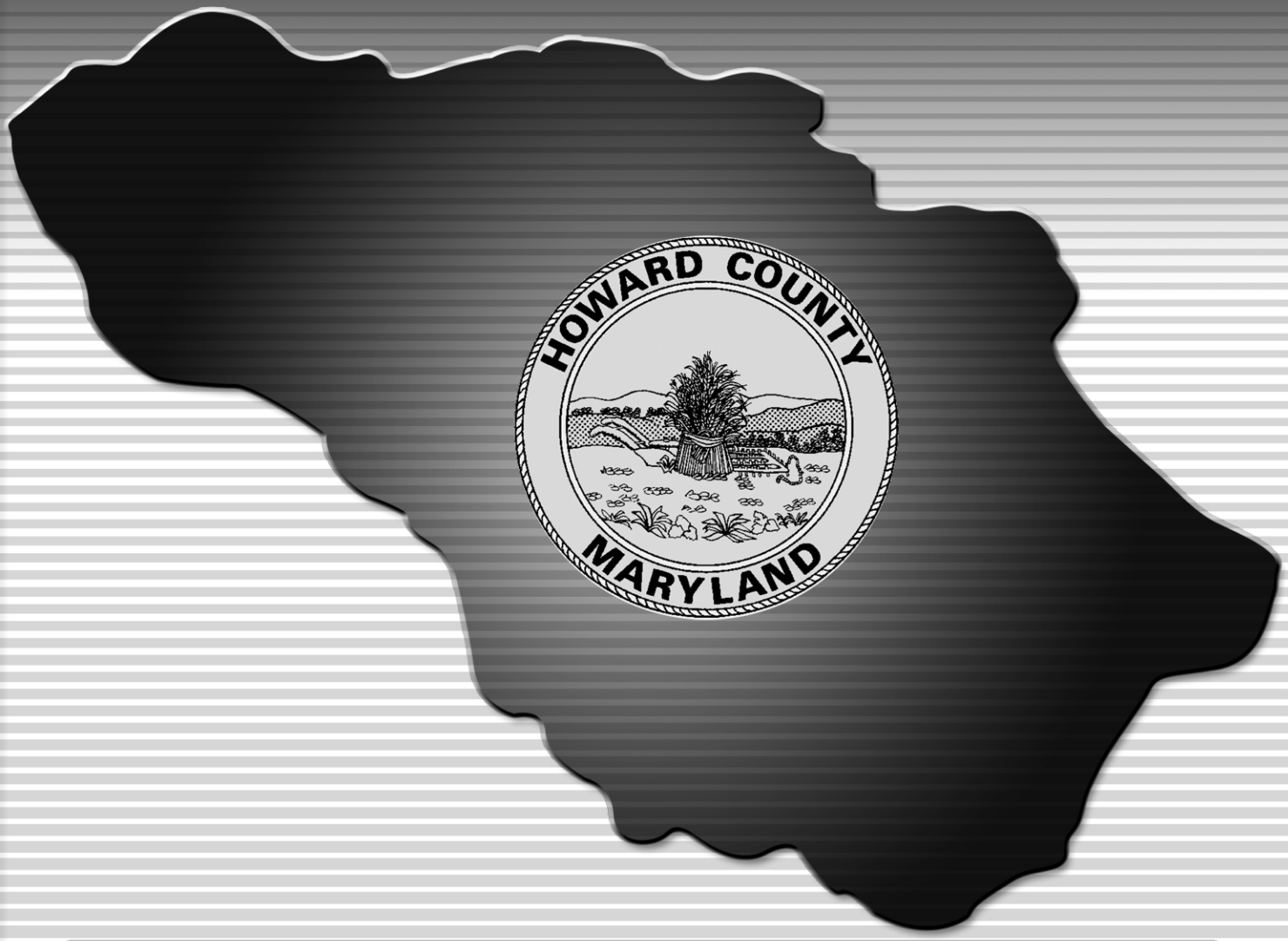
Howard County



Volume IV Design Manual

Standard Specifications and Details for Construction

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VOLUME IV
STANDARD SPECIFICATIONS AND DETAILS FOR CONSTRUCTION

This 2015 edition of the HOWARD COUNTY STANDARD SPECIFICATIONS AND DETAILS FOR CONSTRUCTION - Volume IV, is a revised and updated version of the Design Manual dated May, 2007. This Deign Manual utilizes the SHA "Standard Specifications for Construction and Materials" (July, 2008) and its latest revisions, as a supplement. All revisions, Special Provisions Inserts, and Special Provisions issued by the SHA are either made part of these specifications or adopted by referencing.

Wherever italics font is used in this Standard Specification Design Manual, the italicized text instructs the Design Manual user to amend the referenced SHA Specification by adding or deleting paragraphs, or other editing functions as necessary. These italicized amendments to the SHA Specification shall take precedent over the original SHA text.

The Maryland SHA Specifications, Category 100 through Category 900, will apply to work which is not covered by Volume IV. In the event of any discrepancy between these Specifications and other documents, the following hierarchy will govern:

1. Addenda to Invitation for Bids
2. Information for Contractors
3. Special Provisions
4. Plans (Construction Drawings), see Design Manual Waiver Requirement
5. Technical Specifications
6. Volume IV Design Manual, Standard Specifications and Details for Construction
7. SHA Special Provision Inserts and Special Provisions for January 2001 Specification
8. SHA Standard "Standard Specifications for Construction and Materials" (January, 2001)

When referring to the SHA specifications, all references to the following terminology:

1. "The Administration"
2. "Regional Engineer"
3. "Chief Engineer"
4. "Maryland Standard Method of Tests (MSMT)"
5. "Office of Materials and Technology"
6. "Office of Traffic and Safety"
7. "Office of Bridge Development"
8. "Bridge Inspection and Remedial Engineering Division"
9. "Office of Environmental Design"

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shall be construed to mean the "Howard County Department of Public Works, Bureau of Engineering", unless otherwise directed by Howard County.

Howard County Standard Construction Details are contained in Volume IV. SHA Standard Details are contained in the State of Maryland, Department of Transportation, State Highway Administration "Book of Standards, Highway and Incidental Structures." In the event of a discrepancy between the details in Volume IV and those of the State, the Howard County Standard Details will govern unless otherwise expressly stated in a specific contract document.

Design Manual Waiver Requirement

The Design Manual Waiver Request is provided to the Engineer of Record and Developer as an alternative resolution to their design and construction efforts. If for any reason they find it necessary to use procedures and criteria other than those included in standards, a design professional shall identify the deviations, design objectives, and justification for change in the Design Manual Waiver Request and apply to the County for approval. Alternative design or procedures only can be implemented after County's approval of the request. Refer to each Design Manual Volume for specific requirements of the Design Manual Waiver request.

Howard County Specifications were adopted in December, 1980 and revised in October, 1981; October, 1982; January, 1984; March, 1986; January, 1989; January, 1990; May, 2007; June, 2011;July, 2011 and May, 2014.
At the time of each revision and update, the latest State of Maryland Department of Transportation, State Highway Administration (SHA)," Standard Specifications for Construction and Materials" and " Standard Details" have been adopted and used as supplement to the Howard County Standard Specifications and Details for Construction.

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HOWARD COUNTY
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HOWARD COUNTY GENERAL CONDITIONS
FOR CONSTRUCTION CONTRACTS

GENERAL CONDITIONS

GC-SECTION 1
DEFINITIONS AND TERMS

These General Conditions include certain basic conditions and standard specifications common to all construction projects.

GC-1.01 GENERAL

Wherever in these General Conditions or in other Contract Documents the following terms or abbreviations are used, the meaning shall be as follows:

GC-1.02 ORGANIZATIONAL DEFINITIONS

(a) **Chief Engineer** - Chief of the Bureau of Engineering within the Howard County Department of Public Works.

(b) **Engineer** - The word Engineer will refer to the County's assigned Project Representative within the Howard County Department of Public Works or his/her duly authorized representative.

(c) **County** - The County of Howard County, Maryland, a body corporate and politic.

(d) **Department** - The word Department shall mean the Howard County Department of Public Works.

(e) **Director** - The Howard County Director of Public Works.

(f) **Inspector** - The authorized representative of the Engineer assigned to make detailed inspection for compliance with the Contract Documents of any or all portions of the work, or materials thereof.

(g) **Purchasing Agent** - The Chief Administrative Officer of the County or his/her designee.

(h) **Engineer of Record** - A Professional Engineer registered in the State of

Maryland in a discipline suitable for the work required who is responsible for design and preparation of construction documents. Examples of this are: structural, roadway and underground utility engineering; this term includes geotechnical engineering for design, quality control monitoring and certifying the roadway subsurface.

GC-1.03 DEFINITIONS

1. **Advertisement** - The public announcement, as required by law, inviting Bids for work to be performed or materials to be furnished.

2. **Agencies** - Whenever in the Contract Documents reference is made to any federal, state, or county agency or officer, such reference shall be deemed made to any agency or officer succeeding in accordance with law to the powers, duties, jurisdictions and authority of the agency or officer mentioned.

3. **Award** - The acceptance by the County of the Bid of the lowest responsive and responsible Bidder for the Work, subject to the execution and approval of a satisfactory Contract therefore and Bond when required to secure the performance thereof, and to such other conditions as may be specified or otherwise required by law.

4. **Base Course** - The layer or layers of specified selected material of designed thickness placed on a subbase or a subgrade to support a surface course.

5. **Bid (Also referred to as Proposal)** - A statement of price, terms of sale, and description of the supplies, services, construction or construction-related services offered by a Bidder to the County in response to an Invitation for Bids.

6. **Bid Security** - The security in the form required by the County in the Bid and executed by the Bidder and its Surety. All costs of the Bid Security shall be paid by the Bidder. The Bid Security (when required) shall be in the amount designated by the County as a guarantee on the part of the Bidder to enter into a Contract with the County, if the work of constructing the improvement is awarded to the Bidder, and to post acceptable Payment and Performance Bonds.

7. **Bid Item** - An item of work specifically described in the Invitation for Bids and for which a price, either unit or lump sum, is provided. It includes the performance of all work and the furnishing of all labor, equipment and materials. A Bid Item is synonymous to a contract item or a pay item.

8. **Bid Form** - The approved form on which the County requires Bids to be set forth and submitted.

9. **Bidder** - A Person formally submitting a Bid for the Work contemplated, acting directly or through a duly authorized representative.

10. **Bridge** - A bridge shall be any structure so defined under the FHWA Guidelines. It shall also include any bridge or highway grade separation structure and shall embrace the substructure and superstructure and the approaches thereto, and such entrance plazas, interchanges, overpasses, underpasses, connecting highways and other structures which the County may deem necessary in connection therewith, together with all property rights, easements, franchises and interests acquired by the County for the construction and operation of such bridge.

    For the convenience of and definition by the County, a bridge will also be known as a structure more than 20 feet in span. The County's definition of length shall be the out-to-out dimension of the floor or from back wall to back wall of abutments. Bridges less than 20 feet in span shall be considered culverts or small structures. Culverts may be designated as arches, box culverts, or pipes. For arches, the length shall be clear span. For box culverts and batteries of pipes, the length shall be out to out of outer walls and out to out of shells of outside pipes. For lengths, all dimensions shall be parallel to the center line of the roadway. The dimensions of handrails will not be taken into account in measuring bridge lengths.

11. **Calendar Day** - Every day shown on the calendar, Saturdays, Sundays, and Holidays included.

12. **Change Order** - A written order issued by the Purchasing Agent and approved by the Chief Engineer and the Assistant to the Director of Public Works which changes the Contract Documents within the general scope of the Contract and establishes the basis of payment or credit and/or time adjustments for the work affected by the changes.

13. **Construction Strip** - An area, adjacent to the right-of-way or easement, temporarily acquired for the use of the Contractor during the execution of the work. This area is only present when shown on the plans.

14. **Contingent Item** - Any item listed on the Plans or called for in the Special Provisions and included in the Bid merely for the purpose of obtaining a Contract price in case it may be needed.

15. **Contract** - The written agreement executed between the County and the successful Bidder, covering the performance of the work and furnishing of labor, equipment and materials, by which the Contractor is bound to perform the work and furnish the labor, equipment and materials, and by which the County is obligated to compensate him, therefore, at the mutually established and accepted rate or price.

16. **Contract Documents** - The Contract Documents consist of the Invitation

for Bids, the Bid, the Contract, the Payment and Performance Bonds, General Conditions, Specifications, all Special Conditions, all Drawings, all Addenda, Award Letter, Notice to Proceed, also any written Change orders and Supplemental Agreements that are issued to complete the construction of the work in an acceptable manner, including authorized extensions thereof.

17. **Contract Time or Completion Date** - The number of working or calendar days shown in the Bid indicating the time allowed for the completion of the work contemplated in the contract. In case a calendar date of completion is shown in the Bid, in lieu of the number of working or calendar days, such work shall be completed by that date.

18. **Contractor** - A Person undertaking the execution of the Work under the terms of the Contract Documents acting directly or through its agents or employees.

19. **County Road** - The term "County Road" means any public road in Howard County, excluding State Highways, title to which, or the easement for the use of which, is vested in a public body or governmental agency by grant, condemnation, dedication, or operation of law.

20. **Culvert** - an arched drain for the passage of water under a roadway, driveway, entranceway or other passageway.

21. **Domestic Manufacture** - When referring to metallic items such as structural steel, pipe, reinforcement, bridge rails, etc., the term "Domestic Manufacture" is intended to mean those metals whose final alloying has taken place within the confines of the Continental United States.

22. **Drainage Ditch** - In general, any open water course other than gutters, constructed beyond the limits of cut or fill slopes for excavation or embankment as indicated by the typical section shown on the Plans.

23. **Equipment** - All machinery, tools, and apparatus necessary for the proper construction and acceptable completion of the Work, together with the necessary supplies for operation, transportation, storage, upkeep, and maintenance.

24. **Estimate** - The measurement of quantities by the Engineer or the Inspector of various pay items and/or lump sum items of work based on the Contract definitions for method of measurement and basis of payment for each item.

25. **Extra Work** - Work that was not provided for in the original Contract. Extra Work is synonymous with additional work.

26. **Fixed-Price Contingent Items** - Bid Items for which unit prices are

established by the County to compensate the Contractor for the cost of work and materials in the event that the item may be needed. In the event that a quantity is shown on the Bid sheet for a Fixed-Price Contingent Item, such quantity is intended solely for the purpose of generating a total price extension which will be added to the price totals of items Bid. No representation is made or intended to be made that the quantity shown, or any quantity, will be used.

27. **Holidays**

(1) The County observes a five-day work week and the following holidays:

January 1	-	New Year's Day
January (3rd Monday)	-	Martin Luther King Day
February (3rd Monday)		President's Day
April	-	Good Friday
May (last Monday)		Memorial Day
July 4	-	Independence Day
September (1st Monday)		Labor Day
October 12	-	Columbus Day
November 11	-	Veterans Day
November (4th Thursday)	-	Thanksgiving Day
November (4th Friday)	-	Day after Thanksgiving Day
December 25	-	Christmas Day

(2) If any holiday occurs on Sunday, the following Monday shall be considered a holiday. If the holiday occurs on Saturday, the Friday immediately preceding shall be considered a holiday.

