

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT			1. CONTRACT ID CODE	PAGE OF PAGES 1
2. AMENDMENT/MODIFICATION NO. 0001	3. EFFECTIVE DATE 28-May-2004	4. REQUISITION/PURCHASE REQ. NO. W25PHS-1152-7399	5. PROJECT NO. (If applicable)	
6. ISSUED BY U.S. Army Engineer District, Philadelphia Contracting Division Wanamaker Building 100 Penn Square East Philadelphia, PA 19107-3390	CODE	7. ADMINISTERED BY (If other than Item 6) SEE BLOCK 6		
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)		(√)	9A. AMENDMENT OF SOLICITATION NO. W912BU-04-B-0019	
		×	9B. DATED (SEE ITEM 11) 11-May-2004	
			10A. MODIFICATION OF CONTRACTS/ORDER NO.	
			10B. DATED (SEE ITEM 13)	
CODE	FACILITY CODE	11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS		

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers tended. is extended, is not ex-

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:
 (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)
DELAWARE CANAL RECONSTRUCTION

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

<input checked="" type="checkbox"/>	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
<input type="checkbox"/>	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
<input type="checkbox"/>	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
<input type="checkbox"/>	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor is not, is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

THIS AMENDMENT DOES NOT EXTEND THE BID OPENING DATE OF THURSDAY, JUNE 10, 2004 AT 11:00 A.M.

(CONTINUED ON NEXT PAGE)

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
_____ (Signature of person authorized to sign)		BY _____ (Signature of Contracting Officer)	

14. DESCRIPTION OF AMENDMENT (continued)

a. SF 1442 AND BIDDING SCHEDULE: Section 00010, Page 3 - Please delete page 00010-3 in its entirety and substitute the new page of the same number, annotated Amendment No. 0001, attached hereto.

b. TECHNICAL SPECIFICATIONS:

NOTE: The following sections were amended. For simplicity, the complete section is being reissued to enable complete substitution/insertion of the section in existing hard copies. To make detection of changes easier, only those pages with changes on them are annotated with "Amendment No. 0001" in the upper right corner. In addition, changes on a page are highlighted in ***bold italics***.

(1) Section 01010 - SUMMARY OF WORK: Please delete this section in its entirety and substitute the new section, annotated Amendment No. 0001, attached hereto.

(2) Section 01355 - ENVIRONMENTAL PROTECTION: Please delete this section in its entirety and substitute the new section, annotated Amendment No. 0001, attached hereto.

(3) Section 02220 - EXCAVATION OF CANAL AND CONSTRUCTION OF TOWPATH: Please delete this section in its entirety and substitute the new section, annotated Amendment No. 0001, attached hereto.

(4) Section 02378 - GEOSYNTHETIC CLAY LINER: Please delete this section in its entirety and substitute the new section, annotated Amendment No. 0001, attached hereto.

c. CONTRACT DRAWINGS: Drawing Nos. 61052 and 61053 - Please delete these drawings in their entirety and substitute the revised sheets, of the same Drawing Numbers, with a revision date of 27 May 2004, attached hereto.

d. Please indicate receipt of this amendment on Standard Form 1442(SOLICITATION, OFFER, AND AWARD) as Amendment No.0001. Failure to acknowledge all amendments may be cause for rejection of the bid.

BIDDING SCHEDULE
(To be attached to SF 1442)

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
1.	Clearing and Grubbing	1	JOB	L.S.	\$
2.	Damming, Diversion and Dewatering	1	JOB	L.S.	\$
3.	Excavation	1,130	CY	\$	\$
4.	Erosion Control Mat	710	SY	\$	\$
5.	Construction of Towpath	1	JOB	L.S.	\$
6.	Turtle Basking Platforms	1	JOB	L.S.	\$
7.	Geosynthetic Clay Liner	1,470	SY	\$	\$

TOTAL ESTIMATED AMOUNT \$ _____

SECTION 01010

SUMMARY OF CONTRACT WORK

PART 1 GENERAL

1.1 SCOPE

This section presents a general description of the work to be accomplished under this contract.

1.2 DESCRIPTION OF THE CONTRACT WORK

Contract work involves the reconstruction of a portion of the historic Delaware Canal in Morrisville, PA. The reconstruction work includes creating a canal between two existing terminuses of the Canal and constructing a new towpath alongside this new portion of canal. The construction of the new portion of canal includes excavating the canal cross section and lining the cross section with a geosynthetic clay liner and soil-filled erosion control mat. The construction of the new towpath includes placing compacted aggregate. The contract work also includes, but is not limited to: clearing and grubbing, seeding and mulching; and all associated damming and dewatering ~~of the canal~~ required to complete the work. The Contractor shall also fabricate wood turtle basking platforms, to be installed by others.

