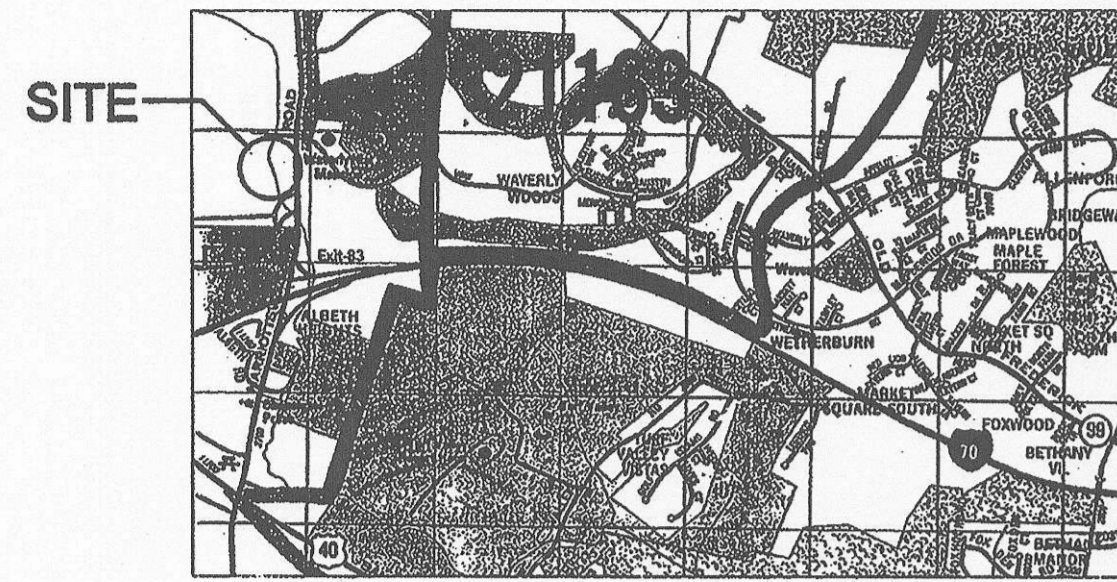


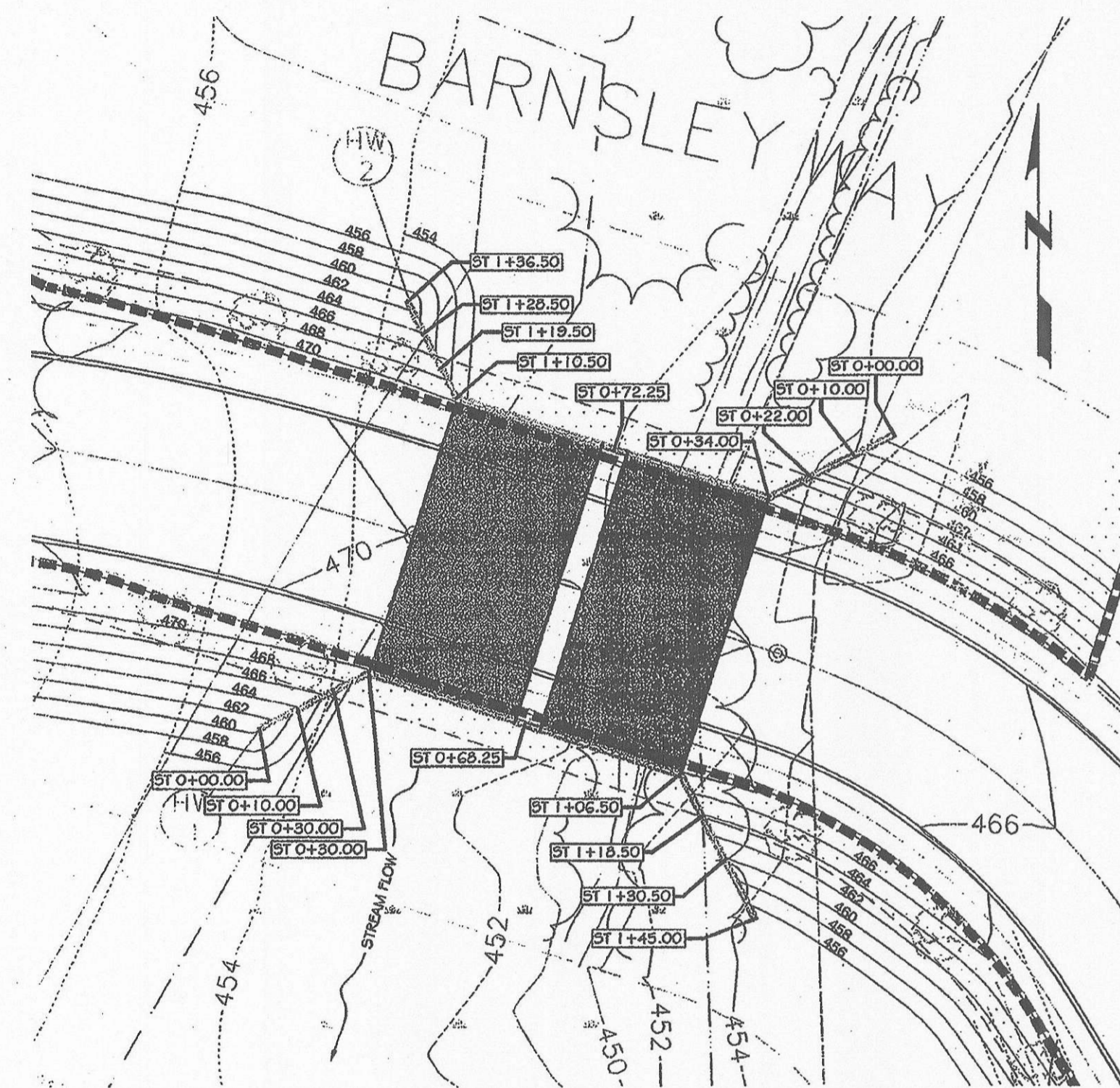
# COURTYARDS AT WAVERLY WOODS

WEST SUBDIVISION, HOWARD COUNTY, MARYLAND

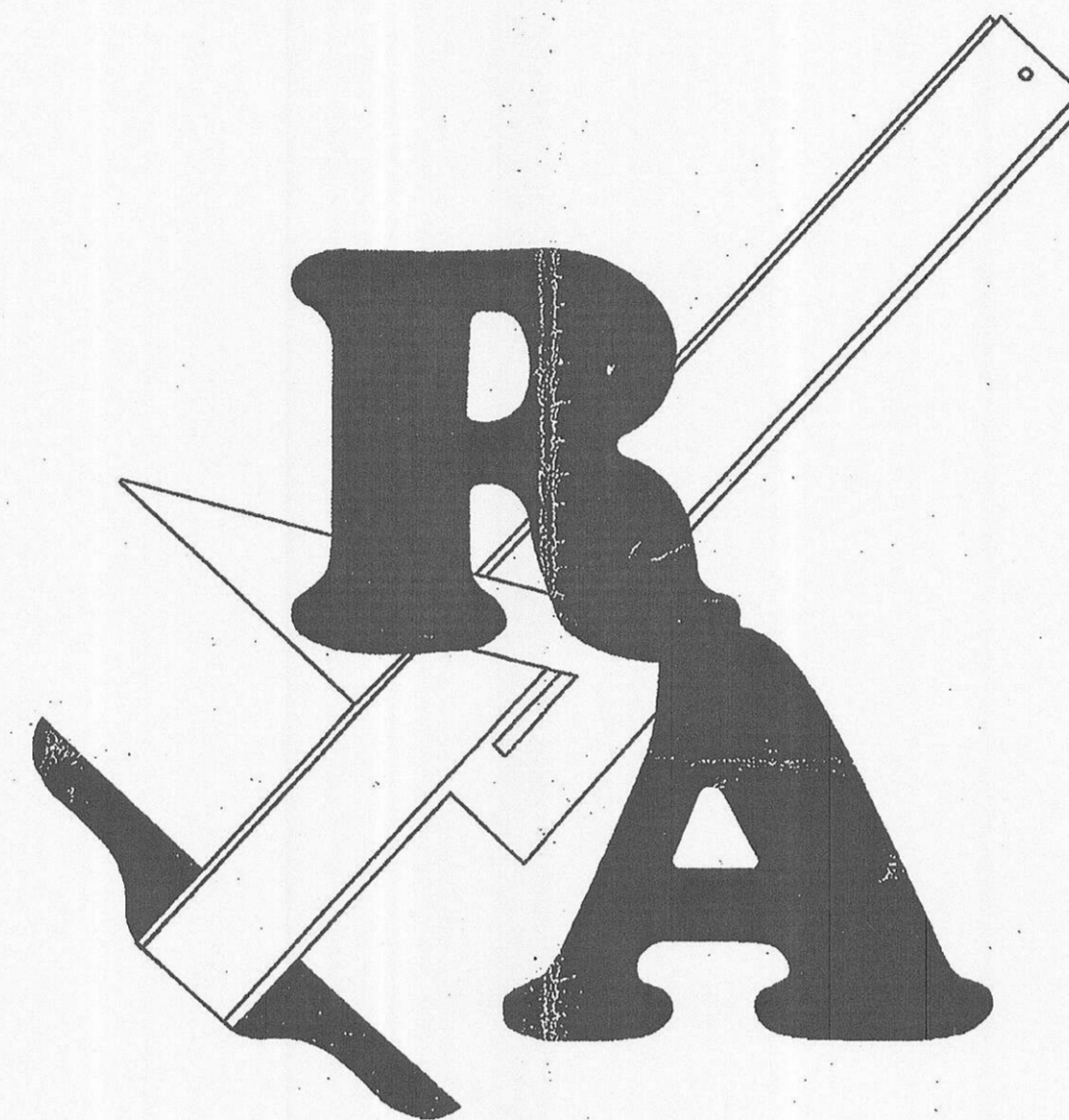


VICINITY MAP  
SCALE: N.T.S.

## 34'7"x11'4" 3ga PLATE ARCH CULVERT STRUCTURAL DESIGN



SITE PLAN  
SCALE: 1" = 30'



### RYAN & ASSOCIATES

A Division of WKR Consulting, Inc.

CONSULTING & DESIGN ENGINEERS

**HAGERSTOWN, MD OFFICE**

1825 HOWELL RD, SUITE 3  
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FAX: (301) 360-9574

**FREDERICK, MD OFFICE**

2412 WYNFIELD CT.  
FREDERICK, MD 21701  
PHONE: (301) 360-9534  
FAX: (301) 360-9574

e-mail: [info@ryanandassociates.net](mailto:info@ryanandassociates.net)

SPECIALIZING IN STRUCTURAL ENGINEERING, GEOTECHNICAL  
ENGINEERING AND RETAINING WALL DESIGN

[www.ryanandassociates.net](http://www.ryanandassociates.net)

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CHIEF, BUREAU OF HIGHWAYS	DATE
APPROVED: DEPARTMENT OF PLANNING AND ZONING	
CHIEF, DIVISION OF LAND DEVELOPMENT	DATE
CHIEF, DEVELOPMENT ENGINEERING DIVISION	DATE

THESE DRAWINGS ARE THE PROPERTY OF RYAN & ASSOCIATES. UNAUTHORIZED REPRODUCTION FOR ANY PURPOSE IS AN INFRINGEMENT UPON COPYRIGHT LAWS. VIOLATORS WILL BE SUBJECT TO PROSECUTION BY THE FULLEST EXTENT OF THE LAW.

WRITTEN DIMENSIONS ON THE DRAWINGS SHALL HAVE PRECEDENCE OVER SCALE DIMENSIONS. CONTRACTORS SHALL VERIFY AND BE RESPONSIBLE FOR ALL DIMENSIONS AND CONDITIONS ON THE JOB AND THIS OFFICE MUST BE NOTIFIED OF ANY VARIATION FROM THE DIMENSIONS AND CONDITIONS SHOWN BY THESE DRAWINGS.

Scope: The plate arch culvert engineer's (Ryan & Associates) scope consists of preparing the culvert design to enable the contractor to obtain necessary permits and properly construct the arch. The design considers the internal and local stability of the arch and is in accordance with acceptable engineering practice and these specifications. Services outside this scope such as responding to the owner's engineering firm (civil, structural, geotechnical or otherwise), provision of quality control testing & inspection, certification of arch construction, investigation of failed or non-conforming arches or any other services may be provided on a time & materials basis or for a negotiated fee. The scope of Ryan & Associates (RA) for this project does not include arch stakeout or any other civil engineering/surveying.

INSTALLATION MUST CONFORM TO THE ATTACHED "Ryan & Associates Structural Specifications and Guidelines".

PLATE ARCH MATERIALS: Structural Plate Arch to be supplied by Lane Enterprises, Inc. and to be 3 gauge steel (.249" thick). Structure type to be LA4108 low profile arch.

CONSTRUCTION REVIEW & CERTIFICATION: CONSTRUCTION INSPECTION, TESTING AND CERTIFICATION BY A STRUCTURAL/GEOTECHNICAL ENGINEER QUALIFIED IN THE DESIGN OF STEEL PLATE ARCH STRUCTURES IS A REQUIREMENT OF THESE PLANS. ACCEPTANCE OF THE USE OF THESE PLANS INDICATES AGREEMENT FOR PROFESSIONAL ENGINEERING CONSTRUCTION REVIEW AND CERTIFICATION

#### DRAWING INDEX

- Sheet 1 - Cover Sheet
- Sheet 2 - Head Walls, Wing Walls and Culvert Footings Plan
- Sheet 3 - Wall and Arch Profiles
- Sheet 4 - Culvert & Footing Cross-Sections
- Sheet 5 - Plate Arch Sections & Details
- Sheet 6 - Specifications

#### PROJECT INFORMATION

Project : Courtyards at Waverly Woods - West Stream Crossing  
Location : Marriottsville Rd., North Side of I-70, Howard County, MD  
Jurisdiction : Howard County, MD  
Contractor : T.B.D.  
Site Civil Engineer : Fisher, Collins & Carter, Inc.  
Owner/Developer : Land Design & Development, Inc.  
RA Project Manager : Chris Heyrend



CALL "MISS UTILITY"  
TELEPHONE 1-800-257-7777 FOR UTILITY LOCATIONS  
AT LEAST 48 HOURS BEFORE CONSTRUCTION.

FISHER, COLLINS & CARTER, INC.  
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HW 48 - 2005

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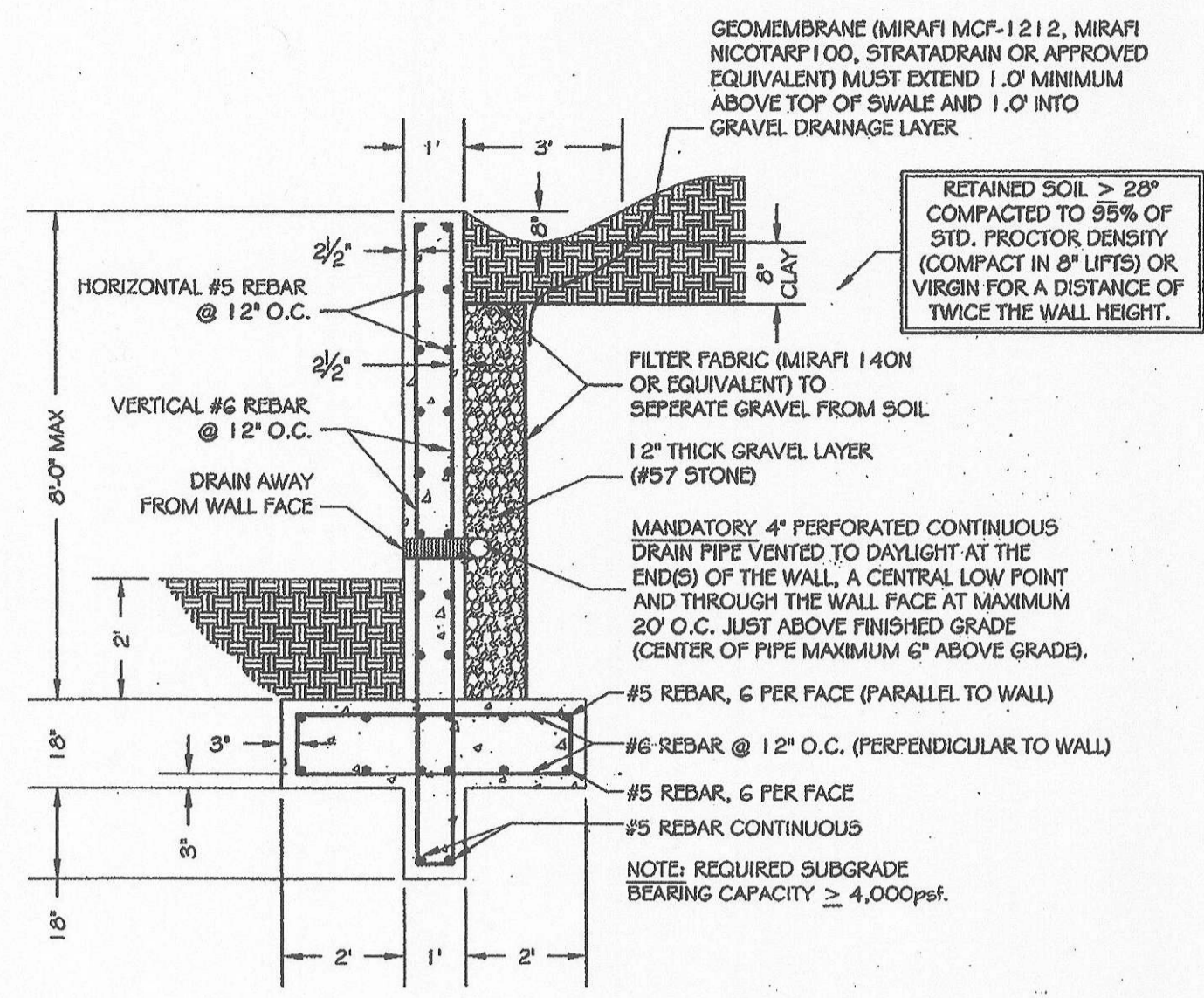
DEVELOPER  
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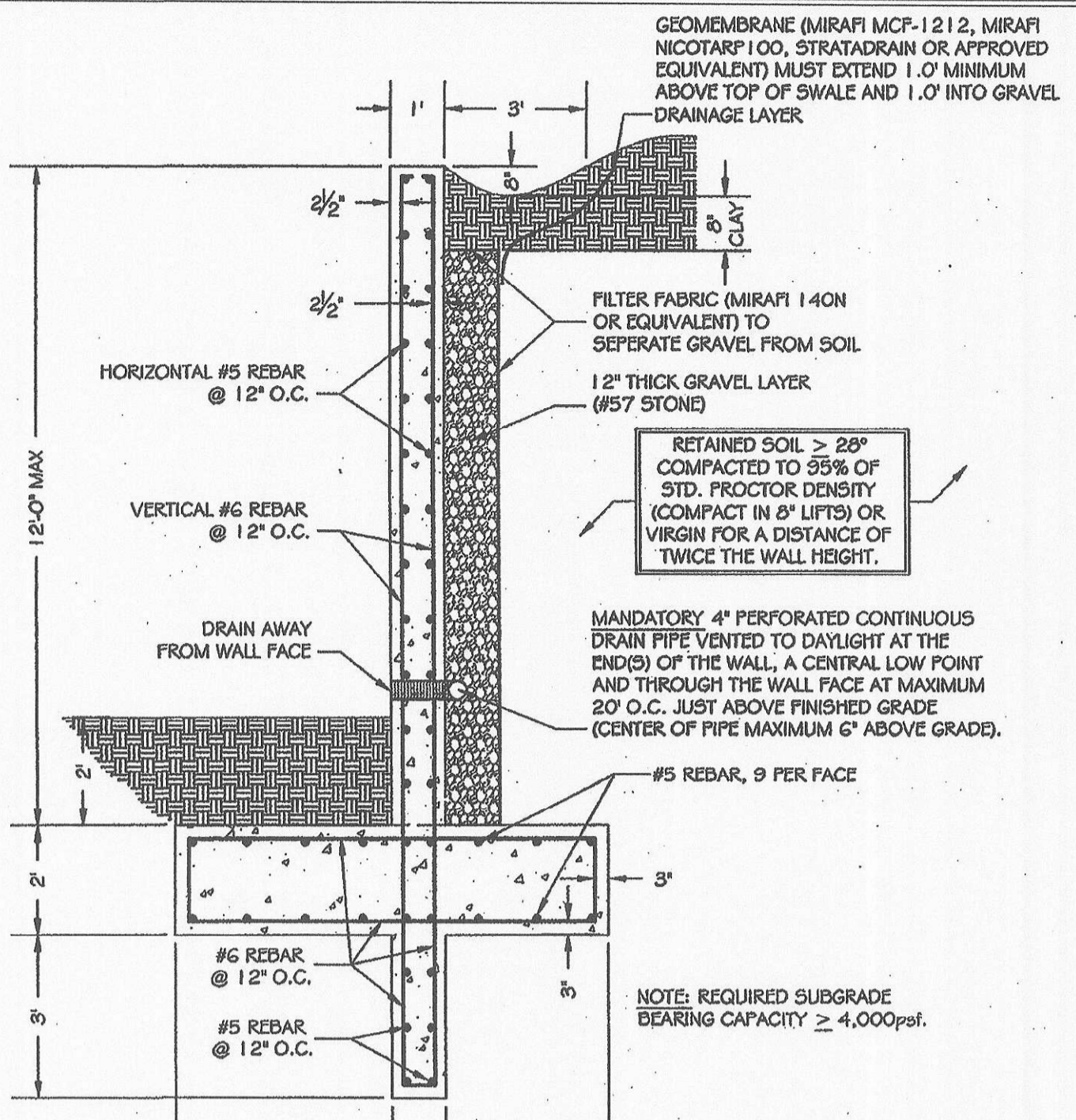
Documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.  
William K. Ryan, P.E.  
License No. 21604  
Expiration Date: 09/09/2009

GTW'S WAVERLY WOODS  
SECTION 14  
BULK PARCELS 'A' & 'B' AND  
OPEN SPACE LOT 1  
(A SUBDIVISION OF THE PROPERTY OF WAVERLY WOODS DEVELOPMENT CORPORATION, LIBER 4079, FOLIO 307)  
ZONING: P5C & PEC  
TAX MAP NO. 16 PARCEL Nos. 120, 221 & P/O 249 GRID Nos. 3 & 4  
THIRD ELECTION DISTRICT HOWARD COUNTY, MARYLAND  
DATE: DECEMBER 5, 2008  
SHEET 14 OF 22

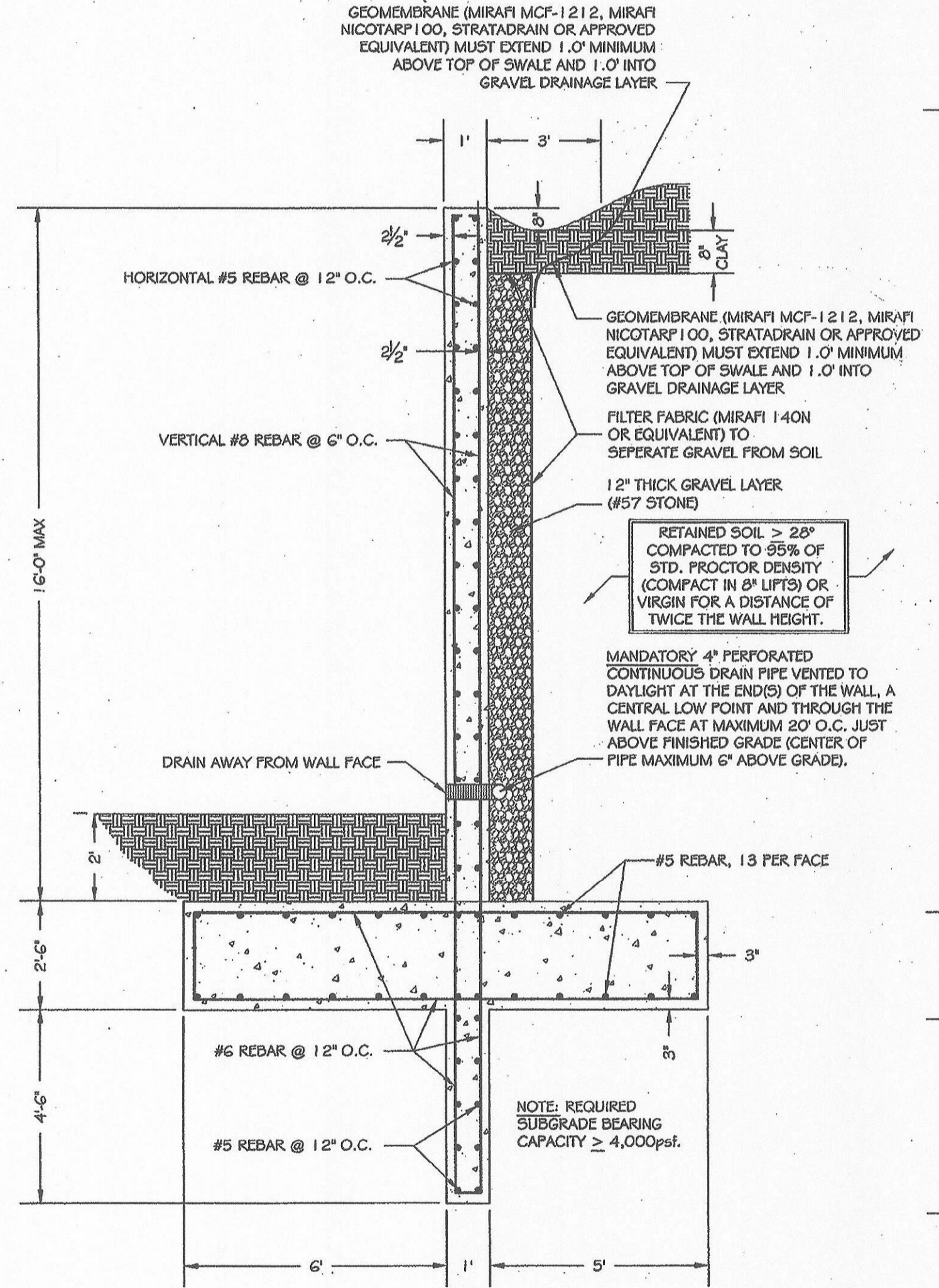




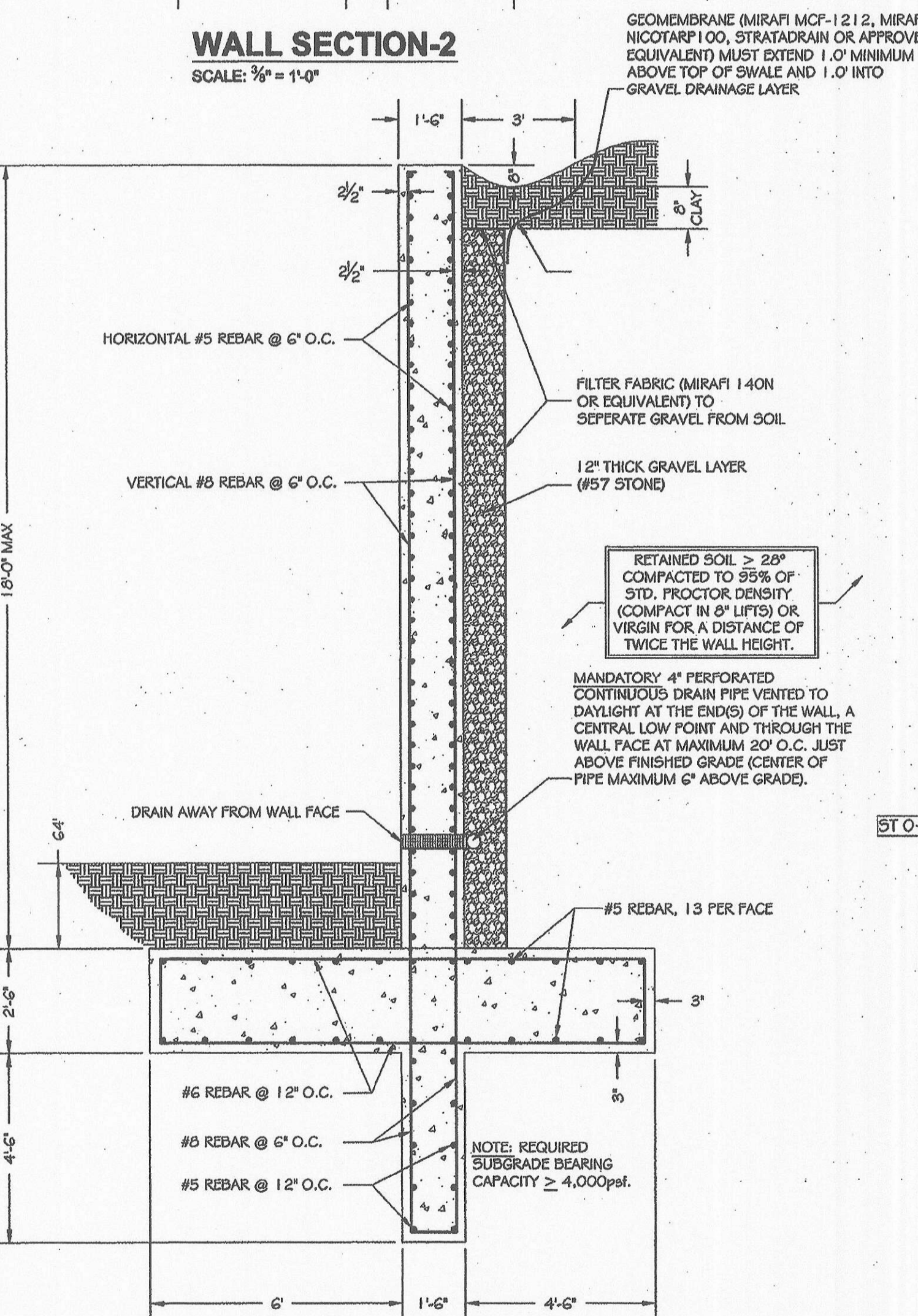
**WALL SECTION-1**  
SCALE: 3/8" = 1'-0"



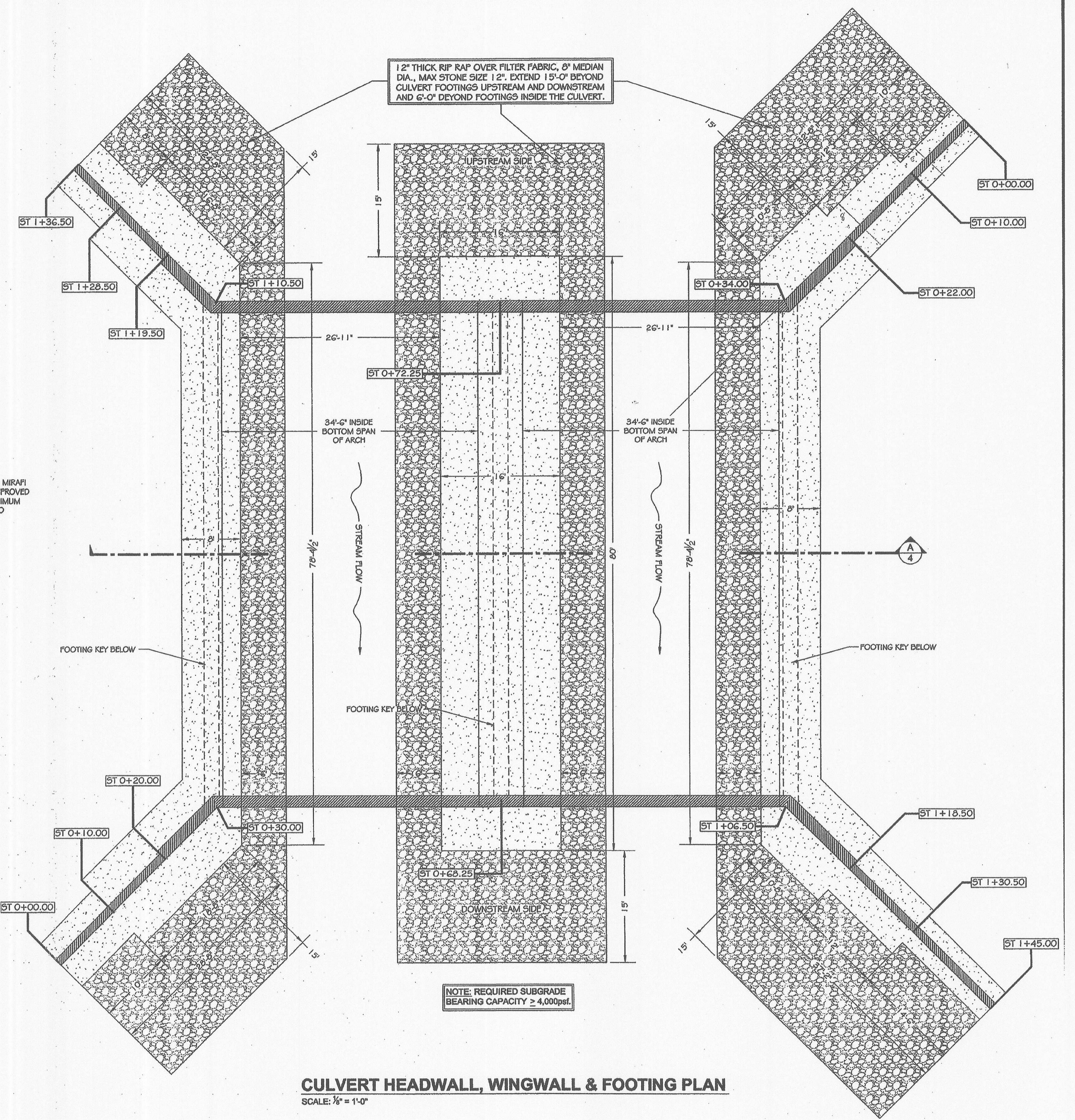
**WALL SECTION-2**  
SCALE: 3/8" = 1'-0"



**WALL SECTION-3**  
SCALE: 3/8" = 1'-0"



**WALL SECTION-4**  
SCALE: 3/8" = 1'-0"



**CULVERT HEADWALL, WINGWALL & FOOTING PLAN**  
SCALE: 3/8" = 1'-0"

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APPROVED: DEPARTMENT OF PUBLIC WORKS	DATE
CHIEF, BUREAU OF HIGHWAYS	DATE
APPROVED: DEPARTMENT OF PLANNING AND ZONING	DATE
CHIEF, DIVISION OF LAND DEVELOPMENT	DATE
CHIEF, DEVELOPMENT ENGINEERING DIVISION	DATE

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301-360-9574 (fx)

Frederick, MD Office  
2412 Wynfield Ct.  
Frederick, MD 21702  
301-360-9534 (ph)  
301-360-9574 (fx)



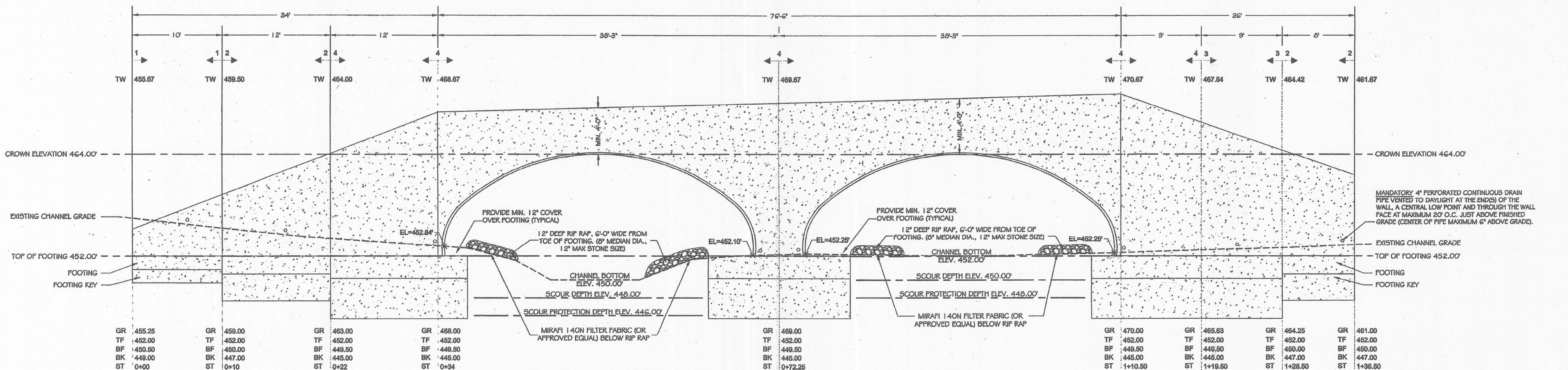
**PROFESSIONAL CERTIFICATION**

I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.

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License No. 21698  
Expiration Date 05/06/2009

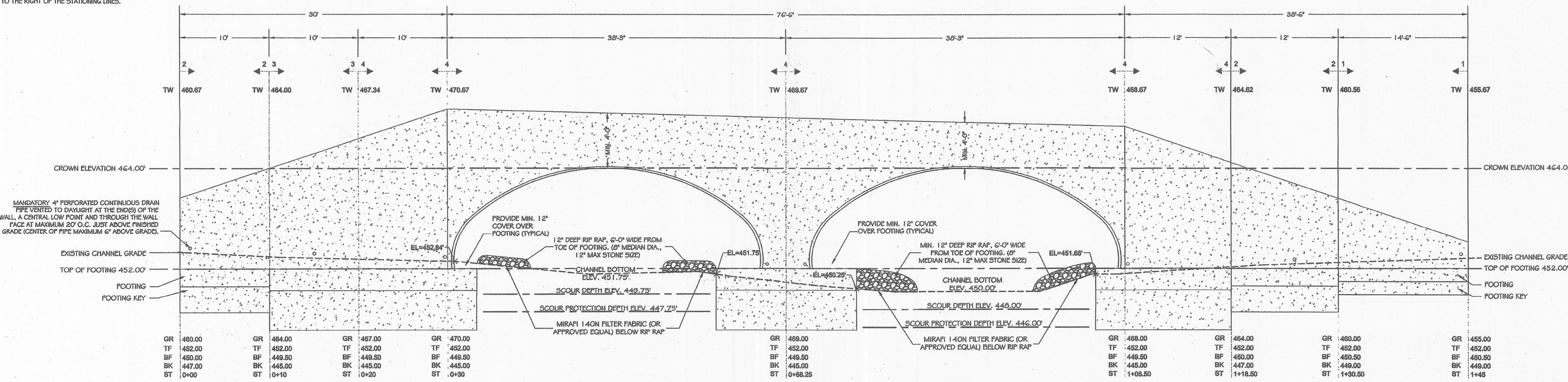
CULVERT PLAN AND DETAILS  
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THIRD ELECTION DISTRICT HOWARD COUNTY, MARYLAND  
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SHEET 15 OF 22





**KEY**  
GR - PROPOSED GRADE BEHIND WALL  
TF - TOP OF FOOTING  
BF - BOTTOM OF FOOTING  
BK - BOTTOM OF KEY  
ST - STATION  
NOTE: FOOTING AND KEY ELEVATIONS ARE TO THE RIGHT OF THE STATIONING LINES.

NOTE: SCOUR PROTECTION DEPTH IS AS INDICATED ON THESE PLANS OR 4' BELOW GRADE ELEVATION NEXT TO TOP OF FOOTING, WHICHEVER IS DEEPER. SCOUR DEPTH BASED ON SCOUR ANALYSIS REPORT BY RYAN AND ASSOCIATES DATED 06/19/08. AT A MINIMUM LEAN CONCRETE SHALL BE POURED TO SCOUR PROTECTION DEPTH.



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NOTE: THE ROAD GRADES & ELEVATIONS SHOWN ON THESE PLANS ARE BASED ON THE CIVIL ENGINEERS DRAWINGS. IF A DISCREPANCY EXISTS BETWEEN THESE PLANS AND THE CIVIL ENGINEERS, THE CIVIL ENGINEERS GRADES GOVERN AND SHALL BE USED.

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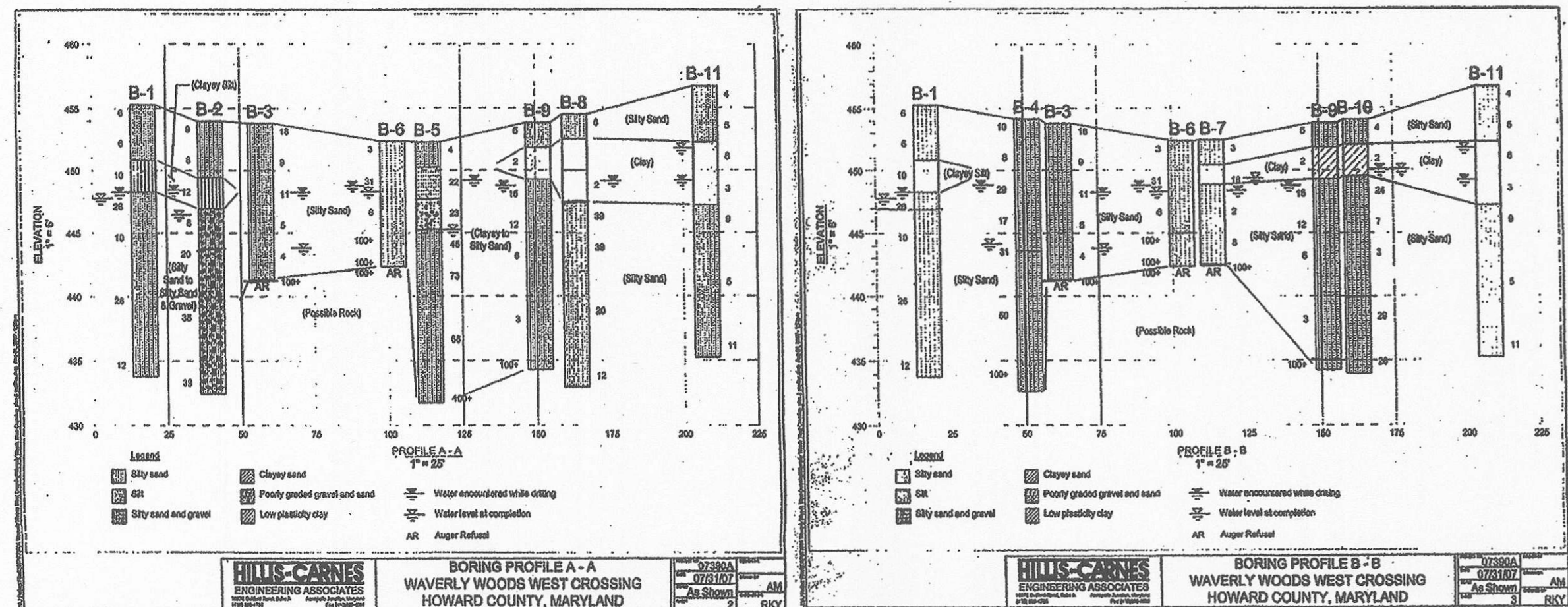
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301-360-9534 (ph)  
301-360-9574 (fx)



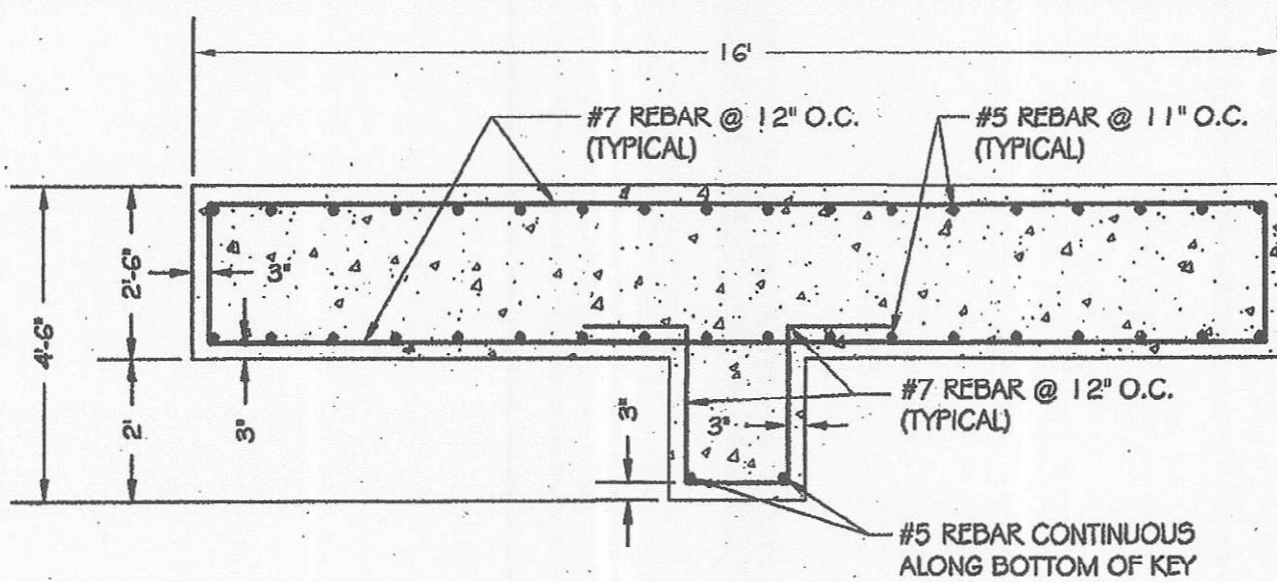
**PROFESSIONAL CERTIFICATION**  
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.  
*William K. Ryan, P.E.*  
License No: 21568  
Expiration Date: 08/01/2009

CULVERT WALL PROFILES  
**GTW'S WAVERLY WOODS**  
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ZONING: PSC & PEC  
TAX MAP NO. 16 PARCEL Nos. 120, 221 & P/O 249 GRID Nos. 3 & 4  
THIRD ELECTION DISTRICT HOWARD COUNTY, MARYLAND  
DATE: DECEMBER 5, 2008  
SHEET 16 OF 22

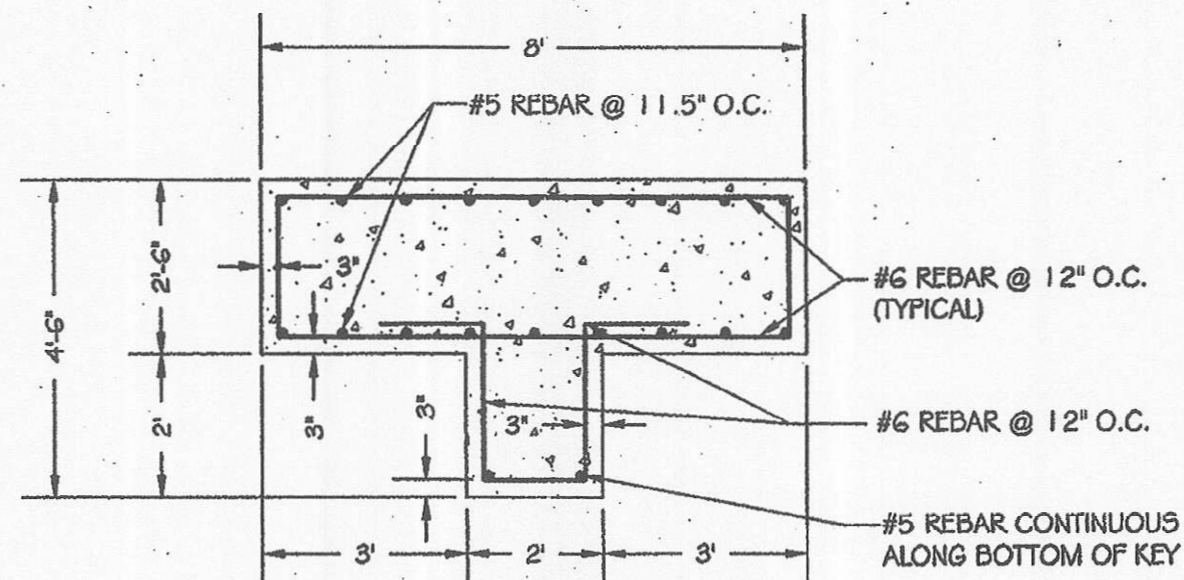




**BORING PROFILES**  
SCALE: N.T.S.  
(REFER TO SHEET-5 FOR LOCATION MAP)

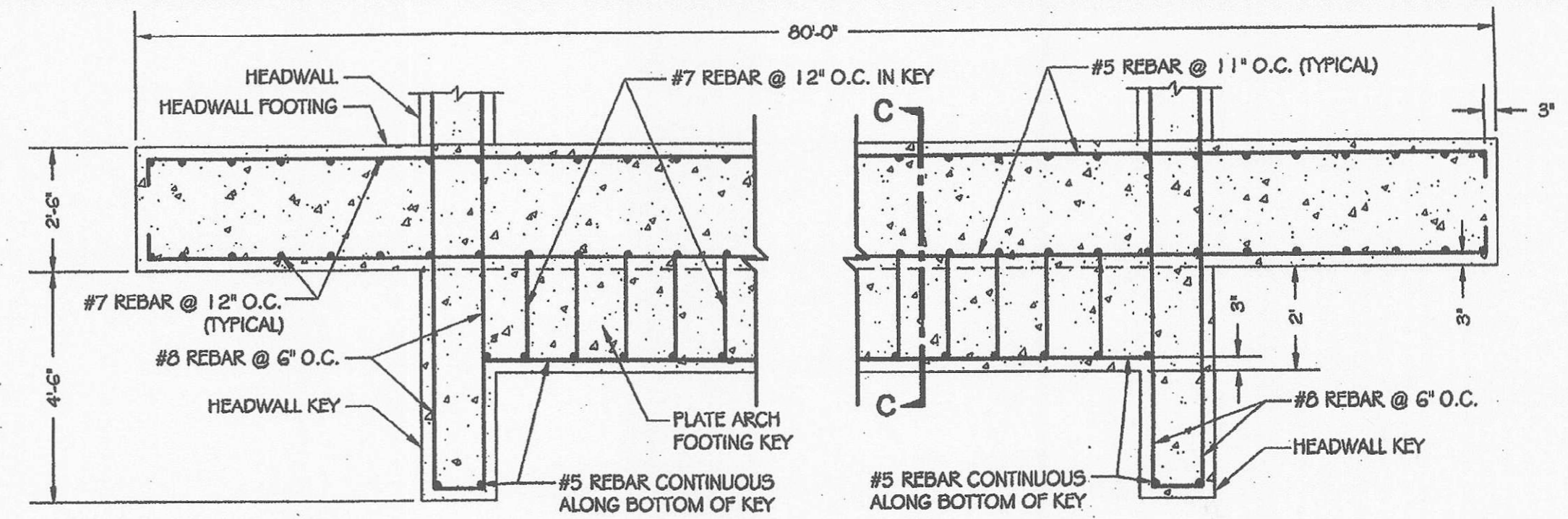


**COMBINED FOOTING CROSS-SECTION C-C**  
SCALE: 3/8" = 1'-0"

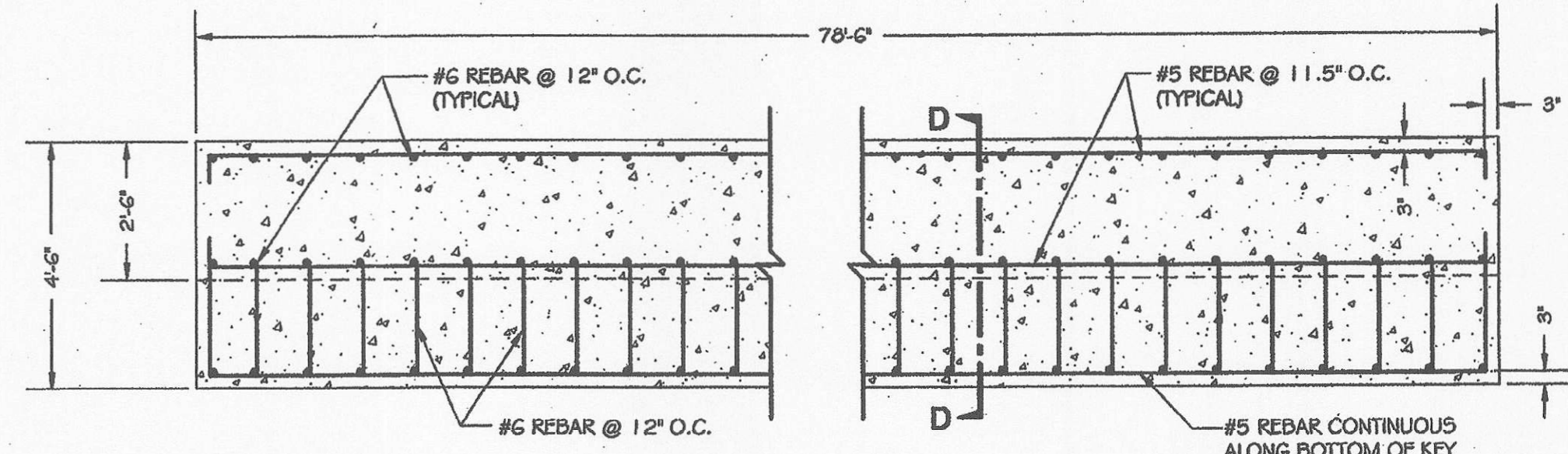


**FOOTING CROSS-SECTION D-D**  
SCALE: 3/8" = 1'-0"

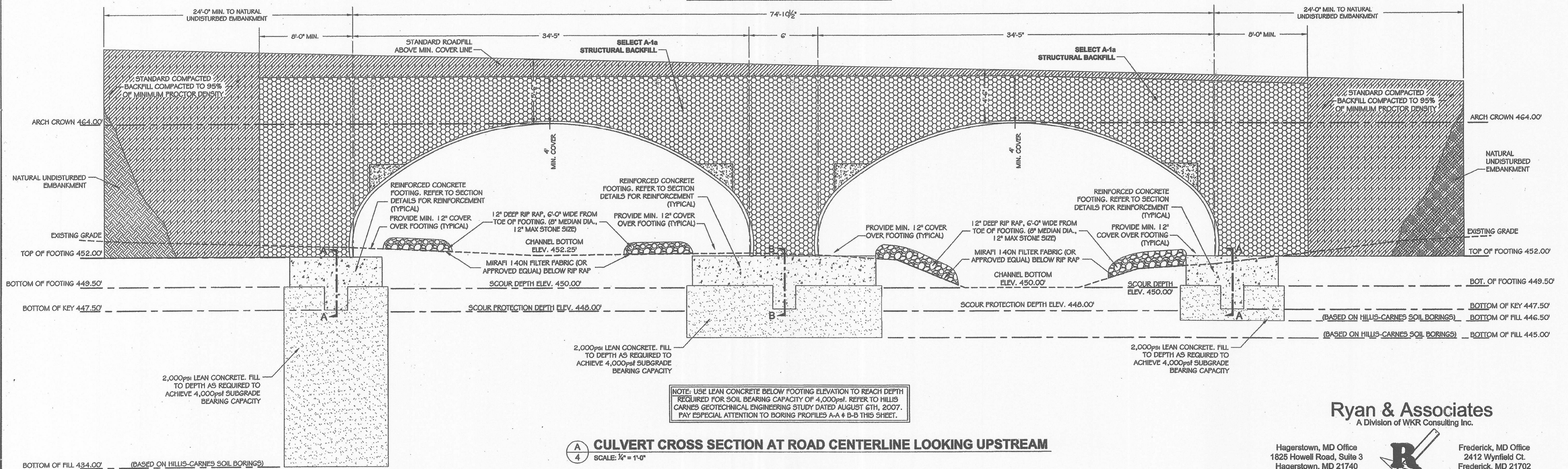
NOTE: NO BACKFILL MAY BE PLACED AGAINST THE LONGSPAN ARCH OR IN THE SELECT BACKFILL ZONE WITHOUT THE PRESENCE OF A TECHNICIAN UNDER THE SUPERVISION OF THE SITE PROFESSIONAL GEOTECH ENGINEER.



