarification.

1B.11 MINIMUM WAGES

(a) The Contractor and each of his Subcontractors, or any other person employing laborers and/or mechanics at the site in the performance of this Contract, shall pay the various classes of laborers and mechanics no less than the hourly rate set forth in the attached prevailing wage rate scale determined by the Department of Labor of the State of Delaware, (Section 1F).

(b) The Contractor and each of his Subcontractors shall pay all mechanics and laborers employed directly on the site of the work, unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account, the full amounts accrued at time of payment, computed at wage rates not less than those stated in the attached wage rate scale, regardless of any contractual relationship which may be alleged to exist between the Contractor or Subcontractor and such laborers and mechanics.

(c) The scale of wages attached hereto shall be posted by the Contractor in a prominent and accessible place at the project site.

(d) The owner may withhold from the Contractor so much of the accrued payment as he may consider necessary to pay to laborers and mechanics employed by the Contractor or any Subcontractor the difference between the rates of wages required by the Contractor to be paid to laborers and mechanics employed in the work and the rates of wages received by such laborers and mechanics and not refunded to the Contractor, Subcontractor, or their agents.

(e) The Contractor shall furnish sworn payroll information to the Department of Labor weekly. Sample copies enclosed.

1B.12 NON-DISCRIMINATION

The Department prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political belief, and marital or family status.

1B.13 LUMP SUM BID

Notwithstanding any other provision of this contract to the contrary, this is a Lump Sum Bid contract and the State shall not be responsible for any cost escalations whatsoever, under any circumstances. In the event that this provision conflicts with any other provision of this contract, this provision shall control.

1B.14 ACCEPTANCE OF BID AND AWARD OF CONTRACT

(a) A formal Contract shall be executed with the successful Bidder within twenty (20) calendar days after the award of the Contract.

(b) Per Section 6962(d)(13) a., Title 29, Delaware Code, “The contracting agency shall award any public works contract within thirty (30) days of the bid opening to the lowest responsive and responsible Bidder...”

(c) Each Bid on any Public Works Contract must be deemed responsive by the Agency to be considered for award. A responsive Bid shall conform in all material respects to the requirements and criteria set forth in the Contract Documents and specifications.

(d) The successful Bidder shall execute a formal contract, submit the required Insurance Certificate, and furnish good and sufficient bonds, unless specifically waived in the General Requirements, in accordance with the General Requirement, within twenty (20) days of official notice of contract award. The successful Bidder shall provide two business days prior to contract execution, copies of the Employee Drug Testing Program for the Bidder and all listed Subcontractors. Bonds shall be for the benefit of the Agency with surety in the amount of 100% of the total contract award. Said Bonds shall be conditioned upon the faithful performance of the contract. Bonds shall remain in effect for period of one year after the date of substantial completion.

(e) If the successful Bidder fails to execute the required Contract and Bond, as aforesaid, within twenty (20) calendar days after the date of official Notice of the Award of the Contract, their Bid guaranty shall immediately be taken and become the property of the State for the benefit of the Agency as liquidated damages, and not as a forfeiture or as a penalty. (A sample copy of the required contract is attached). Award will then be made to the next lowest qualified Bidder of the Work or re-advertised, as the Agency may decide.

(f) Each bidder shall supply with its bid its taxpayer identification number (i.e.: federal employer identification number or social security number) and a copy of its Delaware Business License, and should the vendor be awarded a contract, such vendor shall provide to the Agency the taxpayer identification license numbers of such sub-contractors. Such numbers shall be provided on the later of the date on which such sub-contractor is required to be identified or the time the contract is executed. The successful Bidder shall provide to the Agency to which it is contracting within 30 days of entering into such public works contract, copies of all Delaware Business Licenses of sub-contractors and/or independent contractors that will perform work for such public works contract. However, if a sub-contractor or independent contractor is hired or contracted more than 20 days after the Bidder entered the public works contract the Delaware Business License of such sub-contractor or independent contractor shall be provided to the agency within 10 days of being contracted or hired.

(g) The Bid Security shall be returned to the successful Bidder upon the execution of the formal contract. The Bid Security of unsuccessful bidders shall be returned within thirty (30) calendar days after the opening of the Bids.

SECTION 1C

GENERAL CONDITIONS - PART 1

AWARD AND EXECUTION OF CONTRACT

1C.01 AWARD OF CONTRACT

If the contract is awarded, it will be awarded to the eligible bidder whose Base Bid Price Bid selected by the Department produces the lowest net bid. If the contract is awarded, the Department will give the successful bidder written notice of the award within thirty (30) days after the opening of the bids. The contract award shall not be final until an approved Delaware State Purchase Order has been received by the Contractor.

1C.02 DELIVERY OF BONDS

The successful bidder must furnish the State of Delaware for the benefit of the Department of Natural Resources and Environmental Control a **performance bond and a payment bond**, each in an amount equal to the total contract price (sample copy attached). Delaware Code requires that all bonds for this bid and the ensuing contract be signed by a bona-fide agent duly empowered to represent the bonding/surety company, (also duly authorized to do business in the State of Delaware) that will furnish said bonds.

SECTION 1D

GENERAL CONDITIONS PART II

1D.01 NOTICE TO PROCEED

The work shall be started at the job site promptly upon receipt of the State of Delaware Purchase Order and shall be performed with such progress as may be necessary to prevent any delay to other contractors, or to the general completion of the project. The work shall be prosecuted at such times and with such forces, materials, and equipment as may be necessary to assure the substantial completion of the work in accordance with the Contract Time. If the work falls behind the Progress Schedule submitted by the Contractor, the Contractor shall employ additional labor and equipment as necessary to bring the work up to schedule.

1D.02 PRECONSTRUCTION CONFERENCE

Before starting the work, a conference will be held to review schedules to establish procedures for handling shop drawings and other submissions and for processing Applications for payment, and to establish a working understanding between the parties as to the project. Present at the conference will be the Secretary or his authorized representative, the Contractor and the superintendent.

1D.03 SCHEDULES

(a) Delivery Schedule - The Contractor shall, within ten (10) calendar days after the award of the contract for the work prepare and submit to the Department, in triplicate, a Delivery Schedule in a form acceptable to the Department. The Delivery Schedule shall list the principal and critical equipment and materials required for the contract work, both of the Contractor's own production and those parts to be procured from others, with dates and time period of deliveries at the site. The Delivery Schedule shall be submitted each month on or before the 10th day of the month, corrected to reflect the current status of orders and deliveries until the completion of the deliveries.

(b) Progress Schedule - Prior to the starting date of erection of the work, the Contractor shall prepare and submit to the Department, in triplicate, a Progress Schedule in a form acceptable to the Department, listing the principal component parts of the work, and showing the proposed starting dates and duration of time allotted for the erection and installation of each component part. The Progress Schedule shall be submitted each month with the Application for Payment to show percentage of each component part of the work completed as of that date.

(c) Schedule of Values - At least ten days prior to submitting the first application for a progress payment, the Contractor will submit a schedule of values of the work including quantities and unit prices, aggregating the Contract Price. This schedule shall be satisfactory in form and substance to the Owner and shall subdivide the work into component parts in sufficient detail to serve as the basis for progress payments during construction. Upon approval of the Schedule of Values by the Owner, it shall be incorporated into the form of application for payment.

(d) The Contractor's Delivery Schedule and Progress Schedule shall be designed to meet the completion dates and sequences of construction required by the Contract Documents.

(e) It shall be the Contractor's responsibility to check with the Department concerning actual delivery dates, actual progress of the construction and other work being carried on by the Department and to schedule the arrival of his materials, equipment and labor at the site so as to properly coordinate his work with the Owner's work and the work of other contractors. There will be no extra compensation for work resulting from extra work which the Contractor must perform due to failure to coordinate this work with the Owner's work and the work of other contractors.

(f) In no case shall the contractor, except as instructed by the Department, delay the progress of the work, or any part thereof, on account of changes in the work or disputes of any nature, without limitation, caused by proposed or ordered changes in the work, or any disputes or disagreements as to the equitable value of the changes.

1D.04 INTENT OF CONTRACT DOCUMENTS

It is the intent of the contract documents, specifications and drawings, to describe a complete project to be performed under the Contract.

The Contract Documents comprise the entire agreement between the Department and the Contractor. They may only be altered by a modification or as provided in Section 1D.17, 1D.18, 1D.19 and 1D.20.

1D.05 CORRELATION AND INTERPRETATION OF CONTRACT DOCUMENTS

The Contract Documents are complementary; what is called for by one is as binding as if called for by all; if the Contractor finds a conflict, error or discrepancy in the Contract Documents, he will call it to the Owner's attention in writing before proceeding with the Work affected thereby. In resolving such conflicts, errors, or discrepancies, the documents shall be given precedence in the following order: Contract, Specifications, Drawings. Within the specifications the order of the precedence shall be as follows: Special Conditions, Instructions to Bidders, General Conditions, Technical Provisions. Figures dimensions on Drawings shall govern over scale dimensions, and detailed drawings shall govern over general drawings. Any work that may be reasonably inferred from the specifications or drawings as being required to produce the intended result shall be supplied whether or not it is specifically called for. Work, materials, or equipment described in words which so applied have a well-known technical or trade meaning shall be deemed to refer to such recognized standards. The Contractor assumes full responsibility for having familiarized himself with the nature and extent of the Contract Documents, work locality, conditions that may in any manner affect the work to be done.

1D.06 WORK BY OTHERS

(a) The Owner may perform work related to the project by himself, or he may let other direct contracts therefore which shall contain General Conditions similar to these. The Contractor will afford the other contractors who are parties to such direct contracts (or the Owner, if he is

performing the additional work himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of work, and shall properly connect and coordinate his work with theirs.

(b) If any part of the Contractor's work depends for proper execution or results upon the work of any such other contractor (or the Owner), the Contractor will inspect and promptly report to the Owner in writing any defects or deficiencies in such work that render it unsuitable for such proper execution and results. His failure so to report shall constitute an acceptance of the other work as fit and proper for the relationship of his work except as to defects and deficiencies which may appear in the other work after the execution of his work.

(c) The Contractor will do all cutting, fitting and patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by such other work. The Contractor will not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of the Owner.

(d) If the performance of additional work by other contractors or the Owner is not noted in the Contract Documents prior to the award of the Contract, written notice thereof shall be given to the Contractor prior to starting any such additional work. The contractor will afford the Owner and the other contractors who are parties to such direct contract reasonable opportunity for the introduction and storage of materials and equipment and the execution of their work. If the Contractor believes that the performance of such additional expense entitles him to an extension of the Contract Time, he may make a claim therefore as provided in Section 1D.18 and 1D.19.

1D.07 SUBCONTRACTORS

The following is in compliance with Title 29, Chapter 69 of the Delaware Code:

(a) "Subcontractor" means any person, partnership, firm, corporation, or other business association which enters into a contract directly with a contractor to perform actual construction labor on the site, or to perform actual construction labor and provide material in connection with such labor on the site. Labor performed in the delivery and unloading of material at the project site is not to be construed to mean actual construction labor.

(b) In the case of any public works contract for the construction, reconstruction, alteration or repair of any public building (not a road, street or highway) of the State, of any county in the State, of any public school district, or of any political subdivision of the State, there shall be a meeting of all prospective bidders and of the Agency called by the agency upon reasonable notice and at a place and time stated in such notice which meeting shall be at least fifteen (15) days before the date for the submission of bids; at the meeting all the participants, including the agency, shall attempt to agree upon a listing of all subcontractor categories to be included in the bids for performing the work as required, and any such agreed listing shall be final and binding upon all bidders and upon the agency. If all of the participants do not agree on such a listing at the meeting then the agency itself at least ten (10) days before the due date for the submission of bids shall determine the subcontractor categories to be included in the listing. The listing, whether agreed to by all of the participants at the meeting or determined by the agency itself in the absence of the

unanimous agreement of the participants at the meeting, shall be published by the agency at least ten (10) days before the due date for the submission of bids by mailing and listing to all of the participants at the meeting. The listing as so published shall be final and binding upon all bidders and the agency and it shall be filled out completely in full without any abbreviations (Section 3C).

(c) Such contract shall be awarded only to a bidder whose bid is accompanied by a statement containing for each subcontractor category set forth in the listing as provided in S6962, the name and address and State of Delaware Business License number of the subcontractor whose services he intends to use in performing the work and providing the material, for such subcontractor category. No bidder for such a contract shall list himself in any accompanying statement as the subcontractor of any part of the public building unless the bidder, in addition to being licensed as a contractor of the State, shall also be recognized in the industry not only as a prime contractor, but also as a subcontractor or contractor in and for any such part or parts of such work so listed in such accompanying statement.

(d) Neither the State nor County nor public school district nor any political subdivision of the State, nor any agency of any of them, shall accept any bid for such a contract or award any such contract to any bidder, as the prime contractor, if the bidder has listed himself as the subcontractor for any subcontractor category set forth on the listing as provided in Section 6962, unless it has been established to the satisfaction of the awarding agency that the bidder has customarily performed the specialty work of such subcontractor category by artisans regularly employed by the bidder is duly licensed by the State to engage in such specialty work, if the State requires such licenses, and that the bidder is recognized in the industry as a bona fide subcontractor or contractor in such specialty work and subcontractor category. Illustrative only (and not intended to be exhaustive) of typical subcontractor categories involving their own respective types of specialty work, are plumbing, electrical wiring, heating, roofing, insulating, weather stripping, masonry, bricklaying and plastering. The decision of the awarding agency as to whether a bidder who lists himself as the subcontractor for a subcontractor category set forth in the listing as provided in Section 6962(b2) for such subcontractor category, shall be final and binding upon all bidders, and no action of any nature shall lie against any awarding agency because of its decision in this regard.

1D.08 SUBCONTRACTS

(a) The Contractor shall not make any substitution of subcontractors or suppliers who have been submitted with the Contractor's proposal without the written authorization of the Owner. The Contractor will not make any substitution for any subcontractor or supplier who has been accepted by the Owner unless the Owner determines that there is good cause for doing so.

(b) The Contractor will be fully responsible for all acts and omissions of his subcontractors and of persons directly or indirectly employed by them and of persons whose acts may be liable to the same extent that he is responsible for the acts and omissions of persons directly employed by him. Nothing in the Contract Documents shall create any contractual relationship between any subcontractor and the Owner or any obligation on the part of the Owner to pay or to see to the payment of any moneys due any subcontractor. The Owner may furnish to any subcontractor, to the extent practical, evidence of amounts paid to the Contractor on account of specific work done in accordance with the schedule of values.

(c) The divisions or sections of the specifications or the identifications of any drawings shall not control the Contractor in dividing the work among subcontractors or delineating the work to be performed by any trade.

(d) The Contractor agrees to specifically bind every subcontractor to all of the applicable terms and conditions of the Contract Documents. Every subcontractor, by undertaking to perform any of the work, will thereby automatically be deemed to be bound by such terms and conditions.

1D.09 MATERIALS, EQUIPMENT AND LABOR

(a) Unless otherwise specified the Contractor will provide and pay for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water and sanitary facilities and all other facilities and incidentals necessary for the execution, testing, initial operation and completion of the work.

(b) Unless otherwise specified all materials and equipment will be new. If required by the Owner, the Contractor will furnish satisfactory evidence as to the kind and quality of materials and equipment.

(c) All manufactured materials and equipment shall be applied, installed, connected, erected, used, cleansed, and conditioned as directed by the manufacturer.

(1) General - All materials, fittings and equipment shall be new, unless otherwise specified, of the best quality obtainable within the class or type specified, and in strict compliance with the requirements of the specifications.

(2) Substitutions - Where materials or equipment are specified by description or by brand or manufacturer's names, they are so named in the specifications to denote the kind and quality required, whether or not the words "or approved equal" are used, and bids shall be based on the products described or named. The Contractor's having submitted a bid shall be a representation that he is prepared to furnish the products described or named or substitutes acceptable and approved by the Department. Regardless of whether or not the phrase "or approved equal" or similar notation appears in the specifications or on the drawings, no substitutions for any materials or equipment will be allowed except upon written request of the Contractor and written approval of the Department and subject to the conditions specified below:

a. All requests for substitutions shall be made in a consolidated request submitted with the Contractor's Delivery Schedule within ten (10) days after the award of the contract. Requests shall give complete description of the proposed alternate material, the reason for substitution, and comparison of the price of the substitution with the price of the material specified. No requests for substitution will be considered unless accompanied by technical information sufficient for comparison with the quality and suitability of the specified products. Samples shall be provided by the Contractor if requested by the Department.

b. No request for substitution will be considered thereafter except for emergency requests made because of non-availability of the specified material, danger of schedule delay, or to adjust unforeseen field conditions. All emergency requests shall be made through the Inspector. If in connection with such emergency requests the Contractor's proposed substitute is declined, the Department shall have the privilege of specifying a substitute material or equipment, provided that, if the Contract is performed on a lump sum, unit price or maximum sum basis, the current market price of the Substitute specified by the Department does not exceed the current market price of the product named in the specifications.

c. The Contractor shall not be entitled to additional compensation for additional cost or extra work resulting from any substitutions requested by him. If the cost of the material substituted is less than the cost of the material specified, such savings in cost shall be credited to the Department and deducted from the Contract Price.

d. The Department may decline substitutions and require that products specified be furnished.

(3) Warranties - In addition to and not in limitation of the provisions of Section 1D.24, the Contractor shall fulfill any special warranties of material or equipment he is furnishing. The Contractor's having submitted a bid shall be a representation that he is able and prepared to obtain manufacturer's warranty bonds, where required for the products named in the specifications.

(4) Samples - The Contractor shall furnish, for approval, samples of the items he is to supply, as required by the Contract Documents or requested by the Department. The work shall be in accordance with the approved samples.

(5) Department Furnished Materials & Equipment - If any materials or equipment are to be furnished by the Department for the work, they will be so specified in the Contract Documents. Unless otherwise specified, it shall be the Contractor's responsibility to locate, receive, handle and store, if necessary, any item of Department furnished material or equipment which he is required by the Contract to install, erect or handle in any way, from the time it is received by the Contractor at the job site or other Department approved location until completion of the work in accordance with the Contract Documents. Damaged or lost Department furnished items shall be repaired or replaced by the Contractor without additional cost to the Department.

1D.10 PATENT FEES AND ROYALTIES

The Contractor will pay all license fees and royalties and assume all costs incidental to the use of any invention, design, process or device which is the subject of patent rights or copyrights held by others. He will indemnify and hold harmless the Department and the Engineer and/or Architect and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses (including attorney's fees) arising out of any infringement of such rights during or after completion of the work, and shall defend all such claims in connection with any alleged infringement of such right.

1D.11 USE OF PREMISES

(a) The Contractor will confine his equipment, the storage of materials and equipment and the operation of his workmen to limits indicated by law, ordinances, permits or the requirements of the Contract Documents and shall not unreasonably encumber the premises with materials or equipment.

(b) The Contractor will not load nor permit any part of the structure to be loaded with weight that will endanger the structure.

(c) Storage areas will be provided for the storage of the Contractor's materials and equipment and he shall confine his materials, equipment and operations of his workmen to such limits as indicated by the Department and shall not encumber the premises. Unless otherwise indicated in the specifications, the storage areas will be outdoors, and the Contractor shall provide whatever shelter is necessary for his storage and fabricating needs. No workmen shall trespass within areas or buildings of the Department other than those related to the work of the contract. The Contractor shall rigidly enforce this regulation. Any materials, equipment, or temporary structures belonging to the Contractor shall be moved when so directed by the Department to permit the execution of the work of others in connection with the project.

1D.12 TESTS

(a) If the Contract Documents, the Owner's instructions, laws, ordinance or any public authority requires any work to be tested specifically or approved by another authority, the Contractor will give the Inspector timely notice of readiness therefore. The Contractor will furnish the Department the required certificates of testing or approval. All such tests will be in accordance with the methods prescribed by the American Society for Testing and Materials, or as otherwise required by the Department or by applicable codes or ordinances. If any such work required to be tested is covered up without written approval or consent of the Inspector, it must, if directed by the Inspector be uncovered for examination at the Contractor's expense. The cost of all such tests shall be borne by the Contractor; provided that, if such test is called for only by the Department's instructions (and not required by the Contract Documents or otherwise) and if the test reveals that the work involved meets the requirements of the Contract Documents, the Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time directly attributable to making the test if he makes claim therefore as provided in Section 1D.18, 1D.19, or 1D.20.

(b) Any work which fails to meet the requirements of any such test or approval and any work which meets the requirements of any such test or approval but does not meet the requirements of the Contract Documents shall be considered defective or may be rejected. Rejected work shall be removed promptly from the site by the Contractor unless the deficiencies are corrected promptly by him. If, instead of requiring correction or removal of any such defective work, the Department prefers to accept it, they may do so, in which case a Change Order shall be issued incorporating the necessary revisions in the Contract Documents including an appropriate reduction in the Contract Price.

1D.13 CONTRACTOR'S SUPERVISION AND SUPERINTENDENCE

(a) The Contractor will supervise and direct the work efficiently and with his best skill and attention. He will be solely responsible for techniques and sequences of construction. Before undertaking the work he will carefully study and compare the Contract Documents and check and verify all figures shown thereon and all field measurements. He will at once report in writing to the Department any conflict, error or discrepancy which may be discovered. The Contractor will be responsible to see that the finished work complies accurately with the Contract Documents.

(b) He shall keep on the work site at all times during its progress a competent resident superintendent and supervisory staff. The superintendent will be the Contractor's representative at the site and shall have authority to act on behalf of the Contractor. All instructions and notices given to the superintendent will be as binding as if given to the Contractor.

(c) The Contractor will provide competent, suitably qualified personnel to survey and lay out the work and perform construction as required by the Contract Documents. He will at all times maintain good discipline and order among his employees at the site.

(d) The Department will not be responsible for the acts or omissions of the Contractor, or any subcontractors, or any of his or their superintendents, supervisory staffs, agents or employees.

1D.14 SAFETY AND PROTECTION: EMERGENCIES

(a) The Contractor will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury, or loss to:

1. All employees and other persons who may be affected thereby.
2. All the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site.
3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor will comply with all applicable safety and building laws and codes of federal, state, municipal, and other governmental bodies for the safety of persons or property to protect them from damage, injury, or loss. He will maintain and erect, as required by the conditions and progress of the work, all necessary safeguards for their safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners of adjacent utilities. When the use or storage of explosives or other hazardous materials is necessary for the prosecution of the work, the Contractor will exercise the utmost care and will carry on such activities under the supervision of licensed specially qualified personnel. All damage injury or loss to any such property caused, directly or indirectly, in whole or in part, by the Contractor, any subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, will be remedied by the Contractor.

(b) In emergencies affecting the safety of persons or the work or property at the site or adjacent thereto, the Contractor, without special instructions or authorization from the Owner, is obligated to act, at his discretion, to prevent threatened damage, injury or losses. He will give the Owner prompt written notice of any significant changes in the work or deviations from the Contract Documents caused thereby, and a Change Order will thereupon be issued covering the changes and deviations involved. If the Contractor believes that additional work done by him in an emergency which arose from causes beyond his control entitles him to an increase in the Contract Price or an extension of the Contract Time, he may make a claim therefore as provided in Section 1D.18 or 1D.19 or 1D.20.

(c) The Contractor shall at all times protect all work, materials, equipment and fixtures against dirt, water, chemical and mechanical injury. The Contractor shall make good at his own expense any and all damage to his work, to the work of others, or to any materials or equipment in place or stored in the structure, whether such damage is caused directly in or indirectly by his work or by his failure to take adequate protective measures. During the progress of the work the Contractor shall handle the materials and equipment with care and good judgment to avoid the accumulation of unnecessary dirt, and shall use special care to prevent foreign materials from entering the interior parts of the equipment.

(d) The Contractor shall be responsible for maintaining the proper fire prevention safeguards and discipline necessary for the type of work he is performing, and shall institute procedures for giving alarm and protecting adjacent work and materials in case of fire, so as to minimize loss or damage.

(e) The Contractor shall use established roadways except as otherwise authorized and shall be responsible for the coordination of his work activities with those of others so as to minimize traffic congestion on roads, streets and highways and shall cooperate with officials who have jurisdiction over those facilities.

(f) All construction must be done in compliance with the Occupational Safety and Health Act of 1970 and all rules and regulations thereto appurtenant.

1D.15 CLEANING UP

The Contractor will keep State property free from accumulations of waste materials, rubbish, and other debris from and about the site clean and ready for occupancy by the Department. The Contractor will restore to their original condition those portions of the site not designated for alteration by the Contract Documents.

It shall be understood that the cost of regular or continuous cleanup as required to keep the worksite clean has been included in the Contract Price.

1D.16 ACCESS TO THE WORK: UNCOVERING FINISHED WORK

(a) The Department will at all times have access to the work. The Contractor will provide proper facilities for such access and observation of the work or for any examination or testing thereof.

(b) Should it be considered necessary or advisable by the Department to reexamine any part of work already fabricated, installed, or completed, the Contractor, at the Department's request, will uncover, expose or otherwise make available for examination or testing that portion of the work in question, furnishing all necessary labor, material and equipment. If it is found that such work, does not meet the requirements of the Contract Documents, the Contractor will defray all the expense of such examination, and testing of satisfactory reconstruction.

If, however, such work is found to meet the requirements of the Contract Documents, the Contractor will be allowed an increase in the Contract Price or extension of the Contract Time directly attributable to such uncovering, exposure, examination and testing, if he makes a claim therefore as provided in Section 1D.18, 1D.19 and 1D.20.

1D.17 DEFECTIVE OR NEGLECTED WORK

(a) All work not conforming to the requirements of the Documents shall be considered defective, and all defective work, whether in place or not, may be rejected. Rejected work shall be removed promptly from the site by the Contractor unless the deficiencies are corrected promptly by him. The Contractor will also bear the expense of making good all work of other contractors destroyed or damaged by removal or replacement of his defective work. If the Contractor does not correct such deficiencies within a reasonable time, fixed by written notice from the Department, the Department may correct the deficiency or remove the rejected work. All direct or indirect costs of such correction or removal will be charged against the Contractor. If, instead of requiring correction or removal of any such defective work, the Department prefers to accept it, they may do so in which case a Change Order shall be issued incorporating the necessary revisions in the Contract Documents including an appropriate reduction in the Contract Price.

(b) If the Contractor should neglect to prosecute the work in accordance with the Contract Documents, including any requirements of the Progress Schedule, the Department, after three days written notice to the contractor may, without prejudice to any other remedy he may have, make good such deficiencies and the cost thereof shall be charged against the Contractor, in which case a Change Order shall be issued incorporating the necessary revisions in the Contract Documents, including an appropriate reduction in the Contract Price.

1D.18 CHANGES IN WORK

(a) Without invalidating the Contract, the Department may, at any time or from time to time, order additions, deletions or revisions in the work; these will be authorized by Change Orders. Upon receipt of a Change Order, the Contractor will proceed with the work involved. All such work shall be executed under the applicable conditions of the Contract Documents. If any Change

Order causes an increase or decrease in the Contract Price or an extension/shortening of the Contract Time, the change in the Contract Price/Time, will be noted in the Change Order. Any equitable adjustment will be made as provided in Sect. 1D.19 and 1D.20.

(b) The Inspector may authorize minor changes and/or alterations in the work not involving extra cost and not inconsistent with the over-all intent of the Contract Documents by means of a Field Work Order. If the Contractor believes that any minor change or alteration authorized by the Inspector entitles him to an increase in the Contract Price or Contract Time, he shall not proceed with the work until after receipt of a Change Order.

(c) The Contractor shall submit a written lump sum quotation within forty-eight (48) hours after receipt of a Field Work Order from the Inspector at the jobsite, or within five (5) days after receipt of a change notice from the Department for changes or alterations which the Contractor believes entitles him to an increase in the Contract Price. These time limits may be extended only with the written consent of the Department.

(d) Additional work performed by the Contractor without authorization of a Change Order will not entitle him to an increase in the Contract Price or an extension of the Contract Time, except in case of an emergency as provided in Section 1D.14b and except as provided in Section 1D.06b, 1D.12a and 1D.16b.

(e) The Department will execute any appropriate Change Order for work performed in an emergency as provided in Section 1D.19b and any other valid claim of the Contractor accompanied by a lump sum quotation agreeable to the Department for a change in the Contract Time or the Contract Price approved by the Department.

(f) It is the Contractor's responsibility to notify his Surety for any changes affecting the general scope of the work or change in the Contract Price and the amount of the applicable Bonds shall be adjusted accordingly. The Contractor will furnish proof of such adjustment to the Department.

1D.19 CHANGE OF CONTRACT PRICE

(a) The Contract Price constitutes the total compensation payable to the Contractor for performing the work. All duties, responsibilities, and obligations assigned to or undertaken by the Department shall be at his expense without change in the Contract Price.

(b) The Contract Price may only be changed by a Change Order. If the Contractor is entitled by the Contract Documents (Section 1D.06, 1D.12b, 1D.18a and 1D.18b) to make a claim for an increase in the Contract Price, his claim shall be in writing delivered to the Department within fifteen (15) days of the occurrence of the event giving rise to the claim. Any change in the Contract Price resulting from any such claim shall be incorporated in a Change Order.

(c) The value of any work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

1. Where the work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantity of the times involved.
2. By mutual acceptance of a lump sum.
3. By payment of Reimbursable Costs and mutually acceptable fixed amount for overhead and profit.
4. Reimbursable Costs and overhead shall be as defined in Section 1D.31 of these General Conditions, and shall apply only to costs incurred solely for the work covered by the Change Order, claim or allowance.

The amount of credit to be allowed by the Contractor to the Owner for any such change which results in a net decrease in cost, will be the amount of the actual net decrease agreed by the Owner.

The additional cost, or credit to the Owner resulting from a change in the work shall be by mutual agreement of the Owner, Contractor and the Architect. In all cases, this cost or credit shall be based on the "DPE" wages required and the "invoice price" of the materials/equipment needed.

"DPE" shall be defined to mean "direct personnel expense". Direct payroll expense includes direct salary (prevailing wage rates) plus customary fringe benefits and documented statutory costs such as workman's compensation insurance, Social Security/Medicare, and unemployment insurance (a maximum of the prevailing wage rate times 1.35.)

"Invoice price" of materials/equipment shall be defined to mean the actual cost of materials and /or equipment that is paid by the Contractor, (or subcontractor), to a material distributor, direct factory vendor, store, material provider, or equipment leasing entity. Rates for equipment that is leased and/or owned by the Contractor or subcontractor(s) shall not exceed those listed in the latest version of the "Means Building Construction Cost Data" publication.

In addition to the above, the General Contractor is allowed a fifteen percent, 15%, overhead and profit for additional work performed by the General Contractor's own forces. For additional subcontractor work, the Subcontractor is allowed a fifteen percent overhead and profit on change order work above and beyond the direct costs stated previously. To this amount, the General Contractor will be allowed a mark-up not exceeding five percent, 7.5%, on the subcontractors work. These mark-ups shall include all costs including, but not limited to: overhead, profit, bonds, insurance, etc. There will be no other costs associated with the change order.

1D.20 CHANGE OF THE CONTRACT TIME

(a) The Contract Time may only be changed by a Change Order. If the Contractor is entitled by the Contract Documents to make a claim for an extension in the Contract Time, his claim shall be in writing delivered to the Owner within 10 days of the occurrence of the event giving rise to

the claim. Any change in the Contract Time resulting from any such claim shall be incorporated in the Change Order.

(b) The Contract Time will be extended to an amount equal to time lost due to delays beyond the control of the Contractor if he makes a claim therefore as provided in Section 1D.19a.

1D.21 APPLICATION FOR PROGRESS PAYMENT

(a) At least ten days prior to submitting the first application for a progress payment, the Contractor will submit a schedule of values of the work including quantities and unit prices, aggregating the Contract Price. This schedule shall be satisfactory in form and substance to the Owner and shall subdivide the work into component parts in sufficient detail to serve as the basis for progress payments during construction. Upon approval of the schedule of values by the Owner, it shall be incorporated into the form of application of payment.

(b) At least ten (10) days before each progress payment falls due (but not more often than once a month), the Contractor will submit to the Inspector for review the Application for Payment filled out and signed by the Contractor covering the work completed as of the date of application and supported by such data as the Architect/Project Manager may reasonably require.

(c) The Contractor warrants that he and all his subcontractors have and will have good title to all materials and equipment incorporated in the Project and all material and equipment otherwise listed in an Application for Payment, free and clear of all liens, claims, security interests and encumbrances; and he will not permit any Subcontractor to, acquire any such material and equipment subject to an agreement under which an interest therein or encumbrance thereon is retained by the seller or otherwise imposed by the Contractor.

(d) The Inspector will, within ten (10) days after receipt of each application for payment, either indicate in writing his approval of payment, or return the Application to the Contractor indicating in writing his reasons for refusing to approve payment. In the latter case, the Contractor may make the necessary corrections and re-submit the application. The Department will, within ten (10) days of presentation to him of an approved Application of Payment, pay the Contractor the amount approved by the Inspector.

1D.22 APPROVAL OF PAYMENTS

(a) The Inspector's approval of any payment requested in an Application of Payment shall constitute a representation by him, based on the on-site observation of work in progress and on his review of the Application of Payment and the supporting data, that the work has progressed to the point indicated; that, to the best of his knowledge, information and belief, the quality of the work is in accordance with the Contract Documents (subject to the results of any subsequent tests called for in the Contract Documents and any qualifications stated in his approval); and that the Contractor is entitled to payment of the amount approved. However, by approving any such payment the Inspector shall not thereby be deemed to have represented that he made exhaustive or continuous on-site inspections to check the quality or the quantity of the work, or that he has made

any examination to ascertain how or for what purpose the Contractor has used monies paid or to be paid to him on account of the Contract Price.

(b) The Inspector may refuse to approve the whole or any part of any payment if, in his opinion, he is unable to make such representations. He may also refuse to approve any such payment, or, because of subsequent tests, nullify in his opinion to protect the Department from loss because:

1. The work does not comply with the requirements of the Contract Documents.
2. Claims have been filed or there is reasonable evidence indicating the probable filing thereof.
3. The Contract Price has been reduced because of modifications, or
4. The Department has been required to correct faulty or defective work or complete work in accordance with Section 1D.16.

1D.23 SUBSTANTIAL COMPLETION

Prior to final payment, the Contractor may, in writing to the Department certify that the entire project is substantially complete and request that the Department issue a certificate of Substantial Completion. With a reasonable time thereafter, the Contractor and Inspector will make an inspection of the project to determine the status of completion. If the Department does not consider the project substantially complete, the Department will execute and deliver to the Contractor a certificate of Substantial Completion with a tentative list of items to be completed or corrected before final payment will be made and the certificate shall fix the time within which such items shall be completed or corrected.

The Department shall have the right to exclude the Contractor from the project after the date of Substantial Completion, but the Department will allow the Contractor reasonable access to complete or correct items on the tentative list.

1D.24 GUARANTEES AND CORRECTION OR WORK AFTER SUBSTANTIAL COMPLETION

The Contractor warrants and guarantees that all work, materials, and equipment will be of good quality and free from faults or defects and in accordance with the Contract Documents. Upon receipt of written instructions from the Department, he will correct all faults and deficiencies in the work and remedy all variations from the Contract Documents which appear within one year after Substantial Completion and also comply with the terms of any special guarantee provided in the Contract Documents. The Department will give prompt written notice of observed defects. The warranties and guarantees provided in this Section shall be in addition to and not a limitation of any other remedies provided by the Contract Documents or by law.

If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee, the Department may have the work corrected and the Contractor and his surety shall be liable for all expenses incurred.

1D.25 FINAL PAYMENT

(a) Upon written notice from the Contractor that the project is complete, the Inspector and Engineer will make final inspection with the Contractor and will notify the Contractor in writing of any particulars in which this inspection reveals that the work does not comply with the requirements of the Contract Documents. The Contractor shall immediately make such corrections as are necessary to meet such requirement.

(b) After the Contractor has completed any such corrections to the satisfaction of the Department and delivered all maintenance and operating instructions, schedules, guarantees, bonds, certificates or inspection and other documents, all as required by the Contract Documents, he may make application for final payment following the procedure for progress payments. The final application for payment shall be accompanied by such supporting data as the Inspection may require, together with complete and legally effective releases and releases (satisfactory to the Department) of all liens arising out of the Contract Documents and the labor and services performed and the material and equipment furnished receipts and releases in full and affidavit of the Contractor that the releases and receipts include all labor, services, materials and equipment for which a lien could be filed. If any Subcontractor or supplier fails to furnish a release or receipt in full, the Contractor shall furnish a bond satisfactory to the Department to indemnify him against any liens.

(c) If, on the basis of his observation and review of the work during construction, his final inspection and review of the final application for payment, all as required by the Contract Documents, the Inspector is satisfied that the work has been completed and the Contractor has fulfilled all of his obligations under the Contract Documents, he will within ten (10) days after receipt of the final application for payment indicate in writing his approval of payment and present the application to the Department for payment. Otherwise, he will return the application to the Contractor indicating in writing his reasons for refusing to approve final payment, in which case the Contractor will make the necessary corrections and re-submit the application.

(d) The acceptance by the Contractor of the final payment made shall operate as and be released to the Owner and every agent thereof from all claims and liabilities to the Contractor for anything done or furnished for or relating to the work, or for any act or neglect of the Owner or of any persons relating to or affecting this work.

1D.26 WAIVERS OF CLAIMS AND CONTINUING OBLIGATIONS

(a) The Contractor's obligation to perform the work and complete the project in accordance with the Contract Document shall be absolute. Neither approval of any progress for the issuance of a certificate of Substantial Completion, nor any payment by the Department to the Contractor under the Contract Documents, nor any use of occupancy of the project or any part thereof by the Department, nor any act of acceptance by the Department nor any failure to do so, nor any

correction of faulty or defective work by the Department shall constitute an acceptance of work not in accordance with the Contract Documents.

(b) The making and acceptance of final payment shall constitute:

1. A waiver of all claims by the Department against the Contractor other than those arising from unsettled liens, from faulty or defective work appearing after final payment or from failure to comply with the requirements of the Contract Documents or the terms of any special guarantees specified therein, and

2. A waiver of all claims by the Contractor against the Department other than those previously made in writing and still unsettled.

1D.27 INDEMNIFICATION

The Contractor will indemnify and hold harmless the Department and the Engineer and/or Architect and all of their agents and employees from and against all claims, damages, losses and expenses (including attorney's fees) arising out of or resulting from operations under the Contract Documents by the Contractor, any Subcontractor, anyone directly or indirectly employed by the Contractor or any Subcontractor, or anyone for who's acts the Contractor or Subcontractor, may be liable, the indemnification obligations of the Contract under this Section 1D.26 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor, or any Subcontractor, under Workman's Compensation Laws, disability benefit laws, or other employee benefit laws.

1D.28 OWNER'S RIGHTS TO SUSPEND WORK

The Owner may, at any time without cause, suspend the work or any portion thereof for a period of not more than ninety (90) days by notice in writing to the Contractor which shall fix the date on which work shall be resumed. The Contractor will resume the work on the date so fixed. In general, no allowance will be made for suspended work except for possible extension of the Contract Time, if completion of the work is later carried on to successful conclusion. If the Contractor believes that the suspension of work by the Owner entitled him to increase in the Contract Price of any extension of the Contract Time directly attributable to any suspension, he may make a claim within five (5) days after receipt of a notice of suspension and any equitable adjustment will be made as provided in Sections 1D.18 and 1D.19.

1D.29 OWNER'S RIGHT TO TERMINATE

(a) If the Contractor is adjudged as bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for the Contractor or for any of his property, or if he files petition to take advantage of any debtors act, or to reorganize under the bankruptcy or similar laws, or if he refuses to supply sufficient skilled workmen or suitable materials and equipment, or if he fails to make prompt payments to Subcontractor or for labor, materials or equipment or if he disregards laws and ordinances, or if he otherwise violates any provision of the Contract Documents, then the Owner, may without prejudice to any other right or

remedy and after giving the Contractor seven (7) days written notice, terminate the services of the Contractor and take work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the project, including compensation for additional professional services, such excess shall be paid to the Contractor. If such costs exceed such unpaid balance the Contractor will pay the difference to the Owner.

(b) Where the Contractor's services have been so terminated by the Owner, said termination shall not affect any rights of the Owner against the Contractor then existent or which may thereafter accrue. Any retention or payment of monies by the Owner due the Contractor will not release the Contractor from liability.

(c) Upon seven (7) days written notice to the Contractor, the Owner may, without cause and without prejudice to any other right or remedy, elect to abandon the project and terminate the Agreement. In such case, the Contractor shall be paid for all work executed and any expense sustained plus a reasonable profit.

1D.30 CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE

If, through no act or fault of the Contractor, the work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Owner's Representative fails to act on any application for payment within thirty (30) days after it is submitted, or the Owner fails to pay the Contractor any sum approved by the Owner's Representative or awarded by arbitrators within thirty (30) days of its approval and presentation, then the Contractor may, upon seven (7) days written notice to the Owner, terminate the Agreement and recover from the Owner payment for all work executed and any expense sustained plus a reasonable profit.

1D.31 PAYMENT FOR EXTRA WORK

(a) All extra work done will be paid for in the following manner.

(b) Labor. For all labor and foreman indirect charge of the specific operations, the Contractor shall receive the State wage rates (or scale) agreed upon in writing before beginning work for each and every hour that said labor and foreman are actually engaged in such work.

The Contractor shall receive the actual cost paid to, or in behalf of, workmen by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits or other benefits, when such amounts are required by collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the work. An amount equal of 20% of the sum of the above items will also be paid the Contractor.

(c) Bond, Insurance and Tax. For property damage, liability, and workmen's compensation insurance premiums, unemployment insurance contributions and social security taxes on the force account work, the Contractor shall receive the actual cost, to which cost 6% will be added. The

Contractor shall furnish satisfactory evidence of the rate or rates paid for such bond, insurance, and tax.

(d) Materials. For materials accepted by the Engineer and used, the Contractor shall receive the actual cost of such materials delivered on the work, including transportation charges paid by him (exclusive of machinery rentals as hereinafter set forth), to which cost 15% will be added.

(e) Equipment. For any machinery or special equipment (other than small tools) including fuel and lubricants, plus transportation costs, the use of which has been authorized by the Engineer, the Contractor shall receive the rental rates agreed upon in writing before such work is begun for the actual time that such equipment is in operation on the work, to which rental sum 15% will be added.

(f) Miscellaneous. No additional allowance will be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided.

(g) Compensation. The Contractor's representative and the Engineer shall compare records daily of the cost of work done as ordered on a force account basis.

(h) Statements. No payment will be made for work performed on a force account basis until the Contractor has furnished the Engineer with duplicate itemized statements of the cost of such force account work detailed as follows:

1. Name, classification, date, daily hours, total hours, rental rate, and extension for each laborer and foreman.

2. Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.

3. Quantities of materials, prices, and extensions.

4. Transportation of materials.

5. Cost of property damage, liability and workmen's compensation insurance premiums, unemployment insurance contributions, and social security tax.

(i) Statements shall be accompanied and supported by invoices for all materials used and transportation charges. However, if materials used on the force account work are not specifically purchased for such work but are taken from the Contractor's stock, then in lieu of the invoices the Contractor shall furnish an affidavit certifying that such materials were taken from his stock, that the quantity claimed was actually used, and that the price and transportation claimed represent the actual cost to the Contractor. If unit measurement is by weight, certified weight slips will be required.

Should the Contractor refuse or fail to prosecute the work as directed or to submit his claim as required, the Engineer may withhold payment of all current estimates until the Contractor

complies with these requirements or, after giving the Contractor due notice, the Engineer may make payment for said work on the basis of a reasonable estimate for the value of work performed.

1D.32 ASSIGNMENT OF ANTITRUST CLAIMS

As consideration for the award and execution by the Owner of this Contract, the Contractor hereby grants, conveys, sells, assigns and transfers to the State of Delaware all of its right, title and interests in and to known or unknown causes of action it presently has or may now or hereafter acquire under the antitrust laws of the United States and the State of Delaware, relating to the particular goods or services purchased or acquired by the Owner pursuant to this Contract.

1D.33 MISCELLANEOUS

(a) Whenever any provision of the Contract Documents requires the giving of written notice, it shall be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, who it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to him who gives the notice.

(b) Should the Owner or the Contractor suffer injury or damage to its person or property because of any error, omission or act of the other or of any of his employees or agents or others for whose acts he is legally liable, claim shall be made in writing to the other party within a reasonable time of the first observance of such injury or damage.

(c) The Contract Documents shall be governed by all Delaware laws and all such laws shall be as binding as though quoted herein and their applicable provisions shall be fully adhered to by all parties affected thereby.

1D.34 ARCHAEOLOGICAL EVIDENCE

When in the course of construction any archaeological evidence is encountered on the surface or below the surface of the ground the Contractor shall notify the Bureau of Archives and Historic Preservation and suspend work in the immediate area for a reasonable time to permit those authorities, or persons designated by them to examine the area and insure the proper removal of the archaeological evidence for suitable preservation in the State Museum.

1D.35 SAFETY AND HEALTH REGULATIONS

All contracts shall be governed by the Department of Labor Safety and Health Regulations for Construction, provided by the Associated General Contractors of America, printed March 14, 1972.

1D.36 FOREST PROTECTION

In carrying out work within or adjacent to State, County and National Forests and/or Parks, the Contractor shall comply with all regulations of the State Fire Marshal, Conservation

Commission, State Forestry Department, or other Authority having jurisdiction, governing the protection of forests and the carrying out of work within forests, and shall observe all sanitary laws and regulations with respect to the performance of work in forest areas. He shall keep the areas in an orderly condition, dispose of refuse, and obtain permits for the construction and maintenance of all construction camps, stores, warehouses, residences, latrines, cesspools, septic tanks, and other structures in accordance with the requirements of the State Forester.

The Contractor shall take all responsible precautions to prevent and suppress forest fires and shall require his employees and subcontractors, both independently and at request of the forest or park officials, to do all reasonably within their power to prevent and suppress and to assist in preventing and suppressing forest fires and make every possible effort to notify a forest or park official at the earliest possible moment of the location and the extent of any fire seen by them.

SECTION 1E

SPECIAL CONDITIONS - PART 1

SCOPE OF WORK

1E.01 SCOPE OF WORK

Furnishing all materials, labor and supervision, and performing all operations required to complete the construction described in Section 1J, Special Provisions, as shown on the drawings or described in the specifications and as evidently necessary to complete the work.

1E.02 LOCATION AND ACCESS

The site upon which the contract work is to be performed, and its access, is set out in Section 1J, Special Provisions.

1E.03 REFERENCE POINTS

The Owner and/or Engineer will, if required, establish a base line as shown on the drawings and an adjacent bench mark. The Contractor will be responsible for the layout of the work and will protect and preserve the established reference points and will make no changes or relocations without the prior written approval of the Department. The Contractor will be responsible for replacing and accurately relocating reference points lost, destroyed, or moved.

1E.04 DATUM

The datum, from which all elevations mentioned herein or shown on the drawings, is measured from North American Vertical Datum (NAVD 88) with NAVD88 understood to mean zero depth and zero elevation. References to Mean Lower Low Water (MLLW) shown in parenthesis on the drawings are for reference purposes only.

1E.05 COOPERATION WITH PUBLIC UTILITY CORPORATIONS

It shall be the duty of the Contractor to ascertain from the utility corporations the locations of services adjacent to the work under this contract. Wherever water or gas pipes, telephone or electric cable ducts or poles are encountered, and may be interfered with in any way, the Contractor shall keep the utility company involved fully informed of same. He shall fully protect such structure and, where necessary, shall cooperate with the utility company in the removal, relocation, or replacement of same. Any damage caused by the neglect of the Contractor to first locate these structures shall be repaired by the Contractor at his expense.

1E.06 WORK IN OR OVER NAVIGABLE WATERS

All work in, on or over waters declared navigable by the Department of the Army of the United States shall conform to all applicable Federal Rules and Regulations. All such rules and

regulations are hereby made a part of the Contract. The Contractor is cautioned and charged with the responsibility of obtaining complete knowledge thereof and complying therewith. The Contractor shall also comply with the provisions of other applicable Federal, State, and local laws which pertain to work in these locations.

1E.07 USE OF EXPLOSIVE

The use of explosives will not be permitted adjacent to or on any existing structures unless authorized in writing by the Engineer. When the use of explosives is permitted, the Contractor shall use the utmost care, so as not to endanger life or property. Whenever necessary the number of charges and size of the charge shall be reduced. The Contractor's attention is directed to the necessity of safeguarding the public during dynamiting operations and a sufficient number of watchmen, flagmen signs, etc., shall be clearly marked, and shall be in care of competent watchmen at all times. Explosives shall be stored and handled in conformity with the provisions of the statutes of the State of Delaware, and local laws and ordinances.

The Contractor shall notify each public utility company, having structures in proximity to the site of the work, of his intention to use explosives and such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury. Such notice shall not relieve the Contractor of responsibility for any damage resulting from his blasting operations.

1E.08 EROSION CONTROL AND WATER POLLUTION

The Contractor shall schedule and conduct his operations to minimize erosion of soils and to prevent silting and muddying of streams, rivers, irrigation systems and impoundments (lakes, reservoirs, etc.). Construction of drainage facilities and performance of other contract work which will contribute to the control of erosion and sedimentations shall be carried out in conjunction with earthwork operations or as soon thereafter as practicable. The area of bare soil exposed at any one time by construction operations shall be kept to a minimum.

Prior to suspension of construction operations for appreciable lengths of time the Contractor shall shape the earthwork in a manner that will permit storm run-off with a minimum of erosion. Temporary erosion and sediment control measures such as berms, dikes, slope drains, or sedimentation basins deemed necessary by the Engineer shall be provided and maintained until permanent drainage facilities and erosion control measures are installed. Temporary measures will not be paid for directly, but will be considered as a subsidiary obligations of the Contractor covered under the various contract items of work.

The Contractor shall also conform to the following practices and controls:

1. When borrow material is obtained from other than commercially operated sources, erosion of the borrow site shall be so controlled during and after completion of the work that erosion will be minimized and sediment will not enter streams or other bodies of water. Waste or disposal areas and construction roads shall be located and constructed in a manner that will keep sediment from entering streams.

2. Frequent fording of live streams will not be permitted; therefore, temporary bridges or other structures shall be used wherever an appreciable number of stream crossings are necessary. Unless otherwise approved in writing, mechanized equipment shall not be operated in live streams.

3. When work areas or gravel pits are located in or adjacent to live streams, such areas shall be separated from the main stream by a dike or other barrier to keep sediment from entering a flowing stream. Care shall be taken during the construction and removal of such barriers to minimize the muddying of a stream.

4. All waterways shall be cleared as soon as practicable of falsework, piling, debris or other obstructions placed during construction operations and not a part of the finished work.

5. Water from aggregate washing or other operations containing sediment content shall not contain more sediment than that of the stream into which it discharges.

6. Pollutants such as fuels, lubricants, bitumens, raw sewage and other harmful materials shall not be discharged into or near rivers, streams, and impoundments or into natural or manmade channels leading thereto. Wash water or waste from concrete mixing operations shall not be allowed to enter live streams.

7. All applicable regulations of fish and wildlife agencies and statutes relating to the prevention and abatement of pollution shall be complied with in the performance of the contract.