(3) The Contractor will not be permitted to work on the above-mentioned holidays, or Saturdays unless requested 48 hours in advance by written notice. The Engineer will authorize this in writing and the Contractor will not be charged for the inspector's time. In the event that the contractor fails to work its forces as indicated in its written request, it shall be charged a minimum of 1/2 day for inspection time at the overtime rate.

(4) The normal number of working hours per day on this contract will be limited to nine, unless otherwise authorized by the Engineer in writing.

(5) In case of an emergency, which may require that work be done on Saturdays, Sundays, holidays, or longer than nine hours per day, the Contractor shall request permission of the Engineer to do so. If, in the opinion of the Engineer the emergency is bona fide, it will grant permission to the Contractor to work such hours as may be necessary. Also, if in the opinion of the Engineer a bona fide emergency exists, it may direct the Contractor to work such hours as may be necessary whether the Contractor requests permission to do so or not.

28. **Invitation For Bids** - The advertisement soliciting Bids for all work and/or materials on which Bids are required. Such advertisement or Invitation for Bids will indicate with reasonable accuracy the location and magnitude of the work to be done and/or the character and quantity of the material to be furnished and the time and place of the opening of Bids.

29. **Laboratory** - The testing laboratory of Howard County or any other testing laboratory that may be designated by the Engineer.

30. **Materials** - Any substances specified for use in the construction of the Project and its appurtenances.

31. **Median** - The portion of a divided highway separating the traveled ways for traffic in opposite directions.

32. **Notice To Proceed** - A written Notice to the Contractor of the date on or before which it shall begin the prosecution of the work to be done under the Contract.

33. **Payment Bond** - The security in the form approved by the County and executed by the Contractor and its Surety, and paid for by the Contractor, as a guarantee that it will pay, in full, all bills and accounts for materials and labor used in the construction of the work, as provided by law.

34. **Performance Bond** - The security in the form approved by the County and executed by the Contractor and its surety, and paid for by the Contractor, guaranteeing complete performance of the Contract including indemnification, warranties, and repair of latent defects.

35. **Person** - Any individual, partnership, firm, corporation, association, or joint venture authorized to conduct business in Maryland.

36. **Plans or Drawings** - The official plans and drawings issued by the County as part of the Contract Documents, including those incorporated in the Contract Documents by reference. These include the official approved drawings, profiles, typical cross sections, working drawings and supplemental drawings or exact reproduction thereof which show the location, character, dimensions and details of the work to be done. Plans are synonymous with contract drawings.

37. **Profile Grade** - The trace of a vertical plane intersecting the top surface of the proposed wearing surface usually along the longitudinal centerline of the roadbed. Profile grade means either elevation or gradient of such trace according to the context.

38. **Project** - The construction of, reconstruction of, relocation of, or the

major maintenance of any County facility, or portion thereof.

39. **Project Representative** - The executive representative of the Contractor authorized to receive and execute instructions from the Engineer and who shall manage and direct the Project.

40. **Questionnaire** - The approved form or forms upon which the Bidder shall furnish the information as to its ability to perform the work, its experience in similar work, the equipment to be used, and its financial condition as related to its ability to finance the work.

41. **Request For Payment** - The Contractor's formal submittal for payment for work completed, usually on a monthly basis and at the conclusion of the Contract, to the Howard County Department of Finance and the Engineer using the format specified by the Engineer.

42. **Roadside** - A general term denoting the area adjoining the outer edge of the roadbed within the right-of-way. Extensive areas between the roadways of a divided highway may also be considered roadside.

43. **Roadside Development** - Those items necessary to the complete Road or Highway which provide for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching and the placing of other ground covers; such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the Road or Highway.

44. **Road or Street** - Both the word "Road" and the word "Street" include rights of way, roadway surfaces, roadway subgrades, shoulders, median dividers, drainage facilities and structures, roadway cuts, roadway fills, guardrails, bridges, highway grade elimination structures, tunnels, overpasses, underpasses and other structures forming an integral part of a road or highway.

45. **Seal Coat** - An application of bituminous material followed by an application of cover coat aggregate.

46. **Shoulder** - The portion of the roadbed contiguous with the traveled way for accommodation of stopped vehicles, for emergency use and for lateral support of base and surface courses.

47. **Shop Drawings** - All drawings, diagrams, illustrations, schedules, and other data which are specifically prepared by or for the Contractor to illustrate some portion of the work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a supplier and submitted by the Contractor to illustrate material or equipment for some portion of the Work.

48. **Sidewalk, Pathway, or Walkway** - That portion of the roadway primarily constructed for the use of pedestrians.

49. **Slopes** - The inclined graded area beyond the shoulder and extending from the shoulders to the natural undisturbed surface of the ground.

50. **Special Conditions** - Special directions, provisions, or requirements applicable to the Project.

51. **Standard Details** - Detailed drawings with dimensions of components which have been established for general application and repetitive use.

52. **State** - The State of Maryland acting through its authorized agency or representative.

53. **State Highway System** - That system of roads which is from time to time owned by the State and which the State by resolution from time to time designates as State roads to be maintained and operated by the State Highway Administration.

54. **State Road** - Any public road included in the State Highway System.

55. **Subbase** - The layer or layers of specified selected material of designed thickness placed on subgrade to support a base course.

56. **Subcontractor** - Any Person undertaking the construction of a part of the Work by virtue of an agreement with the Contractor, who, prior to such undertaking, received the consent of the Surety and the approval of the County.

57. **Subgrade** - The material in any excavation (cuts) and embankments (fills) immediately below any subbase, base, pavement, shoulder, or other improved course.

58. **Substructure** - All of that part of the structure below bottoms of bearings of simple and continuous spans, skewbacks of arches, and tops of footings of rigid frames, together with the backwalls and wingwalls.

59. **Superstructure** - All of that part of the structure above bottoms of bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, except as noted for Substructure.

60. **Surety** - The approved corporate body bound with and for the Contractor, for the full and complete performance of the Contract, and for the payment of all debts pertaining to the work. When applying to the Bid Bond, it refers to the corporate body that engages to be responsible in the execution by the Bidder of a

satisfactory Contract and the posting of Payment and Performance Bonds.

61. **Surface Treatment** - The application of one or more seal coats with vehicles, exclusive of shoulders and auxiliary lanes.

62. **Trench** - An excavation made for the purpose of installing or removing pipes, drains, catch basins, etc.

63. **Utilities** - Storm drain, sanitary sewers, water mains, gas, electric, and communication equipment and all appurtenances thereto.

64. **Work** - The furnishing of all labor, materials, equipment and other incidentals necessary to the successful completion of the Project and the carrying out of all the duties and obligations imposed by the Contract Documents.

GC-1.04 METRIC SYSTEM

(a) The County recognizes the gradual transition in the construction and other industries to the use of the International System of Units (SI). In keeping with this trend, these General Conditions frequently show approximate equivalencies between U. S. Customary Units and the International System of Units. Selection of units and symbols, conversion, rounding and other matters relating to the equivalencies have been carried out in accordance with AASHTO R-I. Should the necessity for additional conversion arise, the same practice shall be followed.

(b) It is the intent of these General Conditions that where values in both systems are shown in describing a single requirement, the first named will govern regardless of the system from which it is derived.

GC-1.05 LANGUAGE

In order to avoid cumbersome and confusing repetition of expressions in these General Conditions, it is provided that whenever anything is, or is to be, done, if, as, or, when, or where "contemplated, required, determined, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable, suitable, accepted, satisfactory, sufficient, insufficient, rejected, or condemned," it shall be understood as if the expression were followed by the words "by the Engineer" or "to the Engineer" unless the context clearly indicates otherwise.

GC-SECTION 2
BIDDING REQUIREMENTS AND CONDITIONS

GC-2.01 BID IRREVOCABLE

Unless otherwise provided in the Invitation for Bids, Bid prices are irrevocable for 60 days following Bid opening.

GC-2.02 CONTENTS OF BID FORMS

(a) After the date is fixed for the letting of the Work, the County will give notice of such letting to Bidders. The Notice of Letting will contain a description of the proposed Work, the time and place where Sealed Bids will be received, together with information regarding access to information to the Contract Documents, the price of these documents, and the reservation of the right of the County to reject any or all Bids.

(b) All papers included in, bound thereto or attached to the Bid Form are necessary parts thereof and shall not be detached, separated, or altered. All Contract Documents with the exception of subsurface data and borings, will be considered a part of the Bid form whether attached thereto or not. Any subsurface data and borings are provided for informational purposes only, and are not part of the Contract Documents.

(c) The Invitation for Bids shall describe location and type of work contemplated by the Contract and include a listing of pay items. Where pay items are unit price items, the Bid Forms will further show an estimate of quantities expected to occur in such unit price items. The Special Provisions, as needed, shall be included in the Invitation for Bids. The Invitation for Bids will also set forth the place, date and time of opening Bids, the requirements of a Bid Bond and the time to be allowed for completing the Contract. The County may charge a fee for each set of Invitation for Bids and Contract Documents. The amount of such charge will be set forth in the Invitation for Bids. The fee charged for Invitation for Bids and the Contract Documents is not returnable.

(d) Should one or more addenda be issued during the bidding period of this Contract, a certificate of receipt shall accompany such addenda. All certifications of receipts of addenda must be signed by the Bidder and accompany its Bid Form, otherwise its Bid shall not be accepted.

GC-2.03 INTERPRETATION OF QUANTITIES IN BID SCHEDULE

(a) Where designated as estimated quantities, the quantities appearing in the prepared Bid Schedule are approximate only and are prepared for the canvassing of Bids. Payment to the Contractor will be made only for the actual quantities of work performed

or materials furnished in accordance with the Contract and as provided for in GC-4.04, Variations in Estimated Quantities. It is understood that the scheduled quantities of work to be done and materials to be furnished may each be increased, diminished or omitted without in any way invalidating prices Bid, except as hereinafter provided.

GC-2.04 SITE INVESTIGATION

(a) The Bidder acknowledges that it has investigated and satisfied itself as to the conditions affecting the Work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during prosecution of the Work. The Bidder further acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the County, as well as from information presented by the drawings and Specifications made a part of this Contract.

(b) Available subsurface data and the results of subsurface investigations shall be made available to the Contractor. Unless the Contract Documents expressly state otherwise, this data is not guaranteed, warranted, or represented as accurate by the County. Geological conditions should be independently investigated and/or verified by the Bidder prior to submission of its Bid. No adjustment in contract price will be allowed by the County for differing subsurface conditions.

(c) Where subsurface conditions are indicated in the Contract Documents, they have been so indicated from the best information available and for the information of all parties concerned. The County assumes no responsibility for the accuracy of such information and should any Bidder or Contractor rely solely on such information in the preparation of its Bid for the performance of the work, it does so at its own risk. Whether or not subsurface conditions are shown in the Contract Documents, the Bidder or Contractor is not relieved of the responsibility of making its own investigation to determine for itself the conditions present and in what quantity. The presence or absence of a material, or the increase or decrease in quantities indicated, shall not entitle the Contractor to additional compensation above or beyond the stipulated contract sum.

GC-2.05 TAXES-RESPONSIBILITY FOR PAYMENT, EXEMPTIONS, FORMS TO BE FILED, ETC.

(a) The Contractor is responsible for and by submitting a Bid agrees to pay all retail sales, income, real estate, sales and use, transportation and special taxes applicable to and assessable against any materials, equipment, processes and operations incident to or involved in the Project. The Contractor is responsible for ascertaining and acquainting

itself with such taxes and making all necessary arrangements to pay same.

(b) The Contractor shall indicate its Federal Tax Identification or Social Security number on the face of each Request for Payment to the County.

(c) The County hereby reserves the right to withhold payment under this Contract until the Contractor and any subcontractor performing any duties under this Contract have furnished or caused to be furnished the Comptroller of the State of Maryland with all properly completed forms required by the said Comptroller and until all of said retail sales and/or use taxes due the State of Maryland by the Contractor have been paid and the Contractor exhibits a release or receipt from the Comptroller evidencing such payment.

GC-2.06 PREPARATION OF BID

(a) The Bidder shall submit its Bid upon the Bid Form(s) furnished by the County in duplicate. The Bidder shall specify a price in dollars and cents, for each pay item given, and shall show the products of the respective unit prices and quantities written in figures in the column provided for that purpose, together with the total amount of the Bid obtained by adding the amounts of the several items. Bidders must not change any item in the Bid for which a price has been stipulated by the County. Any such change will cause rejection of the Bid.

(b) The Bid Form(s) shall be filled out in ink or typed. All Bids shall be signed in ink. All erasures or alterations shall be initialed by the signer in ink. The Bid, if submitted by an individual, shall be signed by the individual; if submitted by a partnership, shall be signed by such member or members of the partnership as have authority to bind the partnership; if submitted by a corporation, the same shall be signed by an officer and attested by the corporate secretary or an assistant corporate secretary; if submitted by a joint venture, the same shall be signed by such member or members of the joint venture as have authority to bind the joint venture. If not signed by an officer, as aforesaid, there must be attached a copy of that portion of the Bylaws or a copy of a Board resolution, duly certified by the corporate secretary, showing the current authority of the person so signing on behalf of the corporation. In lieu thereof, the corporation may file such evidence with the County, duly certified by the corporate secretary, together with a list of the names of those officers having authority to execute documents on behalf of the corporation, which listing shall remain in full force and effect until such time as the County is advised in writing to the contrary. In any case where a Bid is signed by an Attorney in Fact, the same must be accompanied by a copy of the appointing document, duly certified.

(c) If the Invitation for Bids requires the Bidder to furnish samples or descriptive literature, it shall be submitted with the Bid, unless the Invitation for Bids provides otherwise.

(d) Bidders shall identify those portions of their Bids that they deem to be confidential, proprietary information or trade secrets and provide any justification of why such materials should not be disclosed by the County under the Maryland Public Information Act, Section 10-611 et seq. of the County Government Article of the Annotated Code of Maryland.

GC-2.07 BID SECURITY

(a) No Bid will be considered unless accompanied by a Bid Security of the character and in an amount not less than the specific dollar value indicated in the Bid Form, and made payable to the Howard County Director of Finance.

(b) Acceptable forms of security for Bid Security shall be:

(1) A bond in a form satisfactory to the County underwritten by a surety company authorized to do business in this State and which is on the United States Department of Treasury Approved List; or

(2) A bank certified check, bank cashier's check, or bank treasurer's check.

GC-2.08 DELIVERY OF BIDS

Each Bid must be submitted in a sealed envelope plainly marked to indicate its contents or in an envelope furnished by the County. The blank spaces on the County envelope should be filled in so as to clearly indicate its contents. When sent by mail, the sealed Bid must be addressed to the Howard County Office of Purchasing, 6751 Columbia Gateway Drive, 5th Floor, Columbia, Maryland 21046; Attention: Division Chief. All Bids shall be filed prior to the time and at the place specified in the Invitation for Bids, as amended by any applicable addenda. Bids received after the time for opening of Bids will be returned to the Bidder unopened.

GC-2.09 COMMUNICATIONS AND INTERPRETATIONS - PRIOR TO BID OPENING

Any information regarding the requirements or the interpretation of any provision of the General Conditions, Specifications, Supplemental Specifications, or any part of the Contract Documents shall be requested, in writing, from the Office of Purchasing, and delivered no later than 10 days prior to the scheduled date of Bid opening. Responses to questions or inquiries having any material effect on the Bids shall be made by written addenda, or by written notice sent to all prospective Bidders. DO NOT MAKE VERBAL INQUIRIES. Any verbal interpretations or oral pre-Bid statements made by County employees or their representatives shall not be binding upon the County.