**LONGITUDINAL FOOTING SECTION B-B**  
SCALE: 3/8" = 1'-0"



**LONGITUDINAL FOOTING SECTION A-A**  
SCALE: 3/8" = 1'-0"



NOTE: USE LEAN CONCRETE BELOW FOOTING ELEVATION TO REACH DEPTH REQUIRED FOR SOIL BEARING CAPACITY OF 4,000psf. REFER TO HILLIS CARNES GEOTECHNICAL ENGINEERING STUDY DATED AUGUST 6TH, 2007. PAY ESPECIAL ATTENTION TO BORING PROFILES A-A & B-B THIS SHEET.

**CULVERT CROSS SECTION AT ROAD CENTERLINE LOOKING UPSTREAM**  
SCALE: 3/8" = 1'-0"

APPROVED: DEPARTMENT OF PUBLIC WORKS	DATE
CHIEF, BUREAU OF HIGHWAYS	DATE
APPROVED: DEPARTMENT OF PLANNING AND ZONING	DATE
CHIEF, DIVISION OF LAND DEVELOPMENT	DATE
CHIEF, DEVELOPMENT ENGINEERING DIVISION	DATE

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License No. 21686  
Expiration Date: 06/30/2009

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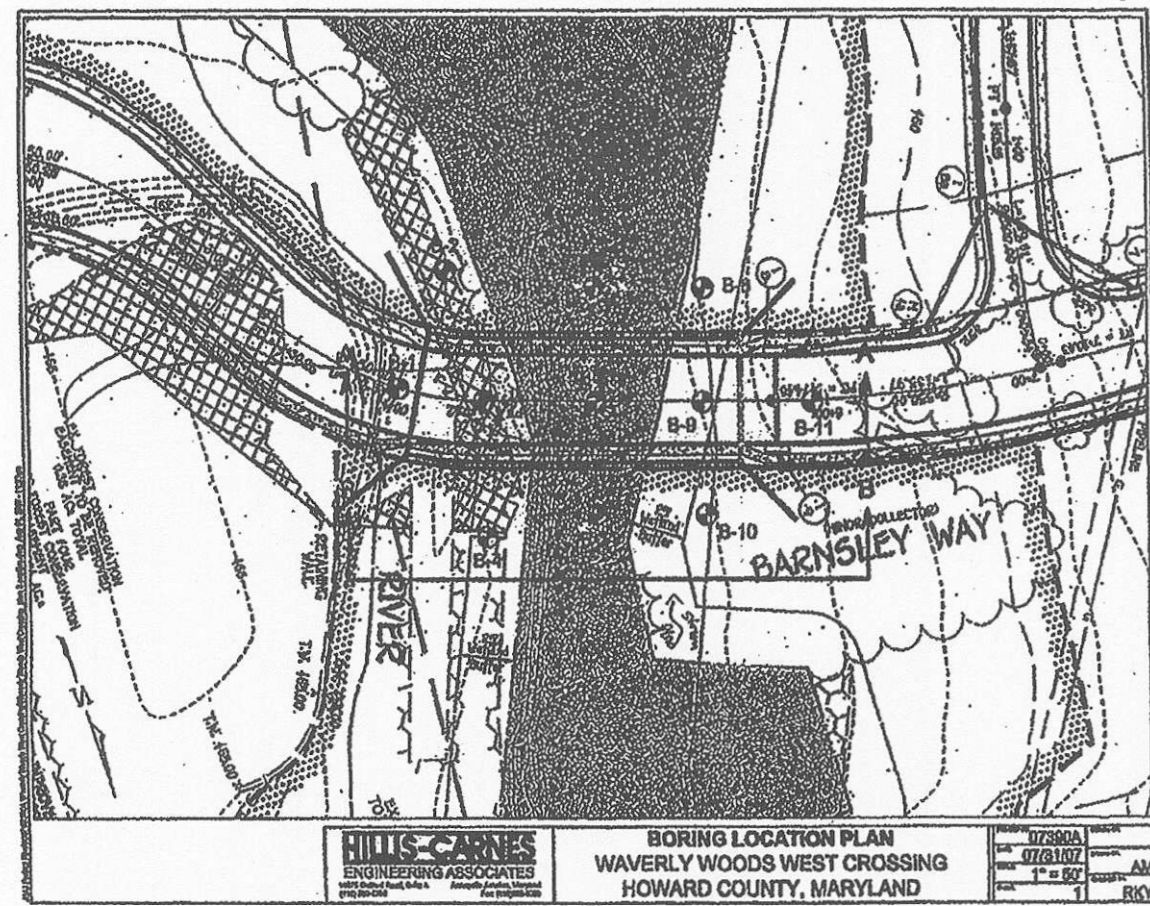


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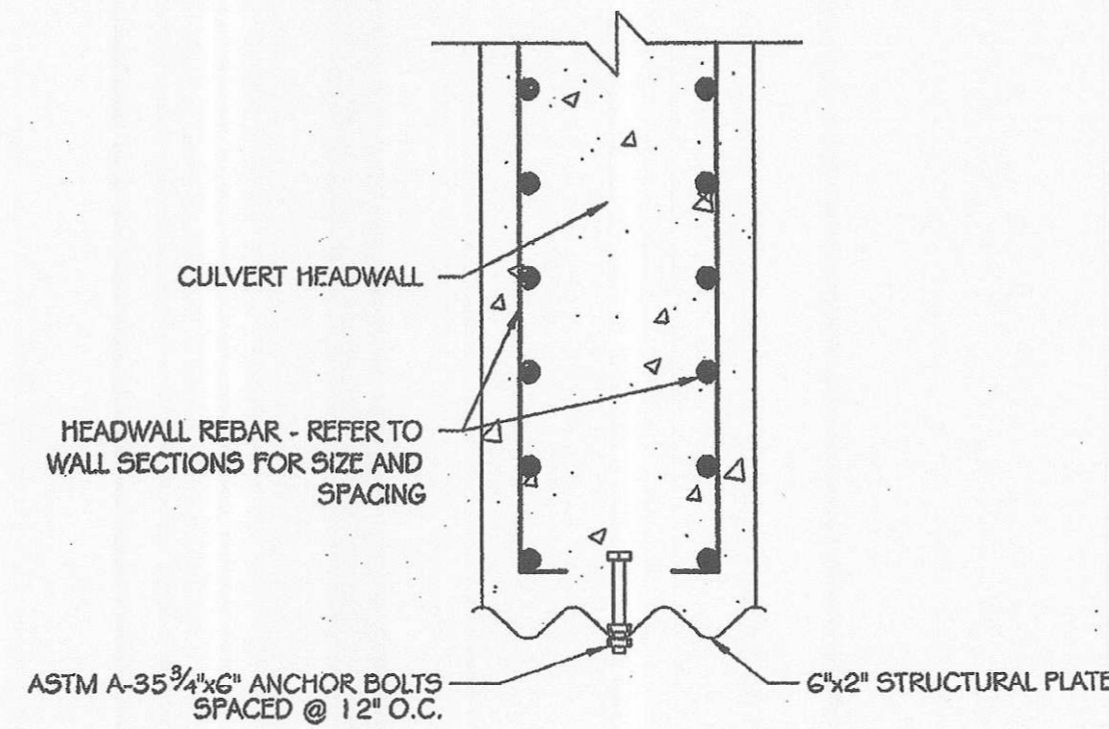
CULVERT CROSS-SECTION & DETAILS  
**GTW'S WAVERLY WOODS**  
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ZONING: PSC & PEC  
TAX MAP NO. 16 PARCEL Nos. 120, 221 & P/O 249 GRID Nos. 3 & 4  
THIRD ELECTION DISTRICT HOWARD COUNTY, MARYLAND  
DATE: DECEMBER 5, 2008  
SHEET 17 OF 22

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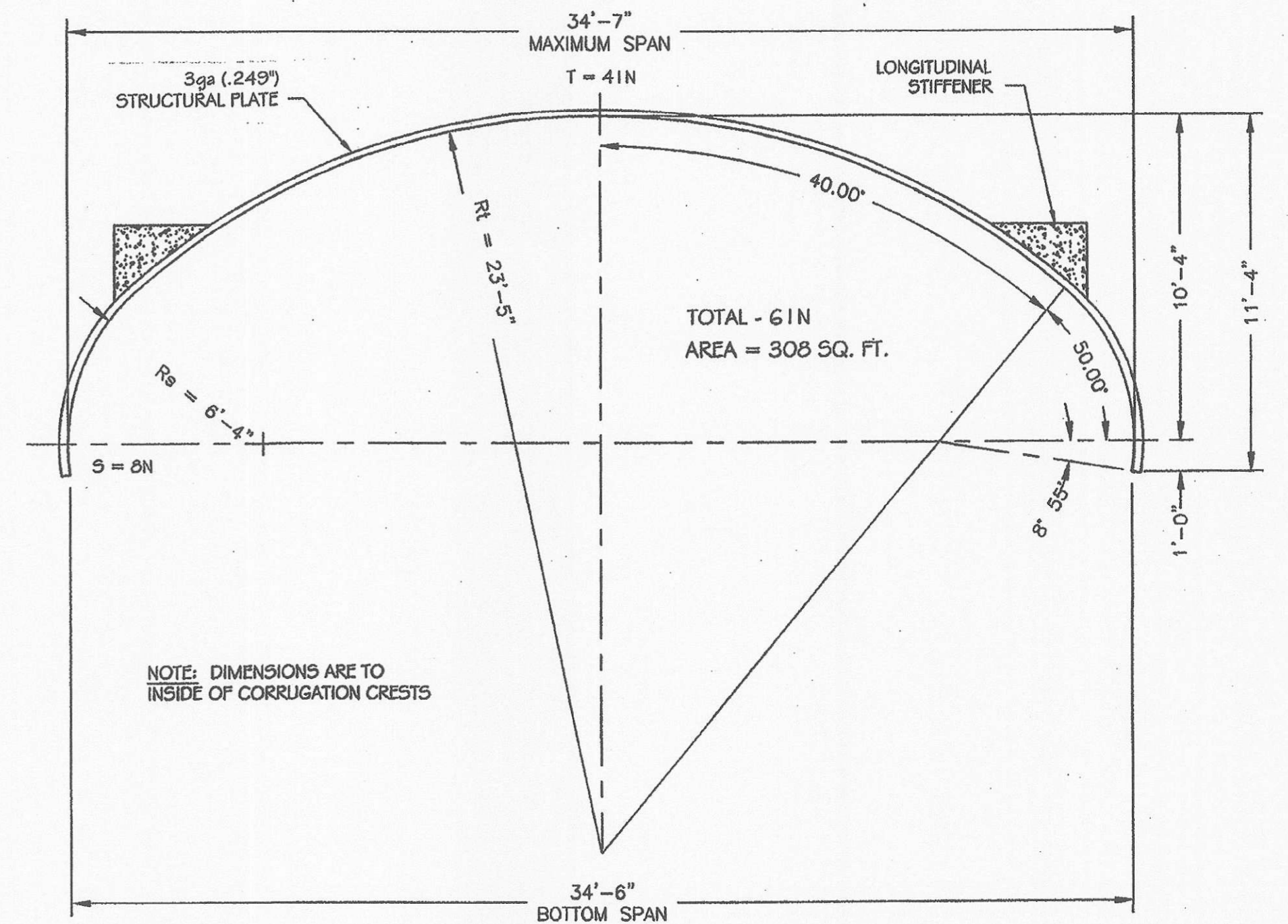




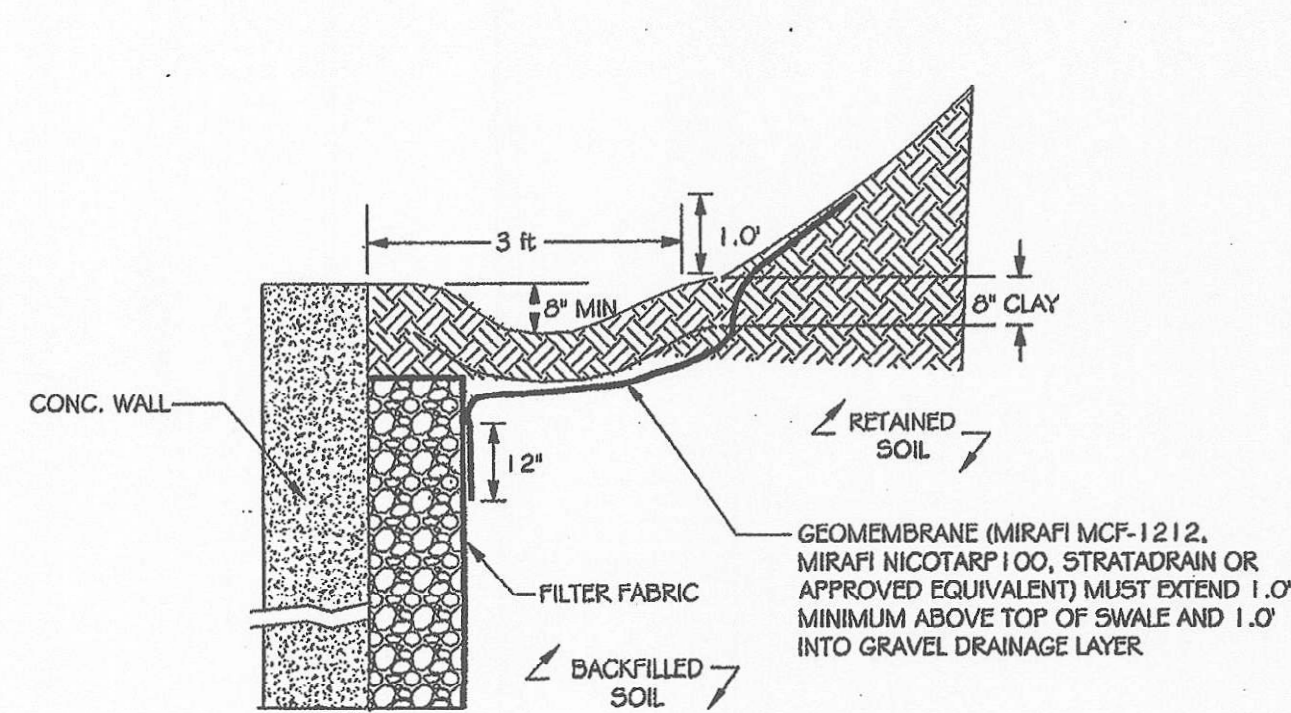
**BORING LOCATION MAP**  
SCALE: N.T.S.  
(REFER TO SHEET-4 FOR BORING PROFILES)



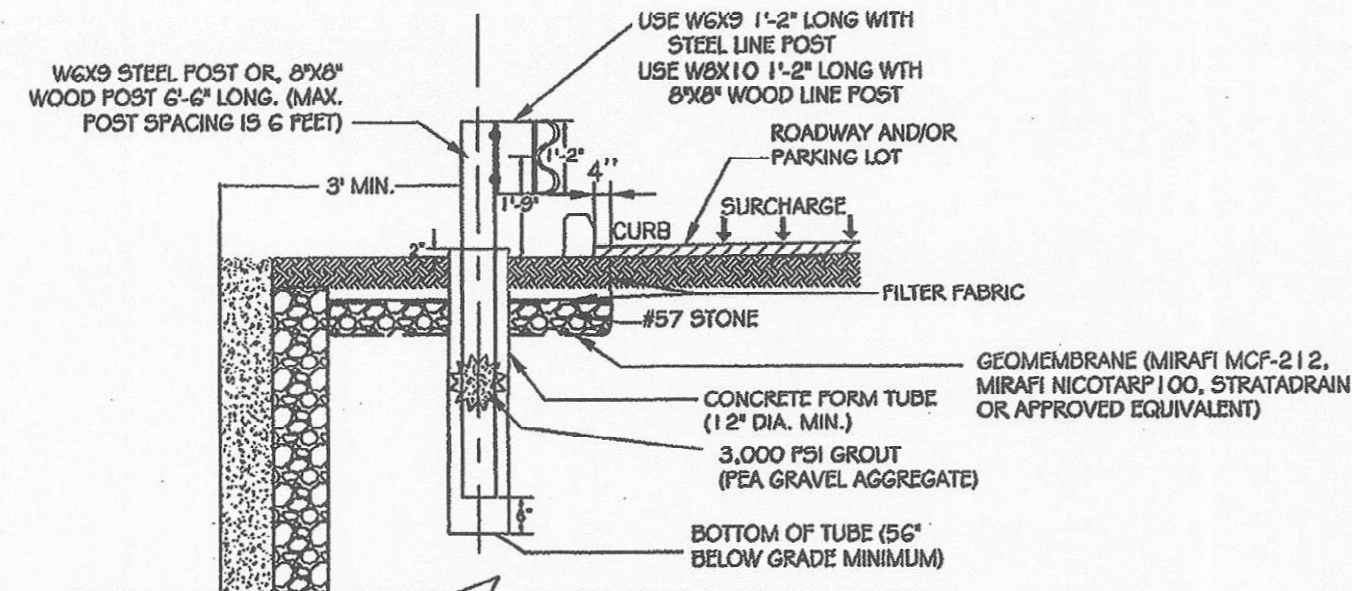
**HEADWALL CONNECTION DETAIL**  
SCALE: 1" = 1'-0"



**PLATE ARCH CROSS-SECTION**  
SCALE: 1/2" = 1'-0"

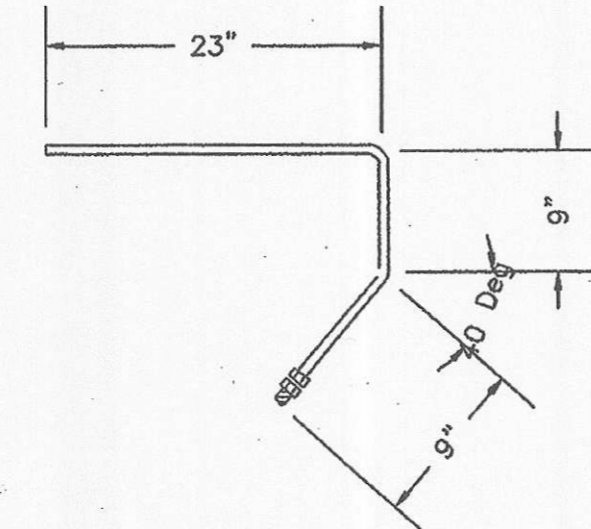


**GEOMEMBRANE LINED SWALE**  
N.T.S.

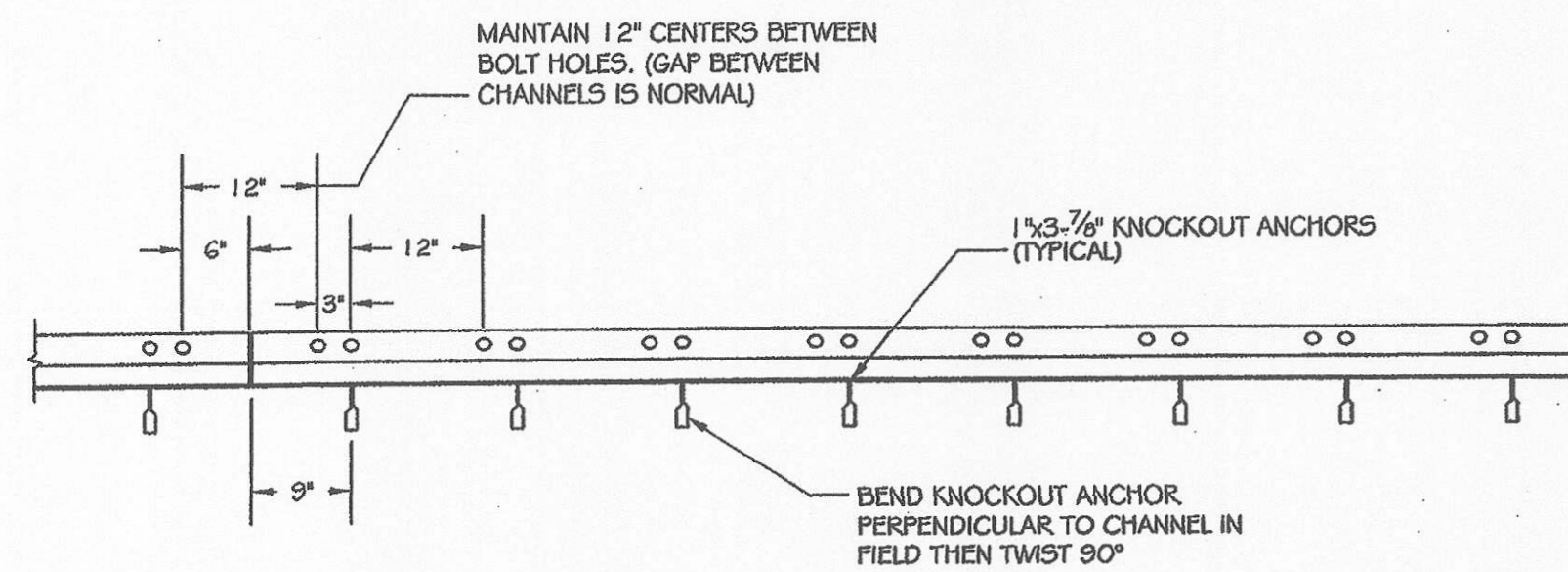


- NOTES:**
1. ENSURE PROPER SLOPE BETWEEN GUARDRAIL AND WALL SO AS TO DIVERT WATER AWAY FROM WALL.
  2. ALL STRUCTURAL STEEL SHALL CONFIRM TO ASTM A36.
  3. MINIMUM COMPRESSIVE STRENGTH OF CONCRETE SHALL BE 3000 PSI AT 28 DAYS.
  4. THE WALL INSTALLER TO PLACE THE GUARD RAIL POST SONOTUBES IN ACCORDANCE WITH THIS DETAIL FOR THE FENCE INSTALLER TO INSTALL GUARDRAIL POSTS AT A LATER DATE. THE SONOTUBES MUST BE COVERED WITH A SECURED PLASTIC SHEET TO PREVENT RAINWATER OR WATER RUN-OFF TO ENTER THE POST HOLES. IT IS HIGHLY RECOMMENDED THAT THE GUARDRAIL BE INSTALLED WITHIN A FEW DAYS OF WALL CONSTRUCTION COMPLETION.

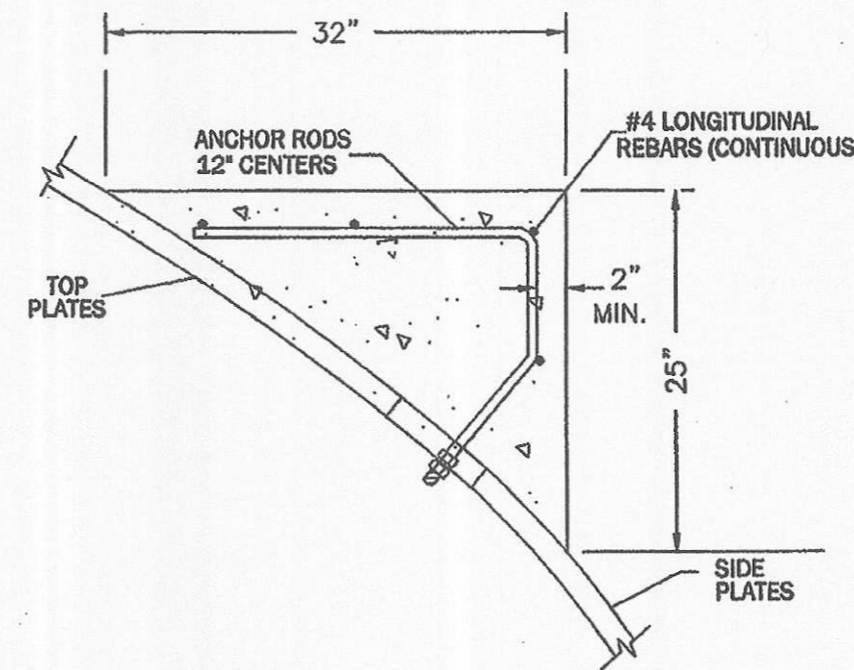
**GUARDRAIL DETAIL**  
N.T.S.



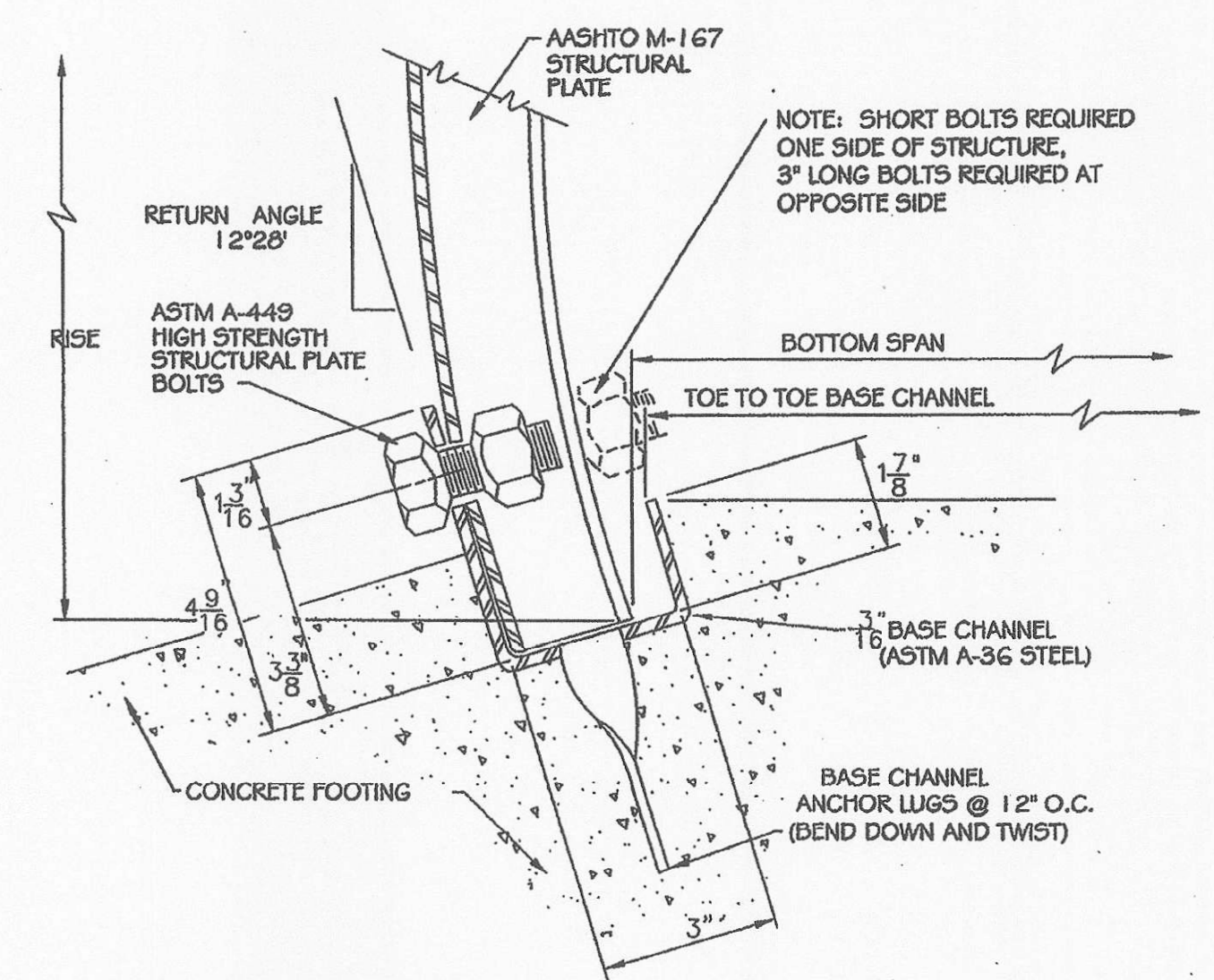
**LONGITUDINAL STIFFENER BAR BENDING DETAIL**  
SCALE: N.T.S.



**BASE CHANNEL DETAIL**  
SCALE: 3/4" = 1'-0"



**LONGITUDINAL STIFFENER DETAIL**  
SCALE: N.T.S.



**BASE CHANNEL SECTION**  
SCALE: N.T.S.

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PROFESSIONAL CERTIFICATION

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*William K. Ryan, P.E.*  
William K. Ryan, P.E.  
License No. 21699  
Expiration Date: 05/01/2009



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CHIEF, DEVELOPMENT ENGINEERING DIVISION	DATE

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CULVERT DETAILS  
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THIRD ELECTION DISTRICT HOWARD COUNTY, MARYLAND  
DATE: DECEMBER 5, 2008  
SHEET 10 OF 22



# STRUCTURAL NOTES & SPECIFICATIONS

## 1: DEFINITIONS

- 1.01 Owner: Land Design and Development, Inc., Ellicott City, MD 21042
- 1.02 Contractor: TBD
- 1.03 Design Structural Engineer: Ryan & Associates, Hagerstown Office, MD 21740
- 1.04 Site Civil Engineer: Fisher, Collins & Carter, Ellicott City, MD 21042
- 1.05 Site Geotechnical Engineer: Hills Carnes Engineering Associates, Inc., Annapolis Junction, MD 20701

If any of the above responsibilities change it is the owner's responsibility to notify LSBC prior to the start of the work. It is the owner's responsibility to make sure all parties listed above are aware of their roles, requirements, responsibilities and final submittals.

## 1.06 Reference Standards

- A. ASTM 3034- Specification for Polyvinyl Chloride (PVC) Plastic Pipe
- B. ASTM C 140- Sampling and Testing Concrete Masonry Units and related units
- C. ASTM D 422- Gradation of Soils
- D. ASTM D 698- (AASHTO T99) Standard Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort
- E. ASTM D 1248- Polyethylene Plastics Extrusion Materials for wire and Cable
- F. ASTM D 1557- (AASHTO T 180) Standard Test Method for Laboratory Compaction Characteristics of Soil using Modified Effort
- G. ASTM D 1586- Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils
- H. ASTM D 2166- Unconfined Compressive Strength of Cohesive Soil
- I. ASTM D 2487- Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- J. ASTM D 3080- Direct Shear Test of Soils Under Consolidated Drained Conditions
- K. ASTM D 4318- Liquid Limit, Plastic Limit and Plasticity Index of Soils
- L. ASTM D 2850- Unconsolidated, Undrained Compressive Strength of Cohesive Soils in Triaxial Compression
- M. ASTM A 615- Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- N. ACI 318-02. Concrete Building Design and Construction
- O. ACI 315-99 "Manual of Standard Practice for Detailing Reinforcing Concrete Structures"
- P. AASHTO LRFD Bridge Design Specifications, 3rd Edition, 2004
- Q. AASHTO Standard Specifications For Highway Bridges, 17th Edition, 2002
- R. AISI Handbook of Steel Drainage & Highway Construction Products, 1994 Edition

## 2: GENERAL

- 2.01 Contractor shall notify oversite review engineer responsible for construction certification of any discrepancies, omissions, or conflicts between the various elements of the working drawings and/or specifications before proceeding with any work involved. In all cases, unless otherwise directed by the engineer in writing, the most stringent requirements shall govern and be performed.
- 2.02 Contractor shall verify all conditions, dimensions and elevations, etc., at the site and shall coordinate work performed by all trades. Do not scale drawings.
- 2.03 Shop drawings shall be reviewed and approved by the structural engineer (RA) prior to fabrication.
- 2.04 Sizes, locations, loads, and anchorage of equipment shall be verified in the field with equipment manufacturers (suppliers) prior to fabrication or installation of supporting structures.
- 2.05 Temporary bracing designed by a professional bracing/structural engineer shall be provided wherever necessary to take care of all loads to which the structure may be subjected, including wind. Such bracing shall be left in place as long as may be required for safety or until all the structure elements are complete, as determined by the bracing engineer.
- 2.06 During and after construction the contractor and/or owner shall keep loads on the structure within the limits of the design load until turned over to the county or final owner, then the load restrictions shall be enforced by that entity. Maximum loading is HS 25 as determined by AASHTO.
- 2.07 Contractor shall be responsible for safety and protection within and adjacent to the job site.
- 2.08 Civil engineer is responsible for erosion and sediment control design.
- 2.09 Road pavement design and its appurtenance structure are civil engineer's responsibility. Refer to the civil drawings for all pavement and roadway drainage system information and questions thereby to the civil engineer.

## 3: CONCRETE

- 3.01 All foundation concrete (footings, walls etc.) shall be normal weight concrete with a compressive strength equal to at least 4,000 psi within 28 days after casting. The water/cement ratio shall be no greater than 0.50 and slump shall be 2-4 inches.
- 3.02 All concrete work shall be placed, cured, stripped and protected as directed by these specifications and ACI standards and practices.
- 3.03 Contractor is responsible for all shoring and formwork.
- 3.04 Concrete design and detailing shall conform to the requirements of ACI 318-08. Contractor shall submit mix designs to the oversite review engineer accompanied by appropriate graphs and background data for approval. Mix design shall indicate 7 and 28-day strengths, cement content, air content, water-cement ratio, amount of fine and coarse aggregates and admixtures.
  - a. Minimum ultimate compressive strength of concrete at 28 days shall be as follows, unless noted otherwise:
 

Footings and Walls concrete:	4000 PSI
Unreinforced concrete:	2000 PSI
- 3.05 All exterior concrete and concrete exposed to weather shall be air-entrained. (All concrete used on this project)
- 3.06 Use of additives shall not be permitted unless specifically approved by the oversite review engineer.
- 3.07 The concrete subcontractor shall not reproduce any portion of the structural contract drawings for utilization as shop drawings.

3.08 Concrete shall be consolidated by means of mechanical vibration. Vibrators shall be inserted and removed vertically at regular intervals not to exceed 18" to ensure uniform consolidation. In no case shall vibrators be used to transport the concrete inside the forms.

3.09 Formwork shall follow ACI 347 "Recommended practice for concrete form work". Forms shall conform to the working drawing to shape, line and dimensions members and shall be substantially free from surface defects and sufficiently tight to prevent leakage. They shall be properly braced and tied to maintain position and shape.

3.10 Fresh concrete will be protected from rain, flowing water and mechanical injury, sun, drying winds and freezing for a period of 7 days. The temperature of the concrete must be kept above 50 degrees F for at least 7 days.

3.11 Ground water and surface water within the subgrade excavation area must be maintained below the bottoms of the footer elevation and the bottoms of the excavation during preparation of the subgrade.

## 4: GEOTECHNICAL NOTES

4.01 Geotechnical site information provided by Hills Carnes Engineering Associates, Inc.

4.02 All structural fill soils will have a minimum dry density of 105PCF unless indicated otherwise on this drawing set. Fill shall be compacted to at least 95% of the maximum dry density as determined by the standard proctor ASTM D698 (AASHTO T-99) with the exception of the top foot, which will be 100% of the maximum dry density.

4.03 All structural fill material will be placed in layers, which, before compaction, will not exceed eight inches. Each layer shall be spread to ensure conformity of materials in each layer.

4.04 Virgin/undisturbed soils are defined as soils with a minimum SPT "N" value of 12.

## 5: FOOTINGS

5.01 All footings are based on an allowable soil bearing pressure of 4,000 PSF. Any soil condition encountered during excavation that is contrary to those used for design of footings as outlined in these drawings shall be brought to the attention of the site Geotechnical Engineer for direction before proceeding.

5.02 Bottom of footings shall be a minimum of 30" below finished grade, unless a lower elevation is noted. Footing elevations noted are estimated based on available geotechnical and grading information. All footings adjacent to existing footings shall be lowered to match existing footing elevation.

5.03 All foundation subgrades shall be inspected and approved under the supervision of the registered professional site Geotechnical Engineer or their representative prior to pouring concrete. Footings may be lowered to achieve the minimum footing subgrade bearing capacity of 4,000 PSF. Undercut footing sub-grade as necessary to achieve 4,000psf bearing capacity and fill with unreinforced concrete.

## 6: REINFORCING STEEL

6.01 Reinforcing bars shall be deformed billet steel conforming to ASTM A615, grade 60. All welded wire fabric shall conform to ASTM A185. Bars shall be branded by the manufacturer with bar size and grade of steel and certified mill reports to be submitted to oversite review engineer for approval and record. Reinforcing steel shall be detailed in accordance with the ACI 315-99 "Manual of Standard Practice for Detailing Reinforced Concrete Structures", latest edition. Provide corner bars at junctions of concrete walls and wall footings and lap 48 x bar diameters.

6.02 With wall reinforcing as shown in typical details, size and spacing of corner bars to be same as horizontal wall reinforcing, unless shown otherwise. Where continuous bars are called for, they shall run continuously around corners and lapped as necessary min. 48 x bar diameters. Provide standard hooks at discontinuous ends. Tension and compression lap splices shall not be less than the splice lengths as given in ACI 318. Generally lap top bars at mid span and bottom bars at supports. Provide placing accessories in accordance with ACI recommendations.

6.03 Provide the following minimum concrete cover for reinforcement:

- a. Concrete cast against and permanently exposed to earth ...3"
- b. Concrete exposed to earth or weather:
  - No. 6 through No. 18 bars ...2"
  - No. 5 bar, W31 or D31 wire, and smaller ...1 1/2"
- c. Concrete slabs, walls and joists not exposed to the earth or weather:
  - No. 14 and No. 18 bars ...1 1/2"
  - No. 11 bar and smaller ...3/4"
- d. Beams, columns:
  - Primary reinforcement, ties, stirrups and spirals ... 1 1/2"

## 7: EARTHWORK SPECIFICATIONS

7.01 The contractor shall furnish all labor, material and equipment for the earthwork. The contractor shall perform all work and services except those set out and furnished by Long Span Bridge & Culvert, LLC. (LSBC)

7.02 This work shall consist of all clearing and grading, preparation of the land to be filled, filling of the land, spreading and compaction of the fill, and all subsidiary work necessary to complete the grading of the cut and fill areas to conform with the project lines, grades, slopes and specifications.

7.03 This work is to be accomplished under the observation of the oversite review engineer or their representative. Placement of the backfill material will not be permitted unless the Engineer or their representative is on site.

7.04 Prior to bidding the work, the contractor shall examine, investigate and inspect the construction site as to the nature and location of the work and local conditions at the construction site including, without limitation, the character of the surface or subsurface conditions and obstacles to be encountered on and around the construction site; and shall make such additional investigation as they may deem necessary for the planning and proper execution of the work.

7.05 The professional Site Geotechnical Engineer or their representative in the field shall verify the subgrade soil condition, gravel, and the rock quality. All stone subgrade shall be compacted with a vibratory plate compactor in no more than 8" lifts and verified by the professional Site Geotechnical Engineer or their representative.

7.06 If conditions other than those indicated by the confirmatory subsurface boring program are encountered by the contractor, Long Span Bridge & Culvert, LLC (LSBC) should be notified immediately. The material, which the contractor believes to be a changed condition, should not be disturbed so that LSBC and/or their designated representative can investigate the condition.

7.07 The work for clearing and grubbing includes furnishing all labor, materials, transportation, supervision, tools and construction machinery, which may be necessary to accomplish the clearing and grubbing for this project area.

7.08 All trees, bushes, etc., shall be removed from the limits of the proposed areas to receive fill or other engineered structures. The areas may be extended outside the actual lines of construction only to the distance required to provide the contractor with sufficient space to perform the work.

7.09 All stumps, vegetation, brush, debris or deleterious materials shall be removed from the limits of the fill or other engineered structures.

7.10 The work for stripping includes furnishing all labor, materials, transportation, supervision, tools and construction machinery, which may be necessary to be provided by the contractor.

7.11 When the construction/operation sequence requires, the area of fill or other engineered structures shall be properly stripped. This stripping shall include topsoil and other deleterious materials. Topsoil shall be removed to its full depth and stockpiled for use in the final cover. Any rubbish, organic and objectionable soils and other deleterious material shall be properly disposed of at a site approved by owner or LSBC.

7.12 The lines and grades shall be established by using control benchmarks provided by licensed surveyors.

7.13 Soft or spongy cohesive or silty materials encountered at the base of the excavation shall be removed at the direction of the Site Geotechnical Engineer or their representative. The excavation for the footing wall foundations shall be observed and subgrade-bearing capacity certified by the Site Geotechnical Engineer upon completion of this task. At the direction of the Site Geotechnical Engineer or their representative, soft material will be removed to a depth directed by the Site Geotechnical Engineer or their representative, and replaced with granular backfill compacted at least 100% of the maximum dry unit weight density at a moisture content within 2% of optimum as determined by AASHTO T-99 method / ASTM D698.

7.14 If a shape control technician is supplied by LSBC, no select granular backfill may be placed, without being observed by LSBC's shape control technician.

7.15 Ground water and surface water within the subgrade excavation area must be maintained at least 3 feet below the footer elevation during preparation of the subgrade. If additional excavation is required to remove unsuitable materials, the water must be maintained 3 feet below the deepest excavation elevation.

7.16 The subgrade shall be compacted with a soil vibratory compactor or equivalent with a dynamic force of 50,000 pounds (min.). The top 1 foot of the subgrade soil shall be compacted to at least 100% of the maximum dry unit weight at a moisture content within 2% of optimum as determined by AASHTO T-99 method (standard proctor). All compaction and subgrade bearing capacity to be verified by the site geotechnical engineer or representative.

7.17 All select granular backfill material around the culvert and above the footing shall consist of AASHTO M 145 A-1-a. Recycled concrete material shall not be allowed. The select backfill material shall have fines (pass no. 200 sieve material) maximum 15% by weight. See typical select backfill chart this sheet.

7.18 The select granular backfill material and site soil backfill for the adjoining embankment material shall be tested in the laboratory for grain size distribution (AASHTO T-27 for granular material; AASHTO T-88 for soil material) and moisture-density relationship (AASHTO T-99). The testing described above is for purposes of verification of site soil backfill parameters and is in addition to the general project specifications for the embankment backfill, but does not supersede project specifications that may be more stringent.

7.19 All backfill operations shall place the material evenly on both sides of the plate arch and each lift shall extend for the entire length of the plate arch prior to placement of the next sequential lift. Fill placement shall begin in the middle of the plate arch length and extend equally on both sides in the upstream and downstream directions.