8. It shall be the responsibility of the Contractor to comply with all applicable regulations of the Department of Natural Resources and Environmental Control regarding any open burning operations carried out during the conduct of this contract.

9. When it becomes necessary, the Engineer will inform the Contractor of unsatisfactory construction procedures and operations insofar as erosion control and water pollution are concerned. If the unsatisfactory construction procedures and operations are not corrected promptly, the Engineer may suspend the performance of the other construction until unsatisfactory condition has been corrected. There will not be any adjustment of contract time for suspension of other work in the event it is necessary to suspend the other work until correction of unsatisfactory control of erosion and water pollution has been accomplished.

SECTION 1F

SPECIAL CONDITIONS - PART II

MINIMUM WAGES AND EMPLOYMENT

1F.01 MINIMUM WAGES

The following minimum wages are to be paid various classes of laborers and mechanics as determined by the Department of Labor and Industrial Relations of the State of Delaware in accordance with Title 29, Section 6960, Delaware Code relating to wages. Delaware Code relating to wages further stipulates that the Contractor or his subcontractor shall pay all mechanics and laborers employed directly upon the site of the work, unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account, the full amounts accrued at time of payment, computed at wage rates not less than those stated in the advertised specifications, regardless of any contractual relationship which may be alleged to exist between the contractor or sub-contractor and such laborers and mechanics, and that the scale of wages to be paid shall be posted by the contractor in a prominent and easily accessible place at the site of work; and so much of accrued payments as may be considered necessary by the contracting officer to pay laborers and mechanics employed by the contractor or any sub-contractor on the work, the difference between the rates of wages required by the contractor to be paid laborers and mechanics on the work and rates of wages required received by such laborers and mechanics and not refunded to the contractor, subcontractor or their agents.

These rates in certain instances include a monetary equivalent for health, welfare and pension, benefits which are given employees pursuant to a bona fide enforceable, uniformly applied agreement between employers and employees. The direct payment to the employee may be reduced by such monetary equivalent. In the absence of any such agreement, the full amount indicated, less any legal deductions, shall be paid directly to the employee.

The Wage scale for this project is; Heavy Construction in New Castle, Kent and Sussex Counties:

The Scope of Work includes: Earthwork to perform levee raising and installation of new water control structures.

In addition, the following information shall be furnished weekly to the Department by the Contractor and Sub-Contractor (if any) in the form of sworn copies of payrolls.

- (a) Identification of the contract.
- (b) Payroll period covered.
- (c) For each worker listed on the payroll:

1. Name of worker

2. Job classifications or classifications at which he was employed during the payroll period.
3. Hourly rate paid for work at such classification or classifications.
4. Number of hours worked at such classification or classifications.

The Department may withhold from the contractor and sub-contractors the amount of funds necessary to pay laborers and mechanics employed on the work the minimum prevailing hourly wages.

The Delaware Code (Title 29, Chapter 69, Section 6960, Paragraph (c)) requires the Contractor to keep and maintain the sworn payroll information for a period of 2 years from the last day of the work week covered by the payroll.

If the Contractor needs further clarification pertaining to prevailing wage rates, the Department has on file two publications published by the Delaware Department of Labor, entitled “Delaware Prevailing Wage Regulations” and “Classifications of Workers Under Delaware Prevailing Wage Law.” These publications are available for review upon request. These documents and other relevant information can also be found online at:

<http://www.delawareworks.com/industrialaffairs/services/LaborLawEnforcementinfo.shtm1#pw1>

1F.02 SUNDAYS AND OFFICIAL HOLIDAYS

Except with the written permission of the Secretary, and extreme emergencies, there shall be no contract work performed on Saturdays, Sundays and the following official holidays of this Department:

- | | |
|----------------------|--------------------------------|
| New Year's Day | Veterans Day |
| M.L. King's Birthday | Return Day (Sussex Co. only) |
| Election Day | after 12:00 noon Election Year |
| Good Friday | Thanksgiving Day |
| Memorial Day | Day after Thanksgiving |
| Independence Day | Christmas Day |
| Labor Day | |

1F.03 OVERTIME WORK

(a) Overtime Notices:

If the contractor should desire to perform work at night or outside regular working hours, he shall notify the Secretary and shall allow ample time for satisfactory arrangements to be made for observation by the Inspector of the work in progress. The contractor shall adequately light the work as necessary for safety and for satisfactory performance of the work.

(b) Compensation for Overtime:

If and when the Owner orders the contractor to perform work included in the Contract outside of regular working hours for purposes not covered by the Contract, the contractor shall be

paid an extra to the contract price. The payment for such overtime ordered by the Owner shall be at the applicable rate for overtime hours, minus the applicable rate for straight time hours. The contractor shall not be entitled to extra compensation for overtime necessary to meet the construction schedule of the completion date of the Contract. Note: The provisions of this paragraph 1F.02 (b) apply only when the Contract is performed on a lump sum, unit price or maximum sum basis.

1F.04 DELAWARE STATE EMPLOYMENT AGENCY (BRANCH OFFICES)

New Castle County	Delaware State Employment Agency 3403 Lancaster Ave. Wilmington, DE 19805
Kent County	Delaware State Employment Agency Carrolls Plaza - Rt. 113 Dover, Delaware 19901
Sussex County	Delaware State Employment Agency Rt. 113 & 20 Georgetown, DE 19947

1F.05 DELAWARE LAW, SECTION 6913 OF TITLE 29 OF THE DELAWARE CODE (AS AMENDED)

"On the construction of all public works for city, county or the State, preference in employment of laborers, workmen or mechanics shall be given to bona fide legal citizens of the State, who have established such citizenship by residence of at least 90 days in the State. Each contract for the construction of public works for city, county or the State shall contain a stipulation that any person, company or corporation who violates the provisions of this section shall pay a penalty to the State Treasurer equal to the amount of compensations paid to any person, in violation of this chapter. This section shall not apply to any project or contract, any part of the cost of which shall be paid by the United States Government, if the provisions of this section are contrary to or inconsistent with any Federal statute, regulation or rule governing or applying to the Federal participation in the cost of such project."

SECTION 1G

SPECIAL CONDITIONS PART III

PERMITS, LAWS, TAXES, INSURANCE AND INDEMNIFICATION

1G.01 PERMITS

The Owner will secure the U.S. Army Corps of Engineers and State of Delaware DNREC permits. The Contractor will secure and pay for all remaining construction permits and licenses including all governmental and public utility charges and inspection fees necessary for the prosecution of the Work.

1G.02 LAWS AND REGULATIONS

The Contractor will give all notices and comply with all laws, ordinances, rules and regulations applicable to work. If the Contractor observes that the Specifications or Drawings are at variance therewith, he will give the Owner prompt written notice thereof. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Owner, he will bear all costs arising therefrom.

During the contract Work, the Contractor and each listed Subcontractor, shall implement an Employee Drug Testing Program in accordance with OMB Regulation 4104- "Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on "Large Public Works Projects". "Large Public Works" is based upon the current threshold required for bidding Public Works as set by the Purchasing and Contracting Advisory Council.

1G.03 INSURANCE AND INDEMNIFICATION

2. Insurance coverage

- 2.1 The Contractor shall carry all insurance required by law, such as Unemployment Insurance, etc. He shall carry such insurance coverage as he desires on his own property such as his field office, storage sheds or other structures erected upon the project site that belong to him and for his own use. The Subcontractors involved with this project shall carry whatever insurance protection they consider necessary to cover the loss of any of their personal property, etc.
- 2.2 Upon being awarded the contract, the Contractor shall obtain a minimum of two (2) copies of all required insurance certificates called for herein, and submit one (1) copy of each certificate, to the Owner, within 20 days of contract award.
- 2.3 Bodily Injury Liability and Property Damage Liability Insurance shall, in addition to the coverage included herein, include coverage for injury to or destruction of any property arising out of the collapse of or structural injury to any building or structure due to

demolition work and evidence of these coverages shall be filed with and approved by the Owner.

2.4 The Contractor's Property Damage Liability Insurance shall, in addition to the coverage noted herein, include coverage on all real and personal property in their care, custody and control damaged in any way by him or his Subcontractors during the entire construction period on this project.

2.5 The Contractor and his Subcontractors shall be responsible for insuring building materials (installed and stored) and their tools and equipment whenever in use on the project, against fire damage, theft, vandalism, etc.

2.6 Certificates of the insurance company or companies stating the amount and type of coverage, terms of policies, etc., shall be furnished to the Owner, within 20 days of the contract award.

2.7 The Contractor shall, at his own expense, (in addition to the above) carry the following forms of insurance:

2.7.1 Contractor's Contractual Liability Insurance

Minimum coverage to be:

Bodily Injury \$ 500,000 for each person
 \$ 1,000,000 for each occurrence
 \$ 1,000,000 aggregate

Property Damage \$ 500,000 for each occurrence
 \$ 1,000,000 aggregate

2.7.2 Contractor's Protective Liability Insurance

Minimum coverage to be:

Bodily Injury \$ 500,000 for each person
 \$ 1,000,000 for each occurrence
 \$ 1,000,000 aggregate

Property Damage \$ 500,000 for each occurrence
 \$ 500,000 aggregate

2.7.3 Automobile Liability Insurance

Minimum coverage to be:

Bodily Injury \$ 1,000,000 for each person

\$ 1,000,000 for each occurrence

Property Damage \$ 500,000 per accident

2.7.4 Prime Contractor's and Subcontractor's policies shall include contingent and contractual liability coverage in the same minimum amounts as 2.7.1 above.

2.7.5 Workman's Compensation (including Employer's Liability):

Minimum Limit on employer's liability to be as required by law.

Minimum Limit for all employees working at one site.

2.7.6 Certificates of Insurance must be filed with the Owner guaranteeing fifteen (15) days prior notice of cancellation, non-renewal, or any change in coverage and limits of liability shown as included on certificates.

2.7.7 Social Security Liability

2.7.7.1 With respect to all persons at any time employed by or on the payroll of the Contractor or performing any work for or on his behalf, or in connection with arising out of his business, the Contractor shall accept full and exclusive liability for the payment of any and all contributions or taxes or unemployment insurance, or old age retirement benefits, pensions or annuities now or hereafter imposed by the Government of the United States and the State or political subdivision thereof, whether the same be measured by wages, salaries or other remuneration paid to such persons or otherwise.

2.7.7.2 Upon request, the Contractor shall furnish Owner such information on payrolls or employment records as may be necessary to enable it to fully comply with the law imposing the aforesaid contributions or taxes.

2.7.7.3 If the Owner is required by law to and does pay any and/or all of the aforesaid contributions or taxes, the Contractor shall forthwith reimburse the Owner for the entire amount so paid by the Owner.

SECTION 1H

SPECIAL CONDITIONS - PART IV

DRAWINGS

1H.01 BIDDING DRAWINGS

Proposals shall be based upon the bidding drawings as listed in the Special Provisions Section J, and included with the specifications as issued to all bidders, which drawings may be modified by addenda issued by the Department during the bidding period, and later will, as modified by the addenda, become the contract drawings.

1H.02 CONSTRUCTION DRAWINGS

The owner will furnish to the Contractor, free from charge, five (5) sets of the drawings as issued or released for construction and for each subsequent construction revision. The Contractor shall bear the cost of reproduction of any additional copies which he may require.

1H.03 RECORD OR AS-BUILT DRAWINGS

The Contractor shall keep at the site a record set of prints on which he shall clearly and accurately record all approved changes and/or additions to the contract work made to meet field conditions. The set of drawings shall be used for this purpose only. At project completion, the Contractor shall obtain a set of sepia reproducibles, and neatly transfer to it all the recorded as-built information; and then provide two (2) prints of these sepias, along with the sepias themselves. These drawings shall be delivered to the Owner at the completion of the work, before the final payment shall be due and payable, as an accurate record of the work as actually executed.

1H.04 ADJACENT CONDITIONS

Wherever existing conditions, or construction not required as part of the work of this contract are shown on the drawings, they are so shown as a source of information to the Bidder. The Owner while believing such information to be substantially correct assumes no responsibility therefore. The Contractor shall have made himself familiar with all conditions affecting the nature and manner of performing the work and shall not be entitled to any extra compensation for any work or expense arising from or caused by his neglect to have verified all existing conditions and requirements.

1H.05 DIMENSIONS

The drawings are made to scale unless otherwise noted on drawing. All working dimensions shall be taken from the figured dimensions, or by actual measurements at the job. The Contractor shall study and compare all drawings and verify all figures before laying out or constructing the work and shall be responsible for any and all errors in his work which might have been avoided thereby. Whether or not an error is believed to exist, deviations from the drawings

and the dimensions given thereon shall be made only after all measurements of existing established conditions notwithstanding the figured dimensions on the drawings. When figured dimensions are not in agreement with the Contractor's measurements, he shall immediately notify the Owner, who shall promptly adjust the same.

1H.06 DISCREPANCIES

If the Contractor discovers any discrepancies between the physical conditions of the work and the drawings, he shall immediately notify the Owner, who shall promptly adjust the same. Any work performed after such discovery without the approval of the Owner shall be at the Contractor's risk and expense.

1H.07 SHOP DRAWINGS

(a) After checking and verifying all field measurements, the Contractor will submit to the owner for approval in accordance with the accepted schedule of shop drawings submissions, a minimum of three copies of all shop or setting drawings or schedules for approval, two will be retained by the Department and one copy will be returned. When the drawings or schedules have been corrected, if necessary, and approved, six (6) copies shall be furnished to the Owner, including, if requested, one (1) transparent reproducible copy. All shop drawings shall have been checked and approved by the Contractor before submitting to the Owner. The date shown on the shop drawings will be complete with respect to dimensions, design criteria, materials of construction and the like to enable the Owner to review the information as required.

(b) The Contractor will also submit to the Owner for approval with such promptness as to cause no delay in the work, all samples required by the Contract Documents. All samples will have been checked and approved by the Contractor, identified clearly as to material, manufacturer, any pertinent catalog numbers and the use for which intended.

(c) At the time of each submission, the Contractor will, in writing, call the Owner's attention to any deviations that the shop drawing or sample may have from the requirements of the Contract Documents. Substitution of alternate materials or equipment will be considered for approval by the Owner only in accordance with the provisions of Section 1D.09.

(d) The Owner will check and approve with reasonable promptness shop drawings and samples, but his checking and approval shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents. The Contractor will make any corrections required by the Owner and return the required number of corrected copies of shop drawings or resubmit new samples. The approval of a separate item as such will not indicate approval of the assembly in which the item functions.

(e) No work requiring a shop drawing or sample submission shall be proceeded with until the submission has been approved by the Owner.

(f) The Owner's approval of shop drawings or samples shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless the

Contractor has in writing called the Owner's attention to such deviations at the time of submission and the Owner has given written approval to the specific deviation, nor shall it relieve the Contractor from errors or omissions in the shop drawings.

1H.08 LIST OF BIDDING DRAWINGS

The drawings issued for bidding and which are a part of these specifications are listed in Section 1J, Special Provisions.

SECTION 1I

SPECIAL CONDITIONS PART V

COMPLETION DATE AND PENALTY CLAUSE

1I.01 COMPLETION DATE

All work of this contract shall be completed within the time limit set out in Section 1-J of the Special Provisions, (1J19; 1J20).

1I.02 FAILURE TO COMPLETE WORK ON TIME

Failure to Complete on Time. For each calendar day or work day that work remains uncompleted after the Contract time has expired or beyond the completion date established by the Contract, the sum specified in Subsection 1.03 will be deducted from any money due the Contractor. This sum shall not be considered and treated as a penalty but as liquidated damages due the Department by reason of inconvenience to the public, added cost of engineering and supervision, and other extra expenditures of public funds due to the Contractor's failure to complete the work on time. Any adjustment of the Contract time for completion of work granted will be considered in the assessment of liquidated damages.

The column indicated in the charts as "Calendar Day" will also be used in the assessment of liquidated damages for contracts with a predetermined completion date.

Computations for the assessment of liquidated damages shall be made in accordance with the daily computations described in the definition of working day, when the Contract is a working contract. On all other contracts each and every consecutive calendar day, including Saturdays, Sundays and holidays, shall be included in the computations for the assessment of liquidated damages.

The Contractor shall become liable for liquidated damages for delays commencing from the date on which the Contract time shall expire.

If there is a delay in the delivery of critical materials, such as steel, copper, or aluminum, due to defense needs, energy crisis, etc. a time extension shall be allowed for such delays. Each case will be independently evaluated to determine if delays were, in fact, beyond the control of the Contractor or fabricator and delayed the Project completion. Satisfactory supported time extension requests shall be made concurrently with the delay and not after the fact.

Requests for time extensions shall be subject to review by the Engineer, and the Engineer will determine the amount of time extension allowed.

There will be no acceptance of unsupported claims of delays in delivery of material as a basis for time extensions. The Contractor is presumed to have included in its Contract price, allowance for any anticipated delays in procurement of materials, which procurement is its sole

responsibility. Unless some unusual market condition such as an industry wide strike, natural disaster, or area wide storages arises after bids are taken and prevents procurement of materials within the allowable time limitations, delays in delivery of such materials do not provide sufficient reason for suspending time charges.

Permission for the Contractor or surety to continue and finish work after the Contract time and approved extensions have elapsed shall not waive the Department's rights under the Contract.

The Department may waive such portions of the liquidated damages as may accrue after the work is substantially complete and is in a condition for safe and convenient use by the traveling public.

Payment of liquidated damages will be deducted from payments otherwise due the Contractor or be made by direct payment by the Contractor in the event the total liquidated damages due exceed said deductions.

Subsection I.03 Schedule of Liquidated Damages

Schedule of Liquidated Damages

Awarded Contract Value		Daily Change	
For More Than---	To and including--	Work Day	Calendar Day
\$ 0	\$ 25,000	\$ 380.00	\$ 275.00
25,000	50,000	400.00	290.00
50,000	100,000	540.00	390.00
100,000	500,000	840.00	600.00
500,000	1,000,000	1,090.00	780.00
1,000,000	2,000,000	1,350.00	960.00
2,000,000	5,000,000	1,410.00	1,010.00
5,000,000	10,000,000	1,590.00	1,130.00
10,000,000	15,000,000	2,510.00	1,790.00
15,000,000	20,000,000	4,180.00	2,990.00
20,000,000	25,000,000	5,850.00	4,180.00
25,000,000	30,000,000	7,520.00	5,370.00
30,000,000	35,000,000	9,190.00	6,570.00
35,000,000	Over	10,870.00	7,760.00

CONTRACT NO. NAT201502/TED.HARVEY

SPECIAL PROVISIONS (SECTION 1-J)

DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

CONTRACT NO. NAT201502/TED.HARVEY

SECTION 1-J

SPECIAL PROVISIONS

1J.01 GENERAL

These special conditions shall govern over the drawings and other sections of these Specifications.

1J.02 SCOPE OF WORK

A. The Contractor shall not begin construction until authorization is received from the State.

B. The plans and specifications are intended to cover a complete project. It should be distinctly understood that failure to mention any work that would be required to complete this project shall not relieve the Contractor of his responsibility to perform such work.

C. The work to be done under this contract includes, but is not limited to furnishing all labor, materials, tools, equipment, superintendent, transportation and performing all work in strict accordance with these specifications and required drawings.

D. The work shall be accomplished under contract to and supervision of Department of Natural Resources and Environmental Control (DNREC) for the State of Delaware.

E. The Contractor shall assume all responsibility for the project and construction site until accepted by DNREC, Division of Fish & Wildlife.

F. The work under this Contract including all necessary temporary items required for good, safe and sanitary construction practices and administration of the project, is subject to the approval of the Owner or Owner's Representative.

G. The work shall be complete in all its parts and ready for use in the time specified and in strict accordance with the terms and conditions of the Contract. Any deviation shall be subject to the written approval of the Owner and Owner's Representative.

H. The Contractor shall follow the requirements of all the permits issued for the proposed construction.

1J.03 CONTRACT DOCUMENTS AND SCHEDULE OF DRAWINGS

A. The Contract Documents consist of these specifications and all subsequent addenda thereto and the Drawings as listed below.

The following list of, Inc. drawings all dated January 2016 form a part of the Contract Documents.

INDEX OF SHEETS

G-001	Title Sheet with Vicinity and Location Maps
G-002	Index of Drawings, Legend, Abbreviations and General Notes
G-101	Plan – General Arrangement and Site Access
G-102	Plan – General Arrangement and Sequence of Construction
D-101	Plan – Demolition of West and East Water Control Structures
D-102	Section – Demolition of West Water Control Structure
D-103	Section – Demolition of East Water Control Structure
C-101	Plan – Dike Repair – Sheet 1 of 7
C-102	Plan – Dike Repair – Sheet 2 of 7
C-103	Plan – Dike Repair – Sheet 3 of 7
C-104	Plan – Dike Repair – Sheet 4 of 7
C-105	Plan – Dike Repair – Sheet 5 of 7
C-106	Plan – Dike Repair – Sheet 6 of 7
C-107	Plan – Dike Repair – Sheet 7 of 7
C-108	Plan – West Water Control Structures
C-109	Plan – East Water Control Structures
C-301	Sections – Typical Dike
C-302	Dike Cross Sections Sheet 1 of 7
C-303	Dike Cross Sections Sheet 2 of 7
C-304	Dike Cross Sections Sheet 3 of 7
C-305	Dike Cross Sections Sheet 4 of 7
C-306	Dike Cross Sections Sheet 5 of 7
C-307	Dike Cross Sections Sheet 6 of 7
C-308	Dike Cross Sections Sheet 7 of 7
S-001	Structural Notes and Design Criteria
S-401	Plan – Water Control Structure Foundation
S-402	Plan - Water Control Structure Intermediate Level Framing
S-403	Plan – Water Control Structure Top Framing
S-501	Sections – Water Control Structure
S-502	Sections and Details – Sheet 1 of 2
S-503	Sections and Details – Sheet 2 of 2
S-504	48 Inch Riser Structure
S-505	Combo Gate Valve
S-506	Details – Chain Link Fence and Handrail
S-601	Pile Schedule

1J.04 PROJECT SITE

A. The project site is located within the Ted Harvey Conservation Area north of the St. Jones River, near Dover, Kent County, Delaware as indicated on the Drawings.

B. The project site will be turned over to the Contractor as is, including any and all structures and/or construction work that may be present. He shall perform all work of every description necessary to permit him to proceed with the execution of all the work called for in the Specifications and/or as shown or indicated on the Contract Drawings.

C. The Contractor shall satisfy himself as to the accuracy and completeness of these specifications regarding the nature and extent of all work described.

D. The Contractor shall exercise extreme care in his construction operations. The Contractor shall secure the approval of the DNREC for the particular method of ingress and egress, place for storage of materials and equipment, etc., prior to beginning work.

E. The existing levee elevations, alignment and water control structures shown on the Drawings were correct when surveyed. The Contractor shall satisfy himself as to all conditions at the time of bidding this project and include in his proposal any changes that would be necessary to accomplish a complete and functional project.

F. The Contractor shall make all necessary field measurements at the job site so as to complete the project as required in the specifications.

G. Should there be any discrepancies between the Drawings, Specifications and/or field conditions after bidding and prior to the beginning work, the Contractor shall bring such discrepancies to the attention of the Owner or Owner's Representative at the initiation conference.

H. The Contractor shall take all necessary precautions and measures to protect all properties from damage. He shall repair all damage caused by his operations to all public and private property including roads, walks, curbing, utilities, trees, shrubs, plantings, etc. and leave the property in good condition and/or at least equivalent to the condition found.

I. The Contractor shall, at all times, keep the work site free from accumulation of waste materials, rubbish, surplus materials, etc. and shall leave the work area completely clean.

1J.05 PRE-BID MEETING AND BID OPENING

There is no pre-bid meeting for this bid. The bid quotation reply section must be completed and returned no later than **2:00 P.M., May 11, 2016**. The bid must be returned in a sealed envelope clearly marked on the outside, **“Contract No. NAT201502/TED.HARVEY, Ted Harvey Conservation Area Enhancement Project”** to **DNREC DIVISION OF FISH & WILDLIFE** the bid opening will be held in Room B172, 89 Kings Highway, Dover, Delaware 19901.

1J.06 PRICE

Prices shall be quoted net 30 days.

1J.07 BOND REQUIREMENTS

A. Bid Bond

Each bidder shall furnish a bond to the State of Delaware, for the benefit of the Department of Natural Resources and Environmental Control, in the amount equal to 10% of the total bid. The bond shall be drawn upon an insurance or bonding company authorized to do business in the State of Delaware. If the enclosed State of Delaware bond form is not used, the substitute bond must reflect the minimum conditions specified in the standard form. A certified check made out to the Department of Natural Resources and Environmental Control in an amount equal to 10% of the total contract value may be submitted in lieu of a bid bond.

B. Performance Bond and Payment Bonds

Vendors awarded contracts are required to furnish 100% Performance Bond AND Payments Bonds to the State of Delaware for the benefit of the Department of Natural Resources with each surety in the amount of the 100% of total contract. Said bonds shall be conditioned upon the faithful performance of the contract. These guarantees shall be submitted in the form of good and sufficient bond drawn upon an insurance or bonding company authorized to do business in the State of Delaware. If the Department form is not utilized, the substituted bond form must reflect the minimum conditions specified in the form. (1C.03)

1J.08 DRAWINGS

Any required drawings shall be produced by the Contractor, following on the job measurements. All drawings must be approved by the Owner and/or Engineer before fabrication or construction begins.

1J.09 SPECIFICATIONS

The Technical specification section lists the materials to be used for this project. The list generally indicates the type and quality of the desired item. Substitutes are permitted provided the substituted item is of equal quality and will provide the same functionality and longevity as the item specified. Items with the initials OAE (OR APPROVED EQUAL) will require written approval of the Project Manager for substitution.

1J.10 REFUSE & WASTE MATERIALS

The Contractor shall at all times keep the project site clean and free from refuse and construction waste materials. It shall be the contractor's responsibility to arrange for removal of any and all waste material generated from this project. The project area shall be clean and free from construction refuse at project completion.

1J.11 BID ALTERNATIVES

Bid alternatives that provide comparable functionality, maintenance, and utility, while reducing the project cost, will be entertained as a value engineering issue following the award of the contract.

1J.12 CONTACT PERSON(S)

Jeremey Ashe
DNREC – Division of Fish & Wildlife
(302) 735-3601

1J.13 FUNDING

The Department reserves the right to award partially by BID Item or to make no award pending availability of funds.

1J.14 AWARD OF CONTRACT

A. COMPARISON OF BIDS

After the Bids have been opened and read, the bid prices will be compared and the result of such comparisons will be made available to the public. Comparisons of the Bids may be based on the Base Bid plus desired Alternates. The State shall have the right to accept Alternates in any order or combination, to be consistent with allowable moneys and to best serve the interest of the State.

1J.15 SPECIAL INSTRUCTIONS TO THE CONTRACTOR

A. As soon as possible after the Award of Contract, and before starting work, the Contractor shall meet with the State on site, to discuss all aspects of the proposed work. At this meeting the Contractor shall be prepared to review all procedures involved in carrying out the proposed work and shall deliver a planned work schedule and material delivery schedule.

B. The Contractor shall coordinate his work schedule with the State at all times. The Contractor shall not perform any work at the site without representatives of the State present unless he has previously obtained the permission from the State.

C. The Contractor shall not ingress into the existing wetlands areas except where indicated on the drawings for placement of the dredged material.

D. Existing Utilities: The Contractor shall contact Miss Utility at 1-800-257-7777 at least 72 hours prior to the onset of construction, so that existing utilities in the work area may be located and marked. If utilities are to remain in place, provide adequate means of protection during earthwork operations. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Owner or Owner's Representative immediately for directions on how to proceed. Cooperate with the Owner and utility companies in keeping

respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when permitted in writing by the Owner or Owner's representative, and then only after acceptable temporary utility services have been provided.

E. While it is believed that the soil borings accurately indicate subsurface conditions for boring locations on the date taken, the Owner and Engineer assume no responsibility for actual conditions which may be encountered in execution of Contract. Should Contractor rely, for any purpose, upon accuracy or completeness of said borings, or log thereof, he does so at his own risk.

F. Certifications, material testing, and soil testing as outlined elsewhere in these Specifications shall be performed by an independent testing firm approved by the State or State's Representative. The testing firm shall coordinate and perform all testing with the General Contractor and his suppliers. Certification and test reports shall be submitted to the Project Manager for approval. Costs associated with testing shall be borne by the General Contractor and included in the Contractor's lump sum price bid.

G. The Contractor shall be allowed to work the dredging aspect of the Contract 24 hours a day, 7 days a week. Otherwise, construction work is allowed from 7:00 am to 6:00 pm.

1J.16 SCHEDULES

The Contractor shall coordinate his work schedule with the Owner at all times. The Contractor shall not perform any work at the site without representatives of the Owner and Engineer present unless he has previously obtained the permission of both.

1J.17 TRAFFIC

Local traffic at the site must be maintained as necessary in accordance with plans which must be approved at the pre-construction meeting.

1J.18 COMPLETION DATE

Levee raising (including alternative 3 if awarded) shall be completed no later than July 1, 2017. Water control structure alternatives 1 and 2 if awarded shall be completed no later than October 1, 2017.

1J.19 GUARANTEE

The Contractor shall guarantee the work of its employees, suppliers and subcontractors for one year from time of final payment, and the Contractor shall, at his expense, remedy any defects of which the Contractor is given written notice, in a manner acceptable to the owner.

1J.20 INSPECTION

Inspection of the supplies, material and/or work will be performed by the Department and/or its authorized representative. The Department reserves the right to reject or stop any or all portions of the work which fail to meet these specifications.

1J.21 INVOICES

All billing shall be to the Department of Natural Resources and Environmental Control Division of Fish & Wildlife, 89 Kings Highway, Dover, DE 19901 and marked Contract No. NAT201502/TED.HARVEY; Attention: Jeremy Ashe.

1J.22 BASIS OF PAYMENT

Payment of this contract shall be at the accepted contractual bid price. There will be monthly progress payments allowed based on percentage complete. Request for payments must be submitted by the 25th of each month. As referenced in 29 DELC 6962 (c) (5) (a): "Retainage shall be withheld from each monthly request for payment. The amount withheld shall be ten (10) percent of each request for payment. Upon completion of ninety (90) percent of the project the retainage shall be reduced to five (5) percent. Upon completion of the final punch list and acceptance of the project the remaining retainage shall be released."

1J.23 ENGINEER AND/OR ARCHITECT

Moffatt & Nichol
2700 Lighthouse Point East, Suite 501
Baltimore, Maryland 21224

CONTRACT NO. NAT201502/TED.HARVEY

**SECTION 2
TECHNICAL SPECIFICATIONS**

SECTION 02 41 00 – DEMOLITION OF WATER CONTROL STRUCTURES

PART 1 - GENERAL

1.01 UNIT PRICES

- A. Demolition of Water Control Structures – Alternates No. 1 and No. 2
 - 1. Payment for “Demolition of Water Control Structures” shall include all site and structural demolition work required to remove the existing water control structures shown on the Contract Drawings. This shall include, but is not limited to: all required excavation, removal of existing water control structures, removal of debris, removal of fasteners, selective demolition of existing timber retaining wall, and offsite disposal of all removed elements shown in the Contract Drawings.
 - 2. Measurement: The quantity to be paid shall be the lump sum unit price quoted on the bid form for “Demolition of Water Control Structures”.
 - 3. Unit of Measure: Lump Sum (LS).

1.02 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO M 145 - Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
 - 2. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
- C. American Society of Safety Engineers (ASSE/SAFE)
 - 1. ASSE/SAFE A10.6 - Safety Requirements for Demolition Operations
- D. U.S. Army Corps of Engineers (USACE)
 - 1. USACE EM 385-1-1 - Safety and Health Requirements Manual

1.03 PROJECT DESCRIPTION

- A. Demolition/Deconstruction Plan: Prepare a Schedule and submit proposed demolition and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress. Plan shall be approved by Engineer prior to work beginning.

- B. General Requirements: Do not begin demolition or deconstruction until authorization is received from the Engineer. Remove rubbish and debris from Owner property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Engineer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.04 ITEMS TO REMAIN IN PLACE

- A. Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Owner. Repair or replace damaged items as approved by the Engineer. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work.
- B. Existing Construction Limits and Protection: Do not disturb beyond the extent indicated or necessary for installation of new construction.

1.05 SUBMITTALS

- A. General: Submit the following to the Design Engineer for approval. Note that approval of submittals by the Engineer shall not be construed as relieving the Contractor from responsibility for compliance with the Specifications nor from responsibility of errors of any sort in the submittals.
 - 1. Preconstruction Submittals
 - a. Existing Conditions
 - b. Demolition Plan
 - 2. Closeout Submittals
 - a. Receipts

1.06 QUALITY ASSURANCE

- A. Notification: Submit timely notification to the client and the Engineer in writing 10 working days prior to the commencement of work. Comply with federal, state, and local hauling and disposal regulations. Use of explosives will not be permitted.

1.07 PROTECTION

- A. Perform the removal as indicated with workmen skilled in the trades involved. Repair or replace items which are damaged by the Contractor with new undamaged items as approved by the Engineer.

1.08 EXISTING CONDITIONS

- A. Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Engineer showing the condition of facilities adjacent to areas of alteration or removal. Submit survey results.

PART 2 - PRODUCTS

2.01 FILL MATERIAL

- A. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill voids, depressions or excavations resulting from demolition or deconstruction of structures.
- B. Fill material shall conform to the definition of satisfactory soil material as defined in Specification Section 31 00 00 Earthwork. In addition, fill material shall be free from roots and other organic matter, trash, debris, frozen materials, and stones larger than 2 inches in any dimension.

PART 3 - EXECUTION

3.01 CONCURRENT EARTH-MOVING OPERATIONS

- A. Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition or deconstruction work in areas to be demolished or deconstructed until all demolition and deconstruction in the area has been completed and debris removed.

3.02 DISPOSITION OF MATERIAL

- A. Title to Materials: Except for salvaged items, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Owner property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Engineer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Engineer to begin demolition and deconstruction. The Owner will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.03 CLEANUP

- A. Remove debris and rubbish from excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.04 DISPOSAL OF REMOVED MATERIALS

- A. Regulation of Removed Materials: Dispose of debris, rubbish, scrap, and other non-salvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified. Storage of removed materials on the project site is prohibited.
- B. Burning on Owner Property: Burning of materials removed from demolished and deconstructed structures will not be permitted on Owner property.
- C. Removal from Owner Property: Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Owner property for legal disposal. Dispose of waste soil as directed.

3.05 REUSE OF SALVAGED ITEMS

- A. Salvaged materials may be reused as approved by the Engineer.

END OF SECTION

02 46 00 – STEEL H-PILES

PART 1 - GENERAL

1.01 UNIT PRICES

- A. Furnish HP12x74 Piles – Alternates No. 1 and No. 2
 - 1. Payment: Payment for “Furnish HP12x74 Piles” shall include furnishing the coated H-piles, transporting them to the project site, and storing them at the project site.
 - 2. Measurement: The quantity to be paid shall be the number of feet of each pile size indicated, as ordered by the Contractor and reviewed by the Engineer. Unless otherwise specified, order lengths shall be based on the distance from the pile cut-off elevation to the minimum tip elevation established by the Contract Drawings. If a pile has to be lengthened during driving to achieve the required bearing capacity and/or penetration, then the additional length shall be measured on a vertical linear foot basis.
 - 3. Unit of Measure: Vertical Linear Foot (VLF).
- B. Handling and Driving HP12x74 Piles – Alternates No. 1 and No. 2
 - 1. Payment: Payment for “Handling and Driving HP12x74 Piles” include handling, driving to required bearing and depth specified, cutting off excess pile top and disposing of cut-offs offsite.
 - 2. Measurement: Handling and driving HP12x74 steel piles, including indicator piles, shall be measured on a per each basis.
 - 3. Unit of Measure: Per Each (EA).
- C. Re-Strike HP12x74 Piles – Alternates No. 1 and No. 2
 - 1. Payment: Payment for “Re-Strike HP12x74 Piles” shall include moving the driving rig (as necessary), re-driving the pile, and recording the results of re-strike. No payment shall be made for re-striking piles up to one hour after initial drive or re-striking heaved piles.
 - 2. Measurement: Re-striking steel H-piles shall be measured on a per each basis.
 - 3. Unit of Measure: Per Each (EA).
- D. Field Splicing HP12x74 Piles – Alternates No. 1 and No. 2
 - 1. Payment: Payment for “Field Splicing HP12x74 Piles” shall include all materials, labor, and equipment associated with providing the pile splice detail shown in the Contract Drawings.

2. Measurement: Field Splicing HP12x74 Piles shall be measured on a per each basis.
3. Unit of Measure: Per Each (EA).

1.02 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. ASTM International (ASTM)
 1. ASTM A 572 (2015) – High-Strength Low-Alloy Columbium-Vanadium Structural Steel
 2. ASTM A 690 (2013a) – High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments
- C. American Welding Society, Inc. (AWS)
 1. AWS D1.1 - (2015) Structural Welding Code – Steel
 2. AWS D1.5 - (2010) Bridge Welding Code

1.03 SYSTEM DESCRIPTION

- A. The work covered by this Section includes the furnishing of all materials and equipment and the performing of all labor necessary to install steel H-piles as shown on the Contract Drawings and as herein specified or directed by the Engineer.

1.04 DEFINITIONS

- A. An indicator or test pile is a pile driven prior to production piles, that based upon driving resistance and load tests, is used to determine the ordering length and driving resistance of production piles.

1.05 SUBMITTALS

- A. General: Submit the following to the Design Engineer for approval. Note that approval of submittals by the Engineer shall not be construed as relieving the Contractor from responsibility for compliance with the Specifications nor from responsibility of errors of any sort in the submittals.
- B. Certifications, test procedures, and other submittals shall show the appropriate ASTM test(s) for each material.
- C. Statement of Contractor Qualifications

- D. Submit manufacturer's certified test reports, for each heat, indicating that materials have been tested and certified to meet the specified chemical, mechanical, and section properties prior to delivery at the site. Certifications shall be submitted for all materials, including but not limited to:
 - 1. Steel H-Piling (for each heat)
- E. Driving Equipment
 - 1. Pile hammer
 - a. Hammer classification (i.e. diesel, air/steam, etc.)
 - b. Hammer type (single acting, double acting, etc.)
 - c. Energy range
 - d. Weight of striking part
 - e. Total weight
 - f. Total length
 - g. Maximum stroke, if applicable.
 - 2. Driving helmets
 - 3. Capblocks
 - 4. Pile cushions
 - 5. Pile centering guide
 - 6. Leads
 - 7. Special driving shoes or points (if used)
 - 8. Vibratory hammer (if used)
 - 9. Driving template, gate, and other temporary structures for maintaining alignment and position of piling during installation
- F. Splices
 - 1. The Contractor shall submit the method of field splicing, including welding rod type, for approval by the Engineer.
 - 2. Welding procedures, qualifications, and testing shall be submitted in conformance with the requirements of Section 05 50 00, "Metal Fabrications."
- G. Qualifications
 - 1. Inspector
- H. Pile Driving Records
- I. Work Plan
 - 1. Submit work plan for steel H-pile installation, including but not limited to, proposed sequence of construction, equipment descriptions, anticipated production rates, equipment placement, template configurations, handling, cutoff and disposal plan, and other relevant installation information. Work plan shall be approved before ordering materials.

1.06 PROJECT SITE CONDITIONS

- A. Subsurface Data: Subsurface soil boring logs are included in Appendix 2 of these specifications. These data represent subsurface information at the boring locations; however, variations may exist in the subsurface between boring locations. Groundwater levels indicated on the soil boring logs were levels found at the time of exploration. The groundwater table can vary significantly depending on time of year, variation from normal precipitation, and river stage or tide level.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Materials delivered to the site shall be new and undamaged and shall be accompanied by certified test reports. The manufacturer's logo and mill identification mark shall be provided on the piling as required by the referenced specifications.
- B. H-piles shall be stacked during delivery and storage so that each pile is maintained in a straight position and is supported every 10 feet or less along its length (ends inclusive) to prevent exceeding the maximum permissible camber or sweep. Supports between multiple lifts shall be in a vertical plane. Piles shall not be stacked more than 5 feet high.
- C. Piles shall be lifted using a cradle or multiple point pick-up to ensure that the maximum permissible camber or sweep is not exceeded due to insufficient support, except that a one-point pick-up may be used for lifting piles that are not extremely long into the driving leads. Point pick-up devices for the piles shall be of the type that clamp to both pile flanges at each pick-up point. Holes may be burned in the flanges or webs of piles above the cutoff length for lifting piles into the leads. Piles shall not be dragged across the ground. The Contractor shall inspect piles for excessive camber and sweep and for damage before transporting them from the storage area to the driving area and immediately prior to placement in the driving leads. Camber, curvature in the pile in the direction normal to the pile flanges, shall be measured with the pile flange base laying on a flat surface and shall be the distance between the flange base at the mid-length of the pile and the flat surface. Sweep, curvature in the pile in the direction parallel to the pile flanges, shall be measured with the pile flange tips laying on a flat surface and shall be the distance between the flange tips at the mid-length of the pile and the flat surface. The maximum permissible camber or sweep shall be 2 inches over the length of the pile. Piles having excessive camber or sweep will be rejected. Camber and sweep for casings shall be as required for achieving the specified tolerances for piling.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel H-Piles: ASTM A 572, Grade 50 or ASTM A 690.
- B. Welding materials: AWS D1.5

2.02 STEEL COATING SYSTEM

- A. Steel H-Piles shall be coated in accordance with Section 09 97 00, "Coating of Steel Waterfront Structures."

2.03 EQUIPMENT

A. Pile Driving Hammer

1. Furnish a hammer capable of developing the indicated ultimate pile capacity considering the hammer impact velocity; ram weight; stiffness of hammer and pile cushions; cross section, length, and total weight of pile; and character of subsurface material to be encountered. Use the same type pile hammer, operating at the same rate and in the same manner, as that used for driving test piles. The striking part of the hammer shall in all cases be of sufficient and proper size to drive the pile to the required depth and/or penetration resistance and load capacity, without damage to the pile.
2. H-piles may be driven with air, steam, diesel, or hydraulic hammers.
 - a. The plant and equipment furnished for air/steam hammers shall have sufficient capacity to maintain at the hammer, under working conditions, the volume and pressure specified by the manufacturer. The plant and equipment shall be equipped with accurate pressure gauges which are easily accessible to the Engineer. The weight of the striking parts of air and steam hammers shall not be less than 1/3 the weight of helmet and pile being driven, and in no case shall the striking parts weigh less than 2750 pounds.
 - b. Open-end (single acting) diesel hammers shall be equipped with a device such as a jump stick to permit the Engineer to visually determine hammer stroke at all times during pile driving operations. Also, the Contractor shall provide the Engineer a chart from the hammer manufacturer equating stroke and blows per minute for the open-end diesel hammer being used.
 - c. Closed-end (double acting) diesel hammers shall be equipped with a bounce chamber pressure gauge, in good working order, mounted near ground level so as to be easily read by the Engineer. Also, the Contractor shall provide the Engineer a chart, calibrated to actual hammer performance within 90 days of use, equating bounce chamber pressure to either equivalent energy or stroke for the closed-end diesel hammer to be used.
 - d. The power plant for hydraulic hammers shall have sufficient capacity to maintain at the hammer, under working conditions, the volume and pressure specified by the manufacturer. The power plant and equipment shall be equipped with accurate pressure gauges which are easily accessible to the Engineer.

B. Approval of Pile Driving Equipment

1. All pile driving equipment furnished by the Contractor shall be subject to the approval of the Engineer. It is the intent of this Specification that all pile driving equipment is sized in such a way that the project piles can be driven with reasonable effort without damage.

C. Drive System Components and Accessories

1. Hammer Cushion: Impact pile driving equipment designed to be used with a hammer cushion shall be equipped with a suitable thickness or hammer cushion material to prevent damage to the hammer or pile and to insure uniform driving behavior. Hammer cushions shall be made of durable manufactured materials, provided in accordance with the hammer manufacturer's guidelines. Wood, wire rope, and asbestos hammer cushions are specifically disallowed and shall not be used. A striker plate as recommended by the hammer manufacturer shall be placed on the hammer cushion to insure uniform compression of the cushion in the presence of the Engineer after each 100 hours of pile driving. Any reduction of hammer cushion thickness exceeding 25% of the original thickness shall be replaced by the Contractor before driving is permitted to continue.
2. Helmet: Piles driven with impact hammers require an adequate helmet or drive head to distribute the hammer blow to the pile head. The helmet shall be axially aligned with the hammer and pile. The helmet shall be guided by the leads and not be free-swinging. The helmet shall fit around the pile head in such a manner as to prevent transfer of torsional forces during driving, while maintaining proper alignment of hammer and pile.
3. Leads: Piles shall be supported in line and position with leads while being driven. Pile driver leads shall be constructed in a manner that affords freedom of movement of the hammer while maintaining alignment of the hammer and the pile to insure concentric impact for each blow. Leads may be either fixed or swinging type. Swinging leads, when used, shall be fitted with a pile gate at the bottom of the leads and, in the case of batter piles, a horizontal brace may be required between the crane and the leads. The pile section being driven shall not extend above the leads. The leads shall be adequately embedded in the ground or the pile constrained in a structural frame such as a template to maintain alignment. The leads shall be of sufficient length to make the use of a follower unnecessary, and shall be so designed as to permit proper alignment of batter piles.
4. Template: Use a system of structural framing sufficiently rigid to resist lateral and driving forces and to adequately support the piling until design pile capacity and/or minimum tip elevation is achieved. Use templates or guide structures of a spacing and configuration that is appropriate for the length and batter of piling being installed. Templates and other guide structures shall not move when supporting piling. The template configuration is the responsibility of the Contractor.
5. Followers: Followers may be used for underwater pile installation.
6. Skirt: If a diesel hammer is used, it must be equipped with a skirt or sleeve to prevent fuel spray.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Inspect piles when delivered and when in the leads immediately before driving. Where cut off is below existing ground or mudline elevation, complete excavation, sheeting, dewatering, and backfilling before pile is driven to cut off elevation.
- B. Prior to driving, the pile shall be marked continuously at 1 foot intervals with paint or keel beginning at an appropriate length above water level to allow delineation of pile length during installation.
- C. The heads of all piles shall be plane and perpendicular to the longitudinal axis of the pile before the helmet is attached.

3.02 TEST PILE PROGRAM

- A. Drive indicator piles at the locations shown on the Contract Drawings.
- B. Drive H-piles to the penetration criteria established by the wave equation analysis to achieve the ultimate pile capacities shown on the Contract Drawings. See Section 02 46 80, "High-Strain Dynamic Pile Testing," for wave equation analysis requirements.
- C. Restrike the indicator piles after a minimum waiting period of seven (7) days.
- D. Monitor both initial drive and restrike using the Pile Driving Analyzer (PDA) as specified in Section 02 46 80, "High-Strain Dynamic Pile Testing."
- E. Upon completion of the indicator pile program, the Dynamic Testing Consultant will review the available data and establish a recommended pile driving criteria for installation of production piles, subject to approval by the Engineer. Pile driving criteria shall be established based on revised WEAP criteria developed considering restrike and load test data.
- F. The actual tip elevations for the indicator piles shall be used in conjunction with the estimated tip elevations and soil profiles given in the Contract Drawings to determine order lengths for the piling. After driving of the indicator piles in the respective east and west water control structure tandems is complete, the Contractor shall submit his proposed pile order lengths for that area to the Engineer for approval.

3.03 PRODUCTION PILE INSTALLATION

- A. Proposed use of a vibratory hammer to provide initial advancement of H-Piles shall only be permitted by way of written approval from the Engineer. The Engineer reserves the right to evaluate use of vibratory installation on a per case basis, and shall consider the specific subsurface condition at the respective water control structure locations. Vibratory installation shall be limited or shall

not be used where, in the opinion of the Engineer; it adversely affects driving installation or other components or areas of the work.

- B. The Contractor is responsible for providing a temporary outboard cofferdam configuration that accommodates the clear passage of all permanent steel H-Piles during driving. The Contractor is solely responsible for resolving any conflicts or obstructions resulting from the location of his embedded temporary shoring. At no additional cost to DENREC, the Contractor shall extract and replace any and all damaged piles resulting from conflicts with his temporary shoring systems.
- C. Take care to avoid damaging piles during handling, placing in the leads, and driving. Square the heads and tips of piles to the driving axis. Laterally support piles during driving, but do not unduly restrain piles from rotation in the leads. Where pile or projecting reinforcement orientation is essential, take measures to maintain the orientation during driving. Carefully support battered piles to prevent excessive bending stresses in the pile.
- D. Drive production piles in accordance with the established driving criteria. Drive piles with the same hammer, cushion, or cap block, and use the same operating conditions as the test piles. If a pile fails to reach the tip elevation or if the required driving resistance is reached before the pile tip elevation, notify the Engineer; the Engineer will determine the procedure to be followed.
- E. If upon reaching the estimated tip elevation, the pile has not attained the specified penetration resistance, the Contractor shall stop driving. After a period of at least 48 hours, the Contractor shall restrike the pile with or without performing dynamic analysis, as directed by the Engineer. If the pile has still not attained the specified bearing capacity, then the Engineer shall direct the Contractor to what corrective measures are required, such as splicing or driving additional piles.
- F. If an obstruction is encountered during driving, the Contractor shall extract the pile and then determine the depth and lateral extent of the obstruction by probing. The Engineer shall then determine whether the obstruction should be removed, the pile offset, or additional piles driven.
- G. Splicing
 1. Splicing, when anticipated, shall be done prior to the start of driving so that there is no interruption during driving operations; provide piles for their full anticipated length.
 2. Splicing of H-piles shall be a full penetration butt for the full periphery in accordance with Section 05 50 00, "Metal Fabrications" and as indicated on the Contract Drawings. Splices shall develop the full strength of the pile in compression, tension, and bending.
 3. The number of splices permitted shall be compatible with driving conditions at the site and the standard lengths of piling recommended by manufacturers.
 4. Pile lengths spliced shall be in proper alignment so that no eccentricity exists between the axes of the two spliced lengths.

- H. Jetting of piles is not permitted.
- I. Pre-drilling of piles is not permitted.
- J. Cut-offs
 1. The tops of all piles shall be cut off at the elevations specified on the Contract Drawings and on a true plane parallel with the foundation slab surface unless otherwise specified.
 2. The Contractor shall dispose of cut-offs offsite.

3.04 TOLERANCES

- A. Tolerances specified are not mutually exclusive. All piles shall be driven within all of the specified tolerances. Manipulation of driven piles is not allowed.
- B. At cut off elevation, butts shall be within 4 inches of the horizontal location shown on the Contract Drawings.
- C. Top of pile after cut-off shall be within 1/2-inch of the cut-off elevation indicated on the Contract Drawings.
- D. A maximum variation of 0.25 inch per foot of pile length from the vertical for plumb piles or 0.50 inch per foot of pile length from the required angle for batter piles is permitted.
- E. Plumb piles may be rotated from the as-planned axis. Batter piles may not be rotated from the as-planned axis.
- F. The clear distance between the heads of piles and the edges of concrete foundation mats shall be at least 4 inches. If approved in advance by the Engineer, the Contractor may provide additional concrete and reinforcement to maintain the required minimum clear distance. Redesign of concrete foundation mat or additional work required due to improper location of piles is the Contractor's responsibility.
- G. Heaved piles which have been forced up by more than 0.25-inches by any cause shall be re-driven. Inspect piles for heave after all piles within a 50-foot radius have been driven.