GC-2.10 ADDENDA TO INVITATIONS FOR BIDS

(a) **Form**. Each addendum to an Invitation for Bids shall be in writing and identified as such.

(b) **Acknowledgments.** Unless otherwise provided, the Bidder shall acknowledge receipt of all addenda.

GC-2.11 PRE-OPENING MODIFICATION OR WITHDRAWAL OF BIDS

(a) **Procedure** - Bids may be modified or withdrawn by written notice received in the office designated in the Invitation for Bids before the time and date set for Bid opening. A notice of withdrawal or modification to a Bid must be signed in accordance with the requirements of GC-2.06(b). The requirements of this subparagraph may be satisfied by a FAX.

(b) No withdrawal or modifications shall be accepted after the time for Bid opening except as expressly permitted in the Invitation For Bids. During the Bid opening the successful Bidder on one or more Projects may withdraw its Bid(s) on any other Project(s) which have been submitted prior to the reading of any Bid for that Project(s).

(c) **Disposition of Bid Security -** If a Bid is withdrawn in accordance with this Section, the Bid Security, if any, shall be returned to the Bidder.

GC-2.12 LATE BIDS, LATE WITHDRAWALS, AND LATE MODIFICATION

(a) **Policy** - Any Bid received at the place designated in the Invitation for Bids after the time and date set for receipt of Bids is late. **Any** request for withdrawal or request for modification received at the place designated in the Invitation for Bids after the time and date set for receipt of Bids will not be honored.

(b) **Treatment** - A late Bid, late request for modification, or late request for withdrawal may not be considered. Late Bids will be returned to the Bidder unopened.

GC-2.13 OPENING AND RECORDING OF BIDS

(a) **Opening and Recording** - Bids and modifications shall be opened publicly, at the time, date, and place designated in the Invitation for Bids. The name of each Bidder, the total Bid price, and such other information as is deemed appropriate shall be read aloud or otherwise made available. This information also shall be recorded at the time of Bid opening. The Bids shall be tabulated or a Bid abstract made. The opened Bid shall be available for public inspection at a reasonable time after Bid opening

but in any case before Contract award except to the extent the Bidder designates trade secrets or other proprietary data to be confidential. Material so designated shall accompany the Bid and shall be readily separable from the Bid in order to facilitate public inspection of the non-confidential portion of the Bid. Prices, makes, and model or catalog numbers of the items offered, deliveries, and terms of payment shall be publicly available at a reasonable time after Bid opening but in any event before Contract award regardless of any designation to the contrary at the time of Bid opening.

(b) **Confidential Data** - The Engineer shall examine the Bids to determine the validity of any requests for nondisclosure of trade secrets and other proprietary data identified in writing. Confidential, proprietary information, and trade secrets furnished by a Bidder may be disclosed to another County agency if there is a need for the information and may not be disclosed outside of County government except as provided by the Public Information Act or other applicable laws of this State.

GC-2.14 MISTAKES IN BIDS

(a) **Mistakes Discovered Before Opening** - A Bidder may correct mistakes discovered before the time and date set for Bid opening by withdrawing or correcting the Bid as provided in GC-2.11.

(b) **Confirmation of Bid** - If the Engineer knows or has reason to conclude that a mistake may have been made, the Bidder may be required to confirm the Bid. Situations in which confirmation may be requested include obvious, apparent errors on the face of the Bid or a Bid unreasonably lower than the other Bids submitted. If the Bidder alleges mistake, the Bid may be corrected or withdrawn upon written approval of the County Office of Law if any of the following conditions are met:

(1) If the mistake and intended correction are clearly evident on the face of the Bid form, the Bid shall be corrected to the intended correct Bid and may not be withdrawn. Examples of mistakes that may be clearly evident on the face of the Bid form are typographical errors, errors in extending unit prices, transposition errors, and arithmetical errors.

(2) A Bidder may be permitted to withdraw a low Bid if:

(A) A mistake is clearly evident on the face of the Bid form but the intended correct Bid is not similarly evident; or

(B) The Bidder submits proof of evidentiary value that clearly and convincingly demonstrates that a mistake was made.

(3) In situations where the Purchasing Administrator determines that the low Bid submitted is so low due to a demonstrable mistake other than a mistake in judgment, such that the bidder may incur severe loss if awarded the Contract, and that a

potential unconscionable contract would be made, the Bidder may be allowed to withdraw the Bid, subject to forfeiture of the Bid deposit.

(c) **Mistakes Discovered After Award -** Mistakes may not be corrected after award of the Contract except when the Engineer and the Purchasing Administrator make a determination that it would be unconscionable not to allow the mistake to be corrected. Changes in price are not permitted.

GC-2.15 IRREGULARITIES

(a) **Bids having one or more of the following faults will be considered irregular and may be rejected:**

(1) If the Bid Form furnished by the County is not used or is altered;

(2) If not prepared as directed in 2.06;

(3) If there is an omission of a necessary word(s) or numeral(s) required to make a price unmistakably clear, as well as any other omission; addition of item(s) not called for;

(4) Failure to include a price for each item required except in the case of designated alternate pay item(s) or contrary to the conditions of the advertisement;

(5) If there are additions, conditions or unauthorized alternate Bids.

(6) If the Bidder adds any provisions reserving the right to accept or reject the Award;

(7) If not accompanied by a Bid Security when required from Surety guaranteeing that the Payment and Performance Bonds will be furnished if the Bidder is determined to be the low Bidder; or

(8) If all the required Bid certifications and/or documents are not duly executed.

(b) **Minor irregularities -**

(1) Minor irregularities or informalities in Bids, as defined below, may be waived if the County determines that it shall be in the County's best interest. The County may either give a Bidder an opportunity to cure any deficiency resulting from a technicality or minor irregularity in its Bid, or waive the deficiency where it is to the County's advantage to do so.

(2) When at any public opening of Bids, a Bid appears to be irregular,

as herein specified, this fact may be announced when read. Said Bid shall be read as other Bids and then referred to the Engineer for consideration and appropriate action thereon in accordance with these General Conditions, and applicable laws and regulations.

(3) A minor irregularity is one that is merely a matter of form and not of substance or pertains to some immaterial or inconsequential defect or variation of a Bid from the exact requirement of the Invitation for Bids, the correction or waiver of which would not be prejudicial to other Bidders or offerors. The defect or variation in the Bid is immaterial and inconsequential when its significance as to price, quantity, quality, or delivery is trivial or negligible when contrasted with the total cost or scope of the supplies or services being procured and the intent and meaning of the entire Bid is clear.

GC-2.16 CANCELLATION OF INVITATIONS FOR BIDS

(a) Before Bid opening, an Invitation for Bids may be canceled in whole or in part when the County determines this action is fiscally advantageous or otherwise in its best interest.

(b) When an Invitation for Bids is canceled before Bid opening, the Bids shall be returned unopened to the Bidders submitting them and notice of cancellation shall be included.

(c) When it is determined before an award but after opening that the Invitation for Bids contains inadequate, deficient or ambiguous specifications; does not provide for consideration of all factors; or the scope of the work needs to be modified; then the bid shall be canceled and returned.

(1) Each Bidder shall be notified of the cancellation.

(2) The notice shall state the reason for such action.

GC-2.17 REJECTION OF INDIVIDUAL BIDS OR PROPOSALS

(a) A Bid opened and read at any Bid opening may be subsequently rejected if found to be irregular for any of the reasons specified in GC-2.14.

(b) A Bid opened and read at any Bid opening will be subsequently rejected if there is found to be interest by the same individual, partnership, firm or corporation in more than one Bid on a Contract, except that any individual, partnership, firm or corporation may have an interest in a Contract as a Bidder and also be named in other Bids as a Subcontractor.

(c) Any Bid may be rejected in whole or in part when it is in the best interest of the County to do so.

(d) Reasons for rejection of a Bid may include but are not limited to:

(1) The Bid is not responsive i.e., it does not conform in all material respects to the Invitation for Bids;

(2) Unreasonable price(s);

(3) The Bidder submitting the Bid is determined to be non-responsible, or

(4) The Bidder fails to supply information to the Engineer promptly after notification from the Engineer that such information is required in connection with a determination to be made pursuant to this section.

(e) A determination of non-responsibility may be made for, but is not limited to, any of the following reasons:

(1) Bidder debarred by any public body or ineligible to Bid to any public body and the period of debarment or ineligibility has not expired.

(2) The unit prices contained in a Bid are unbalanced.

(3) Evidence of collusion among Bidders.

(4) Inadequate quantity and/or quality of experience, plant, equipment, financing, manpower or other resources required to perform the Contract.

(5) Bidder's workload which, in the judgment of the County, might hinder or prevent the prompt completion of the subject work if awarded.

(6) Default by the Bidder on other contracts with the County.

(7) Failure to pay or satisfactorily settle all reasonable and just bills due for labor and material on prior or current contracts with the County.

(8) The same person has an interest in more than one Bid on a Contract exclusive of being named by another Bidder as a subcontractor.

(9) Failure to perform satisfactorily on other contracts awarded, and the conditions leading to unsatisfactory performance remain unresolved.

(10) The Bidder is not authorized to conduct business in Maryland.

(11) Any other reason affecting the Bidder's ability to perform, or record of business integrity.

(12) Bidder not otherwise qualified and eligible to receive an award under applicable laws and regulations.

(f) Refusal or failure by the Bidder to comply with the County's request for the submission of a Contractor's Qualifications Questionnaire will be cause for rejection of the Bid and for the forfeiture of the Bid Security, which shall become the property of the County not as a penalty but in liquidation of damages sustained.

GC-2.18 REJECTION OF ALL BIDS

(a) After Bid opening but before award, all Bids may be rejected in whole or in part when the Engineer, with the approval of the Director, determines that this action is fiscally advantageous or otherwise in the County's best interest.

(b) A notice of rejection of all Bids shall be sent to all Bidders, Bids that have been opened shall be retained by the County.

GC-2.19 BID EVALUATION AND AWARD

(a) **General -** The Contract is to be awarded to the lowest responsive and responsible Bidder whose Bid meets the requirements and evaluation criteria set forth in the Invitation for Bids, and is either the lowest Bid or lowest evaluated Bid. After Bids have been publicly opened and read, the Bids will be audited and reviewed for mathematical accuracy to determine that there are no irregularities as outlined in GC-2.14 and 2.15.

(b) **Determination of Lowest Bidder** - Bids shall be evaluated to determine which Bidder offers the lowest cost to the County in accordance with the evaluation criteria set forth in the Invitation for Bids. Except as otherwise provided under GC-2. 14 Mistakes in Bids:

(1) The unit price will govern in the event of a discrepancy between the unit price Bid and the extended price (product of unit price multiplied by the quantity).

(2) The sum of the extended prices will govern in the event of a discrepancy between the total amount Bid and the extended prices.

(3) The written words will govern in the event of a discrepancy between the prices written in words and the prices written in figures.

(4) If a unit price has been omitted, the unit price will be determined by dividing the extended price by the quantity.

(c) The County reserves the right to make the award by Bid Item, or groups of Bid Items, or total Bid if it is in the best interest of the County to do so unless the Bidder specifies in its Bid that a particular or progressive award is not acceptable.

(d) Before any Contract is awarded, the Bidder may be required to furnish a complete statement of the origin, composition and manufacture of any or all materials to be used in the construction of the Work together with samples, which samples may be subjected to the tests provided for in the Specifications to determine their quality and fitness for the Work.

(e) **Award** - Upon determination of the lowest Bidder, review of the Bid for responsiveness and satisfaction that the Bidder is responsible, the Contract may be awarded to that Bidder. A Contract may be awarded to a Bidder offering a higher quality item than that designated in the Invitation for Bids if that Bidder is also the lowest responsive and responsible Bidder. The successful Bidder will be notified (by letter mailed to the address shown on the Bid Form) that its Bid has been accepted and that it has been awarded the Contract.

(f) A Notice of Award may be rescinded by the County at any time prior to execution of the Contract. After Notice of Award, the County shall forward the formal Contract and other appropriate forms and certifications to the Bidder for execution. The Bidder will then execute the Contract and return same, together with fully executed Payment and Performance Bonds, insurance certificates, and any other forms required by the Contract Documents, to the County within ten days after the Notice of Award is sent. After receipt of the properly executed Contract and acceptable Payment and Performance Bonds, the County will execute the Contract and forward the Bidder a copy, together with the Purchase Order signed by the County Purchasing Agent, which is the official statement that the obligation of funds for construction have been authorized. No Bidder shall withdraw its Bid within the time specified in the Bid.

GC-2.20 TIE BIDS

(a) **Definition**. Tie Bids are responsive Bids from responsible Bidders that are identical in price, terms, and conditions and which meet all the requirements and evaluation criteria set forth in the Invitation for Bids.

(b) **Award**. If identical low Bids are received from an in-County and out-of-County Bidder, the award shall be made to the in-County Bidder. If identical low Bids are received from in-County Bidders or from out-of-County Bidders, a drawing shall be conducted, and a witness shall be present to verify and certify the result.

GC-2.21 MULTIPLE OR ALTERNATE BIDS

Unless multiple or alternate Bids are requested in the Invitation for Bids, these

Bids may not be accepted. However, if a Bidder clearly indicates a base Bid, it shall be considered for Award as though it were the only Bid submitted by the Bidder.

GC-2.22 BID PROTESTS

(1) A Bidder may deliver a written protest to the Chief, Office of Purchasing, within 10 days of issuance of award notifications. The written protest shall set forth all particulars supporting the protest and enclose all supporting exhibits and evidence.

(2) The Chief, Office of Purchasing, shall review the protested decision, examine any additional information provided by the Bidder and respond to the Bidder within 10 days of receipt of the protest. The decision of the Chief, Office of Purchasing shall be final and unappealable to the fullest extent allowed by law.

GC-SECTION 3
AWARD AND EXECUTION OF CONTRACT

GC-3.01 AWARD OF CONTRACT (See GC-2.19)

(a) Written Notice of Award shall be sent to the successful Bidder.

(b) The County reserves the right to cancel the award of any Contract at any time before the execution of the said Contract by all parties without any liability against the County.

(c) The successful Bidder on each Contract advertised by the Department will receive upon award five (5) sets of Drawings and Specifications free of charge. Any additional sets required by the Contractor may be purchased at the price stated in the Notice of Letting.

GC-3.02 RETURN OF BID SECURITY

(a) All Bid Securities, except those of the three lowest Bidders, will be returned immediately following opening and the review of the Bids. The Bid Securities of the three lowest Bidders will be returned following the execution of the Contract and submission and approval of the Payment and Performance Bonds. The Contractor has the right to substitute a Bid Bond for other Bid Security, acceptable to the County, at any time prior to return of the Bid Security.