1.3 ENVIRONMENTAL RESTRICTION ON WORK: RED-BELLY TURTLE

See Section 01355 ENVIRONMENTAL PROTECTION for the environmental window which restricts the Contractor's work. This environmental window is required for protection of the red-belly turtle.

1.4 REQUIRED ORDER OF WORK

The Contractor shall construct the new canal by proceeding from Station -0+13.22 towards Station 2+71.48.

1.5 PROTECTION OF THE SITE

1.5.1 Temporary Haul Road

The Contractor may elect to construct a temporary haul road to prevent damage to the existing towpath due to equipment and trucks.

1.5.2 Restoration of Site

Any damage to the existing towpath or any disturbance to any area or item, due to the Contractor's operations, shall be restored to original conditions. This restoration shall be at the Contractor's expense and shall be subject to the COR's approval and acceptance.

NOTE: The existing canals are comprised of 1-foot thick clay surface layers. The Contractor shall replace these materials in kind if disturbed by the Contractor's operations.

1.6 TEMPORARY ROUTING OF TOWPATH TRAFFIC

The Contractor shall create a detour route for the existing towpath

pedestrian and bicycle traffic. The Contractor shall provide adequate signage and other protective devices to ensure the protection and safety of the public in and around the project site.

PART 2 PRODUCTS

PART 3 EXECUTION

-- End of Section --

SECTION 01355

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 SCOPE OF SECTION

This section covers the furnishing of all labor, material and equipment and performing all work required for the protection of the environment during construction operations except for those measures set forth in other sections of these specifications.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

NOTE: Any submittals classified as "SD-01 Preconstruction Submittals" are submittals required to be submitted to, and approved (if "G" designation) or reviewed by (if for information only), the CO prior to mobilization to the contract work site. All other submittals, classified as "SD-02" through "SD-11," shall be submitted to, and approved (if "G" designation) or reviewed by (if for information only), the CO prior to commencing the particular task to which the submittal is associated.

SD-01 Preconstruction Submittals

Environmental Protection Plan; G DO.

Prior to commencement of the work, the Contractor shall submit to the Contracting Officer for approval his proposed environmental protection plan. The Contractor shall also prepare and submit to the Bucks County Soil Conservation District for certification, a Soil Erosion and Sediment Control Plan. The Contractor shall also furnish a copy of the letter of permission from the landfill to be used for any excess material, which shall include any special handling required by the landfill. This shall be followed by a meeting with representatives of the Contracting Officer to develop mutual understandings relative to compliance with this provision and administration of the environmental protection program. Approval of the Contractor's plan for environmental protection will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants.

SD-02 Shop Drawings

Location of Storage Facilities G COR.

Plans showing storage and other construction facilities shall be submitted for approval of the Contracting Officer.

1.3 GENERAL

For the purpose of this specification, environmental protection is defined as the retention of the environment in its natural state to the greatest

extent possible during project construction and to enhance the natural appearance in its final condition. Environmental protection requires consideration of air, water, and land resources and involves noise, solid waste-management and management of other pollutants. In order to prevent, and to provide for abatement and control of any environmental pollution arising from the construction activities in performance of this contract, the Contractor and his subcontractors shall comply with all applicable Federal, state, and local laws and regulations and shall obtain all necessary permits required by same.

1.4 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any non-compliance with the aforementioned Federal, state, or local laws or regulations. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. The Contractor shall, after receipt of such notice, immediately inform the Contracting Officer of proposed corrective action and take such action as may be approved. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made subject of a claim for extension of time or for excess costs or damages by the Contractor.

1.5 SUBCONTRACTORS

Compliance with the provisions of this section by subcontractors will be the responsibility of the Contractor.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 PROTECTION OF LAND RESOURCES

3.1.1 General

The land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction that will appear to be natural and not detract from the appearance of the project. The Contractor shall confine his construction activities to areas defined by the plans and specifications. The following additional requirements are intended to supplement the requirements of the Contract Clauses.

3.1.2 Prevention of Landscape Defacement

Except in areas indicated on the plans or specified to be cleared, the Contractor shall not deface, injure, or destroy trees or shrubs, nor remove or cut them without the authority of the Contracting Officer. Ropes, cables, or guys shall not be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized. Where such special emergency use is permitted, it shall be performed in such a manner as to avoid damage to the trees. The Contractor shall in any event be responsible for any damage resulting from such use. Where the possibility exists that trees may be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or operations, the Contractor shall adequately

protect such trees. Stone, earth or other material that is displaced into uncleared areas shall be removed. Monuments and markers shall be protected before construction operations commence.