7.20 The select granular backfill shall be placed in horizontal layers not to exceed 8" loose depth. The lift thickness may be reduced by the Site Geotechnical Engineer or their representative to obtain the required compaction, fill all the voids, achieve the proper seating of the backfill material and achieve the stability of the backfill material and the plate arch. The granular backfill shall be compacted to 98% of the maximum dry unit weight as determined by the standard proctor test (AASHTO T-99). Greater emphases shall be given to a uniform degree of compaction throughout each lift than to achieving a degree of compaction greater than the minimum specified criteria. Site Geotechnical Engineer shall do testing of select granular backfill.

7.21 All granular material shall be compacted using mechanical devices, vibrating plates or other equipment approved by the Site Geotechnical Engineer. Compaction equipment weighing more than 24,000 pounds shall not be used within 2.5' of the corrugated metal structure. The compaction equipment shall be capable of compacting the material under the haunch of the plate arch (i.e., below the spring line of the plate arch).

7.22 The soil backfill (compacted normal backfill) within 32'-0" or to natural undisturbed embankment backfill on each side shall be placed in layers not to exceed 8" loose depth. The lift thickness may be reduced by the Site Geotechnical Engineer to obtain the required compaction. The soil backfill shall be compacted to a minimum of 95% of the maximum dry unit weight as determined by the standard proctor test (AASHTO T-99) and to a moisture content within 2% of the optimum moisture content as determined by the same test. Field nuclear density test shall be performed at a minimum frequency of four tests per every other lift and every 25' on the soil backfill on each side of the structure. The testing described above is in addition to the general project specifications for the embankment backfill, but does not supersede project specifications that may be more stringent than those requirements. The Site Geotechnical Engineer is responsible for testing and recording measurements of the soil backfill.

7.23 If at any time longitudinal cracks develop in the backfill surrounding the pipe to a distance of 30' from the spring line of the plate arch, these features must be brought to the immediate attention of the field QA/QC personnel and the Site Geotechnical Engineer.

7.24 While compacting granular backfill material with a vibrator compactor and adjacent to the plate arch, the opposite side of the plate arch should be observed to note if vibrations are loosening the granular material on that side. This may be more prevalent at higher elevations of the backfill with respect to the plate arch. If this condition occurs, the field QA/QC technician and Site Geotechnical Engineer should be notified prior to placement of a sequential lift on either side.

7.25 The structure should not be crossed with equipment heavier than a D4 dozer. No other equipment or highway (HS25) loading shall be allowed to cross the structure until the asphalt pavement is placed unless there is a minimum of 12" of soil cover or span/8 inches of soil cover whichever is greater, covering the plate arch. Top filling should begin at the middle of the structure (lengthwise) with the backfill being pushed up and over the structure with a D4 or preferably smaller type dozer. The fill should be pushed over the structure in a manner 45 to 90 degrees to the axis of the structure. Field nuclear density test shall be performed at a minimum frequency of four tests per every lift on the soil backfill on each side of the structure. The testing described above is in addition to the general project specifications for the embankment backfill, but does not supersede project specifications that may be more stringent than those requirements. The contractor shall submit to the owner samples of all proposed soil backfill material for laboratory testing to verify moisture and density relationships (AASHTO T-99/ASTM D698) and grain size relationships (AASHTO T-27/ASTM C136).

7.26 All construction to be certified at the end of the job by a Professional Structural/Geotechnical Engineer (oversite review engineer) qualified in the design and construction of plate arch culverts (minimum 10 years experience) that all work performed by contractor meets these design requirements and specifications. Certification to be submitted to LSBC, RA and the local jurisdiction for record file.

## 8: REQUIRED SUBMITTALS

- 8.01 The contractor must submit the following items to the oversite review engineer for approval in writing at least 2 weeks prior to use:
  - a. Manufacturer certification for yield strength of reinforcing steel.
  - b. Manufacturer certification for concrete design.
  - c. Shop drawings of all concrete work.
  - d. Plate arch shop drawings.

## 9: DEWATERING REQUIREMENTS

9.01 Dewater footing excavations using sump pumps or well points as required. Footing excavation must be dewatered and maintained that way for a minimum of seven days or concrete strength of 3,000psi has been reached, whichever is greater

## 10: CONSTRUCTION OVERSIGHT CERTIFICATIONS

9.01 The plate arch construction requires engineering oversight and inspection. The oversite review, Civil, Structural and Geotechnical Engineers must provide LSBC certification reports of all footings and retaining wall/headwalls reinforcing placement and the following items:

a. Subgrade bearing capacity and backfill (select granular and compacted normal backfill) compaction testing, field reports, testing results, testing locations, and registered professional engineer's certification.

b. Field reports of concrete placement review, laboratory test results of concrete cylinder breaks at 7 and 28 days and certified by a Registered Professional Structural Engineer.

c. Final report of construction certification that the construction was performed in accordance with the design and the material testing and inspection verifying the same, stamped by a Registered Professional Structural/Geotechnical Engineer.

## 11: ENVIRONMENTAL PERMITTING

10.01 These plans do not address environmental permitting requirements, which must be addressed and applied for with the state and Army Corp of Engineers, as required.

## 12: SAFETY

11.01 All contractors (and owners), their representatives and their crew must be qualified/certified to perform all works within their scope. They must adhere to OSHA's health and safety laws. The General Contractor is solely responsible for all site safety.

## 13: RA'S RESPONSIBILITY

12.01 RA's scope of work for this project are design of plate arch (minimum steel thickness stress analysis), footings, headwalls and wingwalls and RA is responsible for that only. Acceptance of the plan drawings by our client & the owner means they agree to our scope and responsibilities.

## 14: LONG SPAN BRIDGE & CULVERT, LLC SCOPE OF WORK

13.01 Long Span Bridge & Culvert, LLC (LSBC) will deliver, furnish and assemble the Long Span low profile arch on footings designed by Ryan & Associates and prepared by Site Contractor. The base channel will be furnished by LSBC and installed in the concrete foundations by the Site Contractor in accordance with the plans. Structural plate for this job to be 3ga (.249" thick) steel.

13.02 LSBC will conduct a pre-construction meeting prior to foundation preparation and arch assembly. Attendance at the pre-construction meeting is mandatory for the owner or the owner's representative (e.g. Site Civil Engineer, Site Contractor and Concrete Contractor) and the oversite review Structural/Geotechnical Engineer. It is the owner's responsibility to have each party in attendance. If a party is not in attendance it is the owner's responsibility to inform that entity of its responsibilities and duties prior to the start of work.

13.03 LSBC will provide a shape control technician to monitor structure's shape and observe the proper placement and compaction of the select fill material, unless provided otherwise and approved in writing by LSBC.

13.04 LSBC will require the Site Contractor to unload the structure plates and base channel. LSBC will require the Site Contractor to provide access to the structure for a rubber-tired crane. Parallel access roads shall be within 30' of the centerline of the structure on each side.

## BACKFILL CHART

AASHTO M 145- TABLE 2 (MODIFIED*)				
GROUP CLASSIFICATION	A-1		A-2 (MODIFIED)	
SIEVE ANALYSIS, PERCENT PASSING	A-1-a	A-1-b	A-2-4	A-2-5
NO. 10 (2.00 mm)	50 max	—	—	—
NO. 40 (425 mm)	30 max	50 max	—	—
NO. 100 (150 mm)	—	—	50 max	60 max
NO. 200 (.075 mm)	15 max	25 max	20 max	20 max
Characteristics of fraction passing No. 40 (0.425 mm)				
Liquid Limit	—	—	40 max	41 max
Plasticity Index	6 max	6 max	10 max	10 max
Usual Material Types	Stony Fragments Gravel and Sand		Silty or Clayey Gravel and Sand	

\*Modified to be more select than M-145

**Ryan & Associates**  
A Division of WKR Consulting Inc.

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1825 Howell Road, Suite 3  
Hagerstown, MD 21740  
301-671-3200 (ph)  
301-360-9574 (fx)

Frederick, MD Office  
2412 Wynfield Ct.  
Frederick, MD 21702  
301-360-9534 (ph)  
301-360-9574 (fx)

## PROFESSIONAL CERTIFICATION

I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.

*William K. Ryan, P.E.*  
William K. Ryan, P.E.  
License No. 21566  
Expiration Date: 05/01/2009



APPROVED: DEPARTMENT OF PUBLIC WORKS	
CHIEF, BUREAU OF HIGHWAYS	DATE
APPROVED: DEPARTMENT OF PLANNING AND ZONING	
CHIEF, DIVISION OF LAND DEVELOPMENT	DATE
CHIEF, DEVELOPMENT ENGINEERING DIVISION	DATE

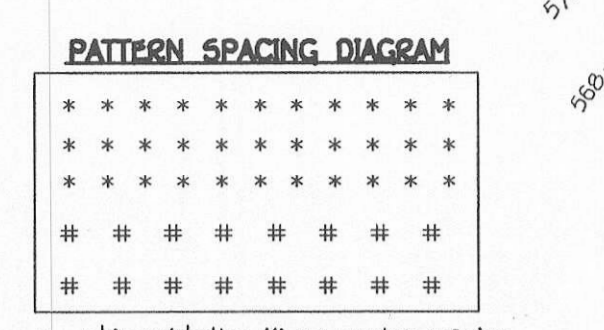
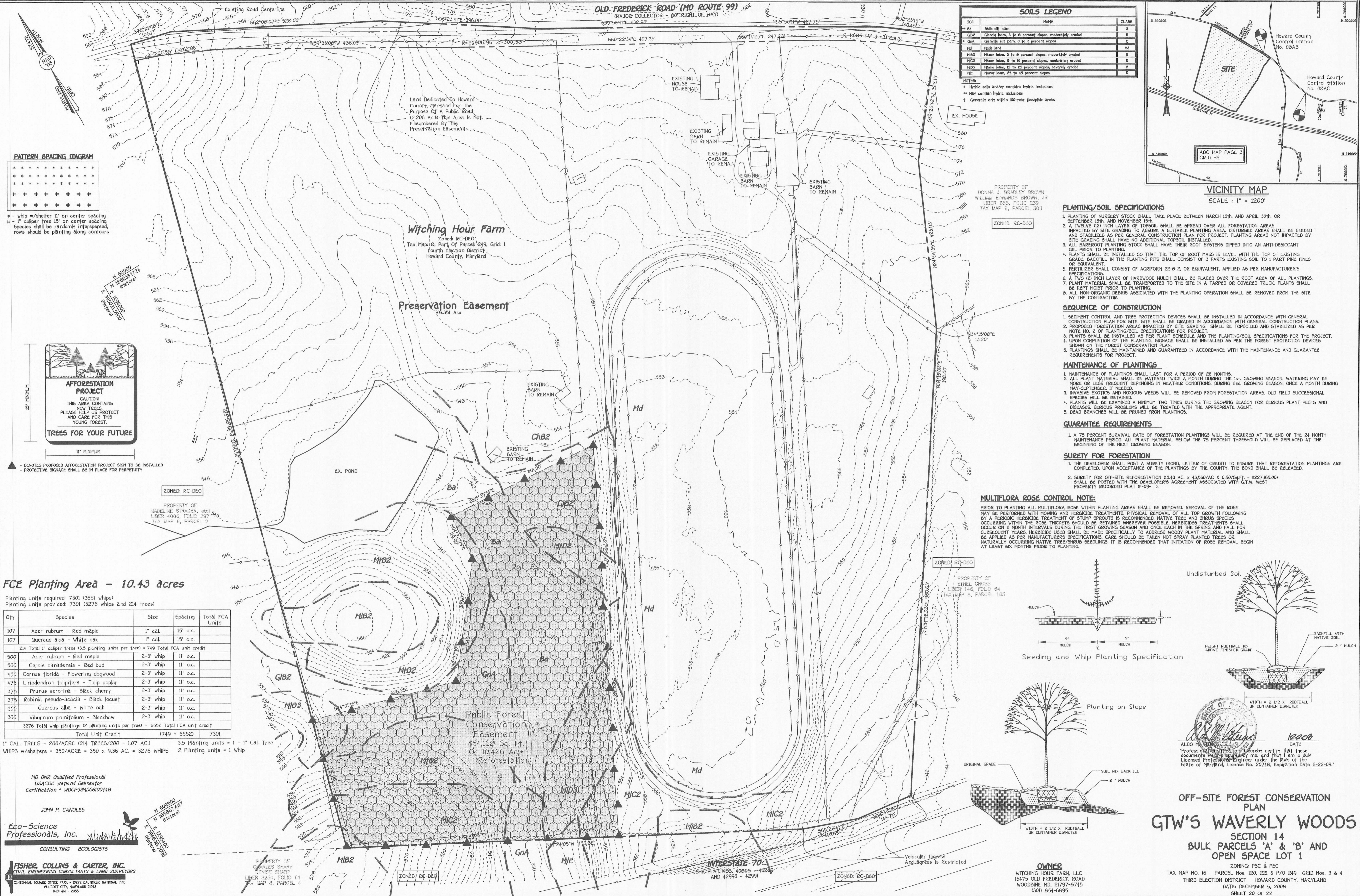
**OWNERS**  
WAVERLY WOODS DEVELOPMENT CORPORATION,  
HOLD IN THE GOVERNMENT, LLC, &  
GTW JOINT VENTURE  
C/O LAND DESIGN AND DEVELOPMENT, INC.  
5300 DORSEY HALL DRIVE, SUITE 102  
ELLICOTT CITY, MARYLAND 21042  
(443-367-0422)

**DEVELOPER**  
WAVERLY WOODS DEVELOPMENT CORP.  
C/O LAND DESIGN AND DEVELOPMENT,  
INC. 5300 DORSEY HALL DRIVE, SUITE 102  
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**FISHER, COLLINS & CARTER, INC.**  
CIVIL ENGINEERING CONSULTANTS & LAND SURVEYORS  
CENTRAL SQUARE OFFICE PARK - 10272 DALLWOOD NATIONAL FKE  
ELLICOTT CITY, MARYLAND 21042  
410 461 - 2895

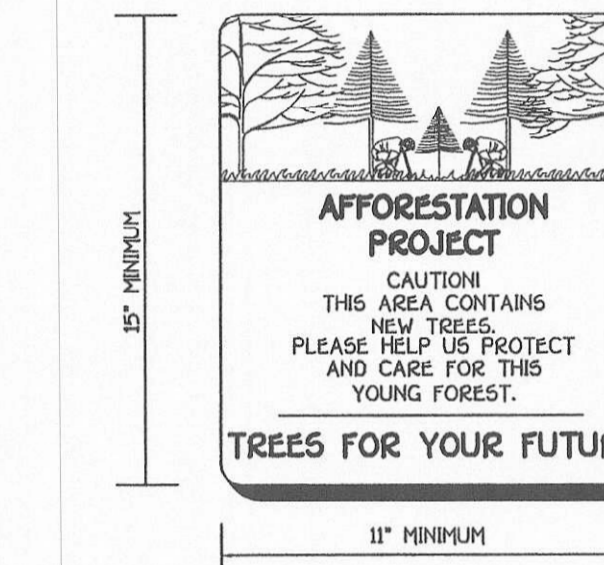
CULVERT SPECIFICATIONS  
**GTW'S WAVERLY WOODS**  
SECTION 14  
BULK PARCELS 'A' & 'B' AND  
OPEN SPACE LOT 1  
(A SUBDIVISION OF THE PROPERTY OF WAVERLY WOODS DEVELOPMENT CORPORATION, LIBER 4879, FOLIO 307)  
ZONING: FSC & PEC  
TAX MAP NO. 16 PARCEL NOS. 120, 221 & P/O 249 GRID NOS. 3 & 4  
THIRD ELECTION DISTRICT HOWARD COUNTY, MARYLAND  
DATE: DECEMBER 5, 2008  
SHEET 19 OF 22





CAUTION  
 THIS AREA CONTAINS  
 NEW TREES  
 PLEASE HELP US PROTECT  
 AND CARE FOR THIS  
 YOUNG FOREST.

**TREES FOR YOUR FUTURE**



▲ - DENOTES PROPOSED AFFORESTATION PROJECT SIGN TO BE INSTALLED  
 - PROTECTIVE SIGNAGE SHALL BE IN PLACE FOR PERPETUITY

**FCE Planting Area - 10.43 acres**

Planting units required: 7301 (3651 whips)  
 Planting units provided: 7301 (3276 whips and 214 trees)

Qty	Species	Size	Spacing	Total FCA Units
107	Acer rubrum - Red maple	1" cal.	15' o.c.	
107	Quercus alba - White oak	1" cal.	15' o.c.	
214 Total 1" caliper trees (3.5 planting units per tree) = 749 Total FCA unit credit				
500	Acer rubrum - Red maple	2-3' whip	11' o.c.	
500	Cercis canadensis - Red bud	2-3' whip	11' o.c.	
450	Cornus florida - Flowering dogwood	2-3' whip	11' o.c.	
476	Liriodendron tulipifera - Tulip poplar	2-3' whip	11' o.c.	
375	Prunus serotina - Black cherry	2-3' whip	11' o.c.	
375	Robinia pseudo-acacia - Black locust	2-3' whip	11' o.c.	
300	Quercus alba - White oak	2-3' whip	11' o.c.	
300	Viburnum prunifolium - Blackhaw	2-3' whip	11' o.c.	
3276 Total whip plantings (2 planting units per tree) = 6552 Total FCA unit credit				
Total Unit Credit (749 + 6552)				7301

1" CAL. TREES = 200/ACRE (214 TREES/200 = 1.07 AC.) 3.5 Planting units = 1 - 1" Cal. Tree  
 WHIPS w/shelters = 350/ACRE = 350 x 9.36 AC. = 3276 WHIPS 2 Planting units = 1 Whip

MD DNR Qualified Professional  
 USACOE Wetland Delimitation  
 Certification # WDCP93MD0310044B

JOHN P. CANOLES

**Eco-Science Professionals, Inc.**  
 CONSULTING ECOLOGISTS

**FISHER, COLLINS & CARTER, INC.**  
 CIVIL ENGINEERING CONSULTANTS & LAND SURVEYORS

CENTENAL SQUARE OFFICE PARK - 10272 BALTIMORE NATIONAL PIKE  
 ELICOTT CITY, MARYLAND 21042  
 410.461.2955

PROPERTY OF  
 CHARLES SHARP  
 LIBER 8250, FOLIO 61  
 TAX MAP B, PARCEL 4

**SOILS LEGEND**

SOIL	NAME	CLASS
DA	Dalle silt loam	D
QB2	Glenny loam, 3 to 6 percent slopes, moderately eroded	B
GNA	Glennville silt loam, 0 to 3 percent slopes	C
Md	Mide hard	Md
MB2	Moran loam, 3 to 6 percent slopes, moderately eroded	B
MC2	Moran loam, 6 to 15 percent slopes, moderately eroded	B
MIB2	Moran loam, 15 to 25 percent slopes, severely eroded	B
MI2	Moran loam, 25 to 45 percent slopes	B

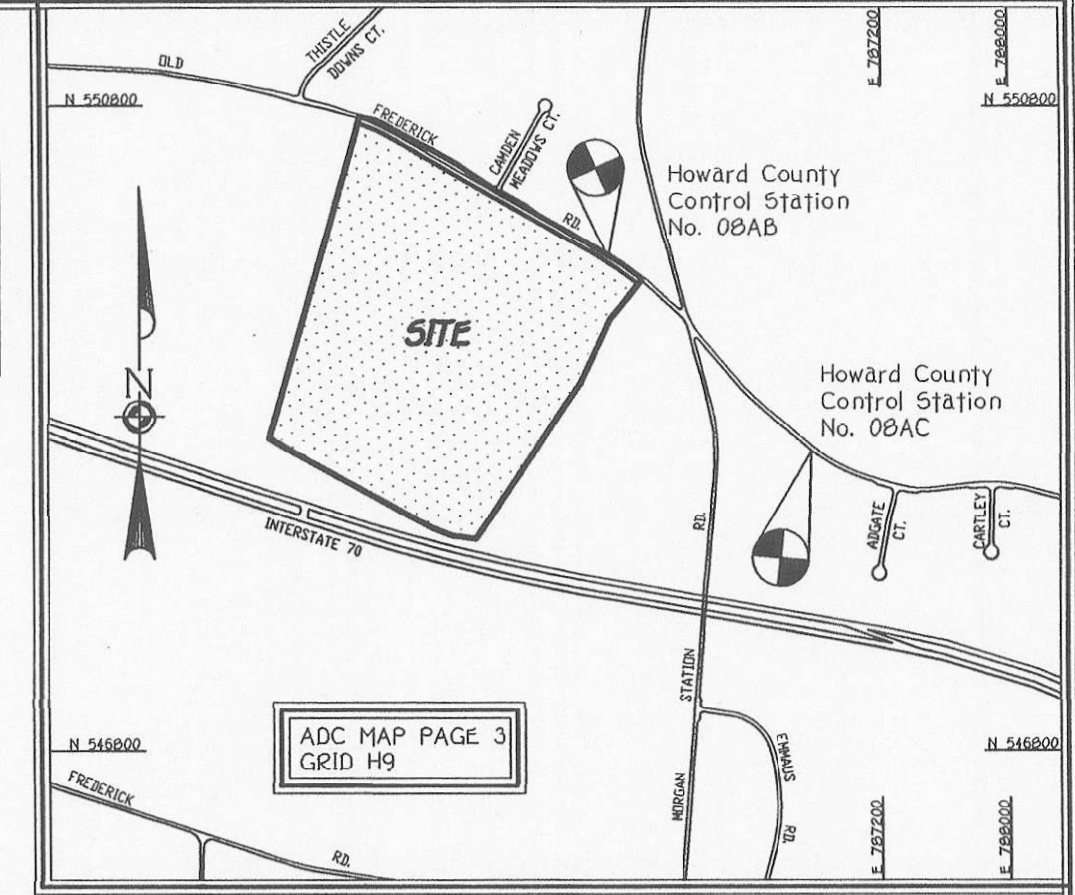
NOTES:  
 \* Hydric soils and/or contain hydric inclusions  
 \*\* May contain hydric inclusions  
 † Generally only within 100-year floodplain areas

PROPERTY OF  
 DONNA J. BRADLEY BROWN  
 WILLIAM EDWARDS BROWN, JR  
 LIBER 855, FOLIO 239  
 TAX MAP B, PARCEL 30B

ZONED: RC-DEO

PROPERTY OF  
 ETHEL CROSS  
 LIBER 1446, FOLIO 64  
 TAX MAP B, PARCEL 165

ZONED: RC-DEO



- PLANTING/SOIL SPECIFICATIONS**
- PLANTING OF NURSERY STOCK SHALL TAKE PLACE BETWEEN MARCH 15th AND APRIL 30th OR SEPTEMBER 15th AND NOVEMBER 15th.
  - A TWO (2) INCH LAYER OF TOPSOIL SHALL BE SPREAD OVER ALL FORESTATION AREAS IMPACTED BY SITE GRADING TO ASSURE A SUITABLE PLANTING AREA. DISTURBED AREAS SHALL BE SEEDED AND STABILIZED AS PER GENERAL CONSTRUCTION PLAN FOR PROJECT. PLANTING AREAS NOT IMPACTED BY SITE GRADING SHALL HAVE NO ADDITIONAL TOPSOIL INSTALLED.
  - ALL BAREROOT PLANTING STOCK SHALL HAVE THEIR ROOT SYSTEMS DIPPED INTO AN ANTI-DESICCANT GEL PRIOR TO PLANTING.
  - PLANTS SHALL BE INSTALLED SO THAT THE TOP OF ROOT MASS IS LEVEL WITH THE TOP OF EXISTING GRADE. BACKFILL IN THE PLANTING PITS SHALL CONSIST OF 3 PARTS ISINGWORTH TO 1 PART PINE FINES OR EQUIVALENT.
  - FERTILIZER SHALL CONSIST OF AGRIFORM 22-0-2, OR EQUIVALENT, APPLIED AS PER MANUFACTURER'S SPECIFICATIONS.
  - A TWO (2) INCH LAYER OF HARDWOOD MULCH SHALL BE PLACED OVER THE ROOT AREA OF ALL PLANTINGS.
  - PLANT MATERIAL SHALL BE TRANSPORTED TO THE SITE IN A TARPED OR COVERED TRUCK. PLANTS SHALL BE KEPT MOIST PRIOR TO PLANTING.
  - ALL NON-ORGANIC DEBRIS ASSOCIATED WITH THE PLANTING OPERATION SHALL BE REMOVED FROM THE SITE BY THE CONTRACTOR.

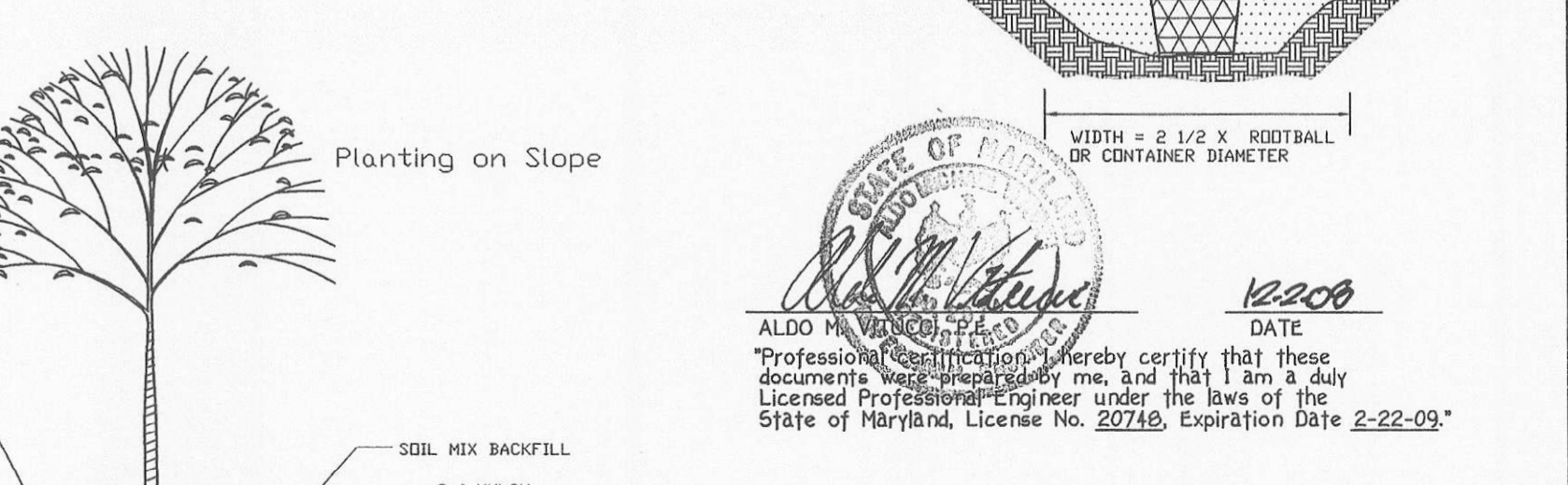
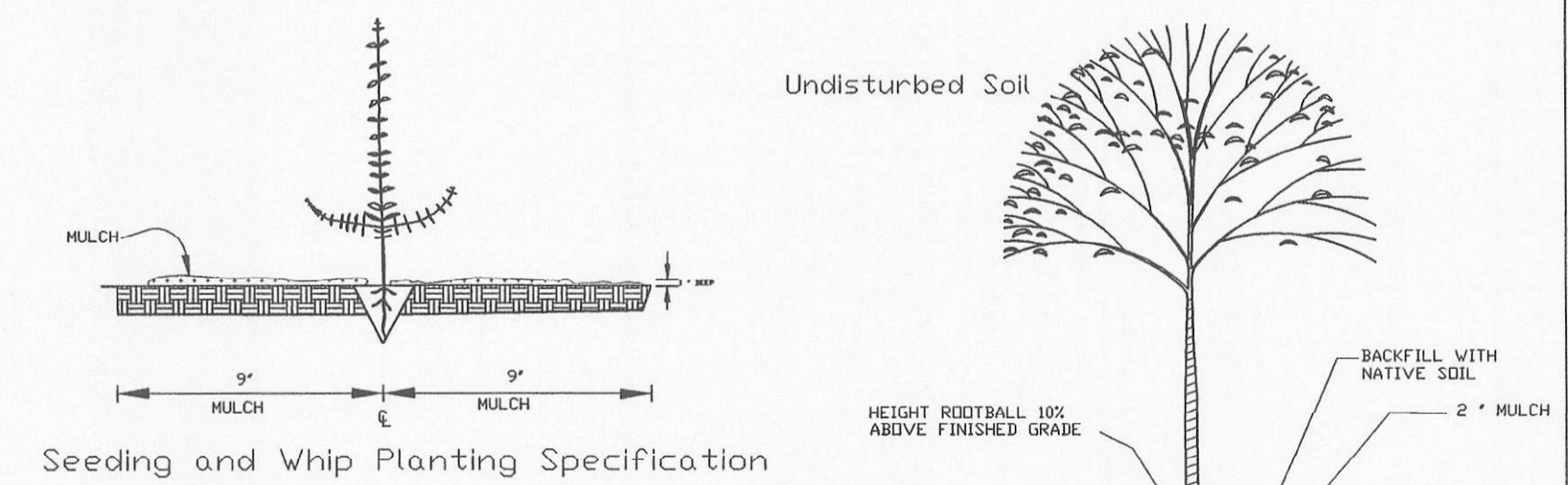
- SEQUENCE OF CONSTRUCTION**
- SEDIMENT CONTROL AND TREE PROTECTION DEVICES SHALL BE INSTALLED IN ACCORDANCE WITH GENERAL CONSTRUCTION PLAN FOR SITE. SITE SHALL BE GRADED IN ACCORDANCE WITH GENERAL CONSTRUCTION PLANS.
  - PROPOSED FORESTATION AREAS IMPACTED BY SITE GRADING SHALL BE TOPSOILED AND STABILIZED AS PER NOTE NO. 2 OF PLANTING/SOIL SPECIFICATIONS FOR PROJECT.
  - PLANTS SHALL BE INSTALLED AS PER PLANT SCHEDULE AND THE PLANTING/SOIL SPECIFICATIONS FOR THE PROJECT.
  - UPON COMPLETION OF THE PLANTING, SIGNAGE SHALL BE INSTALLED AS PER THE FOREST PROTECTION DEVICES SHOWN ON THE FOREST CONSERVATION PLAN.
  - PLANTINGS SHALL BE MAINTAINED AND GUARANTEED IN ACCORDANCE WITH THE MAINTENANCE AND GUARANTEE REQUIREMENTS FOR PROJECT.

- MAINTENANCE OF PLANTINGS**
- MAINTENANCE OF PLANTINGS SHALL LAST FOR A PERIOD OF 26 MONTHS.
  - ALL PLANT MATERIAL SHALL BE WATERED TWICE A MONTH DURING THE 1st GROWING SEASON. WATERING MAY BE MORE OR LESS FREQUENT DEPENDING ON WEATHER CONDITIONS. DURING 2nd GROWING SEASON, ONCE A MONTH DURING MAY-SEPTEMBER, IF NEEDED.
  - INVASIVE EXOTICS AND NOXIOUS WEEDS WILL BE REMOVED FROM FORESTATION AREAS. OLD FIELD SUCCESSIONAL SPECIES WILL BE RETAINED.
  - PLANTS WILL BE EXAMINED A MINIMUM TWO TIMES DURING THE GROWING SEASON FOR SERIOUS PLANT PESTS AND DISEASES. SERIOUS PROBLEMS WILL BE TREATED WITH THE APPROPRIATE AGENT.
  - DEAD BRANCHES WILL BE PRUNED FROM PLANTINGS.

- GUARANTEE REQUIREMENTS**
- A 75 PERCENT SURVIVAL RATE OF FORESTATION PLANTINGS WILL BE REQUIRED AT THE END OF THE 24 MONTH MAINTENANCE PERIOD. ALL PLANT MATERIAL BELOW THE 75 PERCENT THRESHOLD WILL BE REPLACED AT THE BEGINNING OF THE NEXT GROWING SEASON.

- SURETY FOR FORESTATION**
- THE DEVELOPER SHALL POST A SURETY (BOND, LETTER OF CREDIT) TO ENSURE THAT REFORESTATION PLANTINGS ARE COMPLETED UPON ACCEPTANCE OF THE PLANTINGS BY THE COUNTY. THE BOND SHALL BE RELEASED.
  - SURETY FOR OFF-SITE REFORESTATION (0.43 AC. x 43,560/AC x 0.50/54 Ft. = \$227,165.00) SHALL BE POSTED WITH THE DEVELOPER'S AGREEMENT ASSOCIATED WITH G.T.W. WEST PROPERTY RECORDED PLAT IF-09-1.

**MULTIFLORA ROSE CONTROL NOTE:**  
 PRIOR TO PLANTING ALL MULTIFLORA ROSE WITHIN PLANTING AREAS SHALL BE REMOVED. REMOVAL OF THE ROSE MAY BE PERFORMED WITH MOWING AND HERBICIDE TREATMENTS. PHYSICAL REMOVAL OF ALL TOP GROWTH FOLLOWING BY A PERIODIC HERBICIDE TREATMENT OF STUMP SPROUTS IS RECOMMENDED. NATIVE TREE AND SHRUB SPECIES OCCURRING WITHIN THE ROSE THICKETS SHOULD BE RETAINED WHEREVER POSSIBLE. HERBICIDE TREATMENTS SHALL OCCUR ON 2 MONTH INTERVALS DURING THE FIRST GROWING SEASON AND ONCE EACH IN THE SPRING AND FALL FOR SUBSEQUENT YEARS. HERBICIDE USED SHALL BE MADE SPECIFICALLY TO ADDRESS WOODY PLANT MATERIAL AND SHALL BE APPLIED AS PER MANUFACTURER'S SPECIFICATIONS. CARE SHOULD BE TAKEN NOT SPRAY PLANTED TREES OR NATURALLY OCCURRING NATIVE TREE/SHRUB SEEDLINGS. IT IS RECOMMENDED THAT INITIATION OF ROSE REMOVAL BEGIN AT LEAST SIX MONTHS PRIOR TO PLANTING.



UNDISTURBED SOIL

HEIGHT ROOTBALL 100% ABOVE FINISHED GRADE

BACKFILL WITH NATIVE SOIL

2" MULCH

WIDTH = 2 1/2 X ROOTBALL OR CONTAINER DIAMETER

DATE: 12/20/08

ALDO M. VANDERKAM, P.E.  
 PROFESSIONAL ENGINEER

Professional Registration: I hereby certify that these documents were prepared by me, and that I am a duly Licensed Professional Engineer under the laws of the State of Maryland, License No. 20748, Expiration Date 2-22-09.

**OFF-SITE FOREST CONSERVATION PLAN**  
**GTW'S WAVERLY WOODS**  
 SECTION 14  
 BULK PARCELS 'A' & 'B' AND  
 OPEN SPACE LOT 1

ZONING: PSC & PEC  
 TAX MAP NO. 16 PARCEL NOS. 120, 221 & P/O 249 GRID NOS. 3 & 4  
 THIRD ELECTION DISTRICT HOWARD COUNTY, MARYLAND  
 DATE: DECEMBER 5, 2008  
 SHEET 20 OF 22

**OWNER**  
 WITCHING HOUR FARM, LLC  
 15475 OLD FREDERICK ROAD  
 WOODBINE MD, 21797-0745  
 (301) 854-6695



# SPECIFICATIONS

## KEYSTONE MODULAR CONCRETE BLOCK RETAINING WALL

### PART 1: GENERAL

- 1.01 Description**  
**A.** Work shall consist of furnishing and construction of a KEYSTONE Retaining Wall System in accordance with these specifications and in reasonably close conformity with the lines, grades, design, and dimensions shown on the plans.  
**B.** Work includes preparing foundation soil, furnishing and installing leveling pad, unit drainage fill and backfill to the lines and grades shown on the construction drawings.  
**C.** Work includes furnishing and installing geogrid soil reinforcement of the type, size, location, and lengths designated on the construction drawings.

- 1.02 Delivery, Storage and Handling**  
**A.** Contractor shall check all materials upon delivery to assure that the proper type, grade, color, and certification has been received.  
**B.** Contractor shall protect all materials from damage due to job site conditions and in accordance with manufacturer's recommendations. Damaged materials shall not be incorporated into the work.

### PART 2: PRODUCTS

#### 2.01 Modular Concrete Retaining Wall Units

- A.** Modular concrete units shall conform to the following architectural requirements:  
 face color - concrete gray - standard manufacturer's color may be specified by the Owner.  
 face finish - sculptured rock face in angular tri-planer configuration. Other face finishes will not be allowed without written approval of Owner.  
 bond configuration - running with bonds nominally located at midpoint vertically adjacent units, in both straight and curved alignments.  
 exposed surfaces of units shall be free of chips, cracks or other imperfections when viewed from a distance of 10 feet under diffused lighting.  
**B.** Modular concrete materials shall conform to the requirements of ASTM C1372 - Standard Specifications for Segmental Retaining Wall Units.  
**C.** Modular concrete units shall conform to the following structural and geometric requirements measured in accordance with appropriate references:  
 compressive strength = 3000 psi minimum;  
 absorption = 8% maximum (8% in northern states) for standard weight aggregates;  
 dimensional tolerances = ± 1/8" from nominal unit dimensions not including rough split face, ± 1/16" unit height - top and bottom planes;  
 unit size - 8" (H) x 18" (W) x 18" (D) minimum;  
 unit weight - 100 lbs/unit minimum for standard weight

- aggregates;  
 inter-unit shear strength - 1000 pif minimum at 2 psi normal pressure;  
 geogrid/unit peak connection strength - 1000 pif minimum at 2 psi normal force.  
**D.** Modular concrete units shall conform to the following constructability requirements:  
 vertical setback = 1/8"± per course (near vertical) or 1/4"± per course per the design;  
 alignment and grid positioning mechanism - fiberglass pins, two per unit minimum;  
 maximum horizontal gap between erected units shall be - 1/2 inch.

- 2.02 Shear Connectors**  
**A.** Shear connectors shall be 1/2 inch diameter thermoset isophthalic polyester resin-impregnated fiberglass reinforcement rods or equivalent to provide connection between vertically and horizontally adjacent units.  
 Strength of shear connectors between vertical adjacent units shall be applicable over a design temperature of 10 degrees F to + 100 degrees F.  
**B.** Shear connectors shall be capable of holding the geogrid in the proper design position during grid pre-tensioning and backfilling.

#### 2.03 Base Leveling Pad Material

- A.** Material shall consist of a compacted #57 crushed stone base as shown on the construction drawings.

#### 2.04 Unit Drainage Fill

- A.** Unit drainage fill shall consist of #57 crushed stone

#### 2.05 Reinforced Backfill

- A.** Reinforced backfill shall type SM, be free of debris and meet the following gradation tested in accordance with ASTM D-422 and meet other properties shown on the plan:

Sieve Size	Percent Passing
2 inch	100-75
3/4 inch	100-75
No. 40	0-60
No. 200	0-40

Plasticity Index (PI) <10 and Liquid Limit <40 per ASTM D-4318.

- B.** Material can be site excavated soils where the above requirements can be met. Unsuitable soils for backfill (high plastic clays or organic soils) shall not be used in the reinforced soil mass.

#### 2.06 Geogrid Soil Reinforcement

- A.** Geosynthetic reinforcement shall consist of geogrids manufactured specifically for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn.

#### 2.07 Drainage Pipe

- A.** The drainage pipe shall be perforated corrugated HDPE pipe manufactured in accordance with ASTM D-1248.

### PART 3: EXECUTION

#### 3.01 Excavation

- A.** Contractor shall excavate to the lines and grades shown on the construction drawings. Owner's representative shall be responsible for inspecting and approving the excavation prior to placement of leveling material or fill soils.

#### 3.02 Base Leveling Pad

- A.** Leveling pad material shall be placed to the lines and grades shown on the construction drawings, to a minimum thickness of 6 inches and extend laterally a minimum of 6" in front and behind the modular wall unit.  
**B.** Leveling pad shall be prepared to insure full contact to the base surface of the concrete units.

#### 3.03 Modular Unit Installation

- A.** First course of units shall be placed on the leveling pad at the appropriate line and grade. Alignment and level shall be checked in all directions and insure that all units are in full contact with the base and properly seated.  
**B.** Place the front of units side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with manufacturer's recommendations.  
**C.** Install shearconnecting devices per manufacturer's recommendations.  
**D.** Place and compact drainage fill within and behind wall units. Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill.  
**E.** Maximum stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed three courses.

#### 3.04 Structural Geogrid Installation

- A.** Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.  
**B.** Geogrid reinforcement shall be placed at the strengths, lengths, and elevations shown on the construction design drawings or as directed by the Engineer.  
**C.** The geogrid shall be laid horizontally on compacted backfill and attached to the modular wall units. Place the next course of modular concrete units over the geogrid. The geogrid shall be pulled taut, and anchored prior to

- backfill placement on the geogrid.  
**D.** Geogrid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geogrid or gaps between adjacent pieces of geogrid are not permitted.

#### 3.05 Reinforced Backfill Placement

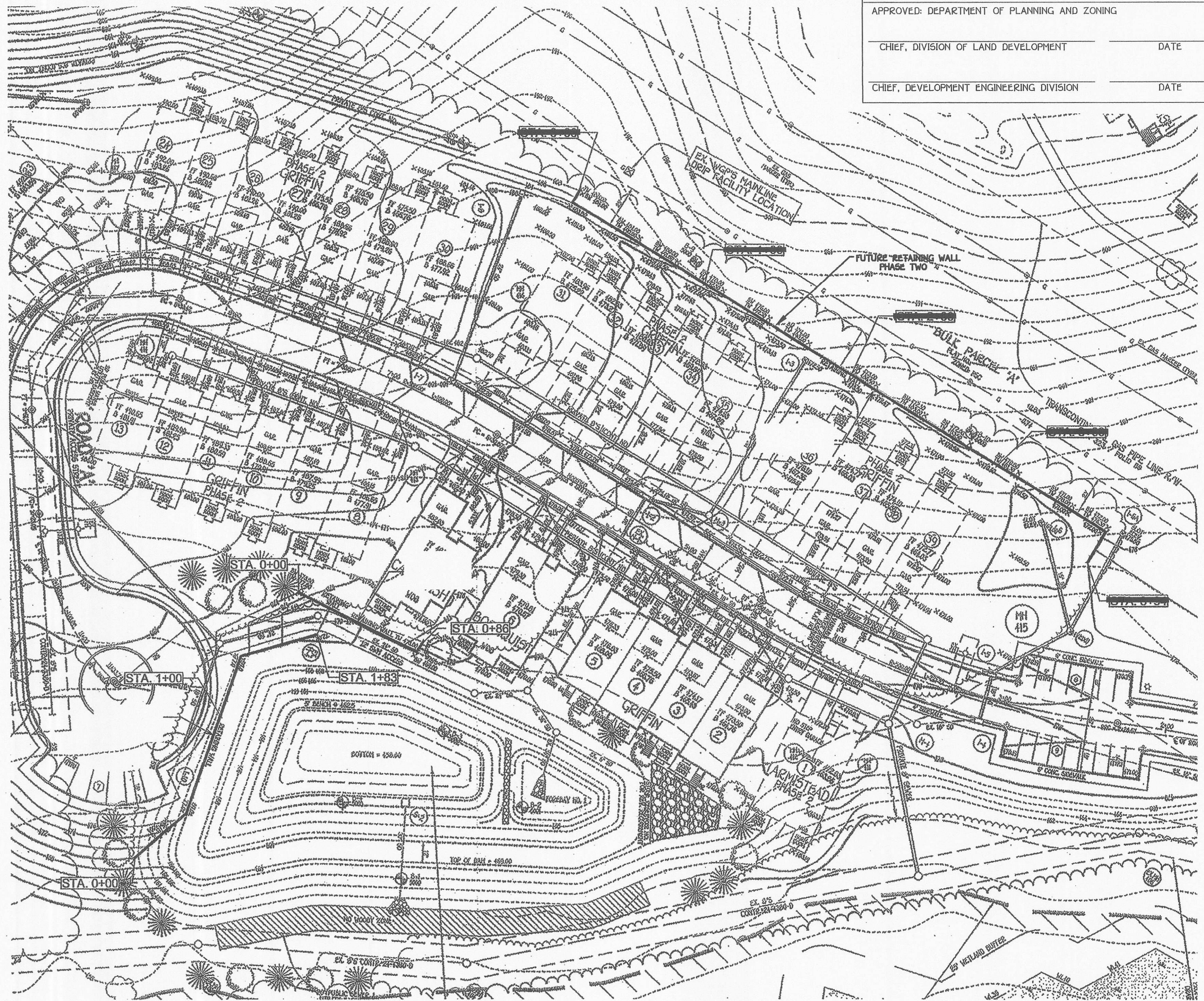
- A.** Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geogrid and installation damage.  
**B.** Reinforced backfill shall be placed and compacted in lifts not to exceed 6 inches where hand compaction is used, or 8 - 10 inches where heavy compaction equipment is used. Lift thickness shall be decreased to achieve the required density as required.  
**C.** Reinforced backfill shall be compacted to 95% of the maximum density as determined by ASTM D698. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be + 3% to - 3% of optimum.  
**D.** Only lightweight hand-operated equipment shall be allowed within 3 feet from the tail of the modular concrete unit.  
**E.** Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.  
**F.** Rubber tired equipment may pass over geogrid reinforcement at slow speeds, less than 10 MPH. Sudden braking and sharp turning shall be avoided.  
**G.** At the end of each day's operation, the Contractor shall slope the last lift of reinforced backfill away from the wall units to direct runoff away from wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

#### 3.06 Cap Installation

- A.** Cap units shall be glued to underlying units with an all-weather adhesive recommended by the manufacturer.

#### 3.07 Field Quality Control

- A.** The Owner shall engage inspection and testing services, including independent laboratories, to provide quality assurance and testing services during construction.  
**B.** As a minimum, quality assurance testing should include foundation soil inspection, soil and backfill testing, verification of design parameters, and observation of construction for general compliance with design drawings and specifications.



WALL LOCATION PLAN

1" = 40'

### GENERAL NOTES:

- No trees shall be planted within 10 feet of the top of the retaining wall.
- Retaining walls shall only be constructed under the observation of a registered professional engineer and a (NICET, WACEL, or equiv.) certified soils technician.
- The required bearing pressure beneath the wall system shall be verified in the field by a certified soils technician. Testing documentation must be provided to the Howard County Inspector prior to start of construction. The required bearing test shall be the Dynamic Cone Penetrometer test ASTM STP-399.
- The suitability of fill material shall be confirmed by the on-site soils technician. Each 8" lift must be compacted to a minimum 95% standard proctor density and the testing report shall be made available to the Howard County Inspector upon completion of construction.
- Walls shall not be constructed on uncertified fill materials.
- Walls shall not be constructed within a Howard Co. right-of-way or easement.

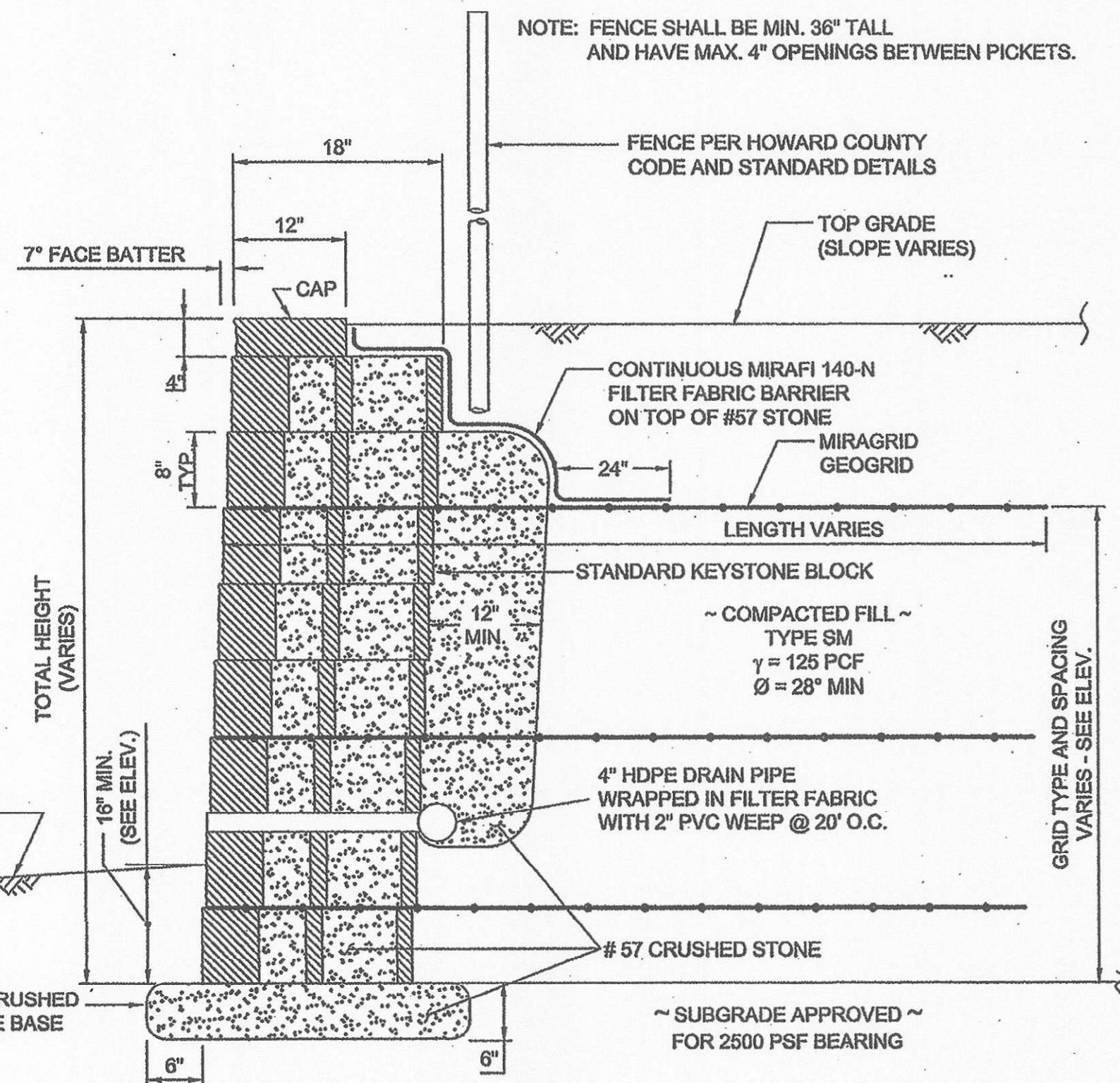
APPROVED: DEPARTMENT OF PUBLIC WORKS

CHIEF, BUREAU OF HIGHWAYS DATE

APPROVED: DEPARTMENT OF PLANNING AND ZONING

CHIEF, DIVISION OF LAND DEVELOPMENT DATE

CHIEF, DEVELOPMENT ENGINEERING DIVISION DATE



TYPICAL WALL SECTION

NTS

NOTE: FENCE SHALL BE MIN. 36" TALL AND HAVE MAX. 4" OPENINGS BETWEEN PICKETS.