GC-3.03 PERFORMANCE BOND AND PAYMENT BOND REQUIREMENTS

(a) **Performance and Payment Bonds**. The successful Bidder shall provide to the County a Performance Bond and a Payment Bond, each in an amount equal to at least 100 percent of the Contract price. The form of the Bonds and the security shall be acceptable to the County. The name of the underwriting agency for said Bond shall be shown thereon. The Bonds shall be delivered by the Bidder to the **County** no later than the time the Contract is to be executed. If the Bidder fails to deliver the required Bonds, its Bid shall be rejected, its Bid Security shall be enforced, and award of the Contract may be made to the next lowest responsive and responsible Bidder.

(b) Corporations executing Payment and/or Performance Bonds as sureties must appear on the United States Department of Treasury's most current list of approved sureties and must act within the limitations listed therein. In the event that during the performance of the Contract the corporate surety is removed from the Department of Treasury's most current list of approved sureties or its limitation is reduced below the amount of the Payment and Performance Bonds, the Contractor will be in default and will immediately obtain additional or replacement Bonds to the satisfaction of the County.

(c) The Bonds shall be on forms provided by the County.

GC-3.04 EXECUTION OF CONTRACT

(a) The Contract shall be effective only upon receipt by the County of the proper, executed Contract and Performance and Payment Bonds (if required), and execution of the Contract by the County.

(b) After a Notice of Award, as provided in GC-3.01, has been issued to a Bidder, the County shall forward the formal Contract form and the appropriate forms for the Payment and Performance Bonds (if any) to the Bidder for execution. The Bidder will execute the Contract form and return same, together with fully executed Payment and Performance Bonds (if any), to the County within 10 days after receipt of same. After receipt of properly executed Contract form and Payment and Performance Bonds, (if any), the County will execute the Contract within 60 days and forward the Bidder a copy; provided, however, that the Board has approved the Contract (if such approval is required). If the County fails to execute the Contract and the period of irrevocability has expired, the Bidder may, as its sole remedy, withdraw its Bid(s).

(c) If the lowest responsible Bidder is not notified of the County's acceptance of its Bid within sixty (60) calendar days of Bid opening or the time or date otherwise specified in the contract documents, the Contractor shall have the right to withdraw its Bid without penalty.

(d) By executing the Contract, the Contractor represents that it understands the Contract Documents, has obtained clarification as to the intent of these documents, has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated its observations with the requirements of the Contract

Documents. It is assumed the Contractor has obtained, before award of the Contract, clarification of all questions as to the intent of the Contract Documents, and any conflict between two or more items in Contract Documents. Should Contractor fail to obtain such clarification, then the Engineer shall direct work to proceed by the method indicated, specified or required by Contract Documents which will produce the best results, as judged by the Engineer. Such direction by Engineer shall not constitute a basis for any claim for extra cost by Contractor.

GC-3.05 FAILURE TO EXECUTE CONTRACT

(a) Failure of the Bidder to execute the Contract and file acceptable Performance and Payment Bonds within the time aforesaid shall be just cause for the annulment of the Award. The County may then issue an Award to the next lowest responsive, responsible Bidder or the work may be readvertised and constructed under Contract or otherwise, as the County may decide. The Contractor shall immediately upon demand pay over to the County the difference between the amount of its Bid and such larger amount for which the County may, in good faith contract with another party to perform the work covered by contractor=s bid, plus an additional sum of Two Thousand Dollars ($2,000.00) representing the reasonable approximation of the damages suffered by the County for administrative expenses arising out of the Contractor's failure to execute the Contract and/or file acceptable Performance and Payment Bonds. In the event the Contractor fails to make said payment, the County may proceed against the Bid Security and liquidate said Bid Security to the extent necessary to satisfy the demand. In the event the Bid Security is insufficient to fully compensate the County for its demand, the Contractor shall be liable for the unpaid portion of the demand and the County may proceed against the Contractor for the deficiency.

GC-SECTION 4
SCOPE OF WORK

GC-4.01 INTENT OF CONTRACT

(a) The Contractor shall (within specified tolerances) perform all work in accordance with the lines, grades, typical cross sections, dimensions, and other data shown on the Drawings or as modified by written orders including the furnishing of all materials, implements, machinery, equipment, tools, supplies, transportation, labor, and all other things necessary to the satisfactory prosecution and completion of the Project in full compliance with the Contract Documents.

(b) The documents composing the Contract Documents are intended to be complementary, and to describe the construction and completion of the Work. Anything mentioned in the Specifications and not shown on the Drawings and not mentioned in the Specifications, shall be of like effect as if it is shown or mentioned in both. The intention

of the Contract Documents is to include all labor, materials, equipment and other items necessary for the proper execution and completion of the Work and which is reasonably inferable from the Contract Documents to produce the intended results. The terms and conditions of the Contract Documents control over any conflicting terms and conditions of any Purchase Order issued to fund the payments under this Contract.

(c) Words which have well-known technical or trade meanings are used herein in accordance with such recognized meanings. Omissions from the Drawings or Specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the Drawings and Specifications or that are customarily performed shall not relieve the Contractor from performing such omitted or misdescribed details of work, but they shall be performed as if fully and correctly set forth and described in the Drawings and Specifications.

(d) In the event the Contractor discovers any discrepancies in the Contract Documents, it shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the Contract. In the event of any irreconcilable discrepancy between the drawing and figures written thereon, the figures, unless obviously incorrect, will govern over scaled dimensions. In the case of any irreconcilable discrepancy between the Drawings and Specifications, the Drawings govern.

(e) The organization of the Specifications into divisions, sections, and articles, and the arrangement of the Drawings shall not control the Contractor in dividing the Work among Subcontractors, or in establishing the extent of Work to be performed by any trade.

(f) Written interpretations necessary for the proper execution or progress of the Work, in the form of drawings or otherwise, will be issued with reasonable promptness by the Engineer and in accordance with any schedule agreed upon.

(g) All decisions, corrections and interpretations made by the Engineer pursuant to this paragraph GC-4.01 shall be final.

GC-4.02 GENERAL CONDITIONS CONTROLLING

In the event of a conflict between these General Conditions and any other provision of the Contract Documents that cannot be reconciled in accordance with GC-4.01, the job specific provisions of the Contract Documents shall be controlling.

GC-4.03 ENTIRE CONTRACT

(a) The Contract Documents represent the entire and integrated agreement between the parties hereto and supersede all prior negotiations, representations, or

agreements either written or oral. The Contract may only be amended or modified in accordance with these General Conditions.

(b) Unless otherwise expressly set forth herein, the parties hereto do not intend to and do not create any third party beneficiaries to this Contract.

GC-4.04 VARIATIONS IN ESTIMATED QUANTITIES

(a) Where the quantity of a pay item in this Contract is an estimated quantity and where the actual quantity of such pay item varies more than 25 percent above or below the estimated quantity stated in this Contract, an equitable adjustment in the Contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 125 percent or below 75 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Engineer shall, upon receipt of a written request for an extension of time within 10 days from the beginning of the delay, or within a further period of time which may be granted by the Engineer before the date of final settlement of the Contract, ascertain the facts and make the adjustment for extending the Completion Date as in its judgment the findings justify.

(b) When the Engineer directs adjustments to pay item quantities for normal prosecution of work in pursuing the original scope, a Change Order will be executed prior to exceeding contract quantities for that pay item. The Change Order will be based upon the unit prices Bid for that pay item except that when quantities vary more than 25 percent above or below the estimated quantity stated in this Contract, an equitable adjustment shall be made upon demand of either party as set forth above.

(c) Should any Pay Items contained in the Bid be found unnecessary for the proper completion of the Work contracted, the Engineer may, upon written Change Order to the Contractor, eliminate such Pay Items from the Contract under the terms and conditions described above. Such action will in no way invalidate the Contract, and no allowance will be made for items so eliminated in making final payment to the Contractor except as stipulated in this section and/or for such work as may have been done, materials actually delivered and bona fide equipment costs prior to notification of the elimination of the items.

GC-4.05 DIFFERING SITE CONDITIONS

(a) The Contractor shall within seven (7) days of encountering, and before such conditions are disturbed, notify the Engineer in writing of:

(1) Unknown physical conditions at the site of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract and not discoverable in the

Contractor's site investigation required under GC-2.04. Subject to the limitations of 2.04 regarding subsurface conditions, the Engineer shall promptly investigate the conditions, and if it finds that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the Work under this Contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made and the Contract modified in writing accordingly.

(b) The Contractor shall immediately notify the Engineer upon encountering hazardous waste.

(c) No claim of the Contractor under this section shall be allowed unless the Contractor has given notice as required in (a) above. Any claim for an equitable adjustment arising out of said condition shall be furnished to the Engineer within thirty (30) days from the date of the notice under (a) above and shall proceed in accordance with GC-4.06.

(d) No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract.

(e) Failure to provide notice or to submit a claim within the time prescribed herein shall operate as a waiver of any such claim regardless of whether the County incurred or demonstrates any prejudice by the failure to give such notice or to submit such claim.

GC-4.06 CHANGES

(a) The Engineer may unilaterally, at any time, without notice to the Surety, if any, by written order designated or indicated to be a change order, make any change in the Work within the general scope of the Contract Documents, including but not limited to changes:

(1) In the Specifications (including drawings and designs);

(2) In the method or manner of performance of the Work;

(3) In the County-furnished facilities, equipment, materials, services, or site; or

(4) Directing acceleration in the performance of the Work.

An order of the Engineer by virtue of being called or referred to as a "change order" does not necessarily constitute a change in the scope of the Contract or in the work required under the Contract. The Contractor should not be entitled to additional compensation, a time extension or other relief for complying with an order of the Engineer if the Contract otherwise requires the Contractor to perform as stated in the order.

(b) Any other act or event or written or oral order including a direction, instruction, interpretation, or determination from the Engineer shall not entitle Contractor to additional compensation unless the Contractor gives the Engineer written notice stating within seven (7) days of the act or event or of the Contractor's receipt of said order, the date, circumstances, and source of the act or event or of the order and that the Contractor believes that it is entitled to additional compensation. Failure to timely provide said notice shall operate as a waiver of any claim by the Contractor for an equitable adjustment, regardless of whether the County incurred or demonstrates any prejudice by the failure to give timely notice. In the event of a dispute between the Engineer and the Contractor as to whether any work was included in the scope of the Contract such that the Contractor would be obligated to provide that Work at no additional cost to the County, the Engineer may order the Contractor under this Section to perform the Work. If the Contractor considers such an order to be a change in the scope of the Contract entitling the Contractor to additional compensation, a time extension, or other relief, the Contractor must provide the notice required by this subparagraph and initiate a claim therefore in accordance with this Section and other contract requirements.

(c) Any proposal for changed work offered by or requested from the Contractor for which a Change Order is necessary shall include a complete breakdown of labor, materials and equipment along with justification for any increase requested in the contract time. When changed work is to be performed by a subcontractor, a copy of the subcontractor's proposal shall also be included in the submission. When requested by the Engineer, proposals and supporting documentation shall be sent to the Engineer within a reasonable time for its review. Any delay resulting from the failure of the Contractor to submit a complete price proposal within a reasonable time shall not be excused or compensated. The Engineer will process a Change Order upon approval of the Contractor's Bid.

(d) If the Engineer deems that a bona fide emergency exists, it may direct in writing that work proceed prior to issuing an executed Change Order. The Engineer will estimate the quantities and prepare a Change Order for the appropriate contract items. The work shall proceed and the Contractor may file a request for an equitable adjustment as provided by this section.

(e) Except as herein provided, no order, statement, or conduct of the County shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment in the Contract Documents.

(f) Subject to paragraph (g), if any change or order under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the Work under this Contract, an equitable adjustment shall be made and the Contract modified in writing accordingly. Provided, however, that no claim for any change under (b) above shall be allowed for any costs incurred more than seven (7) days before the Contractor gives written notice as therein required.

(g) If the Contractor intends to assert a claim for an equitable adjustment

under this section, it shall, within 30 days after receipt of a written Change Order under (a) above, or a directive under (d) above, submit to the Engineer a written statement setting forth the nature and monetary extent of such claim, including the submission of full particulars of the claim, including a full breakdown of all labor, material, equipment, and subcontractor costs, and full justification for any extension of the Completion Date. As to claims under (b) above supporting data shall be provided with the notice of a claim. As to any supporting data which is not available at the time of the notice, Contractor shall provide with the notice its best estimate of the total cost of the claim and further supporting data shall be provided as soon as it becomes available. As to any claim for Equitable Adjustment asserted under this Contract, the Contractor shall certify that the claim was made in good faith, that the supporting data are accurate and complete to the best of its knowledge and belief, and that the amount requested accurately reflects the contract adjustment for which Contractor believes the County is liable. The failure to timely submit the written statement with full particulars will be deemed a waiver by the Contractor of any right to an equitable adjustment, regardless of whether the County incurred or demonstrates any prejudice by the failure to timely submit the written statement and full particulars, unless this period is extended by the County in writing by the Engineer. The statement of claim hereunder may be included in the notice under (b) above.

(h) When changes involve work for which a Pay Item is included in the Contract, the changed work shall be paid for or a credit provided to the County at the price bid subject to GC-4.04. When changes involve work for which a Bid Item is not included in the Contract, the changed work shall be paid or a credit provided to the County at the unit or lump sum price agreed upon in writing by the Contractor and the Engineer in accordance with GC-4.07. No changed work, except for emergency work, shall be performed until the Contractor has received an executed Change Order. If the Engineer and Contractor cannot agree on the amount of the equitable adjustment, the work shall be done in accordance with GC-9.02.

(i) Each Change Order that affects the Contract price shall be subject to the prior written approval of the Purchasing Agent and other appropriate authorities and to prior certification of the appropriate fiscal authority of fund availability and the effect of the Change Order on the project budget or the total construction cost. If, according to the certification of the fiscal authority, the Change Order will cause an increase in cost that will exceed budgeted and available funds, the Change Order may not be made unless sufficient additional funds are made available or the scope of the Project is adjusted to permit its completion within the project budget.

(j) No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract.

(k) Contractor may not unilaterally “reserve his rights” to file any claims or requests for extensions of time. The Contractor’s rights to additional compensation or time extensions are contingent upon Contractor strictly complying with the Notice, Filing and Certification requirements of the Contract Documents.

GC-4.07 PAYMENT PROVISIONS - CHANGES, EQUITABLE ADJUSTMENTS, DELAYS

(a) Unless the Contractor has been directed to proceed under GC-9.02 (Force Account), if the Contractor is entitled to an equitable adjustment, the cost or credit to the County shall be determined in one or more of the following ways:

(1) by mutual acceptance of a lump sum properly itemized;

(2) by unit prices stated in the Contract Documents or subsequently agreed upon; or

(3) by cost plus a fixed percentage fee.

(b) Under (a)(3) above, the Contractor shall be allowed to add the following maximum percentages for overhead and profit to its costs for labor and materials:

(1) Twenty percent may be added by the Contractor for overhead and profit for work performed by its own forces.

(2) Fifteen percent may be added by the subcontractor for overhead and profit for work performed by the subcontractor; the Contractor may add an additional 5 percent of the subcontractor's costs for labor and materials.

(3) The County may require the Contractor to produce independent audits to verify overhead and profit rates claimed by the Contractor.

(4) The provisions of (a) and (b) above do not apply to Variations In Estimated Quantities as provided for in GC-4.04.

(c) Payment for materials and equipment shall be in accordance with GC-9.02.

(d) Delay Damages.