3.1.3 Restoration of Landscape Damage

Any tree, turfed areas or other landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored to a condition satisfactory to the Contracting Officer. Restoration of scarred and damaged trees shall be performed in an approved manner by experienced workmen. Trees damaged beyond restoration shall be removed and disposed of under requirements for excavation. Trees that are to be removed because of damage shall be replaced at the Contractor's expense by nursery-grown trees of the same species or a species approved by the Contracting Officer. The size and quality of nursery-grown trees shall also be approved by the Contracting Officer. Any disturbed turfed (grassed) areas shall be seeded and mulched as directed by the Contracting Officer.

3.1.4 Location of Staging Area

Contractor's staging area shall be in the area indicated on the contract drawings.

3.1.5 Post Construction Cleanup or Obliteration

The Contractor shall obliterate all signs of temporary construction facilities, excess materials, or any other vestiges of construction as directed by the Contracting Officer. The area will be restored to near natural conditions which will permit the growth of vegetation thereon.

3.2 RECORDING AND PRESERVING HISTORICAL AND ARCHAEOLOGICAL FINDS

All items having any apparent historical or archaeological interest which are discovered in the course of any construction activities shall be carefully preserved. The Contractor shall leave the archaeological find undisturbed and shall immediately report the find to the Contracting Officer so that proper authorities may be notified.

3.3 PROTECTION OF WATER RESOURCES

3.3.1 General

The Contractor shall not pollute any streams, rivers or waterways with fuels, oils, bitumens, calcium chloride, acids, insecticides, herbicides or other harmful materials. The Contractor shall investigate and comply with all applicable Federal, state, county, and municipal laws concerning pollution of rivers and streams.

3.3.2 Soil Erosion and Sediment Control

The Contractor shall conduct his operations in conformance with his certified Soil Erosion and Sediment Control Plan. Surface drainage from cuts and fills within the limits of the work shall be held in suitable sedimentation ponds or shall be graded to control erosion within acceptable limits. Temporary erosion and sediment control measures shall be provided and maintained until the permanent work is completed and operative. The area of bare soil exposed at any given time by construction shall be restricted to a minimum. Fills and waste areas shall be constructed by selective placement of materials to eliminate silts or clays on the surface

which may erode and contaminate the adjacent waterway. The Contractor shall comply with all applicable laws concerning soil erosion and sediment control.

3.3.3 Disposal

Disposal of any debris resulting from the contract work and any wastes, effluents, trash, garbage, oil, grease, chemicals, etc., in or adjacent to the work area will not be permitted. If any waste material is dumped in unauthorized areas, the Contractor shall remove the material and restore the area to its original condition. If necessary, contaminated ground shall be excavated, disposed of as directed by the Contracting Officer, replaced with suitable fill material, compacted and finished with topsoil, and planted as required to reestablish vegetation.

3.4 PROTECTION OF FISH AND WILDLIFE

3.4.1 General

The Contractor shall at all times perform all work and take such steps required to minimize interference with or disturbance to fish and wildlife. The Contractor will not be permitted to alter water flows or otherwise disturb native habitat adjacent to the work area which, in the opinion of the Contracting Officer, are critical to fish and wildlife.

3.4.2 *Red-Belly Turtle*

Between 01 October and 15 July, in-water work, of any kind, is not allowed in the canal. This is to protect the red-belly turtle. Consequently, the Contractor shall complete construction of the cofferdam(s), prior to 01 October, thereby preventing flow of the canal into the contract work area. The Contractor shall maintain the hydraulic connection between the existing canals.

3.5 DISPOSAL OF DEBRIS

All debris resulting from construction operations on this contract shall be removed from the work site and disposed of at the Contractor's expense. Such disposal shall comply with all applicable Federal, state, and local laws. Such materials shall be removed from the site of the work before the date of completion of the work under these specifications.

3.6 MAINTENANCE OF POLLUTION, EROSION AND SEDIMENTATION CONTROL FACILITIES DURING CONSTRUCTION

During the life of this contract, the Contractor shall maintain all facilities constructed for pollution, erosion and sedimentation control under this contract as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created. During the construction period, the Contractor shall conduct frequent training sessions on environmental protection. The curricula should include methods of detecting and avoiding pollution; familiarity with pollution standards, both statutory and contractual; and installation and care of vegetative covers, plants and other facilities to prevent and correct environmental pollution.