FENCE PER HOWARD COUNTY CODE AND STANDARD DETAILS

TOP GRADE (SLOPE VARIES)

CONTINUOUS MIRAFI 140-N FILTER FABRIC BARRIER ON TOP OF #57 STONE

MIRAGRID GEOGRID

LENGTH VARIES

STANDARD KEYSTONE BLOCK

~ COMPACTED FILL ~ TYPE SM

γ = 125 PCF

Ø = 28" MIN

4" HDPE DRAIN PIPE WRAPPED IN FILTER FABRIC WITH 2" PVC WEEP @ 20" O.C.

# 57 CRUSHED STONE

~ SUBGRADE APPROVED ~ FOR 2500 PSF BEARING

**HILLIS-CARNES**  
 ENGINEERING ASSOCIATES

10975 Guilford Road, Suite A  
 (410) 880-4788

**OWNERS**  
 WAVERLY WOODS DEVELOPMENT CORPORATION,  
 HOLE IN THE DOUGHNUT, LLC, &  
 CTW JOINT VENTURE,  
 C/O LAND DESIGN AND DEVELOPMENT, INC.  
 5300 DORSEY HALL DRIVE, SUITE 102  
 ELLICOTT CITY, MARYLAND 21042  
 (410) 367-0422

**DEVELOPER**  
 WAVERLY WOODS DEVELOPMENT CORP.  
 C/O LAND DESIGN AND DEVELOPMENT,  
 INC. 5300 DORSEY HALL DRIVE, SUITE 102  
 ELLICOTT CITY, MARYLAND 21042  
 (410) 367-0422

PROFESSIONAL CERTIFICATION  
 I HEREBY CERTIFY THAT THESE PLANS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 14434, EXPIRATION DATE: 09/13/09.



RETAINING WALL Nos. 2 & 3 @ B.M.P. No.1  
 PLAN & CONSTRUCTION DETAILS

**GTW'S WAVERLY WOODS**  
 SECTION 14  
 BULK PARCELS 'A' & 'B' AND  
 OPEN SPACE LOT 1

(A SUBDIVISION OF THE PROPERTY OF WAVERLY WOODS DEVELOPMENT CORPORATION, LIBER 1079, FOLIO 3077)  
 ZONING: PSC & PEC  
 TAX MAP NO. 16 PARCEL Nos. 120, 221 & P/O 249 GRID Nos. 3 & 4  
 THIRD ELECTION DISTRICT HOWARD COUNTY, MARYLAND  
 DATE: DECEMBER 2, 2008  
 SHEET 21 OF 22



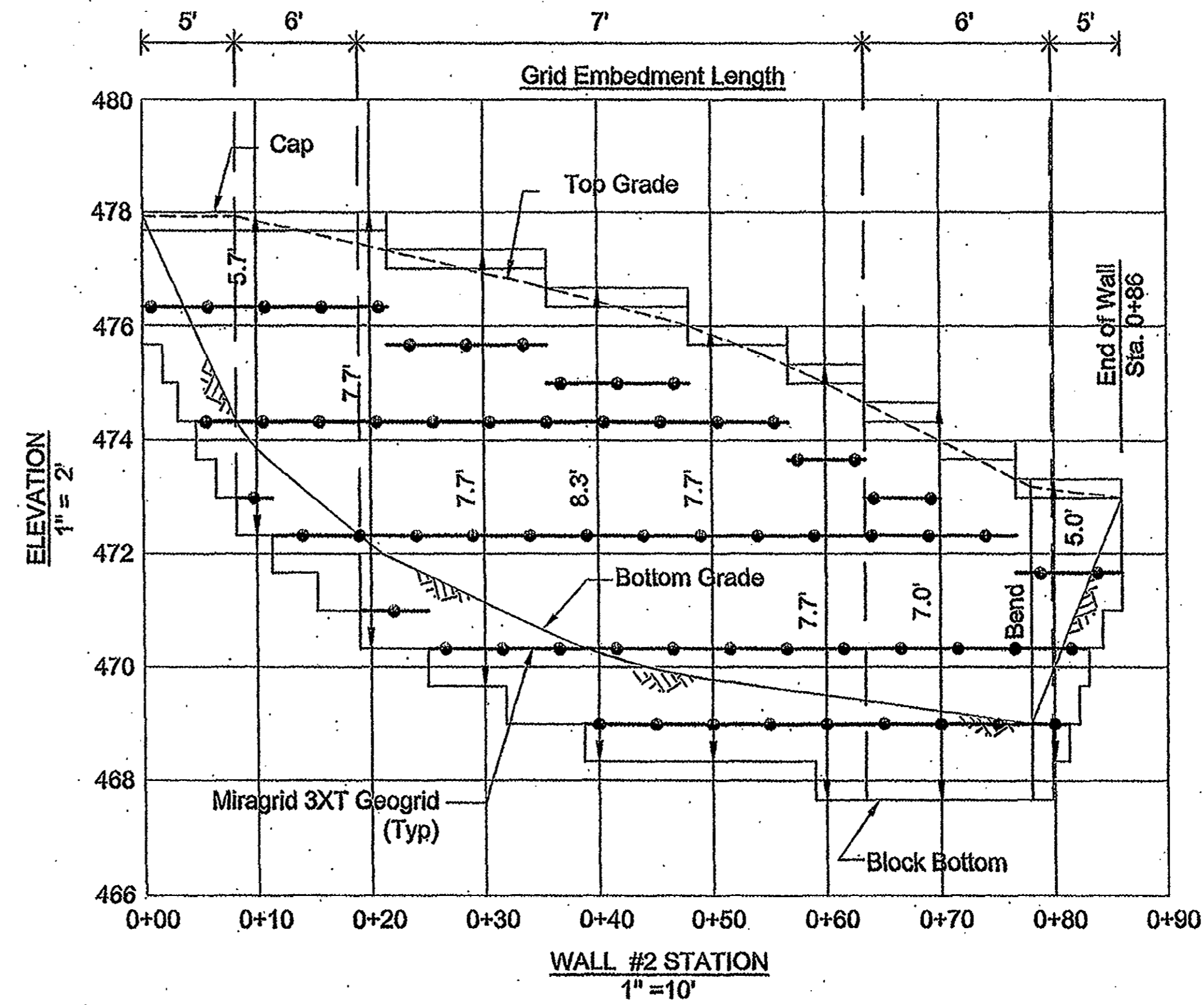
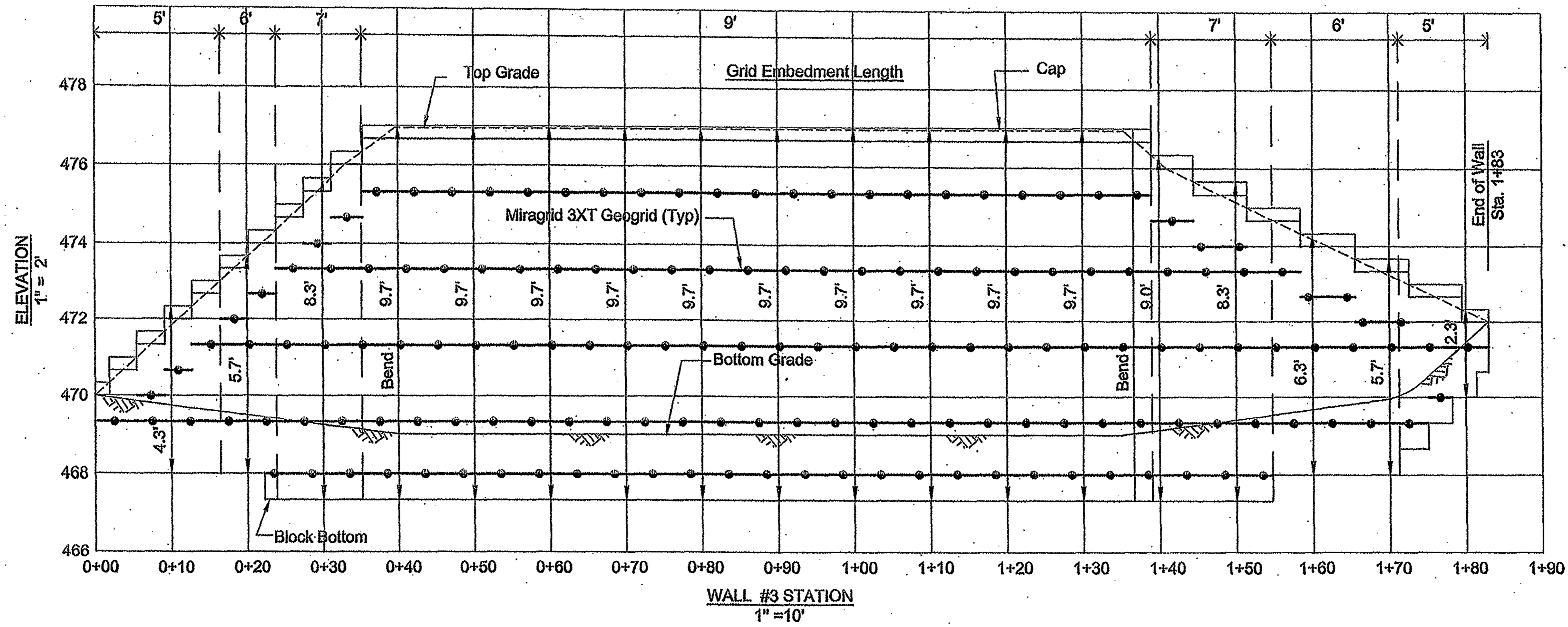
APPROVED: DEPARTMENT OF PUBLIC WORKS

CHIEF, BUREAU OF HIGHWAYS \_\_\_\_\_ DATE \_\_\_\_\_

APPROVED: DEPARTMENT OF PLANNING AND ZONING

CHIEF, DIVISION OF LAND DEVELOPMENT \_\_\_\_\_ DATE \_\_\_\_\_

CHIEF, DEVELOPMENT ENGINEERING DIVISION \_\_\_\_\_ DATE \_\_\_\_\_



RETAINING WALL Nos. 2 & 3 @ B.M.P. No.1  
ELEVATIONS

**GTW'S WAVERLY WOODS**  
SECTION 14  
BULK PARCELS 'A' & 'B' AND  
OPEN SPACE LOT 1  
(A SUBDIVISION OF THE PROPERTY OF WAVERLY WOODS DEVELOPMENT CORPORATION, LIBER 4879, FOLIO 307)  
ZONING: PSC & PEC  
TAX MAP NO. 16 PARCEL Nos. 120, 221 & P/O 249 GRID Nos. 3 & 4  
THIRD ELECTION DISTRICT HOWARD COUNTY, MARYLAND  
DATE: DECEMBER 5, 2008  
SHEET 22 OF 22

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE PLANS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 14434, EXPIRATION DATE: 09/13/09.

**FISHER, COLLINS & CARTER, INC.**  
CIVIL ENGINEERING CONSULTANTS & LAND SURVEYORS  
CENTENNIAL SQUARE OFFICE PARK - 10272 BALTIMORE NATIONAL PLE  
ELLCOTT CITY, MARYLAND 21114  
410.661.2955

**HILLIS-CARNES**  
ENGINEERING ASSOCIATES

10975 Guilford Road, Suite A Annapolis Junction, MD  
(410) 880-4788 Fax: (410)880-4088

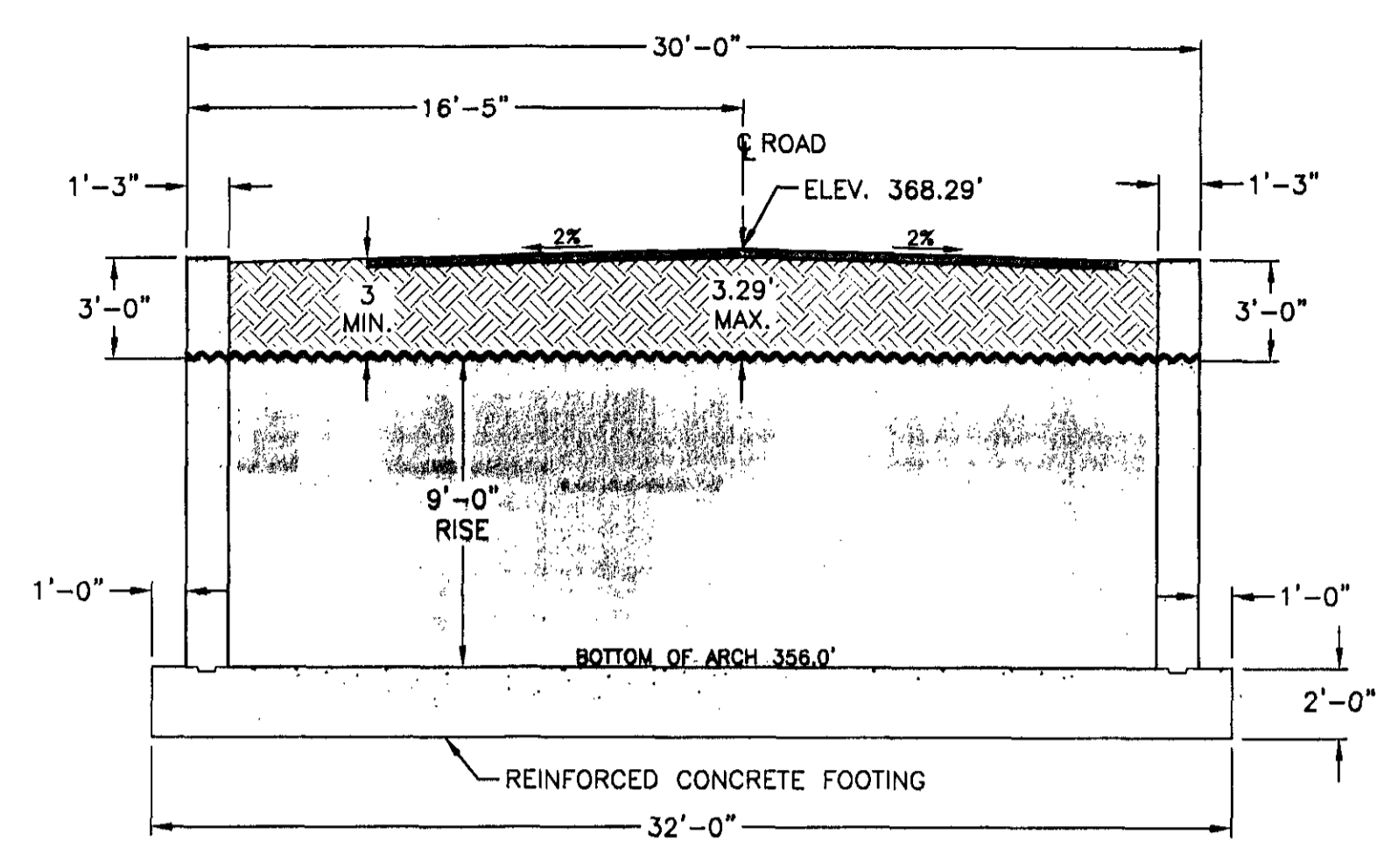
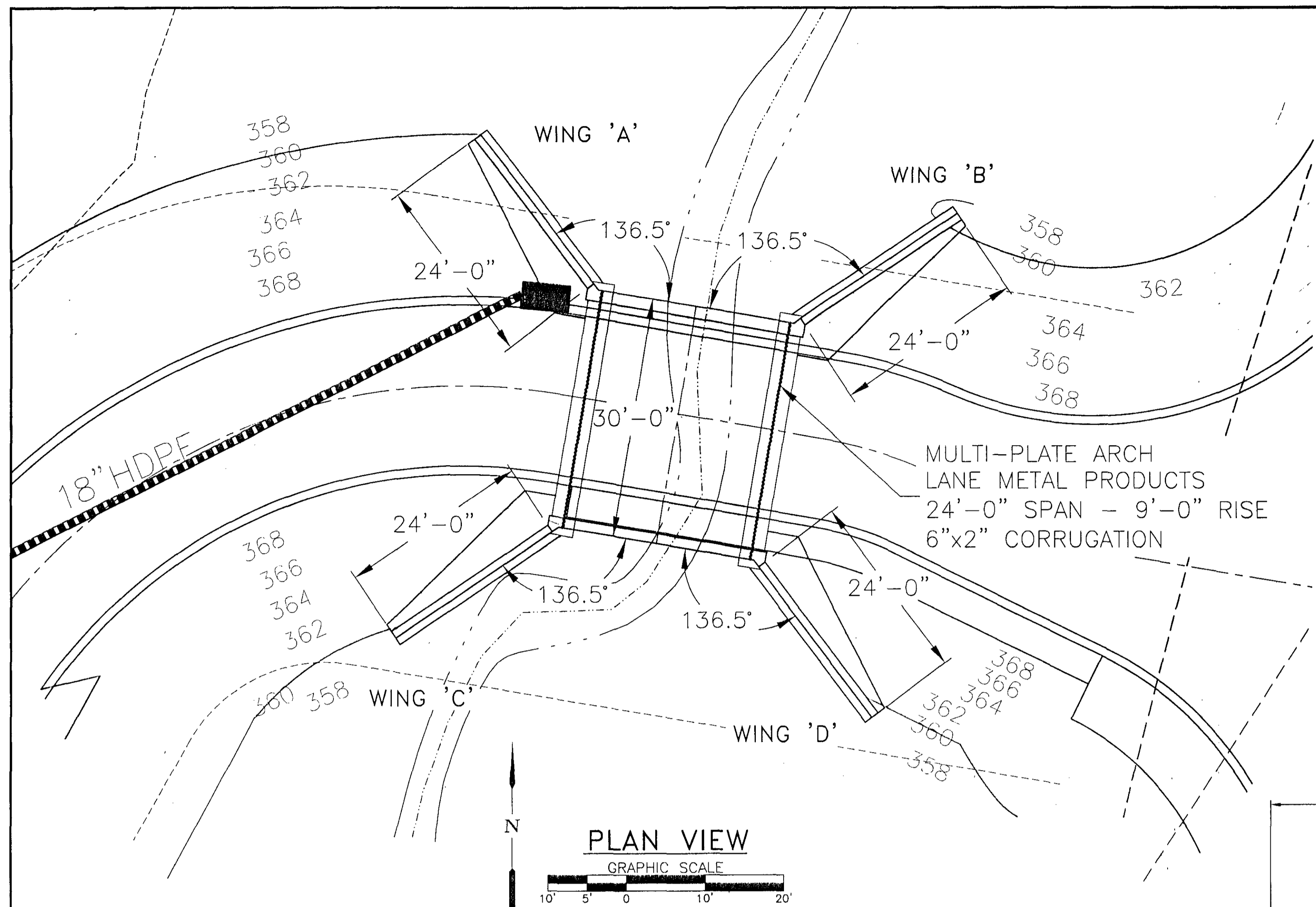
**OWNERS**

WAVERLY WOODS DEVELOPMENT CORPORATION,  
SOLE IN THE DOUGHNUT, LLC, &  
GTW JOINT VENTURE  
C/O LAND DESIGN AND DEVELOPMENT, INC.  
5300 DORSEY HALL DRIVE, SUITE 102  
ELLCOTT CITY, MARYLAND 21042  
(413-367-0422)

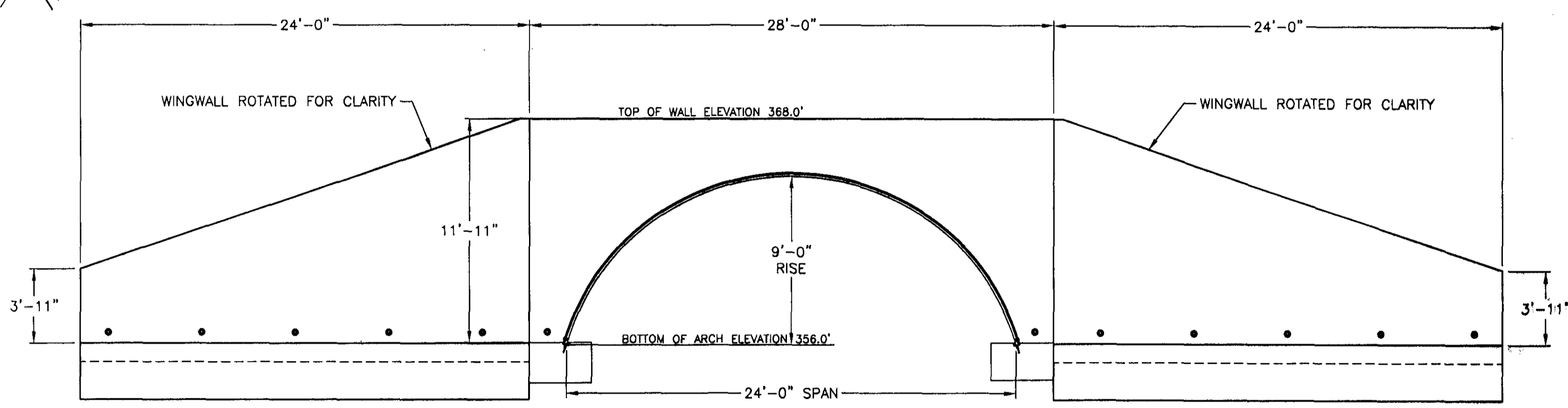
**DEVELOPER**

WAVERLY WOODS DEVELOPMENT CORP.  
C/O LAND DESIGN AND DEVELOPMENT,  
INC. 5300 DORSEY HALL DRIVE, SUITE 102  
ELLCOTT CITY, MARYLAND 21042  
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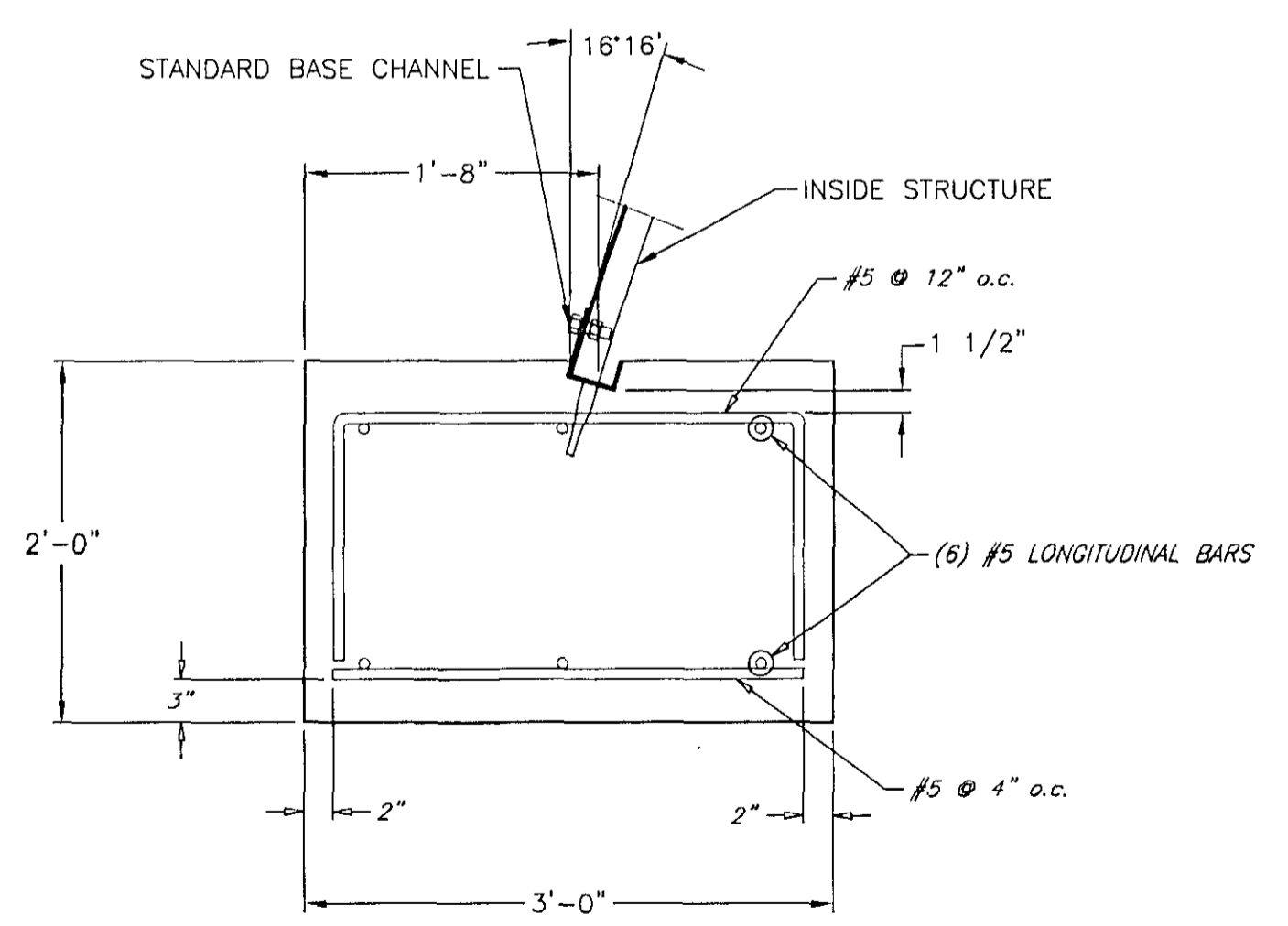




**PROFILE VIEW**  
GRAPHIC SCALE  
5' 2.5' 0' 5' 10'

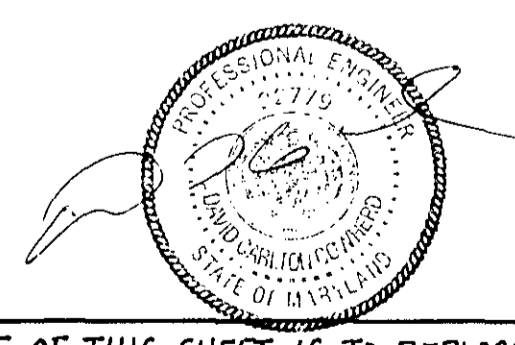


**ELEVATION VIEW**  
GRAPHIC SCALE  
5' 2.5' 0' 5' 10'



**TYPICAL FOOTING DESIGN**  
GRAPHIC SCALE  
1' .5' 0' 1' 2'

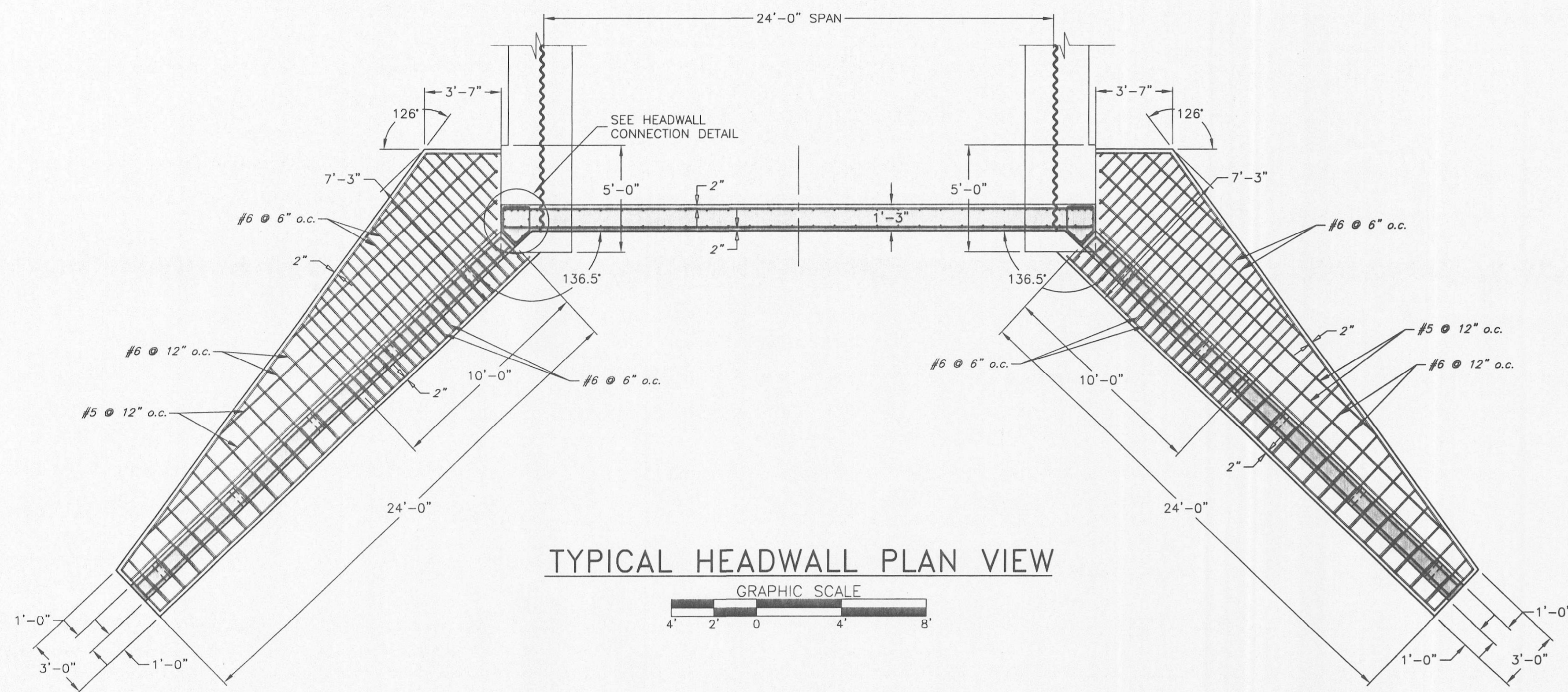
- NOTES FOR FOOTING:**  
 1.) CONCRETE SHALL BE f'c = 3500 psi.  
 2.) REINFORCEMENT SHALL BE ASTM A-615 GRADE 60.



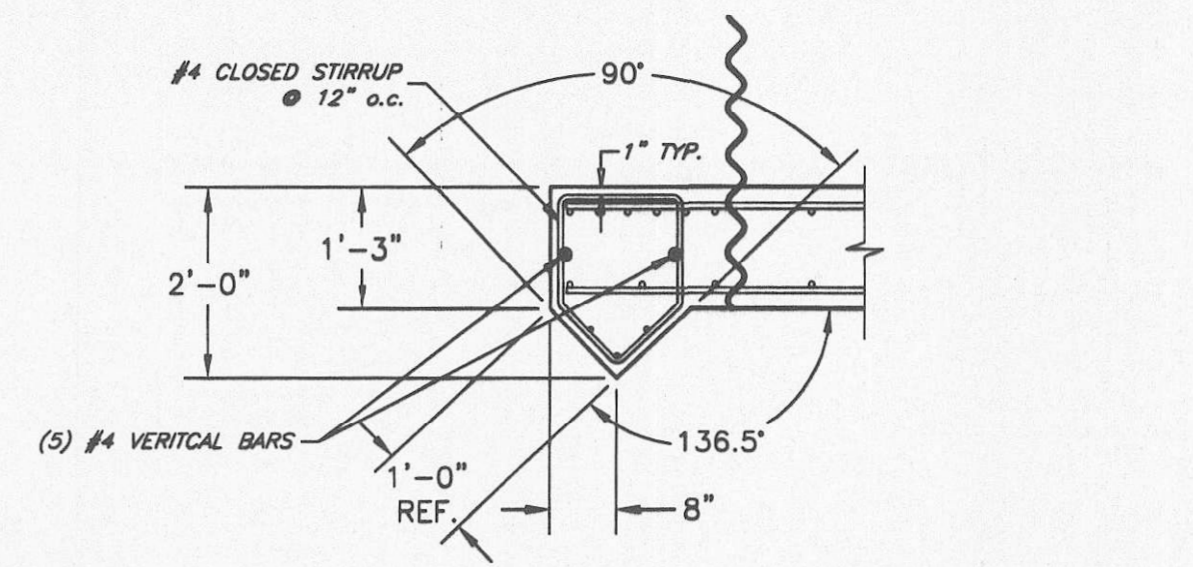
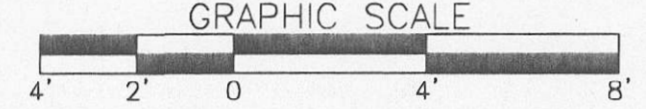
THE PURPOSE OF THIS SHEET IS TO REPLACE SHEET 13, BONNIE BRANCH OVERLOOK F-00-95.  
 APPROVED: DEPARTMENT OF PUBLIC WORKS  
 CHIEF, BUREAU OF HIGHWAYS \_\_\_\_\_ DATE \_\_\_\_\_  
 APPROVED: DEPARTMENT OF PLANNING AND ZONING  
 CHIEF, DIVISION OF LAND DEVELOPMENT JA \_\_\_\_\_ DATE \_\_\_\_\_  
 CHIEF, DEVELOPMENT ENGINEERING DIVISION MAI \_\_\_\_\_ DATE \_\_\_\_\_

		<b>REVISED PLAN, PROFILE &amp; DETAILS</b>	
		Drawn By: DWR Date: 07/31/01	WILDMAN ENVIRONMENTAL SERVICES DESIGN OF MULTI-PLATE ARCH BONNIE BRANCH OVERLOOK HOWARD COUNTY, MARYLAND
Scale: GRAPHIC	Project No.: CBC-3237	Rev.: -	Sheet: 15 OF 16

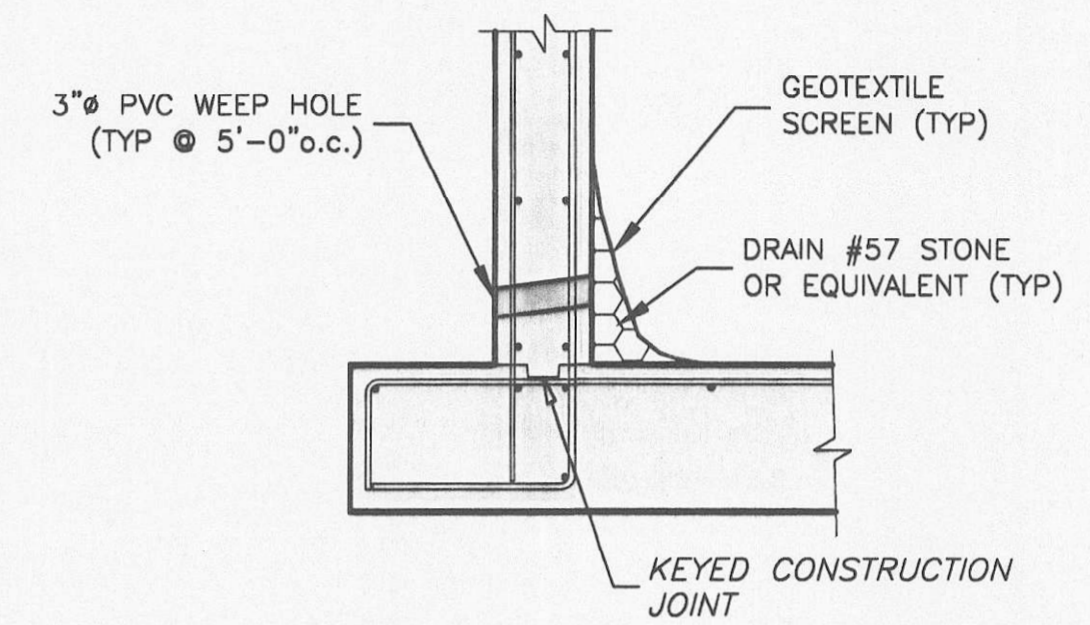
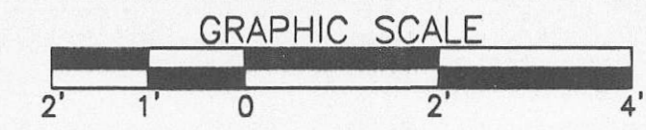




TYPICAL HEADWALL PLAN VIEW

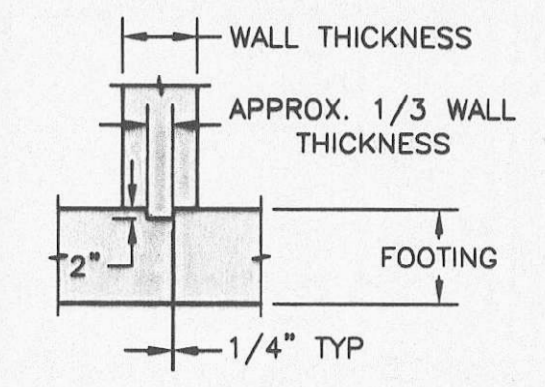


HEADWALL CONNECTION DETAIL



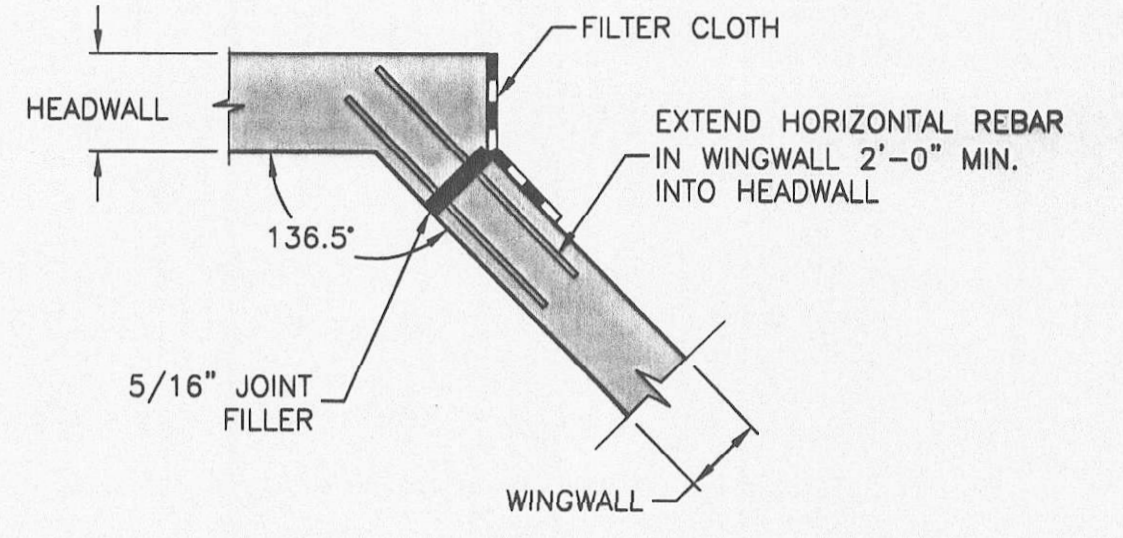
WEEP HOLE DETAIL

NOT TO SCALE



KEYED CONSTRUCTION JOINT DETAIL

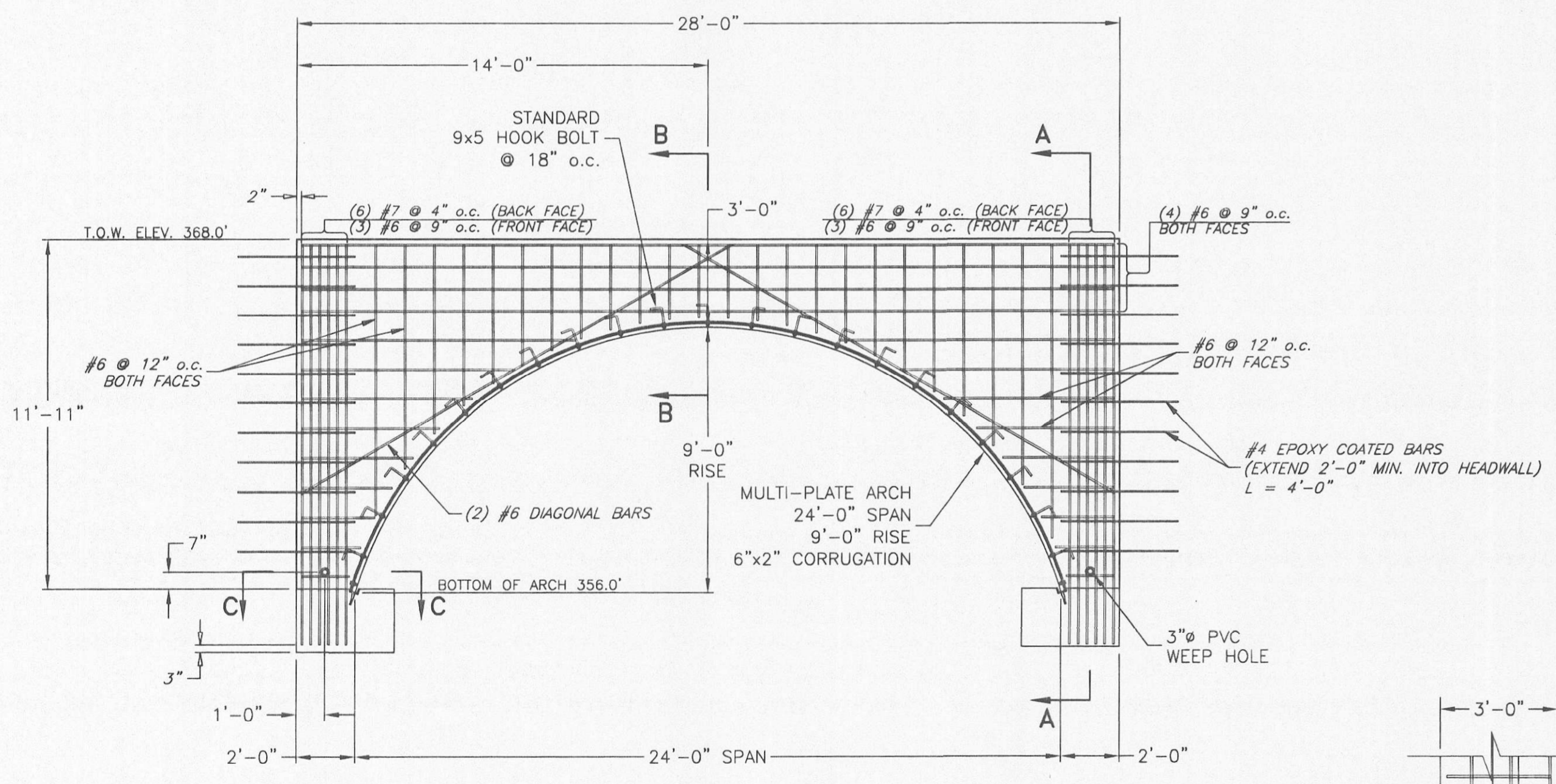
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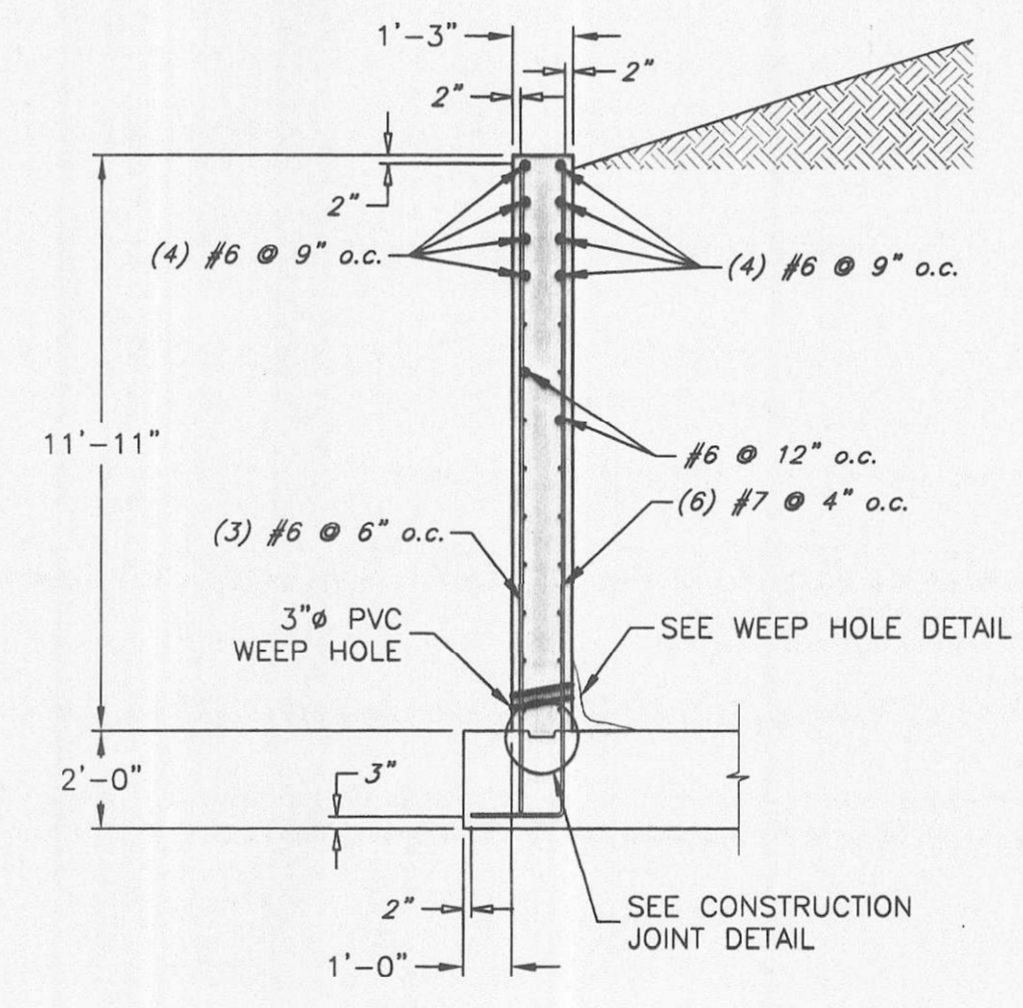
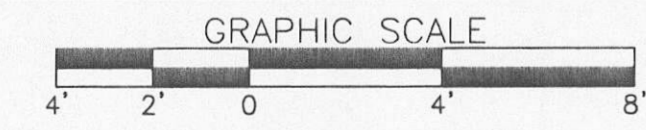
EXPANSION JOINT DETAIL

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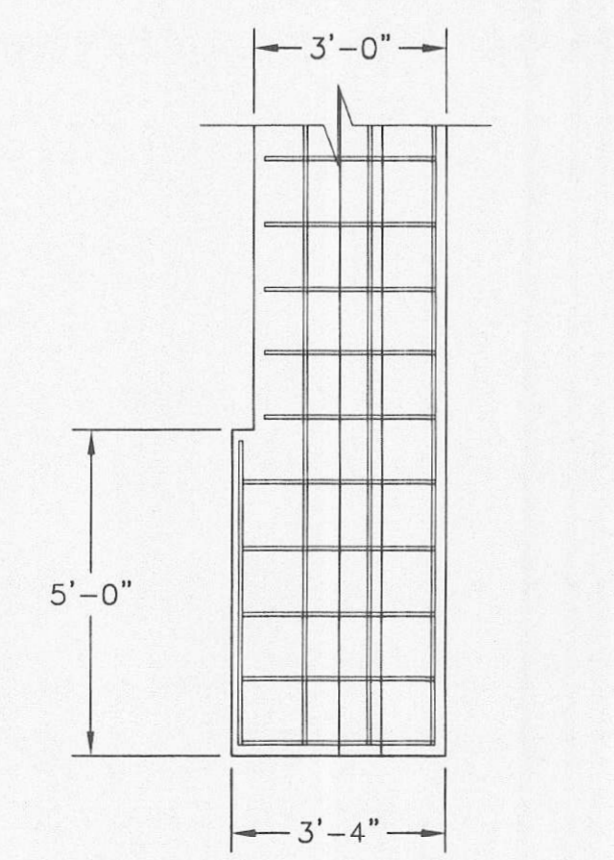
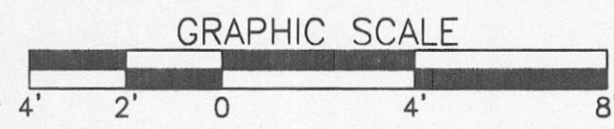
NOTES FOR EXPANSION JOINT:  
 A FILTER CLOTH THREE FOOT IN WIDTH AND DOUBLE THICKNESS SHALL BE APPLIED TO ALL TRANSVERSE JOINTS IN THE FOOTING AND WALLS. THE MATERIAL SHALL BE CENTERED ON THE JOINT AND THE EDGES SEALED WITH A MASTIC OR WITH TWO SIDED TAPE. THE FILTER CLOTH SHALL BE A GEOTEXTILE MEETING THE APPROVAL OF THE ENGINEER.  
 JOINT FILLER SHALL BE SECURELY STITCHED TO ONE FACE OF THE CONCRETE WITH No. 10 GAGE COPPER WIRE OR No. 12 GAGE SOFT DRAWN GALVANIZED STEEL WIRE.