(1) In the event the Contractor asserts a claim for delay damages it is agreed and understood that the Contractor’s compensation shall be limited to direct costs of any such delay. Direct costs may include extended field overhead costs, idle equipment costs as allowed in GC 9.02(c)(6), and the costs of any directed accelerations and/or material escalations, with an allowance of an additional 10% for Contractor’s overhead and profit on all direct costs allowed herein. No other damages or compensation or loss whether consequential, direct or indirect shall be allowed, including but not limited to damages for:

(a) lost profits;

(b) lost business opportunities;

(c) extended home office or other overhead other than that specified under this subparagraph;

(d) loss of bonding capacity;

(e) lost income;

(f) lost productivity;

(g) consequential damages;

(h) punitive damages;

(i) interference with contractual relations;

(j) any like tort damages;

(k) claim preparation; or

(l) attorney's fees.

(2) Costs claimed, agreed to, or determined pursuant to this section must also be allowable, reasonable, lawful, and allocable to the Work and accounted for in accordance with generally accepted accounting principles. Guidance for any determination of whether the costs allowable, reasonable, lawful, allocable, and accounted for in accordance with generally accepted accounting principles will be provided by the Contract Cost Principles and Procedures of the Code of Maryland Regulations currently in effect, which as of January 1, 1996 were located at COMAR 21.09.01.

(e) In no event shall any dispute over the amount to be paid by the County to the Contractor be cause for the Contractor to cease performance of the Work and in all events the Work shall proceed expeditiously pending the resolution of any such dispute as provided for in the Contract Documents.

(f) All requirements for notices of claim and timely submission of, and certification of, claim statements and full particulars found in GC-4.06 and elsewhere in the Contract Documents are a condition precedent to the Contractor's right to delay or any other type of damages or compensation regardless of whether the County has incurred or demonstrates any prejudice by the Contractor's failure to comply with these requirements.

GC-4.08 UNAUTHORIZED WORK

(a) Unauthorized work shall be at the expense of the Contractor and shall not be measured or paid for by the County. At the Engineer's discretion, unauthorized work may be ordered removed and/or replaced within a reasonable time at the Contractor's expense.

(b) Unauthorized Work includes, but is not limited to:

(1) Work performed by the Contractor before receipt of the Notice to Proceed;

(2) Work contrary to or in disregard of the instructions of the Engineer;

(3) Work performed beyond the lines and grades described in the Plans and Specifications; or

(4) Extra Work performed without written authority.

GC-4.09 FINAL CLEAN UP

(a) Upon completion of the work specified in the Contract and before final payment will be made, the Contractor shall, without charge therefore, disassemble (or demolish) and remove all temporary buildings and other structures built by it. The construction area and all other adjoining areas, occupied by the Contractor during the construction of said Contract, shall be cleaned of all surplus and discarded materials, spilled materials, excess materials left deposited on the Work as a result of the Contractor's operations, false work, and rubbish. The adjoining areas mentioned above, outside the normal pay limits for seeding, will be reshaped, seeded and mulched, according to the Contract Documents at the Contractor's expense. If the disturbed area was part of an established lawn or was maintained as such, the Contractor shall sod the area in accordance with the Contract Documents at its own expense.

GC-4.10 WARRANTY OF CONSTRUCTION

(a) In addition to any other warranties at law or set out elsewhere in this Contract, the Contractor warrants for one year after final acceptance of the Work, that all Work performed under this Contract conforms to the Contract Documents and is free of any defect of equipment, material, or design furnished, or workmanship performed by the Contractor or any of its subcontractors or suppliers at any tier. With respect to any part of the Work which the County takes possession of prior to final acceptance, the warranty on that Work shall run for a period of one year from the date the County takes possession and has beneficial use of that part of the Work. Under this warranty, the Contractor shall remedy

at its own expense any such failure to conform or remedy any such defect. In addition, the Contractor shall remedy at its own expense any damage to County owned or controlled real or personal property, when that damage is the result of the Contractor's failure to conform to the Contract Documents or any defect of equipment, material, workmanship, or design. The Contractor shall also restore any work damaged in fulfilling the terms of this section. The Contractor's warranty with respect to work repaired or replaced hereunder will run for one year from the date of such repair or replacement.

(b) The County shall notify the Contractor in writing within a reasonable time after the discovery of any failure, defect, or damage.

(c) Should the Contractor fail to remedy any such failure, defect, or damage described in (a) above within 15 days after receipt of notice thereof or such longer time as specified in writing by the Engineer, the County shall have the right to replace, repair, or otherwise remedy such failure, defect, or damage at the Contractor's expense.

(d) In addition to the other rights and remedies described in this section, all subcontractors', manufacturers', and suppliers' warranties, express or implied, respecting any work and materials shall, at the direction of the County, be enforced by the Contractor for the benefit of the County. In such case, if the Contractor's warranty under (a) above has expired, any suit directed by the County to enforce a subcontractor's, manufacturer's or supplier's warranty shall be at the expense of the County.

(e) The Contractor shall obtain any warranties that the subcontractors, manufacturers, or suppliers would give in normal commercial practice. If directed by the Engineer, the Contractor shall require any such warranties to be executed in writing to the County.

(f) Notwithstanding any other provision of this section, unless such a defect is caused by the negligence of the Contractor or its subcontractors or suppliers at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the County nor for the repair of any damage which results from any such defect in County furnished material or design.

(g) The warranty specified herein shall not limit the County's rights under the Contract Documents and is only intended to create the right and obligation of the Contractor to correct defective items during the warranty period. Nothing contained in the warranty shall be construed to establish a period of limitation with respect to other obligations which the Contractor has under the Contract and shall not be construed to waive or limit any claims against Contractor or its Surety arising after the expiration of the warranty period, including without limitation, faulty or defective work, indemnification obligations, and failure of the Work to conform to the Contract Documents. Moreover, nothing contained herein is intended to waive or limit any claim the County has or may have against the Contractor or Surety for latent defects appearing in the Work after the expiration of the warranty period.

(h) To secure the County against the nonpayment of such costs resulting from the Contractor's failure to make repairs during the warranty period as set forth herein, the Contractor will be required to post a guarantee bond, in a form acceptable to the County, in the amount of five (5) percent of the total value of the Contract, or $10,000.00 whichever is greater. The guarantee bond shall be posted prior to Final Payment. The guarantee bond must be executed by a surety satisfactory to the County and shall be effective for the longest guarantee period called for in the Contract Documents.

GC-4.11 VALUE ENGINEERING CHANGE PROPOSALS

(a) The Contractor may submit to the Engineer, in writing, Value Engineering Change Proposals (VECP) for modifying the Contract Documents for the purpose of reducing the total cost of construction without reducing design capacity or quality of the finished product. The Engineer will then forward the proposal to the Chief Engineer with recommended action. The decision to accept or deny the proposal will be made by the Chief Engineer. The Chief Engineer will be the sole judge of the acceptability of a VECP. The decision will be final. The County will not consider appeals once the final decision is made. If accepted by the County, net savings resulting from a VECP will be equally divided by the County and the Contractor.

The Contractor may elect to pursue one of the following options:

Option 1 - Submit the detailed Plans, Specifications and estimate of savings;

Option 2 - Submit a written concept of the VECP for tentative approval and if accepted, submit the detailed plans, Specifications, and estimate of savings for final approval at a later date.

(b) Each VECP shall result in a net savings to the Contract cost without impairing essential functions and characteristics of the items or of any other part of the project, including but not limited to service life, reliability, economy of operation, ease of maintenance, desired aesthetics and safety.

(c) As a minimum, the Contractor shall submit the following information before final approval of a VECP can be given:

(1) A statement that the proposal is submitted as a VECP.

(2) A statement concerning the basis for the VECP and benefits to the County together with an itemization of the Contract items and requirements affected by the VECP.

(3) A detailed estimate of the cost under the existing Contract and under the VECP.

(4) Proposed Plans, Specifications and recommendations as to how the VECP changes shall be accomplished.

(5) A statement as to the time by which an extra work order adopting the VECP must be issued so as to obtain the maximum cost effectiveness. Typically, the County will require four weeks to review and approve a VECP.

(6) The Contractor's engineering cost for the VECP.

(d) The County will process the VECP in the same manner as prescribed for any other proposal that would necessitate issuance of a Change Order. The County may accept in whole or in part any VECP by issuing a Change Order which will identify the VECP on which it is based. The County will not be liable to the Contractor for failure to accept or act upon any VECP submitted pursuant to these requirements nor for any delays to the work attributable to any VECP proposal. Until a proposal is effected by Change Order, the Contractor shall remain obligated to the terms and conditions of the existing Contract. If an executed Change Order has not been issued by the date upon which the Contractor's proposal specifies that a decision thereon should be made, or any other date as the Contractor may subsequently have specified in writing, the proposal shall be deemed rejected.

(e) The Change Order effecting the necessary Contract modification will establish the net savings agreed upon, will provide for adjustment in the Contract prices and/or Contract time and will indicate the net savings to be equally divided between the Contractor and the County. The Contractor's costs for preparation of the VECP and the County's costs to review and administer the VECP will be deducted from the gross savings. The County reserves the right to include in the Change Order any conditions it deems appropriate for consideration, approval and implementation of the proposal. The Contractor's 50 percent share of the net savings shall constitute full compensation for effecting all changes pursuant to the Change Order.

(f) Acceptance of the VECP and performance of the work thereunder will not change the Contract time limit as a result of the VECP, unless specifically provided for in the Change Order authorizing the VECP.

(g) The County expressly reserves the right to adopt a VECP for general use in Contracts administered by the County when it determines that the proposal is suitable for application to other contracts. VECPs identical or similar to previously submitted proposals will be eligible for consideration and compensation under this section if such proposals were not previously adopted for general application to other contracts administered by the County. When a VECP is adopted for general use, compensation pursuant to these requirements will be applied only to those contracts awarded and for which the subject VECP has been submitted prior to the date of adoption of the specific VECP.

(h) Proposed changes in the basic design of a bridge or pavement type, or

requiring modification to the right-of-way limits, will not normally be considered as an acceptable VECP. Quantity decreases or elimination of any Contract pay items as a result of changing field conditions, errors, etc. will not be considered as an acceptable VECP. If a VECP is based upon or similar to a change in the Plans, Specifications or Special Provisions adopted by the County prior to submission of the VECP, the Chief Engineer will not accept the proposal.

(i) The requirements herein apply to all VECPs initiated and developed by the Contractor and which are identified as such by the Contractor at the time of its submission to the Chief Engineer; however, nothing herein shall be construed as requiring the Chief Engineer to consider or approve a VECP submitted by the Contractor.

(j) Subject to the provisions contained herein, the County or any other public agency shall have the right to use all or part of any accepted VECP on other projects without obligation or compensation of any kind to the Contractor.

(k) In the event a VECP is accepted by the County, the provisions of the Contract Documents that pertain to adjustment of Contract unit prices due to alterations of Contract quantities will not apply to the items adjusted or deleted as a result of effecting the VECP by Change Order.

GC-4.12 CONTINGENT ITEMS

Construction items for which quantities are identified in the "Contingent Fixed Price Items Unit Schedule" or listed in the "Invitation for Bids Form" are established for the purpose of obtaining bids on one or more pay items that may be incorporated into the Project.

The Engineer shall have sole discretion in determining whether and to what extent such items will be incorporated into the Project. The Engineer may order incorporation of such items at any location within the Contract and at anytime during the Work. These items may not be located on the Plans. The estimated quantities set out in the Invitation for Bids for such items are presented solely for the purpose of obtaining a representative bid price. The actual quantities employed may be only a fraction of, or many times the estimated quantity. The requirements of GC-4.04 (Variations in Estimated Quantities) shall apply.

GC-SECTION 5
CONTROL OF THE WORK

GC-5.01 AUTHORITY OF THE ENGINEER

(a) The Engineer shall decide all questions that may arise as to the quality and

acceptability of materials furnished and work performed and as to the rate of progress of said work; all questions that may arise as to the interpretation of any or all Drawings and Specifications; and all questions as to the acceptable fulfillment of the Contract on the part of the Contractor.

(b) The Engineer shall determine the amount and quantity of work performed and materials that are to be paid for under the Contract.

(c) The Engineer shall have the authority to suspend the work wholly or in part due to the failure of the Contractor to carry out provisions of the Contract.

GC-5.02 CONFORMITY WITH CONTRACT REQUIREMENTS

(a) All work performed and all materials furnished shall be in conformity with the Contract Documents.

(b) In the event the Engineer finds that the materials or the finished product in which the materials are used or the work performed are not in conformity with the Contract Documents and have resulted in an inferior or unsatisfactory product, the Engineer may order that the work or materials be removed and replaced or otherwise corrected within a reasonable time by and at the expense of the Contractor.

(c) In the event the Engineer finds the materials or the finished product in which the materials are used on the work performed are not in conformity with the Contract Documents but that acceptable work has been produced, the Engineer shall then make a determination if the work shall be accepted. In this event, the Engineer will document the basis of acceptance by a Change Order that will provide for an appropriate equitable adjustment in the Contract price. Any action taken pursuant to this section may not result in an increase of the Contract price.

GC-5.03 DISCREPANCIES IN THE CONTRACT DOCUMENTS

In the event the Contractor discovers any discrepancies in the Contract Documents, it shall immediately notify the Engineer. The Engineer will then make such instructions, corrections, and/or interpretations as may be deemed necessary for fulfilling the intent of the Contract Documents. The decision of the Engineer shall be rendered within a reasonable time and shall be final.

GC-5.04 COOPERATION BY CONTRACTOR

(a) The Contractor will keep available on the project site at all times one complete set of Contract Documents.

(b) The Contractor shall give the work the constant attention necessary to facilitate the progress thereof, and shall cooperate with the Engineer and the Inspectors in every way possible.

(c) The Contractor shall assign to the Contract as its agent, a competent Project Representative capable of communicating in English and capable of reading and thoroughly understanding the Contract Documents and thoroughly experienced in the type of work being performed, who shall receive instructions from the Engineer or the Engineer's authorized representatives. The Project Representative shall be satisfactory to the Engineer and shall not be changed or replaced except with the written consent of the Engineer, unless the Project Representative proves to be unsatisfactory to the Contractor and/or ceases to be employed by the Contractor. The Project Representative shall have full authority to execute the orders or directions of the Engineer without delay, and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required. Such management personnel shall be furnished irrespective of the amount of work sublet. Said Project Representative shall be available at all times when the work is in progress on the project site.

GC-5.05 COOPERATION WITH UTILITIES

(a) The Contractor shall consider in its Bid all of the permanent and temporary utility appurtenances in their present or relocated positions and that no additional compensation will be allowed for delays, inconvenience, or damage sustained by it due to any interference from the said utility appurtenances or the operation of moving them.

(b) The Contractor shall have responsibility for notifying all affected utility companies prior to the necessity of performing any work on their utilities and shall cooperate with them in achieving the desired result. All damage to utility facilities caused by the Contractor's operations shall be the responsibility of the Contractor.

(c) Approximate locations of existing utilities are shown on the Drawings. The Contractor shall take all necessary precautions to protect the existing utilities and to maintain uninterrupted service. Any damage incurred due to the Contractor's operation shall be repaired immediately at the Contractor's expense.

(d) The Contractor shall locate existing utilities well in advance of construction activities, clear all utilities by a minimum of Twelve (12) inches, and maintain adequate clearance for utility poles, brace for tunnel as required.