3.05 PILE DRIVING RECORDS

- A. The Contractor shall employ the services of a third party inspector to monitor pile installation and keep all records as required below. The Engineer may also have a representative observing pile driving operations and keeping records as noted below. All direction as required by the pile driving operation shall be the sole responsibility of the Contractor. The Engineer's representative is only an observer.
- B. The inspector shall keep a complete and accurate record of each pile driven. Indicate the pile location, deviation from indicated location, cross section shape and dimensions, original length, ground elevation, tip elevation, cut off elevation,

penetration in blows per foot for the entire length of penetration, penetration in inches per blow for the last ten blows, hammer data including rate of operation, make, and size, and all unusual pile behavior or circumstances experienced during driving such as re-driving, heaving, weaving, obstructions, jetting, predrilling, and unanticipated interruptions. Make pile driving records available to the Engineer at the site within 24 hours of completion of driving each pile. Submit complete records of installed piles to Engineer within 15 calendar days after completion of the pile driving.

- C. Notify the Engineer immediately of any unusual pile behavior or problems during driving.
- D. Provide actual tip elevations in digital format for the Pile Schedule on the As-Built Contract Drawings.

END OF SECTION

02 46 40 – STEEL SHEET PILING

PART 1 - GENERAL

1.01 UNIT PRICES

- A. Steel Sheet Piles – Alternates No. 1 and No. 2
 - 1. Payment: Payment for steel sheet piling associated with the water control structures shall be included under the unit prices bid for the following items: “Steel Superstructure”. The price shall include furnishing coated steel sheet piling, transporting them to the project site, storing them at the site, handling, driving to required tip elevation, splicing, cutting off excess pile top, disposing of cutoffs offsite, sheet pile location surveys, and all work incidental thereto.
 - 2. Measurement: Steel sheet piling is not measured.
 - 3. Unit of Measure: N/A

1.02 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A 6 – (2014) General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling
 - 2. ASTM A 325 – (2014) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - 3. ASTM A 572 – (2015) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
 - 4. ASTM A 690 – (2013a) High-Strength Low-Alloy Nickel, Copper Phosphorous Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments
- C. American Welding Society (AWS)
 - 1. AWS D1.1 – (2015) Structural Welding Code – Steel

1.03 SYSTEM DESCRIPTION

- A. The work covered by this Section includes the furnishing of all materials and equipment and the performing of all labor necessary to construct permanent hot-rolled steel sheet pile walls as shown on the Contract Drawings and as herein specified or directed by the Engineer. Work includes, but is not limited to, preparation, line clearing, templates, metal fabrications, driving, cutting splicing, inspecting, recording, and all other associated work.

1.04 SUBMITTALS

- A. General: Submit the following to the Design Engineer for approval. Note that approval of submittals by the Engineer shall not be construed as relieving the Contractor from responsibility for compliance with the Specifications nor from responsibility of errors of any sort in the submittals.
- B. Certifications, test procedures, and other submittals shall show the appropriate ASTM test(s) for each material.
- C. Submit manufacturer's certified test reports, for each heat, indicating that materials have been tested and certified to meet the specified chemical, mechanical, and section properties prior to delivery at the site. Certifications shall be submitted for all materials, including but not limited to:
 - 1. Steel sheet piling
 - 2. Structural steel plate and shapes
 - 3. Bolting materials
- D. Welding procedures, qualifications, and testing shall be submitted in conformance with the requirements of Section 05 50 00, "Metal Fabrications."
- E. Shop Drawings: Submit drawings for approval prior to start of work or ordering materials. Drawings for sheet piling shall include complete dimensions, minimum section properties, fabricated sections, and an overall layout including interface with the water control structure foundation and steel superstructure. Include details of top protection, special reinforcing tips, tip protection, lagging, splices, fabricated additions to plain piles, and corrosion protection.
- F. Work Plans
 - 1. The Contractor shall submit to the Engineer details of equipment, materials, methods, and procedures for the following items:
 - a. Sheet Pile Installation: Plan shall include methods for handling piling, driving, and cut-off methods, details and dimensions of templates and other temporary guide structures for installing the piling.
 - b. Pulling piling
 - c. Clearing obstructions
 - d. The work plans shall provide details of the method of handling piling to prevent permanent deflection, distortion, or damage to piling interlocks.
 - 2. Approval by the Engineer will not relieve the Contractor of his responsibility to perform work in accordance with the contract documents and Specifications.
- G. Driving Equipment
 - 1. Pile hammer
 - 2. Hammer classification (i.e. diesel, air/steam, vibratory, etc.)
 - 3. Hammer type (single acting, double acting, etc.)
 - 4. Energy range

5. Weight of striking part, if applicable
 6. Total weight
 7. Total length
 8. Maximum stroke, if applicable
 9. Driving helmets
 10. Capblocks
 11. Pile centering guide
- H. Pile Driving Records: Submit pile driving records in accordance with the requirements herein.
- I. As Built Drawings: Submit marked up drawings showing all deviations from planned arrangement or details that occurred during construction.

1.05 QUALITY ASSURANCE

- A. The Contractor shall be fully experienced in all aspects of steel sheet pile installation. The firm shall be thoroughly experienced in similar installations under like subsurface conditions. The Contractor shall submit a list of similar installations performed in the last five (5) years.
- B. Before beginning work, the Contractor shall submit details of the piling to be furnished, the pile driving equipment and a description of the proposed method of installation including pile splicing; all shall be subject to the approval of the Engineer.

1.06 PROJECT SITE CONDITIONS

- A. Subsurface Data: Subsurface soil boring logs are included in Appendix 2 of these specifications. These data represent subsurface information at the boring locations; however, variations may exist in the subsurface between boring locations. Groundwater levels indicated on the soil boring logs were levels found at the time of exploration. The groundwater table can vary significantly depending on time of year, variation from normal precipitation, and river stage or tide level.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Materials delivered to the site shall be new and undamaged and shall be accompanied by certified test reports. The manufacturer's logo and mill identification mark shall be provided on the sheet piling as required by the referenced specifications.
- B. Steel sheet piling shall be stored and handled in the manner recommended by the manufacturer to prevent permanent deflection, distortion, or damage to the interlocks. Support on level blocks or racks spaced not more than 10 feet apart and not more than 2 feet from the ends. Supports between multiple lifts shall be in a vertical plane. Storage of sheet piling should also facilitate required inspection activities.

- C. Protect piling to prevent damage to coatings and to prevent corrosion prior to installation.
- D. Sheet piling over 80 feet in length shall be handled using a minimum of two pickup points.

PART 2 - PRODUCTS

2.01 STEEL SHEET PILING

- A. Provide heavy gage, hot-rolled steel sheet pile conforming to ASTM A 572, Grade 50 or ASTM A 690.
- B. Cutoff and closure walls shown on the Contract Drawings is based on a PZ 22 steel sheet piling with a minimum elastic section modulus of 18.1 cubic inches per foot width.
- C. Testing of steel sheet piling shall meet the requirements of ASTM A 6.
- D. The interlocks of sheet piling shall be hot-rolled and free-sliding, provide a swing angle suitable for the intended installation, but not less than five (5) degrees.
- E. Corners may be hot-rolled shapes or fabricated from ASTM A 572, Grade 50 structural steel. Fabricated units shall be bolted using bolts, washers, and nuts conforming to ASTM A 325.
- F. Sheet piling including special fabricated sections and hot-rolled interlock shapes, shall be full-length sections of the dimensions shown on the Contract Drawings.

2.02 STEEL PLATES

- A. Structural steel plates for splices and other fabrication appurtenances shall conform to ASTM A 572, Grade 50.

2.03 BOLTS, NUTS, AND WASHERS

- A. ASTM A 325, Type 1 or 2.

2.04 STEEL COATING SYSTEM

- A. Steel H-Piles shall be coated in accordance with Section 09 97 00, "Coating of Steel Waterfront Structures."

PART 3 - EXECUTION

3.01 ORDER LENGTHS

- A. Base bids on the number, size, and length of piles from cut-off to the estimated tip elevations shown on the Contract Drawings.
- B. Submit pile type, material grade, and order lengths for review by Engineer prior to placing order.

3.02 STEEL SHEET PILING INSTALLATION

- A. For steel sheet piling not requiring a driven embedment, the elements shall be handled, placed, and connected in accordance with the requirements specified by the manufacturer and the Contract Documents. Piling shall be handled in a manner to prevent permanent deflection, distortion, or damage to the interlocks.
- B. For steel sheet piling specified to be driven in the Contract Drawings, furnish a hammer capable of providing sufficient force or energy to achieve the required pile penetration considering the cross section, length, and total weight of pile; and character of subsurface material to be encountered. Operate at the rate(s) recommended by the manufacturer throughout the entire driving period. Repair damage to piling caused by use of a pile hammer with excess delivered force or energy. In the event a diesel hammer is employed, it shall be equipped with a skirt to prevent fuel spray.
- C. Place driving helmet, or cap and cushion block combination, capable of protecting the head of the pile between top of pile and the ram to prevent impact damage to pile. The helmet or block shall uniformly transmit energy to pile with a minimum loss of energy.
- D. Prior to driving, the pile shall be marked continuously at 1 foot intervals with paint or keel beginning at an appropriate length above ground (or water) level to allow delineation of pile length during installation.
- E. Provide a template or driving frame suitable for aligning, supporting, and maintaining piling in the correct position during setting and driving. Use a system of structural framing sufficiently rigid to resist lateral and driving forces and to adequately support the piling until design tip elevation is achieved.
- F. Pile Driving: Steel sheet pile system shall be carefully and accurately located as shown on the plans. Maintain piling vertical during driving. Drive piles in such a manner as to prevent damage to the piles and to provide a continuous closure. Coordinate driving of steel sheet piling with the installation of steel H-piles as stipulated in Section 02 46 00, "Steel H-Piles". Where possible, drive pile with the ball end leading. If an open socket is leading, a bolt or similar object placed in the bottom of the interlock will minimize packing material into it and ease driving for the next sheet. Incrementally sequence driving of individual piles such that the tip of any sheet pile shall not be more than 4 feet below that of any adjacent sheet pile. When the penetration resistance exceeds five blows per inch, the tip of any pile shall not be more than 2 feet below any adjacent sheet pile.
- G. Obstructions: If obstructions restrict driving a piling to the specified elevation the obstruction shall be removed or penetrated with a chisel beam at no additional cost to DENREC. If the Contractor demonstrates that removal or penetration is impractical, the Engineer shall modify the alignment of the piling to maintain the integrity of the structure.
- H. Jetting: Jetting of piles is not permitted.

- I. Splicing
 - 1. Piles driven below the required top elevation and piles damaged by driving and cut off to permit further driving shall be extended as required to reach the top elevation by splicing when directed by the Engineer.
 - 2. If splices are required in adjoining piles the splices must be spaced at least 2 feet apart in elevation.
 - 3. Splicing of sheet piles shall be performed using a full penetration weld. Welding of splices shall conform to the requirements of AWS D1.1 and Section 05 50 00, "Metal Fabrications." Ends of piles to be spliced shall be squared before splicing to eliminate dips or camber. Splice piles with concentric alignment of the interlocks so that there are no discontinuities, dips or camber at the abutting interlocks.
 - 4. Spliced piles shall be free-sliding and able to obtain the maximum swing with contiguous piles.
 - 5. Repair coating on and around patches in accordance with Section 09 97 00, "Coating of Steel Waterfront Structures."

- J. Patching: Holes in sheet piles not embedded in concrete caps shall be made watertight by welding steel plates over the holes after the pile installation is complete. Repair coating on and around patches in accordance with Section 09 97 00, "Coating of Steel Waterfront Structures."

3.03 INSTALLATION RECORDS

- A. Maintain a pile driving record for each sheet pile.
- B. Indicate on the installation record installation dates and times, type and size of hammer, rate of operation, total driving time, dimensions of driving helmet and cap used, blows or time for vibratory hammer required per foot for the final 5 feet of penetration, final driving resistance or time for vibratory hammer in blows for final 6 inches, pile locations, tip elevations, ground elevations, cut-off elevations, and any reheading or cutting of piles.
- C. Record any unusual pile driving problems during driving. Notify the Engineer of any such occurrences.

3.04 POST SHEET PILE INSTALLATION SURVEY

- A. Within seven (7) days of the sheet pile installation, provide an independent third party surveyor to survey the horizontal and vertical position of the top of the sheet piling. The horizontal position of the pile shall be recorded in terms of station and offset relative to the appropriate centerline of construction. Upon completion of the survey, the third party surveyor shall submit a spreadsheet summarizing the as driven location of the sheet piling and any deviation from the plan position.

3.05 PILE TIP ELEVATIONS

- A. Piles shall be driven to the tip elevations indicated on the Contract Drawings.

3.06 TOLERANCES

- A. At cut off elevation, the top of sheet pile shall be within 3 inches of the location shown on the Contract Drawings.
- B. A maximum variation of 0.25 inch per foot of pile length from the vertical is allowed.
- C. The clear distance between the heads of sheet piles and the edges of concrete pile caps shall be at least 4 inches. If approved in advance by the Engineer, the Contractor may provide additional concrete and reinforcement to maintain the required minimum clear distance. Redesign of pile caps or additional work required due to improper location of piles is the Contractor's responsibility.
- D. Manipulation of sheet piles to achieve the specified tolerances is not permitted.

3.07 PILE CUT-OFFS

- A. The tops of all piles shall be cut off at the elevations specified on the Contract Drawings and on a true plane perpendicular to the axis of the pile unless otherwise specified.
- B. Pile cut-offs shall become the property of the Contractor and shall be disposed of offsite.
- C. Trim the tops of piles excessively battered during driving, when directed, at no additional cost. Use a straight edge in cutting by burning to avoid abrupt nicks. Do not use explosives for cutting.

3.08 FIELD REPAIR OF COATING DAMAGE

- A. Repair coating in accordance with Section 09 97 00, "Coating of Steel Waterfront Structures."

END OF SECTION

02 46 80 – HIGH-STRAIN DYNAMIC PILE TESTING

PART 1 - GENERAL

1.01 UNIT PRICES

- A. Dynamic Pile Test HP12x74 Piles – Alternates No. 1 and No. 2
 - 1. Payment for “Dynamic Pile Test HP12x74 Piles” shall include providing the wave equation analysis, furnishing the pile driving analyzer equipment, monitoring the driving, and preparing dynamic testing report. This work shall be performed during initial driving and shall include the cost of restriking the pile up to one (1) hour after initial drive.
 - 2. Measurement: The quantity to be paid shall be the number of high strain dynamic pile tests actually conducted.
 - 3. Unit of Measure: Per Each (EA).
- B. Dynamic Pile Test Re-Strike HP12x74 Piles – Alternates No. 1 and No. 2
 - 1. Payment for “Dynamic Pile Test Re-Strike HP12x74 Piles” shall include furnishing the pile driving analyzer equipment, monitoring the driving, and preparing dynamic testing report.
 - 2. Measurement: Restrikes for high-strain dynamic pile testing shall be measured on a per each basis for each pile tested.
 - 3. Unit of Measure: Per Each (EA).

1.02 REFERENCES

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. Unless otherwise indicated, the most recent edition of the publication, including any revisions, shall be used.
- C. American Society for Testing and Materials (ASTM)
ASTM D 4945 - (2012) High-Strain Dynamic Testing of Deep Foundations

1.03 SUBMITTALS

- A. General: Submit the following to the Design Engineer for approval. Note that approval of submittals by the Engineer shall not be construed as relieving the Contractor from responsibility for compliance with the Specifications nor from responsibility of errors of any sort in the submittals.
- B. Dynamic Testing Consultant Qualifications
- C. Wave Equation Analysis

1. Submit wave equation analysis as described in paragraph entitled "Preconstruction Wave Equation Analyses" of this Section to support selection of driving equipment.
2. Analysis shall be submitted for each type, size, and batter configuration of piles specified.
3. Submittal should summarize the required driving resistance, maximum compressive stress, and maximum tensile stress anticipated based on the analysis.
4. Submit at least two (2) weeks prior to pile installation.
5. Should the proposed driving equipment for any pile type be changed at any time during the term of the Contract the wave equation analysis shall be resubmitted for that equipment.

D. Dynamic Testing Reports

E. Refined Wave Equation Analysis

1. Following completion of the test pile program, submit refined wave equation analysis as described in this Specification.
2. Analysis shall be submitted for each type, size, and batter configuration of piles specified. Submittal shall summarize the required driving resistance, maximum compressive stress, and maximum tensile stress anticipated based on the analysis.
3. Recommended pile driving criteria.

1.04 QUALITY ASSURANCE

- A. The Contractor shall retain the services of a Dynamic Testing Consultant (DTC) with at least three (3) years experience performing PDA testing services. The DTC shall be in charge of PDA operation and of result interpretation, either on site or by remote connection (PAL-R).
- B. The Dynamic Testing Consultant shall be a third-party Professional Engineer licensed in the State of Delaware and hired by the Contractor. The qualifications of the third-party Engineer shall be submitted to the Engineer for approval.

1.05 DEFINITIONS

- A. An indicator pile is a pile driven prior to production piles that, based upon driving resistance and load tests, is used to determine the ordering length and driving resistance of production piles.
- B. Minimum Steel Yield Strength (Fy)

1.06 SUBSURFACE INFORMATION

- A. Subsurface Data: Subsurface soil boring logs are included in Appendix 2 of these specifications. These data represent subsurface information at the boring locations; however, variations may exist in the subsurface between boring locations. Groundwater levels indicated on the soil boring logs were levels found at the time of exploration. The groundwater table can vary significantly depending on time of year, variation from normal precipitation, and river stage or tide level.

1.07 EQUIPMENT AND PERSONNEL

- A. The dynamic monitoring shall be performed using a Pile Driving Analyzer Model PAK or PAL. The Dynamic Testing Consultant shall furnish all equipment necessary for the dynamic monitoring such as gages, cables, etc. The equipment shall conform to the requirements of ASTM D 4945. The approved Dynamic Testing Consultant shall operate the Pile Driving Analyzer in the field.
- B. The Contractor shall provide power capable of operating an electric drill or a DC drill to prepare the pile for transducer attachment.
- C. The Contractor shall provide a 12 to 24 volt D.C. power source (e.g. car battery) for operating the Pile Driving Analyzer.

PART 2 - EXECUTION

2.01 CONSTRUCTION ACCESS

- A. Prior to lifting the pile to be dynamically tested, the Contractor shall provide a minimum of 3 feet of clear access to 180 degree opposite faces of the pile for pile preparation. The Dynamic Testing Consultant or the Contractor's personnel shall then drill and prepare holes in the pile for attachment of sensors.
- B. The Contractor's personnel shall fasten a pair of transducers and a pair of accelerometers to the pile after the pile has been lightly seated in position for driving. Driving shall then continue using routine pile installation procedures. When the sensors approach the ground surface, water surface, or a pile template, driving shall be halted to remove the sensors from the pile to prevent damage to the sensors.

2.02 TESTING PROCEDURES

- A. Preconstruction Wave Equation Analyses
 - 1. Two (2) weeks prior to driving the piles, the Contractor shall submit the pile and complete driving equipment data form to the Engineer. The Dynamic Testing Consultant shall use the submitted information to perform wave equation analyses and shall prepare a summary report of the wave equation results. The wave equation analyses shall be used to assess the ability of the proposed driving system to install the pile to the required capacity and desired penetration depth within the allowable

driving stresses. Drivability to the estimated tip elevation indicated on the Contract Drawings shall be evaluated.

2. Wave equation analysis (GRLWEAP version 2005 or newer) shall consider at least the following:
 - a. Hammer impact velocity
 - b. Hammer energy
 - c. Hammer ram weight
 - d. Hammer ram stroke
 - e. Driving helmet and cushion
 - f. Hammer cushion or capblock
 - g. Pile size, weight and length
 - h. Character of subsurface material to be encountered
 - i. Effective pile prestress
 - j. Pile stresses during driving (compression and tension)
 - k. Pile design load
 - l. Ultimate pile capacity
 - m. Pile penetration

3. Approval of the proposed driving system by the Engineer shall be based upon the wave equation analyses indicating that the proposed driving system can develop the required ultimate pile capacity (and minimum tip elevation, when applicable), indicated on the Contract Drawings, at an acceptable driving resistance not greater than 12 blows per inch within allowable driving stress limits. The hammer shall also be sized such that the penetration per blow at the required ultimate capacity does not exceed 1/2-inches.

4. The Dynamic Testing Consultant shall recommend preliminary driving criteria based on this wave equation analysis and anticipated soil strength changes after driving, subject to further dynamic testing results. A new pile driving system, modifications to existing system, or new pile installation procedures shall be proposed by the Contractor if the pile installation stresses predicted by wave equation analysis or calculated by the Pile Driving Analyzer exceed the following maximum values:
 - a. Steel Piles
Compression Stresses: $0.9(F_y)$
Tension Stresses: $0.9(F_y)$

B. Indicator Pile Program

1. Indicator piles shall be driven to the required ultimate capacity based upon the preliminary driving resistance indicated by wave equation results. Adjustments to the preliminary driving criteria may be made by the Engineer based upon the dynamic testing results of both initial driving and restrrike tests.
2. All indicator piles shall be redriven with dynamic testing after a minimum waiting period of seven (7) days. The restrrike shall be performed with a warmed up hammer and shall consist of striking the piles for 20 blows or until the pile penetrates an additional three inches, whichever occurs first.

In the event the pile movement is less than 1/2-inch during the restrrike, the restrrike may be terminated after 10 blows.

3. A new pile driving system, modifications to existing system, or new pile installation procedures shall be proposed by the Contractor if the pile installation stresses calculated by the Pile Driving Analyzer exceed the maximum values discussed above.

C. Production Pile Testing

1. Dynamic pile testing (PDA and CAPWAP) shall be performed on approximately 2% of the piles during restrrike over the duration of the production pile installation.
2. The Engineer may request additional piles to be dynamically tested if the hammer and/or driving system is replaced or modified, the pile type or installation procedures are modified, the pile capacity requirements are changed, unusual blow counts or penetrations are observed, or if any piling behavior differs from normal installation.

2.03 DYNAMIC TESTING REPORTS

A. Test Pile Program

1. The Dynamic Testing Consultant shall prepare a written report of the test pile program in accordance with ASTM D 4945. This report shall include a discussion of the pile capacity results obtained from the dynamic testing and comparison with static testing results, if performed. The report shall also discuss hammer and driving system performance, driving stress levels, and pile integrity.
2. The Dynamic Testing Consultant shall perform rigorous laboratory wave analysis of the measured data using the Case Pile Wave Analysis Program (CAPWAP) on data obtained from the end of initial driving and the beginning of restrrike of all the test piles. The Engineer may request additional analyses at selected pile penetration depths to investigate potential alternate bearing layers.
3. The Dynamic Testing Consultant shall perform a refined wave equation analysis or analyses based upon the variations in the subsurface conditions and/or drive system performance observed in the indicator pile program results.

B. Production Piles

1. Within one (1) day of production pile testing, the Dynamic Testing Consultant shall prepare a hand written daily field report summarizing the dynamic testing results. As a minimum, the daily reports shall included the calculated driving stresses, transferred energy, and estimated pile capacity at the time of testing. Variations from previous dynamic pile tests shall also be noted.
2. CAPWAP analyses shall be performed on all of the production piles dynamically tested.

3. Not more than ten (10) working days following testing, the Dynamic Testing Consultant shall prepare a written report in accordance with ASTM D 4945 summarizing the dynamic testing results.

2.04 PRODUCTION PILE DRIVING

- A. Upon completion of the test pile program the Dynamic Testing Consultant will review the available data and establish a recommended pile driving criteria for installation of production piles. Pile driving criteria shall be established based on revised WEAP criteria developed after considering restrike and load test data.

END OF SECTION

02 54 00 – CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 UNIT PRICES

- A. Chain Link Fence – Alternates No. 1 and No. 2
 - 1. Payment for “Chain Link Fence,” shall include supply and placement of posts, base plate connections, fabric, and fittings to the satisfaction of the Engineer.
 - 2. Measurement: Chain Link Fence shall be measured on a per linear foot basis. This quantity shall be the total length in linear feet of fence.
 - 3. Unit of Measure: Linear Foot (LF)
- B. Chain Link Personnel Gate – Alternates No. 1 and No. 2
 - 1. Payment for “Chain Link Personnel Gate” shall include supply and placement of posts, base plate connections, fabric, and fittings to the satisfaction of the Engineer.
 - 2. Measurement: The quantity to be paid shall be the number of chain link personnel gates to be erected.
 - 3. Unit of Measure: Per Each (EA).

1.02 SUMMARY

- A. The work covered by this Section shall include the furnishing of all material and equipment and the performing of all labor to install the security fence and gates as shown on the Contract Drawings and as herein specified or directed by the Engineer.
- B. This work shall include but is not limited to: Installation of 8’ Chain-Link Security Fence and Gates.

1.03 REFERENCES

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. Unless otherwise indicated, the most recent edition of the publication, including any revisions, shall be used.
- C. American Association of State Highway and Transportation Officials
 - 1. AASHTO M181 - (2010) Chain-Link Fence

- D. American Society for Testing and Materials (ASTM)
1. ASTM A 47 – (2009) Ferritic Malleable Iron Castings
 2. ASTM A 53 – (2007) Pipe, steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 3. ASTM A 121 – (2007) Metallic-Coated Carbon Steel Barbed Wire
 4. ASTM A 123 – (2009) Zinc (Hot-Dip Galvanized Coatings on Iron and Steel Products
 5. ASTM A 153/A 153M – (2009) Zinc Coated Steel Chain-Link Fence Fabric
 6. ASTM A 307 - (2010) Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 7. ASTM A 392 - (2011) Zinc-Coated Steel Chain-Link Fence Fabric
 8. ASTM A 641 - (2009a) Zinc-Coated (Galvanized) Carbon Steel Wire
 9. ASTM A 780/A 780M (2009) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

1.04 SUBMITTALS

- A. General: Submit the following to the Design Engineer for approval. Note that approval of submittals by the Engineer shall not be construed as relieving the Contractor from responsibility for compliance with the Specifications nor from responsibility of errors of any sort in the submittals.
- B. Fencing Materials
1. Manufacturer's certification(s).
 2. Drawings showing plan layout, grid, spacing of components, accessories, fittings, and anchorages.
- C. Certifications shall show the appropriate AASHTO/ASTM test(s) for each material and a statement that the material meets the Specification requirement.

PART 2 - PRODUCTS

2.01 FENCING MATERIALS

- A. Post Frames
1. Post frames shall be cylindrical, no circumferential welds, galvanized steel pipe conforming to ASTM A 53.

2. Galvanize material per ASTM A 123, (1.8 ounces per square foot)
 3. Posts shall be sized as follows:
 - a. Terminal, corner and pull posts - 2.875 inch OD (5.79 lb/ft)
 - b. Line posts - 2.375 inch OD (3.65 lb/ft)
- B. Fabric
1. Fabric shall be 2 inch mesh woven from number 9 gauge wire conforming to AASHTO M181.
 2. The ends of the fabric shall have a knuckle selvage at the bottom and a barbed selvage at the top.
 3. Galvanize material per ASTM A 392, Class 2, galvanized coating after weaving (2 ounces per square foot).
- C. Tension Wire
1. The wire shall be number 7 gauge coil spring steel.
 2. Galvanize material per ASTM A 641, Class 3 coating (0.9 ounces per square foot).
- D. Hog Rings
1. Hog rings shall be number 12 gauge steel wire.
 2. Galvanize material per ASTM A 641, Class 3 (0.9 ounces per square foot).
- E. Wire Fabric Ties
1. Ties shall be number 9 gauge steel wire.
 2. Galvanize material per ASTM A 641, Class B3 (0.8 ounces per square foot.)
- F. Flat Band Fabric Ties
1. Ties shall be ½ inch by 0.06 inch steel.
 2. Galvanize material per ASTM A 153, Class B3 (1.3 ounces per square foot).
- G. Stretcher Bars
1. Stretcher bars shall be 3/16 inch by ¾-inch high carbon steel.
 2. Galvanize material per ASTM A 153, Class B1 (2 ounces per square foot).

- H. Truss and Brace Rods
 - 1. Truss and Brace rods shall be 3/8 inch steel.
 - 2. Galvanize material per ASTM A 153, Class B1 (2 ounces per square foot).
- I. Turnbuckles
 - 1. Turnbuckles shall be wrought iron per ASTM A 47 drop forged steel.
 - 2. Galvanize material per ASTM A 153, Class A (2 ounces per square foot).
- J. Stretcher Bands
 - 1. Stretcher bands shall be 1/8 inch by 1 inch ASTM A 123, Class A steel with beveled edges.
 - 2. Galvanize material per ASTM A 153, Class B1 (2 ounces per square foot).
- K. Nuts and Bolts
 - 1. Nuts and bolts shall be ASTM A 307 steel.
 - 2. Galvanize material per ASTM A 153, Class C (1.25 ounces per square foot).
- L. Sleeves
 - 1. Sleeves shall be 1.695-inch I.D. by 0.078-inch wall, drawn tube, 6 inches long. Sleeve shall be self-centering type per ASTM A 53.
 - 2. Galvanize material per ASTM A 153, Class B2 (1.8 ounces per square foot).
- M. Top Rails and Brace Rails
 - 1. Rails shall be 1 ¼-inch ASTM A 53, American Standard Schedule 40 pipe.
 - 2. Galvanize material per ASTM A 153, Class B1 (1.8 ounces per square foot).
- N. Rail, Brace Ends, and Post Caps
 - 1. Rail, brace ends, and posts caps shall be permanent mold casting, sand casting, galvanized malleable iron per ASTM A 47.
 - 2. Galvanize material per ASTM A 153, Class A (2 ounces per square foot).

- O. Rail, Brace Ends, and Post Caps
 - 1. Post tops shall be permanent mold, sand mold, die castings, malleable iron per ASTM A 47.
 - 2. Galvanize material per ASTM A 153, Class A (2 ounces per square foot).
- P. Repair of Zinc-Coated Surfaces: Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A 780 or by the application of stick or thick paste material specifically designed for repair of galvanizing, as approved by the Engineer. Clean areas to be repaired and remove the slag from the welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread the molten material uniformly over surfaces to be coated and wipe the excess material off.

2.02 CONCRETE

- A. All concrete for footings and ground anchors shall be in accordance with Section 800 of the DelDOT Standard Specifications.

PART 3 - PRODUCTS

3.01 CHAIN LINK FENCE INSTALLATION

- A. Install new fence posts. All posts shall be installed and connected to the steel superstructures as shown on the Contract Drawings. Each post shall be placed erected plumb and the posts shall line up horizontally as shown on the plans.
- B. A brace rail shall be installed between each terminal post and each adjacent line post along with a truss rod and turn buckle attachment.
- C. Tension wire shall be provided along the top and bottom of the fence.
- D. Attach new chain link fence fabric in place by securing one end to an end post corner, pull or gate post and applying sufficient tension to remove all slack before making other attachments.
 - 1. Secure fabric to end, corner pull and gate post including vertical gate frame members using stretcher bars attached to posts with tension bands at a maximum spacing of 14 inches.
 - 2. Secure fabric to all line posts and horizontal gate frame members with a double wrap and triple twist of tie wire at maximum spacing of 14 inches.
 - 3. Secure fabric to tension wires with hog rings at a maximum spacing of 2 feet.
- E. The chain link fence shall be erected at the locations shown on the Contract Drawings and approved by the Engineer to the elevations and locations shown on the drawings. The fence shall be true to line, taut and shall comply with the

best practice for chain link fence construction. The bottom of the fabric shall be placed a normal distance of 1 inch above the channel cap.

END OF SECTION

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 UNIT PRICES

- A. Cast-In-Place (CIP) Concrete Pile Caps – Alternates No. 1 and No. 2
 - 1. Payment: Payment for “CIP Concrete Pile Caps” associated with the water control structures shall include all of the material, labor, and equipment associated with providing, placing, consolidating, curing, and protecting the cast-in-place concrete, as well as all required reinforcing steel, joint detailing, laboratory testing, and field testing as specified herein.
 - 2. Measurement: The quantity to be paid shall be the Cubic Yard unit price quoted on the bid form for “CIP Concrete Pile Caps”.
 - 3. Unit of Measure: Cubic Yard (CY).

1.02 REFERENCES

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. Unless otherwise indicated the most recent edition of the publication, including any revisions, shall be used.
- C. Except as modified or otherwise required herein, the Delaware Department of Transportation (DelDOT) “Standard Specifications for Road and Bridge Construction,” August 2001, with all latest addenda are to be used for this Section.
- D. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO M182 - (2012) Burlap Cloth Made from Jute or Kenaf and Cotton Mats
 - 2. AASHTO M194 - (2013) Chemical Admixtures for Concrete
 - 3. AASHTO T259 - (2012) Resistance of Concrete to Chloride Ion Penetration
- E. American Concrete Institute (ACI)
 - 1. ACI 117 - (2010) Tolerances for Concrete Construction and Materials
 - 2. ACI 211.1 - (2009) Selecting Proportions for Normal, Heavyweight, and Mass Concrete
 - 3. ACI 301 - (2010) Specifications for Structural Concrete for Buildings

4. ACI 302.1R - (2004) Guide for Concrete Floor and Slab Construction
 5. ACI 304R - (2009) Measuring, Mixing, Transporting, and Placing Concrete
 6. ACI 304.2R - (2008) Placing Concrete by Pumping Methods
 7. ACI 305R - (2010) Hot Weather Concreting
 8. ACI 306.1 - (2002) Cold Weather Concreting
 9. ACI 308 - (2011) Curing Concrete
 10. ACI 318 - (2011) Building Code Requirements for Structural Concrete
 11. ACI SP-66 - (2004) Detailing Manual
- F. American Society for Testing and Materials (ASTM)
1. ASTM A 184 - (2011) Welded Deformed Steel Bar Mats for Concrete Reinforcement
 2. ASTM A 615 - (2015) Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 3. ASTM A 706 - (2014) Deformed and Plain Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
 4. ASTM A 1064 - (2015) Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 5. ASTM C 31 - (2012) Making and Curing Concrete Test Specimens in the Field
 6. ASTM C 33 - (2013) Concrete Aggregates
 7. ASTM C 39 - (2014) Compressive Strength of Cylindrical Concrete Specimens
 8. ASTM C 78 - (2015) Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
 9. ASTM C 88 - (2013) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
 10. ASTM C 94 - (2015) Ready-Mixed Concrete
 11. ASTM C 143 - (2012) Slump of Hydraulic-Cement Concrete
 12. ASTM C 150 - (2015) Portland Cement
 13. ASTM C 171 - (2007) Sheet Materials for Curing Concrete

14. ASTM C 172 - (2014) Sampling Freshly Mixed Concrete
15. ASTM C 227 - (2010) Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
16. ASTM C 231 - (2010) Air Content of Freshly Mixed Concrete by the Pressure Method
17. ASTM C 260 - (2010a) Air-Entraining Admixtures for Concrete
18. ASTM C 309 - (2011) Liquid Membrane-Forming Compounds for Curing Concrete
19. ASTM C 494 - (2013) Chemical Admixtures for Concrete
20. ASTM C 595 - (2015) Blended Hydraulic Cements
21. ASTM C 666 - (2015) Resistance of Concrete to Rapid Freezing and Thawing
22. ASTM C 881 - (2014) Epoxy-Resin-Base Bonding Systems for Concrete
23. ASTM C 920 - (2014) Elastomeric Joint Sealants
24. ASTM C 989 - (2014) Slag Cement for Use in Concrete and Mortars
25. ASTM C 1077 - (2015) Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
26. ASTM C 1107 – (2014) Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)
27. ASTM C 1218 - (2008) Water-Soluble Chloride in Mortar and Concrete
28. ASTM D 1751 - (2013)e1 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
29. ASTM D 1752 - (2013) Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
30. ASTM D 6690 - (2012) Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
31. ASTM G 61 - (2009) Conducting Cyclic Potentiodynamic Polarization Measurements for Localized Corrosion Susceptibility of Iron-, Nickel-, or Cobalt-Based Alloys

- 32. ASTM G 109 - (2013) Determining Effects of Chemical Admixtures on Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments
- G. American Welding Society (AWS)
 - 1. AWS D1.4 - (2011) Structural Welding Code – Reinforcing Steel
- H. Concrete Reinforcing Steel Institute (CRSI)
 - 1. CRSI MSP-1 - Manual of Standard Practice
- I. Department of Commerce (DOC)
 - 1. DOC PS 1 - Voluntary Product Standard – Construction and Industrial Plywood
- J. British Standards Institution (BS)
 - 1. BS 8443 - (2005) Specification for Establishing the Suitability of Special Purpose Concrete Admixtures
- K. Federal Highway Administration (FHWA)
 - 1. FHWA/RD-83/012 - Time-to-Corrosion of Reinforcing Steel in Concretes, Vol. 5: Calcium Nitrite Admixture or Epoxy-Coated Reinforcing Bars as Corrosion Protection Systems

1.03 PROJECT DESCRIPTION

- A. Reinforced cast-in-place concrete shall be used to construct the lower pile-supported foundation slab for the water control structures at the locations shown in the Contract Drawings.

1.04 DEFINITIONS

- A. “Cementitious material” as used herein shall include all Portland cement, pozzolan, fly ash, silica fume, and ground iron blast-furnace slag.
- B. “Exposed to public view” means situated so that it can be seen from eye level from a public location after completion of the project. A public location is accessible to persons not responsible for maintenance of the project.
- C. “Mass Concrete” is a concrete element with a minimum dimension greater than 3

1.05 SUBMITTALS

- A. General: Submit the following to the Design Engineer for approval. Note that approval of submittals by the Engineer shall not be construed as relieving the Contractor from responsibility for compliance with the Specifications nor from responsibility of errors of any sort in the submittals.

- B. Certifications, test reports and other submittals shall show the appropriate ASTM or AWWA standard(s) for each material.
- C. Submit the following shop drawings for approval:
1. Reinforcing drawings, prior to fabrication, showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes, and spacing.
 2. Form drawings showing details of formwork, joints supports, studding and shoring, and sequence of form and shoring removal.
 3. Lift drawings showing all dimensions, pour locations and designations, location of horizontal and vertical construction joints, concrete volumes, and locations of embedded items.
- D. Work Plans
1. The Contractor shall submit to the Engineer details of the equipment, materials, methods and procedures for the following items:
 - a. Concrete Pumping (if used)
 - b. Cold Weather Concreting (if used)
 - c. Hot Weather Concreting (if used)
 - d. Concrete Finishing
 - e. Concrete Curing
 - f. Equipment for tremie placement
 2. Approval by the Engineer will not relieve the Contractor of his responsibility to perform work in accordance with these Specifications.
- E. Concrete Mix Design
1. Sixty (60) days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Certify, using an independent commercial testing laboratory, that proportioning of mix is in accordance with ACI 211.1 for the specified strength and is based on data, which has been determined by laboratory testing during the last six (6) months.
 2. Submit a complete list of materials including type, brand, source and amount of cement, fly ash, silica fume, ground slag, and admixtures, and applicable reference Specifications.
 3. All materials used in the trial mix design shall be identical to those used in production and the trial batch shall include all stipulated admixtures. In case the source, brand or characteristic properties of the ingredients are varied during the term of the Contract, submit revised mix design and all related submittals.

4. Submit independent laboratory test reports on laboratory letterhead in-lieu of manufacturer's certificates for all mix ingredients demonstrating conformance of the ingredient with all cited standards and these specifications. Mix water is excepted from this provision unless otherwise stipulated by the Engineer.
 5. For all aggregate sources, submit ASTM C 227 test results dated within the last 6 months. Aggregates shall show expansions less than 0.10% at six months when tested in accordance with ASTM C 227 using cement with alkali content above 0.8% (expressed as sodium oxide). Aggregates demonstrating expansions in excess of this limit shall not be accepted.
 6. Submitted admixture data shall include full catalog information and manufacturer's certificates stating that each admixture is compatible with all other materials in the mix design.
 7. Each mix design shall be submitted under separate cover and submittal number, and shall clearly indicate all portions of the construction where the mix is proposed for use.
 8. Submit manufacturer's catalog data and mixing instructions for all admixtures.
 9. Submit calcium nitrate retention test results which validate proposed dosing with the trial batch strength test results for each mix design for which the admixture is stipulated.
- F. Submit manufacturer's data, test reports, certifications, and installation instructions for all materials, including but not limited to:
1. Concrete repair materials
 2. Curing Compounds
 3. Epoxy Bonding Compound
 4. Epoxy Coating Materials
 5. Joint Backing Rod
 6. Joint Filler
 7. Joint Sealer
 8. Form materials and location of use
 9. Form accessories
 10. Form release agents
 11. Mechanical bar splicers/inserts
 12. Mechanical terminators
 13. Mill test reports for reinforcing (tests on each heat, showing chemical and physical analysis)
 14. Nonshrink Grout
 15. Cement
 16. Aggregates
 17. Chemical Admixtures
 18. Slag
 19. Fly Ash

20. Silica Fume

G. Batch Tickets: Submit a delivery ticket from the concrete supplier with each batch delivered to the site setting forth the following information:

1. Name of supplier
2. Name of batching plant and location
3. Serial number of ticket
4. Date
5. Truck number and batch number
6. Specific job designation
7. Volume of concrete (cubic yards)
8. Specific class of concrete
9. Time loaded and amount of water added
10. Type and brand of cement
11. Weight of cement
12. Maximum size of aggregates
13. Weights of coarse and fine aggregates, respectively
14. Type and amount of admixtures
15. Mix design designation

H. Concrete Test Reports

1. Air content
2. Compressive strength tests
3. Corrosion Inhibitor Content Test (when used)
4. Slump
5. Temperature

I. Finish Samples

J. Qualifications

1. Calcium Nitrite Testing Laboratory
2. Concrete Field Technician
3. Independent Concrete Testing Laboratory

1.06 QUALITY ASSURANCE

A. Concrete admixtures shall be manufactured by a firm with a minimum of five (5) year's experience in the production of similar admixtures. Responsible contact person for the firm shall have a minimum of five year's experience in the production of similar admixtures.

B. Formwork and falsework design calculations and associated shop drawings shall be prepared and sealed by a Professional Engineer registered in the State of Delaware.

C. Welding Procedures and Qualifications

1. Welders and procedures shall be qualified in accordance with Section 05 50 00 "Metal Fabrications".

D. Independent Concrete Testing Laboratory

1. Contractor shall furnish and pay for an independent testing laboratory to conduct the concrete laboratory testing for trial batching and field quality control described herein.
2. Independent Testing laboratory shall meet the requirements of ASTM C 1077. The testing laboratory shall be accepted by the Engineer before performing any work.
3. Laboratory's representative performing field quality control testing and preparing test samples shall, as a minimum, possess current certification as an ACI Concrete Field Technician – Grade I.

1.07 MODIFICATION OF REFERENCES

- A. Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean Engineer.

1.08 DELIVERY, HANDLING, AND STORAGE

- A. Do not deliver concrete until forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. ACI 301 for job site storage of materials. Protect materials from contaminants such as grease, oil, and dirt. Ensure materials are clearly identified.

1.09 EQUIPMENT

- A. Conveying equipment shall have a capacity of at least 75 cubic yards per hour. Concrete shall be conveyed from mixer to point of placement as rapidly as practicable and within the time interval specified by methods that will prevent segregation or loss of ingredients. Any concrete transferred from one conveying device to another shall be passed through a hopper that is conical in shape and shall not be dropped vertically more than 5 feet, except where suitable equipment is provided to prevent segregation and where specifically authorized.
- B. Buckets: The interior hopper slope shall be not less than 58 degrees from the horizontal; the minimum dimension of the clear gate opening shall be at least five times the nominal maximum-size aggregate; and the area of the gate opening shall be not less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide

means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

- C. Trucks: Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94. Nonagitating equipment shall not be used for transporting concrete.
- D. Chutes: When concrete can be placed directly from a truck mixer or agitator, the chutes attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Engineer. Separate chutes and other similar equipment will not be permitted for conveying concrete.
- E. Concrete Pumps: Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least three times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped, but not less than 4 inches. Aluminum pipe shall not be used. The nominal maximum-size coarse aggregate shall not be reduced to accommodate the pumps. The distance to be pumped shall not exceed limits recommended by the pump manufacturer. The concrete shall be supplied to the concrete pump continuously. When pumping is completed, concrete remaining the pipeline shall be ejected without contamination of concrete in place. After each operation, equipment shall be thoroughly cleaned, and flushing water shall be wasted outside of the forms. Clean-up of wasted concrete is the Contractor's responsibility.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

- A. All materials shall conform to Section 800 of the DeIDOT "Standard Specifications for Road and Bridge Construction," except as modified herein. Materials and requirements shown below apply to all concrete used in the project.
- B. All Cement: ASTM C 595, Type IS(MS) blended cement except as modified herein:
 - 1. The blended cement shall consist of a mixture of ASTM C 150 Type II cement and ground iron blast-furnace slag. Type I, Type III, and Type V cements shall not be accepted.
 - 2. Ground Iron Blast-Furnace Slag: ASTM C 989, Grade 120. Testing shall be performed no more than six months prior to submittal date.
 - 3. The ground iron blast-furnace slag shall comprise 25% by weight of total cementitious material.
 - 4. For exposed concrete, use one manufacturer for each type of cement and ground slag.

5. The tricalcium aluminate content of the blended cement shall be less than 8% by weight.
- C. For mass concrete and steam cured precast items; the following shall be met in addition to the requirements above:
1. The maximum percent of sulfur reported as sulfate (SO₃) in the blended cement shall be less than 3.0%.
 2. The alkali content of the blended cement shall be less than 0.7%
 3. The molar ratio of sulfate to tricalcium aluminate in the blended cement shall be less than 0.3.
- D. Aggregates
1. Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.
 2. Coarse aggregate shall conform to ASTM C 33, Class 5S, size as specified herein.
 3. Aggregates shall not contain any substance that may be deleteriously reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of the concrete.
 4. Aggregate, when subjected to five cycles of the soundness test in accordance with ASTM C 88, shall not have a loss greater than 10% when sodium sulfate is used.
 5. Aggregates shall show expansions less than 0.10% at six months when tested in accordance with ASTM C 227 using cement with alkali content above 0.8% (expressed as sodium oxide). Aggregates showing expansion greater than 0.10% shall not be accepted. Where aggregates are deemed to possess properties or constituents that are known to have specific unfavorable effects in concrete, these aggregates shall not be accepted.
 6. Furnish aggregates for exposed concrete surfaces from one source.
- E. Admixtures
1. Calcium chloride or any other admixtures containing chloride salts shall not be used.
 2. Six month and one year compressive and flexural strength tests are not required for admixtures.
 3. Accelerating: ASTM C 494, Type C.
 4. Air Entraining: ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

5. Anti-washout admixture shall be Master Builders "Rheomac UW450", Sika Corporation "Sikament 100SC", or Fox Industries "Segnot", or other approved equal in compliance with Army Corps of Engineers Standard CDR-C61. Anti-washout admixture shall be included in all concrete deposited underwater (tremie). Admixture shall be applied in strict accordance with the manufacture's written instructions. Submit CDR-C61 certification laboratory results on laboratory letterhead as follows:
 - a. Initial Compliance results shall meet or exceed the performance limits in Table 1 for control mixes that are similarly proportioned to all mixes subject to washout as identified in this specification. Submit the control mix design(s) with the Initial Compliance results. Include in this documentation all deviation of the setting time for dosed mixtures from the set time for the control mix(es).
 - b. Limited Retesting to confirm current compliance of the admixture is required if Initial Compliance test results are outdated by more than 2 years.
 - c. Uniformity and Equivalence Testing shall be established by both oven drying and specific gravity among concrete lots of 10,000 cubic yards.
 - d. Anti-washout admixtures that have met or exceeded BS 8443:2005 standards for similar mix designs shall be considered to have met the requirements of CDR-C61. Submit BS 8443 mixtures and results for approval.

6. Corrosion Inhibiting:
 - a. Test results which meet or exceed the Physical Requirements (Table 1) of ASTM C 494 for any Type of admixture. Water content (water reduction) may not be applicable.
 - b. Criteria to meet from Table 1 include:
 - 1) Time of setting: between 3½ hours earlier to 3½ hours later than control
 - 2) Compressive strength: minimum 90% of the control at any time period
 - 3) Flexural strength: minimum 90% of the control at any time period
 - 4) Length change, shrinkage: maximum 135% of the control
 - 5) Relative durability factor: minimum 80
 - c. Testing conforming to FHWA/RD-83/012. After one year of testing the corrosion current measured in microamps for the corrosion inhibitor-protected specimen must be approximately 10% of the control when a minimum of five and maximum of ten pounds of chloride ion is admixed into the concrete.
 - d. Test results of ASTM G 109. Run the test for three complete cycles after the control specimens have failed according to Section 8 Period of Testing. The average corrosion current of the corrosion inhibitor-protected specimens must be less than two microamps.
 - e. Test results of ASTM G 61. The test medium shall be modified to contain a calcium hydroxide solution with a pH similar to concrete

of 12.5, and sodium chloride content equivalent to approximately 0.5 molar solution. Protection potentials (E_p) must be more positive than -280 mV versus SCE.

- f. Test results conforming to ASTM G 109 modified with a 1 inch of concrete cover over the reinforcement and a maximum water-to-cement ratio of 0.40. After five years of testing, the corrosion inhibitor-protected test specimens must have a corrosion current in microamps of less than 105 of the control.
 - g. Corrosion inhibiting admixture shall contain a minimum of 30% calcium nitrite by mass.
 - h. Concentration of corrosion inhibitor shall not be less than 5.1 pounds per cubic yard in the hardened concrete.
7. High Range Water Reducing (Superplasticizer): ASTM C 494, Type F or G. The admixture shall contain no chlorides, amines, sugar, urea, foaming agents, or air entraining agents and shall meet the requirements of AASHTO M194, with the following exceptions:
- a. The water content shall be a maximum of 85% of that of the control, and the durability factor shall be a minimum of 90 when tested in accordance with ASTM C 666, Procedure B. Air entrained concrete containing the admixture shall have no more than 1½ % weight loss after 300 freeze-thaw cycles.
 - b. Chloride permeability within a depth of ½ inch to 1 inch shall be a maximum of 226 ppm after 200 days ponding when tested in accordance with AASHTO T259.
 - c. The admixture shall be added at the job site in liquid form as recommended by the manufacturer.
8. Retarding: ASTM C 494, Type D
9. Water Reducing: ASTM C 494, Type A.
- F. Water shall conform to Section 803 of the DelDOT Standard Specifications for Road and Bridge Construction.

2.02 REINFORCING STEEL

- A. Reinforcing steel for the cast-in-place concrete foundation slab shall be deformed billet-steel and shall conform to ASTM A 615, Grade 60.
- B. Spirals shall conform to ASTM A 1064
- C. All reinforcing steel to be welded shall conform to ASTM A 706.

2.03 DOWELS

- A. Reinforcing steel for the H-Pile head anchorage shall be headed reinforcement meeting ACI 318-14 anchorage requirements, and conforming to ASTM A 706.

2.04 FABRICATED BAR MATS

- A. Fabricated bar mats shall conform to ASTM A 184.