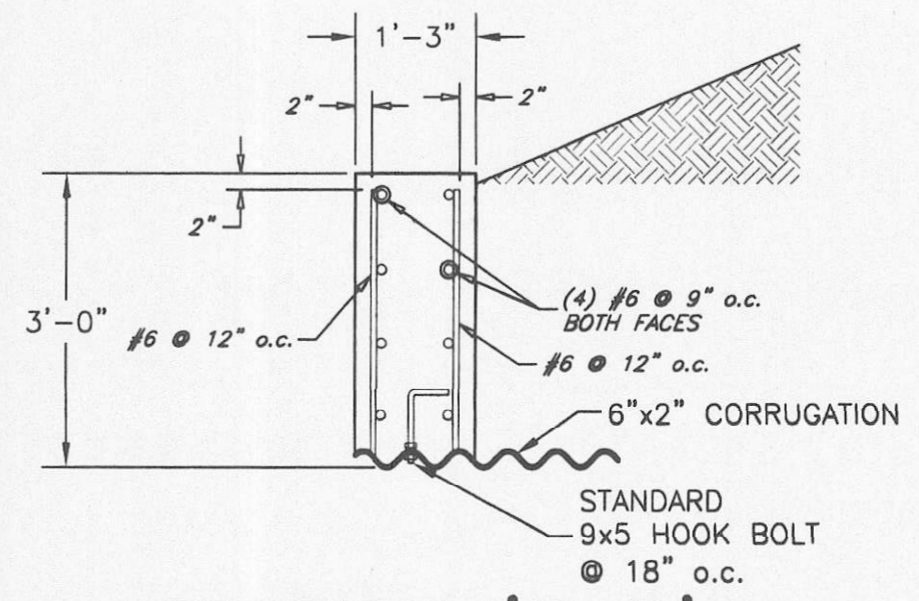
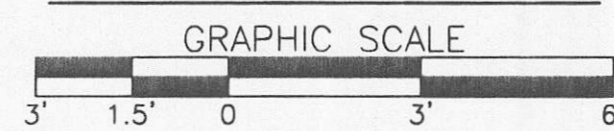
TYPICAL HEADWALL ELEVATION VIEW



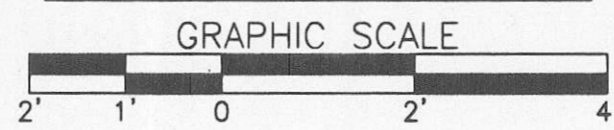
SECTION 'A-A'



SECTION 'C-C'



SECTION 'B-B'



THE PURPOSE OF THIS SHEET IS TO REPLACE SHEET 14, BONNIE BRANCH OVERLOOK F.00-95

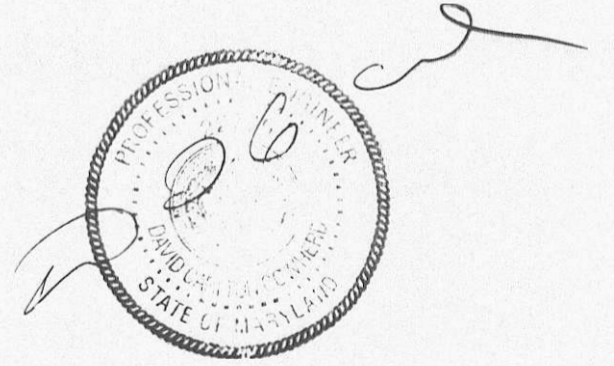
APPROVED: DEPARTMENT OF PUBLIC WORKS

CHIEF BUREAU OF HIGHWAYS \_\_\_\_\_ DATE \_\_\_\_\_

APPROVED: DEPARTMENT OF PLANNING AND ZONING

CHIEF, DIVISION OF LAND DEVELOPMENT JA \_\_\_\_\_ DATE \_\_\_\_\_

CHIEF, DEVELOPMENT ENGINEERING DIVISION MAJ \_\_\_\_\_ DATE \_\_\_\_\_

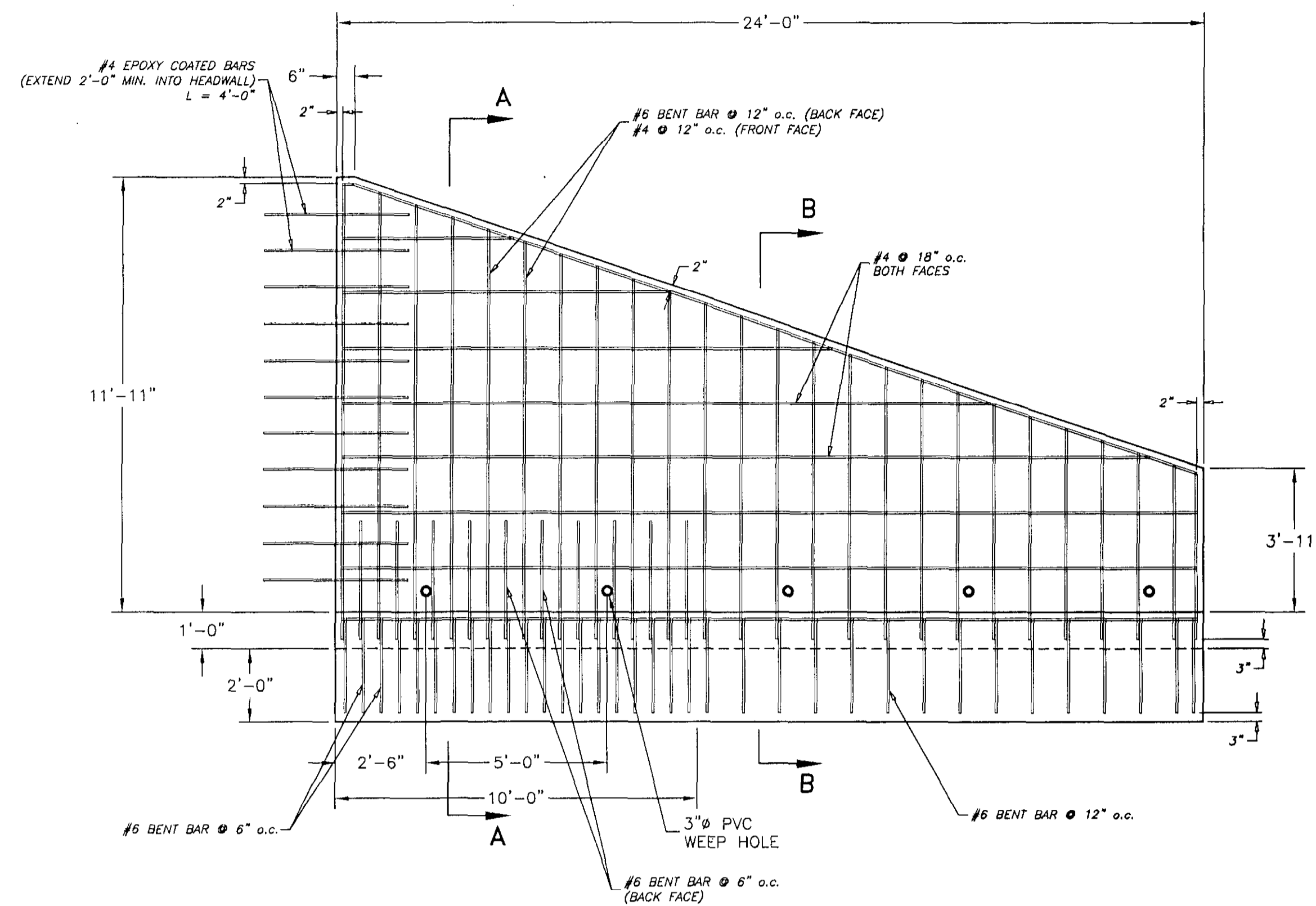


NOTES FOR FOOTING:  
 1.) CONCRETE SHALL BE f'c = 3500 psi.  
 2.) REINFORCEMENT SHALL BE ASTM A-615 GRADE 60.

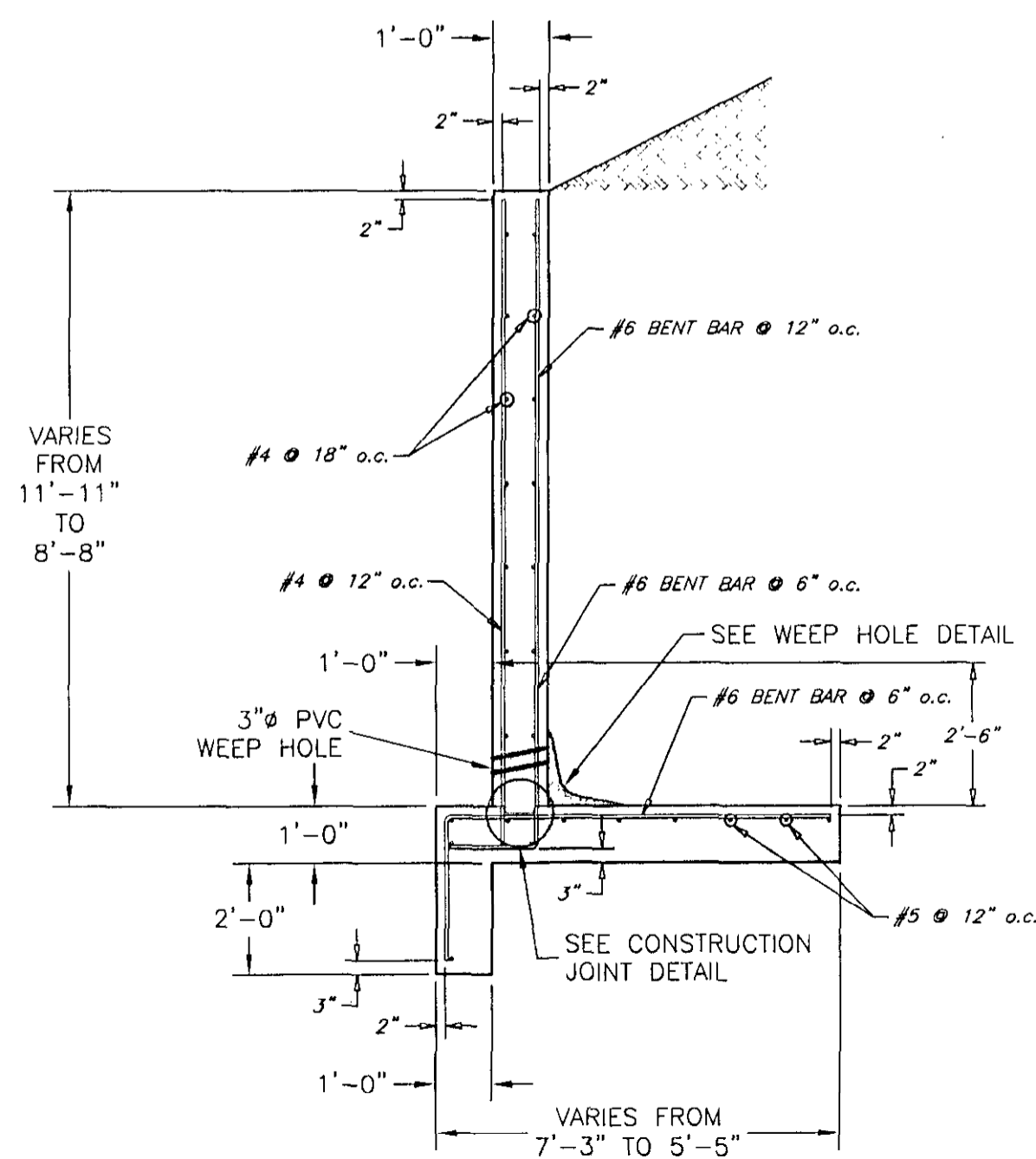
<b>CBC ENGINEERS</b> DAYTON, OHIO			
<b>REVISED HEADWALL DETAILS</b>			
Drawn By DWR	Date 07/31/01	WILDMAN ENVIRONMENTAL SERVICES DESIGN OF MULTI-PLATE ARCH BONNIE BRANCH OVERLOOK HOWARD COUNTY, MARYLAND	
Approved By	Date	Project No. CBC-3237	Rev. Sheet 14 OF 16
Scale GRAPHIC			

F-00-95

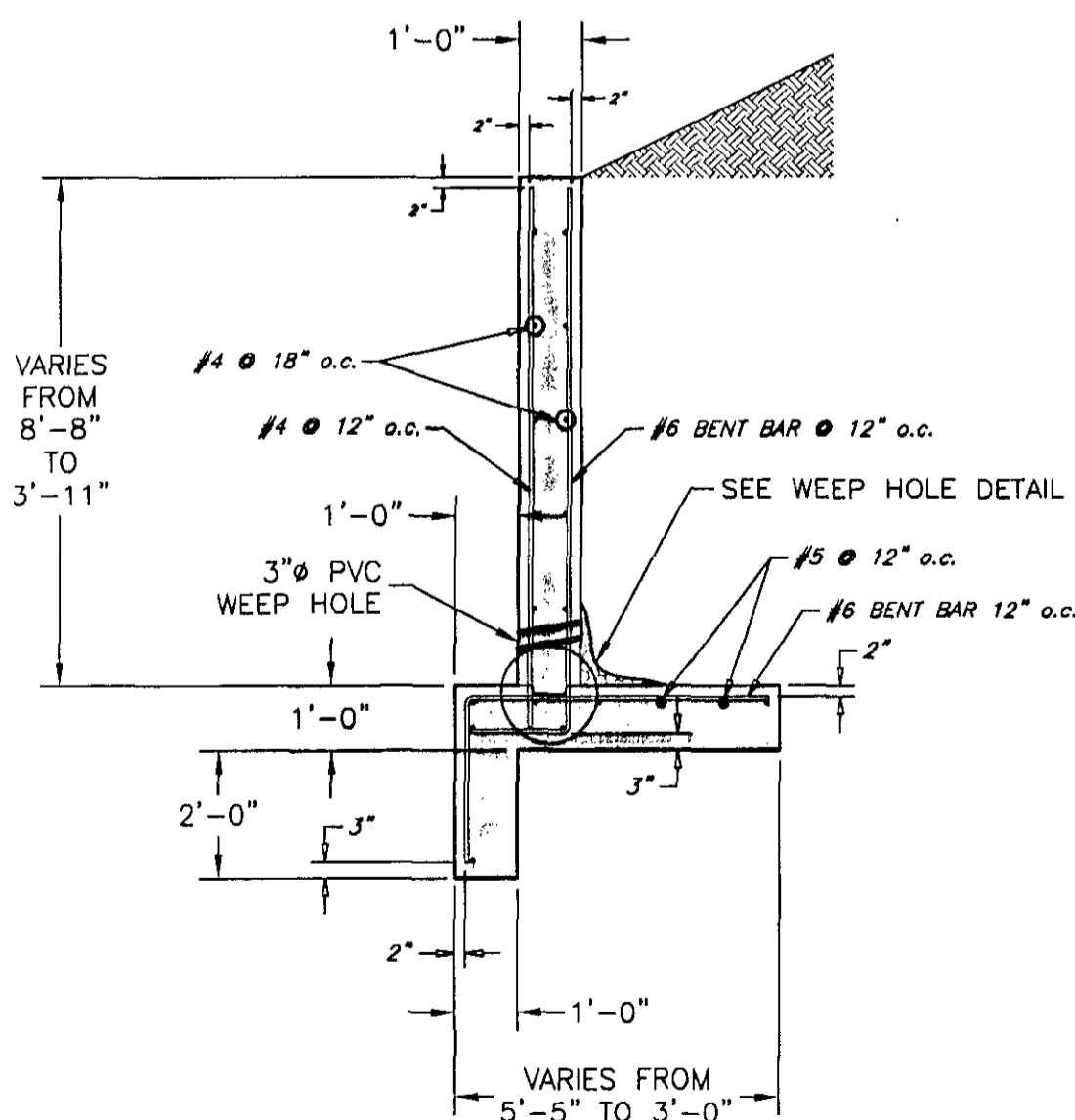




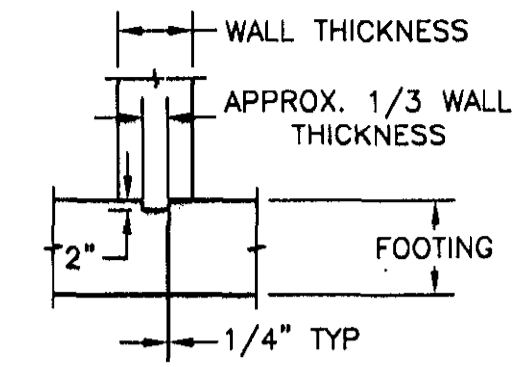
TYPICAL WINGWALL ELEVATION VIEW



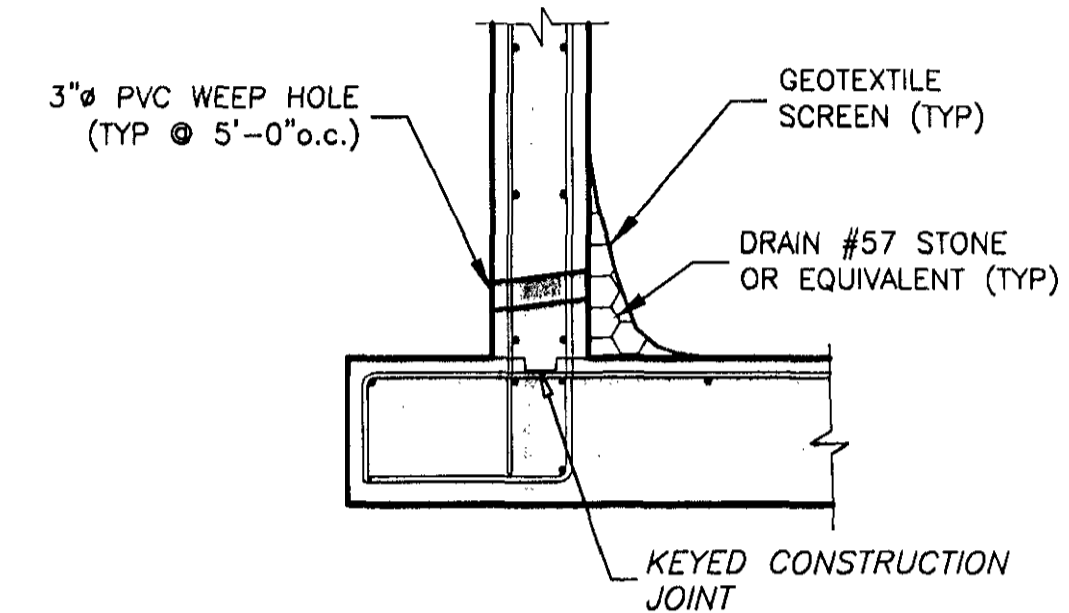
SECTION 'A-A'



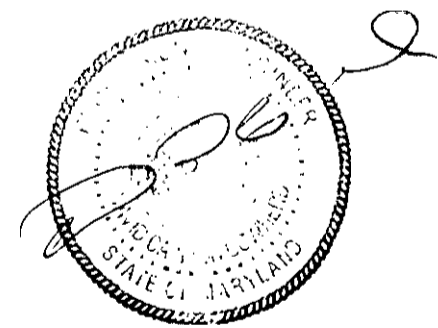
SECTION 'B-B'



KEYED CONSTRUCTION JOINT DETAIL  
NOT TO SCALE



WEEP HOLE DETAIL  
NOT TO SCALE



- NOTES FOR FOOTING:
- 1.) CONCRETE SHALL BE  $f'c = 3500$  psi.
  - 2.) REINFORCEMENT SHALL BE ASTM A-615 GRADE 60.

THE PURPOSE OF THIS SHEET IS TO REPLACE SHEET 15, BONNIE BRANCH OVERLOOK F.00-35

APPROVED: DEPARTMENT OF PUBLIC WORKS	DATE
CHIEF BUREAU OF HIGHWAYS	DATE
APPROVED: DEPARTMENT OF PLANNING AND ZONING	DATE
CHIEF, DIVISION OF LAND DEVELOPMENT	DATE
CHIEF, DEVELOPMENT ENGINEERING DIVISION	DATE

REVISED WINGWALL DETAILS			
Drawn By DWR	Date 07/31/01	WILDMAN ENVIRONMENTAL SERVICES DESIGN OF MULTI-PLATE ARCH BONNIE BRANCH OVERLOOK HOWARD COUNTY, MARYLAND	
Scale GRAPHIC	Project No. CBC-3237	Rev. -	Sheet 15 OF 16



I - GENERAL

1.0 STANDARDS AND DEFINITIONS

- 1.1 STANDARDS - All standards refer to latest edition unless otherwise noted.
  - 1.1.1 ASTM D-698-70 (Method C) "Standard Test Methods for Moisture, Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb (2.5 kg.) Rammer and 12" (305-mm) Drop".
  - 1.1.2 ASTM D-1557 "Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft<sup>3</sup> [2,700 kN m/m<sup>3</sup>])".
  - 1.1.3 ASTM D-2922 "Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)".
  - 1.1.4 ASTM D-1556 "Standard Test Method for Density of Soil in Place by the Sand-Cone Method".
  - 1.1.5 All construction and materials shall be in accordance with the current AASHTO Specifications.

1.2 DEFINITIONS

- 1.2.1 Owner - In these specifications the word "Owner" shall mean Bonnie Branch Subdivision.
- 1.2.2 Engineer - In these specifications the word "Engineer" shall mean the Owner designated engineer.
- 1.2.3 Design Engineer - In these specifications the words "Design Engineer" shall mean CBC Engineers and Associates, Ltd.
- 1.2.4 Contractor - In these specifications the word "Contractor" shall mean the firm or corporation undertaking the execution of any work under the terms of these specifications.
- 1.2.5 Approved - In these specifications the word "approved" shall refer to the approval of the Engineer or his designated representative.
- 1.2.6 As Directed - In these specifications the words "as directed" shall refer to the directions to the Contractor from the Owner or his designated representative.

2.0 GENERAL CONDITIONS

- 2.1 The Contractor shall furnish all labor, material and equipment and perform all work and services except those set out and furnished by the Owner, necessary to complete in a satisfactory manner the site preparation, excavation, footings, culvert installation, head walls, wing walls, filling, compaction, and grading as shown on the plans and as described therein.

This work is to be accomplished under the observation of the Owner or his designated representative.

- 2.2 The Contractor shall examine, investigate and inspect the construction site as to the nature and location of the work, and the general and local conditions at the construction site, including, without limitation, the character of surface or subsurface conditions and obstacles to be encountered on and around the construction site; and shall make such additional investigation as he may deem necessary for the planning and proper execution of the work.

If conditions other than those indicated are discovered by the Contractor, the Owner should be notified immediately. The material which the Contractor believes to be a changed condition should not be disturbed so that the owner can investigate the condition.

- 2.3 The construction shall be performed under the direction of an experienced engineer who is familiar with the multi-plate structures.

II - FOUNDATION PREPARATION

1.0 UNDERCUTS

- 1.1 The soil beneath the bottom of the footings should be undercut to rock for all foundations, including the structure, headwalls, and wingwalls.
- 1.2 The excavations should be cleaned of all debris and loose material and all water should be pumped out before placement of the backfill.
- 1.3 In areas where rock is not present at normal footing depth, the area beneath the footing shall be undercut to rock.
- 1.4 Any excavation beneath the footing bottoms, if required, should be filled with lean concrete (1000 psi).
- 1.5 PROVIDE MSHA MIX NUMBER 3 NON-REINFORCED CONCRETE FORM BEDROCK TO BOTTOM OF FOOTING. NON-REINFORCED CONCRETE SHALL EXTEND 6" ON EITHER SIDE OF THE FOOTING.

2.0 DEWATERING

- 2.1 There may be a need to dewater before excavating. All foundation excavations shall be pumped free of water and all soft and loose material shall be removed before pour concrete.

3.0 INSPECTION

- 3.1 All foundation excavations should be examined by a geotechnical engineer or his representative to determine that they are bearing on proper materials.

III - WINGWALLS AND ENDWALLS

1.0 END TREATMENTS

- 1.1 The endwalls and wingwalls shall consist of reinforced concrete conforming to Division II, Section 8, Class A of the AASHTO Standard Specifications for highway bridges having a minimum compression strength of 3500 psi.
- 1.2 Reinforcing steel shall conform to ASTM A-615, Grade 60, having a minimum yield strength of 60,000 psi.
- 1.3 The foundations for the wingwalls and endwalls shall be prepared as outlined in Section II of these specifications.
- 1.4 The endwalls shall be anchored to the MULTI-PLATE arch in the manner shown on the plans and shall be formed and poured in accordance with the plan dimensions.
- 1.5 Round weep holes spaced not over 5 feet on center shall be placed in the wingwalls as shown on the construction drawings. A granular envelope, consisting of #57 stone or equivalent, shall be placed behind each weep hole for a distance of approximately 1 foot from all edges of the weep hole. A free-draining geotextile screen shall be placed between the weep hole and the stone to prevent erosion of the stone.

IV - CONCRETE

1.0 CODES AND STANDARDS

- 1.1 Reinforced concrete shall conform to the requirements of AASHTO Standard Specifications for Highway Bridges, Division II - Construction, Section 8, "Concrete Structures" having a minimum compressive strength of 3,500 psi.

2.0 STANDARDS FOR MATERIALS

- 2.1 Portland Cement - Conforming to ASTM Specification C-150, Type I or II.
- 2.2 Water - The water shall be drinkable, clean free from injurious amounts of oils, acids, alkalis, organic materials, or deleterious substances.
- 2.3 Aggregates - Fine and coarse aggregates shall conform to current ASTM Specification C-33 "Specification for Concrete Aggregates" except that local aggregates which have been shown by tests and by actual service to produce satisfactory qualities may be used when approved by the Engineer.
- 2.4 Submittals - Test data and/or certifications to the Owner shall be furnished upon request.

3.0 PROPORTIONING OF CONCRETE

3.1 COMPOSITION

- 3.1.1 The concrete shall be composed of cement, fine aggregate, coarse aggregate and water.
- 3.1.2 The concrete shall be homogeneous, readily placeable and uniformly workable and shall be proportioned in accordance with ACI-211.1.
- 3.1.3 Proportions shall be established on the basis of field experience with the materials to be employed.
- 3.1.4 An air-entraining admixture, conforming to the requirements of ASTM C260, shall be used in all concrete furnished under this Contract. The quantity of admixture shall be such as to produce an air content in the freshly mixed concrete of 6 percent plus or minus 1 percent as determined in accordance with ASTM C231 or C173, unless otherwise noted on the Drawings.

3.2 Qualities Required - As indicated in the table below:

TABLE IV-1  
QUALITIES REQUIRED

ITEM	QUALITY REQUIRED
Class	A
Type of Cement	I or II
Compressive Strength f'c (psi) @ 28 days	3,500 psi
Slump, inches	2-4 in.

- 3.3 Maximum Size of Coarse Aggregates - Maximum size of coarse aggregates shall not be larger than 38 mm (1.5").
- 3.4 Rate of Hardening of Concrete - Concrete mix shall be adjusted to produce the required rate of hardening for varied climatic conditions:

Under 40°F Ambient Temperature - Accelerate calcium chloride at 2% is acceptable when used within the recommendations of ACI-306R "Cold Weather Concreting." Admixtures containing chloride ion in excess of 1% by weight of admixture shall not be used in reinforced concrete.

4.0 MIXING AND PLACING

- 4.1 Equipment - Ready Mix Concrete shall be used and shall conform to the "Specifications for Ready-Mix Concrete," ASTM C-94. Approval is required prior to using job mixed concrete.
- 4.2 Preparation - All work shall be in accordance with ACI-304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete." All construction debris and extraneous matter shall be removed from within the forms. Concrete shall be placed on clean surfaces, free from water. Concrete that has to be dropped four (4) feet or more shall be placed through a tremie.
- 4.3 All concrete shall be consolidated by internal mechanical vibration immediately after placement. Vibrators shall be of a size appropriate for the work, capable of transmitting vibration to concrete at frequencies of not less than 4,500 impulses per minute.

5.0 FORM WORK

- 5.1 Forms shall be of wood, steel or other approved material and shall be set and held true to the dimensions, lines and grades of the structure (elements) prior to and during the placement of concrete.
- 5.2 Forms shall not be removed until the concrete has sufficient strength to prevent concrete drainage.

6.0 CURING

Fresh concrete shall be protected from rains, flowing water and mechanical injury for a period of four (4) days.

7.0 REINFORCING STEEL

7.1 MATERIAL

- 7.1.1 All reinforcing bars shall be deformed bars (ASTM-A615) Grade 60.

7.2 BENDING AND SPLICING

- 7.2.1 Bar reinforcement shall be cut and bent to the shapes shown on the plans. Fabrication tolerances shall be in accordance with ACI 315. All bars shall be bent cold, unless otherwise permitted.
- 7.2.2 All reinforcement shall be furnished in the full lengths indicated on the plans unless otherwise permitted. Except for splices shown on the plans and splices for No. 5 or smaller bars, splicing of bars will not be permitted without written approval. Splices shall be staggered as far as possible.
- 7.2.3 In lapped splices, the bars shall be placed and wired in such a manner as to maintain the minimum distance to the surface of the concrete shown on the plans.
- 7.2.4 Substitution of different size bars will be permitted only when authorized by the engineer. The substituted bars shall have an area equivalent to the design area, or larger.

7.3 PLACING AND FASTENING

- 7.3.1 Steel reinforcement shall be accurately placed as shown on the plans and firmly held in position during the placing and setting of concrete. Bars shall be tied at all intersections around the perimeter of each mat and at not less than 2 foot centers or at every intersection, whichever is greater, elsewhere. Welding of cross bars (tack welding) will not be permitted for assembly of reinforcement.
- 7.3.2 Reinforcing steel shall be supported in its proper position by use of mortar blocks, wire bar supports, supplementary bars or other approved devices. Such devices shall be of such height and placed at sufficiently frequent intervals so as to maintain the distance between the reinforcing and the formed surface or the top surface within 1/4 inch of that indicated on the plans.

V - FILTER FABRIC (GEOTEXTILE SCREEN)

- 1.1 A minimum 18 inches of geotextile (filter fabric) shall be placed over all weepholes from all edges of the weepholes. The filter fabric shall be placed between weepholes and the granular material. Filter fabric shall be placed at all locations shown on the construction drawings.
- 1.2 Filter fabric cloth shall meet the following ASTM tests:
  - 1.2.1 ASTM D4751 - Apparent opening size equal to #70 U.S. Standard Sieve Size.
  - 1.2.2 ASTM D4632 (Grab Tensile Test) - Minimum Strength = 160 pounds.
  - 1.2.3 ASTM D4632 (Grab Elongation) - 30-70%.
  - 1.2.4 ASTM D4533 (Trapezoidal Tear) - Minimum Strength = 60 pounds.
  - 1.2.5 ASTM D4355 (Stabilized for Heat and Ultra-Violet Degradation) - 70% strength retained.
- 1.3 The minimum fabric coefficient of permeability (ASTM D4491) shall be 0.24 cm/sec.
- 1.4 The fabric shall be non-woven with a minimum thickness (ASTM D5199) of 60 mils.
- 1.5 Fabric shall not be placed over sharp or angular rocks that could tear or puncture it.
- 1.6 Care should be exercised to prevent any puncturing or rupture of the filter fabric. Should such rupture occur the damaged area should be covered with a patch of filter fabric using an overlap minimum of one (1) foot.

THE PURPOSE OF THIS SHEET IS TO REPLACE SHEET 16, BONNIE BRANCH OVERLOOK F-00-95

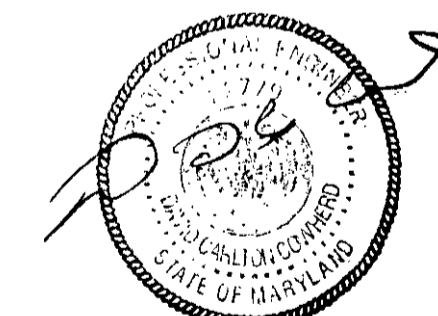
APPROVED: DEPARTMENT OF PUBLIC WORKS

CHIEF BUREAU OF HIGHWAYS \_\_\_\_\_ DATE \_\_\_\_\_

APPROVED: DEPARTMENT OF LAND PLANNING AND ZONING

CHIEF, DIVISION OF LAND DEVELOPMENT JA \_\_\_\_\_ DATE \_\_\_\_\_

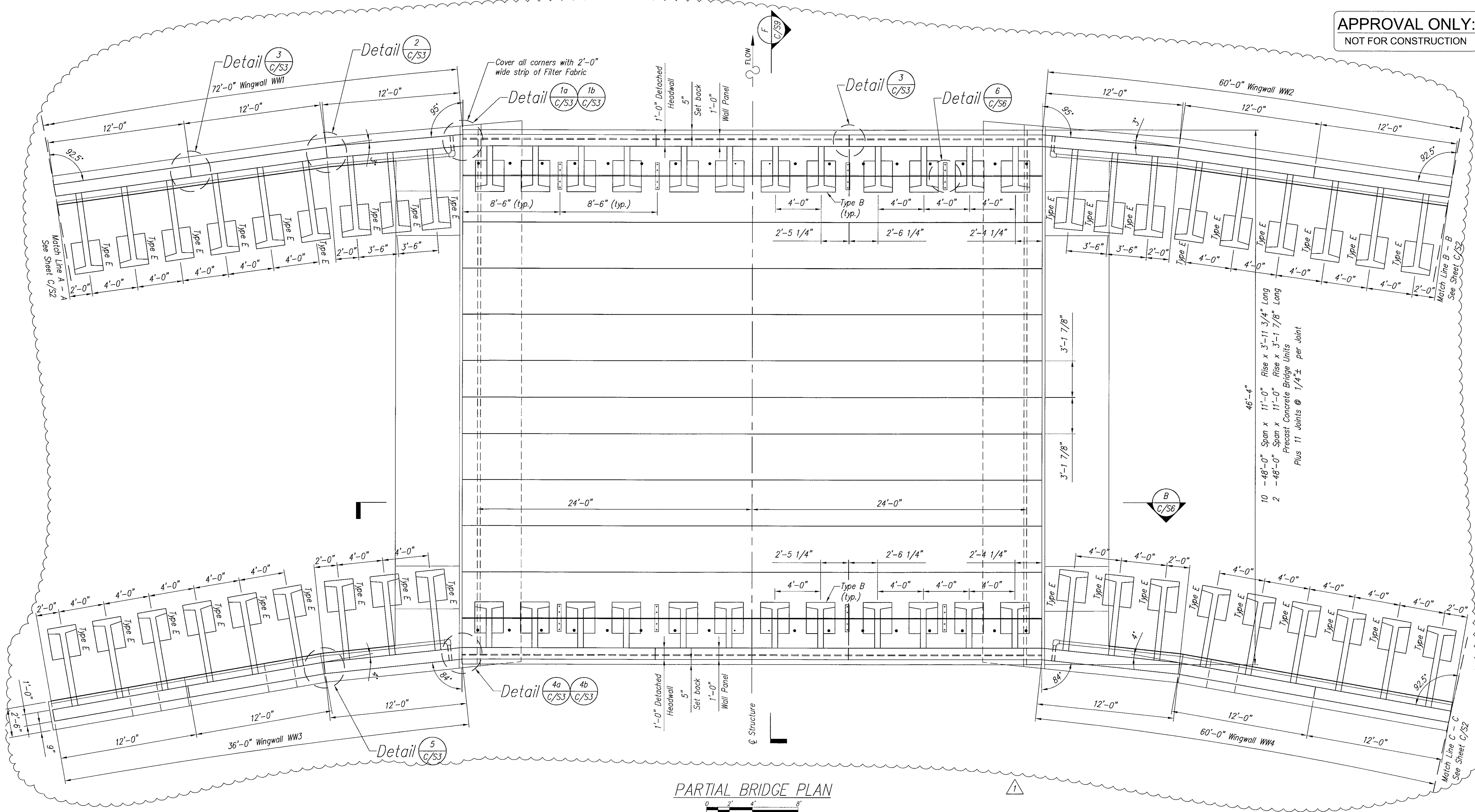
CHIEF, DEVELOPMENT ENGINEERING DIVISION mjt \_\_\_\_\_ DATE \_\_\_\_\_



REVISED SPECIFICATIONS	
Drawn By: DWR Date: 7/31/01	WILDMAN ENVIRONMENTAL SERVICES DESIGN OF MULTI-PLATE ARCH BONNIE BRANCH OVERLOOK HOWARD COUNTY, MARYLAND
Scale: GRAPHIC	Project No.: CBC-3237 Rev.: - Sheet: 16 OF 16



**APPROVAL ONLY:**  
NOT FOR CONSTRUCTION

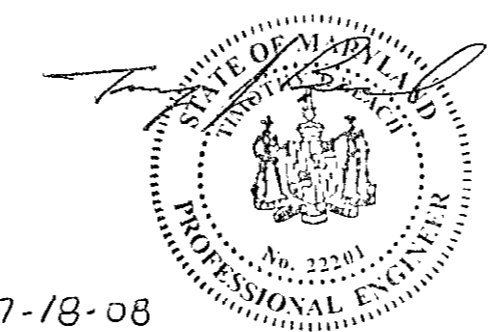


**PARTIAL BRIDGE PLAN**

APPROVED: HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS  
 Chief, Bureau of Highways \_\_\_\_\_ Date \_\_\_\_\_

APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING & ZONING  
 Chief, Division of Land Development \_\_\_\_\_ Date \_\_\_\_\_

Chief, Development Engineering Division \_\_\_\_\_ Date \_\_\_\_\_



Professional Certification: I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 22201, Expiration Date: 12-22-08.

**CONSPAN BRIDGE SYSTEMS**

Designed	KTM	C/S Project No.	14679
Drawn	RPU	Sheet No.	C/S1
Checked	JVP	Date	12/01/06

**GLW GUTSCHICK LITTLE & WEBER, P.A.**  
 CIVIL ENGINEERS, LAND SURVEYORS, LAND PLANNERS, LANDSCAPE ARCHITECTS  
 3909 NATIONAL DRIVE - SUITE 250 - BURTONSVILLE OFFICE PARK  
 BURTONSVILLE, MARYLAND 20866  
 TEL: 301-421-4024 BALT: 410-883-1820 DC/VA: 301-989-2524 FAX: 301-421-4186

DATE	REVISION	BY	APP'R.
6/26/2007	GENERAL REVISIONS - SHEETS C/S1 THRU. C/S9	JCH	KTM

PREPARED FOR  
 OWNER  
 WALNUT GROVE HOLDING, L.L.C.  
 WALNUT GROVE DEVELOPMENT, INC.  
 ROBERT VAN DYKE, PRESIDENT  
 10705 CHARTER DRIVE  
 SUITE 320  
 COLUMBIA, MARYLAND 21044

**CONSPAN BRIDGE SYSTEM DETAILS**

WALNUT GROVE  
 LOTS 1 THRU 88, BUILDABLE PRESERVATION PARCELS "A",  
 NON-BUILDABLE PRESERVATION PARCELS "B" THRU "I" AND  
 NON-BUILDABLE BULK PARCELS "J"  
 L.2927 F.487

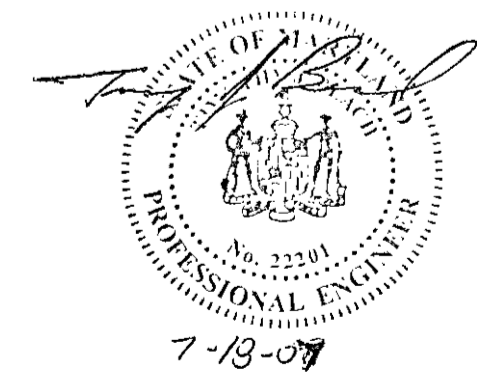
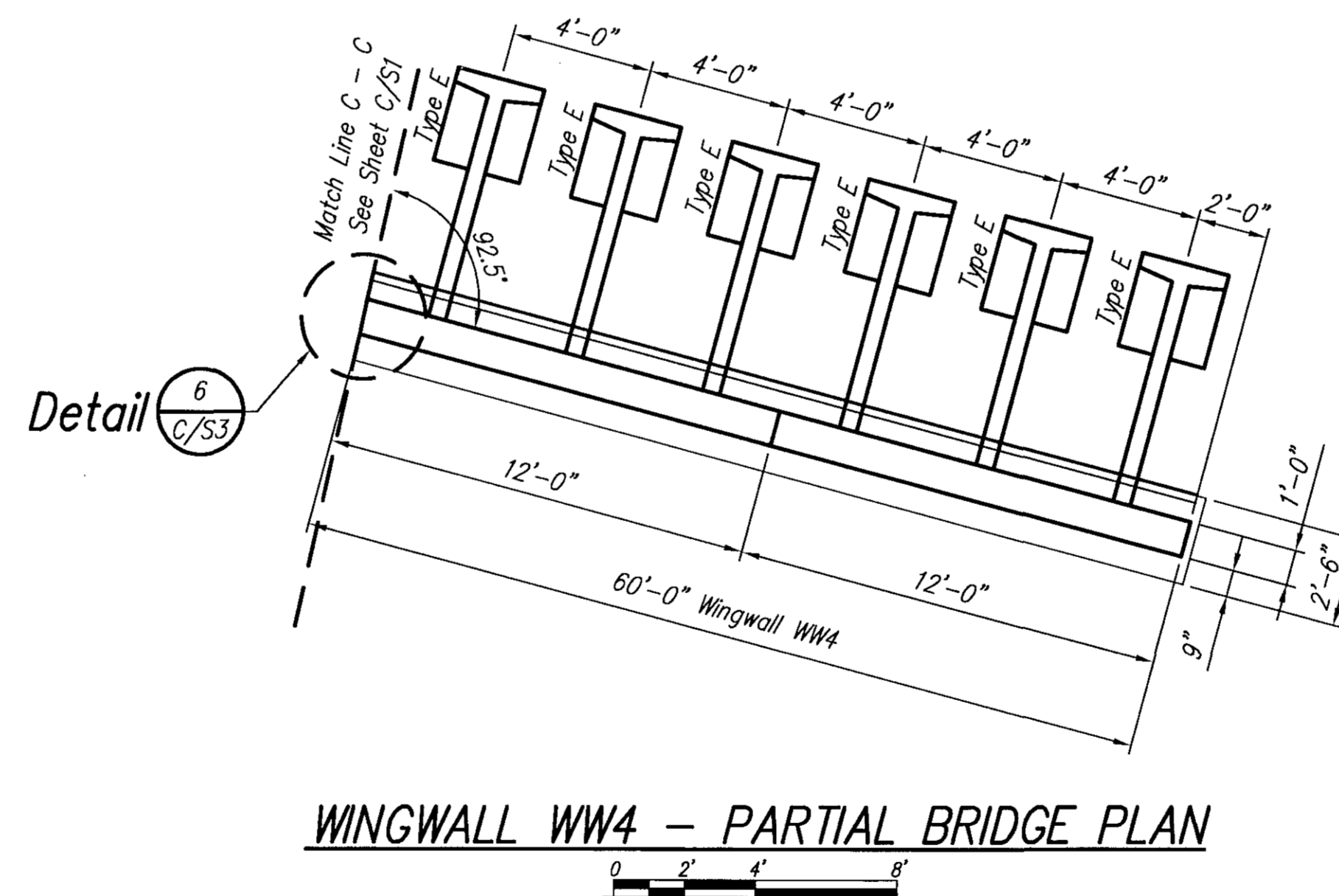
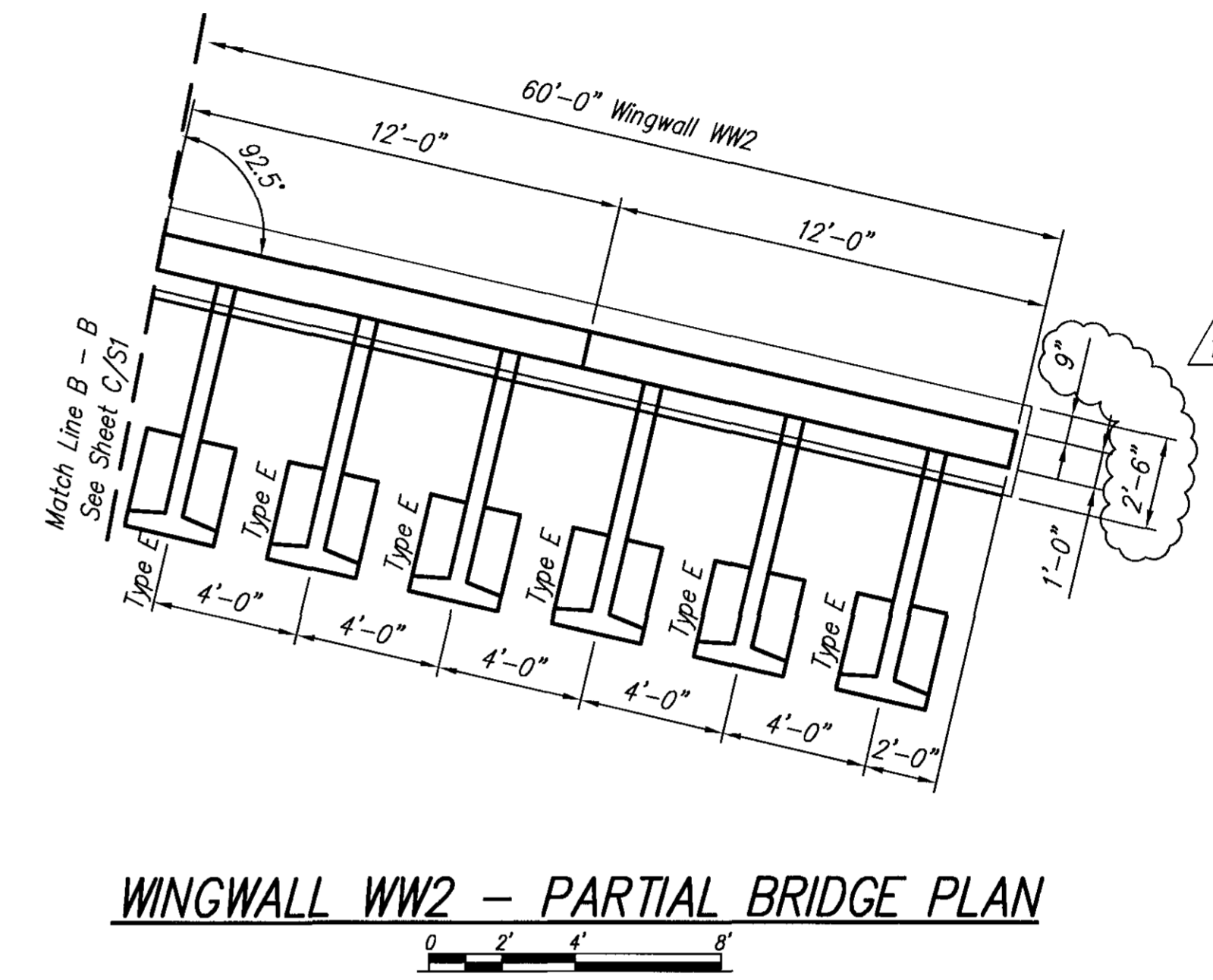
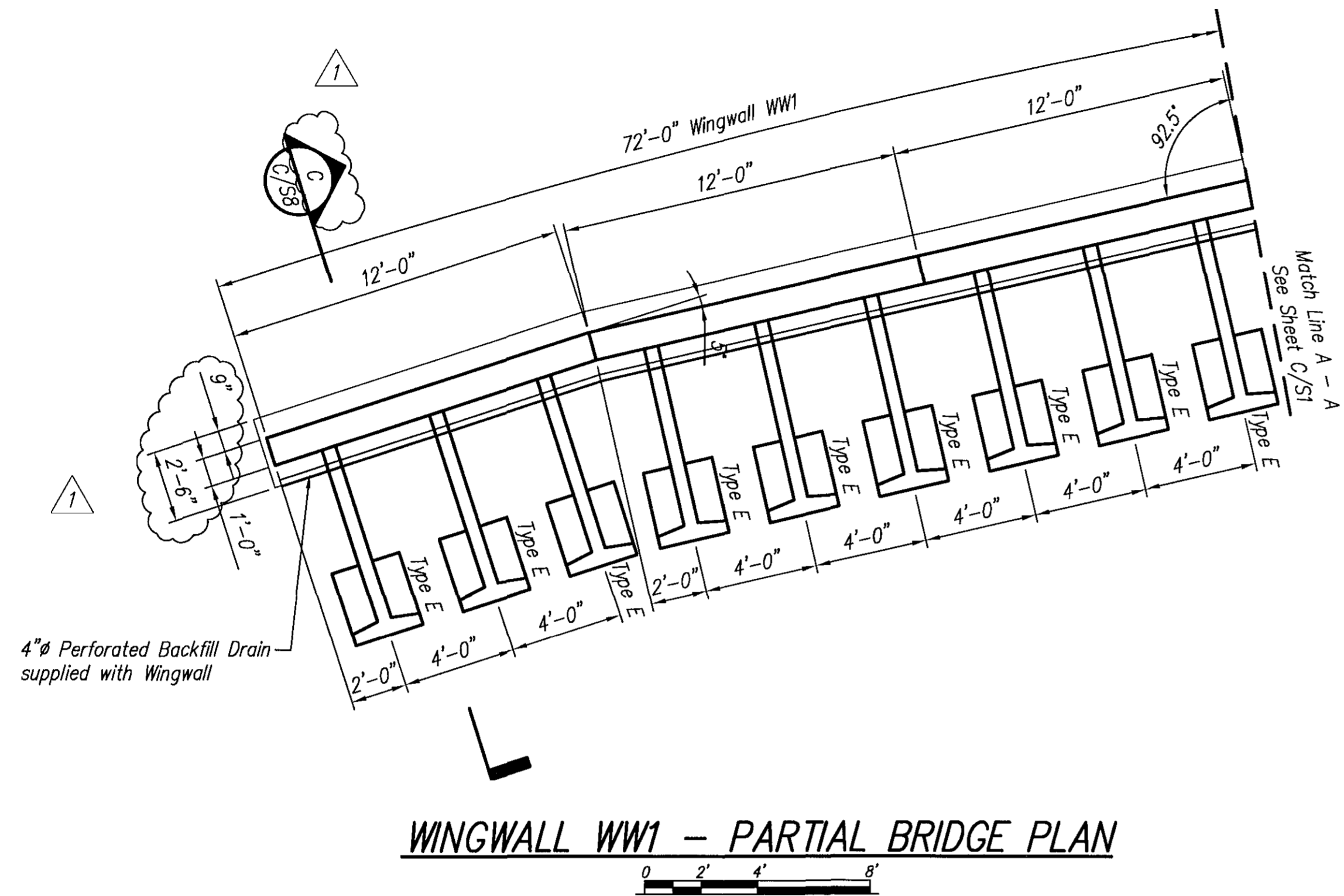
ELECTION DISTRICT No. 5

HOWARD COUNTY, MARYLAND

SCALE	ZONING	G. L. W. FILE No.
AS SHOWN	RC-DEO	00153
DATE	TAX MAP - GRID	SHEET
JULY/2007	PARCEL 74 28 - 18,17	51 OF 78



**APPROVAL ONLY:**  
NOT FOR CONSTRUCTION



APPROVED: HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS  
Chief, Bureau of Highways \_\_\_\_\_ Date \_\_\_\_\_

APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING & ZONING  
Chief, Division of Land Development \_\_\_\_\_ Date \_\_\_\_\_

Chief, Development Engineering Division \_\_\_\_\_ Date \_\_\_\_\_

**CONISPAN**  
BRIDGE SYSTEMS

Designed	KTM	C/S Project No.	
Drawn	RPU		14679
Checked	JVP	Sheet No.	
Date	12/01/06		<b>C/S2</b>

**GLW** GUTSCHICK LITTLE & WEBER, P.A.  
CIVIL ENGINEERS, LAND SURVEYORS, LAND PLANNERS, LANDSCAPE ARCHITECTS  
3909 NATIONAL DRIVE - SUITE 250 - BURTONSVILLE OFFICE PARK  
BURTONSVILLE, MARYLAND 20866  
TEL: 301-421-4024 BAL: 410-880-1820 DC/VA: 301-999-2524 FAX: 301-421-4186

DATE	REVISION	BY	APP'R.
6/26/2007	GENERAL REVISIONS - SHEETS C/S1 THRU C/S9	JCH	KTM

PREPARED FOR  
OWNER  
WALNUT GROVE HOLDING, L.L.C.  
WALNUT GROVE DEVELOPMENT, INC.  
ROBERT VAN DYKE, PRESIDENT  
10705 CHARTER DRIVE  
SUITE 320  
COLUMBIA, MARYLAND 21044

**CONSPAN BRIDGE SYSTEM DETAILS**

**WALNUT GROVE**  
LOTS 1 THRU 88, BUILDABLE PRESERVATION PARCELS "A",  
NON-BUILDABLE PRESERVATION PARCELS "B" THRU "I" AND  
NON-BUILDABLE BULK PARCELS "J"  
L.2927 F.487  
ELECTION DISTRICT No. 5  
HOWARD COUNTY, MARYLAND

SCALE	ZONING	G. L. W. FILE No.
AS SHOWN	RC-DEO	00153
DATE	TAX MAP - GRID	SHEET
JULY/2007	PARCEL 74 28 - 18,17	52 OF 78



**APPROVAL ONLY:**  
NOT FOR CONSTRUCTION

**NOTES**

**GENERAL NOTES:**

- This bridge has been designed for general site conditions. The project engineer shall be responsible for the structure's suitability to the existing site conditions and for the hydraulic evaluation -- including scour and confirmation of soil conditions.
- Prior to construction, contractor must verify all elevations shown through the engineer.
- Only CONTECH Bridge Solutions Inc. the CON/SPAN® approved precaster in Maryland may provide the structure designed in accordance with these plans.
- The use of another precast structure with the design assumptions used for the CON/SPAN® structure may lead to serious design errors. Use of any other precast structure with this design and drawings voids any certification of this design and warranty. CONTECH Bridge Solutions Inc. assumes no liability for design of any alternate or similar type structures.
- Alternate structures may be considered, provided that signed and sealed design drawings (and calculations) are submitted to the engineer 2 weeks prior to the bid date for review and approval.
- Proposed alternates to a CON/SPAN® Bridge System must submit at least two (2) independently verified full scale load tests that confirm the proposed design methodology of the three sided/arch structure(s). The proposed alternate, upon satisfactory confirmation of design methodology, may be considered an acceptable alternate.