GC-5.06 COOPERATION BETWEEN CONTRACTORS

(a) Separate Contractors on adjoining or overlapping work shall cooperate with each other as necessary. It is the responsibility of all Contractors to ensure that

contiguous work is joined in an acceptable manner. Such cooperation shall include:

(1) Arrangement and conduct of work;

(2) Storage and disposal of materials, etc., by each in such manner as to not unnecessarily interfere with or hinder the progress of the work being performed by other Contractors.

(b) The County and Department shall have the right, at any time, to contract for and perform other work on, near, over or under the work covered by this Contract. In addition, other work may be performed under the jurisdiction of another County agency. In such cases, when a dispute arises among Contractors, the Chief Engineer will decide which of the Engineers will have jurisdiction over said dispute. The Contractor shall cooperate fully with such other Contractors and carefully fit its own work to such other work as may be directed by the Engineer.

(c) In the event of dispute as to cooperation the Chief Engineer will act as referee. The Contractor will make no claims against the County for any inconvenience, delay, inefficiency, costs, expenses, additional overhead, damages, or loss experienced because of the presence and operations of other Contractors.

GC-5.07 AUTHORITY AND DUTIES OF INSPECTORS

(a) Inspectors shall be authorized to inspect all work done and all material furnished. Such inspection may extend to all or any part of the Work and to the preparation, fabrication, or manufacture of the materials to be used. The Inspector is not authorized to revoke, alter, or waive any requirements of the Contract Documents, nor is the Inspector authorized to approve or accept any portion of the Work. The Inspector is authorized to call the attention of the Contractor to any failure of the Work or materials to conform to the Contract Documents. The Inspector shall have the authority to reject materials or suspend the Work until any questions at issue can be referred to and decided by the Engineer. Inspectors shall perform their duties at such times and in such manner as will not unnecessarily impede progress on the Contract.

(b) The Inspector shall in no case act as foreman or perform any duties for the Contractor, nor interfere with the management of the Work by the latter. Any advice, instruction, direction, or other order which the Inspector may give the Contractor shall not be construed as binding the Engineer in any way, or releasing the Contractor from fulfilling all of the terms of the Contract Documents.

(c) Where there is disagreement between the Contractor (or its representative) and the Inspector, such as refusal by the Contractor to use properly approved material, performing work not in compliance with Plans and Specifications, and/or refusing to suspend work until problems at issue can be referred to and decided by the Engineer, the Inspector will immediately direct the Engineer's attention to the issues of disagreement.

If the Contractor still refuses to make corrections, comply, or suspend work (as the case may be), the Engineer will prepare and deliver in writing to the Contractor, by mail or otherwise, a written order suspending the Work or any portion thereof and explaining the reason for such shutdown. As soon as the Inspector is advised of the delivery of the shutdown order, the Inspector shall immediately leave the site of the work and any work performed during the inspector's absence will not be accepted or paid for and may be required to be removed and disposed of at the Contractor's expense.

GC-5.08 INSPECTION OF WORK

(a) All materials and each part or detail of the work shall be subject at all times to inspection by the Engineer or his/her authorized representatives and the Contractor will be held strictly to the materials, workmanship, and the diligent execution of the Work in conformity with the Contract Documents. Such inspection may include mill, plant, or shop inspection, and any material furnished under the Contract is subject to inspection at any time. The Engineer or his/her representatives shall be allowed access to all parts of the Work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

(b) At the Engineer's request, the Contractor, at any time before acceptance of the Work, shall remove or uncover such portions of the Work as may be directed. After examination, the Contractor shall restore said portions of the Work to the standards required by the Contract Documents. Should the Work thus exposed or examined prove acceptable, adjustments in Contract time and price will be made pursuant to Section GC-4.06 for the uncovering or removing, and the replacing of the covering or making good of the parts removed. Should the Work so exposed or examined prove unacceptable, the uncovering, or removing and replacing, shall be at the Contractor's expense.

(c) When the United States Government, the State, or any railroad, corporation, or other public body is to pay a portion of the cost of the Work, their respective representatives shall have the right to inspect the Work under the same conditions as apply to the Engineer and/or the Inspector.

(d) The Contractor is not relieved of any obligation under the Contract because of the approval of non-conforming work by the Inspector, or the failure of an Inspector to detect work that is not performed in accordance with the Contract Documents.

GC-5.09 REMOVAL OF DEFECTIVE WORK

(a) All work and materials that do not conform to the requirements of the Contract Documents will be considered unacceptable, unless otherwise determined acceptable under the provisions in GC-5.02.

(b) Any unacceptable work found to exist, whether the result of poor workmanship, use of defective materials, or damage through carelessness or any other cause, shall be removed and replaced within a reasonable time with work and materials that shall conform to the Contract Documents or shall be remedied otherwise in an acceptable manner authorized by the Engineer.

(c) Upon failure on the part of the Contractor to comply promptly with any order of the Engineer made under these General Conditions, the Engineer shall have authority to cause defective work to be remedied or removed and replaced and unauthorized work to be removed and to deduct the costs from any monies due or to become due the Contractor under this Contract.

GC-5.10 LOAD RESTRICTIONS

(a) The Contractor shall comply with all State, County, and local requirements pertaining to speed, size and weight of motor vehicles.

(b) The County may specify in the Contract load restrictions on any road or structure within the vicinity of the Project.

(c) The Contractor shall take into account any and all posted bridges, the crossing of which might be contemplated by the Work. No loads in excess of posted limits will be allowed in the prosecution of the Work on any Contract, unless the required permits are obtained from the appropriate State, County, and local government agencies.

(d) The Contractor shall consider possible detrimental effects of operating heavy paving and grading equipment contiguous to retaining walls, pipe culverts, arches, forms for concrete work, or construction existing prior to this Contract.

(e) The Engineer shall have the right to limit passage of heavy equipment (plus loads) when such passage or usage is causing apparent or visible damage to embankments, paving, structures, or any other property.

GC-5.11 MAINTENANCE OF WORK DURING CONSTRUCTION

(a) The Contractor shall maintain the work during construction and until Final Acceptance. This maintenance shall constitute continuous and effective work prosecuted as required with adequate equipment and forces to the end that all parts of the work be kept in satisfactory condition at all times.

(b) Particular attention shall be given to drainage, both permanent and temporary. The Contractor shall use all reasonable precautionary measures to avoid damage or loss that might result from accumulations and concentrations of drainage water, and material carried by such water and such drainage shall be diverted or removed

when necessary to prevent damage to excavation, embankments, surfacing, structures or property. Suitable measures shall be taken by the Contractor to prevent the erosion of soil in all construction areas where the existing ground cover has been removed.

(c) All cost of maintenance work during construction and before Final Acceptance shall be included in the price Bid (or in the unit price Bid on the various Bid Items as the case may be) and the Contractor will not be paid additional amount for such work, except as otherwise provided in the Contract Documents.

(d) In the event that the Work is ordered shut down, the Contractor shall maintain the entire Project as provided herein, and shall provide such ingress and egress for local residents or tenants adjacent to the Project, for occupants of the Project, for the County, the Engineer, the Inspectors, and for the general public as may be necessary during the period of suspended work or until the Contract has been terminated for convenience or for default.

(e) On projects where traffic flow is maintained, the Contractor shall be responsible for repair of all traffic damages to the Work, either partially or totally completed, until such time as the work is accepted by the Engineer. Responsible, as used here, shall mean the responsibility for restoration and the cost thereof unless otherwise expressly provided for in the Contract Documents.

GC-5.12 FAILURE TO MAINTAIN ENTIRE PROJECT

If the Contractor, at any time, fails to comply with the provisions of GC-5.11 above, the Engineer may immediately notify the Contractor to comply with the required maintenance provisions. In the event that the Contractor fails to remedy unsatisfactory maintenance within 24 hours after receipt of such notice, the Engineer may at his/her sole option immediately proceed with adequate forces and equipment from any source to maintain the Project, and the entire cost of this maintenance will be the responsibility of the Contractor and may be deducted from any monies due the Contractor.

GC-5.13 CLAIMS

(a) All disputes arising under or as a result of a breach of this contract and all requests for an equitable adjustment in the terms of the Contract Documents that are not resolved by mutual agreement shall be resolved in accordance with this section. All requirements for notices of claims and timely submission of, and certification of, claim statements and full particulars found elsewhere in the Contract Documents are a condition precedent to the Contractor's right to proceed under this section regardless of whether the County has incurred or demonstrates any prejudice by the Contractor's failure to comply with these requirements.

(b) As used herein, "Claim" means a written demand or assertion by one of

the parties seeking, as a legal right, an equitable adjustment including the payment of money, adjustment or interpretation of the Contract Documents, or other relief, arising under or relating to this Contract.

(1) A voucher, invoice, or request for payment that is not in dispute when submitted is not a Claim under this section. However, where the submission is subsequently not acted upon in a reasonable time, or is disputed either as to liability or amount, it may be converted to a claim for the purpose of this section.

(2) A Claim by a Contractor shall be made in writing and submitted to the Engineer for decision. A Claim by the County shall be set forth in a decision by the Chief Engineer.

(c) Any Claim of the Contractor against the County for an equitable adjustment, including extensions of time, extra compensation, or damages, whether under this Contract or otherwise, shall be conclusively deemed to have been waived by the Contractor, regardless of whether the County has incurred or demonstrates any prejudice, if not submitted with the following documents and within the time specified:

(1) The Claim shall be set forth in writing describing the specific fact or event that is the basis of the Claim.

(2) The Claim must be accompanied by itemized supporting data supporting the Claim and specifically identifying the actual cost, both direct and indirect, that the Contractor has incurred or will incur by reason of the fact or event that is the basis of the claim for an equitable adjustment.

(3) The accuracy of the supporting data shall be certified under GC-4.06 and signed by an officer or principal of the Contractor.

(4) Unless an extension has been granted by the County, the Claim must be received by the Engineer within thirty (30) days after the fact or event to which the Claim is attributed became known or should have become known to the Contractor.

(d) Review and Response - The Engineer will have 30 calendar days from receipt of the claim to review and respond to the Claim, provided the Contractor has complied with (c) above. In the event that the Engineer does not provide the Contractor with a response within 30 calendar days of receipt to a properly submitted Claim, the Claim shall be considered denied and the Contractor shall proceed with an appeal to the Chief Engineer as set forth below or the Claim will be forever waived and barred.

(e) Appeal to the Chief Engineer

(1) The Contractor may appeal the decision of the Engineer to the Chief Engineer, in writing, provided the Contractor has complied with GC-5.13(b) and (c) above. The appeal shall contain the complete package of information submitted to the

Engineer for consideration and must be filed with the Chief Engineer within 14 days after the Engineer's decision or deemed denial. Unless specifically requested by the Chief Engineer, in writing, the Contractor will not be permitted to submit information that was not offered to the Engineer for review.

(2) The Chief Engineer will have 30 calendar days from receipt of the Claim to review and respond to the Claim and shall issue a written decision on the Claim.

(3) The Chief Engineer's decision on claims not exceeding 10 percent of the original contract value or $50,000.00 (whichever is greater) shall be the final decision of the County. If a claim exceeds 10 percent of the original contract value or $50,000.00 (whichever is greater), the Contractor may appeal the decision of the Chief Engineer to the Director.

(f) Appeal to the Director or his/her Designee

(1) All references to the "Director" shall be deemed to include the Director or his/her Designee.

(2) The Contractor may appeal the decision of the Chief Engineer to the Director, in writing, provided the Contractor has complied with GC-5.13. The Contractor's appeal shall contain the complete package of information submitted to the Chief Engineer for consideration and must be filed with the Director within 14 days after the Chief Engineer's decision. Unless specifically requested by the Director, in writing, the Contractor will not be permitted to submit information that was not offered to the Chief Engineer for review. At the sole option of the County, the Appeal to the Director may be designated in writing to the Contractor as a proceeding under Md. Code Ann. Art. 25A, §1A "Determination By County Officer Subject To Court Review". In this event, a formal hearing shall be held before the Director and the Contractor shall have the right to call witnesses and submit documents or other evidence whether or not previously offered to the Engineer or to the Chief Engineer as well as such other rights as are provided in the Howard County Administrative Procedure Act.

(3) The Director will have 30 calendar days from receipt of the Claim, or from the close of any hearing conducted pursuant to Md. Code Ann. Art. 25A §1A, to review and respond to the Claim, and shall issue a written decision on the Claim.

(4) The Director's decision shall be the final decision of the County.

(g) The Contractor may appeal the County's final decision by filing a complaint with the Circuit Court for Howard County, Maryland within 14 days after the written final decision is issued. The applicable provisions of the Annotated Code of Maryland, including but not limited to Article 25A, §1A, and the Maryland Rules shall govern the conduct of the proceedings before the Circuit Court and shall govern all further appeals.

(h) The failure of the Contractor to timely file any appeal described herein shall forever bar and waive the claim regardless of whether the County incurred or demonstrates any prejudice resulting from the Contractor's failure to timely file any such appeal.

(i) Pending resolution of the Claim, the Contractor shall proceed diligently with the performance of the Contract in accordance with the Engineer's decision.

GC-5.14 SHOP DRAWINGS

(a) **General.** The Contractor shall provide for review and approval submittals such as shop drawings, product data and samples to determine compliance with all applicable laws, statutes, ordinances, codes, orders, rules and regulations; and to determine whether the work, when completed, will be in compliance with the requirements of the Contract Documents.

(1) Shop drawing review shall be as set forth below to ensure that the equipment, materials and installation methods are in accordance with the construction contract documents.

(2) The Drawings will be supplemented by such drawings as are necessary to adequately control the work. All authorized alterations affecting the requirements and information given on the Drawings shall be in writing and approved by the Engineer. When at any time reference is made to the plans, the interpretations shall be based on the Drawings as affected by all authorized alterations then in effect.

(3) The Contractor shall provide at its expense all necessary and required shop drawings and shall have them adequately checked, after which they shall be submitted to the Engineer for review. The Engineer may reject or disapprove such drawings and return them for revisions, in which case the Contractor shall submit new additional or revised drawings as required. No items involving such drawings shall be incorporated in the Work until those drawings have been accepted for use by the Engineer in connection therewith.

(4) All shop drawings shall have a standard title block at lower right corner approximately 4 inches by 8 inches (2 inches for revision column on left side and remaining 6 inches for title) indicating the following information in the order named:

A. Name of Contractor (and subcontractor, if applicable)
B. Address of above
C. Sheet Title (reinforcing details, etc.)
D. Name of Facility
E. For (Howard County, Maryland)
F. By (indicate name of Contractor's official or engineer, or other parties authorized to sign official documents)

(5) The Contractor shall list all County contract numbers and the date the drawings were completed. The left portions of the title block shall be headed "Revisions" and the space used as needed.

(b) At the discretion of the Engineer, shop drawings, and/or calculations for other aspects of the work shall be stamped and signed by a professional Engineer (P.E.) registered in the State of Maryland who has a minimum of five years of experience in the relevant discipline. The submittal shall include the P.E.'s resume showing evidence of the required experience. The P.E.'s Drawings and design calculations shall evaluate and qualify all products and components including manufactured products and proprietary items for their intended service. Acceptance by the Engineer of such drawings and/or calculations shall not in any way relieve the Contractor of the responsibility for the safety and adequacy of the design and construction for the falsework systems and operations, including all components.