2.05 ACCESSORIES

- A. Accessories shall conform to the ACI Detailing Manual SP-66.
- B. Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.06 SUPPORTS

- A. Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks.
- B. Precast concrete blocks shall not be less than 3 inches square when supporting reinforcement on the ground. Precast concrete blocks shall have compressive strength equal to that of the surrounding concrete.
- C. When concrete formed surfaces will be exposed to the weather or where surfaces are to be painted, steel supports within 1 inch of the concrete surface shall be galvanized, plastic protected, or stainless steel.
- D. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface.
- E. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.
- F. Provide commercially available reinforcing cage centralizers for composite steel H-piles.

2.07 CONCRETE MIX

- A. Concrete mixes shall be proportioned in accordance with ACI 211.1 except as modified herein.
- B. The water soluble chloride ion concentrations in hardened concrete between 28 and 42 days shall not exceed 0.15 when tested in accordance with ASTM C 1218.
- C. The properties of the concrete for each portion of the structure(s) shall be as indicated on the Contract Drawings and specified in the following table:

PROPERTY	³ Pile-Supported Concrete Cap & Waterside Structures
28-Day Compressive Strength, ASTM C 39 (psi)	¹ 5,000

PROPERTY	³ Pile-Supported Concrete Cap & Waterside Structures
28-Day Flexural Strength, ASTM C 78 (psi)	--
Coarse Aggregate Size No. ASTM C 33	57 or 67
Water-Cement Ratio (by weight)	0.40
Design Slump (inch)	² 4
Air Entrainment, % (ASTM C 231)	5±1.5
Calcium Nitrite Corrosion Inhibitor	YES
⁴ Water Reducing Admixture Required	YES
⁵ Anti-Washout Admixture	YES

- ¹ Required Average Strength of Mix Design: The selected mixture shall produce an average compressive strength exceeding the specified strength by the amount indicated on ACI 301. When a concrete production facility has a record of at least 15 consecutive tests, the standard deviation shall be calculated and the required average compressive strength shall be determined in accordance with ACI 301. When a concrete production facility does not have a suitable record of tests to establish a standard deviation, the required average strength shall be as follows: For f'c between 3,000 and 5,000 psi, required compressive strength (f'cr) shall be 1,200 psi plus f'c; for f'c over 5,000 and under 10,000 psi, required compressive strength (f'cr) shall be 1,400 psi plus f'c.
- ² When superplasticizers are used, final slump may be increased to 8 inches. Design slump shall be 2 to 4 inches before the superplasticizer is added.
- ³ Pile-Supported Concrete Cap & Waterside Structures shall include any cast-in-place concrete associated with the water control structures.
- ⁴ If required, mix shall contain a water reducing admixture conforming to ASTM C 494, Type A. Should the Contractor wish to modify other mix properties in addition to water reduction, ASTM C 494 - Type D, E, F, or G admixtures may be used in addition to or in lieu of Type A.
- ⁵ Only for concrete deposited underwater (tremie)

2.08 NONSHRINK GROUT

- A. Grout shall be a premixed, packaged, non-ferrous aggregate, nonshrink grout conforming to the requirements ASTM C 1107.

2.09 EPOXY BONDING COMPOUND

- A. Epoxy bonding compounds shall conform to ASTM C 881.
- B. Provide Type I for bonding hardened concrete to hardened concrete; Type II for bonding freshly mixed concrete to hardened concrete; and Type III as a binder in epoxy mortar or concrete, or for use in bonding skid-resistant materials to hardened concrete. Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces. Provide Class A if placement temperature is below 40 degrees F; Class B if placement temperature is between 40 and 60 degrees F; or Class C if placement temperature is above 60 degrees F.

2.10 MATERIALS FOR CURING CONCRETE

- A. Surfaces exposed to public view:
 - 1. Burlap: AASHTO M182, Class 1, 2, or 3.
 - 2. Impervious Sheeting: ASTM C 171, except that polyethylene sheeting shall not be used.
- B. Other Surfaces: Membrane forming curing compounds shall conform to ASTM C 309, Type 1-D or 2.

2.11 JOINT FILLERS AND SEALANTS

- A. Expansion/Contraction/Isolation Joint Filler: ASTM D 1751 or ASTM D 1752, 1/2 inch thick, unless otherwise indicated.
- B. Joint Sealants
 - 1. Horizontal Surfaces (3% maximum slope): ASTM D 6690 or ASTM C 920, Type M, Class 25, Use T.
 - 2. Vertical Surfaces (greater than 3% slope): ASTM C 920, Type M, Class 25, Use T.

2.12 FORM MATERIALS

- A. Forms
 - 1. Forms for surfaces exposed to view shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels.
 - 2. Forms for unexposed surfaces shall be wood, steel or other approved concrete form material.
 - 3. Retain-in-place or stay-in-place metal forms are not permitted.
- B. Form Ties
 - 1. Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal.
 - 2. Solid backing shall be provided for each tie.
 - 3. Except where removable tie rods are used, ties shall not leave holes in the concrete surfaces less than 1/4-inch or more than 1 inch deep and not more than 1 inch in diameter.

4. Removable tie rods shall not be more than 1½-inches in diameter.
- C. Form Releasing Agents
1. Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces.
 2. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water.

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION CONFERENCE

- A. A pre-construction conference shall be held two weeks prior to commencement of operations to manufacture and install the specified product in order to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include formwork, concrete and admixture handling, placing, finishing, curing concrete, storing, and transporting products.
- B. A manufacturer's representative for the concrete admixture(s) shall be present for the pre-construction conference. The Engineer may waive requirement for manufacturer's representative if the Contractor provides sufficient evidence that producer and finisher have adequate experience with admixtures required,

3.02 PLACEMENT OF FORMS

- A. Formwork shall conform to Section 602.08 of the DeIDOT Standard Specifications for Road and Bridge Construction with the following additions:
1. Forms shall conform to the shape, lines, grades and dimensions of the concrete as called for on the Contract Drawings. They shall be mortar tight, and sufficiently rigid to maintain the desired position and shape during and after placing concrete. Surfaces of metal forms shall be free from irregularities, dents, and sags. Lumber used in forms for exposed surfaces shall be evenly matched and free from loose knots and other imperfections that would produce defects on the finished concrete surfaces. Used lumber may be used if it conforms to the above.
 2. Forms shall be capable of producing a surface that meets the requirements of the type of finish specified herein.
 3. All formwork shall be provided with adequate cleanout openings to permit inspection and easy cleaning after reinforcing steel has been placed. Where possible, these openings shall be on the side of the unexposed surfaces.
 4. Form ties shall be of a type that will conform to the reinforcing steel clearance requirements given in the Contract Drawings. Form ties that

are to be completely withdrawn shall be coated with a nonstaining bond breaker. Wire ties shall not be permitted.

5. Forms shall not be reused if there is any evidence of surface wear and tear or defects, which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse.
6. Except as otherwise shown, external corners that will be exposed shall be chamfered by moldings placed in the forms.
7. During periods of high tide, portions of the formwork may be immersed in water.

3.03 PREPARATION

- A. When bonding lifts or pours, apply a thin coat of compound to dry, clean surfaces. Scrub compound into the surface with a stiff-bristle brush. Place concrete while compound is stringy. Do not permit compound to harden prior to concrete placement. Follow manufacturer's instructions regarding safety and health precautions when working with epoxy resins.
- B. The inside of the forms shall be coated with non-staining mineral oil or other approved material. Where oil is used, it shall be applied before the reinforcing steel is placed. All excess oil or other approved material shall be removed before placing concrete.
- C. Before depositing concrete, all debris, ice and water shall be removed from the spaces to be occupied by the concrete. Any flow or water into such spaces shall be diverted through proper side drains to a sump, or be removed by other approved methods, which will avoid washing the freshly placed concrete.
- D. Before placing any concrete, the Contractor shall ascertain that all the work under the other Sections of the Contract which pass through the concrete, such as fittings, pipes, sleeves, anchors, frames, bolts, plates, expansion joint angles, inserts, conduits and any other items normally required but not shown, have been set in place. Plumb anchor bolts, check location, and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.04 JOINTS

- A. Construction Joints: Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.
- B. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
- C. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat

grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

1. Radius: 1/4-inch.
 2. Sawn Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- D. Expansion/Isolation Joints: Provide joint at edges of slabs on grade abutting vertical surfaces, and as indicated. Make joints 1/2-inch wide unless indicated otherwise. Fill expansion joints not exposed to weather with preformed joint filler material. Completely fill joints exposed to weather with joint filler material and joint sealant. Do not extend reinforcement or other embedded metal items bonded to the concrete through any expansion joint unless an expansion sleeve is used.

3.05 BATCHING, MEASURING, MIXING AND TRANSPORTING CONCRETE

- A. Batching, measuring, mixing, and transporting concrete shall conform to ASTM C 94, ACI 301, ACI 302.1R, and ACI 304R, except as modified herein.
- B. Batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances: 1% for cement and water, 2% for aggregate, and 3% for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.
- C. Measuring: Make measurements at intervals as specified in Paragraph 3.17.
- D. Mixing: Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 85 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. When additional water is added, additional 30 revolutions of the mixer at mixing speed is required. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.
- E. Transporting: Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete that has segregated in transporting, and dispose of as directed by the Engineer.

3.06 PLACING REINFORCING STEEL

- A. All reinforcing steel shall be placed accurately in the positions shown on the Contract Drawings or as directed by the Engineer. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits, or other embedded items, the resulting arrangement of the bars, including additional bars required to meet structural requirements, shall be approved by the Engineer before concrete is placed. Cutting and bending shall be in accordance with ACI 318.
- B. All reinforcing steel shall be secured in place true to the lines and grades indicated by the use of metal or concrete supports, spacers, ties and centralizers as approved by the Engineer. Supports shall be of sufficient strength to maintain the reinforcing steel in place throughout the concreting operation. Supports shall be used in such a manner that they will not be exposed on the face of nor in any way discolor or be noticeable in the surface of the finished concrete.
- C. Substitution of different size bars will be permitted only when approved by the Engineer. No additional compensation will be allowed for substituting larger size bars in lieu of the bars indicated on the Contract Drawings.
- D. Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated.
 - 1. All lap splices be Class 'B' tension lap splices in accordance with ACI 318. Lapped bars shall not be spaced farther apart than one-fifth the required lap length or 6 inches, whichever is less. Lap splices shall not be used for bars larger than No. 11.
 - 2. Welded butt splices shall be full penetration butt welds in accordance with AWS D1.4. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars in a straight line.
 - 3. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the splicing device.
 - 4. Butt splices shall develop 125% of the specified minimum yield strength, in compression and tension, of the spliced bars or the smaller bar in transition splices.
- E. All main reinforcing steel shall have the following minimum cover except as noted otherwise on the Contract Drawings:
 - 1. Concrete cast against and permanently exposed to earth.....3”
 - 2. Concrete exposed to water or earth:
 - a. Bottom of beams or slabs.....3”
 - b. Top of beams or slabs.....2”

c. Sides of beams or slabs.....2”

3. The above dimensions shall be measured from the face of the reinforcing steel to the face of the forms.

F. All reinforcing steel shall be secured in place true to the lines and grades indicated by the use of metal or concrete supports, spacers, ties, and centralizers as approved by the Engineer. Supports shall be of sufficient strength to maintain the reinforcing steel in place throughout the concreting operation. Supports shall be used in such a manner that they will not be exposed on the face of nor in any way discolor or be noticeable in the surface of the finished concrete. Metal accessories for exposed concrete surfaces shall be galvanized.

G. All reinforcing steel shall be fully placed, secured and approved by the Engineer before any concrete is placed.

3.07 PLACING DOWELS

A. Dowels shall be installed in slabs on grade at locations indicated on the Contract Drawings and at right angles to the joint being doweled.

B. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement.

C. Dowels shall be rigidly supported during concrete placement.

3.08 PLACING CONCRETE

A. When all the other provisions of this Section have been met and the Contractor is ready to place concrete, the Engineer shall be notified. No concrete shall be deposited before the Inspector has inspected and approved the reinforcing steel and other work in place and given permission in writing on a prepared form to proceed. Do not place concrete when weather conditions prevent proper placement and consolidation in uncovered areas during periods of precipitation or in standing water.

B. The concrete shall be conveyed from the mixer and placed in the following manner so that there shall be no separation of the various ingredients. Concrete discharging from the mixer shall not be chuted directly into the hopper, bucket or concrete cart. The concrete shall be discharged down a chute into a baffled downpipe, dropping vertically the minimum distance necessary to fill the hopper, bucket, or concrete cart. Concrete being chuted into a form shall discharge into a baffled downpipe and then drop vertically the minimum clear distance necessary to avoid clogging the downpipe. Concrete discharging from a conveyor belt or side opening hopper or bucket shall drop vertically through a baffled downpipe or a vertical hopper or bucket opening. Chuting of concrete for distances greater than 20-feet will not be allowed.

C. Concrete shall be deposited as nearly as possible in its final position to avoid segregation due to rehandling or flowing. Concrete shall be placed in the form by dumping against the face of concrete already in place and not by dumping away

from concrete already in place. Concrete placed in forms deeper than 3-feet shall be dumped into a hopper feeding into a vertical drop chute and then falling free only the minimum clear distance necessary to avoid stopping the downpipe. The Contractor shall submit to the Engineer any method of placing and conveying concrete that deviates in any manner from the preceding specification for approval before any such methods are used to place concrete on the job.

- D. At the discretion of the Engineer, the provisions specified above for conveying and placing concrete may be modified to suit conditions encountered in the field.
- E. All concrete (other than tremie concrete) shall be placed with the aid of approved mechanical vibrating equipment. Vibration, unless otherwise approved, shall be transmitted directly through the concrete and in no case through the forms, or through the reinforcing. The duration of vibration at any location shall be the minimum required to produce thorough compaction. Vibration shall be supplemented by forking or spading by hand adjacent to the forms on exposed faces, or as required. Furnish a spare vibrator on the job site whenever concrete is placed.
- F. Tremie Placement
 - 1. Tremie concrete placement will not be permitted when, in the opinion of the Engineer, weather conditions prevent proper placement. Concrete shall be deposited in the tremie hopper and in so depositing there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Sufficient placing capacity shall be provided so that concrete placement can be kept plastic and free of horizontal cold joints while concrete is being placed.
 - 2. Tremie concrete shall be deposited by a tremie or by a valved tremie. The methods and equipment used shall be subject to approval. Concrete buckets will not be permitted for placement of tremie concrete, although they may be used to transport concrete to the tremie hoppers. The tremie shall be watertight and sufficiently large to permit a free flow of concrete, but it shall not be less than 8 inches in diameter. A funnel-shaped hopper of at least 2 cubic yards in volume shall be required at the top of the tremie. Neither the tremie pipe nor the hopper shall be constructed of aluminum. Hoisting equipment for raising and lowering the tremie pipe as the concrete is placed and tools for connecting the tremie pipe sections shall be continuously available and on hand. In lieu of use of a tremie, concrete may be placed using a positive displacement pump and pump line provided the entire operation is approved in writing after a demonstration of its use.
 - 3. Tremie pipe sections shall be suitably secured together and a gasket used at each joint to prevent leakage. A retrievable traveling plug (go-devil) or a dry pipe with a plate and gasket wired to the bottom to prevent contact of the concrete and the slurry in the tremie shall be required to start each placement. The tremie assembly shall be lowered to rest within 6 inches of the bottom of the excavated casing prior to beginning

placement. During placement of the concrete, any unnecessary movement of the pipe shall be avoided. The bottom of the tremie pipe shall remain submerged in fresh concrete at all times. Batches of concrete shall be supplied to the tremie pipe at a uniform rate for a continuous flow. The tremie pipe shall be lifted during placement at a rate that will maintain the bottom of the pipe embedded in fresh concrete. It may be necessary to reduce the amount of embedment as the differential head decreases between the concrete in the tremie pipe and the concrete in the casing. The repeated raising and lowering of the tremie pipe in the fresh concrete to facilitate placement shall be minimized. Placement shall proceed without interruption until the concrete has been brought to the required height. The Contractor shall continuously measure and record the flow during placement with the use of a sounding line. The tremie shall not be moved horizontally during a placing operation except that as the required is reached. Special care shall be taken to ensure that the bottom of the tremie pipe is not lifted out of the fresh concrete. If this occurs, the Contractor shall remove the tremie pipe, insert a dry pipe with a temporary bottom plug, and restart the placement. Also, as soon as practical, the Contractor shall drill a NX-size core boring through concrete input to a depth of at least 10 feet below the depth where the bottom of the tremie pipe was lifted out of the fresh concrete. Unacceptable zones of concrete such as honeycombed, segregated, or uncemented zones found within the core boring shall immediately be repaired or removed and replaced by an appropriate means. All cost incurred because of this failure, including the initial core boring and as many additional core borings as may be required to delineate the limits of the unacceptable concrete and the repair of the pile shall be borne by the Contractor.

4. Required height of tremie concrete. Concrete that is free of laitance, scum, or other contaminants shall be placed at the top of the formwork or casing. All scum, laitance, and contaminated concrete shall be removed from the top of the concrete as the placement is nearing completion and shall be disposed of properly. The top surface shall be finished to grade by screeding.

3.09 REMOVAL OF FORMS

- A. Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement.
- B. Supporting forms and shores shall not be removed from beams, floors and wall until the structural units are strong enough to carry their own weight and any other construction or natural loads. Supporting forms or shores shall not be removed before the concrete strength has reached 70% of the 28-day design strength, as determined by field-cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured

specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

- C. The Engineer may order the forms to remain in place for a longer period than that considered to be sufficient in the judgment of the Contractor. However, should the Engineer acquiesce in the removal of forms by the Contractor, the Engineer assumes no responsibility and the Contractor is in no manner relieved of his responsibility of such removal. All formwork shall be removed before completion of this Contract.

3.10 FINISHING

- A. The Contractor shall notify the Engineer upon removal of forms. The Engineer shall inspect newly stripped surfaces, any portion of which, in the judgment of the Engineer, is damaged beyond repair shall be removed and recast at no additional cost to DENREC. Those surfaces to be repaired shall be repaired in a manner approved by the Engineer.

- B. Horizontal Surfaces

1. Finish types shall be as defined in ACI 301.
2. Slabs on grade, including concrete slope protection: Scream the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by belting. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but gritty nonslip surface is obtained. Drag a strip of clean, wet burlap from 3 to 10 feet wide and 2 feet longer than the pavement width across the slab. Produce a fine, granular, sandy textured surface without disfiguring marks. Round edges and joints with an edger having a radius of 1/8-inch.
3. Surfaces exposed to public view shall receive a troweled finish.
4. Surfaces not exposed to public view shall receive a float finish.
5. Surfaces receiving subsequent bonded overlays or lifts shall be given a raked scratch surface.

- C. Vertical Surfaces

1. Finish types shall be as defined in ACI 301.
2. Surfaces exposed to public view shall receive a grout cleaned finish.

3. Surfaces not exposed to public view shall receive a smooth-form finish. Surfaces shall be produced in forms that impart a texture to the concrete. All faces shall have a true well defined surface. Fill all air pockets and tie holes over 1/4-inch in diameter with nonshrink grout. All form offsets or fins over 1/8-inch shall be ground smooth.
4. Utility structures not exposed to public view shall receive a rough-form finish.

3.11 CURING AND PROTECTION

- A. Concrete curing shall be in accordance with ACI 301 and ACI 308 unless otherwise specified.
- B. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer-hardener or epoxy coating.
- C. Membrane Curing Compound: Do not use membrane curing compounds on surfaces exposed to public view, corrosion inhibitor treated concrete, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded.
- D. High air content and low water-to-cementitious ratio used in corrosion inhibitor concrete will result in less bleed water than in normal concrete. To reduce plastic or drying shrinkage cracks, comply with ACI 302.1R, ACI 308, and ACI 305R.
 1. Use moist curing for corrosion inhibitor treated concrete. When weather conditions are dry and windy, continue fogging above surface of concrete after the finishing operation until prewetted burlap can be placed over the flatwork surface. Use prewetted burlap to cover all flatwork and keep wet for a minimum of seven days or until the time necessary to attain 85% of the specified compressive strength, as recommended by ACI 308 Section 3.1.3.
- E. Moist Curing: Remove water without erosion or damage to the structure.
 1. Ponding or Immersion: Continually immerse the concrete throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete. For temperatures between 40 and 50 degrees F, increase the curing period by 50%.

2. Fog Spraying or Sprinkling: Apply water uniformly and continuously throughout the curing period. For temperatures between 40 and 50 degrees F, increase the curing period by 50%.
 3. Pervious Sheeting: Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6 inches over adjacent sheeting. Sheeting shall be at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete or over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.
 4. Protection of Treated Surfaces: Prohibit pedestrian and vehicular traffic and other sources of abrasion at least 72 hours
- F. Curing Periods: ACI 301 except 10 days for retaining walls or slabs on grade. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval by the Engineer.

3.12 TOLERANCES

- A. Comply with tolerances of ACI 117.
- B. Tolerances for slabs on grade shall be as modified herein:
 1. Elevation: 1/4-inch.
 2. Thickness: Plus 3/8-inch, minus 1/4-inch.
 3. Surface: Gap below 10-foot long, unlevelled straightedge not to exceed 1/4-inch.
 4. Joint Spacing: 3-inches.
 5. Contraction Joint Depth: Plus 1/4-inch, no minus

3.13 PUMPING CONCRETE

- A. Pumping of concrete shall conform to the requirements of ACI 304R and ACI 304.2R.
- B. Pumping shall not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment shall not exceed 2 inches. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy. Rapid changes in pipe sizes shall be avoided. Maximum size of coarse aggregate shall be limited to 33% of the diameter of the pipe. Maximum size of well rounded aggregate shall be limited to 40% of the pipe diameter. Samples for testing shall be taken at both the point of delivery to the pump and at the discharge end.

3.14 COLD WEATHER CONCRETING

- A. Cold weather concreting shall conform to the requirements of ACI 306.1
- B. Adequate protection of concrete against damage by frost during the making and early curing period is absolutely essential whenever the atmospheric temperature is below 40 degrees F or whenever the temperature may fall below 40 degrees F within 24 hours after placement.
- C. The Contractor shall provide and have on the job ready to install, adequate facilities for enclosing the freshly placed concrete and heating the enclosure for the period November 1 to April 1.
- D. The mixing water and aggregates shall be heated by steam coils or other devices so that the concrete during mixing is kept above a minimum temperature of 65 degrees F.
- E. Concrete when placed in the forms shall have a minimum temperature of 55 degrees F. Freshly laid concrete and the surrounding atmosphere shall be maintained at a temperature of 50 degrees F or greater for a period of 48 hours after placement.
- F. A permanent temperature record shall be kept for the days on which protection is required as specified in Paragraph B above, showing the date, hour, outside temperature and temperature within the enclosure to show the most favorable or unfavorable conditions to which the concrete is subjected. The Contractor shall furnish maximum and minimum thermometers or recording thermometers for this purpose. A copy of the temperature record shall be sent to the Engineer at the close of each day's work.
- G. Tarpaulins supported on sawhorses or other framework shall follow closely the placing of the concrete so that only a few feet of the finished work is exposed to the outside atmosphere at any one time. Tarpaulins shall be arranged so that heated air can circulate freely in the space between the tarpaulin and the freshly placed concrete.
- H. Within the enclosure, means for artificial heating shall be provided as well as maintain the temperatures specified continuously and with a reasonable degree of uniformity in all parts of the enclosure.
 - 1. The Contractor shall provide adequate fire protection accessible at all times where heating is in progress and shall maintain watchmen or other attendants to keep the heating units in continuous operation. All heating appliances shall be vented.
 - 2. Heating appliances shall not be placed in a manner as to endanger formwork or centering or expose any area of concrete to drying out or other injury due to excessive temperatures.
- I. The use of salts, chemicals or other foreign material in the mix to lower the freezing point of the concrete is prohibited.

3.15 HOT WEATHER CONCRETING

- A. Hot weather concreting shall conform to the requirements of ACI 305R.
- B. Concrete shall be protected during placement, finishing and curing in hot weather to minimize the formation of plastic shrinkage cracks.
- C. Concrete, when placed in the forms, shall have a maximum temperature of 90 degrees F. Mixing water shall be chilled as required to maintain the temperature of the concrete below this unit.
- D. Forms shall be wetted prior to placement of concrete. Fog spraying may be used to cool the air, cool the forms and reinforcing steel ahead of placement and to lessen the amount of evaporation from the concrete surface before and after finishing.

3.16 DEPOSITING CONCRETE UNDER WATER

- A. Methods and equipment used shall prevent the washing of the cement from the mixture, minimize the formation of laitance, prevent the flow of water through the concrete before it has hardened, and minimize disturbance to the preciously placed concrete. Do not deposit concrete in running water or in water temperatures below 35 degrees F. Deposit fresh concrete so concrete enters the mass of the previously placed concrete from within, displacing water with a minimum disturbance to the surface of the concrete. Place concrete without interruption until the top of the fresh concrete is at the required height.
- B. A tremie shall consist of a watertight tube having a diameter of not less than 10 inches with a hopper at the top. When a batch is dumped into the hopper, the flow of the concrete shall be induced by slightly raising the discharge end, always keeping the discharge end in the deposited concrete.
- C. Concrete pump discharge tubes and tremie tubes used to deposit concrete under water shall be equipped with a device that will prevent water from entering the tube while charging the tube with concrete. The tubes shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering, when necessary, to retard or stop the flow of concrete. The tubes shall be filled by a method that will prevent washing of the concrete. The discharge end shall be completely submerged in concrete at all times and the tube shall contain sufficient concrete to prevent any water entry. The flow shall be continuous until the work is completed, and the resulting concrete seal shall be monolithic and homogeneous.
- D. Before dewatering, the concrete in the seal shall be allowed to cure for not less than five days after placing.
- E. If a concrete seal designed to withstand hydrostatic pressure is placed in water having a temperature below 45 degrees F, the curing time before dewatering shall be increased. Periods of time during which the temperature of the water has been continuously below 38 degrees F shall not be considered as curing time. After sufficient time has elapsed to ensure adequate strength in the

concrete seal, the cofferdam shall be dewatered and the top of the concrete cleaned of all scum, laitance, and sediment. Before fresh concrete is deposited, local high spots shall be removed as necessary to provide proper clearance for reinforcing steel.

3.17 FIELD QUALITY CONTROL AND CONCRETE TESTING

- A. Concrete Testing: The making of all concrete specimens, slump, temperature, and air content tests shall be performed by an ACI Certified Field Technician and witnessed by the Engineer. Laboratory testing of cast-in-place concrete shall be done by a qualified independent testing laboratory paid for by the Contractor. Samples shall be taken by the Field Technician and delivered to the Independent Testing Laboratory.
- B. Test Specimens: The Contractor shall supply all concrete, compression test molds, tamping rods, trowel, metal or glass covers, slump cone, storage box and sand necessary for making test specimens as outlined herein. The Contractor shall make, cure, and remove from molds and transport to the testing laboratory, five specimens for each sample in accordance with ASTM C 31 and ASTM C 172.
- C. Compressive Strength Tests: Make five test cylinders for each set of tests in accordance with ASTM C 31. Precautions shall be taken to prevent evaporation and loss of water from the specimen. Samples for strength tests of each mix design of concrete placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result shall be the average of two cylinders from the same concrete sample tested at 28 days.
- D. Corrosion Inhibitor Content Testing: The Contractor shall furnish and have tested one concrete cylinder for every 100 cubic yards of concrete requiring corrosion inhibiting admixture. Hardened concrete shall be tested in accordance with NCDOT Chem. Proc. C-20.0. The minimum nitrite recovery shall be not less than 5.1 pounds of nitrate per cubic yard. If three consecutive tests indicate a nitrite content is less than the specified minimum recovery, the materials represented by the failing lots may be subject to rejection. Contractor shall revise the quantity and/or type of corrosion inhibitor added to satisfy these Specifications. Additional testing may be performed at the Contractor's expense to dispute failing test results.
- E. Air Content Test: The Contractor shall test the air content in accordance with ASTM C 231. The air content test shall be made and recorded at the same time as specified for slump tests.
- F. Slump Tests: The Contractor shall check the consistency of concrete by means of slump tests conducted in accordance with ASTM C 143. The maximum slump may be increased as specified with the addition of an approved admixture provided the water-cement ratio is not exceeded. Perform tests at

commencement of concrete placement, when test cylinders are made, and for each batch of concrete.

- G. Temperature: Concrete temperature shall be taken and recorded at the same time as specified for slump tests.
- H. Test Reports: Field Technician shall fill in data on concrete test sample form and forward same with test specimens to the Independent Testing Laboratory. When tests have been conducted, the Contractor shall furnish the results of the tests with all pertinent data to the Engineer.
- I. Deficiencies and Remedial Action: In the event that concrete strength test results do not meet the acceptance criteria specified in ACI 301, additional tests of concrete in place as specified in DeIDOT Specifications shall be performed at the sole expense of the Contractor. In the event that tests of concrete in place do not meet the acceptance criteria specified, those portions of the structure affected as determined by the Engineer shall be removed and replaced in a manner acceptable to the Engineer at no additional expense to the DNREC.

END OF SECTION

05 50 00 – METAL FABRICATIONS

PART 1 - GENERAL

1.01 UNIT PRICES

A. Steel Superstructure – Alternates No. 1 and No. 2

1. Payment: Payment for “Steel Superstructure” shall include all of the material, labor, and equipment associated with fabricating, transporting and erecting the structural steel trusses, wales and assemblies, coated steel sheet pile retaining walls, floor grating, as well as all miscellaneous metal fabrications, welding, all connection hardware such as anchor rods, framing bolts, hex nuts, washers, providing hot-dipped galvanized coating for all exposed steel framing, and field testing as specified herein.
2. Measurement: The quantity to be paid shall be the number of steel superstructure to be erected.
3. Unit of Measure: Per Each (EA).

B. Combination Gate Fixtures – Alternates No. 1 and No. 2

1. Payment: Payment for “Combination Gate Fixtures” shall include installing owner-supplied Combination Gate Fixtures in accordance with the configuration and performance criteria specified in the Contract Documents. This cost includes the temporary storage and protection of materials at the project site, and all material, labor, and equipment associated with safe handling and installation of the Combination Gate Fixtures.
2. Measurement: “Combination Gate Fixtures” shall be measured on a Per Each basis.
3. Unit of Measure: Per Each (EA).

C. Metal Handrail – Alternates No. 1 and No. 2

1. Payment: Payment for “Metal Handrails” shall include all of the material, labor, and equipment associated with fabricating, transporting and erecting the metal handrails and posts, as well as all welding, connection hardware, bolts, hex nuts, washers, permanent safety chains at all temporary ladder locations, and providing hot-dipped galvanized coating for all exposed steel framing.
2. Measurement: “Metal Handrails” shall be measured on a Linear Foot basis.
3. Unit of Measure: Linear Foot (LF).

1.02 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. Unless otherwise indicated the most recent edition of the publication, including any revisions, shall be used.
- C. Except as modified or otherwise required herein, the Delaware Department of Transportation (DelDOT) "Standard Specifications for Road and Bridge Construction," August 2001, with all the latest addenda are to be used for this Section.
- D. American National Standards Institute (ANSI)
 - 1. ANSI A10.3 (2006) – Safety Requirements for Powder-Actuated Fastening Systems
 - 2. ANSI B18.2.1 (2010) – Square, Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head and Lag Screws (Inch Series)
 - 3. ANSI B18.2.2 (2010) – Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
 - 4. ANSI B18.6.2 (1998; R2010) – Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws
 - 5. ANSI B18.6.3 (2010) – Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)
 - 6. ANSI B18.21.1 (2009) – Washers: Helical Spring-Lock, Tooth Lock and Plain Washers (Inch Series)
 - 7. ANSI B18.22.1 (2009) – Washers: Helical Spring-Lock, and Plain Washers (Inch Series)
- E. American Society of Mechanical Engineers (ASME)
 - 1. ASME BPVC SEC II-C (2010) – Boiler and Pressure Vessel Code: Section II Material Specifications Part C - Welding Rods, Electrodes, and Filler Metals
- F. American Society for Testing and Materials (ASTM)
 - 1. ASTM A 27 - (2013) Steel Castings, Carbon, for General Application
 - 2. ASTM A 36 - (2014) Carbon Structural Steel
 - 3. ASTM A 48 - (2012) Gray Iron Castings
 - 4. ASTM A 53 - (2012) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

5. ASTM A 123 - (2015) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
6. ASTM A 153 - (2009) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
7. ASTM A 240 - (2015a) Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
8. ASTM A 276 - (2015) Stainless Steel Bars and Shapes
9. ASTM A 320 - (2015) Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
10. ASTM A 325 - (2014) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
11. ASTM A 480 - (2015) General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
12. ASTM A 514 - (2014) High-Yield-Strength Quenched and Tempered Alloy Steel Plate, Suitable for Welding
13. ASTM A 536 - (2014) Ductile Iron Castings
14. ASTM A 563 - (2015) Carbon and Alloy Steel Nuts
15. ASTM A 572 - (2015) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
16. ASTM A 575 - (2013) Steel Bars, Carbon, Merchant Quality, M-Grades
17. ASTM A 653 - (2015) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
18. ASTM A 780 - (2015) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
19. ASTM A 992 - (2015) Specification for Structural Steel Shapes
20. ASTM C 881 - (2014) Epoxy-Resin-Base Bonding Systems for Concrete
21. ASTM D 1187 - (2011e1) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
22. ASTM D 2000 - (2012) Standard Classification System for Rubber Products in Automotive Applications
23. ASTM F 436 - (2011) Hardened Steel Washers
24. ASTM F 593 - (2013) Stainless Steel Bolts, Hex Cap Screws, and Studs

- 25. ASTM F 594 - (2015) Stainless Steel Nuts
- 26. ASTM F 1554 – (2015) Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- G. American Water Works Association (AWWA)
 - 1. AWWA C 561 - (2014) Fabricated Stainless Steel Slide Gates
- H. American Welding Society, Inc. (AWS)
 - 1. AWS D1.1 - (2010) Structural Welding Code – Steel
 - 2. AWS D1.5 - (2010) Bridge Welding Code
 - 3. AWS D3.6 - (2010) Underwater Welding
 - 4. AWS QC1 - (2006) AWS Certification of Welding Inspectors
- I. Federal Specifications (FS)
 - 1. FS TT-P-664 (Rev. D) – Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant
- L. Military Specifications and Standards
 - 1. MIL-PRF-907 - (2004) High Temperature Antisieze Thread Compound
- M. National Association of Architectural Metal Manufacturers (NAAMM)
 - 1. NAAMM AMP 521 (2001) – Pipe Railing Systems Manual
 - 2. NAAMM MBG 531 (2001) – Metal Bar Grating Manual
- N. Steel Structures Painting Council (SSPC)
 - 1. SSPC-SP 1 (2004) – Solvent Cleaning
 - 2. SSPC-SP 6 (2007) – Commercial Blast Cleaning

1.03 SYSTEM DESCRIPTION

- A. The work covered by this Section includes the furnishing of all materials and equipment and the performing of all labor necessary to complete fabrications as shown on the Contract Drawings and as herein specified or directed by the Engineer.

1.04 SUBMITTALS

- A. General: Submit the following to the Design Engineer for approval. Note that approval of submittals by the Engineer shall not be construed as relieving the Contractor from responsibility for compliance with the Specifications nor from responsibility of errors of any sort in the submittals.
- B. Certifications, test procedures, and other submittals shall show the appropriate ASTM test(s) for each material.
- C. Product Data
 - 1. Adhesive anchors
 - 2. Anchor bolts
 - 3. Storm drainage combo gate
- D. Submit manufacturer's certified test reports, for each heat, indicating that materials have been tested and certified to meet the specified chemical, mechanical, and section properties prior to delivery at the site. Certifications shall be submitted for all materials, including but not limited to:
 - 1. Adhesive anchors
 - 2. Anchor bolts
 - 3. Cast steel
 - 4. Cast iron
 - 5. Ductile iron
 - 6. High strength structural steel
 - 7. Stainless steel plates and sheet
 - 8. Structural carbon steel
- E. Shop Drawings
 - 1. Embedded angles, plates, and edge armor
 - 2. Storm drainage combo gate
 - 3. Pipe sleeves and supports
 - 4. Truss fabricated assemblies
 - 5. Wale fabricated assemblies
 - 6. Handrails
- F. Instructions
 - 1. Adhesive anchors
 - 2. Manufacturer's operation and maintenance manuals and information for storm drainage combo gate
- G. Certification Statements
 - 1. Welding procedure qualifications
 - 2. Nondestructive examination (NDE) procedures
 - 3. NDE personnel certification procedures
 - 4. Inspector certification
 - 5. Submit inspector certification and NDE personnel certification for record
 - 6. Manufacturer's equipment warranty for storm drainage combo gate
- H. Certified Welding Inspector, Welding Procedures, Welder, and Welding Operator Qualifications

1. Certified Welding Inspector: Submit qualifications of third party AWS Certified Welding Inspectors (CWI) proposed for welder qualifications and visual/NDE inspections. Inspectors shall be qualified and certified in accordance with the provisions of AWS QC1, Standard for Qualification and Certification of Welding Inspectors. Do not proceed with welder or welding operator qualifications prior to approval of CWI qualifications.
2. Specifications and Test Results: Submit copies of the welding procedure specifications, procedure qualifications, welder and welding operator qualifications test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds.
3. Certification: Before assigning welders or welding operators to the work, submit their names, together with certification that each individual is performance qualified as specified in paragraph 1.05.C. Do not start welding work prior to procedure, welder and welding operator qualification approval. The certification shall state the type of welding and positions for which each welding procedure welder and welding operator is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

I. Records

1. Weld Identifications: Submit a list of the welder's names and symbol for each welder. To identify welds, submit written records indicating the location of welds made by each welder or welding operator.

J. Work Plan

1. Submit work plan for steel fabrication installation and erection, including but not limited to, proposed sequence of construction, equipment descriptions, anticipated production rates, equipment placement, template configurations, handling, and other relevant installation information. Work plan shall be approved before ordering materials.

1.05 QUALIFICATION OF WELDERS

- A. Qualify welders in accordance with AWS D1.1 or AWS D3.6 in accordance with these specifications where applicable, using procedures, materials, and equipment of the type required for the work.

1.06 QUALITY ASSURANCE

A. Welding Procedures, Welders and Welder Qualifications

1. Develop and qualify procedures for welding metals included in the work. Do not start welding until welding procedures, welders, and welding operators have been qualified. Perform qualification testing by a Certified Weld Inspector (CWI) or testing laboratory approved by the Engineer. Notify the Engineer at least 24 hours in advance of the time and place of the tests. When practicable, perform the qualification tests at or near the work site. Maintain current records of the test results obtained in welding procedure, welder and welding operator performance qualifications, and nondestructive examination (NDE) procedures. These records shall be readily available at the site for examination by the Engineer. Qualify the

procedures for making transition welds between different materials or between plates or pipes of different wall thicknesses. The choice of welding process shall be the responsibility of the Contractor.

B. Previous Welding Qualifications

1. Welding procedures, welders, and welding operators previously qualified by test may be accepted for the work without requalification provided that the following conditions are fulfilled:
 - a. Copies of welding procedures, procedures qualification test records, and welder and welding operator performance qualification test records are submitted and approved in accordance with the paragraph entitled "Submittals."
 - b. Testing was performed by an approved testing laboratory or technical consultant or by the Contractor's approved quality control organization. The welding procedures, welders, and welding operators were qualified in accordance with AWS D1.1, or AWS D3.6 where applicable, and base materials, filler materials, electrodes, equipment, and processes conformed to the applicable requirements of this Specification.
 - c. The requirements of paragraph entitled "Welder and Welding Operator Performance Qualification" for renewal of qualification were met, and records showing name of employer and period of employment using the process for which qualified are submitted as evidence of conformance.

C. Performance

1. The Contractor shall be responsible for the quality of joint preparation, welding, and examination. Clearly identify and record materials used in the welding operations. The examination and testing defined in this Specification are minimum requirements. Provide additional examination and testing as necessary to achieve the quality required.
 - a. Welding Procedures Qualification: Qualification of the welding procedures for each group of materials to be welded is required as indicated in AWS D1.1. Qualification of the underwater welding procedures for each group of materials to be welded is required as indicated in AWS D3.6. Record in detail and qualify the "Welding Procedure Specification" for every welding procedure proposed. Qualification for each welding procedure shall conform to the requirements of AWS Standards and to this Specification. The welding procedures shall specify end preparation for weld, including cleaning, alignments, and root openings. Preheat, interpass temperature control, and postheat treatment of welds shall be as required by AWS, unless otherwise indicated or specified. Welding procedure qualifications shall be identified individually and referenced on the shop drawings or suitably keyed to the contract drawings.
 - b. Welder and Welding Operator Performance Qualification: Qualify each welder and welding operator assigned to work covered by this Specification by performance tests using equipment, positions, procedures, base metals, and electrodes or bare filler wires from the same specification, classification, or group number that will be

encountered on his assignment. Welders or welding operators who make acceptable procedure qualification tests will be considered performance-qualified for the welding procedure used. Determine performance qualification in accordance with AWS D1.1 and as specified. Determine performance qualification for underwater welding in accordance with AWS D3.6 and as specified.

- c. Renewal of Qualification: Requalification of a welder or welding operator shall be required under one or any combination of the following conditions:
 - i. When a welder or welding operator has not used the specific welding process for a period of three (3) months. The period may be extended to six (6) months if the welder has been employed on another welding process.
 - ii. There is specific reason to question the welder's ability to make welds that will meet the requirements of the Specifications.
 - iii. The welder or welding operator was qualified by an employer other than those firms performing work under this contract and a qualification test has not been taken within the preceding 12 months. Renewal of qualification under this condition need be made on only a single test joint of any thickness, position, or material to reestablish qualification for any thickness, position, or material for which the welder or welding operator had qualified previously.

D. Qualification of Inspection and Nondestructive Examination (NDE) Personnel.

E. Qualify Inspection and nondestructive examination personnel in accordance with the following requirements:

- 1. Inspector Certification: Qualify welding inspectors in accordance with AWS QC1.
- 2. NDE Personnel Certification Procedures: Certify NDE personnel and establish a written procedure for the control and administration of NDE personnel training, examination, and certification. Base procedures on appropriate specific and general guidelines of training and experience recommended by ASNT SNT-TC-1A, Supplement C-Ultrasonic.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Materials delivered to the site shall be new and undamaged and shall be accompanied by certified test reports. The manufacturer's logo and mill identification mark shall be provided on the piling as required by the referenced specifications.
- B. Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.
- C. Weld Material: Deliver filler metals, electrodes, fluxes, and other welding materials to the site in manufacturer's original packages and store in a dry space until used.

Label and design packages properly to give maximum protection from moisture and to assure safe handling.

1.08 ENVIRONMENT

- A. Do not perform welding when the quality of the completed weld could be impaired by the prevailing work or weather conditions per AWS D1.1. The Engineer will determine when the weather or working conditions are unsuitable for welding.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Anchor Bolts, Nuts and Washers
 - 1. Stainless Steel Bolts
 - a. 1/4" to 5/8" nominal diameter bolts, inclusive, shall conform to ASTM F 593, Alloy 316, Condition CW1. Nuts shall conform to ASTM F 594, Alloy 316, Condition CW1.
 - b. 3/4" to 1 1/2" nominal diameter bolts, inclusive, shall conform to ASTM F 593, Alloy 316, Condition CW2. Nuts shall conform to ASTM F 594, Alloy 316, Condition CW2.
 - c. Washers shall be Alloy 316 meeting the dimensional requirements of ANSI B18.22.1, Type A Plain.
 - 2. Adhesive Anchor Bolts: Adhesive formula shall conform to the requirements of paragraph 2.01.N. Minimum pull out and shear capacity of the adhesive system shall exceed the ultimate capacity of the anchor.
 - 3. Anchor Bolts and Threaded Rods
 - a. Anchor bolts and rods shall conform to ASTM F1554, Grade 105, galvanized
 - b. Nuts shall conform to ASTM A 563, Grade DH, galvanized
 - c. Washers shall conform to ASTM F 436, galvanized
 - 4. Bolts, Nuts, Studs and Rivets: ASMC/ANSI B18.2.2 or ASTM A 325, galvanized, as noted
 - 5. Powder Driven Fasteners: Follow safety provisions of ANSI A10.3
 - 6. Screws: ANSI B18.2.1, ANSI B18.6.2, and ANSI B18.6.3
 - 7. Washers: Provide plain washers to conform to ANSI B18.22.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ANSI B18.21.1
- B. Cast Iron Castings: ASTM A 48, Grade as required by design
- C. Cast Steel: ASTM A 27, Grade 65/35 or better as required by design
- D. Ductile Iron Castings: ASTM A 536, Grade as required by design
- E. High Strength Structural Steel and Plate Stiffeners: ASTM A 572, Grade 50
- F. Hot-rolled Carbon Steel Bars and Bar-shapes: ASTM A 575, Grade as selected by the fabricator

- G. Stainless Steel Sheet and Plate: ASTM A 240 and ASTM A 480, Alloy 316L
- H. Steel Pipe: ASTM A 53, Type E or S, Grade B and AWS D1.1
- I. Structural Carbon Steel and Plate: ASTM A 36 – Unless otherwise noted
- J. Rolled Structural W-Shapes: ASTM A 992
- K. H-Piles: ASTM A 572 Grade 50
- L. Welded Studs: AWS D1.1, Section 7 and AWS D1.5
- M. Plate Washers: ASTM A 514, Grade 100, galvanized
- N. Adhesive Formula
 - 1. Adhesive Formula: Minimum pull out and shear capacity of the adhesive system shall exceed the ultimate capacity of the anchor.
 - 2. The adhesive formula shall be suitable for installation and performance as an applicable overhead anchorage, and shall be conformed to by the current ICC-ES report or approved equivalent.
 - 3. The adhesive formula shall be suitable for installation and performance as an applicable post-installed reinforcing steel connection, and shall be conformed to by the current ICC-ES report or approved equivalent.
 - 4. The adhesive formula shall be suitable for installation and performance as an applicable water saturated anchorage, and shall be conformed to by the current ICC-ES report or approved equivalent.
 - 5. The adhesive formula shall be suitable for post-installed anchorages and meet one of the following adhesive types:
 - a. Epoxy Adhesives: Adhesives shall be a cartridge type, two-component, solid epoxy based system dispensed and mixed through a static mixing nozzle supplied by the manufacturer. The adhesive shall meet the minimum requirements of ASTM C 881 Type IV and V, Grade 2 and 3, Class A, B and C, except gel times. Acceptable installation and performance temperature ranges shall be verified with manufacturer's literature prior to installation. Epoxy adhesives shall have an evaluation report issued by ICC-ES and be tested in accordance with ICC-ES's Acceptance Criteria for Adhesive Anchors in Concrete and Masonry Elements (AC 58) for the following:
 - i. Seismic and wind loading
 - ii. Long term creep at elevated temperatures
 - iii. Static loading at elevated temperatures
 - iv. Damp and water-filled holes
 - v. Freeze-thaw conditions
 - vi. Critical and minimum edge distance and spacing
 - b. Encapsulated Adhesives: Capsule shall be a two-component, vinylester based adhesive capsule-within-a-capsule system supplied in manufacturer's standard packaging. The capsule is

placed in the hole and the resin and initiator components are combined when the rod or rebar is driven to the bottom of the hole through the capsule. No spinning or insert end preparation shall be required for proper installation. Acceptable installation and performance temperature ranges shall be verified with manufacturer's literature prior to installation. Capsule adhesives shall be tested in accordance with ICC-ES's Acceptance Criteria for Adhesive Anchors in Concrete and Masonry Elements (AC 58) for the following:

- i. Long term creep at elevated temperatures
- ii. Critical and minimum edge distance and spacing
- c. Adhesive Limitations:
 - i. Installation Temperature: When the base material temperature drops below 40 degrees F, only Acrylic Adhesives shall be used for adhesive installations. See manufacturer's instructions for additional minimum temperature requirements.
 - ii. Hollow Substrates: The adhesive manufacturer's screen tubes shall be used for adhesive installations into hollow substrate. Encapsulated Adhesives shall not be used in hollow substrate applications.
 - iii. Moisture: Encapsulated Adhesives shall not be used when moisture is present in or around hole.
 - iv. Oversized Holes: Refer to manufacturer's information if drilled hole size is larger than what is recommended.
 - v. Core-drilled holes: Refer to manufacturer's information if holes are drilled with a core-drill bit.

2.02 FABRICATION FINISHES

- A. Steel Galvanize: Anchor bolts, washers, frames, structural shapes, and parts or devices and all other items indicated or specified for galvanizing and as necessary for proper installation, unless indicated otherwise.
- B. Galvanizing
 - 1. Bolts, Nuts, and Washers: ASTM A 153, Class C or D as applicable
 - 2. Plates and Structural Shapes: ASTM A 123, Thickness Grade 100
 - 3. Steel Sheet: ASTM A 653, Coating Designation G210
 - 4. Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable
- C. Surface Preparation: Blast clean surfaces in accordance with SSPC-SP6. Clean surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents in accordance with SSPC-SP1. Steel to be embedded in concrete shall be free of dirt and grease. Do not galvanize bearing surfaces, including contact surfaces within friction-type joints, but coat with rust preventative applied in the shop.
- D. Repair of Zinc-Coated Surfaces: Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A 780 or by the application of stick or thick paste material specifically designed for repair of galvanizing, as approved by the

Engineer / Service. Clean areas to be repaired and remove the slag from the welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread the molten material uniformly over surfaces to be coated and wipe the excess material off.

- E. Nonferrous Metal Surfaces: Protect by plating, anodic, or organic coatings.

2.03 MISCELLANEOUS PLATES AND SHAPES

- A. Provide for items that do not form a part of the structural steel framework, such as miscellaneous mountings, frames, and connections. Provide with connections and fastener welds as indicated.
- B. Mounting plates and plate washers shall conform to ASTM A 514, Grade 100, galvanized.

2.04 STORM DRAINAGE COMBO GATE

- A. General
 - 1. The gates shall be self-contained with yoke and bench stand operators in accordance with the requirements of these specifications.
 - 2. This gate is in compliance with the latest version of AWWA C 561.
 - 3. Specific configurations shall be as noted on the gate schedule or as shown on the plans.
 - 4. Materials:
 - a. Frame, Cover Slides, Yokes Stainless steel: ASTM A 276 and/or ASTM A 240, AISI Type 304, 316, or 2205 Duplex, as specified
 - b. Stems Stainless Steel: ASTM A 276, AISI Type 304, 316, or 2205 Duplex, as specified
 - c. Fasteners and Anchor Bolts Stainless Steel: ASTM A 320, Type 304 CW, 316 CW, or UNS-S32205 Duplex 2205
 - d. Seals Rubber (J-Bulb): EPDM or Neoprene ASTM D 2000 BC 615/625 Grade BE 625
 - e. Guides: Ribbed Ultra High Molecular Weight Polyethylene (UHMW)
 - f. Finish: Mill finish on all stainless steel surfaces.
- B. Frame and Guides
 - 1. The gate frame shall be composed of stainless steel guide rails with UHMW guides upstream and downstream. The seat/seals shall form a tight seal between the frame and the slide (disc). Gate shall be designed where all seals are replaceable without removing the frame from the wall or wall thimble.
 - a. The continuous J-Bulb neoprene or EPDM seal will perform the function of a seal between the frame and the slide (disc).
 - b. This tight seal shall provide an allowable leakage rate of no more than .10 gallons per minute (GPM) per peripheral foot of perimeter opening for seating head.
 - 2. Stainless steel retainer bars, cross bars and head rails (for self-contained gates only) shall be provided. The clear opening shall be the same size as the waterway, unless otherwise specified.