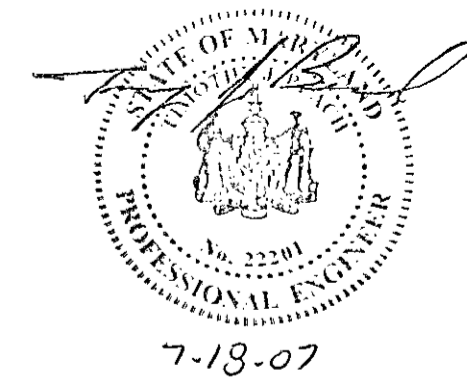
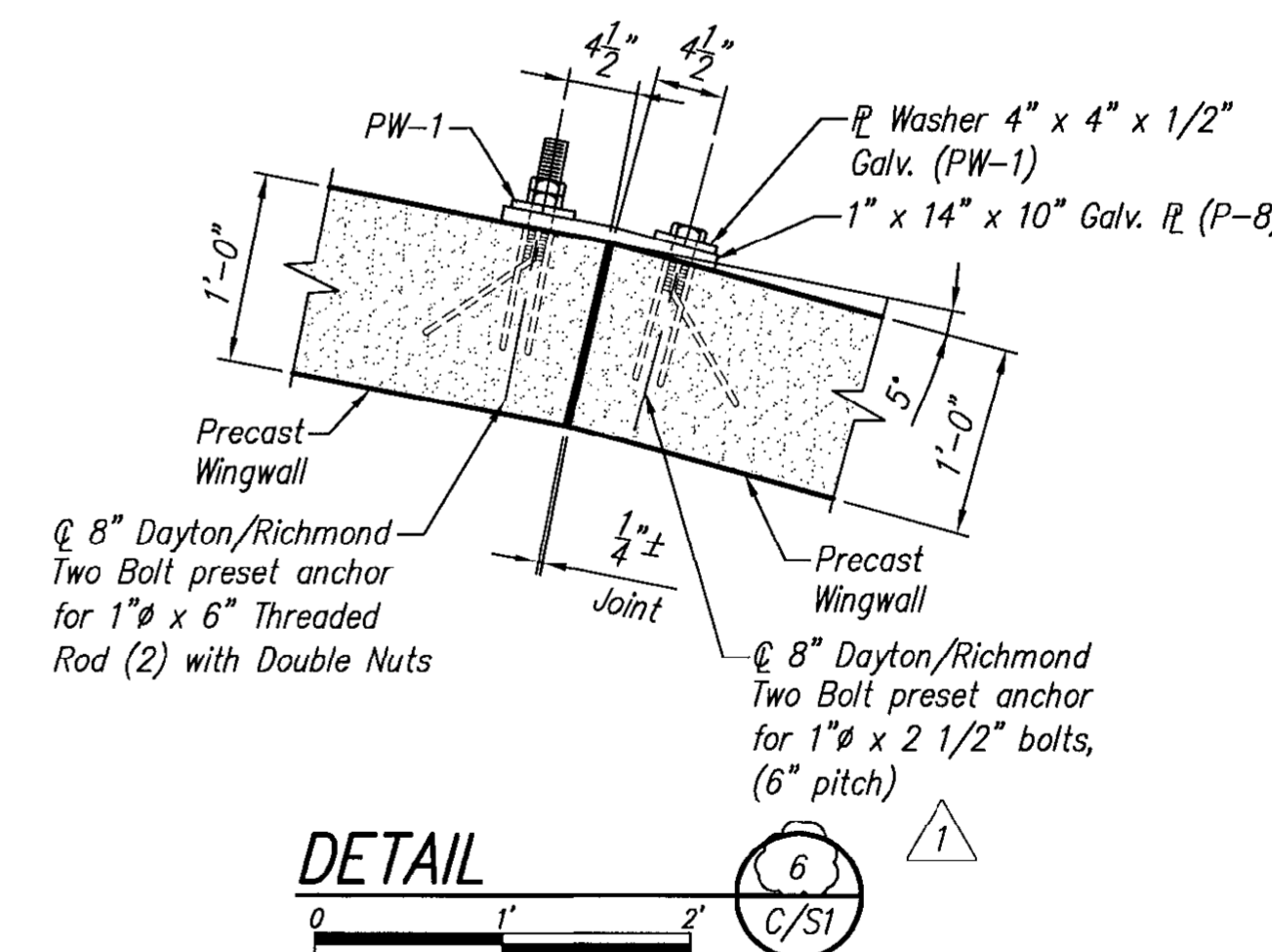
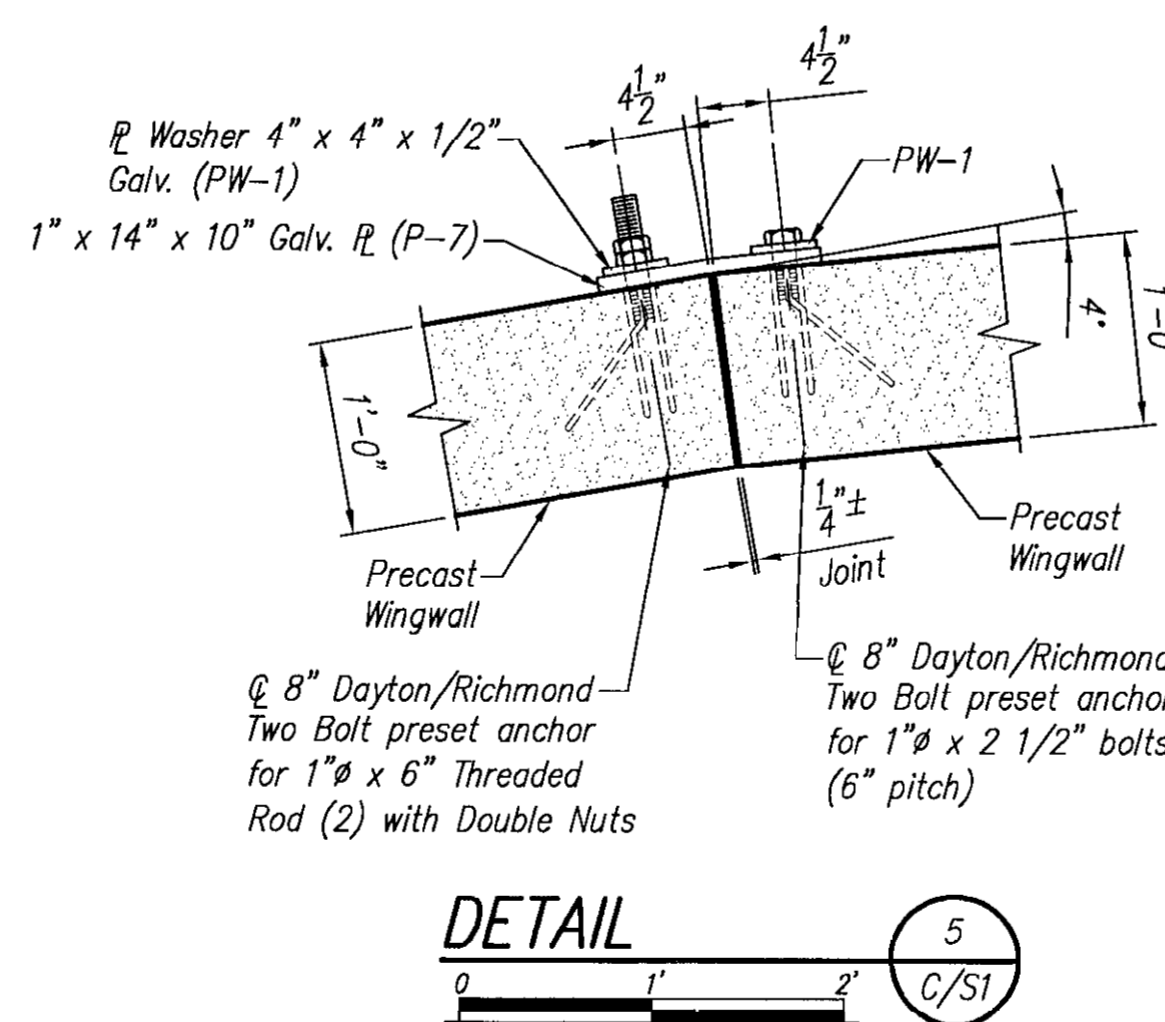
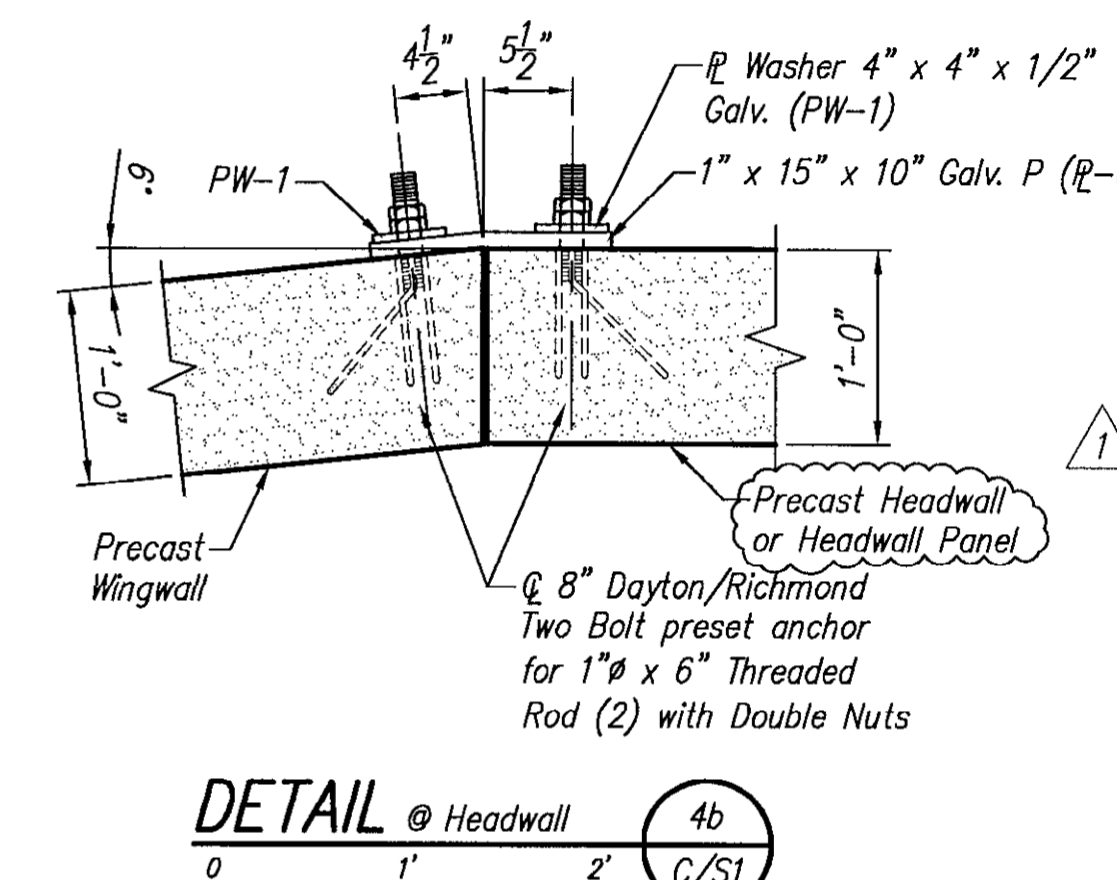
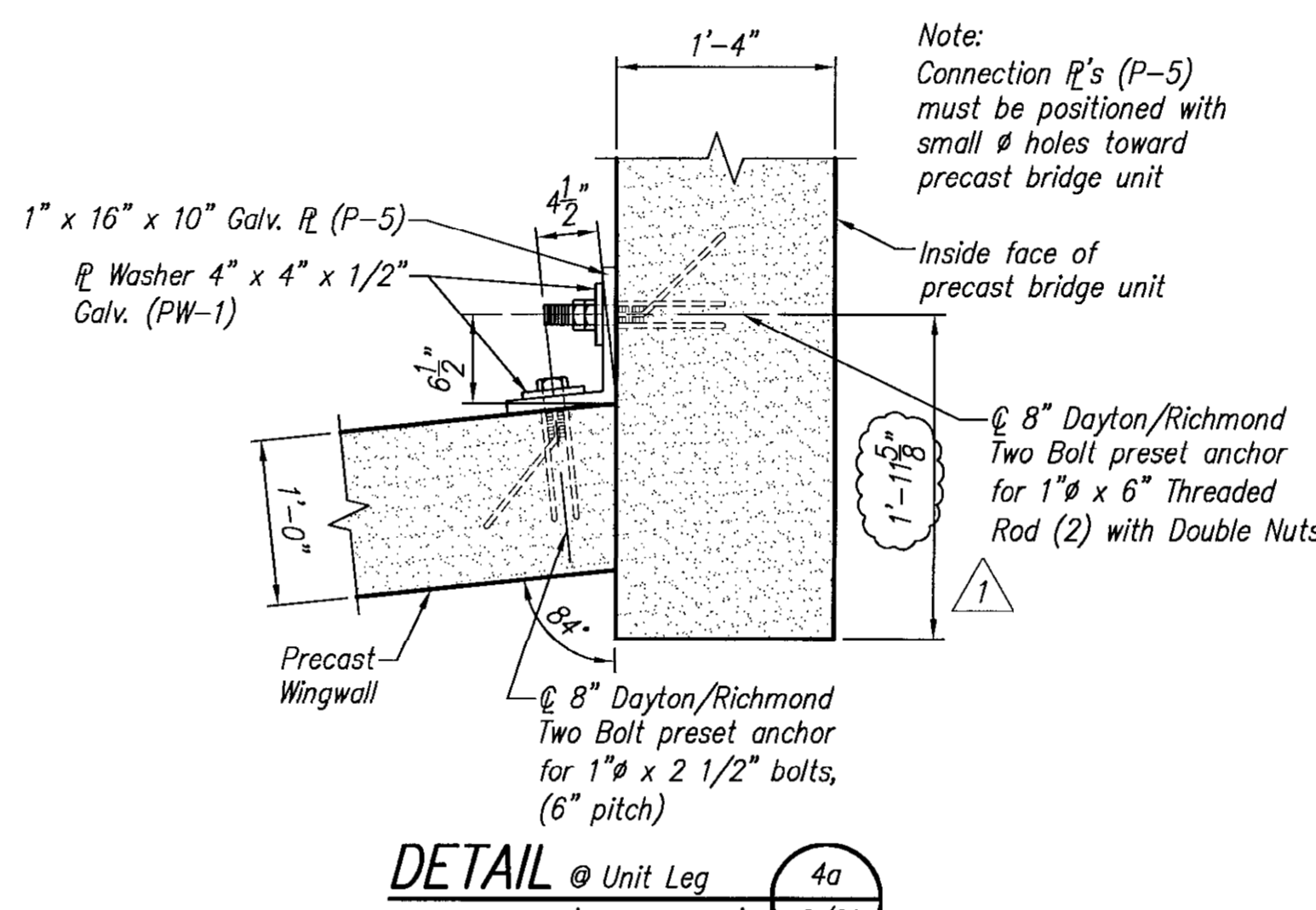
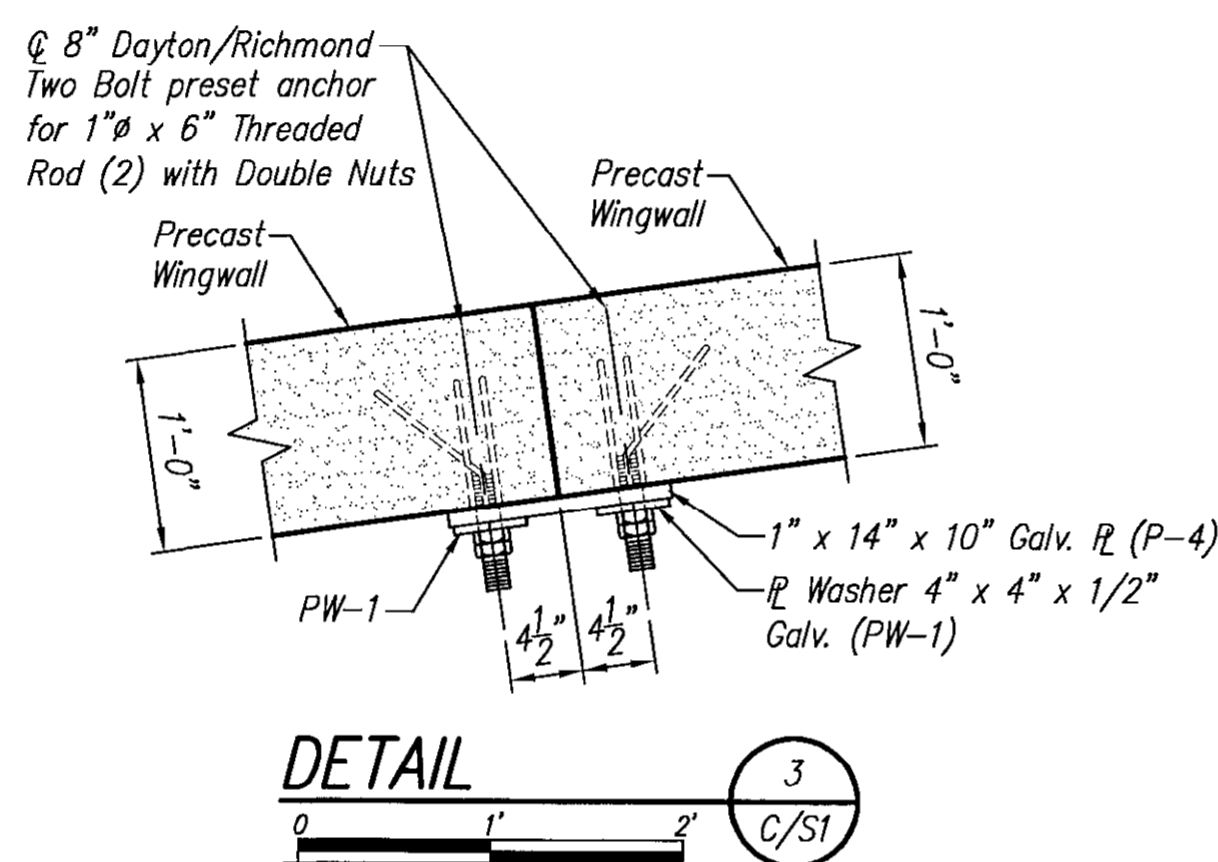
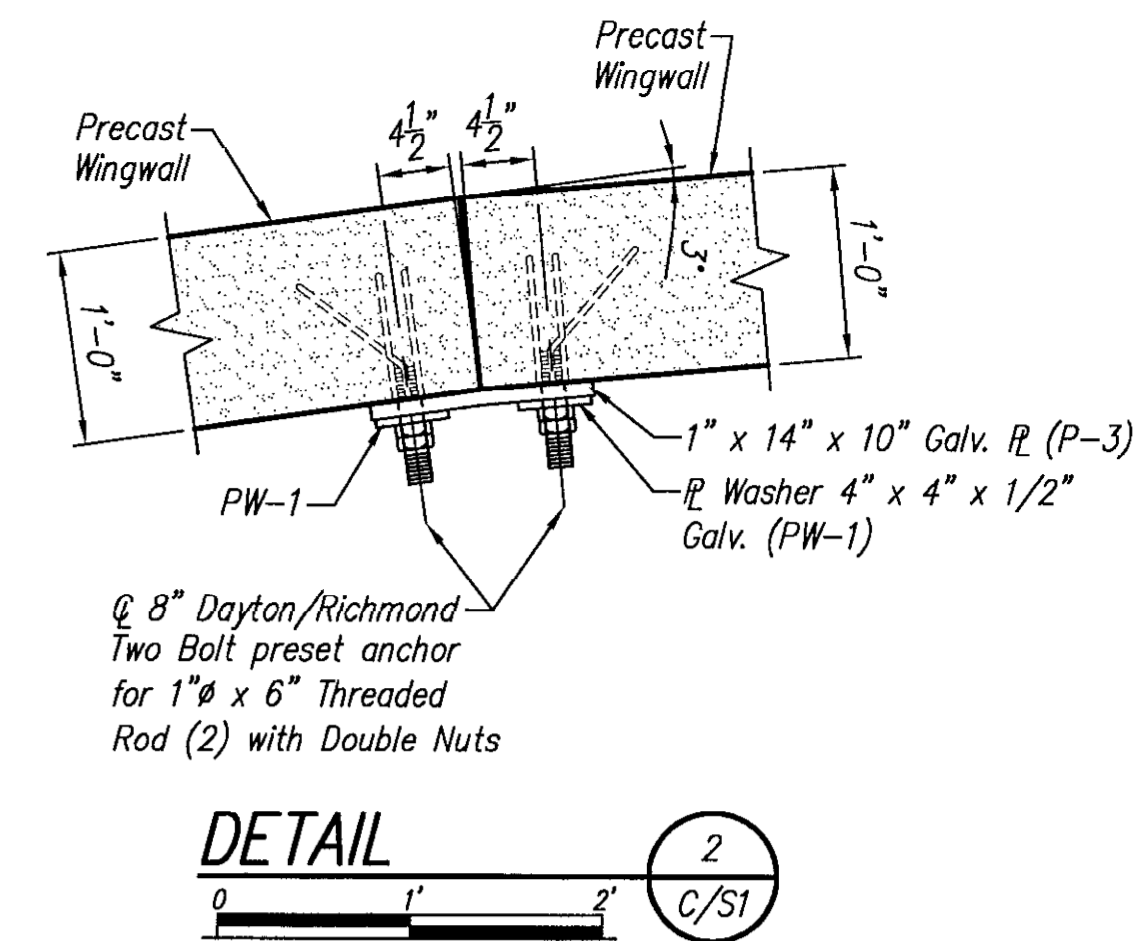
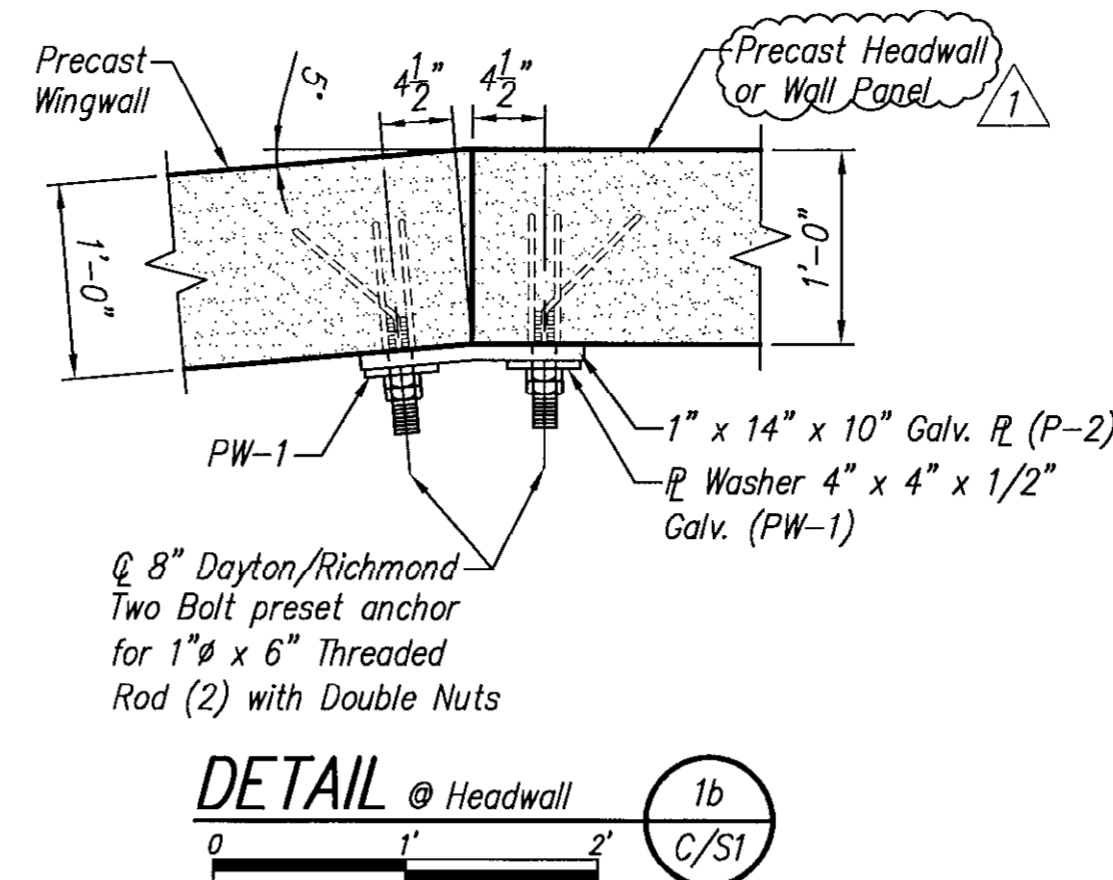
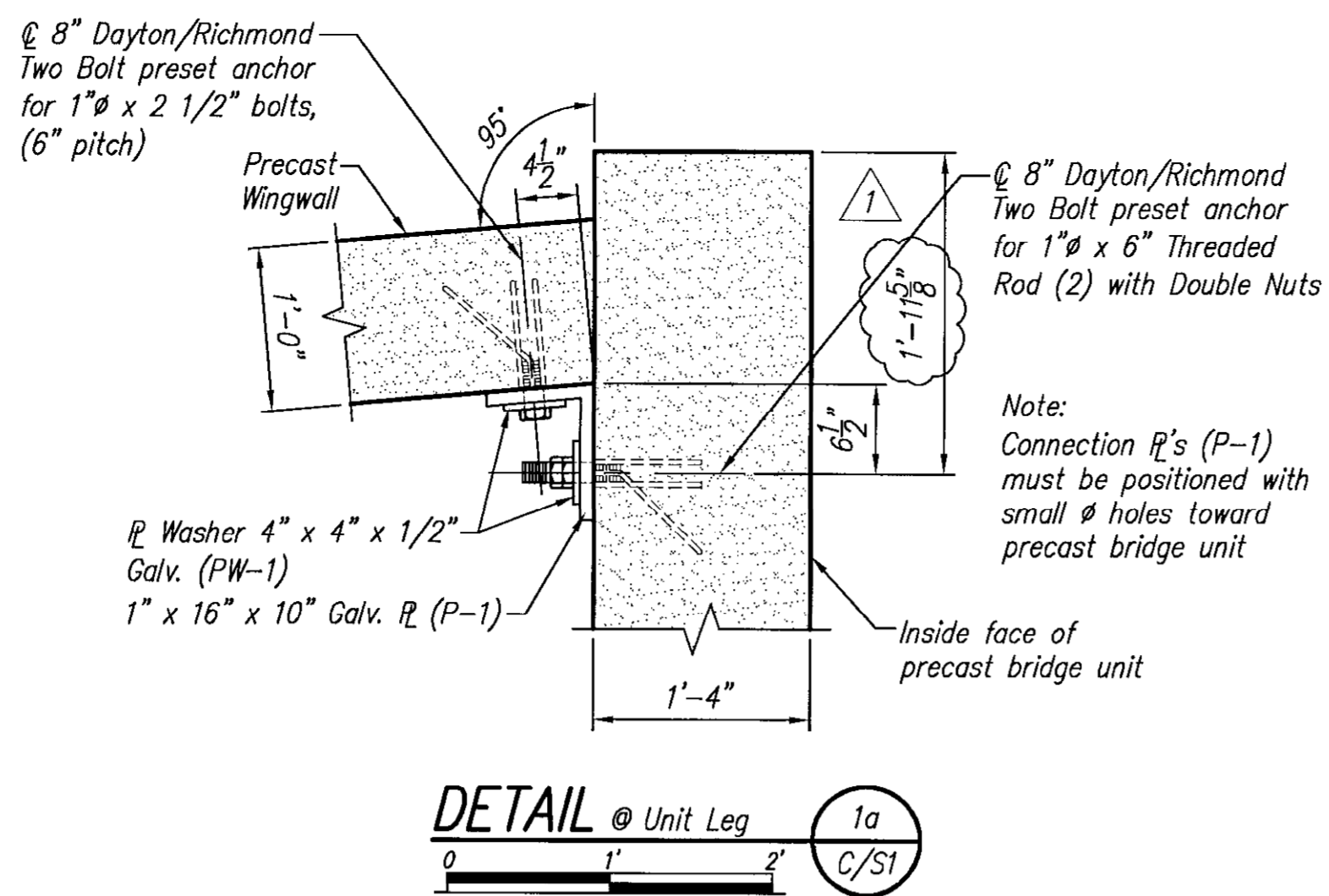
**DESIGN DATA**

Design Loading:  
 Bridge Units: HS25-44  
 Headwalls: Earth Pressure + Live Load Impact  
 Wingwalls: Earth Pressure + Live Load Impact  
 Design Fill Height: 2'-0" min. to 7'-0" max. from top of crown to top of pavement.  
 Design Method: Load factor per AASHTO Specification  
 Net allowable soil bearing pressure: 4000 PSF \*

\*Foundation excavation and subgrade preparation shall be in accordance with the geotechnical report for this project prepared by Hillis-Carnes dated June 1, 2007.

**MATERIALS**

Precast units shall be constructed and installed in accordance with CON/SPAN® Specifications. Concrete for Footings shall have a minimum compressive strength of 4000 psi. Reinforcing steel for footings shall conform to ASTM A615 or A996-Grade 60.



APPROVED: HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS	Date
Chief, Bureau of Highways	
APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING & ZONING	Date
Chief, Division of Land Development	
Chief, Development Engineering Division	Date

GLW GUTSCHICK LITTLE & WEBER, P.A.  
 CIVIL ENGINEERS, LAND SURVEYORS, LAND PLANNERS, LANDSCAPE ARCHITECTS  
 3909 NATIONAL DRIVE - SUITE 250 - BURTONSVILLE OFFICE PARK  
 BURTONSVILLE, MARYLAND 20866  
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5/26/2007	GENERAL REVISIONS - SHEETS C/S1 THRU. C/S9	JCH	KTM
DATE	REVISION	BY	APPR.

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 WALNUT GROVE HOLDING, L.L.C.  
 WALNUT GROVE DEVELOPMENT, INC.  
 ROBERT VAN DYKE PRESIDENT  
 10705 CHARTER DRIVE  
 SUITE 320  
 COLUMBIA, MARYLAND 21044

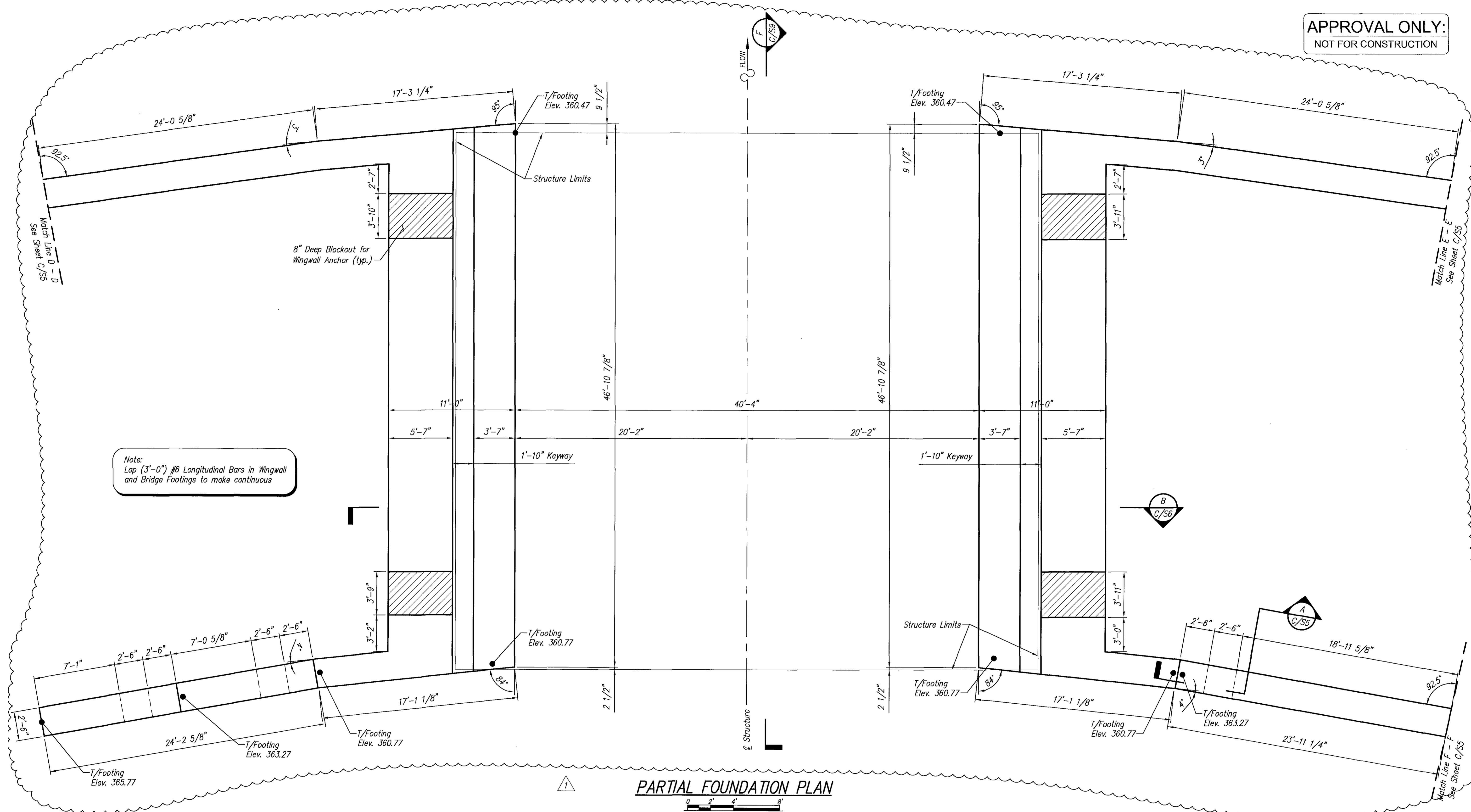
CONSPAN BRIDGE SYSTEM DETAILS  
 WALNUT GROVE  
 LOTS 1 THRU 88, BUILDABLE PRESERVATION PARCELS "A",  
 NON-BUILDABLE PRESERVATION PARCELS "B" THRU "I" AND  
 NON-BUILDABLE BULK PARCELS "J"  
 L.2927 F.487  
 ELECTION DISTRICT No. 5  
 HOWARD COUNTY, MARYLAND

SCALE	ZONING	G. L. W. FILE No.
AS SHOWN	RC-DEO	00153
DATE	TAX MAP - GRID	SHEET
JULY/2007	28 - 18,17	53 OF 78

Designed: KTM  
 Drawn: RPU  
 Checked: JVP  
 Date: 12/01/06  
 Project No: 14679  
 Sheet No: C/S3



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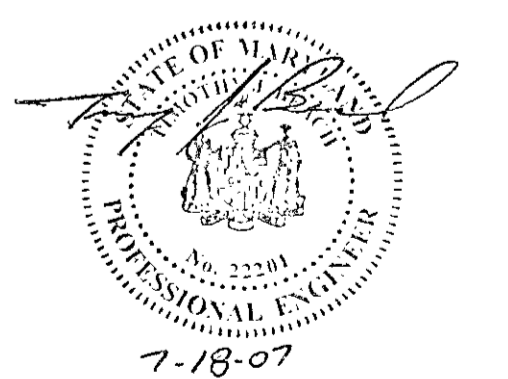


**PARTIAL FOUNDATION PLAN**

APPROVED: HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS  
 Chief, Bureau of Highways \_\_\_\_\_ Date \_\_\_\_\_

APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING & ZONING  
 Chief, Division of Land Development \_\_\_\_\_ Date \_\_\_\_\_

Chief, Development Engineering Division \_\_\_\_\_ Date \_\_\_\_\_



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DATE	GENERAL REVISIONS - SHEETS C/S1 THRU C/S9	REVISION	BY	APP'R.
6/26/2007			JCH	KTM

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 ROBERT VAN DYKE, PRESIDENT  
 10705 CHARTER DRIVE  
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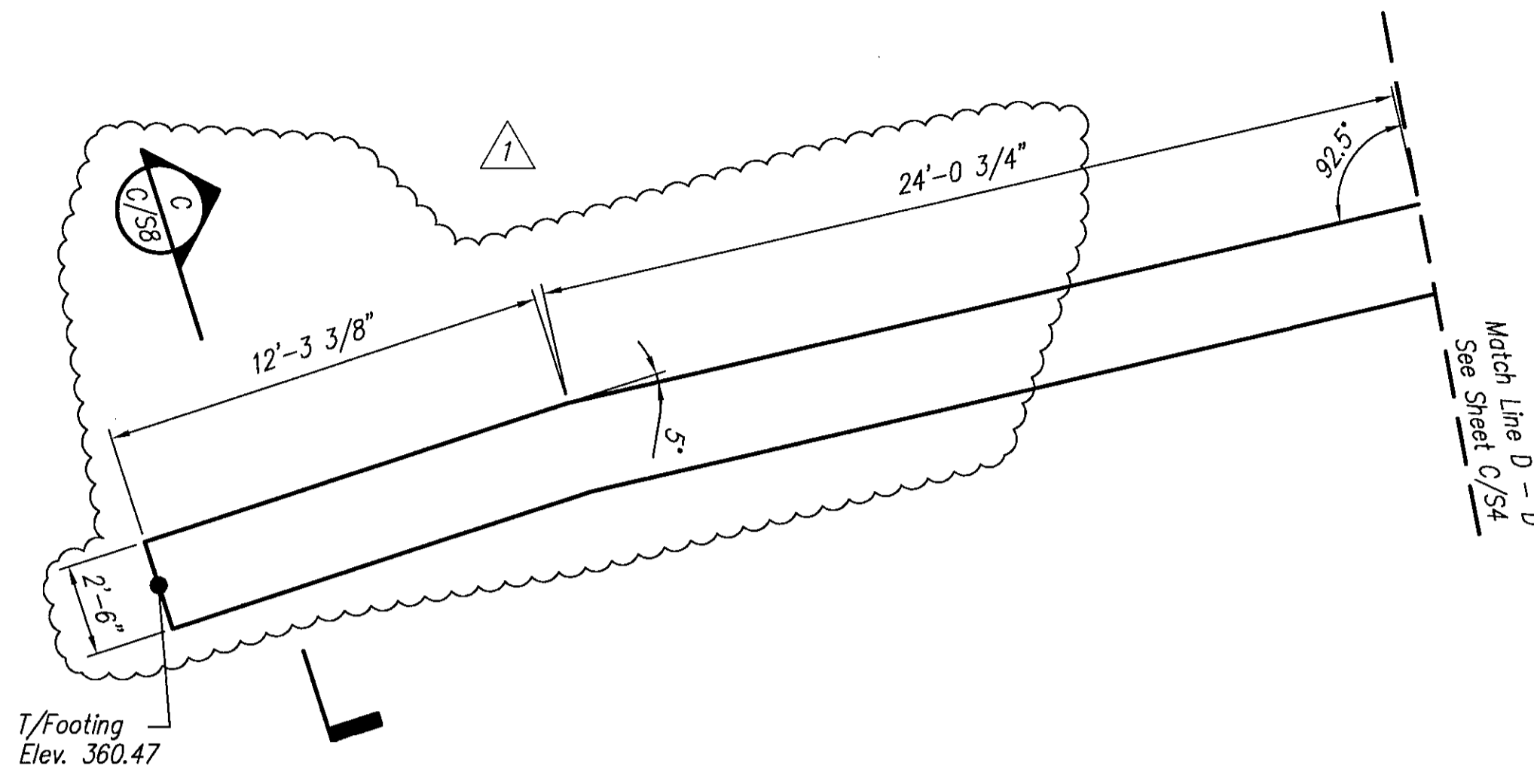
**CONSPAN BRIDGE SYSTEM DETAILS**  
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Designed	KTM	C/S Project No.	14679
Drawn	RPU	Sheet No.	C/S4
Checked	JVP	Date	12/01/06