(c) **Submittal Process:** The Contractor shall submit the specified number of copies of each shop drawing, submittals and final approval data to the Engineer and his designated consultant for review and approval prior to incorporating materials and/or equipment into the work. Unless otherwise specified, the Contractor shall submit eight (8) copies for each item submitted plus the number of copies the Contractor desires to have returned.

(1) Details of shop drawings, data, and literature for fabricated materials or equipment to be incorporated in the Work shall be submitted to the Consultant for review for general compliance with the Contract Documents before fabrication. The Contractor shall obtain manufacturer's shop drawings, certifications, and other pertinent data for conformance with all requirements of the Drawings and Specifications, and in ample time to permit satisfactory progress of the Work. After completion of such checking and verification by the Contractor, the Contractor shall sign and stamp the drawings, which stamp shall state as follows:

CHECKED BY:_____ _____
(Checker's Name) (Date)

SIGNED BY: _____ _____
(Contractor's Name) (Date)

(2) All data, drawings, and correspondence from subcontractors, manufacturers, or suppliers shall be routed through the Contractor. The Contractor is further advised that the Engineer and his designated representatives will not act as coordinators between suppliers and subcontractors. All required coordination shall be the complete responsibility of the Contractor.

(3) At the time of each submission, the Contractor shall call to the Engineer's attention, in writing, any deviations that the shop drawings may have from

the requirements of the Drawings and Specifications. The Contractor shall also provide a list prioritizing the submittals for review. In the event that such a list is not furnished by the Contractor, the Engineer shall exercise discretion regarding the order in which submittals are reviewed. This list shall be attached to each applicable submittal.

(4) The Engineer and his designated consultant will review, stamp, and sign each copy of the accepted shop drawings and submittals with "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".

(5) No extra measurement or payment shall be made for compliance with the requirements of this section of these General Conditions. All costs shall be included in the applicable items.

(6) Corrections or comments made on the shop drawings during review do not relieve the Contractor from compliance with the requirements of the Drawings and Specifications. The County will not be responsible to Contractor for errors or omissions on drawings furnished by the Contractor even though drawings containing such errors or omissions are inadvertently accepted. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; and in performing his work in a safe manner. If the shop drawings deviate from the Contract Documents, the Contractor shall request a deviation from the Contract Documents by submitting to the Engineer a written request accompanying the shop drawings. If this data is not provided with the shop drawings, or is not adequate, the shop drawings shall be rejected and returned to the Contractor.

(7) The Contractor's attention is specifically directed to the fact that no items shall be fabricated, nor equipment or materials ordered nor any construction performed, prior to acceptance of shop drawings and submittals applicable thereto. However, to expedite the project, the Contractor may request, in writing, authorization from the Engineer to order critical items before formal acceptance of the shop drawings but not prior to shop drawing submittals. NO items unless so authorized shall be ordered until drawings are accepted.

(8) It shall be the responsibility of the Contractor to make all the necessary changes in other items, which result from deviations or changes requested by the Contractor and accepted by the Engineer or its consultant, so that all items perform the original requirements and intent of the Contract Documents.

(d) A maximum of two (2) submissions of each submittal will be reviewed, checked, and commented upon without charge to the Contractor. The cost to review submittals (over two submissions) will be deducted from the Contractor's monthly invoice, or from monies retained under the provisions of the Specifications, amounts will be based upon actual additional costs to the County for the additional reviews. It is, therefore, incumbent upon the Contractor to make all modifications and/or corrections as may be required by the Engineer in an accurate, complete, and timely

fashion.

GC - SECTION 6
CONTROL OF MATERIAL

GC-6.01 GENERAL

All materials shall meet all quality requirements of the Contract. In order to expedite the inspection and testing of materials, the Contractor shall notify the Engineer in writing of the materials and the sources from which it proposes to obtain all materials requiring approval, testing, inspection or certification prior to incorporation into the Work. This submittal shall be made within 10 days after receipt of the Notice to Proceed.

GC-6.02 APPROVAL OF MATERIAL SOURCES

(a) **Approval** -- The Engineer will inform the Contractor as to the acceptability of each material and its source as soon as an evaluation of the sources proposed can be made. No material may be incorporated into the Work until approval of the source has been given. Where delivery of materials to the job site is made prior to approval, such delivery is made at the Contractor's risk and subject to immediate removal, at no cost to the County, if it is determined that the source or the material is not acceptable.

(b) **Rejection** - Material sources may be rejected even though prior samples met the applicable Specifications. Where it is evident to the Engineer that the material tends to be of marginal quality, as compared to the Specification tolerances in one or more of its properties, the material source may be rejected.

(c) **Approval Withdrawn** - All source approvals are made subject to continuing production of materials meeting the Specifications. If the materials do not continue to meet the specifications, the approval of any source may be withdrawn by the Engineer at any time. The Contractor shall have or assert no claim against the County for an equitable adjustment when such approvals are withdrawn because the materials fail to meet specifications.

(d) **Substitutions** -

(1) After the Contract has been executed, the Engineer will consider a written request by the Contractor for the substitution of products in place of those specified, under the following conditions:

(A) the request is accompanied by complete data on the proposed substitution substantiating compliance with the

Contract Documents, including project identification and description, performance and test data, references and samples where applicable, and an itemized comparison of the proposed substitution with the products specified or named by addenda, with data relating to contract time schedule, design and artistic effect where applicable, and its relationship to separate contracts.

(B) the request is accompanied by accurate cost data on the proposed substitution in comparison with the product specified, whether or not modification of the contract sum is to be a consideration.

(2) Request for substitution when forwarded by the Contractor to the Engineer, are understood to mean that the Contractor:

(A) represents that it has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

(B) will provide the same guarantee for the substitution as was required for that item originally specified;

(C) certifies that the cost data presented is complete and includes all related cost under the Contract, and that it waives all claims for additional costs related to the substitution that subsequently become apparent; and

(D) will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be completed in all respects in conformity with the Contract Documents.

(3) Substitutions will not be considered if:

(A) they are indicated or implied on shop drawing submissions without written request as set forth above; or

(B) for their implementation they require a substantial revision of the Contract Documents in order to accommodate their use.

(4) No substitution will be approved without the Contractor remitting to the County the difference between the cost to the Contractor of the substitution and the specified item. The substitution must be less expensive than the specified item. The County reserves the right to disapprove any substitution at its sole discretion.

GC-6.03 APPROVAL OF PLANTS AND SHOPS

(a) Five days after receipt of Notice to Proceed, the Contractor shall submit in writing for the Engineer's approval the location and ownership of those plants or fabricating shops at which materials for the project will be processed.

(b) The Engineer will inform the Contractor as to the acceptability of the proposed plants or shops within ten (10) days after receipt of the submittal specified in (a) above. No material is to be shipped from these sources until this approval has been given.

(c) Plant or shop approvals are made subject to continuing production of materials meeting the Specifications. Where this condition is not met, the approval of any plant or shop may be withdrawn by the Engineer at any time. The Contractor shall have or assert no claim against the County for damages or time extensions when such approvals are withdrawn.

GC-6.04 SAMPLES, TESTS, CITED SPECIFICATIONS

(a) All materials used in the Work will be inspected, sampled, and tested in accordance with these requirements and such others as are set forth elsewhere in the Contract Documents where particular reference is made to a specific material. Unless otherwise designated, tests will be made in accordance with the most recently published cited standard tentative or interim methods of AASHTO, ASTM, AWWA or others that are current on the date of the Notice of Letting. These tests will be made by and at the expense of the County unless otherwise expressly required in the Contract Documents.

(b) Acceptance testing by the County as described here and elsewhere is not to be considered as a replacement for quality control testing conducted by the Contractor or a manufacturer producing materials for the Contractor. When the Contractor or manufacturer is not providing adequate quality control testing facilities in its own behalf, the Engineer may refuse to carry out resampling and testing of materials that have been shown to be defective by normal sampling and testing routines. The Engineer may also refuse to resample and test defective materials until and unless corrective action has been taken by the Contractor or manufacturer. The Contractor shall have or assert no claim against the County for damages or time extensions when such approvals are withdrawn.

GC-6.05 CERTIFICATION OF COMPLIANCE

(a) The Engineer may permit use prior to sampling and testing of a particular material or assembly accompanied by a Certificate of Compliance from the manufacturer stating that such materials or assembly fully comply with the requirements of the

Contract. The Certificate shall be signed by the manufacturer and notarized, and submitted to the Engineer for review and approval prior to the material being incorporated into the Work.

(b) A Material or assembly used on the basis of the manufacturer's Certificate of Compliance may be sampled and tested at any time and, if found not to be in conformity with the Contract requirements, will be subject to rejection whether in place or not, at no cost to the County.

(c) The form and distribution of the manufacturer's Certificate of Compliance will be as approved by the Engineer.

(d) The County reserves the right to refuse permission for use of a material or assembly on the basis of a Certificate of Compliance.

GC-6.06 PROJECT CONTROL TESTING

(a) Materials from approved sources, plants, or shops will be subject to control tests by the Engineer at such locations and with such frequency as it deems appropriate.

(b) The point or points of sampling will be those points at which required physical or chemical properties are to be met. It is intended that insofar as is practical these points will be the points in the production process just prior to inclusion into the Work or into combination with other materials. It is also intended that sampling and testing be conducted in such a manner and at such points as to minimize interference with the maintaining of an efficient schedule by the Contractor. Where the nature of the work precludes the attainment of both of these ends simultaneously, the Engineer will designate the points of sampling in a manner so as to ensure compliance with the Contract Documents.

(c) While it is required that all materials will conform to the specified values for all properties, the Engineer may designate different points of sampling and different sampling intervals for separate characteristics of any material.

(d) The Contractor shall assist in the sampling of materials and make provision for safe and reasonable access.

(e) The Engineer may elect where possible to sample and test lots of material at the point of manufacture. In this case, lots may be given approval and where practical so marked by the Engineer. This procedure assumes that consistent production and appropriate storage, handling and shipping practices shall be maintained by the manufacturer, the hauler and the Contractor. Such approval does not preclude subsequent inspection, sampling and/or testing of materials at the job site with acceptance or rejection being predicated on the results of these later procedures.

GC-6.07 STORAGE AND HANDLING OF MATERIALS

(a) Materials shall be so stored as to assure the preservation of their quality and acceptability for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the Work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the right-of-way or project site may be used for storage purposes and for the placing of the Contractor's plant and equipment; such storage areas must be restored to their original condition by the Contractor at its expense. The Contractor will be required to furnish the appropriate traffic control devices to warn and protect the public. Any additional space required must be provided by the Contractor at its expense.

(b) Materials shall be handled in such a manner as to preserve their quality and acceptability for the work. Handling equipment and hauling vehicles shall be so constructed as to prevent loss, contamination or segregation of materials during or after loading.

GC-6.08 UNACCEPTABLE MATERIALS

(a) Materials represented by samples taken and tested in accordance with the specified tests and failing to meet required values shall be considered to be defective regardless of prior tests or approvals.

(b) Unless otherwise allowed by the Engineer as set forth below, defective materials shall be removed from the site with any tags, stamps or other markings implying conformance with Specifications removed or obliterated.

(c) Where defects can be corrected, the Contractor may propose such corrective action as it deems appropriate to the Engineer. The Engineer may approve the corrective action but in so doing does not assume responsibility for the success thereof. At the Contractor's expense retests will be made to determine the acceptability of the material after corrective measures have been taken. No person other than the Engineer may change any provision of the Specifications or the Contract without written authorization. The County reserves the right not to accept damaged materials for use in the Work.

(d) The cost of replacing, correcting, and/or removal of defective material will be the responsibility of the Contractor and the Contractor shall not assert a Claim for an equitable adjustment for said cost.

(e) The cost of repairing or replacing other materials damaged by the installation, correction, and/or removal of defective materials will be the responsibility of the Contractor and the Contractor shall not assert a Claim for an equitable adjustment for said cost.

GC-6.09 MATERIAL FURNISHED BY THE COUNTY

(a) The Contractor shall furnish all materials required to complete the Work, except those specified to be furnished by the County. Materials furnished by the County will be delivered or made available to the Contractor at the point or points specified in the Contract Documents. The cost of handling and placing all materials, after they are delivered to the Contractor, shall be considered as included in the Contract price for the item in connection with which they are used.

(b) The Contractor shall be held responsible for all material delivered to it, and deductions will be made from any monies due it to make good any shortages and deficiencies, from any cause whatsoever, and for any damage that may occur after such delivery, and for any demurrage charges.

(c) In cases where materials are supplied by the County and incorporated in the Contract Work by the Contractor, materials inspection and acceptance will not be prerequisite for acceptance of the final product as the product pertains to these items.

GC-SECTION 7
LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

GC-7.01 COMPLIANCE WITH LAWS

The Contractor hereby represents and warrants that:

(a) It is qualified to do business in the State of Maryland and that it will take such action as, from time to time hereafter, may be necessary to remain so qualified;

(b) It is not in arrears with respect to the payment of any monies due and owing the State of Maryland, or the County, or any department or unit thereof, including, but not limited to the payment of taxes and employee benefits, and that it shall not become so in arrears during the term of this Contract;

(c) The Contractor shall keep fully informed of all Federal, State, and local laws, ordinances, rules and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, rules, ordinances, regulations, orders and decrees; he shall protect and indemnify the County and its representatives against any such claim or liability arising from or based on the violation of any law, ordinance, regulation, order or decree, whether by Contractor or its employees, subcontractors or suppliers and any tier.

(d) All requirements set forth in Federal assistance instruments applicable to this Contract shall be satisfied.

GC-7.02 PERMITS AND LICENSES

(a) Except as provided in Section 7.02(b), the Contractor shall procure such permits and licenses as may be necessary in order to comply with Federal, State, County, and local laws, ordinances and regulations in performance of the work. All permits issued by the County will be at no charge. The Contractor will be responsible for securing and paying for all other permits, governmental fees, landfill fees and licenses necessary for the proper execution and completion of the Work. It shall further give all notices necessary and incidental to the due and lawful prosecution of the Work, including notification to appropriate code enforcement agencies.

(b) Federal permits from the U. S. Corps of Engineers and/or the Environmental Protection Agency will be obtained by the County, and the Contractor shall comply with the requirements of such permits. Permits required from the Maryland State Highway Administration (SHA) will also be obtained by the County and the Contractor shall comply therewith. However, any permits required by these Federal or State agencies which are not required by the Specifications but are desired by the Contractor for temporary structures or other such uses must be applied for and obtained by the Contractor.

(c) The Contractor will not be permitted to move over or operate on any road (except on the road under construction) any power shovels, rollers, concrete mixers, cranes, tractors or any other heavy equipment of weight or dimensions in excess of Maryland Motor Vehicle Law and regulations without first obtaining all necessary permits.

(d) Soil borings or test pits for soil determination in improved roads are not to be excavated by the Contractor, unless permission is obtained from the Howard County Department of Public Works.

GC-7.03 RESTORATION OF SURFACES OPENED BY PERMIT

The right to construct or reconstruct any utility in the road/street and/or to grant permits for same at any time is hereby reserved by Howard County.