3.7 MEASUREMENT AND PAYMENT

The work specified in this section will not be measured separately for payment and all costs in connection therewith will be included in the cost of all the bid items.

-- End of Section --

SECTION 02220

EXCAVATION OF CANAL AND CONSTRUCTION OF TOWPATH

PART 1 GENERAL

1.1 SCOPE OF SECTION

The work covered by this section consists of furnishing all labor, materials, and equipment, and performing all operations required for the excavation and construction of a canal and for construction of a towpath.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 1557	(2000) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2001) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

DEPARTMENT OF TRANSPORTATION, PENNSYLVANIA (PENNDOT)

PennDOT Specifications	(1995) Pennsylvania Department of Transportation Specifications for Roadway and Bridge Construction
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1.3 SUBMITTALS

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NOTE: Any submittals classified as "SD-01 Preconstruction Submittals" are submittals required to be submitted to, and approved by (if "G" designation) or reviewed by (if for information only), the CO prior to mobilization to the contract work site. All other submittals, classified as "SD-02" through "SD-11," shall be submitted to, and approved by (if "G" designation) or reviewed by (if for information only), the CO prior to commencing the particular task to which the submittal is associated.

SD-01 Preconstruction Submittals

Canal Construction Work Plan; G DO.

The Contractor shall prepare and submit plans, for approval, to the Contracting Officer for all work including, but not limited to, handling, transportation and stockpiling of all materials and excavation. The plan shall include detailed descriptions of the personnel, materials, equipment, and methods to be utilized in all phases of the canal construction. This includes detailed description of the personnel, equipment, and methods to be utilized in dewatering the site, as specified herein, for construction of this project.

Towpath Construction Work Plan; G DO.

The Contractor shall prepare and submit plans, for approval, to the Contracting Officer for all work including, but not limited to, handling, transportation and stockpiling of all materials, placing geotextile and placing and compacting the aggregate. The plan shall include detailed descriptions of the personnel, materials, equipment, and methods to be utilized.

SD-05 Design Data

Before Construction Survey Data; G,DO.

Before-survey data shall be provided before placement of the aggregate, as specified herein.

SD-06 Test Reports

Field Density Tests; G, DO.

Copies of field test results within 24 hours after the tests are performed.

SD-07 Certificates

Aggregate; G DO.

The Contractor shall furnish the Contracting Officer no less than 7 days in advance of delivery of material to the work site, in duplicate, an affidavit signed by a legally authorized official from the source of the aggregate. The affidavit shall attest that the aggregate meets the specific requirements stated in these specifications.

SD-11 Closeout Submittals

After Construction Survey Data; G,DO.

After-survey data shall be provided after placement of the aggregate, as specified herein.

1.4 CLASSIFICATION OF MATERIAL

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.5 IDENTIFICATION OF UNDERGROUND UTILITIES

Locations of existing utilities, to the extent known, are as shown on the Contract drawings. The Contractor shall take all reasonable precautions to locate and identify all existing utilities prior to excavating. Underground utility location service is provided by the Pennsylvania One Call System,

Inc., Call Before You Dig!, 1-800-242-1776, or, on the web, <http://www.paonecall.org>. The Contractor shall notify the Pennsylvania One Call System, Inc. a minimum of four days prior to the start of excavation.

1.6 DEGREE OF COMPACTION

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

1.7 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

PART 2 PRODUCTS

2.1 AGGREGATE

The towpath shall be constructed of aggregate as specified for coarse aggregate in paragraph 703.2, quality Type A, of the PennDOT Specifications. The gradation shall be as specified for AASHTO Number "2A" in paragraph 703.2(c), Table C, SIZE AND GRADING REQUIREMENTS FOR COARSE AGGREGATES.

2.2 *Geosynthetic Clay Liner (GCL)*

GCL and cover material shall be as specified in Section 02378 GEOSYNTHETIC CLAY LINER.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

The area shall be cleared and grubbed, as specified in Section 02214 CLEARING AND GRUBBING, as necessary for completion of the contract work.

3.2 UTILITY POLE

A utility pole exists in the project area. The Contractor shall build the project around the pole, making sure to prevent any damage to the pole.

3.3 DAMMING, DIVERSION AND DEWATERING

3.3.1 Damming and Diversion

The Contractor shall ***construct cofferdams at either end of the new canal (the existing terminuses of the existing canal) to keep the canal from flowing into the contract area. The Contractor shall maintain the hydraulic connectivity between the two sides of the existing canal.*** ~~The Contractor shall provide the equipment required to divert water from one side of canal to other to eliminate different levels of water on either side of canal.~~

3.3.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of

construction. The proposed dewatering methods shall be sufficient to continually and effectively dewater the area during and after rainfall. French drains, sumps, ditches or trenches will not be permitted within .5 foot of the foundation of any structure, except with specific written approval.