- C. Slide Cover (DISC)
 - 1. The slide cover (disc) shall be stainless steel plate reinforced with structural shapes welded to the plate.
 - a. The slide cover shall not deflect more than 1/720th of the span, or 1/16" at the sealing surface of the gate under maximum specified head.
 - b. The stem connection shall be either the clevis type, with structural members welded to the slide and a bolt or bolts to act as a pivot pin, or a threaded and bolted (or keyed) thrust nut supported in a welded nut pocket.
 - c. The clevis or pocket and yoke of the gate shall be capable of taking, without damage, at least twice the rated thrust output of the operator at 40 pounds of pull on a hand wheel or hand crank.
- D. Slide Cover Anchor Bolts
 - 1. Anchor hardware shall be provided by the slide gate manufacturer.
 - a. The size, quantity and location of the anchor hardware will be determined by the slide gate manufacturer.
 - b. Anchor hardware consisting of studs, nuts and washers shall be provided by the manufacturer.

2.05 WELDING MATERIALS

- A. Comply with ASME BPVC SEC II-C. Welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures.

2.06 STEEL RAILINGS AND HANDRAILS

- A. NAAMM AMP 521, provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts.
- B. Provide steel handrails, including connections to steel superstructure, steel pipe conforming to ASTM A 53/A 53M. Provide steel railings of 1 ½ inches nominal size, hot-dip galvanized and painted after galvanizing in accordance with Section 09 97 00, "Coating of Steel Waterfront Structures."
 - 1. Fabrication: Joint posts, rail, and corners by one of the following methods:
 - a. All vertical posts shall be 1 ½ inch nominal diameter, SCH 80.
 - b. All horizontal railing shall be 1 ½ inch nominal diameter, SCH 40.
 - c. Flush-type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 3/8 inch hexagonal-recessed-head setscrews.
 - d. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight fitting interior sleeve not less than 6 inches long.
 - e. Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.
- C. Galvanize exterior railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

PART 3 - EXECUTION

3.01 QUALITY CONTROL

- A. Fabrication: Prior to shipment, all miscellaneous metal fabrications shall be examined by the fabricator and/or manufacturer for compliance with the appropriate requirements of this Specification. Noncompliance with any specified requirement or presence of any defects preventing or lessening maximum efficiency shall constitute cause for rejection
- B. Contractor Inspection: The Contractor shall examine each miscellaneous metal fabrication prior to installation and note any damage or defects. Any rejected material shall be segregated and removed from the project site. Any material damaged during Contractor handling and installation shall be repaired in accordance with manufacturer's recommendations or replaced at no additional cost to the Owner.

3.02 INSTALLATION

- A. Install items at locations indicated, according to manufacturer's instructions. Items listed below require additional procedures.

3.03 ANCHORAGE, FASTENINGS, AND CONNECTIONS

- A. Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated: expansion shields or adhesive anchors for concrete; machine and carriage bolts for steel. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.04 BUILT-IN WORK

- A. Form for anchorage metal work built-in with concrete, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.05 FINISHES

- A. Galvanize and paint items as indicated on the Contract Drawings and as specified herein. Surfaces shall be cleaned per the coating manufacturer's recommendations. Paint shall be applied at a thickness as recommended by the manufacturer for exposure to a marine environment.
- B. Field Preparation: Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

- C. Environmental Conditions: Do not clean or paint surfaces when damp or exposed to inclement weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Engineer / Service.
- D. Dissimilar Materials: Where dissimilar metals are in contact, protect surfaces with a coat conforming to FS TT-P-664 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, mortar, or absorptive materials subject to wetting, protect with ASTM D 1187, asphalt-base emulsion.

3.06 BOLTED CONSTRUCTION

- A. Field treat damaged galvanized finish with two coats of high zinc dust oxide paint, cold galvanizing compounds or approved equal conforming to the requirements of ASTM A 780. In addition, all exposed threaded surfaces shall be painted with two coats of high zinc dust oxide paint after installation of unit.
- B. Anti-Seize Compound: The Contractor shall coat threads of all attachment bolts with an anti-seize compound, conforming to MIL-PRF-907, prior to applying washers and nuts. Recoat any bolt thread projection beyond nut after final tightening

3.07 WELDING

- A. Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1 unless noted below. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.
- B. Welding: Do not deviate from applicable codes, approved procedures and approved shop drawings without prior written approval from the Engineer / Service. Materials or components with welds made off the site will not be accepted if the welding does not conform to the requirements of this Specification unless otherwise specified. Assign each welder or welding operator an identifying number, letter, or symbol that shall be used to identify his welds. Each welder or welding operator shall apply his mark adjacent to his weld using an approved rubber stamp or felt-tipped marker with permanent, weatherproof ink or other approved methods that do not deform the metal. For seam welds, place identification marks adjacent to the welds at 3-foot intervals. Confine identification by die stamps or electric etchers to the weld reinforcing crown, preferably in the finished crater.
- C. Welding Operators: Perform welding in accordance with qualified procedures using qualified welders and welding operators.
- D. Examinations and Tests
 1. Visual and nondestructive examinations shall be performed by a third party AWS Certified Welding Inspector (CWI) qualified and certified in accordance with the provisions of AWS QC1, Standard for Qualification and Certification of Welding Inspectors to detect surface and internal discontinuities in completed welds. The CWI shall be approved by the Engineer / Service prior to the start of welding operations. Visual and

ultrasonic examination shall be required as specified. When examination and testing indicates defects in a weld joint, a qualified welder shall repair the weld in accordance with the Paragraph "Corrections and Repairs" of this Section.

2. Visual Examination: Visually examine 100% of welds as follows:
 - a. Before Welding: For compliance with requirements for joint preparation, placement of backing rings or consumable inserts, alignment and fit-up, and cleanliness.
 - b. During Welding: For conformance to the qualified welding procedure.
 - c. After Welding: For cracks, contour and finish, bead reinforcement, undercutting, overlap, and size of fillet welds.
3. Nondestructive Examination (NDE): NDE shall be in accordance with written procedures. Procedures for ultrasonic tests and methods shall conform to AWS D1.1 and for underwater welding procedures for ultrasonic tests and methods shall conform to AWS 3.6. The approved procedure shall be demonstrated to the satisfaction of the Engineer's / Service's QA personnel. In addition to the information required in AWS, the written procedures shall include:
 - a. Timing of the nondestructive examination in relation to the welding operations
 - b. Safety precautions
4. 10 Percent NDE: All steel welding shall be subjected to 10 percent NDE unless noted otherwise. Additional testing may be required if unsatisfactory results are obtained.

E. Acceptable Standards

1. Visual: The following indications are unacceptable:
 - a. Cracks – external surface
 - b. Undercut on surface which is greater than 1/32 inch deep
 - c. Lack of fusion on surface
 - d. Convexity of fillet weld surface greater than 10 percent of longest leg plus 1/32 inch
 - e. Concavity in fillet welds greater than 1/16 inch
 - f. Fillet weld size less than indicated or greater than 1-1/4 times the minimum specified fillet leg length
2. Ultrasonic Examination: Linear type discontinuities are unacceptable if the amplitude exceeds the reference level and discontinuities have lengths which exceed 3/4-inch. Discontinuities interpreted to be cracks, lack of fusion, or incomplete penetration are unacceptable regardless of length.

F. Corrections and Repairs

1. Remove defects and replace welds as specified. Repair defects discovered between weld passes before additional weld material is deposited. Wherever a defect is removed, a repair by welding is required, and the affected area shall be blended into the surrounding surface eliminating sharp notches, crevices, or corners. After defect removal is complete and before rewelding, reexamine the area by the same test methods which first revealed the defect to ensure that the defect has been eliminated. After rewelding, reexamine the repaired area by the same test methods originally used for that area. For repairs to base material, the

minimum examination shall be the same as required for butt welds. Indication of a defect shall be regarded as a defect unless reevaluation by NDE or by surface conditioning shows that no unacceptable indications are present. The use of foreign material to mask, fill in, seal, or disguise welding defects will not be permitted

3.08 FIELD QUALITY CONTROL

- A. Perform field tests, and provide labor, equipment, and incidentals required for testing. The Engineer / Service shall be notified in writing of defective welds within 7 working days of the date of the weld inspection.
- B. Welds
 - 1. Visual Inspection: AWS D1.1. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. Welding inspectors shall visually inspect and mark welds, including fillet welds and returns.
 - 2. Non Destructive Testing: AWS D1.1 Test locations shall be as indicated. If more than 20% of welds made by a welder contain defects identified by testing, then all welds made by that welder shall be tested by radiographic or ultrasonic testing, as approved by the Engineer / Service. When all welds made by an individual welder are required to be tested, magnetic particle testing shall be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

3.09 STORM DRAINAGE COMBO GATE INSTALLATION

- A. Installation of the slide gates shall be done in a workmanlike manner. It shall be the responsibility of the Contractor to handle, store, and install the equipment specified in this Section in strict accordance with the Manufacturer's recommendations.
- B. The Contractor shall review the installation drawings and installation instructions prior to installing the slide gates.
- C. The slide gate frames shall be installed in a true vertical plane, square and plumb, with no twist, convergence or divergence between the vertical legs of the guide frame.

3.10 STORM DRAINAGE COMBO GATE FIELD TESTING

- A. After installation, all slide gates will be field tested in the presence of the Engineer and Owner to ensure that all items of equipment are in full compliance with this Section. Each slide gate assembly shall be water tested by the Contractor at the discretion of the Engineer and Owner, to confirm that leakage does not exceed the specified allowed leakage.

END OF SECTION

SECTION 06 60 00 - FRP PRODUCTS AND FABRICATIONS

PART 1 – GENERAL

1.01 UNIT PRICES

- A. FRP GRATING – Alternates No. 1 and No. 2
 - 1. Payment: Payment for FRP (Fiberglass Reinforced Polymer) grating associated with the water control structures shall be included under the unit prices bid for the following items: “Steel Superstructure”. The price shall include all material, labor, and equipment required to provide the FRP Grating deck surface at the upper level of the water control structures shown in the Contract Drawings.
 - 2. Measurement: FRP Grating is not measured.
 - 3. Unit of Measure: N/A

1.02 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. ANSI/ACMA/FGMC FRP Composites Grating Manual for Pultruded and Molded Grating and Stair Treads.
- C. American Society of Civil Engineers (ASCE)
 - 1. ASCE/SEI 7 – Minimum Design Loads for Buildings and Other Structures
- D. American Society For Testing and Materials (ASTM)
 - 1. ASTM D 635 – (2014) Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
 - 2. ASTM D 4060 – (2014) Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
 - 3. ASTM D 4329 - (2013) Standard Practice for Fluorescent Ultraviolet (UV) Lamp Apparatus Exposure of Plastics
 - 4. ASTM D 4385 – (2013) Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products
 - 5. ASTM E 84 – (2015) Test Method for Surface Burning Characteristics of Building Material

1.03 SUMMARY

- A. This section includes FRP Products & Fabrications for FRP Pultruded Gratings and Stair Treads.

1.04 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals governed by this section necessary to install the fiberglass reinforced polymer (FRP) products as specified herein.

1.05 DESIGN CRITERIA

- A. The design criteria of the FRP pultruded grating, including connections, shall be in accordance with Contract Documents.
- B. Gratings: Design live loads of FRP gratings for walkway applications shall be 100 psf uniformly distributed load per ASCE 7 as required by the Contract Documents. The maximum combined vertical deflection resulting from the uniformly distributed live load and dead loads associated with the FRP grating and steel framing elements shall not exceed 0.25" at any given location of the upper deck surface.
- C. Stair Treads: Stair treads shall be designed for a uniform load of 100 psf per ASCE 7 or a concentrated load of 300 lbs on an area of 4 sq. inches located in the center of the tread, whichever produces greater stress and deflect less than 0.25". The two loads do not act concurrently.
- D. Structural support members shall not deflect more than L/180 of span for structural members unless specifically stated otherwise in the Contract Documents. Connections shall be designed to transfer the design loads.
- E. Temperature exposure is limited to a range of -25 – 110°F unless specifically stated otherwise in drawings and/or supplementary conditions.

1.06 SUBMITTALS

- A. Shop drawings of all fabricated pultruded gratings and treads shall be submitted to the Design Engineer for approval.
- B. Design computations demonstrating conformance to the loading and deflection criteria specified herein. Computations shall be signed and sealed by Professional Engineer, licensed in the State of Delaware.
- C. Manufacturer's catalog data showing:
 - 1. Materials of construction
 - 2. Dimensions, spacings, and construction of grating, handrails and building panels.
- D. Detail shop drawings showing:
 - 1. Dimensions
 - 2. Sectional assembly
 - 3. Location and identification mark
 - 4. Size and type of supporting frames required

- E. Samples of each type of product shall be submitted for approval in accordance with the requirements of Section.

1.07 SHIPPING AND STORAGE INSTRUCTIONS

- A. All gratings and components shall be shop fabricated and assembled into the largest practical size suitable for transporting.
- B. All materials and equipment necessary for the fabrication and installation of pultruded gratings and treads and appurtenances shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the Design Engineer, has become damaged as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.
- C. Identify and match-mark all materials, items and fabrications for installation and field assembly.

1.08 QUALITY ASSURANCE

- A. The material covered by these specifications shall be furnished by an ISO-9001:2008 certified manufacturer of proven ability who is regularly engaged in the manufacture, fabrication and installation of FRP systems.
- B. Substitution of any component or modification of system shall be made only when approved by the Engineer.
- C. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.
- D. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Materials used in the manufacture of the FRP products shall be raw materials in conformance with the specification and certified as meeting the manufacturer's approved list of raw materials.
- B. All raw materials shall be as specified by the contract.
- C. The visual quality of the pultruded shapes shall conform to ASTM D 4385.
- D. FRP pultruded grating and treads shall be manufactured using a pultruded process utilizing polyester, vinylester or phenolic resin with flame retardant and ultraviolet (UV) inhibitor additives. Unless a phenolic resin system is utilized, a

synthetic surface veil fabric shall encase the glass reinforcement. FRP shapes shall achieve a flame spread rating of 25 or less in accordance with ASTM E 84, the flammability characteristics of UL 94 V0 and the self-extinguishing requirements of ASTM D 635.

- E. If required, after fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating.
- F. FRP products exposed to weather shall contain an ultraviolet inhibitor. Should additional ultraviolet protection be required, a UV coating can be applied.
- G. The materials covered by these specifications shall be furnished by an ISO-9001:2008 certified manufacturer.

2.02 PULTRUDED GRATINGS AND TREADS

- A. General
 - 1. Grating shall be shipped from the manufacturer, palletized and banded with exposed edges protected to prevent damage in shipment.
 - 2. Each piece shall be clearly marked showing manufacturer's applicable drawing number.
- B. Design
 - 1. Walkway and platform grating panels shall be 1.50 inches deep.
 - 2. Design live loads of FRP gratings for walkway applications shall be 100 psf uniformly distributed load per ASCE 7 as required by the Contract Documents. The maximum combined vertical deflection resulting from the uniformly distributed live load and dead loads associated with the FRP grating and steel framing elements shall not exceed 0.25" at any given location of the upper deck surface.
 - 3. The bearing bars shall be joined into panels by passing continuous length fiberglass pultruded cross rods through the web of each bearing bar. A continuous fiberglass pultruded bar shaped section shall be wedged between the two cross rod spacers mechanically locking the notches in the cross rod spacers to the web of the bearing bars. Continuous adhesive bonding shall be achieved between the cross rod spacers and the bearing web and between the bar shaped wedge and the two cross rod spacers locking the entire panel together to give a panel that resists twist and prevents internal movement of the bearing bars. Each stair tread shall utilize a box-shaped nosing on its lead edge to enclose cross rods and ensure a smooth vertical edge.
 - 4. The top surface of all panels shall have a non-skid grit affixed to the surface by an epoxy resin followed by a baked-on top coat of epoxy resin.
 - 5. Surface should have a Wear Index of less than 1.0 when tested to ASTM D 4060 (Before and after 750 hours of UV exposure per ASTM D 4329 cycle A).

6. Panels shall be fabricated to the sizes shown on the drawings.
7. Hold down clamps shall be type 316L stainless steel clips or type 316 L stainless steel insert hold downs. Use 2 at each support with a minimum of 4 per panel.
8. Color shall be gray.
9. All bearing bars that are to be exposed to UV shall be coated with polyurethane coating to provide additional UV protection.

C. Products

1. The Pultruded FRP grating and stair treads shall be fabricated from bearing bars and cross rods manufactured by the pultrusion process. The glass fiber reinforcement for the bearing bars shall be a core of continuous glass strand rovings wrapped with continuous strand glass mat. With the exception of grating and stair treads manufactured using phenolic resin, a synthetic surface veil fabric shall encase the glass reinforcement.
2. Fiberglass Grating and Stair Treads
 - a) Fiberglass grating and stair treads shall be made from a chemical resistant, fire retardant polyester, vinyl ester, or phenolic resin system to meet the flame spread rating of 25 or less in accordance with ASTM E 84 testing, the flammability characteristics of UL 94 V0 and satisfies the self-extinguishing requirements of ASTM D 635. UV inhibitors are added to the resin to reduce UV attack.
3. If required, all cut and machined edges, holes and abrasions shall be sealed with a resin or compatible coating with the resin matrix used in the bearing bars and cross rods.
4. All panels shall be fabricated to the sizes shown on the approved shop drawings.

PART 3 – EXECUTION

- 1.
- 2.
- 3.

3.01 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction.
- B. Coordinate delivery of such items to project site.

3.02 INSPECTION AND TESTING

- A. The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.
- B. All labor, power, materials, equipment, and appurtenances required for testing shall be furnished by the Contractor at no cost to the Owner.

3.03 INSTALLATION, GENERAL

- A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction.
- B. Cutting, fitting and placement: Perform cutting, drilling and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; measured from established lines and levels.
- C. Provide temporary bracing or anchors in form work for items that are to be built into concrete masonry or similar construction.
- D. Penetrations through grating may require additional supports in order to meet design criteria. The Contractor shall engage the grating manufacturer for all proposed grating and associated fastener modifications. All proposed grating modifications shall be signed and sealed by a Professional Engineer, licensed in the State of Delaware. All proposed grating modifications are subject to approval in writing by the Engineer of Record.

3.04 ALL FRP INSTALLATION

- A. If required, all field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer. Submit all proposed field touch-up measures to the Engineer of Record for written Approval.
- B. Install items specified as indicated and in accordance with manufacturer instructions, and as approved by the Engineer of Record.

END OF SECTION

SECTION 09 97 00 – COATING OF STEEL WATERFRONT STRUCTURES

PART 1 - GENERAL

1.01 UNIT PRICES

- A. Coating Of Steel Waterfront Structures – Alternates No. 1 and No. 2
 - 1. Payment: Payment for coating of steel waterfront structures associated with the water control structures shall be included under the unit prices bid for the following items: “Steel Superstructure”. The price shall include the furnishing of all materials and equipment and the performing of all labor necessary to complete application of corrosion protection coatings for steel waterfront structures as shown on the Contract Drawings and as herein specified or directed by the Engineer.
 - 2. Measurement: Coating of steel waterfront structures is not measured.
 - 3. Unit of Measure: N/A

1.02 REFERENCES

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. Unless otherwise indicated, the most recent edition of the publication, including any revisions, shall be used.
- C. American Institute of Steel Construction (AISC)
 - 1. AISC SPE Sophisticated Paint Endorsement
- D. American Society for Testing and Materials (ASTM)
 - 1. ASTM D 7091 - (2013) Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nondestructive Coatings Applied to Non-Ferrous Metals
 - 2. ASTM E 376 - (2011) Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods
- E. National Association of Corrosion Engineers (NACE)
 - 1. NACE RP0188 - (2006) Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
- F. Society for Protective Coatings (SSPC)
 - 1. SSPC-PS 11.01 - (1982; E2004) Black (or Dark Red) Coal Tar Epoxy Polyamide Painting System
 - 2. SSPC-QP 3 - (2010) Shop Application of Complex Protective Coating Systems
 - 3. SSPC-SP 1 - (1982; E2004) Surface Preparation Standard No. 1: Solvent Cleaning

4. SSPC-SP 10 - (2010) Joint Surface Preparation Standard: Near-White Blast Cleaning
5. SSPC-Paint 16 - (2015) Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint

1.03 PROJECT DESCRIPTION

- A. The work covered by this Section includes the furnishing of all materials and equipment and the performing of all labor necessary to complete application of corrosion protection coatings for the permanent steel sheet pile elements associated with the water control structures at the locations shown on the Contract Drawings.

1.04 SUBMITTALS

- A. General: Submit the following to the Design Engineer for approval. Note that approval of submittals by the Engineer shall not be construed as relieving the Contractor from responsibility for compliance with the Specifications nor from responsibility of errors of any sort in the submittals.
- B. Certifications, test procedures, and other submittals shall show the appropriate ASTM test(s) for each material.
- C. Coating Materials
 1. Manufacturer's data
 2. Manufacturer's application instructions
- D. Quality Control Procedures
 1. Submit proposed application standards and quality control procedures
 2. Current AISC SPE or SSPC-QP 3 certification
- E. Coating Inspection Reports
 1. Dry film thickness measurements
 2. Holiday test results
- F. Coating Repair Procedures
- G. Qualifications
 1. Shop coating contractor
 2. Shop coating inspector
 3. Third-party coating inspector

1.05 QUALITY ASSURANCE

- A. Shop coating contractor shall possess a current SSPC-QP 3 or AISC SPE certification.
- B. Coating Control: Application of coating in the shop and in the field shall be done under the supervision of an experienced coating inspector. Low voltage electrical inspection shall be performed prior to installation by a third-party inspector experienced in holiday testing of coatings.

1.06 ENVIRONMENTAL CONDITIONS

- A. Start work only when ambient and curing temperatures and humidity are within limits of coating manufacturer's recommendations and at least 5 degrees F above dew point temperature.
- B. Do not clean or apply exterior coatings when damp or exposed to foggy, rainy, or snowy weather, when relative humidity is outside the humidity ranges required by the coating manufacturer, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Engineer.

1.07 HEALTH AND SAFETY PRECAUTIONS

- A. Materials listed in this Section contain coal tar pitch volatiles, which are toxic. Follow safety and health procedures as recommended by the manufacturer. Work in well ventilated areas. Provide and require workers to use impervious clothing, gloves, face shields (8-inch minimum), and other appropriate protective clothing necessary to prevent eye and skin contact with coating materials. Keep coatings away from heat, sparks, and flame.

PART 2 - PRODUCTS

2.01 COATING SYSTEM

- A. Coal Tar Epoxy-Polyamide Coating
 - 1. System: SSPC-PS 11.01
 - 2. Paint: SSPC-Paint 16 Black
- B. Provide catalyst component for coating specific for resin component. Where allowed, use thinners that are compatible with the coating.

PART 3 - EXECUTION

3.01 CLEANING AND PREPARATION OF SURFACES

- A. Solvent Cleaning: SSPC-SP 1. Remove visible oil, grease, and drawing and cutting compounds by solvent cleaning.

- B. Near-White Blast Cleaning: SSPC-SP 10. After solvent cleaning, complete surface preparation by near-white blast cleaning. Grit shall be selected to avoid soluble salt contamination during abrasive blasting. Remove residual dust from blasted surface by blowing with dry, oil-free air, vacuuming, or sweeping. Provide surface profile of at least 2.5 mil thickness.
- C. Additional Preparation: After blast cleaning, surface imperfections that remain shall be removed as necessary to provide for a holiday free coating.
- D. After blast cleaning and any additional preparation, remove visible oil, grease, and drawing and cutting compounds by solvent cleaning in accordance with SSPC-SP 1.

3.02 PROPORTIONING AND MIXING OF COATING SYSTEM

- A. Proportioning of Coal Tar Epoxy-Polyamide System: Coal tar epoxy-polyamide consists of a two-component system. Component A contains a refined coal tar pitch, polyamide resin, and a polyamine promoter to accelerate curing rate. Component B is an epoxy resin. Mix both components in a ratio of 4 parts of Component A to 1 part of Component B by volume. Do not thin coatings when doing so will result in total volatile organic compounds exceeding limits enacted by local air pollution control districts. When thinning is allowed and is necessary for proper application, use xylene or the coating manufacturer's recommended thinner, to a maximum of 1/2 gallon to a 5 gallon batch.
- B. Mixing of Coal Tar Epoxy-Polyamide System: Power stir components to a smooth, uniform consistency. Stir coating periodically during induction period. Follow coating manufacturer's requirements for induction time and pot life of mixed batches.

3.03 COATING APPLICATION

- A. General: Apply primer coating to dry surfaces not more than four (4) hours after near-white blast cleaning. Apply coats of each system so that finished surfaces are free from runs, sags, brush marks and variations in color.
- B. Application Method for Coal Tar Epoxy-Polyamide System: Unless otherwise specified by manufacturer's recommendations, do not allow drying time between coats to exceed 72 hours. Under conditions of direct sunlight or elevated ambient temperatures of 90 degrees F or greater, limit inter-coat drying period to a maximum of 24 hours.
- C. Repair of Defects: Repair detected coating holidays, thin areas, and exposed areas damaged prior to or during installation by surface treatment and application of additional coating or by manufacturer's recommendations. Allow a period of at least 72 hours to pass following final coat before placing in immersion service.
- D. Coal Tar Epoxy-Polyamide System: Apply a minimum of two (2) coats, each coat at a dry film thickness (DFT) of not less than 8 mils.
- E. Dry Film Thickness: Provide total system minimum dry film thickness of 16 mils. Measure using a magnetic gage.

3.04 SURFACES TO BE COATED

- A. Items to be coated include:
 - 1. Permanent Steel Sheet Piling – 10 feet below mudline to pile cut-off elevation on all faces of piling.
 - 2. Steel H-Piles – 10 feet below mudline to pile cut-off elevation, all faces of piling.

3.05 FIELD TESTING

- A. Provide a minimum of 48 hours advance notice to the Engineer of testing.
- B. Conduct the following in the presence of the Engineer:
 - 1. Holiday Testing: Prior to installation, test 100% of coated surfaces for holidays in total coating system in accordance with NACE RP0188. All coated surfaces shall be holiday free immediately prior to installation.
 - 2. Dry Film Thickness: After repair of holidays, measure coating thickness for all coated surfaces with a magnetic-type dry film thickness gage in accordance with ASTM D 7091 and ASTM E 376. If any region of coated surface has insufficient coating thickness or holidays, the coating on that region shall be repaired with an approved coal tar epoxy product. Re-measure after an additional coat is applied, if necessary to meet minimum coating thickness requirements.
- C. Submit report of coating test results. Note defective areas and corrective measures taken.
- D. Field touch up all damaged surfaces following manufacturer's instructions. Inspect piles when delivered and when in the leads immediately before driving.

END OF SECTION

SECTION 31 00 00 – EARTHWORK

PART 1 - GENERAL

1.01 UNIT PRICES

- A. Temporary Shoring and Dewatering – Outboard Locations – Alternates No. 1 and No. 2
 - 1. Payment: Payment for “Temporary Shoring and Dewatering – Outboard Locations” shall include designing and providing the temporary shoring and dewatering systems required to construct the outboard water control structures located outside of the Ted Harvey Conservation as shown on the Contract Drawings. This price shall also include transporting all temporary shoring and dewatering components to and from the project site, storing the components on-site, construction engineering costs associated with outboard shoring and dewatering systems, and extraction of all temporary outboard components.
 - 2. Measurement: The quantity to be paid shall be the per each unit price quoted on the bid form for “Temporary Shoring and Dewatering – Outboard Locations”.
 - 3. Unit of Measure: Each (EA).
- B. Offsite Select Borrow for Levee Raising – Base Bid and Alternate No. 3
 - 1. Payment: Payment for “Offsite Select Borrow for Levee Raising” shall include all handling, hauling, stockpiling, placement, and compaction of fill material associated with raising the height of the existing dike to the elevation shown in the contract drawings.
 - 2. Measurement: The quantity to be paid shall be the Cubic Yard unit price quoted on the bid form for “Offsite Select Borrow for Levee Raising”. The quantity shall be calculated by computing the total volume using the Average End Area Method comparing sections between the existing ground surface pre-placement survey approved by the Engineer and the final surface shown by the post-placement survey approved by the Engineer and accepted as final. Both surveys shall be controlled from the same common baseline of construction and the same common horizontal and vertical datum as shown on the Contract Drawings. Surveys shall be taken on section lines at minimum 25 foot stations perpendicular to the baseline and on minimum ten (10) foot centers along each section line. Survey drawings shall include plan view and cross-sections at each section line extending beyond the placement area.
 - 3. Unit of Measure: Cubic Yard (CY).
- C. Topsoil Stripping – Base Bid

1. Payment: Payment for "Topsoil Stripping" shall include all excavation, handling and stockpiling of material.
 2. Measurement: The quantity to be paid shall be the Square Yard unit price quoted on the bid form for "Topsoil Stripping".
 3. Unit of Measure: Square Yard (SY).
- D. Unsuitable Excavation and Backfill – Base Bid
1. Payment: Payment for "Unsuitable Excavation and Backfill" shall include all excavation, handling, stockpiling, replacement and compaction of material.
 2. Measurement: The quantity to be paid shall be the Cubic Yard unit price quoted on the bid form for "Unsuitable Excavation and Backfill".
 3. Unit of Measure: Cubic Yard (CY).
- E. Seeding – Base Bid and Alternate No. 3
1. Payment: Payment for "Seeding" shall include all fertilizer, mulch and seed.
 2. Measurement: The quantity to be paid shall be the Thousand Square Foot unit price quoted on the bid form for "Seeding".
 3. Unit of Measure: Thousand Square Foot (MSF).

1.02 CRITERIA FOR BIDDING

- A. Base bids on the following criteria:
1. Surface elevations are as indicated.
 2. Pipes or other artificial obstructions, except those indicated, will not be encountered.
 3. Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction. See Geotechnical Reports in Appendix 2 for further information.
 4. Material character is indicated by the boring logs. See Geotechnical Reports in Appendix 2 for further information.

1.03 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. American Association of State Highway And Transportation Officials (AASHTO)

- AASHTO T 180 Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
- AASHTO T 224 Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test
- C. American Welding Society (AWS)
- AWS D1.1/D1.1M Structural Welding Code - Steel
- D. ASTM International (ASTM)
- ASTM C33/C33M (2013) Standard Specification for Concrete Aggregates
- ASTM C136/C136M (2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D422 (2007)e2 Particle-Size Analysis of Soils
- ASTM D698 (2012e2) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
- ASTM D1140 (2014) Standard Test Methods for Determining the Amount of Material Finer than No. 200 (75-micrometer) Sieve in Soils by Washing
- ASTM D1556 (2015) Density and Unit Weight of Soil in Place by the Sand-Cone Method
- ASTM D1557 (2012e1) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2700 kN-m/m³)
- ASTM D2167 (2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
- ASTM D2487 (2011) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- ASTM D2937 (2010) Density of Soil in Place by the Drive-Cylinder Method
- ASTM D4318 (2010e1) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D6938 (2015) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

- E. State of Delaware Department of Transportation
Standard Specifications for Road and Bridge Construction August 2001
- F. U.S. Army Corps of Engineers (USACE)
USACE EM 385-1-1 (2014) Safety and Health Requirements Manual
- G. U.S. Environmental Protection Agency (EPA)
EPA 600/4-79/020 Methods for Chemical Analysis of Water and Wastes
EPA SW-846.3-3 Test Methods for Evaluating Solid Waste:
Physical/Chemical Methods
- H. U.S. General Services Administration (GSA)
CID A-A-203 Paper, Kraft, Untreated

1.04 DEFINITIONS

- A. Satisfactory Materials: Satisfactory materials comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP,. Satisfactory materials for grading comprise stones less than 8 inches
- B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Engineer when encountering any contaminated materials.
- C. Cohesionless and Cohesive Materials: Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C136/C136M, ASTM D422, and ASTM D1140.
- D. Degree of Compaction: Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

- E. Topsoil: Material suitable for topsoils obtained from offsite areas is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.
- F. Unstable Material: Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure.
- G. Select Granular Material:
 - 1. General Requirements: Select granular material consist of materials classified as GW, GP, GM, SW, SP, SM by ASTM D2487 where indicated. The liquid limit of such material must not exceed 40 percent when tested in accordance with ASTM D4318. The plasticity index must not be greater than 12 percent when tested in accordance with ASTM D4318, and not more than 30 percent by weight may be finer than No. 200 sieve when tested in accordance with ASTM D1140

Sieve Size	Percent Passing by Weight
2-1/2 inches	100
No. 4	40 - 85
No. 10	20 - 80
No. 40	10 - 60
No. 200	5 - 25

- H. Initial Backfill Material: Initial backfill consists of select granular material or satisfactory materials free from rocks 8 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than 2 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.
- I. Pile Supported Structure: As used herein, a structure where both the foundation and floor slab are pile supported.

1.05 SYSTEM DESCRIPTION

- A. Subsurface soil boring logs are included in the Geotechnical Report in Appendix 2. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.
- B. Classification of Excavation: No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.
 - 1. Common Excavation: Include common excavation with the satisfactory removal and disposal of all materials not classified as rock excavation.

- C. Dewatering Work Plan: Submit procedures for accomplishing dewatering work.

1.06 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1. Preconstruction Submittals
2. Shoring
3. Dewatering Work Plan
4. Test Reports
5. Testing

PART 2 - PRODUCTS

2.01 REQUIREMENTS FOR OFFSITE SOILS

- A. Test offsite soils brought in for use as backfill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Backfill shall contain a maximum of 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and a maximum of 10ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall pass the TCPL test. Determine TPH concentrations by using EPA 600/4-79/020 Method 418.1. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5030/8020. Perform TCLP in accordance with EPA SW-846.3-3 Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Do not bring material onsite until tests have been approved by the Engineer.

2.02 BURIED WARNING AND IDENTIFICATION TAPE

- A. Provide polyethylene plastic metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED STORM DRAIN LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes	
Red	Electric
Yellow	Gas, Oil; Dangerous Materials
Orange	Telephone and Other Communications

Warning Tape Color Codes	
Blue	Water Systems
Green	Sewer Systems
White	Steam Systems
Gray	Compressed Air

- B. Detectable Warning Tape for Non-Metallic Piping: Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.03 DETECTION WIRE FOR NON-METALLIC PIPING

- A. Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.04 MATERIAL FOR RIP-RAP

- A. Provide bedding material, filter fabric and rock conforming to DeIDOT State Standard for construction indicated.
- B. Bedding Material: Provide bedding material consisting of sand, gravel, or crushed rock, well graded, with a maximum particle size of 2 inches. Compose material of tough, durable particles. Allow fines passing the No. 200 standard sieve with a plasticity index less than six.
- C. Rock: Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Provide fragments sized so that no individual fragment exceeds a weight of 150 pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Provide rock with a minimum specific gravity of 2.50. Do not permit the inclusion of more than trace quantities of dirt, sand, clay, and rock fines.

2.05 SEEDING

- A. Seeding shall conform to DeIDOT Standard Specifications for Road and Bridge Construction Section 734. Seed shall be the mix specified for Permanent Grass Seeding – Dry Ground.

PART 3 - EXECUTION

3.01 STRIPPING OF TOPSOIL

- A. Where indicated or directed, strip topsoil to a depth of 4 inches. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations.

3.02 GENERAL EXCAVATION

- A. Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.
- B. Drainage Structures: Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed. Where pile foundations are to be used, stop the excavation of each pit at an elevation 1 foot above the base of the footing, as specified, before piles are driven. After the pile driving has been completed, remove loose and displaced material and complete excavation, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.
- C. Drainage: Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity [and] [or] provide temporary

ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

- D. Dewatering: Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least one foot below the working level.
- E. Trench Excavation Requirements: Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than four feet high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Shore vertical trench walls more than four feet high. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter, and do not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Owner.
1. Bottom Preparation: Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of two inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.
 2. Removal of Unyielding Material: Where unyielding material is encountered in the bottom of the trench, remove such material six inch below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.
 3. Removal of Unstable Material: Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in

performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Owner.

4. Jacking, Boring, and Tunneling: Unless otherwise indicated, provide excavation by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Engineer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

- F. Underground Utilities: The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Excavation made with power-driven equipment is not permitted within two feet of known Owner-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Engineer. Report damage to utility lines or subsurface construction immediately to the Engineer.

- G. Structural Excavation: Ensure that footing subgrades have been inspected and approved by the Engineer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Engineer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

3.03 SELECTION OF BORROW MATERIAL

- A. Select borrow material to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Obtain borrow material from approved private sources. Unless otherwise provided in the contract, the Contractor is responsible for obtaining the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling from the owners. Borrow material from approved sources on Owner-controlled land may be obtained without payment of royalties. Unless specifically provided, do not obtain borrow within the limits of the project site without prior written approval. Consider necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon related operations to the borrow excavation.

3.04 SHORING

- A. General Requirements: Submit a Shoring and Sheet piling plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheet piling as excavations are backfilled, in a manner to prevent caving.

- B. Geotechnical Engineer: Hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer is responsible for updating the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and submit an updated plan if necessary. Submit a monthly written report, informing the Contractor and Engineer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Engineer is responsible for arranging meetings with the Geotechnical Engineer at any time throughout the contract duration.

3.05 GRADING AREAS

- A. Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory [and unsatisfactory] [and wasted materials] as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.06 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

- A. Do not excavate to final grade until just before concrete is to be placed. For pile foundations, stop the excavation at an elevation of from 6 to 12 inches above the bottom of the footing before driving piles. After pile driving has been completed, complete the remainder of the excavation to the elevations shown. Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.07 GROUND SURFACE PREPARATION

- A. General Requirements: Remove and replace unsatisfactory material with satisfactory materials, as directed by the Engineer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inches, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

- B. Frozen Material: Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary 14 percent of optimum moisture to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3.08 UTILIZATION OF EXCAVATED MATERIALS

- A. Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Submit proposed source of borrow material. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Owner-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.09 BURIED TAPE AND DETECTION WIRE

- A. Buried Warning and Identification Tape: Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.
- B. Buried Detection Wire: Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. Extend the wire continuously and unbroken, from manhole to manhole. Terminate the ends of the wire inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over its entire length. Install wires at manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, terminate the wire in the valve pit at the pump station end of the pipe.

3.10 BACKFILLING AND COMPACTION

- A. Place backfill adjacent to any and all types of structures, and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, to prevent wedging action or eccentric loading upon or against the structure. Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers,

pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

- B. Trench Backfill: Backfill trenches to the grade shown.
1. Replacement of Unyielding Material: Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.
 2. Replacement of Unstable Material: Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6 inches loose thickness.
 3. Bedding and Initial Backfill: Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Compact backfill to top of pipe to 95 percent of ASTM D698 maximum density. Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:
 - a. Class I: Angular, 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
 - b. Class II: Coarse sands and gravels with maximum particle size of 1.5 inch, including various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.
 4. Final Backfill: Fill the remainder of the trench, except for special materials for roadways, railroads and airfields, with satisfactory material. Place backfill material and compact as follows:
 - a. Roadways: Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.
- C. Backfill for Appurtenances: After the structure has been constructed [and the concrete has been allowed to cure for 3 days, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.11 SPECIAL REQUIREMENTS

- A. Special requirements for both excavation and backfill relating to the specific utilities are as follows:
- B. Rip-Rap Construction: Construct rip-rap on bedding material on filter fabric in accordance with DOT State Standard, in the areas indicated. Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

1. Bedding Placement: Spread filter fabric on prepared subgrade as indicated. Finish bedding to present even surface free from mounds and windrows.
2. Stone Placement: Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.12 EMBANKMENTS

- A. Earth Embankments: Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of loose material not more than 12 inches in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise break up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements are identical with those requirements specified in paragraph SUBGRADE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.13 FINISHING

- A. Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turving materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.
- B. Subgrade and Embankments: During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

- C. Grading Around Structures: Construct areas within 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.14 PLACING TOPSOIL

- A. On the slope areas to receive topsoil, prepare the compacted subgrade soil to a 2 inches depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 6 inch and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas. Topsoil shall not be compacted as specified in Paragraph 3.10 but shall be tracked in prior to seeding.

3.15 TESTING

- A. Perform testing by a Corps validated commercial testing laboratory or the Contractor's validated testing facility. Submit qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Corps validated and approved by the Engineer.
 - 1. Determine field in-place density in accordance with ASTM D1556, ASTM D2167, or ASTM D6938. When ASTM D6938 is used, check the calibration curves and adjust using only the sand cone method as described in ASTM D1556.
 - 2. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938; check the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the Engineer. When test results indicate, as determined by the Engineer, that compaction is not as specified, remove the material, replace and recompact to meet specification requirements.
 - 3. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.
- B. Fill and Backfill Material Gradation: One test per 100 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM C136/C136M.
- C. In-Place Densities
 - 1. One test per 1,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

2. One test per 1,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.
- D. Moisture Contents: In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Engineer.
- E. Optimum Moisture and Laboratory Maximum Density: Perform tests for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 1,000 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.
- F. Tolerance Tests for Subgrades: Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.
- G. Displacement of Sewers: After other required tests have been performed and the trench backfill compacted to 2, feet above the top of the pipe, inspect the pipe to determine whether significant displacement has occurred. Conduct this inspection in the presence of the Engineer. Inspect pipe sizes larger than 36 inches, while inspecting smaller diameter pipe by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgment of the Engineer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Owner.

3.16 DISPOSITION OF SURPLUS MATERIAL

- A. Remove surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and to an approved licensed/permitted facility approved by the Engineer.

3.17 SEEDING

- A. Seed side slopes as soon as practical to stabilize soil material and prevent erosion. The horizontal top elevation of the levee shall not be seeded.

3.18 MEASUREMENT PROCEDURES

- A. Excavation: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. The measurements will include authorized excavation of rock (except for piping trenches that is covered below), authorized excavation of unsatisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will

be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material that is scarified or plowed and reused in-place, and will not include the volume excavated without authorization or the volume of any material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow pits, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed grade.

- B. Piping Trench Excavation: Measure trench excavation by the number of linear feet along the centerline of the trench and excavate to the depths and widths specified for the particular size of pipe. Replace unstable trench bottoms with a selected granular material. Include the additional width at manholes and similar structures, the furnishing, placing and removal of sheeting and bracing, pumping and bailing, and all incidentals necessary to complete the work required by this section.
- C. Topsoil Requirements: Separate excavation, hauling, and spreading or piling of topsoil and related miscellaneous operations will be considered subsidiary obligations of the Contractor, covered under the contract unit price for Offsite Select Borrow for Levee Raising.
- D. Overhaul Requirements: Allow the unit of measurement for overhaul to be the station-yard. The overhaul distance will be the distance in stations between the center of volume of the overhaul material in its original position and the center of volume after placing, minus the free-haul distance in stations. The haul distance will be measured along the shortest route determined by the Engineer as feasible and satisfactory. Do not measure or waste unsatisfactory materials for overhaul where the length of haul for borrow is within the free-haul limits.
- E. Select Granular Material: Measure select granular material in place as the actual cubic yards replacing wet or unstable material in trench bottoms within the limits shown. Provide unit prices which include furnishing and placing the granular material, excavation and disposal of unsatisfactory material, and additional requirements for sheeting and bracing, pumping, bailing, cleaning, and other incidentals necessary to complete the work.

3.19 PAYMENT PROCEDURES

- A. Payment will constitute full compensation for all labor, equipment, tools, supplies, and incidentals necessary to complete the work.
- B. Classified Excavation: Classified excavation will be paid for at the contract unit prices per cubic yard for common or rock excavation.
- C. Piping Trench Excavation: Payment for trench excavation will constitute full payment for excavation and backfilling, [including specified overdepth] except in rock or unstable trench bottoms.

- D. Unclassified Excavation: Unclassified excavation will be paid for at the contract unit price per cubic yard for unclassified excavation.
- E. Classified Borrow: Classified borrow will be paid for at the contract unit prices per cubic yard for common or rock borrow.
- F. Unclassified Borrow: Unclassified borrow will be paid for at the contract unit price per cubic yard for unclassified borrow.
- G. Authorized Overhaul: The number of station-yards of overhaul to be paid for will be the product of number of cubic yards of overhaul material measured in the original position, multiplied by the overhaul distance measured in stations of 100 feet and will be paid for at the contract unit price per station-yard for overhaul in excess of the free-haul limit as designated in paragraph DEFINITIONS.
- H. Sheeting and Bracing: Sheeting and bracing, when shown or authorized by the Engineer to be left in place, will be paid for as follows:
 - 1. Timber Sheeting: Timber sheeting will be paid for as the number of board feet of lumber below finish grade measured in place prior to backfilling. Include in the measurement sheeting wasted when cut off between the finished grade and 1 foot below the finished grade.
 - 2. Steel Sheeting and Soldier Piles: Steel sheeting, soldier piles, and steel bracing will be paid for according to the number of pounds of steel calculated. Calculate the steel by multiplying the measured in-place length in feet below finish grade by the unit weight of the section in pounds per foot. Obtain unit weight of rolled steel sections from recognized steel manuals

END OF SECTION

SECTION 31 05 19 - GEOTEXTILE

PART 1 - GENERAL

1.01 Unit Prices

- A. Geotextile – Alternates No. 1 and No. 2
 - 1. Payment for “Geotextile” shall include the cost of materials, equipment, installation, testing, and other costs associated with placement of the geotextile.
 - 2. Measurement: The quantity to be paid shall be the square yard unit price quoted on the bid form for “Geotextile”.
 - 3. Unit of Measure: Square Yard (SY).

1.02 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM)
 - ASTM D 3786 (2009) Bursting Strength of Textile Fabrics – Diaphragm Bursting Strength Tester Method
 - ASTM D 4354 (2009) Sampling of Geosynthetics for Testing
 - ASTM D 4355 (2007) Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
 - ASTM D 4491 (2009) Water Permeability of Geotextiles by Permittivity
 - ASTM D 4533 (2009) Trapezoid Tearing Strength of Geotextiles
 - ASTM D 4595 (2009) Tensile Properties of Geotextiles by the Wide-Width Strip Method
 - ASTM D 4632 (2008) Grab Breaking Load and Elongation of Geotextiles
 - ASTM D 4751 (2004) Determining Apparent Opening Size of a Geotextile
 - ASTM D 4833 (2007) Index Puncture Resistance of Geomembranes and Related Products
 - ASTM D 4873 (2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples
 - ASTM D 5261 (2010) Measuring Mass per Unit Area of Geotextiles

1.03 SUBMITTALS

- A. General: Submit the following in accordance with the Special Provision SP-16, "Submittals," of these Specifications.
- B. Prior to delivery of Geotextile to the job site, the Contractor shall submit the following certified test reports to the Engineer for approval:
 - 1. AASHTO Survivability Class (AASHTO M288)
 - 2. Apparent Opening Size (ASTM D 4751)
 - 3. Grab Tensile Strength and Elongation (ASTM D 4632)
 - 4. Mullen Burst Strength (ASTM D 3786)
 - 5. Permittivity (ASTM D 4491)
 - 6. Puncture Strength (ASTM D 4833)
 - 7. Sewn Seam Strength, if used (ASTM D 4632)
 - 8. Trapezoidal Tear Strength (ASTM D 4533)
 - 9. U.V. Resistance (ASTM D 4355)
 - 10. Wide Width Tensile Strength – Machine Direction (ASTM D 4595)
 - 11. Wide Width Tensile Strength – Cross-Machine Direction (ASTM D 4595)
- C. Manufacturer's recommendations for seaming and/or lapping joints.
- D. Samples: Representative sample of each type of geotextile showing the name of the manufacturer, brand name, type of fiber shall be submitted.
- E. The certification(s) shall show the appropriate ASTM test(s) for each material, the test results, and a statement that the material meets the specifications.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Geotextile labeling, shipment, and storage shall follow ASTM D 4873. Product labels shall clearly show the manufacturer or supplier name, style name, roll number, length and width of the roll.
- B. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants.
- C. Geotextile shall be stored in areas where water cannot accumulate, elevated off the ground, and protected from conditions that will affect the properties or performance. Outdoor storage shall not be for periods that exceed the manufacturer's recommendations, or for two months, whichever is less.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials specified shall be applied as per the Manufacturer's printed instructions and recommendations or as directed by the Engineer.

- B. Any work in which unapproved materials are used shall be performed at the Contractor's risk and will be considered unacceptable, unauthorized, and will not be paid for and may require removal.

2.02 GEOTEXTILE

- A. The geotextile shall be manufactured with fibers consisting of long-chain synthetic polymers composed of at least 95% by weight polyolefins or polyesters. They shall form a stable network such that filaments or yarns retain their dimensional stability relative to each other, including selvages. The geotextile shall be free of any chemical treatment or coating which reduces permeability and shall be inert to chemicals commonly found in soil.
- B. Woven slit film geotextiles will not be allowed.
- C. The geotextile materials shall equal or exceed the minimum (or maximum, if noted) average roll values (MARVs) specified below:

Physical Property	Test Value	Test Method
Survivability Class	Class 1 (nonwoven) Class 2 (woven monofilament)	AASHTO M288
Mass Per Unit Area (Nonwoven Geotextiles Only)	8 oz/sy	ASTM D 5261
Apparent Opening Size (max.)	0.425mm	ASTM D 4751
Permittivity	0.7 sec-1	ASTM D 4491
Percent Open Area (woven geotextile only)	4%	CWO-22125
Porosity (nonwoven geotextiles only)	50%	
UV Resistance	70% strength retained for all classes @ 500 hours	ASTM D 4355

- D. Geotextile shall have a minimum roll width of 12 feet.
- E. The geotextile shall be delivered to the job site in its original manufacturer's container(s). Each roll shall be individually wrapped in a protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling and to avoid moisture pick up. Materials exhibiting wetness, disintegration, decomposition, and/or abrasion due to shipping and handling will be rejected and shall be removed from the job site immediately, at the Contractor's cost.
- F. Installation, handling and storage of geotextile fabric shall be in accordance with the manufacturer's recommendations and the Engineer's direction.

2.03 ANCHORS

- A. Geotextile anchors shall be either:

1. Commercially available or manufactured 12-inch long by 1/8-inch diameter galvanized steel pins placed through the center of 1-inch diameter by 1/8-inch thick galvanized steel washers.
2. Sand bags or rock placed on top of the geotextile to secure it in place prior to rock placement.

PART 3 - EXECUTION

3.01 GEOTEXTILE PLACEMENT

- A. Surface to receive the geotextile shall be prepared in accordance with the requirements of Section 02315, "Earthwork," of these Specifications and shall be accepted by the Engineer prior to geotextile placement.
- B. Surface to receive the geotextile shall be prepared to a relatively smooth condition free of obstructions, sharp objects, stumps, and debris that could damage the geotextile during installation. When directed by the Engineer, rolling shall be used for surface preparation at no cost to the Administration.
- C. Fabric shall be placed with the warp direction roll length oriented parallel to the fill direction.
- D. Geotextile joints shall be made by either overlapping or seaming:
 1. Overlap: The geotextile shall be overlapped at all longitudinal and transverse joints a minimum of 3 feet. The geotextile shall be placed so that the preceding roll overlaps the following roll in the direction the fill material is being spread and upslope geotextile sheets shall be overlapped over downslope sheets.
 2. Seams: Seams shall develop of 90% of the specified grab tensile strength when tested in accordance with ASTM D 4632. All seams shall be subject to the approval of the Engineer.
- E. No mechanical equipment shall be permitted on the fabric surface.