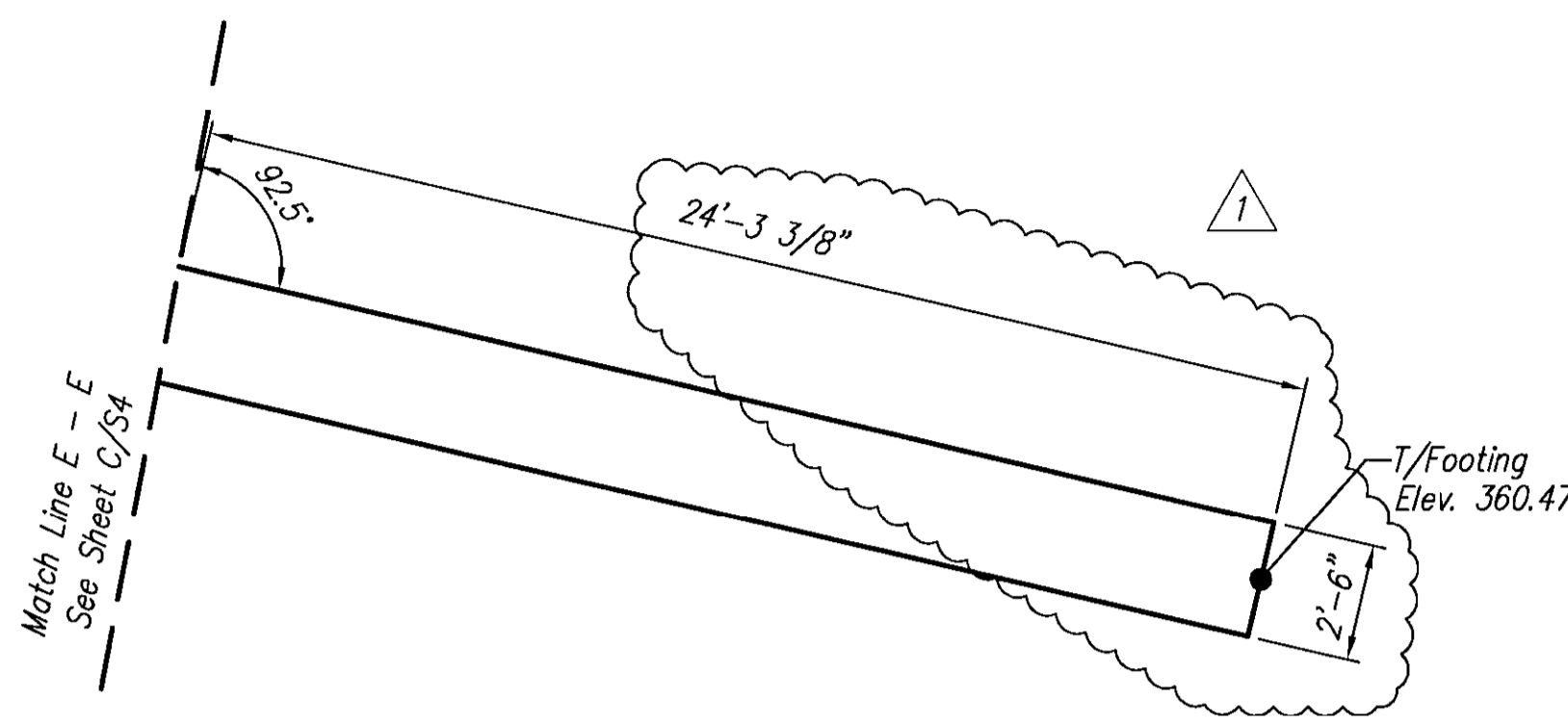
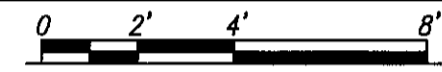
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AS SHOWN	RC-DEO	00153
DATE	TAX MAP - GRID	SHEET
JULY/2007	PARCEL 74 28 - 18,17	54 OF 78



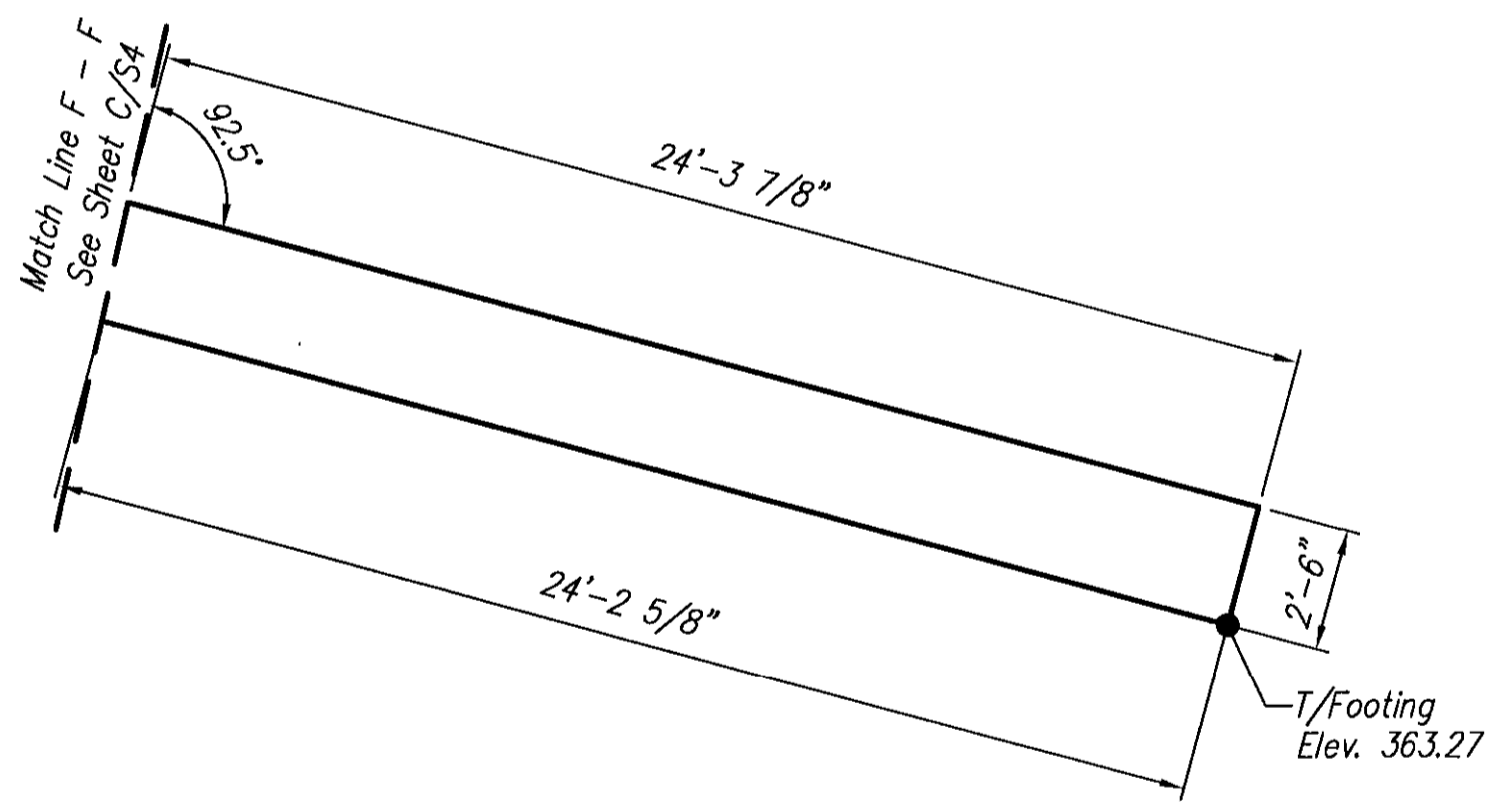
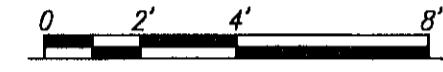
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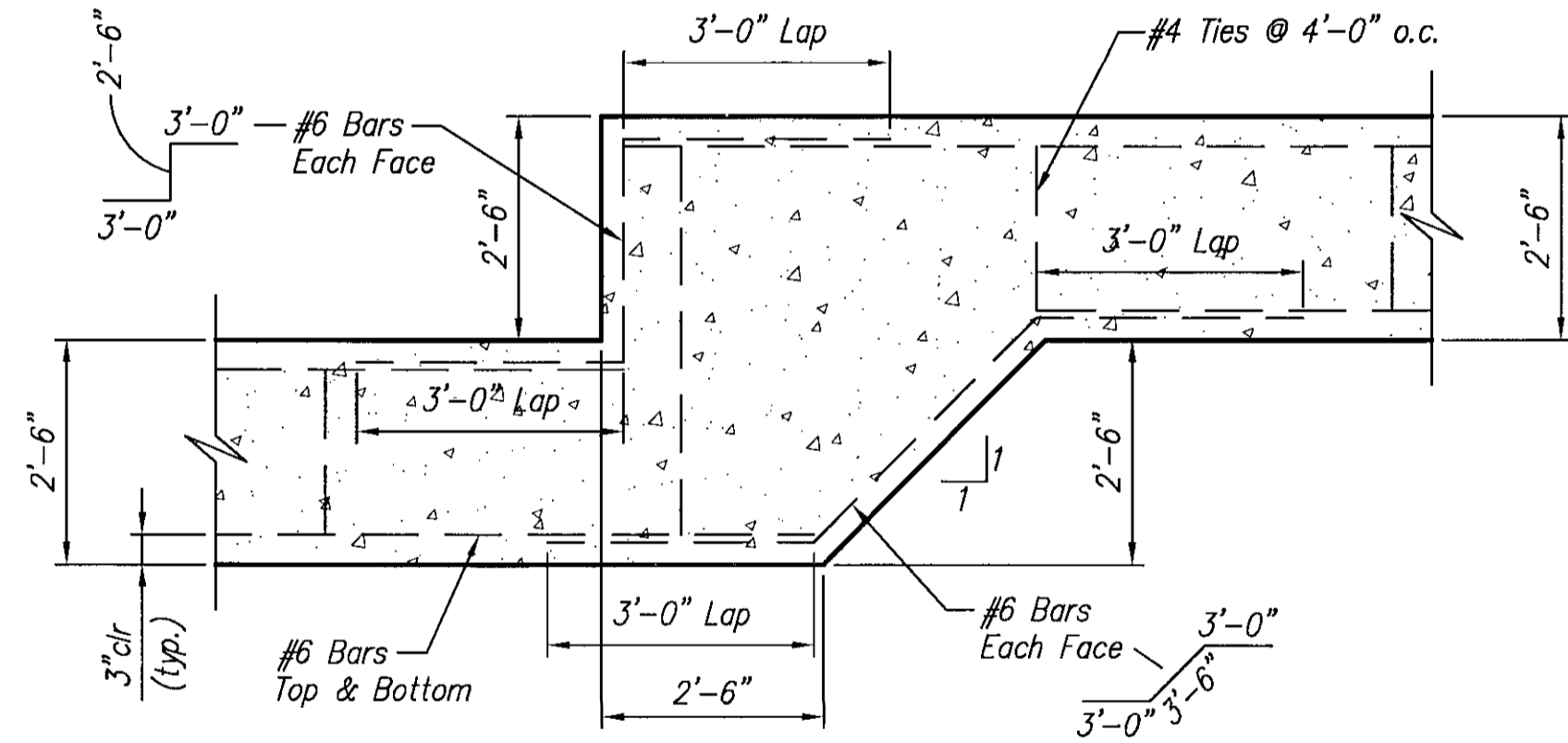
WINGWALL WW1 - PARTIAL FOUNDATION PLAN



WINGWALL WW2 - PARTIAL FOUNDATION PLAN



WINGWALL WW4 - PARTIAL FOUNDATION PLAN



SECTION A-C/S4



HILLIS-CARNES ENGINEERING ASSOCIATES, INC.

June 1, 2007  
Heritage Land Development  
15550 North Avenue  
Lisbon, Maryland 21765  
Attention: Mr. Jeremy Rutter  
Re: Additional Geotechnical Engineering Evaluation  
Walnut Grove Culvert  
Howard County, Maryland  
HCEA Job No. 0543E

Dear Sirs:  
Hillis-Carnes Engineering Associates, Inc. (HCEA) is pleased to submit this letter concerning the additional geotechnical evaluation for the proposed Walnut Grove culvert that is to be located in Howard County, Maryland.  
**Project Background**  
An original geotechnical study was previously performed for the project by HCEA (report dated August 1, 2005). During the subsurface exploration for the original report, auger refusals were encountered at shallow depths in Borings CLV-1 and CLV-2 (at depths of 8.2 ft and 5.5 ft, respectively). The remainder of the borings were typically extended to depths near 40 ft where auger refusal or more suitable materials were generally encountered. In our original report, HCEA recommended that the proposed culvert be supported on a shallow footing system designed utilizing an allowable soil bearing pressure of 2500 psf.  
It was later requested that HCEA perform an additional evaluation to determine if an alternative method of foundation support could be developed because of potential foundation sizing, construction and permitting difficulties. HCEA reviewed the subsurface information provided in our original geotechnical report for the project and determined that two different foundation support conditions could be utilized for the project.

In the vicinity of Borings CLV-1 and CLV-2 (shown on the attached Boring Location Plan), the culvert and wing wall foundations could be supported directly on rock and designed for an allowable bearing pressure of 6000 psf. The limits of this support condition would need to be determined in the field during construction. In the remainder of the culvert and wing wall areas, it was recommended that foundations could be supported on a deep foundation system

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WALNUT GROVE CULVERT - DILATOMETER TESTING  
June 1, 2007 Page 2

consisting of driven steel H-piles extending to rock. The limits of the differing support conditions would need to be determined in the field during construction.  
At a recent site meeting with the Client and the Civil Engineer (Gutschick, Little & Weber), discussion arose as to what could be done to better evaluate the subsurface conditions in the vicinity of the proposed culvert. It was determined that dilatometer testing would be performed to better define the subsurface conditions and to maximize the allowable soil bearing pressure that could be used for design.

**Dilatometer Testing**  
In order to determine the general soil stress and types, two Flat Dilatometer Tests were performed. The dilatometer test locations generally correlated with the following boring locations:

Dilatometer Test	Previous Boring
DMT-1	CLV-7
DMT-2	CLV-3

The dilatometer is a state of the art in-situ testing tool which can be hydraulically advanced into soil without causing any disturbance. The test is best suited for materials finer than gravelly sands. Its suitability in loose sands is noted as one of the best applications of the device by experts in the DMT field.  
To perform the test, a membrane on the side of the blade-shaped tool is expanded into the sidewall of the soil a distance of one point one millimeter. The pressure that is required to expand the membrane into the soil and the pressure prior to the expansion are noted (A and B pressures). The operator then deflates the membrane and records a third pressure (C pressure). The blade is then advanced to the next test depth and the test is repeated. A series of single dilatometer tests is referred to as a DMT sounding.  
This abbreviated stress-strain test can be used to define many geotechnical parameters of soil including soil type, shear strength, constrained deformation modulus (that is, settlement), preconsolidation stress, in-situ pore water pressure and rate of consolidation. By coupling the reduced modulus data from the test with an elastic settlement program such as Schmertmann's Special Method, very accurate settlement predictions can be made for specific foundation load/size cases. Diagrams illustrating the dilatometer test are also attached to this report.

**Results**  
Allowable bearing pressures ranging from 4,000 psf to 6,000 psf were considered for the design of foundations. Based on the available drawings, it was estimated that maximum foundation loads will be on the order of 36 kips/linear foot. Contact

HILLIS-CARNES ENGINEERING ASSOCIATES, INC.

WALNUT GROVE CULVERT - DILATOMETER TESTING  
June 1, 2007 Page 3

stress (simulated load) and dilatometer constrained modulus data was input into a computer-generated elastic settlement program based on Schmertmann's Special Method. Stress distributions under applied loads were computed using the Boussinesq Solution.

Based on the dilatometer results, the following total settlements were predicted for the allowable soil bearing pressures evaluated:

Allowable Soil Bearing Pressure (psf)	Predicted Total Settlement (in.)
4,000	1.06
5,000	1.21
6,000	1.35

It is therefore our professional opinion that the allowable soil bearing pressures outlined above can be utilized for foundation design, provided the structure can tolerate the anticipated settlements predicted for the bearing pressure utilized. The remaining recommendations that were outlined in our original geotechnical report remain valid for the proposed foundations.

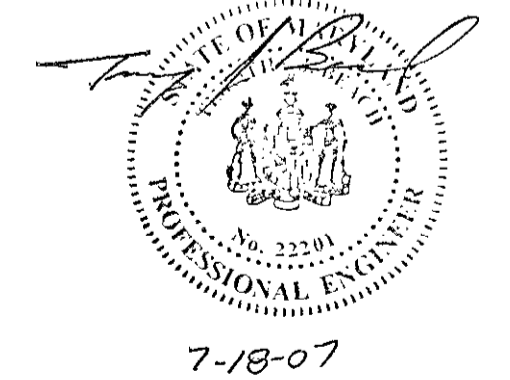
**Remarks**  
Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties either implied or expressed. Hillis-Carnes Engineering Associates, Inc. assumes no responsibility for interpretations made by others based on work or recommendations made by HCEA.

Should any of the project characteristics, structural loading conditions, or required settlement criteria differ from those outlined above, then this office should be contacted for a re-evaluation of the site.

HCEA appreciates having had the opportunity to provide the geotechnical exploration services for this project. Should you have any questions concerning the contents of this report, or should you require additional consultation, design, inspection, or testing services, please contact our Office.

Very truly yours,  
HILLIS-CARNES ENGINEERING ASSOCIATES, INC.  
Michael P. Johnson, P.E.  
Professional Engineer

HILLIS-CARNES ENGINEERING ASSOCIATES, INC.



APPROVED: HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS  
Chief, Bureau of Highways \_\_\_\_\_ Date \_\_\_\_\_

APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING & ZONING  
Chief, Division of Land Development \_\_\_\_\_ Date \_\_\_\_\_

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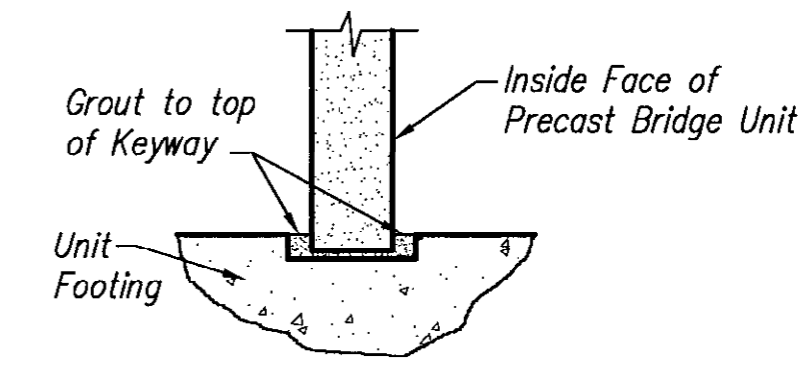
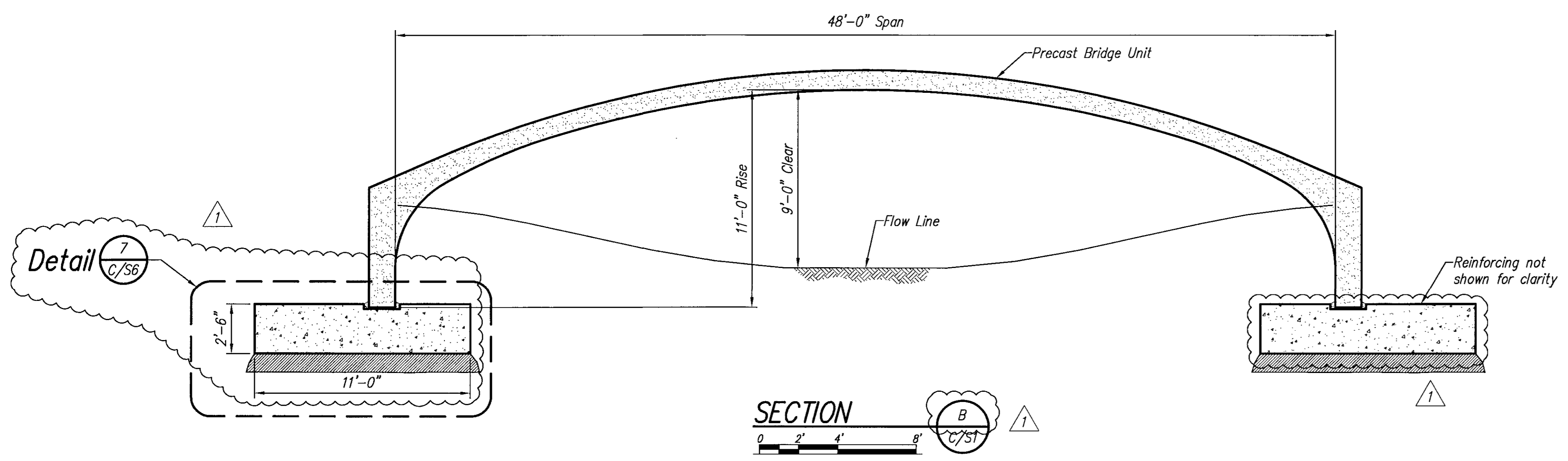
CONSPAN BRIDGE SYSTEM DETAILS  
WALNUT GROVE  
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SCALE	ZONING	G. L. W. FILE No.
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DATE	TAX MAP - GRID	SHEET
JULY/2007	PARCEL 74 28 - 18,17	55 OF 78

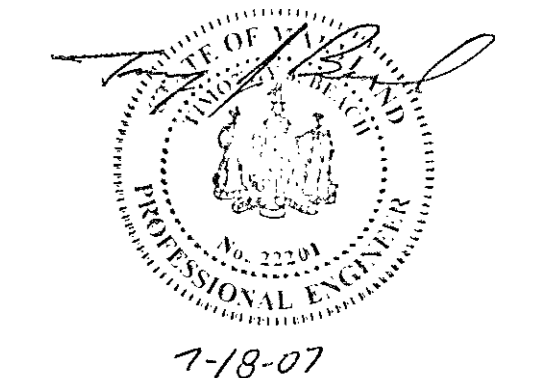
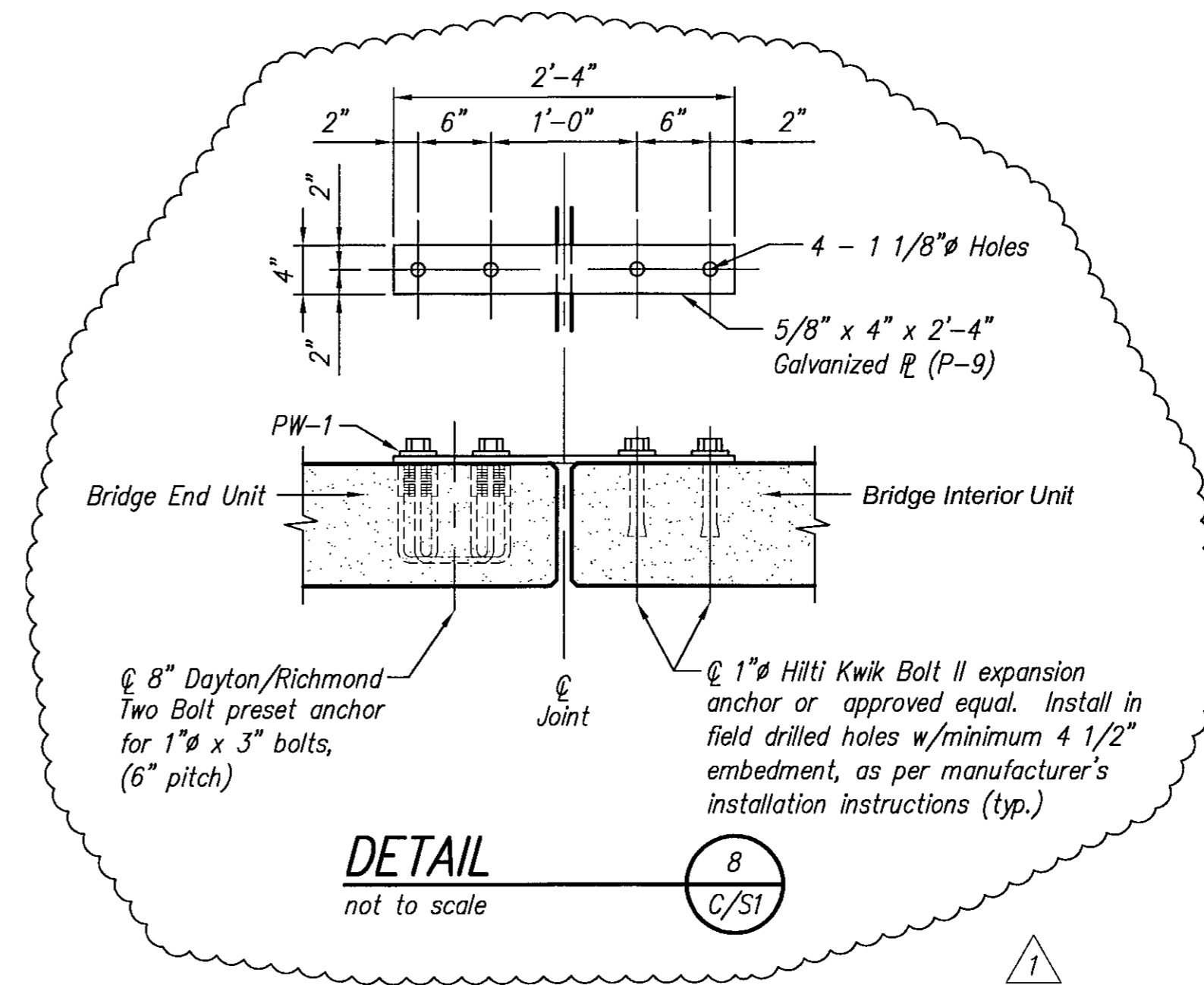
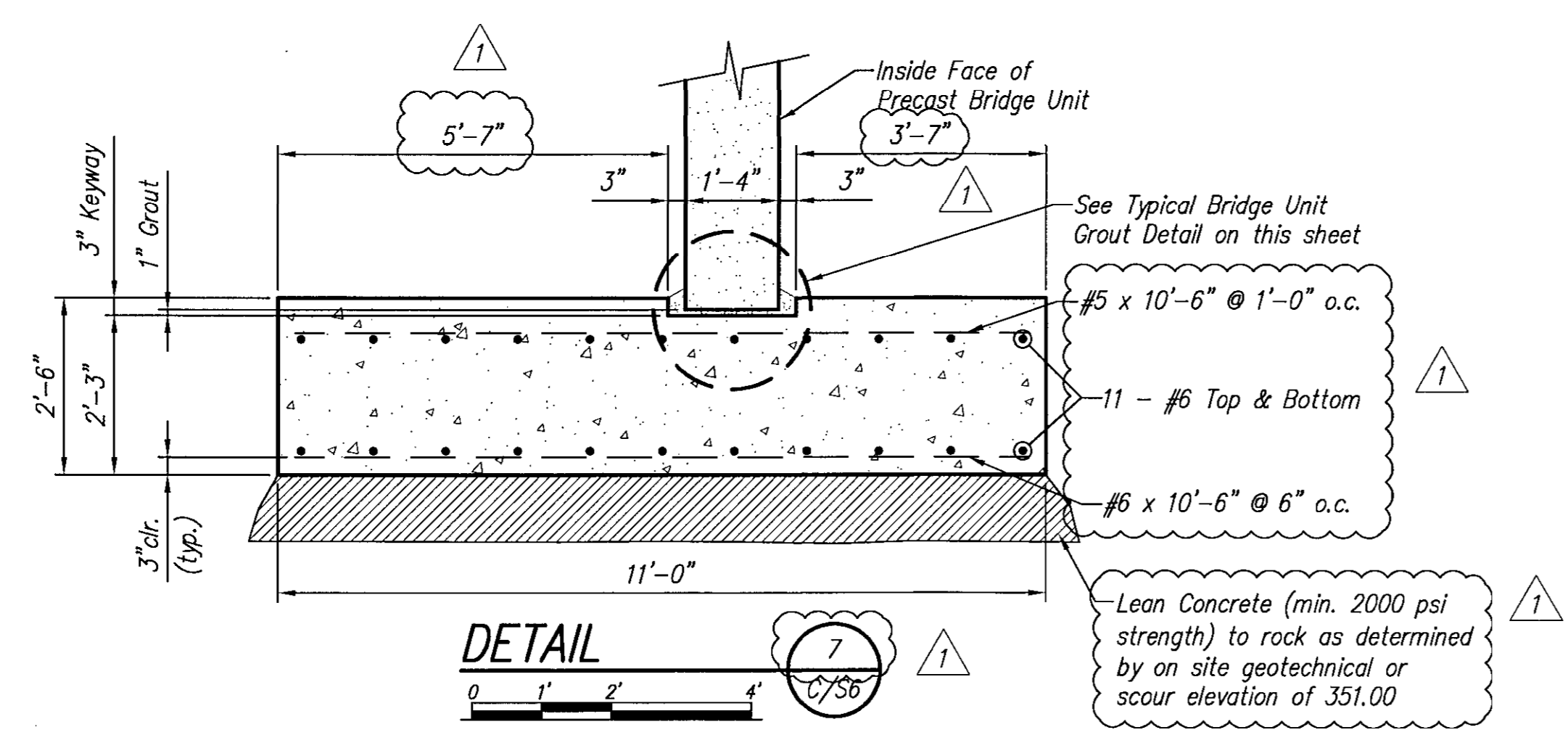
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Designed: KTM  
Drawn: RPU  
Checked: JVP  
Date: 12/01/06  
C/S Project No. 14679  
Sheet No. C/S5



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**TYPICAL BRIDGE UNIT GROUT DETAIL**  
not to scale



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Chief, Bureau of Highways \_\_\_\_\_ Date \_\_\_\_\_

APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING & ZONING  
Chief, Division of Land Development \_\_\_\_\_ Date \_\_\_\_\_

Chief, Development Engineering Division \_\_\_\_\_ Date \_\_\_\_\_

**CONSPAN® BRIDGE SYSTEMS**

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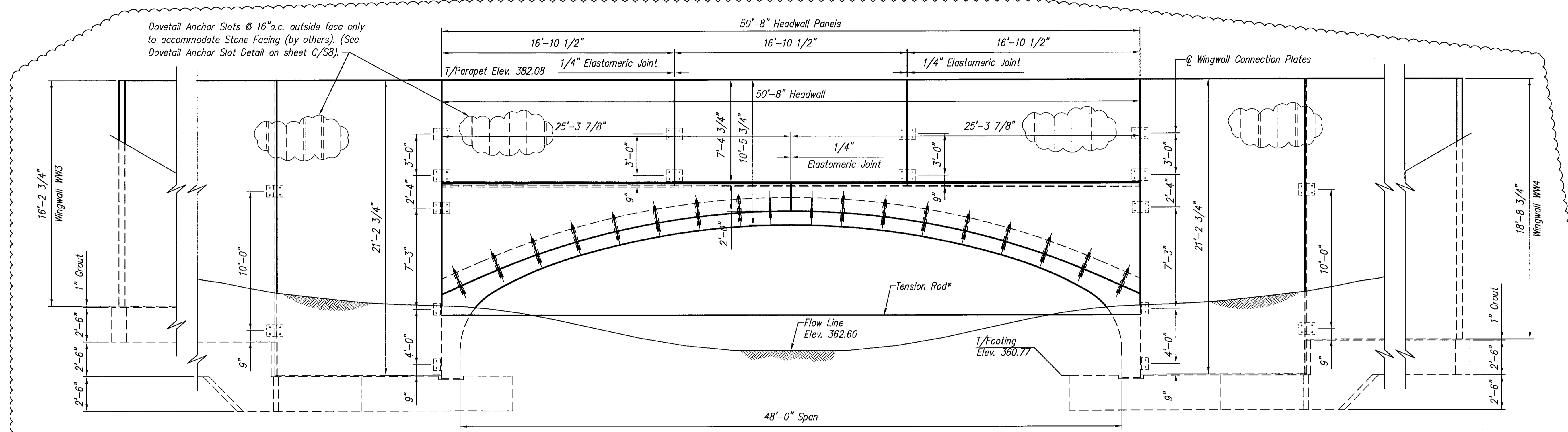
PREPARED FOR OWNER  
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WALNUT GROVE DEVELOPMENT, INC.  
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**CONSPAN BRIDGE SYSTEM DETAILS**  
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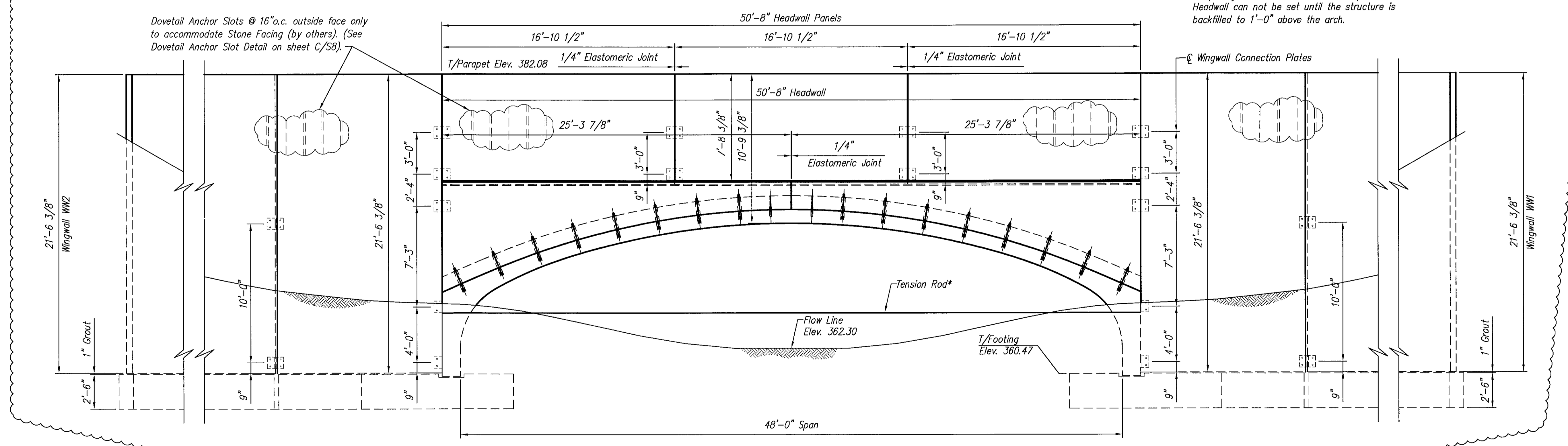


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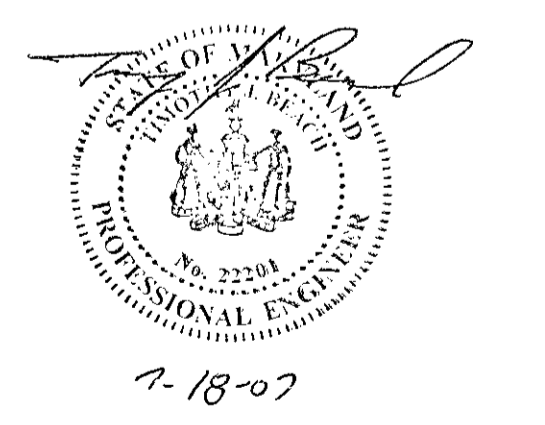


UPSTREAM END ELEVATION

\*Tension Rods will come installed on the last two units on each end. The tension rods can not be removed until the structure is completely backfilled. The Panel on top of the Headwall can not be set until the structure is backfilled to 1'-0" above the arch.



DOWNSTREAM END ELEVATION



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Chief, Development Engineering Division \_\_\_\_\_ Date \_\_\_\_\_

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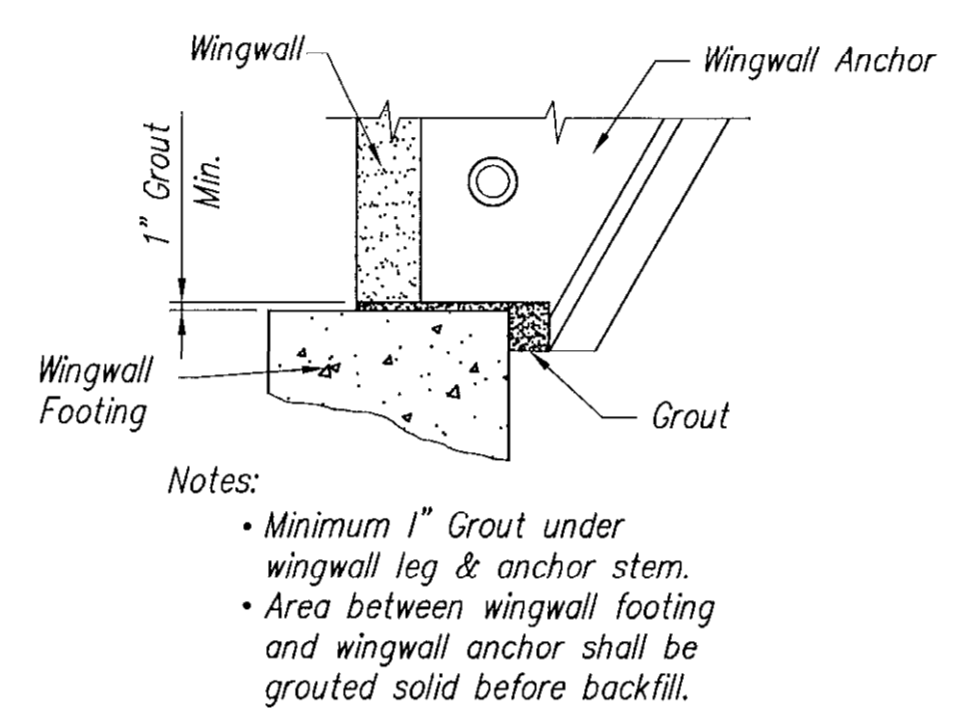
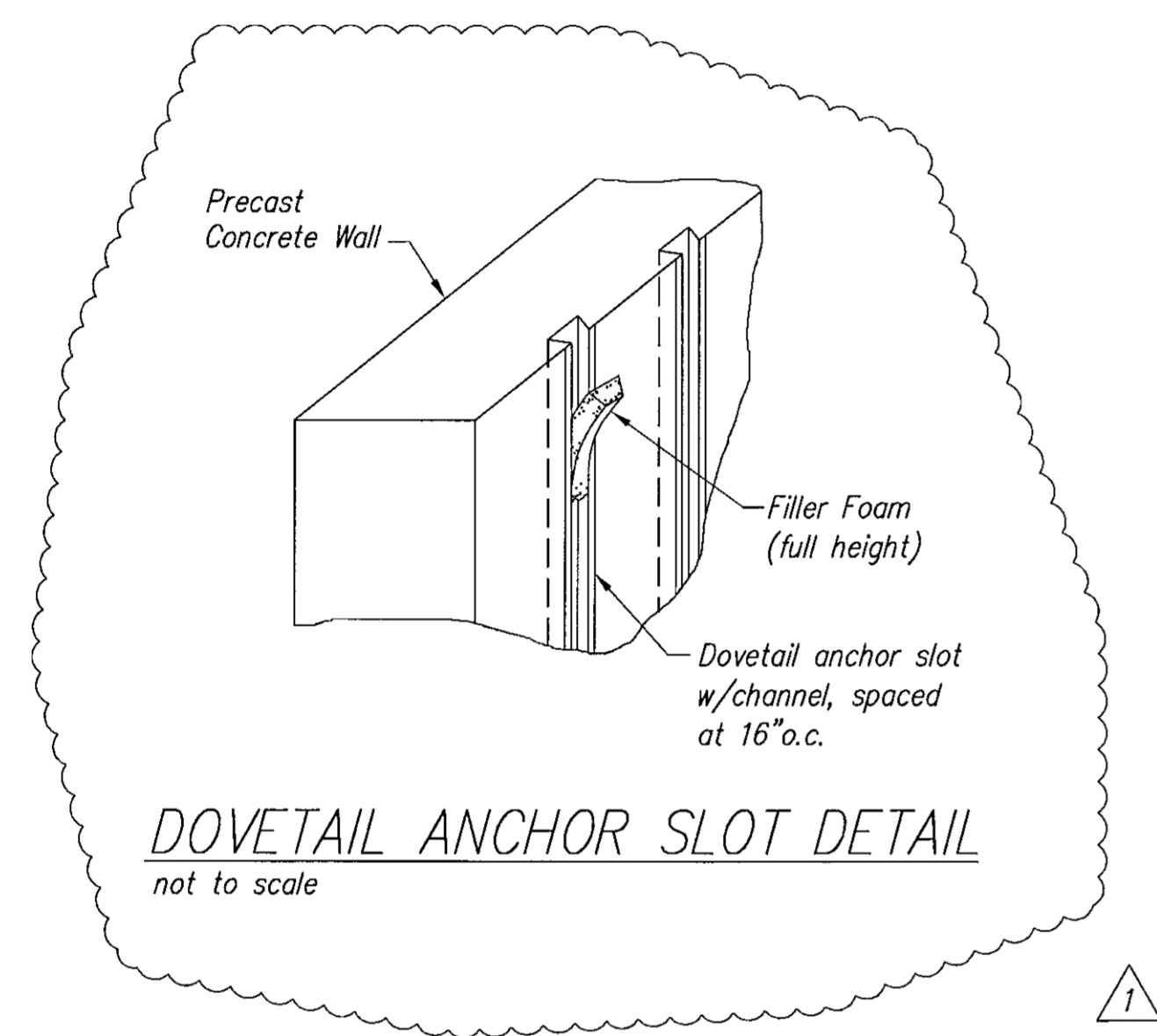
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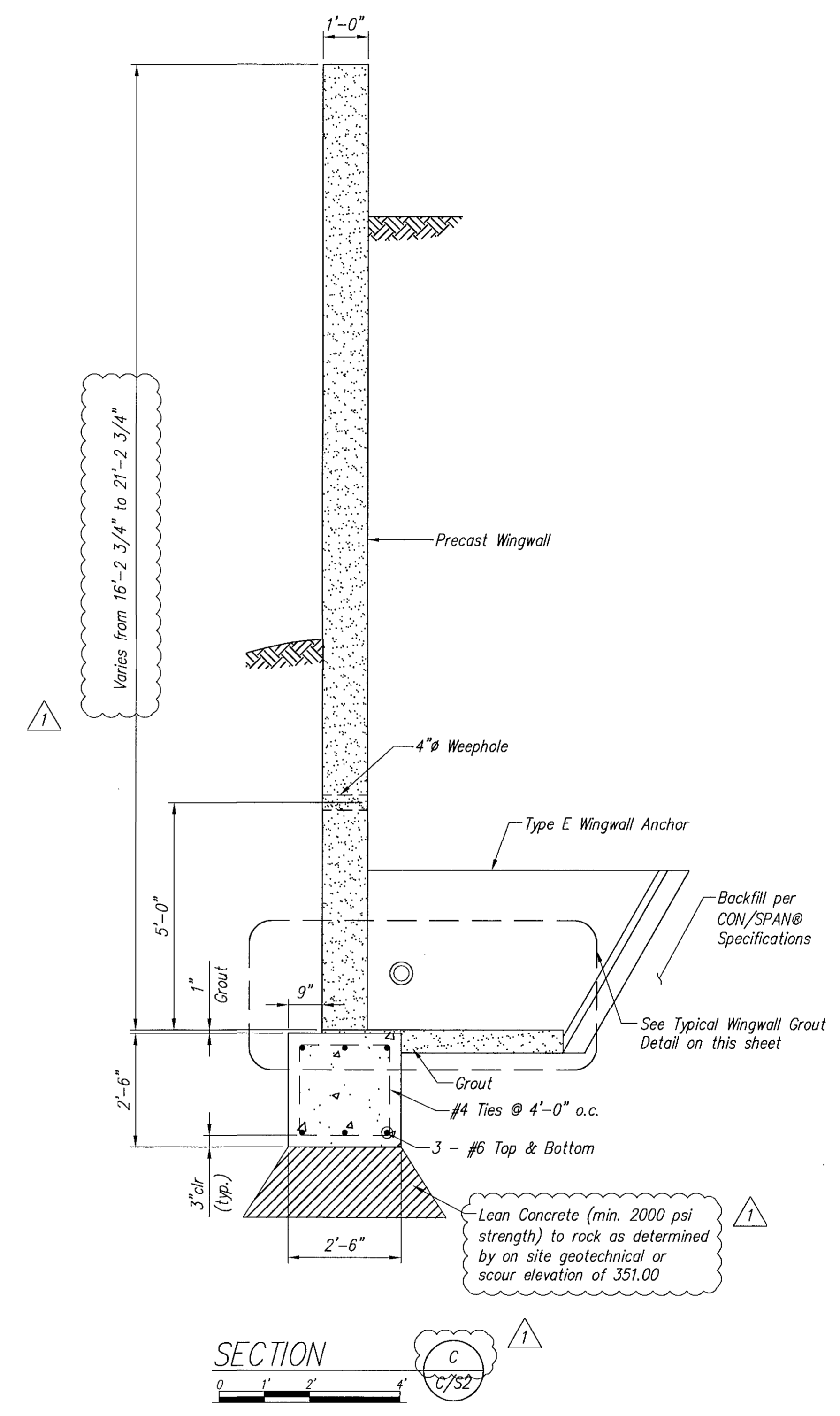
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Checked JVP  
Date 12/01/06



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**TYPICAL WINGWALL GROUT DETAIL**  
not to scale



Professional Engineer  
No. 22201  
7-18-07

APPROVED: HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS

Chief, Bureau of Highways \_\_\_\_\_ Date \_\_\_\_\_

APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING & ZONING

Chief, Division of Land Development \_\_\_\_\_ Date \_\_\_\_\_

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CONSPAN® BRIDGE SYSTEMS

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CONSPAN BRIDGE SYSTEM DETAILS

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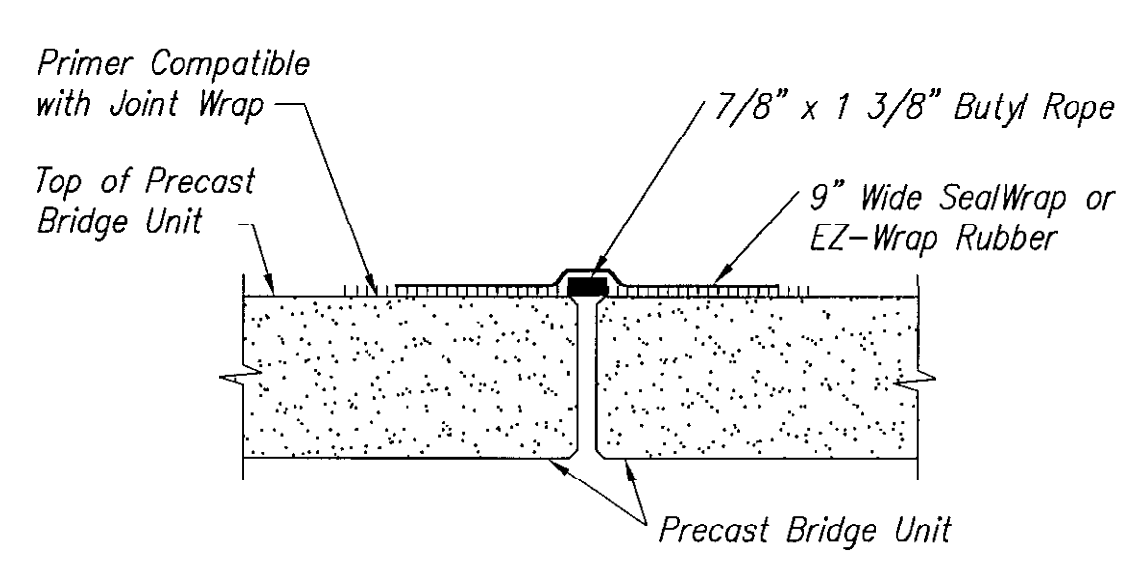
ELECTION DISTRICT No. 5

HOWARD COUNTY, MARYLAND

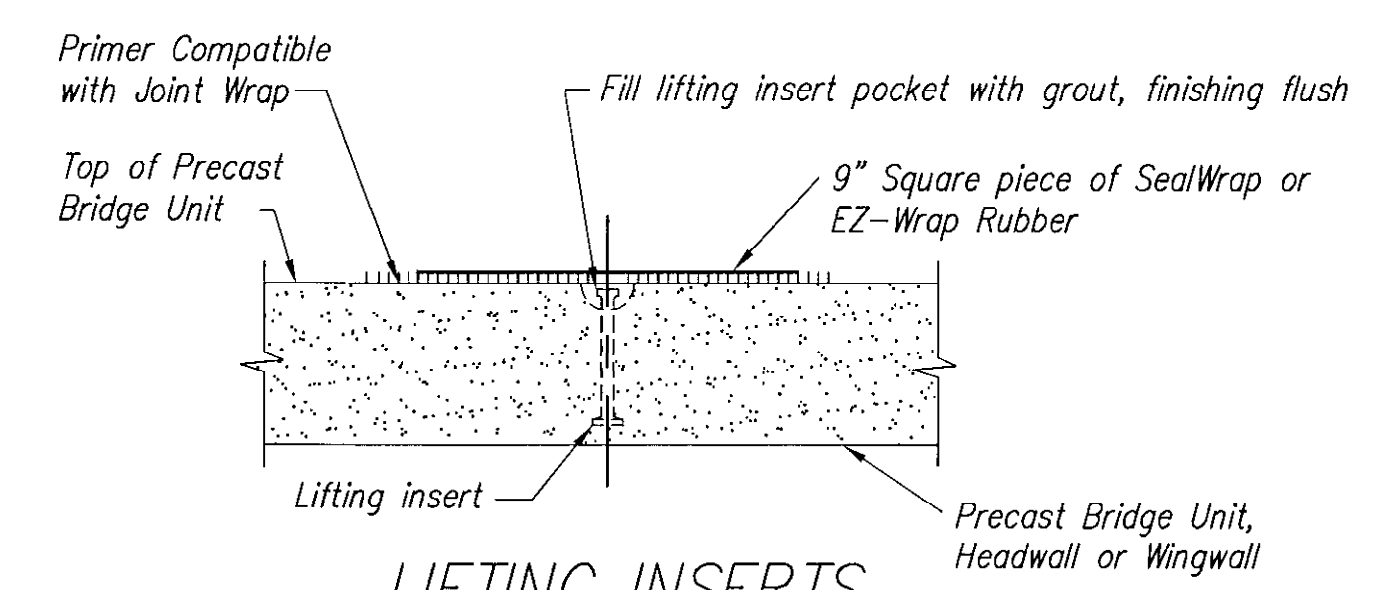
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DATE	TAX MAP - GRID	SHEET
JULY/2007	PARCEL 74 28 - 18,17	58 OF 78