Control measures shall be taken by the time the excavation reaches the final grade of excavation in order to maintain the integrity of the in situ material. The water level shall be maintained continuously at least .5 foot below the ***the geosynthetic clay liner (GCL), continuously, 24 hours per day, 7 days per week, for the remaining contract period.*** This level of dewatering shall be maintained until otherwise approved by the COR. Unstable material, created due to the Contractor's inadequate drainage and dewatering methods, shall be removed and replaced with satisfactory material at the Contractor's expense.

Discharge water from dewatering operations shall be released into the existing canal. The Contractor shall install a silt sack on the end of the discharge line to trap sediment and to prevent discharge of turbid water into the canal.

3.4 CONSTRUCTION OF CANAL

3.4.1 Excavation

The Contractor shall excavate to the lines, slopes, and grades, as shown on the contract drawings. Excavated material shall be removed from the site at the Contractor's expense. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

3.4.2 Placement of Geosynthetic Clay Liner (GCL)

The GCL and its cover material shall be placed as specified in Section 02378 GEOSYNTHETIC CLAY LINER.

3.4.3 Placement of Topsoil and Erosion Control Mat (ECM)

The topsoil beneath the ECM and soil-filled ECM shall be installed as specified in SECTION 02216 EROSION CONTROL MAT.

3.5 CONSTRUCTION OF TOWPATH

3.5.1 Subgrade Preparation

The ground surface of the proposed towpath shall be stripped of live, dead, or decayed vegetation, rubbish, debris, loose rocks greater than 1-1/2 inches in diameter, and any other extraneous matter which would interfere with grading and proper placement of the aggregate. Compaction of the subgrade shall be accomplished by proof rolling. The subgrade shall be proof-rolled until no movement of material under the compaction equipment is detected. The elevation of the finish subgrade shall not vary more than 0.05 foot from the required lines and grades shown on the contract drawings.

3.5.2 Placement of Geotextile

The geotextile shall be installed as specified in SECTION 02215 GEOTEXTILE.

3.5.3 Placement and Compaction of Aggregate

Aggregate shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. The aggregate shall be shaped to line, grade, and cross section, as shown on the contract drawings. Each layer shall be compacted to at least 95 percent maximum density, unless otherwise specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. After compaction, the surface of the aggregate shall not show deviations greater than 1 inch when tested with a 12 foot straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the aggregate shall not vary more than 1 inch from the required lines and grades shown on the contract drawings.

3.6 SURVEY REQUIREMENTS

The Contractor shall be responsible for conducting all surveys required to demonstrate that the construction is in compliance with the specified tolerances and the lines, grades, and elevations shown on the drawings, as specified herein and as specified in Special Clause: QUANTITY SURVEYS. Surveys shall be taken by a Pennsylvania licensed surveyor. Survey cross-sections shall be taken before and after excavation of the canal. The cubic yardage of excavation will be computed by the average end-area method. For construction of the towpath, surveys shall be taken before and after placement of the aggregate. The cross sections shall be taken at the starting and ending stations of each work item and every 25 feet. The survey control to be used for vertical control are where shown on the Contract Drawings and as described in Section 00840 SURVEY DESCRIPTION SHEETS.

3.7 FILLING NEW CANAL

Water shall be released into the new canal in a controlled manner to prevent damage to the new canal.

3.8 TESTS

The following tests shall be performed on the **towpath** in conformance with the applicable standards listed.

3.8.1 Moisture-Density Determinations

The maximum density and optimum moisture content shall be determined in accordance with ASTM D 1557.

3.8.2 Field Density Tests

Density shall be field measured in accordance with ASTM D 2922. For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted if necessary using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material

method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed.

3.9 Testing Frequency

3.9.1 Initial Tests

The following tests in the quantity specified shall be performed on the proposed aggregate materials prior to commencing construction to demonstrate that the proposed aggregate materials meet all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Moisture-density relationship. One moisture-density relationship test shall be conducted for each material proposed for use on the project.

3.9.2 In Place Tests

The following tests shall be performed on samples taken from the placed and compacted aggregate. Samples shall be taken and tested at the rates indicated.

- a. In-place density testing shall be performed on every lift of material placed and at a frequency of one set of tests for every 250 square yards, or portion thereof, of completed area.