END OF SECTION

SECTION 33 42 13 – PIPE CULVERTS

PART 1 - GENERAL

1.01 UNIT PRICES

- A. 36" HDPE Pipe – Alternates No. 1 and No. 2
 - 1. Payment: Payment for "36" HDPE Pipe" shall include the HDPE Pipe, transport of all materials to the project site, temporary storage and protection of materials at the project site, all excavation, handling, stockpiling, replacement and compaction of soil material, all piping connections, gaskets, flanges, connection hardware, and all material, labor, and equipment associated with safe handling and installation of the HDPE pipe.
 - 2. Measurement: "36" HDPE Pipe" shall be measured on a Linear Foot basis.
 - 3. Unit of Measure: Linear Foot (LF)
- B. HDPE Flashboard Riser Fixtures – Alternates No. 1 and No. 2
 - 1. Payment: Payment for "HDPE Flashboard Riser Fixtures" shall include installing owner-supplied HDPE Flashboard Riser Fixtures in accordance with the configuration and performance criteria specified in the Contract Documents. This cost includes temporary storage and protection of materials at the project site, and all material, labor, and equipment associated with safe handling and installation of the HDPE Flashboard Riser Fixtures.
 - 2. Measurement: "HDPE Flashboard Riser Fixtures" shall be measured on a per each basis.
 - 3. Unit of Measure: Per Each (EA)

1.02 SUMMARY

- A. Section Includes:
 - 1. Pipe culverts.
 - 2. Joints and accessories.
 - 3. Bedding.
- B. Related Sections:
 - 1. Section 31 00 00 - Earthwork.

1.03 REFERENCES

- A. ASTM International (ASTM)
 - 1. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

2. ASTM F2160 - Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)
3. ASTM D 2657 - Heat Fusion Joining of Polyolefin Pipe and Fittings
4. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
5. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
6. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter

1.04 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe, fittings and accessories.
- C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.
- D. HDPE Flashboard Riser
 1. Shop Drawings detailing fabrication of HDPE Flashboard Riser, and conformance to all required material and fabrication standards denoted herein.
 2. Design Computations demonstrating conformance to the specified criteria herein.
 3. Design computations shall be signed and sealed by a Professional Engineer, licensed in the State of Delaware.
 4. Handling and Installation plan of the HDPE Flashboard Riser and associated anchorage and piping connections.

1.05 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents:
 1. Accurately record actual locations of pipe runs, connections, and invert elevations.
 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- C. Operation and Maintenance Data: Procedures for submittals.

PART 2 - PRODUCTS

2.01 STORM DRAINAGE PIPING

- A. HDPE Polyethylene Pipe conforming to ASTM F714:
 - 1. HDPE Iron Pipe Size (IPS): 36 inches
 - 2. Diameter Ratio: DR 32.5
 - 3. Joints: ASTM D2657 Heat fusion

2.02 HDPE FLASHBOARD RISER

- A. General: The owner-supplied HDPE Flashboard Riser installation shall conform to the configuration shown in the Contract Drawings.
- B. Steel Anchorage to Concrete Foundation
 - 1. As a minimum design standard, the localized anchorage to the concrete foundation cap shall consist of the following, or as required by design:
 - a. $\frac{3}{4}$ " diameter ASTM F1554 anchor rods
 - b. A prequalified adhesive epoxy formula, conformed to current ICC testing data.
 - c. Bent steel plate straps conforming to ASTM A 36, or as required by design.
 - d. All steel plates and shapes shall be HDG in accordance with ASTM A123.
 - e. All steel anchor rods, bolts, hex nuts, and washers shall be HDG in accordance with ASMT A153.
 - 2. The manufacturer shall provide dielectric isolation between Stainless Steel and HDG finished in accordance with the following:
 - a. Where dissimilar metals are in contact, protect surfaces with a coat conforming to FS TT-P-664 to prevent galvanic or corrosive action.

2.03 BEDDING AND COVER MATERIALS

- A. General: Conform to Section 31 00 00 for bedding and backfill around and on top of pipe.
- B. Bedding for Flexible Pipe (HDPE): Clean course aggregate Gradation No. 57 conforming to Division 700 of the DelDOT Standard Specifications.
- C. Cover and Fill: Conform to Section 31 00 00.

2.04 ACCESSORIES

- A. Geotextile Fabric: Non-woven, non-biodegradable conforming to Division 800 of the DELDOT Standard Specifications for Type 1 Engineering Fabric.
- B. Concrete: Class A Concrete conforming to Division 700 of the DelDOT Standard Specifications.
 - 1. Compressive strength of 3,000 psi at 28 days.
 - 2. Air entrained.

3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.02 PREPARATION

- A. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.03 EXCAVATION AND BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17.
- B. Excavate to lines and grades shown on Drawings or required to accommodate installation of encasement.
- C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- D. Provide sheeting and shoring in accordance with Section 31 23 17.
- E. Place bedding material at trench bottom, level continuous layer not exceeding 8-inch compacted depth; compact to 95 percent per Section 31 23 17.
- F. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION – PIPE

- A. Install in accordance with manufactures instructions and as indicated on Drawings.
- B. Install plastic pipe, fittings, and accessories in accordance with ASTM F2160.
- C. Seal joints watertight.
- D. Begin at downstream end and progress upstream.
- E. Keep pipe and fittings clean until work is completed and accepted by Engineer.

- F. Repair surface damage to pipe with protective coating with two coats of compatible bituminous paint coating.
- G. Install cover at sides and over top of pipe

3.05 INSTALLATION – HDPE FLASHBOARD RISER

- A. General: The HDPE Flashboard Riser shall be installed, anchored, and connected to the Water Control Structure concrete foundation cap in accordance with the manufacturer's requirements and guidelines.
 - 1. The Contractor shall submit a detailed handling and installation plan for the HDPE Flashboard Riser, with consideration for all other construction phasing associated with the water control structure.
 - a. The HDPE Flashboard Riser Shop Drawings, Handling and Installation plans shall be approved by the Engineer prior to construction.
 - b. In addition to the Engineer, the manufacturer shall review and approve the handling and installation plan to ensure the Contractor's proposed methods will not damage or impair the riser element.
 - 2. The Contractor shall construct the slip joint connection under shored and dry conditions to ensure the best quality.
 - 3. The Contractor is responsible for the proper fit and alignment of the timber weir boards.

3.06 PIPE ENDS

- A. Place fill at pipe ends to match embankment slopes, concrete aprons, adjacent construction, end sections, or end walls as indicated on Drawings.

3.07 ERECTION TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Lay pipe to alignment and slope gradients noted on Drawings; with maximum variation from indicated slope of 1/8 inch in 10 feet.
- C. Maximum Variation from Intended Elevation of Culvert Invert: 1/2 inch.
- D. Maximum Offset of Pipe From Indicated Alignment: 1 inch.
- E. Maximum Variation in Profile of Structure from Intended Position: 1 percent.

3.08 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

- B. Request inspection prior to and immediately after placing bedding.
- C. Soil Compaction Testing: In accordance with Section 31 23 17.
- D. When tests indicate Work does not meet specified requirements, remove work, replace, and retest.

3.09 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.
- B. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 35 43 37 RIPRAP SCOUR PROTECTION

PART 1 - GENERAL

1.01 UNIT PRICES

- A. DELDOT R-6 – Alternates No. 1 and No. 2
 - 1. Payment For “DELDOT R-6” shall include all handling, hauling, stockpiling, placement, and compaction of stone associated with Scour Protection as shown in the contract drawings.
 - 2. Measurement: “DELDOT R-6” shall be measure on the basis of tonnage.
 - 3. Unit of Measure: Tonnage (TON)

1.02 SECTION INCLUDES

- A. The work covered by this section includes the furnishing of all transportation, labor, equipment, materials, and incidentals to complete the construction of riprap for scour protection as shown on the Contract Drawings or specified herein. The words rock, riprap and stone used in this section are interchangeable and shall mean one and the same material. The work shall include:
 - 1. Riprap scour protection around water control structures

1.03 RELATED SECTIONS

- A. Section 31 00 00 Earthwork
- B. Section 31 34 19 Geotextiles

1.04 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. Unless otherwise indicated the most recent edition of the publication, including any revisions, shall be used.
- C. Delaware Department of Transportation (DelDOT), Specifications for Road and Bridge Construction, August 2001.
- D. American Society For Testing And Materials (ASTM)
 - ASTM C 88 (2013) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
 - ASTM C 97 (2015) Absorption and Bulk Specific Gravity of Dimension Stone
 - ASTM C 127 (2015) Relative Density (Specific Gravity) and Absorption of Coarse Aggregate

ASTM C 295 (2012) Petrographic Examination of Aggregates for Concrete

ASTM C 535 (2012) Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

E. U.S. Army Corps Of Engineers (USACE)

EM 1110-2-1096 Laboratory Soils Testing

CRD-C 144-73 Method of Testing Stone for Resistance to Freezing and Thawing

1.05 SUBMITTALS

- A. Prior to construction, the Contractor shall submit test results from a certified laboratory, which demonstrate that all rock products meet the specified gradation, sulfate soundness, Los Angeles abrasion, petrography, absorption, and specific gravity requirements. Test results shall be dated within 90 days of the date submitted.

PART 2 - PRODUCTS

2.01 RIPRAP MATERIAL

- A. General: Riprap shall consist of fresh, sound, hard, dense, durable stone of crystalline igneous or metamorphic rock which shall be separated from bedrock by quarrying. No sedimentary rock, schistose rock or any highly foliated rock will be acceptable. Rock shall be free of seams and thin layers of soft, decomposed, weak, or water-soluble materials.
- B. Riprap shall be Delaware Department of Transportation (DeIDOT) Class R-6. This rock shall have a maximum size of 24 inches, 15 to 50 percent smaller than 12 inches, and 0 to 15 percent smaller than 6 inches.
- C. Size and Shape of Stone: Riprap shall be furnished in blocky and angular shapes, with its greatest dimension not greater than three times its least dimension. Flat stones, slabs, boulders, and parts of boulders will be rejected. Not more than 5% by weight of clean spalls resulting from loading and shipment will be allowed in any one vessel.
- D. Petrography: Stone shall be subjected to petrographic and x-ray diffraction analysis in accordance with ASTM C 295. Rock shall be fresh, interlocking crystalline structure, free of objectionable material such as expansive clays.
- E. Evaluation Testing: Rock shall meet the following test criteria:

<u>Property</u>	<u>Test Method</u>	<u>Test Value</u>
Specific Gravity	ASTM C 97	2.65 minimum
Absorption	ASTM C 127	Less than 2%
Abrasion	ASTM C 535	Less than 20% loss for 500 revolutions

Sulfate Soundness	ASTM C 88	Less than 18% for 5 cycles
Freezing and Thawing	CRD-C 144-73	Less than 10% loss for 12 cycles

2.02 SOURCES OF RIPRAP

A. The Contractor may utilize one or more sources of riprap. The Contractor shall provide documentation that rock from these sources meets the requirements of these specifications.

2.03 ROCK NOT MEETING THE SPECIFICATIONS

A. If, during the progress of the work, it is found that the stone being furnished and/or placed by the Contractor does not fully meet all the requirements of the specifications, the Contractor shall be required to furnish other rock of a quality acceptable to DNREC. Any rock rejected at the site of the work as not meeting the requirements of these specifications for quality, condition, size, gradation or otherwise shall be removed from the site by and at the expense of the Contractor, and rock of suitable quality shall be furnished and/or placed at no additional cost to DNREC.

PART 3 - EXECUTION

3.01 PLACEMENT OF RIPRAP

A. General: Care shall be taken to place the riprap to make a compact mass, and form as nearly as practicable a cross-section of uniform height, width, and slopes as shown on the Contract Drawings. Rocks shall be carefully placed so as to leave no large voids between them. Rock shall be placed in accordance with the construction sequence. The rock layers shall be placed to the full specified thickness in one operation.

END OF SECTION

CONTRACT NO. NAT201502/TED.HARVEY

**SECTION 3
BID QUOTATION REPLY**

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

BASE BID QUANTITIES

Bid quantities to be used for the lump sum Base Bid above are as follows:

BID ITEM No. 1 – Mobilization / Demobilization (1 Lump Sum)

BID ITEM No. 2 – Seeding (140 Thousand Square Feet)

BID ITEM No. 3 – Unsuitable Excavation and Backfill (500 cubic yards)

BID ITEM No. 4 – Topsoil Stripping (30,000 Square Yards)

BID ITEM No. 5 – Offsite Select Borrow for Levee Raising (23,000 Cubic Yards)

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

BID QUANTITIES – ALTERNATE NO. 1 – CONSTRUCT WEST WATER CONTROL STRUCTURE

Bid quantities to be used for the ALTERNATE bid above are as follows:

BID ITEM No. 1.1 – Temporary Shoring and Dewatering – Outboard Location (1 Each)

BID ITEM No. 2.1 – Demolition of Water Control Structures (1 Lump Sum)

BID ITEM No. 3.1 – CIP Concrete Pile Caps (33 Cubic Yards)

BID ITEM No. 4.1 – Steel Superstructure (2 Each)

BID ITEM No. 5.1 – Geotextile (125 Square Yards)

BID ITEM No. 6.1 – DelDOT R-6 Riprap (125 Tons)

BID ITEM No. 7.1 – Furnish HP12x74 Piles (1,460 Vertical Linear Feet)

BID ITEM No. 8.1 – Handling and Driving HP 12x74 Piles (16 Each)

BID ITEM No. 9.1 – Re-Strike HP 12x74 Piles (1 Each)

BID ITEM No. 10.1 – Field Splicing HP 12x74 Piles (16 Each)

BID ITEM No. 11.1 – Dynamic Pile Test HP 12x74 Piles (2 Each)

BID ITEM No. 12.1 – Dynamic Pile Test Re-Strike HP 12x74 Piles (2 Each)

BID ITEM No. 13.1 – Metal Handrails (36 Linear Feet)

BID ITEM No. 14.1 – Chain Link Fence (77 Linear Feet)

BID ITEM No. 15.1 – Chain Link Personnel Gate (2 Each)

BID ITEM No. 16.1 – 36” HDPE Pipe (100 Linear Foot)

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

BID QUANTITIES – ALTERNATE NO. 2 – CONSTRUCT EAST WATER CONTROL STRUCTURE

Bid quantities to be used for the ALTERNATE bid above are as follows:

BID ITEM No. 1.2 – Temporary Shoring and Dewatering – Outboard Location (1 Each)

BID ITEM No. 2.2 – Demolition of Water Control Structures (1 Lump Sum)

BID ITEM No. 3.2 – CIP Concrete Pile Caps (33 Cubic Yards)

BID ITEM No. 4.2 – Steel Superstructure (2 Each)

BID ITEM No. 5.2 – Geotextile (125 Square Yards)

BID ITEM No. 6.2 – DelDOT R-6 Riprap (125 Tons)

BID ITEM No. 7.2 – Furnish HP12x74 Piles (1,460 Vertical Linear Feet)

BID ITEM No. 8.2 – Handling and Driving HP 12x74 Piles (16 Each)

BID ITEM No. 9.2 – Re-Strike HP 12x74 Piles (1 Each)

BID ITEM No. 10.2 – Field Splicing HP 12x74 Piles (16 Each)

BID ITEM No. 11.2 – Dynamic Pile Test HP 12x74 Piles (2 Each)

BID ITEM No. 12.2 – Dynamic Pile Test Re-Strike HP 12x74 Piles (2 Each)

BID ITEM No. 13.2 – Metal Handrails (36 Linear Feet)

BID ITEM No. 14.2 – Chain Link Fence (77 Linear Feet)

BID ITEM No. 15.2 – Chain Link Personnel Gate (2 Each)

BID ITEM No. 16.2 – 36” HDPE Pipe (100 Linear Foot)

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

BID QUANTITIES – ALTERNATE NO. 3 – LEVEE RAISING FROM +6.00 TO +8.00

Bid quantities to be used for the ALTERNATE bid above are as follows:

BID ITEM No. 1.3 – Offsite Select Borrow for Levee Raising (11,000 Cubic Yards)

BID ITEM No. 2.3 – Seeding (70 Thousand Square Feet)

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

UNIT PRICES

Unit prices conform to applicable project specification section. Refer to the specifications for a complete description of the following Unit Prices:

BASE BID

	<u>ADD</u>	<u>DEDUCT</u>
UNIT PRICE BID ITEM No. 2: Seeding per Thousand Square Feet:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 3: Unsuitable Excavation and Backfill per Cubic Yard:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 4: Topsoil Stripping per Square Yard:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 5: Offsite Borrow for Levee Raising per Cubic Yard:	\$ _____	\$ _____

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

UNIT PRICES

Unit prices conform to applicable project specification section. Refer to the specifications for a complete description of the following Unit Prices:

ALTERNATE 1

	<u>ADD</u>	<u>DEDUCT</u>
UNIT PRICE BID ITEM No. 2.1: CIP Concrete Pile Caps per Cubic Yard	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 4.1: Geotextile per Square Yard:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 5.1: DelDOT R-6 Riprap per Ton:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 6.1: Furnish HP 12x74 per Vertical Linear Foot	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 7.1: Handling and Driving HP 12x74 Piles per Each:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 8.1: Re-Strike HP 12x74 Piles per Each:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 9.1: Field Splicing HP 12x74 Piles per Each:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 10.1: Dynamic Pile Test HP 12x74 Piles per Each	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 11.1: Dynamic Pile Test Re-Strike HP 12x74 Piles per Each	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 12.1: Metal Handrails per Linear Feet	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 13.1: Chain Link Fence per Linear Feet	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 14.1: Chain Link Personnel Gate per Each	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 15.1: 36" HDPE Pipe per Linear Foot	\$ _____	\$ _____

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

UNIT PRICES

Unit prices conform to applicable project specification section. Refer to the specifications for a complete description of the following Unit Prices:

ALTERNATE 2

	<u>ADD</u>	<u>DEDUCT</u>
UNIT PRICE BID ITEM No. 2.2: CIP Concrete Pile Caps per Cubic Yard	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 4.2: Geotextile per Square Yard:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 5.2: DelDOT R-6 Riprap per Ton:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 6.2: Furnish HP 12x74 per Vertical Linear Foot	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 7.2: Handling and Driving HP 12x74 Piles per Each:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 8.2: Re-Strike HP 12x74 Piles per Each:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 9.2: Field Splicing HP 12x74 Piles per Each:	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 10.2: Dynamic Pile Test HP 12x74 Piles per Each	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 11.2: Dynamic Pile Test Re-Strike HP 12x74 Piles per Each	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 12.2: Metal Handrails per Linear Feet	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 13.2: Chain Link Fence per Linear Feet	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 14.2: Chain Link Personnel Gate per Each	\$ _____	\$ _____
UNIT PRICE BID ITEM No. 15.2: 36" HDPE Pipe per Linear Foot	\$ _____	\$ _____

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

UNIT PRICES

Unit prices conform to applicable project specification section. Refer to the specifications for a complete description of the following Unit Prices:

ALTERNATE 3

ADD

DEDUCT

UNIT PRICE BID ITEM No. 1.3: Offsite Select Borrow per Cubic Yard

\$ _____ \$ _____

UNIT PRICE BID ITEM No. 2.3: Seeding per Thousand Square Feet

\$ _____ \$ _____

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for thirty (30) days from the date of opening of bids (60 days for School Districts and Department of Education), and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid.

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

Should I/We be awarded this contract, I/We pledge to achieve substantial completion of all the work within one hundred forty (150) calendar days of the Notice to Proceed.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

(State of Corporation)

Business Address: _____

Witness: _____ By: _____
(SEAL) (Authorized Signature)

(Title)
Date: _____

ATTACHMENTS

- Sub-Contractor List
- Non-Collusion Statement
- Affidavit(s) of Employee Drug Testing Program
- Bid Security
- (Others as Required by Project Manuals)

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor **must be listed for each category** where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the Division of Fish and Wildlife, **it is required that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work.** This form must be filled out completely with no additions or deletions. **Note that all subcontractors listed below must have a signed Affidavit of Employee Drug Testing Program included with this bid.**

<u>Subcontractor Category</u>	<u>Subcontractor</u>	<u>Address (City & State)</u>	<u>Subcontractors tax payer ID # or Delaware Business license #</u>
1. Earthwork	_____	_____	_____
2. Pile Driving	_____	_____	_____
3. Dynamic Pile Testing	_____	_____	_____
4. Surveying	_____	_____	_____
5. Geotechnical Testing	_____	_____	_____
6. Steel Fabrication	_____	_____	_____
7. Concrete	_____	_____	_____
8. Seeding	_____	_____	_____

TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT
DOVER, DE
CONTRACT NO. NAT201502/TED.HARVEY

BID FORM

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date to the Division of Fish and Wildlife.

All the terms and conditions of Contract No. NAT201502/TED.HARVEY have been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

E-MAIL: _____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____ . NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

**AFFIDAVIT
OF
EMPLOYEE DRUG TESTING PROGRAM**

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors implement a program of mandatory drug testing for Employees who work on Large Public Works Contracts funded all or in part with public funds.

We hereby certify that we have in place or will implement during the entire term of the contract a Mandatory Drug Testing Program for our employees on the jobsite that complies with this regulation:

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF FISH AND WILDLIFE

SECTION 3B

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____
_____ of _____ in the County of _____
_____ and State of _____ as **Principal**, and _____
_____ of _____ in the County of _____
and State of _____ as **Surety**, legally authorized to do business in the State of Delaware
("State"), are held and firmly unto the **State** in the sum of _____
_____ Dollars (\$ _____), or _____ percent not to exceed _____
_____ Dollars (\$ _____)
of amount of bid on Contract No. NAT201502/TEDHARVEY, to be paid to the **State** for the use and benefit
of the **Department of Natural Resources and Environmental Control, Division of Fish and Wildlife** for
which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors,
administrators, and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bonded **Principal**
who has submitted to the **Department of Natural Resources and Environmental Control, Division of Fish
and Wildlife** a certain proposal to enter into this contract for the furnishing of certain material and/or services
within the **State**, shall be awarded this Contract, and if said **Principal** shall well and truly enter into and execute
this Contract as may be required by the terms of this Contract and approved by the **Department of Natural
Resources and Environmental Control, Division of Fish and Wildlife** this Contract to be entered into within
twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal,
then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____ seal and dated this _____ day of _____ in the year of our Lord two
thousand and sixteen (2016).

SEALED, AND DELIVERED IN THE
Presence of

		_____ Name of Bidder (Organization)
Corporate Seal	By:	_____ Authorized Signature
Attest _____		_____ Title
Witness: _____	By:	_____ Name of Surety
		_____ Title

TED HARVEY CONSERVATION AREA
ENHANCEMENT PROJECT
CONTRACT NO. NAT201502/TED.HARVEY

SECTION 3E

CERTIFICATION OF NONSEGREGATED FACILITIES

NOTE: Applicable to federally assisted construction contracts and related subcontracts exceeding \$10,000 which are not exempt from the Equal Opportunity clause.

The federally assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms work area, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color or national origin, because of habit, local custom or otherwise. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed contractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontractors exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause and that he will retain such certifications in his files.

Signature: _____ Date: _____

NOTE: The penalty for making false statement in offers is prescribed in 18 U.S.C. 1001.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED

SWORN TO AND SUBSCRIBED BEFORE ME THIS ____ DAY OF _____, 2015.

NOTARY PUBLIC

CITY of _____; COUNTY of _____; STATE of _____.

SECTION 3F

DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

PURCHASING SECTION

NO BID REPLY FORM

Contract No. _____ Bid Title _____

To assist us in obtaining good competition on our Request for Bid, we ask that each firm that has received an invitation, but does not wish to bid, state their reason. This information will not preclude participation in future invitations to bid.

Unfortunately, we must offer a “no Bid” at this time because:

- _____ 1. We do not wish to participate in the bid process.
- _____ 2. We do not wish to bid under the terms and conditions of the Request for Bid document. Our objections are:

- _____ 3. We do not feel we can be competitive.

Firm Name

Signature

_____ We wish to remain on the Bidder’s List.

_____ We wish to be deleted from the Bidder’s List.

SECTION 3G

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

CONTRACT NO. NAT201502/TED.HARVEY

EQUALITY OF EMPLOYMENT OPPORTUNITY STATEMENT

2) § 6962 (b7) Equality of Employment opportunity on public works.

a) As a condition to the awarding of any contract for public works financed in whole or in part by state appropriation all state contracting agencies shall include in every contract hereinafter entered into the following provisions:

“During the performance of this contract, the Contractor agrees as follows:

(1) The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed color, sex or national origin. Such action shall include, but not limited to, the following: Employment, upgrading, demotion or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous notices to be approved by the contracting agency setting forth this nondiscrimination clause.

(2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, sex or national origin.

b) The term “contract for public works” means construction, reconstruction, demolition, alteration and repair work and maintenance work paid for in whole or in part out of the funds of a public body except work performed under a vocational rehabilitation program. The manufacturing or furnishing of materials, articles, supplies or equipment is not a public work within the meaning of this subsection unless conducted in connection with and at the site of the public work.

c) The Secretary of the Department of Labor shall be responsible for the administration of this section and shall adopt such rules and regulations and issue such orders as he deems necessary to achieve the purposes thereof, provided that no requirement established hereby shall be in conflict with § 6904 of this title. (29 Del. C. 1953, § 6921; 58 Del. Laws, C. 370, §1)

It is agreed by the undersigned bidder that the signed delivery of this bid represents the bidder’s acceptance of the terms and conditions of the invitation to bid including all specifications and special provisions.

NAME OF BIDDER _____

SIGNATURE OF AUTHORIZED REPRESENTATIVE _____

TITLE _____

ADDRESS OF BIDDER _____

PHONE NUMBER _____

PURCHASE ORDERS SHOULD BE SENT TO:

COMPANY NAME _____

ADDRESS _____

CONTACT _____

PHONE NUMBER _____

FEDERAL E.I. NUMBER _____

STATE OF DELAWARE LICENSE NUMBER

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

SWORN TO AND SUBSCRIBED BEFORE ME THIS _____ DAY OF _____, 2015

NOTARY PUBLIC _____

City of _____

County of _____

State of _____

**THESE SECTIONS
TO BE COMPLETED
BY SUCCESSFUL BIDDER
AFTER NOTICE OF AWARD**

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF FISH AND WILDLIFE

PERFORMANCE BOND

Bond Number: _____

KNOW ALL PERSONS BY THESE PRESENTS, that we, _____, as principal (“**Principal**”), and _____, a _____ corporation, legally authorized to do business in the State of Delaware, as surety (“**Surety**”), are held and firmly bound unto the **Department of Natural Resources and Environmental Control, Division of Fish and Wildlife** (“**Owner**”) in the amount of _____ (\$_____), to be paid to **Owner**, for which payment well and truly to be made, we do bind ourselves, our and each and every of our heirs, executors, administrations, successors and assigns, jointly and severally, for and in the whole, firmly by these presents.

Sealed with our seals and dated this _____ day of _____, 2016.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH, that if **Principal**, who has been awarded by **Owner** that certain contract known as Contract No. NAT201502/TED.HARVEY dated the _____ day of _____, 2016 (the “Contract”), which Contract is incorporated herein by reference, shall well and truly provide and furnish all materials, appliances and tools and perform all the work required under and pursuant to the terms and conditions of the Contract and the Contract Documents (as defined in the Contract) or any changes or modifications thereto made as therein provided, shall make good and reimburse **Owner** sufficient funds to pay the costs of completing the Contract that **Owner** may sustain by reason of any failure or default on the part of **Principal**, and shall also indemnify and save harmless **Owner** from all costs, damages and expenses arising out of or by reason of the performance of the Contract and for as long as provided by the Contract; then this obligation shall be void, otherwise to be and remain in full force and effect.

Surety, for value received, hereby stipulates and agrees, if requested to do so by **Owner**, to fully perform and complete the work to be performed under the Contract pursuant to the terms, conditions and covenants thereof, if for any cause **Principal** fails or neglects to so fully perform and complete such work.

Surety, for value received, for itself and its successors and assigns, hereby stipulates and agrees that the obligation of **Surety** and its bond shall be in no way impaired or affected by any extension of time, modification, omission, addition or change in or to the Contract or the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provisions thereof, or by any assignment, subletting or other transfer thereof or of any work to be performed or any monies due or to become due thereunder; and **Surety** hereby waives notice of any and all such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers and hereby expressly stipulates and agrees that any and all things done and omitted to be done by and in relation to assignees, subcontractors, and other transferees shall have the same effect as to **Surety** as though done or omitted to be done by or in relation to **Principal**.

Surety hereby stipulates and agrees that no modifications, omissions or additions in or to the terms of the Contract shall in any way whatsoever affect the obligation of **Surety** and its bond.

Any proceeding, legal or equitable, under this Bond may be brought in any court of competent jurisdiction in the State of Delaware. Notices to **Surety** or Contractor may be mailed or delivered to them at their respective addresses shown below.

IN WITNESS WHEREOF, **Principal** and **Surety** have hereunto set their hand and seals, and such of them as are corporations have caused their corporate seal to be hereto affixed and these presents to be signed by their duly authorized officers, the day and year first above written.

PRINCIPAL

Name: _____

Witness or Attest: Address: _____

Name:

(Corporate Seal)

By: _____(SEAL)
Name:
Title:

SURETY

Name: _____

Witness or Attest: Address: _____

Name:

(Corporate Seal)

By: _____(SEAL)
Name:
Title:

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF FISH AND WILDLIFE

SECTION 3I

PAYMENT BOND

Bond Number: _____

KNOW ALL PERSONS BY THESE PRESENTS, that we, _____, as principal (“**Principal**”), and _____, a _____ corporation, legally authorized to do business in the State of Delaware, as surety (“**Surety**”), are held and firmly bound unto the **Department of Natural Resources and Environmental Control, Division of Fish and Wildlife** (“**Owner**”), in the amount of _____ (\$ _____), to be paid to **Owner**, for which payment well and truly to be made, we do bind ourselves, our and each and every of our heirs, executors, administrations, successors and assigns, jointly and severally, for and in the whole firmly by these presents.

Sealed with our seals and dated this _____ day of _____, 2016.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH, that if **Principal**, who has been awarded by **Owner** that certain contract known as Contract No. NAT201502/TED.HARVEY dated the _____ day of _____, 2016 (the “Contract”), which Contract is incorporated herein by reference, shall well and truly pay all and every person furnishing materials or performing labor or service in and about the performance of the work under the Contract, all and every sums of money due him, her, them or any of them, for all such materials, labor and service for which **Principal** is liable, shall make good and reimburse **Owner** sufficient funds to pay such costs in the completion of the Contract as **Owner** may sustain by reason of any failure or default on the part of **Principal**, and shall also indemnify and save harmless **Owner** from all costs, damages and expenses arising out of or by reason of the performance of the Contract and for as long as provided by the Contract; then this obligation shall be void, otherwise to be and remain in full force and effect.

Surety, for value received, for itself and its successors and assigns, hereby stipulates and agrees that the obligation of **Surety** and its bond shall be in no way impaired or affected by any extension of time, modification, omission, addition or change in or to the Contract or the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provisions thereof, or by any assignment, subletting or other transfer thereof or of any work to be performed or any monies due or to become due thereunder; and **Surety** hereby waives notice of any and all such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers and hereby expressly stipulates and agrees that any and all things done and omitted to be done by and in relation to assignees, subcontractors, and other transferees shall have the same effect as to **Surety** as though done or omitted to be done by or in relation to **Principal**.

Surety hereby stipulates and agrees that no modifications, omission or additions in or to the terms of the Contract shall in any way whatsoever affect the obligation of **Surety** and its bond.

Any proceeding, legal or equitable, under this Bond may be brought in any court of competent jurisdiction in the State of Delaware. Notices to **Surety** or Contractor may be mailed or delivered to them at their respective addresses shown below.

IN WITNESS WHEREOF, **Principal** and **Surety** have hereunto set their hand and seals, and such of them as are corporations have caused their corporate seal to be hereto affixed and these presents to be signed by their duly authorized officers, the day and year first above written.

PRINCIPAL

Name: _____

Witness or Attest: Address: _____

Name:

(Corporate Seal)

By: _____(SEAL)
Name:
Title:

SURETY

Name: _____

Witness or Attest: Address: _____

Name:

(Corporate Seal)

By: _____(SEAL)
Name:
Title:

SECTION 3 J

DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENTAL CONTROL

89 KINGS HIGHWAY

DOVER, DE 19901

CONTRACT DOCUMENT

FOR

TED HARVEY CONSERVATION AREA

ENHANCEMENT PROJECT

CONTRACT NO. NAT201502/TED.HARVEY

THIS AGREEMENT, made and executed this _____ day of _____, 2016, by and between _____ (Hereinafter designated as Contractor) party of the first part, and the Department of Natural Resources and Environmental Control, a Department created under the laws of the State of Delaware (hereinafter designated as Department) party of the second part.

WITNESSETH that the Contractor, in consideration of the covenants and agreements herein contained and made by the Department, agrees to the following:

ARTICLE ONE. The Contractor shall provide and furnish all the material, supplies, machinery, implements, appliances, tools and labor required to complete this contract in Kent County, State of Delaware, as shown and specified in the specifications, proposals, drawings or plans as indicated in the project manual issued for the Department, with specifications, proposals, drawings or plans entitled **TED HARVEY CONSERVATION AREA ENHANCEMENT PROJECT CONTRACT NO. NAT201502/TED.HARVEY** is hereby incorporated by reference as part of this contract. This contract will be binding on both parties upon receipt by the Contractor of an approved State of Delaware Purchase Order. The Contractor must prosecute the work in such order as to complete levee raising no later than July 1, 2017 (including alternative 3 if awarded). The Contractor must prosecute the work in such order as to complete water control structure installation alternatives 1 and 2 (if awarded) no later than October 1, 2017.

CONTRACT DOCUMENT (CONTINUED)

IN WITNESS WHEREOF, the said parties have duly executed this agreement in triplicate the day and year first above written.

IN WITNESS WHEREOF, the parties below have hereunto set their hands on the _____ day of _____, 2016.

Contractor

Witness

By: _____
Title

State of _____
County of _____

Sworn and subscribed before me this _____ day of _____, 2016.

Notary Public

IN WITNESS WHEREOF, the parties below have hereunto set their hands on the _____ day of _____, 2016.

Witness

Project Manager
Division of Fish and Wildlife

State of _____
County of _____

Sworn and subscribed before me this _____ day of _____, 2016.

Notary Public

CONTRACT DOCUMENT (CONTINUED)

IN WITNESS WHEREOF, the parties below have hereunto set their hands on the _____ day of _____, 2016.

Witness

Director, Division of Fish and Wildlife

State of _____
County of _____

Sworn and subscribed before me this _____ day of _____, 2016.

Notary Public

Witness

Secretary, Department of
Natural Resources &
Environmental Control

State of _____
County of _____

Sworn and subscribed before me this _____ day of _____, 2016.

Notary Public

STATE OF DELAWARE

EMPLOYEE DRUG TESTING REPORT FORM

Period Ending: _____

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds submit Testing Report Forms to the Owner no less than quarterly.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

Number of employees who worked on the jobsite during the report period: _____

Number of employees subject to random testing during the report period: _____

Number of Negative Results _____ Number of Positive Results _____

Action taken on employee(s) in response to a failed or positive random test:

Authorized Representative of Contractor/Subcontractor: _____
(typed or printed)

Authorized Representative of Contractor/Subcontractor: _____
(signature)

Date: _____

STATE OF DELAWARE

**EMPLOYEE DRUG TESTING
REPORT OF POSITIVE RESULTS**

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds to notify the Owner in writing of a positive random drug test.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

Name of employee with positive test result: _____

Last 4 digits of employee SSN: _____

Date test results received: _____

Action taken on employee in response to a positive test result:

Authorized Representative of Contractor/Subcontractor: _____
(typed or printed)

Authorized Representative of Contractor/Subcontractor: _____
(signature)

Date: _____

This form shall be sent by mail to the Owner within 24 hours of receipt of test results.

Enclose this test results form in a sealed envelope with the notation "Drug Testing Form – DO NOT OPEN" on the face thereof and place in a separate mailing envelope.

APPENDIX 1
PAYROLL REPORT SAMPLE

APPENDIX 2
GEO TECHNICAL REPORTS

GEO-TECHNOLOGY ASSOCIATES, INC.

GEOTECHNICAL AND
ENVIRONMENTAL CONSULTANTS

A Practicing Geoprofessional Business Association Member Firm



June 10, 2015

Moffatt & Nichol
2700 Lighthouse Point East, Suite 501
Baltimore, Maryland 21224

Attn: Mr. Peter Kotulak, P.E.

Re: Subsurface Exploration
Ted Harvey Conservation Area Restoration Project
Kent County, Delaware

Gentlemen:

In accordance with our agreement dated January 27, 2015, Geo-Technology Associates, Inc. (GTA) has performed a subsurface exploration for the eroded levee and emergency spillway located along the St. Jones River, within the Ted Harvey Conservation Area in Kent County, Delaware. The exploration consisted of performing Standard Penetration Test (SPT) borings at 9 locations and one hand auger boring along the levee and adjacent to the spillway in order to collect subsurface data for engineering analysis. The results of the field testing, laboratory analyses, and our geotechnical recommendations regarding restoration of the levee and spillway are included in this report.

Sincerely,
GEO-TECHNOLOGY ASSOCIATES, INC.

Timothy Hill
Project Manager

Meghan Lester, P.E.
Vice President

TH/ML/amd
150371
Attachments

18 Boulden Circle, Suite 36, New Castle, DE 19720 (302) 326-2100 Fax: (302) 326-2399

◆ Abingdon, MD ◆ Laurel, MD ◆ Frederick, MD ◆ Waldorf, MD ◆ Sterling, VA ◆ Fredericksburg, VA ◆ Somerset, NJ ◆ NYC Metro
◆ New Castle, DE ◆ Georgetown, DE ◆ York, PA ◆ Quakertown, PA ◆ Towanda, PA ◆ Malvern, OH ◆ Williston, ND ◆ Charlotte, NC

Visit us on the web at www.gtaeng.com



REPORT OF GEOTECHNICAL EXPLORATION

**TED HARVEY CONSERVATION AREA
RESTORATION PROJECT**

Kent County, Delaware

June 2015

Prepared For:

MOFFATT & NICHOL
2700 Lighthouse Point East, Suite 500
Baltimore, Maryland 21224

Prepared By:

GEO-TECHNOLOGY ASSOCIATES, INC.
Geotechnical and Environmental Consultants
18 Boulden Circle, Suite 36
New Castle, Delaware 19720
(302) 326-2100
GTA Job No: 150371

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REPORT OF GEOTECHNICAL EXPLORATION

TED HARVEY CONSERVATION AREA RESTORATION PROJECT KENT COUNTY, DELAWARE JUNE 2015

INTRODUCTION

This report presents the results of the geotechnical exploration performed along the existing levee berms and emergency spillway adjacent to the St. Jones River at the Ted Harvey Conservation Area, in Kent County, Delaware. The levee is located in the southern portion of the Ted Harvey Conservation Area and generally extends from the southern end of the existing spillway approximately 4000 feet east towards Delaware Bay. Geo-Technology Associates, Inc. (GTA) understands that the existing levee has undergone some erosion and may have stability issues. We understand that the Delaware Department of Natural Resources and Environmental Control is considering restoring the levee. In addition, DNREC intends to upgrade the emergency spillway. No survey plans were available for the berm embankments at the time this report was prepared; however, it is understood that the levee will be reconstructed to an elevation of approximately 8 feet NAVD.

GTA was retained to perform a geotechnical exploration of the existing levee berms and emergency spillway area. The scope of this study included a field exploration, laboratory testing, and engineering analyses. Included in our field exploration were Standard Penetration Test (SPT) borings and a hand auger boring drilled at 10 locations within the spillway and levee berms to depths of approximately 10 to 50 feet below the existing berm elevation. Limited laboratory testing was performed to verify the visual classifications and characterize general subsurface conditions. Conclusions and recommendations regarding the site were derived from engineering analysis of field and laboratory data, and review of available aerial photographs.

SITE DESCRIPTION

The subject site is generally situated south of Kitts Hummock Road within the Ted Harvey Conservation Area in Kent County, Delaware. Specifically, the emergency spillway and levee berm which were the focus of this investigation are located adjacent to the northern bank of the St. Jones River within the Ted Harvey Conservation Area. The specific areas investigated

included approximately 1,000 feet of berm within the emergency spillway area and about 4,000 feet of berm along the levee alignment adjacent to the St. Jones River. The general location of the site and surrounding features are shown on *Figure 1: Site Location Map*, in Appendix A.

The general area is a tidal and fresh water marsh that is close to mean sea level with top of berm elevations estimated to be about Elevation (EL) 3 to 5. The upland areas and farmland in the vicinity of the spillway and levee are at about EL 3 to 10. Two control structures (weirs) were identified at the eastern and western ends of the levee. No survey of the area was available at the time this report was prepared. However, based visual observations and data obtained from Google Earth imagery the levee berm appears to be about 40 to 70 feet wide at the base and approximately 10 to 20 feet wide at the top.

RELEVANT GEOLOGY

Based on the Geologic Map of Kent Castle County, Delaware (2007), prepared by the Delaware Geological Survey (DGS), the area is situated in the Coastal Plain Physiographic Province, which is characterized by undifferentiated and interlayered sedimentary deposits. Specifically the site is mapped as underlain by Holocene Age marsh deposits. These materials are described as structureless to finely laminated, black to dark gray, organic-rich, silty clay to clayey silt, with discontinuous beds of peat and rare shells. The deposit ranges from 1 to 40 feet thick and is generally mapped where there is salt-tolerant marsh grass present. Refer to the publication for further information.

SUBSURFACE EXPLORATION

The subsurface exploration was conducted March 24, 2015 through April 23, 2015. The field exploration included drilling nine Standard Penetration Test (SPT) borings and one hand auger boring, designated as TH-1 through TH-10, at evenly spaced intervals along the centerline of the emergency spillway and levee berms. The test borings were drilled to depths of approximately 35 to 50 feet below the existing ground surface using an ATV-mounted CME 550X drill rig equipped with hollow stem augers and an auto-trip hammer. Due to a breach in the levee, one of the borings (TH-10) had limited access and was performed with hand auger equipment. The hand auger was performed to a depth of approximately 10 feet below the

existing ground surface. The test locations were selected and field located by GTA by measuring from existing site features. Elevations were interpolated from Google Earth image are should be considered approximate. The approximate test boring locations are indicated on the attached *Exploration Location Plan, Figure 2*.

Standard Penetration Testing was performed in the boreholes, with soil samples obtained at approximate 2-foot intervals in the upper 10 feet and at 5-foot intervals thereafter. Standard Penetration Testing involves driving a 2-inch O.D., 1½-inch I.D. split-spoon sampler with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler 24 inches was recorded in 4 intervals of 6 inches. The total number of hammer blows required to drive the sampler from the 6 to 18 inch interval is the SPT N-value. Uncorrected blow counts are noted on the logs.

Also, undisturbed samples of fine-grained soils were obtained using a thin-wall tube sampler in general accordance with ASTM D1587. The thin-wall (Shelby tube) sampling procedure consisted of slowly pushing a 3-inch O.D. tube into the soil, waiting for a period of about 15 minutes, manually rotating the sampler, and then retrieving the tube. Three Shelby Tube samples were obtained during the investigation. One Shelby Tube sample was obtained at boring location TH-4 at a depth of 13 to 15 feet below ground surface, another Shelby Tube sample was obtained at boring location TH-7 at a depth of 8 to 10 feet below ground surface and the last Shelby Tube sample was obtained at boring location TH-9 at a depth of 8 to 10 feet below ground surface. Recoveries of the undisturbed samples were 100 percent, 60 percent and 86 percent, respectively.

Detailed descriptions of the encountered subsurface conditions are indicated on the individual boring logs, which are included in Appendix B. The soil samples retrieved from the borings were brought to GTA's laboratory for visual classification by engineering personnel and limited laboratory testing. The soil descriptions indicated on the logs are based on visual observations of the individual soil samples using the Unified Soil Classification System (ASTM D2488) as summarized in the *Notes for Exploration Logs* included in Appendix B, supplemented by the laboratory test results.

SUBSURFACE CONDITIONS

In general agreement with the known site conditions and the published geology, test borings TH-1 through TH-10 encountered approximately 2 to 8 feet of fill materials comprised primarily of silt and sand mixtures with varying amounts gravel and/or organic matter. The fill materials were generally encountered in a soft/very loose to stiff/medium dense state and were underlain by very soft to stiff, organic and elastic silts and clays. The very soft to stiff organic and elastic silts and clays were encountered to depths ranging from 33 to 50 feet. Loose silty sand and poorly-graded sand layers were encountered below the organic silts and clays at test locations TH-1 and TH-7, respectively. These sand layers extended to the maximum depth explored (35 feet).

Unconfined compressive strengths of the fine grained soils recovered from the split spoon samples were estimated using a Pocket Penetrometer. Pocket Penetrometer values indicated unconfined compressive strengths varying between less than 200 psf in the very soft soils and 1000 psf in the soft to medium stiff soils. These values correlate to undrained shear strengths varying from less than 100 to about 500 psf.

Groundwater was initially encountered during drilling at depths ranging from 2.2 to 13 feet below existing surface grades. Subsequent groundwater readings after removal of the augers were recorded at depths ranging from 3 to 10 feet below existing surface grades. The boreholes at test locations TH-3, TH-6 and TH-9 caved dry at depths ranging from about 0.7 to 4 feet following removal of the augers. The groundwater elevation likely fluctuates with the level of the water in the St. Jones River and tidal changes in Delaware Bay.

LABORATORY ANALYSIS

Selected samples obtained from the borings were tested for particle-size distribution, Atterberg Limits, natural moisture content, organic content and consolidation characteristics. The particle-size distribution and Atterberg Limits testing were performed on samples to determine their classification using the Unified Soil Classification System (USCS), which provides information regarding soil's engineering behavior. The results of the testing are summarized in the table below.

SUMMARY OF INDEX TESTING

BORING	DEPTH (FEET)	USCS CLASSIFICATION	LL%	PI%	NMC%
TH-2	6 to 8	Organic CLAY with Sand (OH)	73	39	63.2
TH-4	2 to 4	Organic SILT (OH)	107	59	114.6
TH-6	23 to 25	Organic CLAY (OH)	90	53	82.4
TH-7	8 to 10	Organic SILT with Sand (OH)	82	44	105.4
TH-9	13 to 15	Organic CLAY (OH)	136	85	136.0

LL=Liquid Limit; PI=Plasticity Index; NP=Non-plastic; NMC=Natural Moisture Content

The particle size distribution reports are included in Appendix C. One sample selected from Test Boring TH-6 was tested for organic content. The organic content based on a dry weight basis was determined to be 4.8%. The compression index (c_c), coefficients of consolidation (c_v) under specific load conditions, and initial void ratio (e_o) were also calculated, and are indicated on the consolidation test report included in Appendix C.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the boring and laboratory data, there is a 10-foot to greater than 44-foot thick layer of very soft to soft compressible silts and clays below the levee berm. We have considered that this layer is normally consolidated so any new load from regrading and/or berm reconstruction activities will cause additional settlement. Given the width and configuration of the of the levee embankment, there is an adequate factor of safety for slope stability under normal pool conditions and rapid draw down conditions provided no significant changes are made in geometry of the berm.

Estimated settlement at the end of primary consolidation due to an imposed load equal to 5 feet of new embankment fill ranges from about ½ to 1½ feet. Very soft/organic soils typically exhibit large secondary compression settlements under a constant load, and this mechanism is dominant after primary consolidation is complete. Settlements due to secondary compression were estimated to range from about ½ to 2 inches over a period of 30 years, in addition to the ½- to 1½-foot of settlement expected after 90 percent consolidation is achieved.

Grading Activities

At the time this report was prepared, proposed grading changes to the berm were not available. Given the limited work area and the site constraints, filling the embankment and placing additional fill as necessary as settlement occurs is likely the most cost-effective and practical solution to providing the desired freeboard.

Prior to placing any new fill to raise or widen the levee berm, the upstream and downstream face of the slope would need to be cleared and grubbed. Prior to the placement of compacted fill, the area should be stripped to remove any vegetation, organic material, surface debris, or other unsuitable materials from the cartway and slopes. Any surficial materials identified as unstable or unsuitable should be undercut to stable stratum and backfilled with controlled, compacted fill as recommended in the field by the Geotechnical Engineer. Fill should be placed in lifts and be compacted in accordance with the specifications included in this report. The stripping of organics, proofrolling, undercutting of any uncontrolled or unsuitable material, and placement of controlled, compacted fill should be observed by a Geotechnical Engineer or their qualified representative. Off-site borrow, should meet Unified Soil Classification System (USCS) designation ML, CL, SC, SM, or GM. The contractor should provide a sample of the borrow materials to the engineer for testing and approval. All borrow sources should be approved by the geotechnical engineer prior to hauling the material to the site. Structural fill should be placed and compacted to a minimum of 92 percent of the Standard Proctor (ASTM D698) maximum dry density.

Upon satisfactory evaluation of the subgrade, structural fill should be placed in lifts and compacted in accordance with the specifications included in this report. The materials will typically need to be within 3 to 4 percentage points of the optimum moisture before compactive effort is applied. Positive drainage should be maintained on the site during construction to reduce the potential for subgrade degradation due to ponding water. Depending on the moisture content at the time of construction, the soils could require drying to reduce the moisture content to within the required working range for compaction. All structural fill should be constructed in maximum 8-inch thick loose lifts.

The embankment materials shall be spread in level, continuous, horizontal layers for the width and length of such portion at that elevation. Where the lift ties back into an existing slope steeper than 5H:1V, the layer should be keyed or benched into the existing slope. Additionally, GTA recommends that the embankment faces be filled steeper than proposed then reshaped or shaved to their intended design slope. Also, during construction, any previously placed and compacted materials which have become soft or loose due to exposure to weather, which contain erosion channels or cracks, or which are excessively dry, shall be reworked or removed before successive lifts are placed.

Based on the results of the test borings and laboratory analyses, it is anticipated that soft and unstable soils will be encountered below the surficial vegetation along portions of the levee berm. Where these soft and unstable conditions are identified during site preparation activities, the subgrade soils will likely require undercutting and stabilization using geogrids or high strength geotextiles and free draining granular fill. The slopes should generally be limited to 3H:1V (horizontal:vertical) or flatter if the toe of the slope extends into open waterways to reduce the potential for a bearing capacity failure. Due to the soft and compressible nature of the underlying soils and the anticipated variability in the fill placement quantities required to achieve the proposed design elevation, it is anticipated that some differential settlements or localized subsidence may occur after the new embankment fill is placed. Therefore, GTA recommends that a periodic evaluation and maintenance program be implemented to assess and correct any potential areas that may be exhibiting signs of differential settlement or subsidence that could result in a breach of the levee. More specific details for staging, sequence of construction, and instrumentation or monitoring can be provided to address the soft ground issues once a concept plan is prepared.