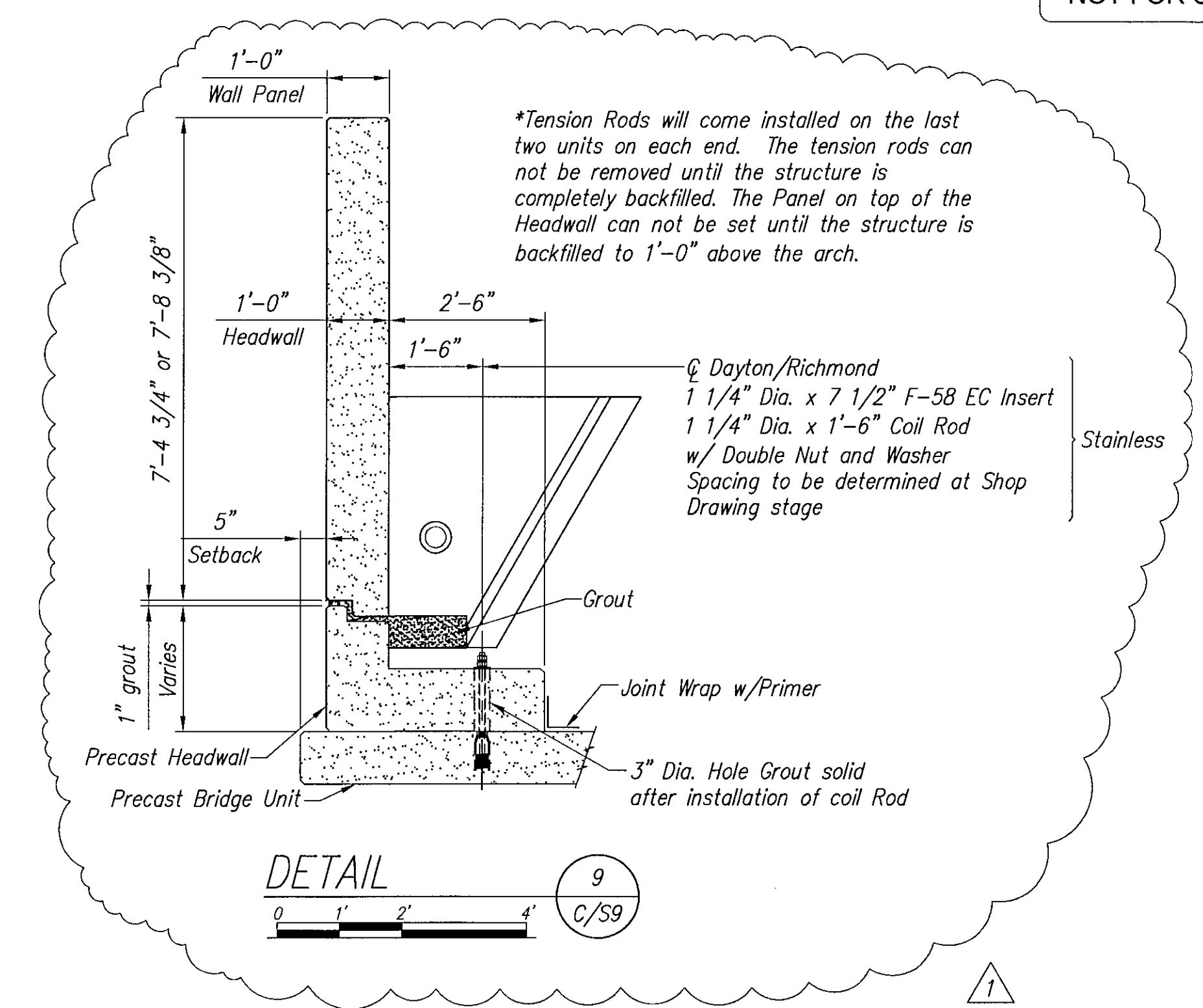
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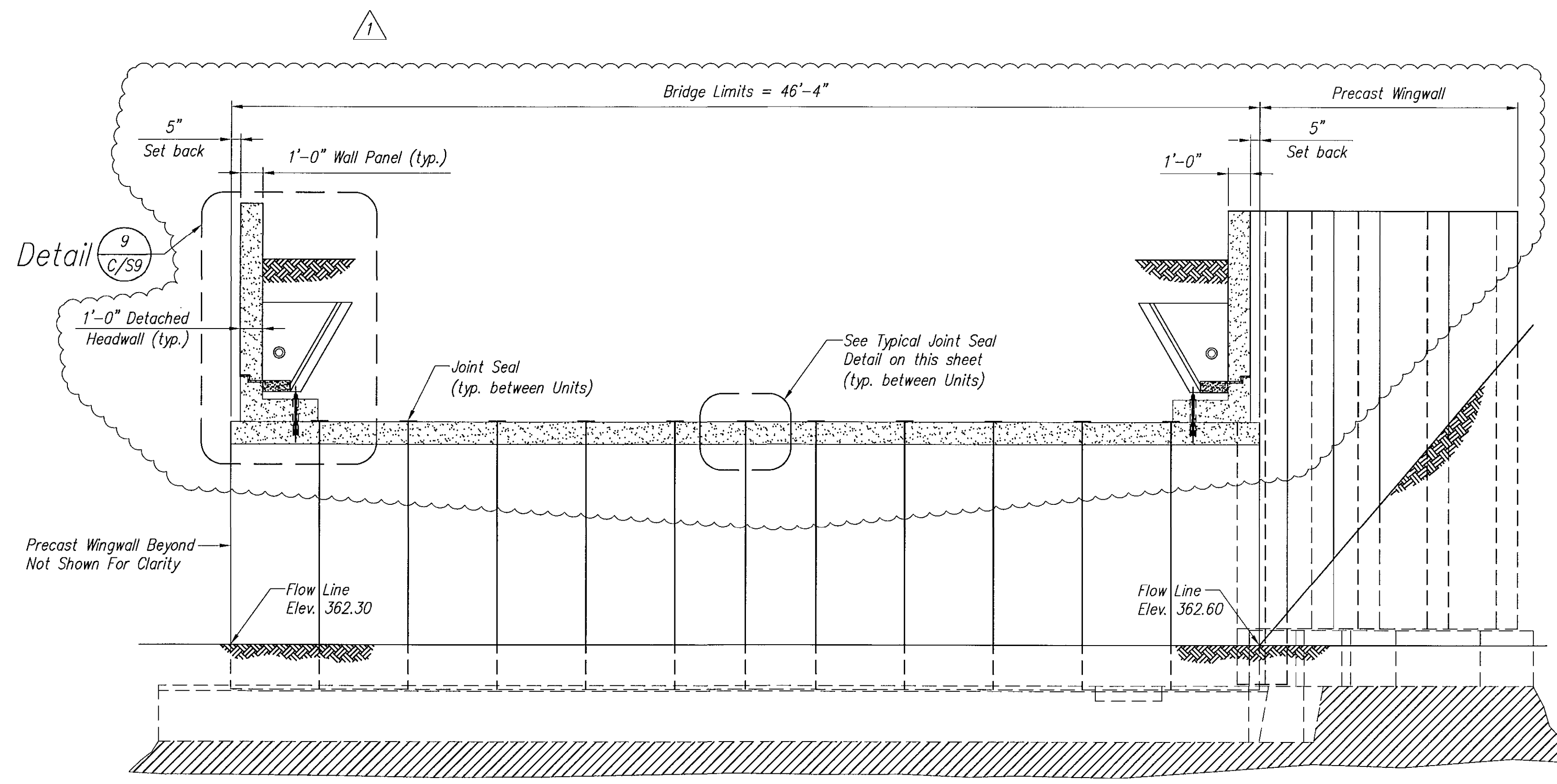
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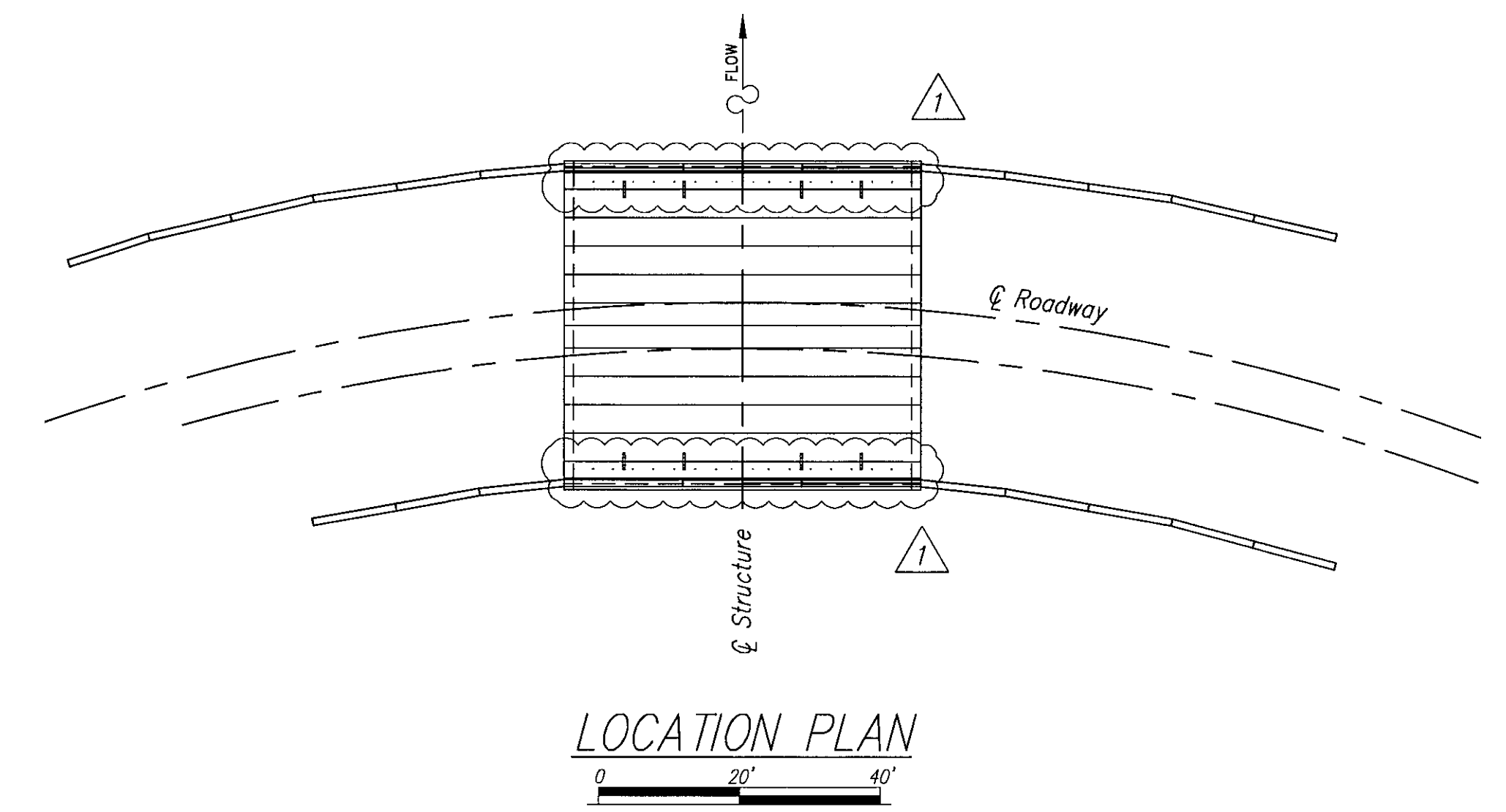
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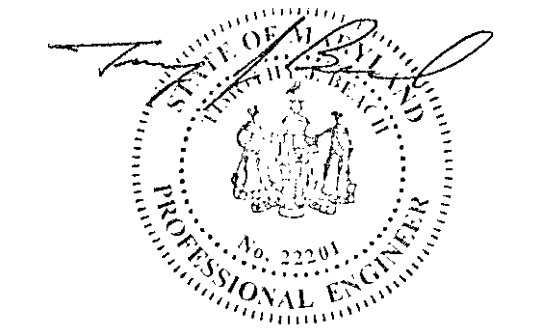
**DETAIL 9**  
C/S9



**SECTION D**  
C/S1



**LOCATION PLAN**



7-18-07

APPROVED: HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS	
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Chief, Division of Land Development	Date
Chief, Development Engineering Division	Date

**CONSPAN**  
BRIDGE SYSTEMS

Designed	KTM	C/S Project No.	14679
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Checked	JVP	Date	12/01/06

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OWNER  
WALNUT GROVE HOLDING, L.L.C.  
WALNUT GROVE DEVELOPMENT, INC.  
ROBERT VAN DYKE, PRESIDENT  
10705 CHARTER DRIVE  
SUITE 300  
COLUMBIA, MARYLAND 21044

**CONSPAN BRIDGE SYSTEM DETAILS**  
WALNUT GROVE  
LOTS 1 THRU 88, BUILDABLE PRESERVATION PARCELS "A",  
NON-BUILDABLE PRESERVATION PARCELS "B" THRU "I" AND  
NON-BUILDABLE BULK PARCELS "J"  
L.2927 F.487  
ELECTION DISTRICT No. 5  
HOWARD COUNTY, MARYLAND

SCALE	ZONING	G. L. W. FILE No.
AS SHOWN	RC-DEO	00153
DATE	TAX MAP - GRID	SHEET
JULY/2007	28 - 18,17	59 OF 78



# SPECIFICATIONS FOR MANUFACTURE AND INSTALLATION OF CON/SPAN® BRIDGE SYSTEMS

APPROVAL ONLY:  
NOT FOR CONSTRUCTION

## 1. DESCRIPTION

This work shall consist of constructing a CON/SPAN® bridge in accordance with these specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on the plans or as established by the Engineer. In situations where two or more specifications apply to this work, the most stringent requirements shall govern.

## 2. TYPES

Precast reinforced concrete CON/SPAN® bridge units manufactured in accordance with this specification shall be designated by span and rise. Precast reinforced concrete CON/SPAN® wingwalls and headwalls manufactured in accordance with this specification shall be designated by length, height, and deflection angle.

## 3. MATERIALS - CONCRETE

The concrete for the culverts shall be air-entrained when installed in areas subject to freeze-thaw conditions, composed of portland cement, fine and coarse aggregates, admixtures and water. Air-entrained concrete shall contain  $6 \pm 2$  percent air. The air entraining admixture shall conform to AASHTO M154.

- 3.1 **Portland Cement** - Shall conform to the requirements of ASTM Specifications C150-Type I, Type II, or Type III cement.
- 3.2 **Coarse Aggregate** - Shall consist of stone having a maximum size of 1 inch. Aggregate shall meet requirements for ASTM C33.
- 3.3 **Water Reducing Admixture** - The manufacturer may submit for approval by the Engineer, a water-reducing admixture for the purpose of increasing workability and reducing the water requirement for the concrete.
- 3.4 **Calcium Chloride** - The addition to the mix of calcium chloride or admixtures containing calcium chloride will not be permitted.

## 4. MATERIALS - STEEL REINFORCEMENT AND HARDWARE

All reinforcing steel for the culverts shall be fabricated and placed in accordance with the detailed shop drawings submitted by the manufacturer.

- 4.1 **Steel Reinforcement** - Reinforcement shall consist of welded wire fabric conforming to ASTM Specification A 185 or A 497, or deformed billet steel bars conforming to ASTM Specification A 615, Grade 60. Longitudinal distribution reinforcement may consist of welded wire fabric or deformed billet-steel bars.

- 4.2 **Hardware:**  
Bolts and threaded rods for wingwall connections shall conform to ASTM A 307. Nuts shall conform to AASHTO M 292 (ASTM A 194) Grade 2H. All bolts, threaded rods and nuts used in wingwall connections shall be mechanically zinc coated in accordance with ASTM B 695 Class 50.

Structural Steel for wingwall connection plates and plate washers shall conform to AASHTO M 270 (ASTM A 709) Grade 36 and shall be hot dip galvanized as per AASHTO M 111 (ASTM A 123).

Inserts for wingwalls shall be 1" diameter Two-Bolt Preset Wingwall Anchors as manufactured by Dayton/Richmond Concrete Accessories, Miamisburg, Ohio, (800) 745-3700.

Ferrule Loop Inserts shall be F-64 Ferrule Loop Inserts as manufactured by Dayton/Richmond Concrete Accessories, Miamisburg, Ohio, (800) 745-3700.

Hook Bolts used in attached headwall connections shall be ASTM A 307.

Inserts for detached headwall connections shall be AISI Type 304 stainless steel, F-58 Expanded Coil inserts as manufactured by Dayton/Richmond Concrete Accessories, Miamisburg, Ohio, (800) 745-3700. Coil rods and nuts used in headwall connections shall be AISI Type 304 stainless steel. Washers used in headwall connections shall be either AISI Type 304 stainless steel plate washers or AASHTO M 270 (ASTM A 709) Grade 36 plate washers hot dip galvanized as per AASHTO M 111 (ASTM A 123).

Reinforcing bar splices shall be made using the Dowel Bar Splicer System as manufactured by Dayton/Richmond Concrete Accessories, Miamisburg, Ohio, (800) 745-3700, and shall consist of the Dowel Bar Splicer (DB-SAE) and Dowel-In (DI).

## 5. MANUFACTURE

- 5.1 **Mixture** - The aggregates, cement and water shall be proportioned and mixed in a batch mixer to produce a homogeneous concrete meeting the strength requirements of this specification. The proportion of portland cement in the mixture shall not be less than 650 pounds (7 sacks) per cubic yard of concrete.

- 5.2 **Curing** - The precast concrete culvert units shall be cured for a sufficient length of time so that the concrete will develop the specified compressive strength in 28 days or less. Any one of the following methods of curing or combinations thereof shall be used:

5.2.1 **Steam Curing** - The culverts may be low pressure, steam cured by a system that will maintain a moist atmosphere.

5.2.2 **Water Curing** - The culverts may be water cured by any method that will keep the sections moist.

5.2.3 **Membrane Curing** - A sealing membrane conforming to the requirements of ASTM Specification C 309 may be applied and shall be left intact until the required concrete compressive strength is attained. The concrete temperature at the time of application shall be within  $\pm 10$  degrees F of the atmospheric temperature. All surfaces shall be kept moist prior to the application of the compounds and shall be damp when the compound is applied.

- 5.3 **Forms** - the forms used in manufacture shall be sufficiently rigid and accurate to maintain the culvert dimensions within the permissible variations given in Section 7 of these specifications. All casting surfaces shall be of a smooth material.

- 5.4 **Handling** - Handling devices or holes shall be permitted in each culvert for the purpose of handling and setting.

- 5.5 **Storage** - The precast elements shall be stored in such a manner to prevent cracking or damage. The units shall not be moved until the concrete compressive strength has reached a minimum of 2500 psi, and they shall not be stored in an upright position until the concrete compressive strength is a minimum of 4,000 psi.

## 6. DESIGN

- 6.1 **The precast element dimension and reinforcement details** shall be as prescribed in the plan and the shop drawings provided by the manufacturer, subject to the provisions of Section 7, below. The minimum concrete compressive strength shall be as shown on the shop drawings. The minimum steel yield strength shall be 60,000 psi, unless otherwise noted on the shop drawings.

- 6.2 **The precast elements are designed in accordance with the "Standard Specifications for Highway Bridges" 17th Edition, adopted by the American Association of State Highway and Transportation Officials, 2002.** A minimum of one foot of cover above the crown of the bridge units is required in the installed condition. (Unless noted otherwise on the shop drawings and designed accordingly.)

- 6.3 **Placement of Reinforcement in Precast Bridge Units** - The cover of concrete over the outside circumferential reinforcement shall be 2 inches minimum. The cover of concrete over the inside circumferential reinforcement shall be 1 1/2 inches minimum, unless otherwise noted on the shop drawings. The clear distance of the end circumferential wires shall not be less than one inch nor more than two inches from the ends of each section. Reinforcement shall be assembled utilizing single or multiple layers of welded wire fabric (not to exceed 3 layers), supplemented with a single layer of deformed billet-steel bars, when necessary. Welded wire fabric shall be composed of circumferential and longitudinal wires meeting the spacing requirements of 6.6, below, and shall contain sufficient longitudinal wires extending through the bridge unit to maintain the shape and position of the reinforcement. Longitudinal distribution reinforcement may be welded wire fabric or deformed billet-steel bars and shall meet the spacing requirements of 6.6, below. The ends of the longitudinal distribution reinforcement shall be not more than 3 inches and not less than 1 1/2 inches from the ends of the bridge unit.

- 6.4 **Placement of Reinforcement for Precast Wingwalls and Headwalls** - The cover of concrete over the longitudinal and transverse reinforcement shall be 2 inches minimum. The clear distance from the end of each precast element to the end transverse reinforcing steel shall not be less than one inch nor more than two inches. Reinforcement shall be assembled utilizing a single layer of welded wire fabric, or a single layer of deformed billet-steel bars. Welded wire fabric shall be composed of transverse and longitudinal wires meeting the spacing requirements of 6.7, below, and shall contain sufficient longitudinal wires extending through the element to maintain the shape and position of the reinforcement. Longitudinal reinforcement may be welded wire fabric or deformed billet-steel bars and shall meet the spacing requirements of 6.7, below. The ends of the longitudinal reinforcement shall be not more than 3 inches and not less than 1 1/2 inches from the ends of the walls.

- 6.5 **Bending of Reinforcement for Precast Bridge Units** - The outside and inside circumferential reinforcing steel for the corners of the bridge shall be bent to such an angle that is approximately equal to the configuration of the bridge's outside corner.

- 6.6 **Laps, Welds, and Spacing for Precast Bridge Units** - Tension splices in the circumferential reinforcement shall be made by lapping. Laps may NOT be tack welded together for any purpose. For smooth welded wire fabric, the overlap shall meet the requirements of AASHTO 8.30.2 and 8.32.6. For deformed welded wire fabric, the overlap shall meet the requirements of AASHTO 8.30.1 and 8.32.5. The overlap of welded wire fabric shall be measured between the outer most longitudinal wires of each fabric sheet. For deformed billet-steel bars, the overlap shall meet the requirements of AASHTO 8.25. For splices other than tension splices, the overlap shall be a minimum of 12" for welded wire fabric or deformed billet-steel bars. The spacing center to center of the circumferential wires in a wire fabric sheet shall be not less than 2 inches nor more than 4 inches. The spacing center to center of the longitudinal wires shall not be more than 8 inches. The spacing center to center of the longitudinal distribution steel for either line of reinforcing in the top slab shall be not more than 16 inches.

- 6.7 **Laps, Welds, and Spacing for Precast Wingwalls and Headwalls** - Splices in the reinforcement shall be made by lapping. Laps may NOT be tack welded together for any purposes. For smooth welded wire fabric, the overlap shall meet the requirements of AASHTO 8.30.2 and 8.32.6. For deformed welded wire fabric, the overlap shall meet the requirements of AASHTO 8.30.1 and 8.32.5. For deformed billet-steel bars, the overlap shall meet the requirements of AASHTO 8.25. The spacing center-to-center of the wires in a wire fabric sheet shall be not less than 2 inches nor more than 8 inches.

## 7. PERMISSIBLE VARIATIONS

### 7.1 Bridge Units

- 7.1.1 **Internal Dimensions** - The internal dimension shall vary not more than 1% from the design dimensions nor more than 1-1/2 inches whichever is less. The haunch dimensions shall vary not more than 3/4 inch from the design dimension.

- 7.1.2 **Slab and Wall Thickness** - The slab and wall thickness shall not be less than that shown in the design by more than 1/4 inch. A thickness more than that required in the design shall not be cause for rejection.

- 7.1.3 **Length of Opposite Surfaces** - Variations in laying lengths of two opposite surfaces of the bridge unit shall not be more than 1/2 inch in any section, except where beveled ends for laying of curves are specified by the purchaser.

- 7.1.4 **Length of Section** - The underrun in length of a section shall not be more than 1/2 inch in any bridge unit.

- 7.1.5 **Position of Reinforcement** - The maximum variation in position of the reinforcement shall be 1/2 inch. In no case shall the cover over the reinforcement be less than 1 1/2 inches for the outside circumferential steel or be less than 1 inch for the inside circumferential steel as measured to the external or internal surface of the bridge. These tolerances or cover requirements do not apply to mating surfaces of the joints.

- 7.1.6 **Area of Reinforcement** - The areas of steel reinforcement shall be the design steel areas as shown in the manufacturer's shop drawings. Steel areas greater than those required shall not be cause for rejection. The permissible variation in diameter of any reinforcement shall conform to the tolerances prescribed in the ASTM Specification for that type of reinforcement.

### 7.2 Wingwalls and Headwalls

- 7.2.1 **Wall Thickness** - The wall thickness shall not vary from that shown in the design by more than 1/2 inch.

- 7.2.2 **Length/ Height of Wall sections** - The length and height of the wall shall not vary from that shown in the design by more than 1/2 inch.

- 7.2.3 **Position of Reinforcement** - The maximum variation in the position of the reinforcement shall be  $\pm 1/2$  inch. In no case shall the cover over the reinforcement be less than 1 1/2 inches.

- 7.2.4 **Size of Reinforcement** - The permissible variation in diameter of any reinforcing shall conform to the tolerances prescribed in the ASTM Specification for that type of reinforcing. Steel area greater than that required shall not be cause for rejection.

## 8. TESTING AND INSPECTION

- 8.1 **Type of Test Specimen** - Concrete compressive strength shall be determined from compression tests made on cylinders or cores. For cylinder testing, a minimum of 4 cylinders shall be taken during each production run. For core testing, one core shall be cut from each of 3 precast elements selected at random from each production group. A production group shall be defined as 15 or fewer bridge units (of a particular size), wingwalls or headwalls in a continuous production run. For each continuous production run, each production group or fraction thereof shall be considered separately for the purpose of testing and acceptance. A production run shall be considered continuous if not interrupted for more than 3 consecutive days.

- 8.2 **Compression Testing** - Cylinders shall be made and tested as prescribed by the ASTM C 39 Specification. Cores shall be obtained and tested for compressive strength in accordance with the provisions of the ASTM C497 Specification.

- 8.3 **Acceptability of Cylinder Tests** - When the average compressive strength of all cylinders tested is equal to or greater than the design compressive strength, and not more than 10% of the cylinders tested have a compressive strength less than the design concrete strength, and no cylinder tested has a compressive strength less than 80% of the design compressive strength, then the lot shall be accepted. When the compressive strength of the cylinders tested does not conform to this acceptance criteria, the acceptability of the lot may be determined as described in section 8.4, below.

- 8.4 **Acceptability of Core Tests** - The compressive strength of the concrete in each production group as defined in 8.1 is acceptable when the average core test strength is equal to or greater than the design concrete strength. When the compressive strength of the core tested is less than the design concrete strength, the precast element from which that core was taken may be re-cored. When the compressive strength of the re-core is equal to or greater than the design concrete strength, the compressive strength of the concrete in that production group is acceptable.

- 8.4.1 **When the compressive strength of any core is less than the design concrete strength, the precast element from which that core was taken shall be rejected. Two precast elements from the remainder of the group shall be selected at random and one core shall be taken from each. If the compressive strength of both cores is equal to or greater than the design concrete strength, the compressive strength of the remainder of that group is acceptable. If the compressive strength of either of the two cores tested is less than the design concrete strength, the remainder of the group shall be rejected or, at the option of the manufacturer, each precast element of the remainder of the group shall be cored and accepted individually, and any of these elements that have cores with less than the design concrete strength shall be rejected.**

- 8.4.2 **Plugging Core Holes** - The core holes shall be plugged and sealed by the manufacturer in a manner such that the elements will meet all of the test requirements of this specification. Precast elements so sealed shall be considered satisfactory for use.

- 8.4.3 **Test Equipment** - Every manufacturer furnishing culverts under this specification shall furnish all facilities and personnel necessary to carryout the test required.

## 9. JOINTS

The bridge units shall be produced with flat butt ends. The ends of the bridge units shall be such that when the sections are laid together they will make a continuous line of with a smooth interior free of appreciable irregularities, all compatible with the permissible variations in Section 7, above. The joint width shall not exceed 3/4 inches.

## 10. WORKMANSHIP AND FINISH

The bridge units, wingwalls, and headwalls shall be substantially free of fractures. The ends of the bridge units shall be normal to the walls and centerline of the bridge section, within the limits of the variations given in section 7, above, except where beveled ends are specified. The faces of the wingwalls and headwalls shall be parallel to each other, within the limits of variations given in section 7, above. The surface of the precast elements shall be a smooth steel form or troweled surface. Trapped air pockets causing surface defects shall be considered as part of a smooth, steel form finish.

## 11. REPAIRS

Precast elements may be repaired, if necessary, because of imperfections in manufacture or handling damage and will be acceptable if, in the opinion of the purchaser, the repairs are sound, properly finished and cured, and the repaired section conforms to the requirements of this specification.

## 12. INSPECTION

The quality of materials, the process of manufacture, and the finished culverts shall be subject to inspection by the purchaser.

## 13. REJECTION

The precast elements shall be subject to rejection on account of any of the specification requirements. Individual precast elements may be rejected because of any of the following:

- 13.1 **Fractures or hairline cracks** (widths less than 0.012") passing through the wall, except for a single end crack that does not exceed one half the thickness of the wall.
- 13.2 **Defects that indicate proportioning, mixing, and molding** not in compliance with Section 5 of these specifications.
- 13.3 **Honeycombed or open texture.**
- 13.4 **Damaged ends, where such damage would prevent making a satisfactory joint.**

## 14. MARKING

Each bridge unit shall be clearly marked by waterproof paint. The following shall be shown on the inside of the vertical leg of the bridge section:  
Bridge Span X Bridge Rise  
Date of Manufacture  
Name or trademark of the manufacturer

## 15. CONSTRUCTION REQUIREMENTS

- 15.1 **Footings** - The bridge units and wingwalls shall be installed on cast-in-place concrete footings. The design size and elevation of the footings shall be as determined by the Engineer. A three inch deep keyway shall be formed in the top surface of the bridge footing three inches clear of the inside and outside faces of the bridge units, unless specified otherwise on the plans. No keyway is required in the wingwall footings, unless otherwise specified on the plans. The footings shall be given a smooth float finish and shall reach a compressive strength of 2,000 psi before placement of the bridge and wingwall elements. The completed footing surface shall be constructed in accordance with grades shown on the plans. When tested with a 10 foot straight edge, the surface shall not vary more than 1/4 inch in 10 feet.

- 15.2 **Placement of the Bridge Units, Wingwalls and Headwalls** - The bridge units, wingwalls and headwalls shall be placed as shown on the Engineer's plan drawings. Special care shall be taken in setting the elements to the true line and grade. The bridge units and wingwalls shall be set on 6" x 6" masonite or steel shims. A minimum gap of 1/2 inch shall be provided between the footing and the bottom of the bridge's vertical legs or the wingwall. The gap shall be filled with cement grout (Portland cement and water or cement mortar composed of Portland cement, sand and water) with a minimum 28-day compressive strength of 3000 psi. If units have been set with temporary ties (cables, bars, etc.) grout must attain a minimum compressive strength of 1500 psi before ties may be removed.

- 15.3 **External Protection of Joints** - The butt joint made by two adjoining bridge units shall be covered with a 7/8" x 1 3/8" preformed bituminous joint sealant and a minimum of a 9 inch wide joint wrap. The surface shall be free of dirt before applying the joint material. A primer compatible with the joint wrap to be used shall be applied for a minimum width of nine inches on each side of the joint. The external wrap shall be either EZ-WRAP RUBBER by PRESS-SEAL GASKET CORPORATION, SEAL WRAP by MAR MAC MANUFACTURING CO. INC. or approved equal. The joint shall be covered continuously from the bottom of one bridge section leg, across the top of the arch and to the opposite bridge section leg. Any laps that result in the joint wrap shall be a minimum of six inches long with the overlap running downhill.

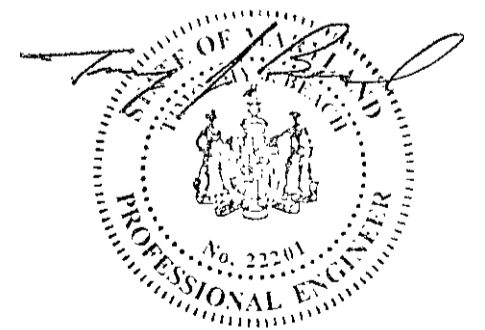
In addition to the joints between bridge units, the joint between the end bridge unit and the headwall shall also be sealed as described above. If precast wingwalls are used, the joint between the end bridge unit and the wingwall shall be sealed with a 2"-0" strip of filter fabric. Also, if lift holes are formed in the arch units, they shall be primed and covered with a 9" x 9" square of joint wrap.

During the backfilling operation, care shall be taken to keep the joint wrap in its proper location over the joint.

- 15.4 **Backfill** - Backfill shall be considered as all replaced excavation and new embankment adjacent to the CON/SPAN® bridge units, wingwalls, and headwalls. The project construction and material specifications which include the specifications for excavation for structures and roadway excavation and embankment construction, shall apply except as modified in this section.

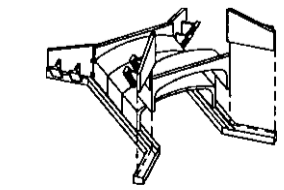
No backfill shall be placed against any structural elements until they have been approved by the Engineer.

Backfill against a waterproofed surface shall be placed carefully to avoid damage to the waterproofing material.



7-18-07

Designed	KTM	C/S Project No.	
Drawn	RPU		14679
Checked	JVP	Sheet No.	
Date	12/01/06		<b>C/S10</b>



**CONSPAN®**  
BRIDGE SYSTEMS

## CONSPAN BRIDGE SYSTEM DETAILS

WALNUT GROVE  
LOTS 1 THRU 88, BUILDABLE PRESERVATION PARCELS "A",  
NON-BUILDABLE PRESERVATION PARCELS "B" THRU "I" AND  
NON-BUILDABLE BULK PARCELS "J"  
L.2927 F.487

ELECTION DISTRICT No. 5

HOWARD COUNTY, MARYLAND

SCALE	ZONING	G. L. W. FILE No.
AS SHOWN	RC-DEO	00153
DATE	TAX MAP - GRID	SHEET
JULY/2007	PARCEL 74 28 - 18,17	60 OF 78

APPROVED: HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS			
Chief, Bureau of Highways	Date		
APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING & ZONING			
Chief, Division of Land Development	Date		
Chief, Development Engineering Division	Date		

GLW GUTSCHICK LITTLE & WEBER, P.A.			
CIVIL ENGINEERS, LAND SURVEYORS, LAND PLANNERS, LANDSCAPE ARCHITECTS			
3909 NATIONAL DRIVE - SUITE 250 - BURTONSVILLE OFFICE PARK			
BURTONSVILLE, MARYLAND 20866			
TEL: 301-421-4024 BAL: 410-963-1820 DC/VA: 301-989-2524 FAX: 301-421-4186			
W:\00Plots\14679-E-IN-E-ACT-A04.dwg	DES. KTM	DRN. RPU	CHK. JVP
DATE	REVISION	BY	APP'R.

PREPARED FOR  
OWNER  
WALNUT GROVE HOLDING, L.L.C.  
WALNUT GROVE DEVELOPMENT, INC.  
ROBERT VAN DYKE, PRESIDENT  
10705 CHARTER DRIVE  
SUITE 320  
COLUMBIA, MARYLAND 21044



# SPECIFICATIONS FOR MANUFACTURE AND INSTALLATION OF CON/SPAN® BRIDGE SYSTEMS

APPROVAL ONLY:  
NOT FOR CONSTRUCTION

## 16. QUALITY ASSURANCE

The Precaster shall demonstrate adherence to the standards set forth in the NPCA Quality Control Manual. The Precaster shall meet either Section 16.1 or 16.2.

16.1 Certification: The Precaster shall be certified by the Precast/Prestressed Concrete Institute Plant Certification Program or the National Precast Concrete Association's Plant Certification Program prior to and during production of the products covered by this specification.

16.2 Qualifications, Testing and Inspection

16.2.1 The Precaster shall have been in the business of producing precast concrete products similar to those specified for a minimum of three years. He shall maintain a permanent quality control department or retain an independent testing agency on a continuing basis. The agency shall issue a report, certified by a licensed engineer, detailing the ability of the Precaster to produce quality products consistent with industry standards.

16.2.2 The Precaster shall show that the following tests are performed in accordance with the ASTM standards indicated. Tests shall be performed for each 150 cubic yards of concrete placed, but not less frequently than once per production run, as defined in §8 of these specifications.

16.2.2.1 Air Content: C231 or C173

16.2.2.2 Compressive Strength: C39, C497

16.2.3 The Precaster shall provide documentation demonstrating compliance with this section to CON/SPAN® Bridge Systems at regular intervals or upon request.

16.2.4 The Owner may place an inspector in the plant when the products covered by this specification are being manufactured.

Mechanical tampers or approved compacting equipment shall be used to compact all backfill and embankment immediately adjacent to each side and over the top of each bridge unit until it is covered to a minimum depth of one foot, unless the design fill height is less than 1'-0". The backfill within the Critical Backfill Zone (shown in the diagrams below) shall be placed in lifts of eight inches or less (loose depth). Heavy compaction equipment shall not be operated in this area or over the bridge until it is covered to a depth of one foot, unless the design fill height is less than 1'-0".

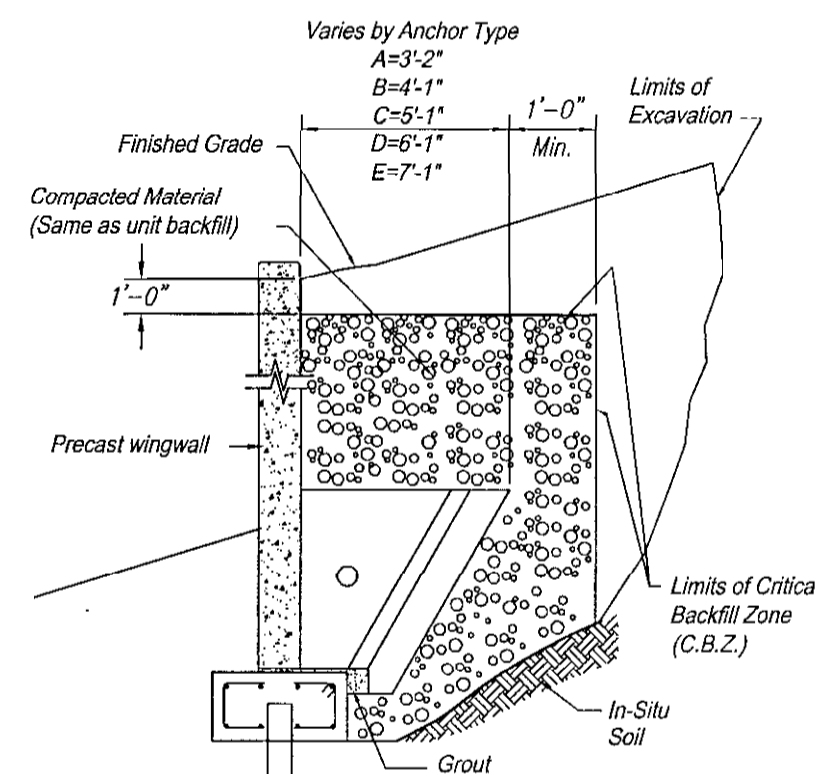
Lightweight dozers and graders may be operated over bridge units having one foot of compacted cover, but heavy earth moving equipment (larger than a D-4 Dozer weighing in excess of 12 tons and having track pressures of eight psi or greater) shall require two feet of cover unless the design cover is less than two feet. In no case shall equipment operating in excess of the design load (HS20 or HS25) be permitted over the bridge units unless approved by CON/SPAN®.

Any additional fill and subsequent excavation required to provide this minimum cover shall be made at no additional cost to the project.

As a precaution against introducing unbalanced stresses in the bridge, when placing backfill at no time shall the difference between the heights of fill on opposite sides of the bridge exceed 24".

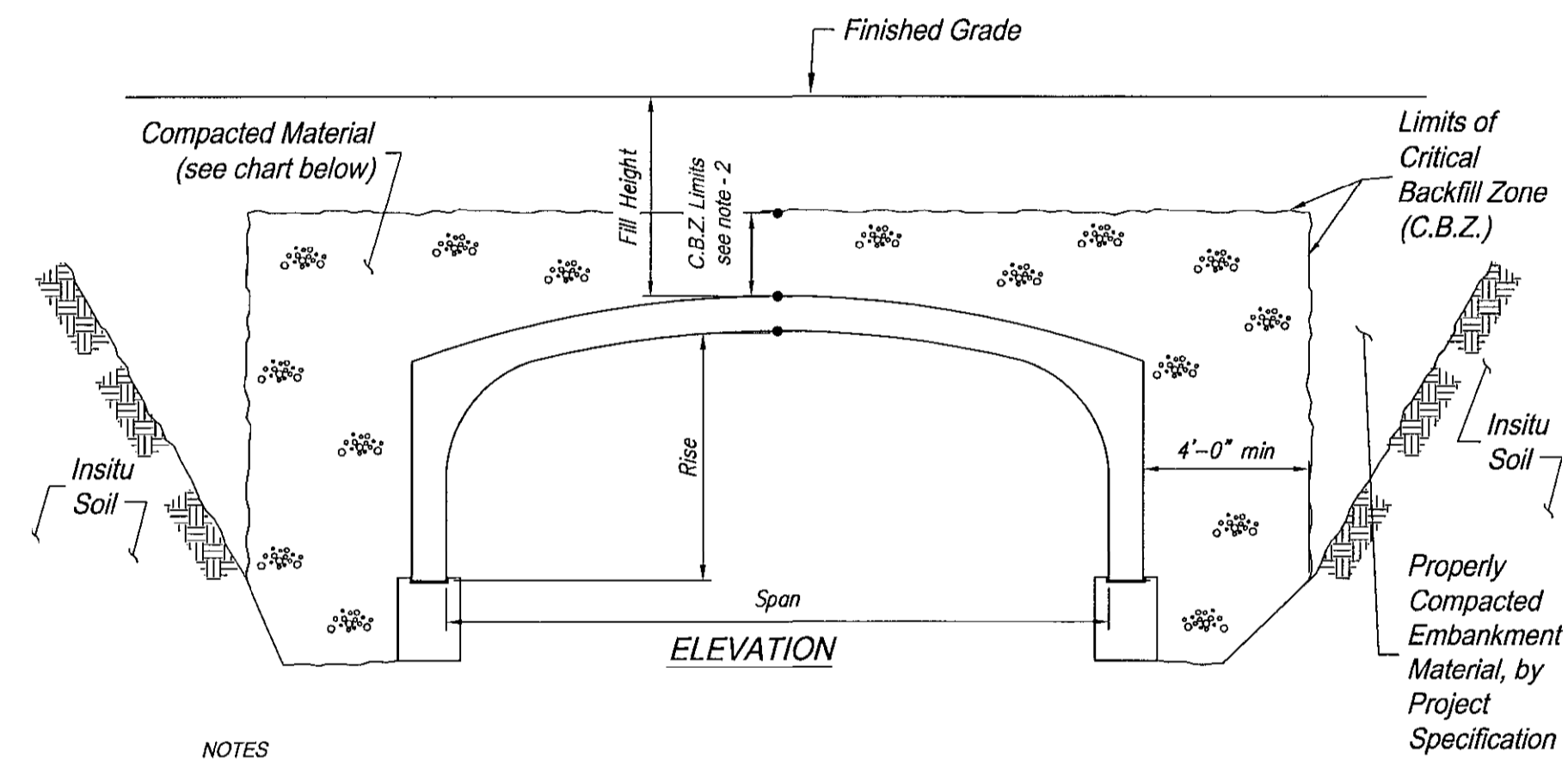
Backfill in front of wingwalls shall be carried to ground lines shown in the plans.

For fill heights over 12 feet, no backfilling may begin until a backfill compaction testing plan has been coordinated with and approved by CON/SPAN® Bridge Systems. Cost of the backfill compaction testing shall be included in the cost of the precast units. This included cost applies only to projects with fill heights over 12 feet (as measured from top crown of arch to finished grade).



WINGWALL BACKFILL REQUIREMENTS

BACKFILL DESCRIPTION (AASHTO M 145-91)							
Group Classification	A-1		A-3	A-2		A-4	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7
Sieve Analysis, Percent Passing (100% Passing 3" Sieve)							
No. 10	50 max.						
No. 40	30 max.	50 max.	51 min.				
No. 200	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	36 min.
Characteristics of Fraction Passing No. 40							
Liquid Limit				40 max.	41 min.	40 max.	41 min.
Plasticity Index	6 max.		N.P.	10 max.	10 max.	11 min.	11 min.
Usual Types of Significant Constituent Materials	Stone Fragments, Gravel & Sand		Fine Sand	Silty or Clayey Gravel and Sand		Silty Soils	
General Rating as Subgrade	Excellent to Good						Fair to Poor



NOTES  
1. SEE CON/SPAN® SPECIFICATIONS SECTION 15.4 FOR BACKFILL SPECIFICATIONS.  
2. FOR FILL HEIGHTS GREATER THAN 2'-0", C.B.Z. LIMIT SHALL BE 2'-0" ABOVE ARCH CROWN. FOR FILL HEIGHTS LESS THAN 2'-0", THE FINISHED GRADE SHALL BE THE BOUNDARY LINE FOR THE C.B.Z.  
3. BACKFILLING OPERATIONS WITHIN THE C.B.Z. SHALL BE PERFORMED IN LIFTS OF 8" OR LESS (LOOSE DEPTH).  
4. MAXIMUM DRY DENSITY SHALL BE DETERMINED BY AASHTO T-99 OR OTHER APPROVED METHODS.  
5. BACKFILL SHALL BE COMPACTED IN LAYERS UNTIL THE DENSITY IS NOT LESS THAN 95% OF THE MAXIMUM DRY DENSITY.

SPAN	FILL HEIGHT	ACCEPTABLE MATERIAL INSIDE C.B.Z.	ACCEPTABLE MATERIAL OUTSIDE C.B.Z.
≤ 24'-0"	≥ 12'-0"	A1, A3	**
≤ 24'-0"	< 12'-0"	A1, A2, A3, A4	**
> 24'-0"	ALL	A1, A3	**

\*\* EMBANKMENT MATERIAL PER PROJECT SPECIFICATIONS

BACKFILL REQUIREMENTS

REVISED 9/1/03 SPEC/DWG  
REVISED 1/15/02 SPEC/DWG  
REVISED 6/12/01 SPEC/DWG  
REVISED 1/20/00 SPEC/DWG  
REVISED 7/14/97 SPEC/DWG  
REVISED 1/14/96 SPEC/DWG  
REVISED 1/14/96 SPEC/DWG  
REVISED 1/14/94 SPEC/DWG  
REVISED 5/25/94 SPEC/DWG  
REVISED 8/10/93 SPEC/DWG



7-13-07

APPROVED: HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS  
Chief, Bureau of Highways \_\_\_\_\_ Date \_\_\_\_\_  
APPROVED: HOWARD COUNTY DEPARTMENT OF PLANNING & ZONING  
Chief, Division of Land Development \_\_\_\_\_ Date \_\_\_\_\_  
Chief, Development Engineering Division \_\_\_\_\_ Date \_\_\_\_\_

GLW GUTSCHICK LITTLE & WEBER, P.A.  
CIVIL ENGINEERS, LAND SURVEYORS, LAND PLANNERS, LANDSCAPE ARCHITECTS  
3909 NATIONAL DRIVE - SUITE 250 - BURTONSVILLE OFFICE PARK  
BURTONSVILLE, MARYLAND 20866  
TEL: 301-421-4024 BALT: 410-880-1820 DC/VA: 301-989-2524 FAX: 301-421-4186

W:\00Plots\14679-E-IN-E-ACT-A04.dwg DES. KTM DRN. RPU CHK. JVP

DATE	REVISION	BY	APP'R.

PREPARED FOR  
OWNER  
WALNUT GROVE HOLDING, L.L.C.  
WALNUT GROVE DEVELOPMENT, INC.  
ROBERT VAN DYKE, PRESIDENT  
10705 CHARTER DRIVE  
SUITE 300  
COLUMBIA, MARYLAND 21044

CONSPAN BRIDGE SYSTEM DETAILS

WALNUT GROVE  
LOTS 1 THRU 88, BUILDABLE PRESERVATION PARCELS "A",  
NON-BUILDABLE PRESERVATION PARCELS "B" THRU "I" AND  
NON-BUILDABLE BULK PARCELS "J"  
L.2927 F.487

ELECTION DISTRICT No. 5

HOWARD COUNTY, MARYLAND

SCALE	ZONING	G. L. W. FILE No.
AS SHOWN	RC-DEO	00153
DATE	TAX MAP - GRID	SHEET
JULY/2007	28 - 18,17	61 OF 78

Designed	KTM	C/S Project No.	14679
Drawn	RPU	Sheet No.	C/S11
Checked	JVP	Date	12/01/06