3.10 MEASUREMENT AND PAYMENT

3.10.1 Damming, Diversion and Dewatering

The work specified in this section for damming, diversion and dewatering will not be measured for payment. All costs in connection therewith shall be included in the contract lump sum price for Bid Item No. 2, "Damming, Diversion and Dewatering."

3.10.2 Construction of Canal

3.10.2.1 Excavation

The work specified in this section for excavation of the canal, and all costs in connection therewith, will be measured for payment by the cubic yard of material removed. Payment for this work will be made at the contract unit price for Bid Item No. 3, "Excavation". Also included are all costs associated with the required surveying, as specified herein, before and after excavation.

3.10.2.2 Geosynthetic Clay Liner (GCL)

The work specified in this section for providing and placing the geosynthetic clay liner (GCL) and its cover material will be measured and paid for as specified in the MEASUREMENT AND PAYMENT paragraph in SECTION 02378 GEOSYNTHETIC CLAY LINER (GCL).

3.10.2.3 Erosion Control Mat

The work specified in this section for providing and placing erosion control mat will be measured and paid for as specified in the MEASUREMENT

AND PAYMENT paragraph in SECTION 02216 EROSION CONTROL MAT.

3.10.3 Construction of Towpath

The work specified in this section for placing and compacting aggregate for the construction of the towpath, and all costs in connection therewith, will not be measured for payment. All costs in connection therewith shall be included in the lump sum price for Bid Item No. 5, "Construction of Towpath." Also included are all costs associated with the required surveying. Also included in this unit price is the geotextile as specified in the Measurement and Payment paragraph of Section 02215 GEOTEXTILE.

-- End of Section --

SECTION 02378

GEOSYNTHETIC CLAY LINER

PART 1 GENERAL

1.1 SUMMARY

The work covered by this section consists of furnishing all labor, material, and equipment, and performing all operations required for providing geosynthetic clay liner (GCL) in the new canal as specified herein and as indicated on the contract drawings.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2216	(1996) Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 4632	(1991) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4643	(1993) Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D 5321	(1992) Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
ASTM D 5887	(1995) Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter
ASTM D 5888	(1995) Storage and Handling of Geosynthetic Clay Liners
ASTM D 5889	(1995) Quality Control of Geosynthetic Clay Liners
ASTM D 5890	(1995) Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
ASTM D 5891	(1995) Fluid Loss of Clay Component of Geosynthetic Clay Liners
ASTM D 5993	(1996) Measuring Mass Per Unit of Geosynthetic Clay Liners

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

GCL Properties; G,DO.

The GCL manufacturer's certified raw and roll material data sheets. The certification shall indicate that the GCL has been continuously inspected for broken needles using an in-line metal detector and all broken needles have been removed. The certified data sheets shall be attested to by a person having legal authority to bind the GCL manufacturing company. Certified test results, along with a sample of the GCL to be used on this project measuring a minimum of 12 inches by 12 inches, shall be submitted at least 5 working days prior to delivery of the GCL.

GCL Warranty

The GCL manufacturer's warranty statement.

Aggregate Cover Material; G,DO

The Contractor shall furnish the Contracting Officer no less than 7 days in advance of delivery of material to the work site, in duplicate, an affidavit signed by a legally authorized official from the source of the aggregate. The affidavit shall attest that the aggregate meets the specific requirements stated in these specifications.

SD-06 Test Reports

GCL Conformance Tests; G,DO.

Independent QC laboratory test results for the GCL including descriptions of equipment and test methods.

1.4 QUALIFICATIONS

The geosynthetic clay liner shall be the product of a GCL manufacturer who has produced the proposed GCL using the same bentonite, geotextiles, sewing thread, and adhesive for at least 5 completed projects and shall have produced a minimum of 1,000,000 square feet of the proposed GCL.

1.5 SHIPMENT, HANDLING, AND STORAGE

1.5.1 Delivery

Delivery, storage, and handling of GCL shall be in accordance with ASTM D 5888. The Contracting Officer shall be present during delivery and unloading of the GCL. Rolls shall be packaged in an opaque, waterproof, protective covering and wrapped around a central core. Tears in the packaging shall be repaired to restore a waterproof protective barrier around the GCL. Unloading of rolls from the delivery vehicles shall be done preventing damage to the GCL and its packaging.

1.5.2 Storage

Field storage shall be in flat dry areas where water cannot accumulate and the GCL rolls can be protected from damage. Storage of the rolls on blocks or pallets will not be allowed unless the GCL rolls are fully supported as approved by the Contracting Officer. Stacks of GCL rolls shall be no greater than three high. Rolls shall be covered with a water proof tarpaulin or plastic sheet if stored outdoors.