Control Structures

Due to the very soft/compressible deposits in the upper 15 to 40+ feet, a deep foundation system which bypasses the fill and compressible deposits and derives its support from the underlying natural granular soils will be necessary for support of new control structures. Pile loads of up to 15 tons are anticipated for the structures. Therefore, it is our opinion that treated timber piles would be the most economical pile type to use on this project. Treated, southern

pine timber piles with a minimum tip diameter of seven inches and minimum butt diameter of 13 inches may be designed for vertical allowable capacities of up to 15 tons when driven to the required capacity within the medium dense sand. A downdrag load of up to 5 tons was considered in the pile capacities due to settlement of the soft/organic soils in the upper 15 to 40+ feet caused by the 5 feet of new fill. Individual pile spacing should be no closer than 3 pile diameters or 3 feet to maintain a group efficiency of one. The piles should conform to the requirements of ASTM D25 for the structural properties of the pile and should be pressure treated in accordance with AWPA C-3 specifications. Pile lengths are expected to range from 45 to 65 feet below the design cutoff elevation to achieve this capacity, depending on the locations of the new structures. We recommend that grading activities be mostly complete prior to pile installation.

The piles should be driven through the organic and soft stratum and into the underlying natural granular soils using a pile driving hammer which delivers a rated energy generally ranging from 16,000 to 25,000 foot-pounds per blow. The piles should be driven to the resistance required by an approved driving formula to achieve the required design capacity. During driving, pore pressures in the granular soils will increase resulting in a temporary reduction of shear stress in the soil and the pile capacity. As pore pressures dissipate, the actual pile capacity will increase. This phenomenon is known as the "pile set up". Therefore, if the estimated depths are reached and the driving criterion has not been met, the piles should be allowed to sit a minimum of 24 hours to allow pore pressures to dissipate. After the "pile set up" time, the piles can be re-struck to evaluate if the driving criteria has been met. If possible, the driving resistance should be maintained for at least 12 inches. Also, the piles should generally penetrate a minimum of 10 feet into the bearing stratum regardless of the driving resistance unless practical refusal is encountered. If practical, test piles can be driven at or near the proposed outlet structures to better estimate the required lengths based on the final design capacity prior to delivering all of the production piles so that adjustments can be made to the delivered lengths. However, the contract documents should make it the sole responsibility of the pile drive to deliver adequate length piles to the site.

All pile driving operations should be observed by a qualified geotechnical engineer or their representative who is familiar with the site conditions and design criteria.

Instrumentation

During grading activities and embankment reconstruction, instrumentation consisting of settlement plates and piezometers should be installed and monitored. A minimum of three settlement plates should be placed on the subgrade soils before placing structural fill for the building pad. The settlement monuments should be constructed of ¼-inch, 18-inch x 18-inch, or larger, steel plate set at or near the current subgrade elevation. Threaded ¾- to 1-inch diameter steel pipe should be welded vertically to the plate. A PVC casing pipe should be placed over the steel pipe to isolate it from the fill. Additional pipe can be added as needed using threaded pipe couplers as the fill is placed. A detail sketch of a settlement monument can be prepared, if necessary.

Surveyed elevation readings should be shot to the nearest 0.005 foot at least prior to and during fill placement. After fill placement, surveyed elevations should be made weekly. The monument riser pipes should be well marked and protected to avoid disturbance by construction traffic. The survey data should be provided to the geotechnical engineer for review.

In addition to the settlement plates, piezometers equipped with pore pressure transducers and/ or vibrating wires can be installed into the alluvial layer at several locations. Weekly readings can be performed to monitor pore pressure dissipation during consolidation. The piezometers and pore pressure readings can be used to better understand the subsurface drainage and to refine the time-rate settlement model using actual field data.

CONSTRUCTION MONITORING SCOPE

We recommended that during final design and construction of the subject project, GTA be retained to provide consultation and observation and testing during construction generally as follows.

- Review final civil plans and specifications to evaluate if they conform to the intent of this report.

- Provide recommendations for an instrumentation program if deemed appropriate based on the final design.
- Provide installation and review of instrumentation during construction to evaluate soft ground response during loading.
- Observe the proof-rolling of the embankment to evaluate stability.
- Provide on-site observation and testing of structural fill.

LIMITATIONS

This report has been prepared for the exclusive use of Moffatt & Nichol in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made. Use and reproduction of this report by any other person without the expressed written permission of GTA and Moffatt & Nichol is unauthorized and such use is at the sole risk of the user.

The analysis and recommendations contained in this report are based on the data obtained from the test borings. The test borings indicate soil conditions only at specific locations and times and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between the test boring locations. If variations in subsurface conditions from those described are noted during construction, recommendations in this report may need to be re-evaluated.

In the event that any changes in the nature, design, or location of the facilities are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report are verified in writing. Geo-Technology Associates, Inc. is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or reuse of the subsurface data or engineering analysis without the express written authorization of Geo-Technology Associates, Inc.

The scope of our services for this geotechnical exploration did not include any environmental assessment or investigation for the presence or absence of wetlands, or hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site.

Any statements in this report or on the logs regarding odors or unusual or suspicious items or conditions observed are strictly for the information of our Client.

This report and the attached logs are instruments of service. If certain conditions or items are noted during our investigation, Geo-Technology Associates, Inc. may be required by prevailing statutes to notify and provide information to regulatory or enforcement agencies. Geo-Technology Associates, Inc. will notify our Client should a required disclosure condition exist.

150371

GEO-TECHNOLOGY ASSOCIATES, INC.

Important Information About Your Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

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

Read the Full Report

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

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

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

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

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

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

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

Subsurface Conditions Can Change

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

Most Geotechnical Findings Are Professional Opinions

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

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

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

Do Not Redraw the Engineer's Logs

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

Give Contractors a Complete Report and Guidance

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

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

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

Obtain Professional Assistance To Deal with Mold

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

Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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APPENDIX A



JOB NUMBER:
150371

FIGURE:
2

REVIEW BY:
ML

SCALE:
NTS

DATE:
JUNE 2015

EXPLORATION LOCATION PLAN
TED HARVEY CONSERVATION AREA
RESTORATION PROJECT
KENT COUNTY, DELAWARE

GEO-TECHNOLOGY ASSOCIATES, INC.
Geotechnical and Environmental Consultants
 18 Boulden Circle, Suite 36
 New Castle, Delaware 19720
 (302) 326-2100
 Fax (302) 326-2399

Key:

 **TH-#** Number and approximate location of Test Borings performed for this study

Notes: (1) Layout was obtained from Google Earth Imagery, Inc from July 2010.
 (2) Exploration Location Plan should be read together with GTA Report Job No. 150371 for complete evaluation.





Notes:

- 1) Base map obtained from Google Earth Imagery, Inc. from July 2010



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Geotechnical and Environmental Consultants
 18 Boulden Circle, Suite 36
 New Castle, Delaware 19720
 (302) 326-2100
 Fax (302) 326-2399

SITE LOCATION MAP
TED HARVEY CONSERVATION AREA
RESTORATION PROJECT
KENT COUNTY, DELAWARE

SCALE

NTS

DATE

JUNE 2015

DRAWN BY

GOOGLE

REVIEW BY

ML

JOB NO.

150371

FIGURE NO.

1

APPENDIX B

NOTES FOR EXPLORATION LOGS

KEY TO USCS TERMINOLOGY AND GRAPHIC SYMBOLS

MAJOR DIVISIONS (BASED UPON ASTM D 2488)			SYMBOLS	
			GRAPHIC	LETTER
COARSE - GRAINED SOILS	GRAVEL AND GRAVELY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% PASSING THE NO. 200 SIEVE)		GW
		GRAVELS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)		GP
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% PASSING THE NO. 200 SIEVE)		SW
		SANDS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)		SP
		SANDS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)		SM
		SANDS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)		SC
FINE - GRAINED SOILS	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	SILT OR CLAY (<15% RETAINED THE NO. 200 SIEVE)		ML
		SILT OR CLAY WITH SAND OR GRAVEL (15% TO 30% RETAINED THE NO. 200 SIEVE)		CL
		SANDY OR GRAVELLY SILT OR CLAY (>30% RETAINED THE NO. 200 SIEVE)		OL
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50	SILT OR CLAY (<15% RETAINED THE NO. 200 SIEVE)		MH
		SILT OR CLAY WITH SAND OR GRAVEL (15% TO 30% RETAINED THE NO. 200 SIEVE)		CH
		SANDY OR GRAVELLY SILT OR CLAY (>30% RETAINED THE NO. 200 SIEVE)		OH
HIGHLY ORGANIC SOILS				PT

NOTE: DUAL SYMBOLS ARE USED TO INDICATE COARSE-GRAINED SOILS CONTAINING AN ESTIMATED 10% FINES BY VISUAL CLASSIFICATION OR WHEN THE SOIL HAS BETWEEN 5 AND 12 PERCENT FINES FROM LABORATORY TESTS; AND FOR FINE-GRAINED SOILS WHEN THE PLOT OF LIQUID LIMIT & PLASTICITY INDEX VALUES FALLS IN THE PLASTICITY CHART'S CROSSHATCHED AREA. RESULTS OF LABORATORY TESTING ARE USED TO SUPPLEMENT THE CLASSIFICATION OF THE SOILS BASED ON THE VISUAL-MANUAL PROCEDURES OF ASTM D2488.

ADDITIONAL TERMINOLOGY AND GRAPHIC SYMBOLS

ADDITIONAL DESIGNATION	DESCRIPTION		GRAPHIC SYMBOLS
	DESCRIPTION	"N" VALUE	
ADDITIONAL DESIGNATION	TOPSOIL		
	MAN-MADE FILL		
	GLACIAL TILL		
	COBBLES AND BOULDERS		
RESIDUAL SOIL DESIGNATION	HIGHLY WEATHERED ROCK	50 TO 50/1"	
	PARTIALLY WEATHERED ROCK	MORE THAN 50 BLOWS FOR 1" PENETRATION, AUGER PENETRABLE	

COARSE-GRAINED SOILS (GRAVEL AND SAND)

DESIGNATION	BLOWS PER FOOT (BPF) "N"
VERY LOOSE	0 - 4
LOOSE	5 - 10
MEDIUM DENSE	11 - 30
DENSE	31 - 50
VERY DENSE	>50

NOTE: "N" VALUE DETERMINED AS PER ASTM D1586

FINE-GRAINED SOILS (SILT AND CLAY)

CONSISTENCY	BPF "N"
VERY SOFT	<2
SOFT	2 - 4
MEDIUM STIFF	5 - 8
STIFF	9 - 15
VERY STIFF	16 - 30
HARD	>30

NOTE: ADDITIONAL DESIGNATIONS TO ADVANCE SAMPLER INDICATED IN BLOW COUNT COLUMN:
WOH = WEIGHT OF HAMMER
WOR = WEIGHT OF ROD(S)

SAMPLE TYPE

DESIGNATION	SYMBOL
SPLIT-SPOON	S-
SHELBY TUBE	U-
ROCK CORE	R-

WATER DESIGNATION

DESCRIPTION	SYMBOL
ENCOUNTERED DURING DRILLING	
UPON COMPLETION OF DRILLING	
24 HOURS AFTER COMPLETION	

NOTE: WATER OBSERVATIONS WERE MADE AT THE TIME INDICATED. POROSITY OF SOIL STRATA, WEATHER CONDITIONS, SITE TOPOGRAPHY, ETC. MAY CAUSE WATER LEVEL CHANGES.

LOG OF BORING NO. TH-1

Sheet 1 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ **8.5** ∇ **13.0** ∇ **4.0**
 DATE: **3/24/15** **3/24/15** **3/26/15**
 CAVED (ft): **In Auger** **N/A** **N/A**

DATE STARTED: **3/24/15**
 DATE COMPLETED: **3/24/15**
 DRILLING CONTRACTOR: **GTA**
 DRILLER: **D. Hans**
 DRILLING METHOD: **Hollow Stem Auger**
 SAMPLING METHOD: **Split Spoon**

WATER ENCOUNTERED DURING DRILLING (ft) ∇ **8.5**
 GROUND SURFACE ELEVATION: **3 ft**
 DATUM: **Google Earth**
 EQUIPMENT: **CME550X**
 LOGGED BY: **T. Hill**
 CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION		REMARKS
									DESCRIPTION		
S-1	0.0	8	3-6-8-9	14	3.0	0	FILL		Brown, moist, medium dense, silty sand FILL, trace gravel		
S-2	2.0	8	3-5-6-5	11					Same		
S-3	4.0	2	3-6-5-6	11		5			Brown, wet, medium dense, gravely sand with silt FILL	∇	
S-4	6.0	11	7-5-7-7	12					Same		
S-5	8.0	15	2-3-4-4	7	-5.0	10	SM		Brown, moist, loose, Silty SAND	∇	
S-6	13.0	12	WH/18	WH/18		15			Gray, wet, very loose, Silty SAND, trace gravel	∇	
S-7	18.0	10	1-1-1-1	2		20			Same		
S-8	23.0	20	2-2-2-2	4	-20.0	25	OL		Dark brown, wet, soft organic SILT/PEAT with root fibers		
S-9	28.0	15	1-2-1-2	3		30			Same		

NOTES: Elevation and location should be considered approximate.



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 New Castle, DE 19720

LOG OF BORING NO. TH-1

Sheet 1 of 2

LOG OF BORING NO. TH-1

Sheet 2 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): 8.5 13.0 4.0
 DATE: 3/24/15 3/24/15 3/26/15
 CAVED (ft): In Auger N/A N/A

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	
									DESCRIPTION	REMARKS
S-10	33.0	13	2-2-2-3	4	-30.0		SM		Green and gray, moist, loose, Silty SAND	
					-32.0	35			Boring terminated at 35.0 feet	
						40				
						45				
						50				
						55				
						60				
						65				



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LOG OF BORING NO. TH-1

Sheet 2 of 2

LOG OF BORING NO. TH-10

Sheet 1 of 1

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): _____
 DATE: _____
 CAVED (ft): _____

DATE STARTED: **4/23/15**
 DATE COMPLETED: **4/23/15**
 DRILLING CONTRACTOR: **GTA**
 DRILLER: _____
 DRILLING METHOD: _____
 SAMPLING METHOD: _____

WATER ENCOUNTERED DURING DRILLING (ft) **2.2**
 GROUND SURFACE ELEVATION: **4 ft**
 DATUM: **Google Earth**
 EQUIPMENT: **Hand Auger**
 LOGGED BY: **T. Hill**
 CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION		REMARKS
									DESCRIPTION		
					4.0	0	FILL		Gray, moist, organic clay FILL, trace root fibers		
					2.0		OL		Gray, wet, Organic SILT, trace root fibers		
						5			Same, some root fibers		
					-6.0	10			Auger boring terminated at 10 feet		
						15					
						20					
						25					
						30					

NOTES: Elevation and location should be considered approximate.



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LOG OF BORING NO. TH-10

Sheet 1 of 1

LOG OF BORING NO. TH-2

Sheet 1 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ 13 ∇ 12.5 ∇ 3.0
 DATE: 3/24/15 3/24/15 3/26/15
 CAVED (ft): In Auger N/A N/A

DATE STARTED: **3/24/15**
 DATE COMPLETED: **3/24/15**
 DRILLING CONTRACTOR: **GTA**
 DRILLER: **D. Hans**
 DRILLING METHOD: **Hollow Stem Auger**
 SAMPLING METHOD: **Split Spoon**

WATER ENCOUNTERED DURING DRILLING (ft) ∇ **13.0**
 GROUND SURFACE ELEVATION: **4 ft**
 DATUM: **Google Earth**
 EQUIPMENT: **CME550X**
 LOGGED BY: **T. Hill**
 CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION		REMARKS
									DESCRIPTION		
S-1	0.0	9	1-5-6-6	11	4.0	0	FILL		Brown, moist, medium dense, silty sand FILL, trace gravel		
S-2	2.0	5	4-3-4-5	7					Same		∇
S-3	4.0	1	3-5-3-3	8		5			Same		
S-4	6.0	4	2-3-3-3	6	-2.0		OH		Dark brown, moist, medium stiff, Organic CLAY with sand		
S-5	8.0	0	WH/24	WH/24	-4.0				no recovery		
						10					
S-6	13.0	1	WH/24	WH/24	-9.0		OL		Dark brown, moist, medium stiff, organic SILT with root fibers		∇ ∇
						15			Same		
S-7	18.0	14	1-1-1-1	2		20					
S-8	23.0	5	WH/24	WH/24	-19.0		ML		Gray, wet, very soft SILT with Sand		
						25					
S-9	28.0	22	WH/24	WH/24		30			Same		

NOTES: Elevation and location should be considered approximate.



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LOG OF BORING NO. TH-2

Sheet 1 of 2

LOG OF BORING NO. TH-2

Sheet 2 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ 13 ∇ 12.5 ∇ 3.0
 DATE: **3/24/15** **3/24/15** **3/26/15**
 CAVED (ft): **In Auger** **N/A** **N/A**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS GRAPHIC SYMBOL	DESCRIPTION	REMARKS
S-10	33.0	26	WH/24	WH/24	-29.0	35	CL	Gray, wet, very soft, organic CLAY, trace roots	
S-11	38.0	23	WH/24	WH/24		40	CL	Same	
S-12	43.0	24	1-1-2-2	3	-39.0	45	ML	Dark brown, wet, soft, organic SILT, trace root fibers	
S-13	48.0	24	WH/24	WH/24	-44.0	50	CL	Dark gray, wet, very soft, organic CLAY, trace root fibers	
					-46.0	50		Boring terminated at 50.0 feet	
						55			
						60			
						65			



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LOG OF BORING NO. TH-2

Sheet 2 of 2

LOG OF BORING NO. TH-3

Sheet 1 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ **13** ∇ **9.5** ∇ **Dry**
 DATE: 3/24/15 3/24/15 3/26/15
 CAVED (ft): In Auger N/A 1.0

DATE STARTED: **3/24/15**
 DATE COMPLETED: **3/25/15**
 DRILLING CONTRACTOR: **GTA**
 DRILLER: **D. Hans**
 DRILLING METHOD: **Hollow Stem Auger**
 SAMPLING METHOD: **Split Spoon**

WATER ENCOUNTERED DURING DRILLING (ft) ∇ **13.0**
 GROUND SURFACE ELEVATION: **4 ft**
 DATUM: **Google Earth**
 EQUIPMENT: **CME550X**
 LOGGED BY: **T. Hill**
 CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS GRAPHIC SYMBOL	DESCRIPTION		REMARKS
S-1	0.0	13	2-3-12-10	15	4.0	0	FILL	Brown, moist, medium dense, gravely sand FILL		
S-2	2.0	12	4-3-2-2	5	1.0		OL	Dark brown, moist, medium stiff, organic SILT with root fibers		
S-3	4.0	7	1-1-1-2	2		5		Same, soft		
S-4	6.0	11	1-1-1-1	2				Same		
S-5	8.0	2	WH/24	WH/24		10		Same, very soft		∇
S-6	13.0	13	WH/24	WH/24	-9.0		MH	Gray, wet, very soft, Elastic SILT with root fibers		∇
S-7	18.0	20	WH/24	WH/24		20		Same, trace gravel		
S-8	23.0	18	WH/24	WH/24		25		Same, no gravel		
S-9	28.0	24	WH/24	WH/24		30		Same		

NOTES: Elevation and location should be considered approximate.



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LOG OF BORING NO. TH-3

Sheet 1 of 2

LOG OF BORING NO. TH-3

Sheet 2 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ 13 ∇ 9.5 ∇ Dry
 DATE: 3/24/15 3/24/15 3/26/15
 CAVED (ft): In Auger N/A 1.0

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
S-10	33.0	24	WH/24	WH/24		35			Same	
S-11	38.0	24	WH/24	WH/24		40			Same, less root fibers	
					-36.0	40			Boring terminated at 40.0 feet	
						45				
						50				
						55				
						60				
						65				



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18 Boulden Circle, Suite 36
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LOG OF BORING NO. TH-3

Sheet 2 of 2

LOG OF BORING NO. TH-4

Sheet 1 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ **3.0** ∇ **6.0** ∇ **3.5**
 DATE: **3/25/15** **3/25/15** **3/26/15**
 CAVED (ft): **In Auger** **N/A** **N/A**

DATE STARTED: **3/25/15**
 DATE COMPLETED: **3/25/15**
 DRILLING CONTRACTOR: **GTA**
 DRILLER: **D. Hans**
 DRILLING METHOD: **Hollow Stem Auger**
 SAMPLING METHOD: **Split Spoon**

WATER ENCOUNTERED DURING DRILLING (ft) ∇
 GROUND SURFACE ELEVATION: **4 ft**
 DATUM: **Google Earth**
 EQUIPMENT: **CME550X**
 LOGGED BY: **T. Hill**
 CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS GRAPHIC SYMBOL	DESCRIPTION		REMARKS
								DESCRIPTION	REMARKS	
S-1	0.0	6	1-2-2-2	4	4.0	0	FILL	Gray, moist, soft, sandy silt with organic fibers	FILL	
S-2	2.0	15	2-2-2-2	4	2.0	2.0	OH	Gray, wet, soft, Organic SILT		∇
S-3	4.0	3	WH/24	WH/24	5	5		Same, very soft		∇
S-4	6.0	24	WH/24	WH/24				Same		∇
S-5	8.0	11	WH/24	WH/24	-4.0		CH	Gray, wet, very soft, Fat CLAY with Sand		
U-1	13.0	24				10				Tube 13-15 feet 100% recovery
S-7	18.0	24	WH/24	WH/24	-14.0	14.0	MH	Gray, wet, very soft, Elastic SILT with root fibers		
S-8	23.0	24	WH/24	WH/24		20		Same		
S-9	28.0	24	WH/24	WH/24		25		Same		
						30				

NOTES: Elevation and location should be considered approximate.



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 18 Boulden Circle, Suite 36
 New Castle, DE 19720

LOG OF BORING NO. TH-4

Sheet 1 of 2

LOG OF BORING NO. TH-4

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft):	3.0	6.0	3.5
DATE:	3/25/15	3/25/15	3/26/15
CAVED (ft):	In Auger	N/A	N/A

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
S-10	33.0	24	WH/24	WH/24	-31.0	35			Same	
									Boring terminated at 35.0 feet	



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LOG OF BORING NO. TH-5

Sheet 1 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ **8.0** ∇ **13.0** ∇ **4.5**
 DATE: 3/25/15 3/25/15 3/26/15
 CAVED (ft): In Auger N/A N/A

DATE STARTED: **3/25/15**
 DATE COMPLETED: **3/25/15**
 DRILLING CONTRACTOR: **GTA**
 DRILLER: **D. Hans**
 DRILLING METHOD: **Hollow Stem Auger**
 SAMPLING METHOD: **Split Spoon**

WATER ENCOUNTERED DURING DRILLING (ft) ∇ **8.0**
 GROUND SURFACE ELEVATION: **4 ft**
 DATUM: **Google Earth**
 EQUIPMENT: **CME550X**
 LOGGED BY: **T. Hill**
 CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION		REMARKS
S-1	0.0	4	2-2-2-2	4	4.0	0	FILL		Gray, moist, soft, sandy silt FILL with root fibers		
S-2	2.0	13	1-1-1-1	2	1.0		MH		Gray, wet, soft, Elastic SILT with root fibers		
S-3	4.0	2	WH/24	WH/24		5					∇
S-4	6.0	9	WH/24	WH/24		-3.0	OL		Dark brown, wet, soft, organic SILT with abundant root fibers (peat)		∇
S-5	8.0	11	WH/24	WH/24		-5.0	CH		Gray, wet, very soft, Fat CLAY with Sand, trace root fibers		
						10					
S-6	13.0	16	WH/24	WH/24		15			Same		∇
S-7	18.0		WH/24	WH/24		20			Same		
S-8	23.0	24	WH/24	WH/24		25			Same		
S-9	28.0	24	WH/24	WH/24		30			Same		

NOTES: Elevation and location should be considered approximate.



GEO-TECHNOLOGY ASSOCIATES, INC.

18 Boulden Circle, Suite 36
 New Castle, DE 19720

LOG OF BORING NO. TH-5

Sheet 1 of 2

LOG OF BORING NO. TH-5

Sheet 2 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft):	8.0	13.0	4.5
DATE:	3/25/15	3/25/15	3/26/15
CAVED (ft):	In Auger	N/A	N/A

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
S-10	33.0	24	WH/24	WH/24	-31.0	35		▨	Same	
									Boring terminated at 35.0 feet	



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 New Castle, DE 19720

LOG OF BORING NO. TH-5

Sheet 2 of 2

LOG OF BORING NO. TH-6

Sheet 1 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ **4.5** ∇ **Dry** ∇ **BOC**
 DATE: **3/26/15** **3/26/15** **3/26/15**
 CAVED (ft): **In Auger** **4.0**

DATE STARTED: **3/26/15**
 DATE COMPLETED: **3/26/15**
 DRILLING CONTRACTOR: **GTA**
 DRILLER: **D. Hans**
 DRILLING METHOD: **Hollow Stem Auger**
 SAMPLING METHOD: **Split Spoon**

WATER ENCOUNTERED DURING DRILLING (ft) ∇ **4.5**
 GROUND SURFACE ELEVATION: **4 ft**
 DATUM: **Google Earth**
 EQUIPMENT: **CME550X**
 LOGGED BY: **T. Hill**
 CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION		REMARKS
S-1	0.0	4	1-1-1-1	2	4.0	0	FILL		Brown, moist, soft, sandy silt FILL with abundant root fibers		
S-2	2.0	11	1-1-1-1	2		2.0	OL		Dark brown, moist, soft, organic SILT with root fibers		
S-3	4.0	2	WH/24	WH/24		0.0	CH		Gray, wet, very soft, Fat CLAY with Sand and trace root fibers	∇	
S-4	6.0	1	WH/24	WH/24					Same		
S-5	8.0	11	WH/24	WH/24		-4.0	OH		Dark gray, wet, Organic CLAY, trace root fibers		
						10			Same		
S-6	13.0	13	WH/24	WH/24		15			Same		
S-7	18.0	24	WH/24	WH/24		-14.0	MH		Dark brown, wet, very soft, Elastic SILT with some root fibers		
						20			Same		
S-8	23.0	21	WH/24	WH/24		25			Same		
S-9	28.0	24	WH/24	WH/24		30			Same, abundant root fibers		

NOTES: Elevation and location should be considered approximate.



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LOG OF BORING NO. TH-6

Sheet 1 of 2

LOG OF BORING NO. TH-6

Sheet 2 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ 4.5 ∇ Dry ∇ BOC
 DATE: 3/26/15 3/26/15 3/26/15
 CAVED (ft): In Auger 4.0

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
S-10	33.0	24	WH/24	WH/24	-31.0	35			Same	
									Boring terminated at 35.0 feet	
						40				
						45				
						50				
						55				
						60				
						65				



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LOG OF BORING NO. TH-6

Sheet 2 of 2

LOG OF BORING NO. TH-7

Sheet 1 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ 6.0 ∇ 5.0 ∇ BOC
 DATE: 3/26/15 3/26/15
 CAVED (ft): In Auger N/A

DATE STARTED: **3/26/15**
 DATE COMPLETED: **3/26/15**
 DRILLING CONTRACTOR: **GTA**
 DRILLER: **D. Hans**
 DRILLING METHOD: **Hollow Stem Auger**
 SAMPLING METHOD: **Split Spoon**

WATER ENCOUNTERED DURING DRILLING (ft) ∇
 GROUND SURFACE ELEVATION: **4 ft**
 DATUM: **Google Earth**
 EQUIPMENT: **CME550X**
 LOGGED BY: **T. Hill**
 CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION		REMARKS
									DESCRIPTION		
S-1	0.0	2	1-2-1-1	3	4.0	0	FILL		Brown, moist, very loose, silty sand FILL with abundant root fibers		<div style="text-align: right;"> ∇ ∇ ∇ </div> Tube 8 - 10 feet 60% recovery
S-2	2.0	1	1-1-1-1	2					Same		
S-3	4.0	1	WH/24	WH/24	0.0	5	PT		Brown, moist, very loose, PEAT		
S-4	6.0	24	WH/24	WH/24	-2.0		OH		Gray, wet, very soft, organic CLAY with abundant root fibers		
U-1	8.0	18					OH		Dark Gray, wet, Organic SILT with sand		
						10			Same		
S-6	13.0	10	WH/24	WH/24		15			Same		
S-7	18.0	22	WH/24	WH/24		20			Same		
S-8	23.0	24	WH/24	WH/24		25			Same		
S-9	28.0	24	1-1-2-2	3	-24.0	30	CH		Gray, wet, soft, Sandy Fat CLAY		

NOTES: Elevation and location should be considered approximate.



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18 Boulden Circle, Suite 36
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LOG OF BORING NO. TH-7

Sheet 1 of 2

LOG OF BORING NO. TH-7

Sheet 2 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): 6.0 5.0 BOC
 DATE: 3/26/15 3/26/15
 CAVED (ft): In Auger N/A

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
S-10	33.0	24	2-3-5-7	8	-30.0	35	SP		Same	
					-31.0				Gray, wet, loose, Poorly-graded SAND	
									Boring terminated at 35.0 feet	
						40				
						45				
						50				
						55				
						60				
						65				



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 18 Boulden Circle, Suite 36
 New Castle, DE 19720

LOG OF BORING NO. TH-7

Sheet 2 of 2

LOG OF BORING NO. TH-8

Sheet 1 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ **5.0** ∇ **10.0** ∇ _____
 DATE: **3/27/15** **3/27/15** _____
 CAVED (ft): **In Auger** **N/A** _____

DATE STARTED: **3/27/15**
 DATE COMPLETED: **3/27/15**
 DRILLING CONTRACTOR: **GTA**
 DRILLER: **D. Hans**
 DRILLING METHOD: **Hollow Stem Auger**
 SAMPLING METHOD: **Split Spoon**

WATER ENCOUNTERED DURING DRILLING (ft) ∇ _____
 GROUND SURFACE ELEVATION: **4 ft**
 DATUM: **Google Earth**
 EQUIPMENT: **CME550X**
 LOGGED BY: **T. Hill**
 CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION		REMARKS
									DESCRIPTION		
S-1	0.0	8	1-1-2-2	3	4.0	0	FILL		Brown, moist, soft, organic silt FILL with root fibers		
S-2	2.0	11	2-2-2-2	4	2.0	2.0	OL		Gray, moist, soft, organic SILT with abundant root fibers		
S-3	4.0	8	WH/24	WH/24		5			Same, wet		∇
S-4	6.0	10	WH/24	WH/24					Same (Peat)		
S-5	8.0	1	WH/24	WH/24		10			Same		∇
S-6	13.0	7	WH/24	WH/24	-9.0	15	MH		Gray, wet, very soft, Elastic SILT, trace root fibers		
S-7	18.0	10	WH/24	WH/24		20			Same		
S-8	23.0	24	WH/24	WH/24		25			Same, no root fibers		
S-9	28.0	24	WH/24	WH/24		30			Same		

NOTES: Elevation and location should be considered approximate.



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 18 Boulden Circle, Suite 36
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LOG OF BORING NO. TH-8

Sheet 1 of 2

LOG OF BORING NO. TH-8

Sheet 2 of 2

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ 5.0 ∇ 10.0 ∇ _____
 DATE: 3/27/15 3/27/15 _____
 CAVED (ft): In Auger N/A _____

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
S-10	33.0	24	WH/24	WH/24	-31.0	35			Same	
									Boring terminated at 35.0 feet	



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 18 Boulden Circle, Suite 36
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LOG OF BORING NO. TH-8

Sheet 2 of 2

LOG OF BORING NO. TH-9

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): 6.0 Dry BOC
 DATE: 3/27/15 3/27/15 3/27/15
 CAVED (ft): In Auger 0.7

DATE STARTED: **3/27/15**
 DATE COMPLETED: **3/27/15**
 DRILLING CONTRACTOR: **GTA**
 DRILLER: **D. Hans**
 DRILLING METHOD: **Hollow Stem Auger**
 SAMPLING METHOD: **Split Spoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽
 GROUND SURFACE ELEVATION: **4 ft**
 DATUM: **Google Earth**
 EQUIPMENT: **CME550X**
 LOGGED BY: **T. Hill**
 CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION		REMARKS
									DESCRIPTION		
S-1	0.0	10	1-1-1-1	2	4.0	0	FILL		Gray, very moist, soft, organic silt FILL with root fibers		
S-2	2.0	14	1-2-2-2	4	2.0	2.0	ML		Black, moist, soft, Sandy SILT with root fibers		
S-3	4.0	12	1-2-2-2	4	0.0	5	OH		Brown, moist, soft, Organic CLAY with trace to some root fibers		
S-4	6.0	10	2-2-2-2	4					Same, gray, wet		▽
U-1	8.0	26				10					Tube 8-10 feet 86% recovery
S-6	13.0	16	WH/24	WH/24		15	OH		Gray, wet, very soft, Organic CLAY		
S-7	18.0	17	WH/24	WH/24		20			Same		
S-8	23.0	24	WH/24	WH/24		25			Same, less fibers		
S-9	28.0	24	WH/24	WH/24		30			Same		

NOTES: Elevation and location should be considered approximate.



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LOG OF BORING NO. TH-9

LOG OF BORING NO. TH-9

PROJECT: **Ted Harvey Conservation Area**
 PROJECT NO.: **150371**
 PROJECT LOCATION: **Kent County, Delaware**

WATER LEVEL (ft): ∇ **6.0** ∇ **Dry** ∇ **BOC**
 DATE: **3/27/15** **3/27/15** **3/27/15**
 CAVED (ft): **In Auger** **0.7**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
S-10	33.0	24	WH/24	WH/24	-31.0	35		Same		
									Boring terminated at 35.0 feet	
						40				
						45				
						50				
						55				
						60				
						65				



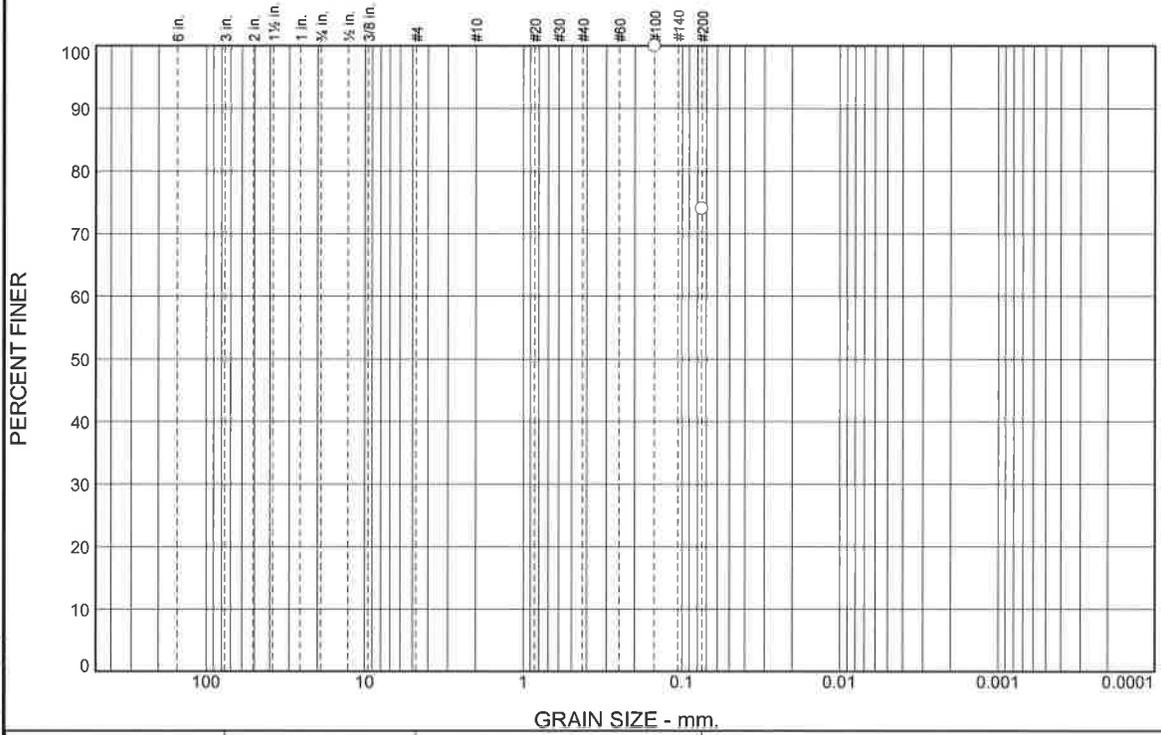
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LOG OF BORING NO. TH-9

APPENDIX C

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	26.1	73.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#100	100.0		
#200	73.9		

(no specification provided)

Soil Description

Dark brown, moist, Organic CLAY with sand

Atterberg Limits

PL= 34 LL= 73 PI= 39 NM= 63.2

Coefficients

D₉₀= 0.1150 D₈₅= 0.1007 D₆₀=
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Classification

USCS= OH AASHTO= A-7-5(31)

Remarks

Source of Sample: TH-2 Depth: 6.0
Sample Number: S-4

Date: 4/6/2015



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New Castle, DE 19720

Client: Moffatt & Nichol
Project: Ted Harvey Conservation Area

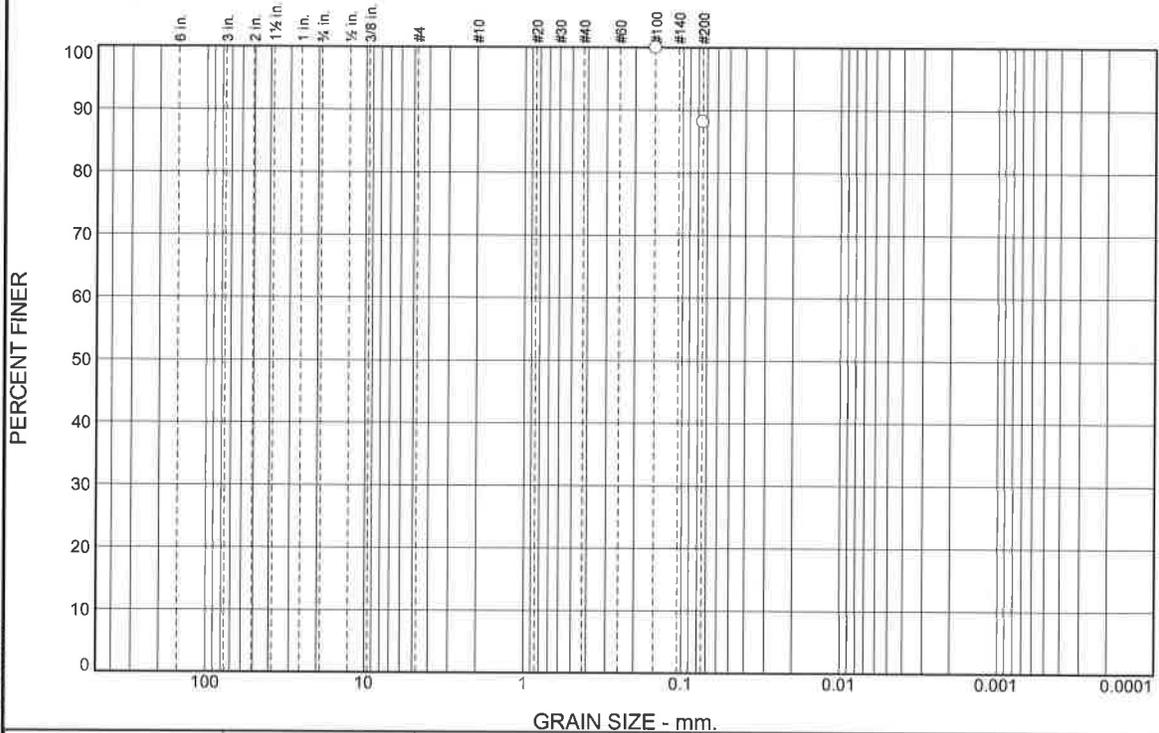
Project No: 150371

Figure 3

Tested By: J. Friant Checked By: M. Lester

ASTM Specifications performed may include D421, D422, D2216, D2217 and D4318.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	11.9		88.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#100	100.0		
#200	88.1		

* (no specification provided)

Soil Description

Gray, wet, soft, Organic SILT

Atterberg Limits

PL= 48 LL= 107 PI= 59 NM= 114.6

Coefficients

D₉₀= 0.0838 D₈₅= D₆₀=
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Classification

USCS= OH AASHTO= A-7-5(64)

Remarks

Source of Sample: TH-4 Depth: 2.0
Sample Number: S-2

Date: 4/6/2015



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New Castle, DE 19720

Client: Moffatt & Nichol
Project: Ted Harvey Conservation Area

Project No: 150371

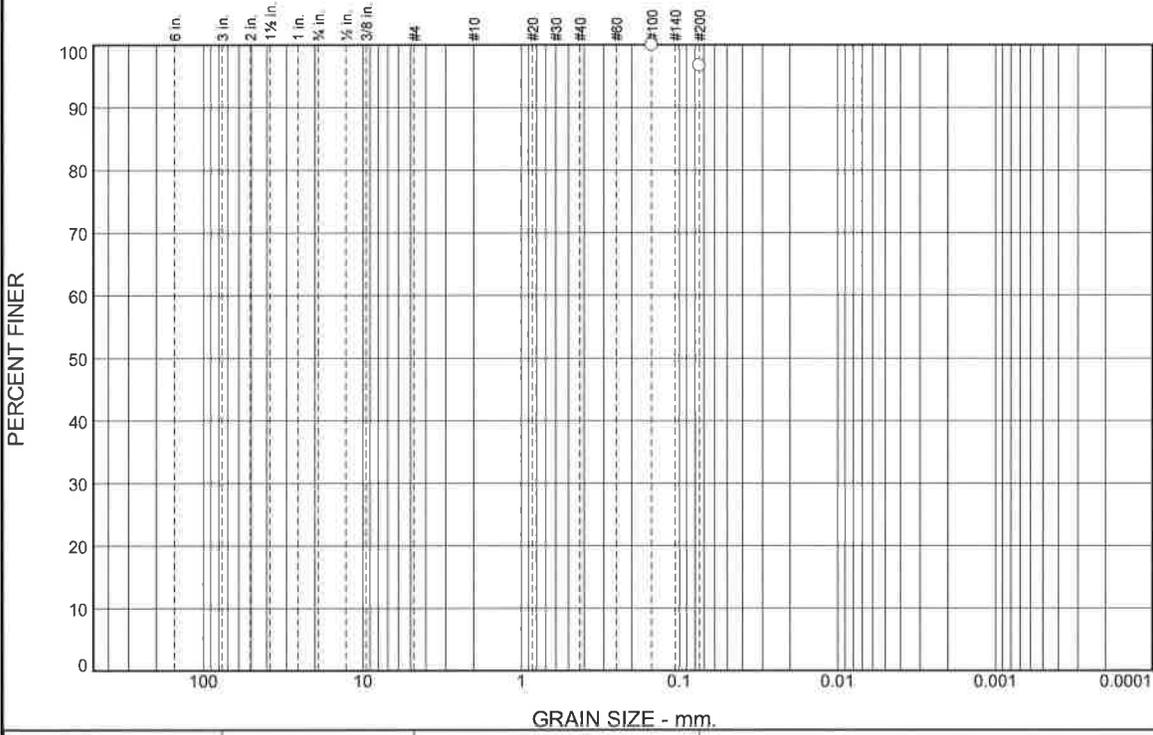
Figure 4

ASTM Specifications performed may include D421, D422, D2216, D2217 and D4318.

Tested By: J. Friant

Checked By: M. Lester

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	3.4	96.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#100	100.0		
#200	96.6		

Soil Description

Dark Gray, wet, Organic CLAY

Atterberg Limits

PL= 37 LL= 90 PI= 53 NM= 82.4

Coefficients

D₉₀= D₈₅= D₆₀=
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Classification

USCS= OH AASHTO= A-7-5(63)

Remarks

Organic Content =4.75%

* (no specification provided)

Source of Sample: TH-6 Depth: 8.0
Sample Number: S-5

Date: 4/6/2015



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New Castle, DE 19720

Client: Moffatt & Nichol
Project: Ted Harvey Conservation Area

Project No: 150371

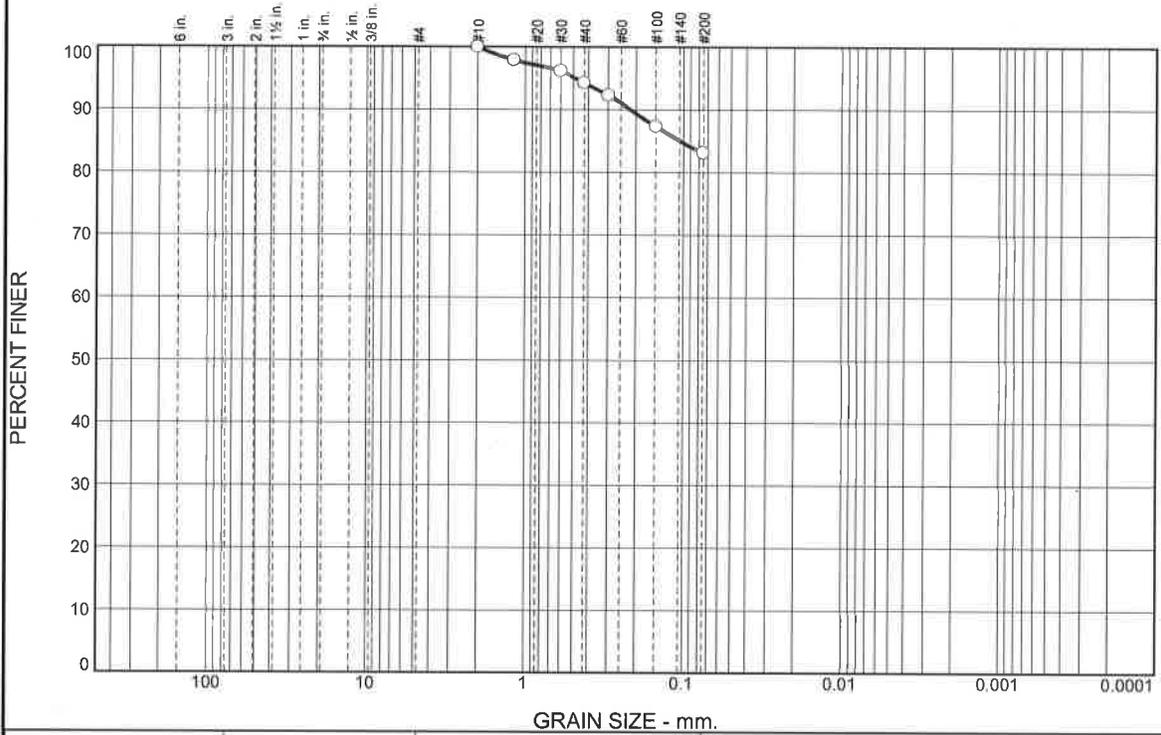
Figure 5

ASTM Specifications performed may include D421, D422, D2216, D2217 and D4318.

Tested By: J. Friant Checked By: M. Lester

ASTM Specifications performed may include D421, D422, D2216, D2217 and D4318.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	5.7	11.2		83.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	97.9		
#30	96.1		
#40	94.3		
#50	92.3		
#100	87.3		
#200	83.1		

* (no specification provided)

Soil Description

Dark Gray, wet, Organic SILT with sand

Atterberg Limits

PL= 38 LL= 82 PI= 44 NM= 105.4

Coefficients

D₉₀= 0.2158 D₈₅= 0.1047 D₆₀=
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Classification

USCS= OH AASHTO= A-7-5(43)

Remarks

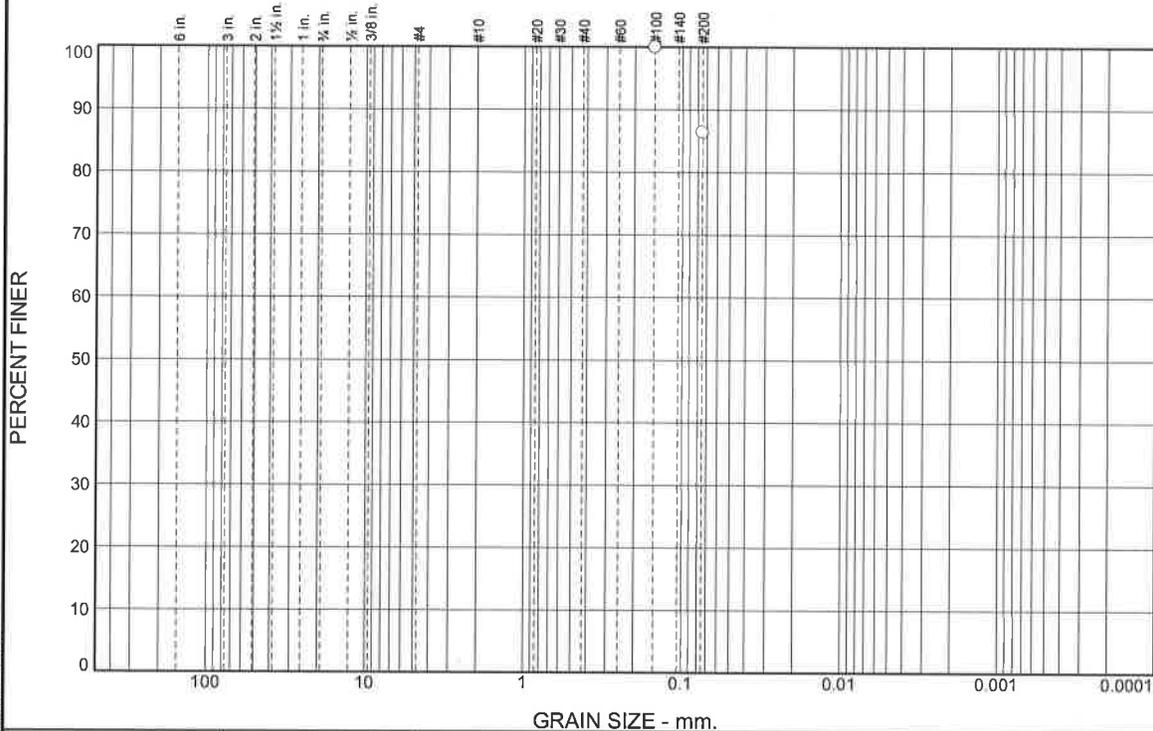
Dry Unit Weight = 41.46 pcf

Source of Sample: TH-7 Depth: 8.0 Date: 4/14/2015
Sample Number: U-1

	GEO-TECHNOLOGY ASSOCIATES, INC. 18 Boulden Circle, Suite 36 New Castle, DE 19720	Client: Moffatt & Nichol Project: Ted Harvey Conservation Area Project No: 150371
		Figure 6

Tested By: J. Day Checked By: M. Lester

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	13.7	86.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#100	100.0		
#200	86.3		

* (no specification provided)

Soil Description

Gray, wet, very soft, Organic CLAY

Atterberg Limits

PL= 51 LL= 136 PI= 85 NM= 136.0

Coefficients

D₉₀= 0.0904 D₈₅= D₆₀=
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Classification

USCS= OH AASHTO= A-7-5(88)

Remarks

Source of Sample: TH-9 Depth: 13.0
Sample Number: S-6

Date: 4/6/2015



GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

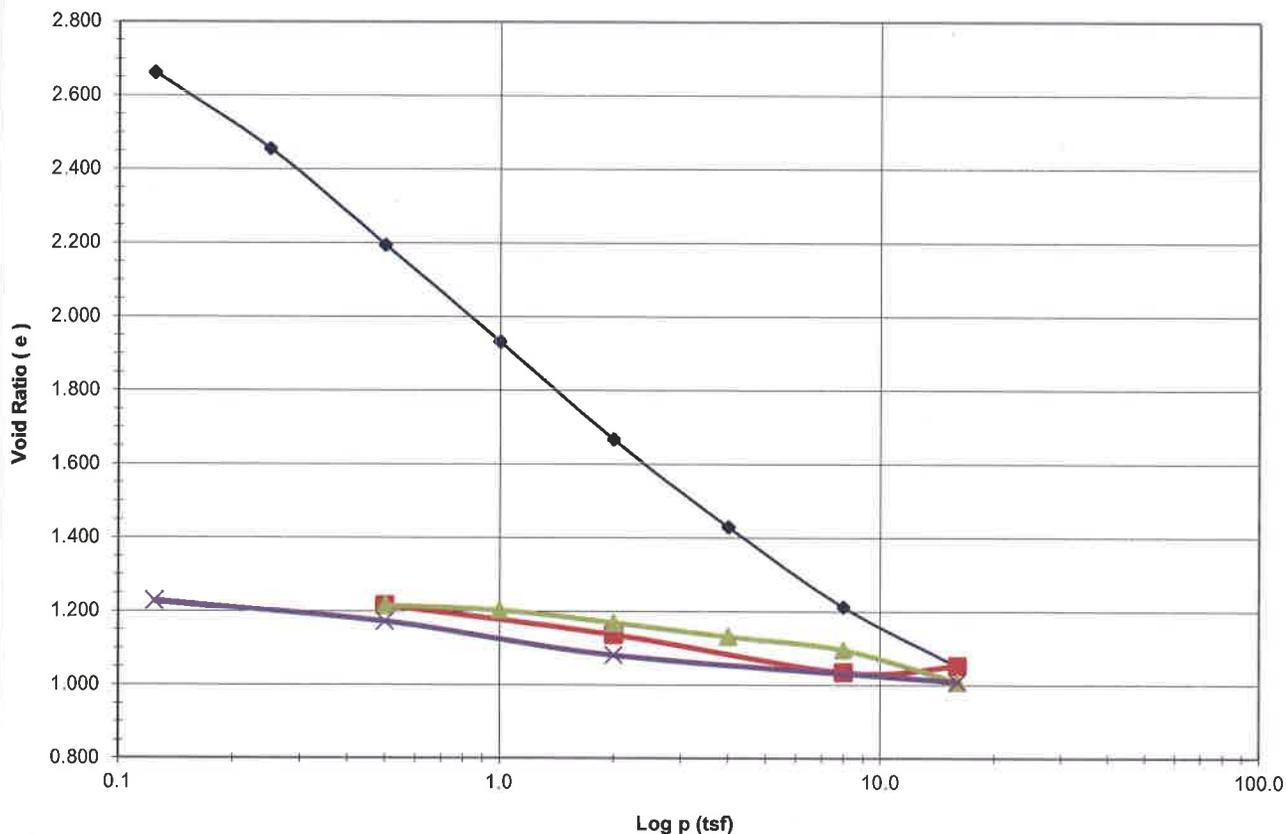
Client: Moffatt & Nichol
Project: Ted Harvey Conservation Area
Project No: 150371

Figure 7

ASTM Specifications performed may include D421, D422, D2216, D2217 and D4318.