1.5.3 Handling

Rolls shall not be dragged, lifted by one end, or dropped to the ground from the delivery vehicle. A pipe or solid bar of sufficient strength to support the full weight of the roll without significant bending shall be used for all unloading and handling activities. The diameter of the pipe shall be small enough to be easily inserted through the core of the GCL roll. Chains shall be used to link the ends of the core pipe to the ends of a spreader bar. The spreader bar shall be wide enough to prevent the chains from rubbing against the ends of the GCL roll. Alternatively, a stinger bar protruding from the end of a forklift or other equipment may be used. The stinger bar shall be at least three-fourths the length of the core and also must be capable of supporting the full weight of the GCL without significant bending. If recommended by the manufacturer, a sling handling method utilizing appropriate loading straps may be used.

1.6 INSPECTIONS, VERIFICATIONS, AND TESTING

1.6.1 GCL Manufacturing Sampling and Testing

The GCL and its components shall be sampled and tested in accordance with the GCL manufacturer's approved QC manual. The GCL manufacturer's QC procedures shall be in accordance with ASTM D 5889. Test results not meeting the requirements specified in Table 3 shall result in the rejection of applicable rolls. The GCL manufacturer's QC manual shall describe procedures used to determine rejection of applicable rolls. As a minimum, rolls produced immediately prior to and immediately after the failed roll shall be tested for the same failed parameter. Testing shall continue until a minimum of three successive rolls on both sides of the original failing roll pass the failed parameter.

PART 2 PRODUCTS

2.1 GEOSYNTHETIC CLAY LINER

The GCL shall be "Bentomat DN", manufactured by CETCO, or an approved equal, meeting the requirements specified herein. The GCL shall be a manufactured product consisting of a sodium montmorillonite clay (bentonite) layer evenly distributed between two geotextiles. The GCL shall conform to the property requirements listed in Table 3 and shall be free of tears, holes, or other defects which may affect its serviceability.

Encapsulating geotextiles shall be mechanically bonded together using a needle punch. The GCL shall be continuously inspected for broken needles using an in-line metal detector and broken needles shall be removed. The minimum manufactured GCL sheet width shall be 14.5 feet and the minimum manufactured GCL sheet length shall be 150 feet.

TABLE 3 - GCL PROPERTIES

	TEST METHOD	TEST VALUE
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BENTONITE		
Swell Index Test, minimum	ASTM D 5890	24 mL
Fluid Loss, maximum	ASTM D 5891	18 mL
COMPOSITE		
Bentonite Mass/Unit Area, MARV, Notes 1 and 2	ASTM D 5993	0.75 lbs/sq foot
Tensile Strength, MARV	ASTM D 4632	90 lbs/in
Peak Mid-Plane Shear Strength (hydrated), minimum at a normal stress of 200 psf	ASTM D 5321	500 psf
Index Flux, maximum	ASTM D 5887	.00000001 cubic m/sq m/sec
Peel Strength, MARV	ASTM D 4632	15 lbs.

Note 1: MARV = minimum average roll value.

Note 2: Bentonite mass/unit area shall be computed at 0 percent moisture content. Moisture content shall be determined by ASTM D 2216 or ASTM D 4643. Bentonite mass/unit area is exclusive of glues added to the bentonite.

2.2 COVER MATERIAL

Cover material shall be PennDOT 2A aggregate as specified for the towpath aggregate material in Section 02220 EXCAVATION OF CANAL AND CONSTRUCTION OF TOWPATH.

PART 3 EXECUTION

3.1 INSTALLATION OF THE GCL

3.1.1 Subgrade Preparation

The subgrade shall be nominally compacted using the excavator's bucket. The compacted subgrade surface shall be smooth and free of vegetation, standing water, and angular stones or other foreign matter that could damage the GCL. At a minimum, the subgrade surface shall be compacted to remove any wheel ruts, footprints, or other abrupt grade changes. All protrusions extending more than 0.5 inches from the subgrade (or less if recommended by the manufacturer) shall either be removed, crushed, or pushed into the surface with the compactor. The GCL shall not be installed on a frozen subgrade. Each day during placement of GCL, the Contracting Officer and installer shall inspect the surface on which GCL is to be placed and certify in writing that the surface is acceptable.

3.1.2 Placement

GCL shall be installed approximately perpendicular to the canal centerline, but parallel to the line of maximum slope. GCL shall be installed such that the upstream panel shingles over the adjacent downstream panel. GCL shall be installed as soon as practical after completion and approval of the subgrade; but, GCL shall not be deployed if it is frozen. Rolls shall be delivered to the work area in their original packaging. Immediately prior to deployment, the packaging shall be carefully removed without damaging the GCL. GCL which has been hydrated prior to being covered by a minimum of 12 inches of cover materials shall be removed and replaced. Hydrated GCL is defined as material which has become soft as determined by squeezing the material with finger pressure or material which has exhibited swelling. On side slopes, GCL shall be anchored at the top and deployed down the slope to minimize wrinkles. Dragging of GCL panels over the ground surface shall be minimized. The Contracting Officer has the option of requiring the use of a slip sheet. Deployed GCL panels shall lie flat on the subgrade surface, with no wrinkles or folds.

3.1.3 Anchor Trench

Where anchor trenches are required, they shall be placed a minimum of 12 inches back from the edge of slopes to be covered. Anchor trenches shall be a minimum of 24 inches deep and 18 inches wide. The front edge of the trench shall be rounded so as to eliminate sharp corners that could damage the GCL. The GCL shall extend down the front wall and across the bottom of the anchor trench as shown on the contract drawings. Soils used for backfill shall have a maximum particle size of 1.0 inch and shall be placed in two lifts.

3.1.4 Seams

On side-slopes, GCL shall be placed with seams oriented parallel to the line of maximum slope and shall be free of tension or stress upon completion of the installation. Panels shall be positioned with the overlap recommended by the manufacturer, but not less than 12 inches after shrinkage for panel sides or **24 inches** after shrinkage for panel ends (only allowed on canal bottom). No horizontal (a.k.a., end) seams shall be permitted on the canal side slopes. Dirt or other foreign matter shall be removed from the overlap area immediately prior to seaming. **Granular bentonite of the same type as the bentonite used for the GCL shall be placed along the entire overlap at a minimum rate of 0.25 lbs/linear foot. The underlying edge of the longitudinal overlap shall be exposed and then a continuous bead of granular sodium bentonite shall be applied along a zone defined by the edge of the underlying panel and the 6-inch line. A similar bead of granular sodium bentonite shall be applied at the end-of-roll overlap.**

3.1.5 Protection

Only those GCL panels which can be anchored and covered in the same day shall be unpackaged and installed. If exposed GCL cannot be permanently covered before the end of a working day, it shall be temporarily covered with plastic or other waterproof material to prevent hydration.

3.2 REPAIRS

Holes or tears in GCL shall be repaired by placing a patch of GCL extending a minimum of 12 inches beyond the edges of the hole or tear on all sides. If recommended by the manufacturer, granular bentonite or bentonite mastic shall be applied in the overlap area. Patches shall be secured with a construction adhesive or other approved methods as recommended by the manufacturer.

3.3 COVERING

GCL shall not be covered prior to inspection and approval by the Contracting Officer. Cover materials shall be aggregate, and, where erosion control mat is to be installed, the cover material shall be topsoil. Cover materials shall not be dropped directly onto the GCL from a height greater than 1 foot. The materials shall be pushed out over the GCL in an upward tumbling motion. The direction of backfilling shall proceed in the direction of down gradient shingling of GCL overlaps; except that on side slopes, materials shall be placed from the bottom of the slope upward. Cover materials shall be placed preventing materials from entering the GCL overlap zone and tensile stress from being mobilized in the GCL. No equipment shall be operated on the top surface of the GCL without permission from the Contracting Officer. **The cover material shall be placed in one lift such that, upon compaction, the final compacted layer shall be 12 inches. The cover material shall be compacted by making two passes over the entire surface area with an approved equipment.** Equipment with ground pressures less than 5.0 psi shall be used to place **and compact** the cover materials over the GCL. No equipment is permitted on the side slopes once the GCL has been placed.

3.4 MEASUREMENT AND PAYMENT

The work specified in this section for the complete and satisfactory installation of the GCL will be measured for payment by the square yard. All costs in connection therewith shall be included in the unit price for Bid Item No. 7, "Geosynthetic Clay Liner." Measurement will be made of the total surface area covered by GCL in square yards as shown on the contract drawings. Final quantities will be based on as-built conditions. Allowance will be made for GCL in anchor trenches; however, no allowance will be made for waste, overlap, repairs, or materials used for the convenience of the Contractor. This unit price shall include all costs in connection with placing the aggregate cover material. (Topsoil cover material shall be included in the unit price for the soil-filled erosion control mat.) No payment will be made for GCL replaced because of waste, contamination, damage, repair, or due to contractor fault or negligence.

-- End of Section --