Tested By: J. Friant Checked By: M. Lester

e vs log p



Test	Load	Cv	Test	Load	Cv	Test	Load	Cv
1	0.5 TSF	0.009						
2	1.0 TSF	0.008						
3	2.0 TSF	0.015						

Specimen Identification	Classification (USCS)	Dry Density (pcf)	Natural Moisture	LL (%)	PI (%)
TH-7, U-1, 8 to 10 feet	OH	41.5	105.4%	82	44

Remarks: Test performed in general accordance with ASTM D2345. Cv values in feet squared per day.
 Maximum past pressure = 460 psf
 Cc = 0.877



Geo-Technology Associates, Inc.
 18 Boulden Circle, Suite 36
 New Castle, Delaware 19720
 Telephone: (302) 326-2100
 Fax: (302) 326-2399

CONSOLIDATION TEST REPORT

Project: Ted Harvey Conservation Area
 Client: Moffatt & Nichol
 Number: 150371

APPENDIX 3

PREVAILING WAGE RATE DETERMINATION

STATE OF DELAWARE
DEPARTMENT OF LABOR
DIVISION OF INDUSTRIAL AFFAIRS
OFFICE OF LABOR LAW ENFORCEMENT
PHONE: (302) 451-3423

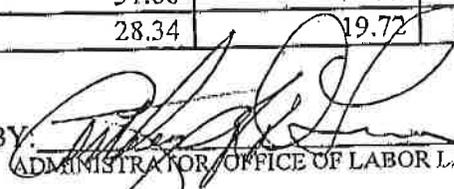
Mailing Address:
225 CORPORATE BOULEVARD
SUITE 104
NEWARK, DE 19702

Located at:
225 CORPORATE BOULEVARD
SUITE 104
NEWARK, DE 19702

PREVAILING WAGES FOR HEAVY CONSTRUCTION
EFFECTIVE MARCH 13, 2015 - AMENDED JULY 15, 2015

CLASSIFICATION	NEW CASTLE	KENT	SUSSEX
ASBESTOS WORKERS	21.14	18.60	40.43
BOILERMAKERS	73.62	30.73	56.37
BRICKLAYERS	44.98	22.19	23.83
CARPENTERS	51.86	51.86	41.22
CEMENT FINISHERS	43.00	23.30	16.00
ELECTRICAL LINE WORKERS	62.75	26.30	62.75
ELECTRICIANS	63.60	63.60	63.60
GLAZIERS	19.54	16.96	11.48
INSULATORS	53.38	53.38	53.38
IRON WORKERS	60.12	60.12	55.78
LABORERS	40.95	40.95	40.95
MILLWRIGHTS	65.23	65.23	51.80
PAINTERS	75.26	75.26	75.26
PILEDRIVERS	71.17	37.64	29.30
PLASTERERS	18.40	15.97	10.80
PLUMBERS/PIPEFITTERS/STEAMFITTERS	76.78	76.78	17.12
POWER EQUIPMENT OPERATORS	59.81	59.81	59.81
SHEET METAL WORKERS	29.40	18.23	17.13
SPRINKLER FITTERS	31.68	11.99	9.93
TRUCK DRIVERS	28.34	19.72	21.40

CERTIFIED: 2/22/16

BY: 
ADMINISTRATOR, OFFICE OF LABOR LAW ENFORCEMENT

NOTE: THESE RATES ARE PROMULGATED AND ENFORCED PURSUANT TO THE PREVAILING WAGE REGULATIONS ADOPTED BY THE DEPARTMENT OF LABOR ON APRIL 3, 1992.

CLASSIFICATIONS OF WORKERS ARE DETERMINED BY THE DEPARTMENT OF LABOR. FOR ASSISTANCE IN CLASSIFYING WORKERS, OR FOR A COPY OF THE REGULATIONS OR CLASSIFICATIONS, PHONE: (302) 451-3423.

NON- REGISTERED APPRENTICES MUST BE PAID THE MECHANICS RATE.

Project: NAT201502/Ted.Harvey - Ted Harvey Conservation Area Enhancement Project - Kent County, DE

APPENDIX 4

**DNREC SUBAQUEOUS PERMIT &
COASTAL MANAGEMENT CONSISTENCY REVIEW**



STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES &
ENVIRONMENTAL CONTROL
DIVISION OF WATER
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

WETLANDS & SUBAQUEOUS
LANDS SECTION

TELEPHONE (302)739-9943
FACSIMILE (302)739-6304

January 21, 2016

DNREC Division of Fish and Wildlife
c/o: Jeremey Ashe
89 Kings Highway
Dover, DE 19901

RE: SP-385/15A and WE-386/15A: Addendum to Subaqueous Lands Permit and Wetlands Permit issued to DNREC Division of Fish and Wildlife, this addendum allows for the placement of an additional 11,000 cubic yards of fill within the same foot print of the approved dike repair. The addendum also approves the removal of rip-rap and the placement of new rip-rap at the aprons of the coffer dam.

Dear Mr. Ashe:

This letter is to serve as an addendum to the above-referenced permit. By this letter, the Wetlands and Subaqueous Lands Section authorizes the construction details to be modified as described in the revised approved plans dated January 13, 2016. The new drawings (33 sheets) approved on January 21, 2016 shall replace the previously approved drawings (28 sheets) dated November 25, 2015. The purpose of this addendum is to update the quantity of fill and rip-rap per the 95% design for the project.

All other terms and conditions of the Permit remain in full force and effect.

A copy of this letter, the approved plans and the approved Permit must be available on-site at all times during the construction. This authorization may be revoked upon violation of any of the permit conditions.

Sincerely,

A blue ink handwritten signature of Steven M. Smailer, consisting of a large, stylized 'S' followed by a horizontal line.

Steven M. Smailer
Section Manager
Wetlands & Subaqueous
Lands Section

Delaware's good nature depends on you!



STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES &
ENVIRONMENTAL CONTROL
DIVISION OF WATER
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

WETLANDS & SUBAQUEOUS
LANDS SECTION

TELEPHONE (302) 739-9943
FACSIMILE (302) 739-6304

DEC - 7 2015

DNREC Division of Fish & Wildlife
co: Jeremy Ashe
89 Kings Highway
Dover, DE 19901
Re: Subaqueous and Wetlands Permit: SP-385/15, WE-386/15

Dear Mr. Ashe:

Enclosed are the Subaqueous Lands Permit and Wetlands Permit granted by the State of Delaware. Please read carefully all Special and General Permit Conditions. The Permittee is responsible to ensure that all conditions are strictly adhered to.

Please be advised that the Permittee is required to submit the Contractors Completion Report within ten (10) days from completion of construction of the above referenced permit.

If you have any questions, please feel free to contact this office at 302-739-9943.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Tyler Brown', with a long horizontal flourish extending to the right.

Tyler Brown
Program Manager
Wetlands & Subaqueous Lands Section

Delaware's good nature depends on you!



STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES &
ENVIRONMENTAL CONTROL
DIVISION OF WATER
89 KINGS HIGHWAY
DOVER, DELAWARE 19901



WETLANDS AND SUBAQUEOUS PERMIT
CONTRACTOR'S COMPLETION REPORT
POST-CONSTRUCTION

Subaqueous Lands Lease No.: WE-386/15, SP-385/15

Scientist: Tyler Brown

Name: DNREC Division of Fish & Wildlife

Project Description: TO REPAIR AND EXPAND APPROXIMATELY 5,000 LINEAR FEET OF EXISTING DIKES CONSISTING OF 29,000 CUBIC YARDS OF MATERIAL, TO ADD A NEW DITCH PLUG CONSISTING OF 1,000 CUBIC YARDS OF MATERIAL, TO REPAIR AND IMPROVE TWO WATER CONTROL STRUCTURES AND THE ASSOCIATED SHEET PILING AROUND THE STRUCTURES IN THE TED HARVEY SOUTH IMPOUNDMENT, WITHIN THE TED HARVEY WILDLIFE AREA, KENT COUNTY, DE

I hereby certify that I have constructed the project authorized by the above-referenced Permit/Lease in accordance with the approved plans for the project.

Printed Name of Contractor

Name of Company

Contractor's Signature

Date

Daytime Telephone Number

Upon completion of construction, this form shall be completed, signed by the contractor, and mailed to the Wetlands and Subaqueous Lands Section at:

**DNREC
Wetlands and Subaqueous Lands Section
89 Kings Highway
Dover, Delaware 19901**

Or faxed to the Wetlands and Subaqueous Lands Section at: 302/739-6304

This form must be received by the Department within ten days of the date that construction is completed. Once the form has been received, the Department will call the contractor's telephone number listed above to confirm receipt.

For official use only

Compliance inspection date _____ Built in accordance with plans Yes No Scientist

Delaware's good nature depends on you!



STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES &
ENVIRONMENTAL CONTROL
DIVISION OF WATER
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

WETLANDS & SUBAQUEOUS
LANDS SECTION

TELEPHONE (302) 739-9943
FACSIMILE (302) 739-6304

Subaqueous Lands Permit No.: SP-385/15
Wetlands Permit No.: WE-386/15
Date of Issuance: 12/7/2015
Construction Expiration Date: 12/7/2018
Tax Parcel #: 2-00-10600-01-2301-00001

DNREC Division of Fish and Wildlife
c/o: Jeremy Ashe
89 Kings Highway
Dover, DE 19901

**SUBAQUEOUS LANDS PERMIT/WETLANDS PERMIT
GRANTED TO DNREC DIVISION OF FISH AND WILDLIFE TO REPAIR AND
EXPAND APPROXIMATELY 5,000 LINEAR FEET OF EXISTING DIKES
CONSISTING OF 29,000 CUBIC YARDS OF MATERIAL, TO ADD A NEW DITCH
PLUG CONSISTING OF 1,000 CUBIC YARDS OF MATERIAL, TO REPAIR AND
IMPROVE TWO WATER CONTROL STRUCTURES AND THE ASSOCIATED SHEET
PILING AROUND THE STRUCTURES IN THE TED HARVEY SOUTH
IMPOUNDMENT, WITHIN THE TED HARVEY WILDLIFE AREA,
KENT COUNTY, DE**

Pursuant to the provisions of 7 Del. C., §7205, and the Department's Regulations Governing the Use of Subaqueous Lands; and 7 Del. C. §6604, and the Department's Wetlands Regulations permission is hereby granted on this 7th day of December A.D. 2015 to perform the above referenced project in accordance with the approved plans for this Permit (28 Sheets), as approved on November 25, 2015; and the application dated September 15, 2015, and received by this Division on September 15, 2015.

WHEREAS, pursuant to the provisions of 7 Del. C., §7203; and 7 Del. C. §6604, the Secretary of the Department of Natural Resources and Environmental Control through his duly authorized representative finds that it is not contrary to the public interest if this project is approved subject to the terms and conditions herein set forth.

This Permit is issued subject to the following conditions:

Delaware's good nature depends on you!

SPECIAL CONDITIONS

1. Erosion and sediment control measures shall be implemented in accordance with the specifications and criteria in the current Delaware Erosion and Sediment Control Handbook so as to minimize entry and dispersal of sediment and other contaminants in surface waters.
2. Areas disturbed during construction/restoration shall be returned to pre-disturbance elevations and stabilized to avoid impact to wetlands and waters. Erosion control matting, if used, shall not contain plastic or other non-degradable components. Only native plants and seed appropriate to the physiographic region shall be used for stabilization.
3. All equipment and machinery utilized in construction shall arrive on-site in a clean condition and shall be maintained free of fluid leaks. An emergency spill kit shall be available on-site to handle any fluid leaks or spills from machinery.
4. Access through State wetlands shall be limited to the minimum area necessary to perform the maintenance work. All access shall be by any of the following: a) by foot, b) by using low-ground-pressure vehicles suitable to work in marshes or c) using temporary matting for construction equipment.
5. All fill materials associated with the proposed project shall be clean and free from oils, grease, asphalt and other contaminants.
6. The repair and improvement of the water control structures shall be planned for periods of low waterway base flows. In the event that sediment and erosion controls are damaged or destroyed due to storm events, such controls shall be repaired and/or replaced immediately.
7. A site review, with representatives of the Wetlands and Subaqueous Lands Section, shall be completed at low tide within 60 days of the completion of the project to evaluate the site for impacts to tidal marsh and mudflat wetlands. If impacted areas are noted, the disturbed areas shall be returned to pre-construction conditions, including elevations and vegetation.
8. Disturbance of wetlands and/or aquatic vegetation adjacent to the permitted construction by burning, cutting, herbicide treatments, heavy equipment, filling or other methods is prohibited. Disturbance of wetlands and/or aquatic wetlands in the path of the construction shall be minimized.
9. To avoid impacts to Migratory Shorebirds, including Red Knots, no work shall take place from April 15th through June 7th east of WPT 17, where the dike takes a sharp turn towards the beach. If work is unavoidable during this time frame, an appropriately-qualified observer must be onsite recording Red Knot presence. If Red Knots are present and there is evidence of disturbance/flushing all work must cease.
10. There shall be no stockpiling of construction material or equipment staging in regulated wetlands or subaqueous lands.

11. The permittee shall employ measures during construction to prevent spills of fuels or lubricants. In the event of a spill, efforts shall be taken to prevent its entry into wetlands and aquatic areas. Any spills entering wetlands and aquatic areas shall be removed immediately. This office shall be notified of any spill(s) within six hours of occurrence. This office will determine the effectiveness of spill and contamination removal and specify remediation as necessary.
12. The work authorized by this Permit is subject to the terms and conditions of the Army Corps of Engineers Nationwide Permit 27.
13. This Permit is granted for the purpose wetland and impoundment restoration. Any other use without prior written approval shall constitute reason for this Permit being revoked.
14. The Contractors Completion Report shall be filled out and returned within 10 days of completion of the authorized work.
15. Please contact Bill McAvoy for the appropriate species to be used in the seed mix for the dike restoration.
16. Please contact Kate Fleming from the Wildlife Species Conservation and Research Program if the beach will be used for construction access.

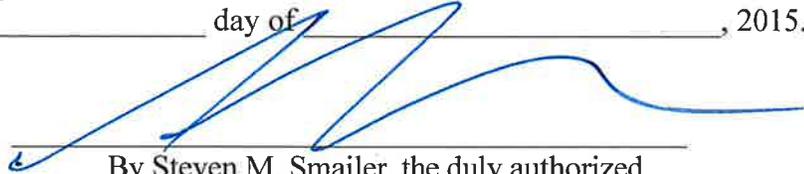
GENERAL CONDITIONS

1. The permittee and contractor shall at all times comply with all applicable laws and regulations of the Department of Natural Resources and Environmental Control.
2. The activities authorized herein shall be undertaken in accordance with the permit conditions, the final stamped and approved plans, and with the information provided in the permit application.
3. A copy of this Permit and the stamped approved plans shall be available on-site during all phases of construction activity.
4. The conditions contained herein shall be incorporated into any and all construction contracts associated with the construction authorized herein. The permittee and contractor are responsible to ensure that the workers executing the activities authorized by this Permit have full knowledge of, and abide by, the terms and conditions of this Permit.
5. The permittee shall protect and hold the State of Delaware harmless from any loss, cost or damage resulting from the activities authorized herein.

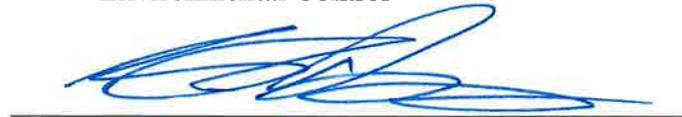
6. The issuance of this Permit does not constitute approval for any activities that may be required by any other local, state or federal government agency.
7. The issuance of this Permit does not imply approval of any other part, phase, or portion of any overall project the permittee may be contemplating.
8. This Permit authorizes only the activities described herein. Modifications to the project may require a supplemental approval from this office prior to the initiation of construction. A determination of the need for a supplemental approval will be made by this office pursuant to the permittee submitting written notification and revised plans indicating project changes. Failure to contact the Department prior to executing changes to the project shall constitute reason for this Permit being revoked.
9. Representatives of the Department of Natural Resources and Environmental Control shall be allowed to access the property to inspect all work during any phase of the construction and may conduct pre and post-construction inspections, collect any samples or conduct any tests that are deemed necessary.
10. The activities authorized herein shall be conducted so as not to violate the State of Delaware's Surface Water Quality Standards, as amended October 11, 2014.
11. All construction materials, waste or debris associated with this activity shall be properly disposed of and contained at all times to prevent its entry into waters or wetlands. Construction materials shall not be stockpiled in subaqueous lands or wetlands.
12. Disturbance of subaqueous lands or wetlands adjacent to the authorized structures or activities is prohibited. Disturbance of subaqueous lands or wetlands in the path of construction activity shall be minimized. Any temporarily impacted subaqueous lands or wetlands shall be returned to pre-disturbance elevations and conditions.
13. The permittee and contractor shall employ measures during construction to prevent spills of fuels, lubricants or other hazardous substances. In the event of a spill, the permittee and contractor shall make every effort to stop the leak and contain the spill, and shall immediately contact the Hazardous Spill Response Team (HAZMAT) at 1-800-662-8802 and this office at (302) 739-9943. The permittee and contractor are responsible to comply with all directives to contain and clean up the spilled material(s) as stipulated by the HAZMAT team, and to restore the site as may be required by this office.
14. None of the activities authorized herein shall occur after the construction expiration date identified on Page 1 of this Permit. The permittee may file one construction expiration date extension request of up to one (1) year if necessary to complete the authorized work. Such requests must be received by the Department at least thirty (30) days prior to the construction expiration date.
15. The permittee shall notify the Wetlands and Subaqueous Lands Section prior to the commencement of the work authorized by this Permit.

16. Any actions, operations or installations which are found by the Department to be contrary to the public interest may constitute reason for the discontinuance and/or removal of said action, operation or installation. Removal and restoration shall be at the expense of the permittee and/or upland property owner within thirty (30) days of receipt of written notice of revocation and demand for removal.
17. The permittee shall maintain all authorized structures and activities in a good and safe condition.
18. This Permit is personal but may be transferred provided the permittee provides prior notice to the Department of the intent to transfer and the new property owner provides appropriate documentation to substantiate ownership of the adjacent upland property and/or the structures authorized herein. Failure to transfer this Permit to a new owner may result in the revocation of the Permit and the removal of all structures authorized by this Permit at the expense of the permittee.
19. Failure to comply with any of the terms or conditions of this Permit may result in enforcement action, which could include the revocation of this Permit, and subsequent restoration of the site to preconstruction conditions.

IN WITNESS WHEREOF, I, Steven M. Smailer, the duly authorized representative of David S. Small, Secretary of the Department of Natural Resources and Environmental Control, have hereunto set my hand this _____ day of _____, 2015.



By Steven M. Smailer, the duly authorized
representative of the Secretary of the
Department of Natural Resources and
Environmental Control



Tyler Brown, Program Manager
Wetlands and Subaqueous Lands Section

APPENDIX 5

U.S. ARMY CORPS OF ENGINEERS (USACE) PERMIT



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

Regulatory Branch
Application Section I

FEB 03 2016

SUBJECT: CENAP-OP-R-2015-1051-85 (NWP27 Modification)
Project Name: DDNREC Ted Harvey Wildlife Area Restoration Project KE
Latitude/Longitude: 39.0728°N /-75.41046°W

Jeremey Ashe
Delaware Division of Fish and Wildlife
89 Kings Highway
Dover, Delaware 19901

Dear Jeremey Ashe:

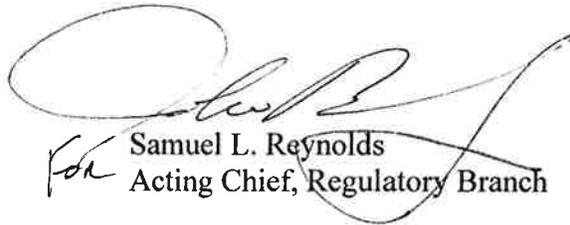
Reference is made to Department of the Army Permit CENAP-OP-R-2015-1051, dated October 30, 2015, authorizing the Delaware Division of Fish and Wildlife to restore a 428 acre brackish wetland impoundment by repairing approximately 5,000 linear feet of an existing dike and repairing 2 water control structures located at the Ted Harvey Wildlife Area (Tax Map Parcel # 2-00-10600-01-2301-00001) in Dover, Kent County, Delaware.

In accordance with your request dated January 13, 2016, the plans dated January 2016, entitled *Ted Harvey Conservation Area Enhancement Project*, 33 sheets are approved to supersede the previously approved plans dated September 2015. The revised plans provide for updated fill quantities and updated water control structure details.

All other conditions to which this permit was made subject remain in full force and effect. This authorization does not affect your responsibility to obtain any other Federal, State or local approvals required by law for this project before beginning work.

If you should have any questions regarding this matter, please contact Michael Yost by telephone at 302-736-9763, by email at michael.d.yost@usace.army.mil, or write to 1203 College Park Drive, Suite 103, Dover, Delaware 19904.

Sincerely,



For Samuel L. Reynolds
Acting Chief, Regulatory Branch

Enclosure



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

Regulatory Branch
Application Section I

OCT 30 2015

SUBJECT: CENAP-OP-R-2015-1051-85 (NWP27)
Project Name: DDNREC Ted Harvey Wildlife Area Restoration Project KE
Latitude/Longitude: 39.0728°N /-75.41046°W

Jeremey Ashe
Delaware Division of Fish and Wildlife
89 Kings Highway
Dover, Delaware 19901

Dear Jeremey Ashe:

This is in regard to your proposal to restore a 428 acre brackish wetland impoundment by repairing approximately 5,000 linear feet of an existing dike and repairing 2 water control structures located at the Ted Harvey Wildlife Area (Tax Map Parcel # 2-00-10600-01-2301-00001) in Dover, Kent County, Delaware.

Under current Federal regulations, a Department of the Army permit is required for work or structures in navigable waters of the United States and/or the discharge of dredged or fill material into waters of the United States including their adjacent wetlands.

Based upon our review of the information you have provided, it has been determined that the proposed work is approved by the existing Department of the Army Nationwide Permit (NWP) described in Enclosure 1, provided the work is conducted in compliance with the project specific special conditions listed below and the attached general conditions (Enclosure 2). Initiation of any authorized work shall constitute your agreement to comply with all of the NWP's conditions. You should also note that the authorized work may be subject to periodic inspections by a Corps of Engineers representative. The verification of a nationwide permit including all general and special conditions is not subject to appeal.

On March 16, 2012 the Division Engineer approved several Regional Conditions for NWPs within the Philadelphia District. The enclosed table (Enclosure 3) identifies those NWPs which require a preconstruction notification (PCN) to the Corps of Engineers, those which have been regionally conditioned by the Division Engineer, and those which have been denied 401 Water Quality Certification (WQC) and/or Coastal Zone Management (CZM) consistency by the Delaware Department of Natural Resources and Environmental Control (DDNREC). It should be carefully noted that DDNREC has denied the requisite WQC and CZM for certain NWP activities in ALL waters of the United States in Delaware. For other NWP activities, DDNREC

has denied the requisite WQC and CZM for projects located in waters of the United States which have been determined to be critical resource waters.

For those NWP's for which DDNREC has denied the requisite WQC and CZM, the NWP authorization is considered denied without prejudice by the Corps of Engineers until an individual, project-specific WQC and/or CZM review and approval has been obtained from DDNREC. Furthermore, copies of the WQC and CZM approvals must be provided to the Corps of Engineers before the authorized work begins. Any project-specific conditions required by DDNREC for the WQC and/or CZM approval will automatically become part of the NWP authorization as well.

Please note that CZM consistency from DDNREC is only required for those activities in or affecting Delaware's coastal zone. Additionally, some of the NWP's do not involve a discharge of dredged or fill material and, as such, do not require a 401 WQC. For those NWP's not requiring a 401 WQC, the appropriate rows and columns of the enclosed table (Enclosure 3) have been identified with the term "NA".

PROJECT SPECIFIC SPECIAL CONDITIONS:

1. All work performed in association with the above noted project shall be conducted in accordance with the project plans prepared by Moffatt & Nichol, dated September 2015, entitled: *Ted Harvey Conservation Area Enhancement Project Dover, Delaware*, 28 sheets. The stated purpose of the project is to restore water control within the impoundment to manage the brackish wetland environment, promoting healthy wetland vegetation for waterfowl, mud flats for shorebirds, and estuarine fish habitat.
2. Any deviation in construction methodology or project design from that shown on the above noted drawings must be approved by this office, in writing, prior to performance of the work. All modifications to the above noted project plans shall be approved, in writing, by this office. No work shall be performed prior to written approval of this office.
3. This office shall be notified at least 10 days prior to the commencement of authorized work by completing and signing the enclosed Notification/ Certification of Work Commencement Form (Enclosure 4). This office shall also be notified within 10 days of the completion of the authorized work by completing and signing the enclosed Notification/Certification of Work Completion/Compliance Form (Enclosure 5). All notifications required by this condition shall be in writing and shall be transmitted to this office by registered mail. Oral notifications are not acceptable. Similar notification is required each time maintenance work is to be done under the terms of this Corps of Engineers permit.
4. Representatives of the U.S. Army Corps of Engineers shall be permitted to inspect the project during its phase of construction, and to collect any samples, or to conduct any tests deemed necessary.
5. The permittee is responsible for ensuring that the contractor and/or workers executing the activity(s) authorized by this permit have knowledge of the terms and conditions of the

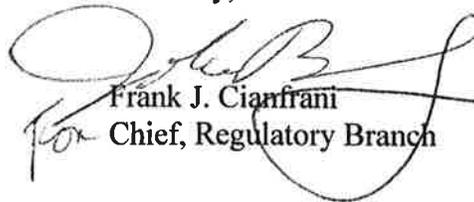
authorization and that a copy of the permit document is at the project site throughout the period the work is underway.

6. The mechanical equipment used to execute the work authorized shall be operated in such a way as to minimize turbidity that could degrade water quality and adversely affect aquatic plant and animal life.
7. The disposal of trees, brush and other debris in any stream corridor, wetland or surface water is prohibited.
8. Every effort shall be made to keep construction debris from entering the waterway or wetland. Debris in the waterway or wetland shall be removed immediately.
9. All material to be used as fill shall be obtained from an upland source. The fill material shall be free of oil and grease, debris, wood, general refuse, plaster, and other pollutants, and shall contain no broken asphalt.
10. Appropriate erosion and siltation controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills must be permanently stabilized at the earliest practicable date
11. This permit authorizes temporary impacts to waters of the United States associated with the project. Upon completion of the authorized work, all wetland areas disturbed during construction shall be returned to their pre-construction grades and elevations.
12. Work shall not occur between April 15 and June 7 of any year east of the eastern most water control structure. If it becomes unavoidable to be working on that section of the project during May, then the permittee must have an observer on the beach recording red knot presence. If Red Knots are present and there is evidence they are being flushed – then the work must stop until birds are not in the immediate area and being flushed. If there are no red knots present – the work can proceed.
13. This permit does not obviate the permittee from obtaining any State or local approvals required by law for the activity authorized.

This verification is valid until the NWP is modified, reissued, or revoked. All of the existing NWPs are scheduled to be modified, reissued, or revoked prior to March 16, 2017. It is incumbent upon the permittee to remain informed of changes to the NWPs. We will issue a public notice when the NWPs are reissued. Furthermore, if you commence or are under contract to commence this activity before the date that the relevant NWP is modified or revoked, you will have 12 months from the date of the modification or revocation of the NWP to complete the activity under the present terms and conditions of this NWP.

Also enclosed is a pre-addressed postal card (Enclosure 6) soliciting your comments on the processing of your application. Any comments, positive or otherwise, on the procedures, timeliness, fairness, etc., may be made on this card. If you have any questions regarding this matter, please contact Michael Yost at 302-736-9763 or write to the above address.

Sincerely,



Frank J. Cianfrani
Chief, Regulatory Branch

Enclosures

2012 Nationwide Permits

NWP 27. Aquatic Habitat Restoration, Establishment, and Enhancement Activities. Activities in waters of the United States associated with the restoration, enhancement, and establishment of tidal and non-tidal wetlands and riparian areas, the restoration and enhancement of non-tidal streams and other non-tidal open waters, and the rehabilitation or enhancement of tidal streams, tidal wetlands, and tidal open waters, provided those activities result in net increases in aquatic resource functions and services. To the extent that a Corps permit is required, activities authorized by this NWP include, but are not limited to: the removal of accumulated sediments; the installation, removal, and maintenance of small water control structures, dikes, and berms, as well as discharges of dredged or fill material to restore appropriate stream channel configurations after small water control structures, dikes, and berms, are removed; the installation of current deflectors; the enhancement, restoration, or establishment of riffle and pool stream structure; the placement of in-stream habitat structures; modifications of the stream bed and/or banks to restore or establish stream meanders; the backfilling of artificial channels; the removal of existing drainage structures, such as drain tiles, and the filling, blocking, or reshaping of drainage ditches to restore wetland hydrology; the installation of structures or fills necessary to establish or re-establish wetland or stream hydrology; the construction of small nesting islands; the construction of open water areas; the construction of oyster habitat over unvegetated bottom in tidal waters; shellfish seeding; activities needed to reestablish vegetation, including plowing or discing for seed bed preparation and the planting of appropriate wetland species; re-establishment of submerged aquatic vegetation in areas where those plant communities previously existed; re-establishment of tidal wetlands in tidal waters where those wetlands previously existed; mechanized land clearing to remove non-native invasive, exotic, or nuisance vegetation; and other related activities. Only native plant species should be planted at the site. This NWP authorizes the relocation of non-tidal waters, including non-tidal wetlands and streams, on the project site provided there are net increases in aquatic resource functions and services.

Except for the relocation of non-tidal waters on the project site, this NWP does not authorize the conversion of a stream or natural wetlands to another aquatic habitat type (e.g., stream to wetland or vice versa) or uplands. Changes in wetland plant communities that occur when wetland hydrology is more fully restored during wetland rehabilitation activities are not considered a conversion to another aquatic habitat type. This NWP does not authorize stream channelization. This NWP does not authorize the relocation of tidal waters or the conversion of tidal waters, including tidal wetlands, to other aquatic uses, such as the conversion of tidal wetlands into open water impoundments.

Compensatory mitigation is not required for activities authorized by this NWP since these activities must result in net increases in aquatic resource functions and services.

Reversion. For enhancement, restoration, and establishment activities conducted: (1) In accordance with the terms and conditions of a binding stream or wetland enhancement or restoration agreement, or a wetland establishment agreement, between the landowner and the U.S. Fish and Wildlife Service (FWS), the Natural Resources Conservation Service (NRCS), the Farm Service Agency (FSA), the National Marine Fisheries Service (NMFS), the National Ocean Service (NOS), U.S. Forest Service (USFS), or their designated state cooperating agencies; (2) as voluntary wetland restoration, enhancement, and establishment actions documented by the NRCS or USDA Technical Service Provider pursuant to NRCS Field Office Technical Guide standards; or (3) on reclaimed surface coal mine lands, in accordance with a Surface Mining Control and Reclamation Act permit issued by the Office of Surface Mining Reclamation and Enforcement (OSMRE) or the applicable state agency, this NWP also authorizes any future discharge of dredged or fill material associated with the reversion of the area to its documented prior condition and use (i.e., prior to the restoration, enhancement, or establishment activities). The reversion must occur within five years after expiration of a limited term wetland restoration or establishment agreement or permit, and is authorized in these circumstances even if the discharge occurs after this NWP expires. The five-year reversion limit does not apply to agreements without time limits reached between the landowner and the FWS, NRCS, FSA, NMFS, NOS, USFS, or an appropriate state cooperating agency. This NWP also authorizes discharges of dredged or fill material in waters of the United States for the reversion of wetlands

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that were restored, enhanced, or established on prior-converted cropland or on uplands, in accordance with a binding agreement between the landowner and NRCS, FSA, FWS, or their designated state cooperating agencies (even though the restoration, enhancement, or establishment activity did not require a section 404 permit). The prior condition will be documented in the original agreement or permit, and the determination of return to prior conditions will be made by the Federal agency or appropriate state agency executing the agreement or permit. Before conducting any reversion activity the permittee or the appropriate Federal or state agency must notify the district engineer and include the documentation of the prior condition. Once an area has reverted to its prior physical condition, it will be subject to whatever the Corps Regulatory requirements are applicable to that type of land at the time. The requirement that the activity results in a net increase in aquatic resource functions and services does not apply to reversion activities meeting the above conditions. Except for the activities described above, this NWP does not authorize any future discharge of dredged or fill material associated with the reversion of the area to its prior condition. In such cases a separate permit would be required for any reversion.

Reporting. For those activities that do not require pre-construction notification, the permittee must submit to the district engineer a copy of: (1) The binding stream enhancement or restoration agreement or wetland enhancement, restoration, or establishment agreement, or a project description, including project plans and location map; (2) the NRCS or USDA Technical Service Provider documentation for the voluntary stream enhancement or restoration action or wetland restoration, enhancement, or establishment action; or (3) the SMCRA permit issued by OSMRE or the applicable state agency. The report must also include information on baseline ecological conditions on the project site, such as a delineation of wetlands, streams, and/or other aquatic habitats. These documents must be submitted to the district engineer at least 30 days prior to commencing activities in waters of the United States authorized by this NWP.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing any activity (see general condition 31), except for the following activities:

- (1) Activities conducted on non-Federal public lands and private lands, in accordance with the terms and conditions of a binding stream enhancement or restoration agreement or wetland enhancement, restoration, or establishment agreement between the landowner and the U.S. FWS, NRCS, FSA, NMFS, NOS, USFS or their designated state cooperating agencies;
- (2) Voluntary stream or wetland restoration or enhancement action, or wetland establishment action, documented by the NRCS or USDA Technical Service Provider pursuant to NRCS Field Office Technical Guide standards; or
- (3) The reclamation of surface coal mine lands, in accordance with an SMCRA permit issued by the OSMRE or the applicable state agency. However, the permittee must submit a copy of the appropriate documentation to the district engineer to fulfill the reporting requirement. (Sections 10 and 404)

Note: This NWP can be used to authorize compensatory mitigation projects, including mitigation banks and in-lieu fee projects. However, this NWP does not authorize the reversion of an area used for a compensatory mitigation project to its prior condition, since compensatory mitigation is generally intended to be permanent.

Nationwide Permit General Conditions (2012)

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR §§ 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR § 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. Navigation. (a) No activity may cause more than a minimal adverse effect on navigation. (b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States. (c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. Aquatic Life Movements. No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species.

3. Spawning Areas. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. Migratory Bird Breeding Areas. Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. Shellfish Beds. No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. Suitable Material. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

7. Water Supply Intakes. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. Adverse Effects From Impoundments. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. Management of Water Flows. To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization and storm water management activities, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. Fills Within 100-Year Floodplains. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. Equipment. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. Soil Erosion and Sediment Controls. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.

13. Removal of Temporary Fills. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. Proper Maintenance. Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. Single and Complete Project. The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. Wild and Scenic Rivers. No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service).

17. Tribal Rights. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

18. Endangered Species. (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless Section 7 consultation addressing the effects of the proposed activity has been completed.

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will review the documentation and determine whether it is sufficient to address ESA compliance for the NWP activity, or whether additional ESA consultation is necessary.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed work or that utilize the designated critical habitat that might be affected by the proposed work. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the project, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification the proposed activities will have "no effect" on listed species or critical habitat, or until Section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific regional endangered species conditions to the NWPs.

(e) Authorization of an activity by a NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the U.S. FWS or the NMFS, The Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. FWS and NMFS or their world wide web pages at <http://www.fws.gov/> or <http://www.fws.gov/ipac> and <http://www.noaa.gov/fisheries.html> respectively.

19. Migratory Birds and Bald and Golden Eagles. The permittee is responsible for obtaining any “take” permits required under the U.S. Fish and Wildlife Service’s regulations governing compliance with the Migratory Bird Treaty Act or the Bald and Golden Eagle Protection Act. The permittee should contact the appropriate local office of the U.S. Fish and Wildlife Service to determine if such “take” permits are required for a particular activity.

20. Historic Properties. (a) In cases where the district engineer determines that the activity may affect properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of Section 106 of the National Historic Preservation Act. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will review the documentation and determine whether it is sufficient to address section 106 compliance for the NWP activity, or whether additional section 106 consultation is necessary.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the authorized activity may have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties may be affected by the proposed work or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of or potential for the presence of historic resources can be sought from the State Historic Preservation Officer or Tribal Historic Preservation Officer, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of Section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted and these efforts, the district engineer shall determine whether the proposed activity has the potential to cause an effect on the historic properties. Where the non-Federal applicant has identified historic properties on which the activity may have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects or that consultation under Section 106 of the NHPA has been completed.

(d) The district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA Section 106 consultation is required. Section 106 consultation is not required when the Corps determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR §800.3(a)). If NHPA section 106 consultation is required and will occur, the district engineer will notify the non-Federal applicant that he or she cannot begin work until Section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(e) Prospective permittees should be aware that section 110k of the NHPA (16 U.S.C. 470h-2(k)) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. Discovery of Previously Unknown Remains and Artifacts. If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. Designated Critical Resource Waters. Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with general condition 31, for any activity proposed in the designated critical resource waters including wetlands adjacent to those

waters. The district engineer may authorize activities under these NWP's only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. Mitigation. The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that adverse effects on the aquatic environment are minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse effects of the proposed activity are minimal, and provides a project-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in minimal adverse effects on the aquatic environment. Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in minimal adverse effects on the aquatic environment.

(2) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, wetland restoration should be the first compensatory mitigation option considered.

(3) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) – (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).

(4) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.

(5) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan.

(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation, such as stream rehabilitation, enhancement, or preservation, to ensure that the activity results in minimal adverse effects on the aquatic environment.

(e) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWP's. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any project resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that a project already meeting the established acreage limits also satisfies the minimal impact requirement associated with the NWP's.

(f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the restoration or establishment, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, riparian areas may be the only compensatory mitigation required. Riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to establish a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or establishing a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(g) Permittees may propose the use of mitigation banks, in-lieu fee programs, or separate permittee-responsible mitigation. For activities resulting in the loss of marine or estuarine resources, permittee-responsible compensatory mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(h) Where certain functions and services of waters of the United States are permanently adversely affected, such as the conversion of a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse effects of the project to the minimal level.

24. Safety of Impoundment Structures. To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. Water Quality. Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA Section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. Coastal Zone Management. In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. Regional and Case-By-Case Conditions. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. Use of Multiple Nationwide Permits. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. Transfer of Nationwide Permit Verifications. If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature: "When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

(Transferee)

(Date)

30. Compliance Certification. Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

- (a) A statement that the authorized work was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;
- (b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and
- (c) The signature of the permittee certifying the completion of the work and mitigation.

31. Pre-Construction Notification. (a) **Timing.** Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

- (1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special

conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or in the vicinity of the project, or to notify the Corps pursuant to general condition 20 that the activity may have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or Section 106 of the National Historic Preservation (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWP 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Pre-Construction Notification: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed project;

(3) A description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause, including the anticipated amount of loss of water of the United States expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. The description should be sufficiently detailed to allow the district engineer to determine that the adverse effects of the project will be minimal and to determine the need for compensatory mitigation. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the project and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(4) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many waters of the United States. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(5) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse effects are minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(6) If any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, for non-Federal applicants the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work. Federal applicants must provide documentation demonstrating compliance with the Endangered Species Act; and

(7) For an activity that may affect a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, for non-Federal applicants the PCN must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property. Federal applicants must provide documentation demonstrating compliance with Section 106 of the National Historic Preservation Act.

(c) Form of Pre-Construction Notification: The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is a PCN and must include all of the information required in paragraphs (b)(1) through (7) of this general condition. A letter containing the required information may also be used.

(d) Agency Coordination: (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

(2) For all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States, for NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of intermittent and ephemeral stream bed, and for all NWP 48 activities that require pre-construction notification, the district engineer will immediately provide (e.g., via e-mail, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (U.S. FWS, state natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Office (THPO), and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to telephone or fax the district engineer notice that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's

compliance with the terms and conditions of the NWP, including the need for mitigation to ensure the net adverse environmental effects to the aquatic environment of the proposed activity are minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(3) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(4) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

D. District Engineer's Decision

1. In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. For a linear project, this determination will include an evaluation of the individual crossings to determine whether they individually satisfy the terms and conditions of the NWP(s), as well as the cumulative effects caused by all of the crossings authorized by NWP. If an applicant requests a waiver of the 300 linear foot limit on impacts to intermittent or ephemeral streams or of an otherwise applicable limit, as provided for in NWPs 13, 21, 29, 36, 39, 40, 42, 43, 44, 50, 51 or 52, the district engineer will only grant the waiver upon a written determination that the NWP activity will result in minimal adverse effects. When making minimal effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of resource that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

2. If the proposed activity requires a PCN and will result in a loss of greater than 1/10acre of wetlands, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for projects with smaller impacts. The district engineer will consider any proposed compensatory mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects to the aquatic environment of the proposed activity are minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects on the aquatic environment are minimal, after considering mitigation, the district engineer will notify the permittee and include any activity-specific conditions in the NWP verification the district engineer deems necessary. Conditions for compensatory mitigation requirements must comply with the appropriate provisions at 33 CFR 332.3(k). The district engineer must approve the final mitigation plan before the permittee commences work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the proposed compensatory mitigation plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure no more than minimal adverse effects on the aquatic environment. If the net adverse effects of the project on the aquatic environment (after consideration of the compensatory mitigation proposal) are determined by the district engineer to be minimal, the district engineer will provide a timely written response to the applicant. The response will state that the project can proceed under the terms and conditions of the NWP, including any activity-specific conditions added to the NWP authorization by the district engineer.

3. If the district engineer determines that the adverse effects of the proposed work are more than minimal, then the district engineer will notify the applicant either: (a) That the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (b) that the project is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level; or (c) that the project is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse effects occur to the aquatic environment, the activity will be authorized within the 45-day PCN period, with activity-specific conditions that state the mitigation requirements. The authorization will include the necessary conceptual or detailed mitigation or a requirement that the applicant submit a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level. When mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan or has determined that prior approval of a final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation.

NWP CZM and WQC Status Table: Delaware, New Jersey, Pennsylvania (4.4.2012)

NWP #	PCN	DE CZM	DE WQC	NJ CZM	NJ WQC	PA CZM	PA WQC
NWP 1	NO	ISSUED	N/A				
NWP 2	NO	ISSUED	N/A				
NWP 3	YES *	DENIED #	DENIED #				
NWP 4	NO	ISSUED	ISSUED				
NWP 5	NO	ISSUED	ISSUED				
NWP 6	NO	ISSUED	ISSUED				
NWP 7	YES	ISSUED	ISSUED				
NWP 8	YES	DENIED	N/A				
NWP 9	NO	ISSUED	N/A				
NWP 10	YES *	ISSUED	N/A				
NWP 11	YES*	ISSUED	N/A				
NWP 12	YES	ISSUED	ISSUED				
NWP 13	YES *	DENIED #	DENIED #				
NWP 14	YES	ISSUED	ISSUED				
NWP 15	YES *	ISSUED	ISSUED				
NWP 16	NO	ISSUED	ISSUED				
NWP 17	YES	ISSUED	ISSUED				
NWP 18	YES *	DENIED #	DENIED #				
NWP 19	YES	ISSUED	ISSUED				
NWP 20	NO	ISSUED	ISSUED				
NWP 21	YES	ISSUED	ISSUED				
NWP 22	YES *	ISSUED	ISSUED				
NWP 23	YES	ISSUED	ISSUED				
NWP 24	NO	ISSUED	N/A				
NWP 25	YES *	ISSUED	ISSUED				
NWP 27	YES *	ISSUED	ISSUED				
NWP 28	YES	ISSUED	N/A				
NWP 29	YES	DENIED #	DENIED #				
NWP 30	YES *	ISSUED	ISSUED				
NWP 31	YES	ISSUED	ISSUED				
NWP 32	N/A	ISSUED	ISSUED				
NWP 33	YES	ISSUED	ISSUED				
NWP 34	YES	ISSUED	ISSUED				
NWP 35	YES	ISSUED	N/A				
NWP 36	YES *	ISSUED	ISSUED				
NWP 37	YES	ISSUED	ISSUED				
NWP 38	YES	ISSUED	ISSUED				
NWP 39	YES	DENIED #	DENIED #				
NWP 40	YES	DENIED	DENIED				
NWP 41	YES	DENIED	DENIED				
NWP 42	YES	DENIED	DENIED				
NWP 43	YES	DENIED	DENIED				
NWP 44	YES	DENIED	DENIED				
NWP 45	YES	ISSUED	ISSUED				
NWP 46	YES	DENIED	DENIED				
NWP 48	YES	ISSUED	ISSUED				
NWP 49	YES	ISSUED	ISSUED				
NWP 50	YES	ISSUED	ISSUED				
NWP 51	YES	DENIED	DENIED				
NWP 52	YES	DENIED	DENIED				

Note: *A PCN is required under certain circumstances. Review the terms of the NWP, general conditions, or regional conditions to identify those circumstances. # The State of Delaware has denied the CZM and WQC for this NWP in critical resource waters only.

NOTIFICATION/CERTIFICATION OF WORK COMMENCEMENT FORM

Permit Number: CENAP-OP-R-2015-1051-85 (NWP27)
Name of Permittee: DDNREC, Division of Fish and Wildlife
Project Name: DDNREC Ted Harvey Wildlife Area Restoration Project KE
Waterway: St. Jones River
County: Kent State: Delaware
Compensation/Mitigation Work Required: Yes No

TO: U.S. Army Corps of Engineers, Philadelphia District
Wanamaker Building - 100 Penn Square East
Philadelphia, Pennsylvania 19107-3390
Attention: CENAP-OP-R

I have received authorization to restore a 428 acre brackish wetland impoundment by repairing approximately 5,000 linear feet of an existing dike and repairing 2 water control structures located at the Ted Harvey Wildlife Area (Tax Map Parcel # 2-00-10600-01-2301-00001) in Dover, Kent County, Delaware.

The work will be performed by:

Name of Person or Firm _____

Address: _____

I hereby certify that I have reviewed the approved plans, have read the terms and conditions of the above referenced permit, and shall perform the authorized work in strict accordance with the permit document. The authorized work will begin on or about _____ and should be completed on or about _____.

Please note that the permitted activity is subject to compliance inspections by the Army Corps of Engineers. If you fail to return this notification form or fail to comply with the terms or conditions of the permit, you are subject to permit suspension, modification, revocation, and/or penalties.

Permittee (Signature and Date)

Telephone Number

Contractor (Signature and Date)

Telephone Number

NOTE: This form shall be completed/signed and returned to the Philadelphia District Office a minimum of 10 days prior to commencing work.

NOTIFICATION/CERTIFICATION OF WORK COMPLETION/COMPLIANCE FORM

Permit Number: CENAP-OP-R-2015-1051-85 (NWP27)
Name of Permittee: DDNREC, Division of Fish and Wildlife
Name of Contractor: _____
Project Name: DDNREC Ted Harvey Wildlife Area Restoration Project KE
County: Kent State: Delaware
Waterway: St. Jones River

Within 10 days of completion of the activity authorized by this permit, please sign this certification and return it to the following address:

U.S. Army Corps of Engineers, Philadelphia District
Wanamaker Building - 100 Penn Square East
Philadelphia, Pennsylvania 19107-3390
Attention: CENAP-OP-R

Please note that the permitted activity is subject to a compliance inspection by an Army Corps of Engineers representative. If you fail to return this notification form or fail to perform work in compliance with the permit, you are subject to administrative, civil and/or criminal penalties. Further, the subject permit may be suspended or revoked.

The authorized work was commenced on _____.

The authorized work was completed on _____.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the above noted permit.

Signature of Contractor

Signature of Permittee

Address: _____

Address: _____

Telephone Number: _____

Telephone Number: _____

For project located in areas identified as shellfish habitat, you must include with this form a bill of lading; sales order or any other document(s) demonstrating non-polluting materials were purchased and utilized for your project. I hereby certify that I and/or my contractor have utilized non-polluting materials as defined in the above noted permit.

Signature of Contractor

Signature of Permittee