Upon the presentation of a duly authorized and satisfactory permit which provides that all necessary repair work shall be paid for by the party to whom such permit is issued, the Contractor shall allow parties bearing such permits to make openings in the highway.

When ordered by the Engineer, the Contractor shall make in an acceptable manner all necessary repairs due to such openings. If such necessary work is part of this Contract, all costs associated with these repair shall be borne by the Contractor. If it is determined that the costs for such repairs are not the Contractor's responsibility, they will be paid for as extra work under the appropriate unit price items provided for in the Contract. When no such unit price items are provided in the Contract, the costs shall be determined as set forth in GC-4.06.

GC-7.04 PATENTED DEVICES, MATERIALS AND HEALTH STANDARDS

If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, it shall provide for such use by suitable legal agreement with the patentee or owner and a copy of such agreement shall be filed with the County. If no such agreement is made or filed as noted, the Contractor and the surety shall indemnify and save harmless the County, any affected third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, materials or process, or any trademark or copyright, and shall indemnify, protect and save harmless the County, its officers, agents and employees with respect to any claim, action, cost, expense, attorney's fees, damages or judgment for patent, trademark or copyright infringement, arising out of purchase or use of materials, construction, supplies, equipment or services covered by this Contract.

GC-7.05 FEDERAL PARTICIPATION

When the United States Government and/or the State of Maryland pays all or any portion of the cost of a Project, the Work shall be subject to the inspection of the appropriate federal and/or state agency. Such inspection shall in no sense make the federal and/or state governments a party to this Contract, shall not constitute approval of Work not in conformity with the Contract Documents, and will not interfere, in any way, with the rights of either party hereunder.

GC-7.06 CONSTRUCTION SAFETY AND HEALTH STANDARDS

(a) It is a condition of this Contract, and shall be made a condition of each subcontract entered into pursuant to this Contract, that the Contractor and any subcontractor shall not require any laborer or mechanic employed in performance of the Work to work in surroundings or under working conditions that are unsanitary, hazardous, or dangerous to its health or safety, as determined under construction safety and health standards and regulations under Federal, State or local law.

(b) The Contractor and each subcontractor shall permit inspection without delay and at any reasonable time on any premises where the Work is being performed by a federal or state inspector authorized to investigate compliance with the above

mentioned federal and state statutes and regulations.

(c) The Contractor further agrees to correct any violations found to exist during such inspection within a reasonable time after the issuance of any citation, unless it contests the validity thereof through the appropriate administrative and judicial process.

GC-7.07 PUBLIC CONVENIENCE AND SAFETY

The Contractor at all times shall conduct the work in such a manner as to ensure the least practicable obstruction to all forms of traffic. The convenience of the general public, tenants, and of the residents along and/or adjacent to the improvement shall be provided for. Equipment and/or materials stored upon the Project shall be placed so as to cause a minimum of obstruction to the public. Sprinkling shall be performed at the direction of the Engineer. The Contractor shall, unless otherwise specified, provide and maintain in passable condition such temporary access, roads and bridges as may be necessary to accommodate traffic diverted from the Project under construction, or using the Project under construction and shall provide and maintain in a safe condition temporary approaches to, and crossings of the Project. Existing County facilities planned to be removed, but which might be of service to the public during construction are not to be disturbed until other and adequate provisions are made. Existing mailboxes shall be maintained or reset in positions accessible to the public and to mail deliveries during construction and subsequent to construction in their final locations in a satisfactory condition. On County facilities occupied by railroad tracks, temporary platforms for the entrance and exit of passengers to and from the railway cars shall be provided and maintained in an approved manner by the Contractor. Fire hydrants on or adjacent to the project shall be kept accessible to fire apparatus at all times, and no material or obstruction shall be placed within 15 feet of any such hydrant. All footways, gutters, sewer inlets and portions of the project adjoining the work under construction shall not be obstructed more than is absolutely necessary. Work closed down for the winter or at any other times shall be left entirely accessible at all points to fire apparatus. Where the construction lies within rights-of-way, the County has or will obtain permission from the owner of the property to occupy, during construction, construction strips outside the limits of the rights-of-way as shown on the drawings. The Contractor shall not move any equipment or materials in the rights-of-way or construction strips and shall not commence any clearing within rights-of-way until authorized to do so by the Engineer.

GC-7.08 MAINTENANCE OF TRAFFIC

(a) The purpose of this section of the General Conditions is to provide for the safe and continuous maintenance of traffic (both vehicular and pedestrian) through the project site and to minimize accidents and accident severity while at the same time minimizing inconvenience to the traveling public and the Contractor.

(b) The Contractor will be required to adhere to the Traffic Control Plans,

and to the Manual on Uniform Traffic Control Devices (MUTCD), current edition. In lieu of complying with the above, the Contractor has the option of preparing and submitting a Traffic Control Plan (TCP) of its own design. The TCP developed by the Contractor may not be utilized until it is approved, in writing, by the Chief Engineer.

(c) All work for maintenance of traffic shall be performed in accordance with Section 104 of the SHA Standard Specifications for Construction and Materials.

(d) All provisions and methods for maintaining traffic shall comply with the requirements of the Manual of Uniform Traffic Control Devices (MUTCD), current edition. Also, all materials, devices and flagging procedures shall conform to the requirements of MUTCD. The Contractor shall provide, maintain in first class condition, and move when necessary and/or directed, all traffic control devices used for the guidance and protection of vehicles.

(e) Traffic must be maintained at all times through the entire length of the Project, and traveled lane(s) of the Road may be closed with the approval of the Chief, Bureau of Engineering. Throughout the period of construction, traffic is to be maintained by implementing one or more of the Traffic Control Plans (TCP's) included in the Standards of Highway and Incidental Structures of the Maryland State Highway Administration. In addition, flaggers will be used where and when deemed necessary by the Engineer.

(f) The Contractor shall provide a sufficient number of flagmen and take all necessary precautions for the protection of the Work and safety of the public, all as indicated in the MUTCD.

(g) Marking for Work Areas:

(1) All existing and new signs that may cause driver confusion during various stages of construction shall be either removed, covered, or altered subject to the approval of the Engineer.

(2) All existing and new pavement markings that may cause driver confusion during various stages of construction may be removed by any method that the Engineer approves, provided that they are removed and not painted over.

(3) The entire signing and marking procedure shall be reviewed by the Engineer prior to its initiation and shall not be utilized until approved by the Engineer.

(4) No temporary paint striping will be permitted. The Contractor will be required to furnish, install, and maintain temporary pavement marking tape which shall delineate lane configuration through each stage of construction.

(5) Pavement marking tape used on this project shall be a type similar to "Scotchlane Highway Grade" for temporary pavement marking or approved equal.

The Engineer will determine which tape is to be used for each stage of construction and may limit the Contractor to a specific type at its discretion.

(6) The Engineer will continually monitor the condition of the tape and shall direct the immediate removal and replacement of any tape which becomes deteriorated under the use of traffic. The Contractor will be responsible to install the tape in accordance with manufacturer's specifications, and will continually monitor the condition, of the tape and shall notify the Engineer to approve the immediate removal and replacement of any tape that becomes deteriorated under the use of traffic. Manufacturer's specifications for tape installation shall be submitted to the Engineer for its approval.

(7) All pavement markings used shall be temporary and removable along points of traffic lane shifts and detours caused by construction activities. All such markings shall be placed at the time traffic patterns are actually altered and promptly removed at such time traffic patterns are restored to normal lines.

(h) Sign on Windmaster-type sign supports within the limits of the work zone shall be mounted in such manner that the bottom of the sign is at least one foot off the ground.

(i) The channelization devices shall be a minimum of Type II barricades or plastic reflective drums with Type C steady burn lights (2 faces) attached to the inner barricades. The first barricade in either direction will have attached to it a Type A low intensity flashing light (2 faces). All Type III barricades will have attached to them 2 Type A low intensity flashing lights.

(j) Traffic cones used shall be 36" in height with the predominant color being orange in accordance with section 6C-3 of the MUTCD. No improvisations will be accepted. Nighttime use of traffic cones shall require a white reflective sleeve.

(k) No equipment or materials shall be stored or permitted to stand unprotected where traffic is maintained, or where they would restrict adequate intersection sight distance. At the conclusion of each working day, the Contractor shall store all equipment and materials in protected areas (behind guardrails) or remove them to a minimum distance of 30’ from where traffic is maintained.

(l) Any earth or surfacing material that may be dropped on the surface where traffic is being maintained, shall be removed immediately to avoid creating a slippery or hazardous condition.

(m) The Contractor will be required to designate a traffic manager prior to any work being done. The traffic manager will be responsible for the proper implementation of the TCP and for maintaining a regular surveillance over all aspects of traffic control and safety.

(n) The cost of maintenance of traffic shall be included in the appropriate lump sum and unit prices bid. Where no unit prices or lump sum items are provided, the cost will be provided for in other items in the contract. This would include all costs associated with the maintenance of traffic including the furnishing, placement, maintenance, removal, related labor, tools, equipment and incidentals such as lights, cones, flags, vests, flaggers, traffic manager, and temporary traffic signs, etc.

(o) With the appropriate traffic control and appurtenances, the Contractor will be permitted to work normal working hours with the following exceptions: there will be no work allowed that requires a traffic lane to be closed between the hours of 7:00 am. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m., unless permission is granted by the Engineer. Also, full traffic capacity must be restored at the end of each work day, unless approved by the Engineer. See also GC 1.03 - Holidays.

(p) The County reserves the right to modify or explain the methods of traffic control specified herein and to restrict the working hours if, in the opinion of the Engineer, the Contractor's operations are a detriment to traffic.

(q) Failure to comply with this section will result in an immediate order to stop work at no expense to the County.

GC-7.09 MAINTENANCE OF TRAFFIC FOR PRIVATE AND COMMERCIAL PROPERTIES

(a) The County has obtained various permits, rights-of-way, and working strips along the line of work as indicated on the Drawings. The Contractor will schedule its work so as to cause the least amount of inconvenience to commercial and private properties. Where such properties have more than one entrance to the establishment, the Contractor may close one entrance to the establishment with the approval of the Engineer. Work on the second entrance shall not proceed until the first closed entrance is fully completed, all trenches are capped with crusher run and two (2) inches of cold patch material, and the entrance is opened to traffic. At locations where only one entrance exists, the Contractor will confine its work to not more than one-half (1/2) of the entrance. The Contractor will bring the first half to completion before work continues through the remainder of the entrance. The Contractor will maintain at all times continuous vehicular ingress and egress to commercial properties.

(b) Once work is started through a private driveway or entrance, the Contractor will be required to complete the work before ending operations for the day, unless approved by the Engineer. Unless the Contractor has submitted to the Engineer written approval from the property owner, no private driveways or entrances will remain closed overnight. Written approval must be provided to the Engineer prior to commencement of work through the driveway or entrance.

(c) There will be no measurement and payment for this item; the cost will be

included in the unit prices Bid for other appropriate Bid Items.

GC-7.10 ACCESS TO RAILROAD RIGHTS-OF-WAY

(a) **COUNTY'S RESPONSIBILITIES**. Where the Contractor is required to perform work within the rights-of-way of any railroad, the County has made arrangements with that railroad authority for written approval.

(b) **CONTRACTOR'S RESPONSIBILITIES**. Where the Contractor desires to enter onto railroad property or establish a temporary crossing of the railroad property for its own convenience and operation, the Contractor shall make its own arrangements with the railroad and provide written approval from the railroad authority for the use of any private crossing.

All work on portions of structures over railroad rights-of-way shall conform to all rules and regulations of the owners of the rights-of-way. The Contractor is hereby made responsible for acquiring full knowledge of these rules and regulations and complying therewith to the satisfaction of the owners of the railroad rights-of-way. Where the County has entered into a license agreement or other written arrangement with the railroad authority pertaining to work within the railroad's right-of-way, the Contractor acknowledges the terms and conditions of said agreement and agrees to be bound by these terms and conditions as if fully set forth herein.

(c) **COORDINATION OF WORK.** All work to be performed by the Contractor within the railroad right-of-way shall be done in a manner satisfactory to the railroad company and shall be performed at such times and in such manner as not to unnecessarily interfere with the movement of trains or traffic upon the track of the railroad company. The Contractor shall exercise all care and precaution in order to avoid accidents, damage, unnecessary delay or interference with the railroad company's trains or other property, and the Contractor shall indemnify and hold harmless the County for the Contractor's failure to exercise such care and precaution.

(d) **INSURANCE REQUIREMENTS.** Prospective Bidders on contracts crossing railroad rights-of-way are advised that the Contractor will be required to obtain, pay for and have approved by the railroad, certain broad forms of public liability and property damage insurance policies as set forth in the Special Provisions, before entering upon the railroad property. In situations where the Contractor requires access to railroad property for convenience, the Contractor shall communicate directly with the railroad authority for written approval. As a general rule, details of such policies are set forth in the Special Provisions; but in the event of an omission from the Special Provisions, the Contractor shall communicate directly with the railroad authority so as to ascertain type of insurance required, if any, and make provisions for same in the proposal.

Unless otherwise provided in the Proposal, costs of insurance policies whether described in the Special Provisions or ascertained by the Contractor will not be provided

for in any special item and the cost shall be considered incidental to the several items set forth in the proposal.

GC-7.11 PRESERVATION AND RESTORATION OF PROPERTY

(a) The Contractor shall not enter upon public or private property (outside of the right-of-way or construction strip) for any purpose without obtaining permission and it shall be responsible for the preservation of all public and private property, trees, monuments, signs and markers and fences thereon, and shall use every precaution necessary to prevent damage or injury thereto.

(b) All County signs and markers that are affected by the Work shall be carefully removed when grading operations begin and delivered to the Engineer. The Contractor shall take suitable precautions to prevent damage to underground or overhead public utility structures; shall protect carefully from disturbances or damages all land monuments and property markers until the Engineer has referenced their location; and shall replace them as directed by the Engineer.

(c) The Contractor shall be responsible for all damage or injury to property of any character during the prosecution of the work, resulting from any act, omission, neglect or misconduct in its manner or method of executing said Work, or at any time due to defective work or materials, and said responsibility shall not be released until the Work shall have been completed and accepted. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the Work or in consequence of the non-execution thereof on the part of the Contractor, it shall restore, at its own expense, such property to a condition similar to, or equal to, that existing before such damage or injury, in an acceptable manner. In case of the failure on the part of the Contractor to restore such property or make good such damage or injury, the Engineer may, upon 48 hours notice, proceed to repair, rebuild or otherwise restore such property as may be deemed necessary and the cost thereof will be deducted from any monies due or which may become due the Contractor under this Contract.

(d) **Protection Of Geodetic Control Monuments** - It shall be the Contractor's responsibility to protect all geodetic monuments within the limits of Work. The Contractor shall carefully protect all geodetic control monuments from disturbance or damage until such time as the Howard County Survey Division has referenced or relocated the monuments. All geodetic control monuments damaged or disturbed by the Contractor shall be replaced by the County at the Contractor's expense. The Contractor shall coordinate the preservation of all geodetic control monuments with the Howard County Construction Inspection Division.

(e) **Protection Of Property Corners** - All property corners not shown on the drawings that are encountered by the Contractor during the course of construction shall be protected from disturbance or damage until the Engineer has referenced their

locations. All property corners shown on the plans that are disturbed or damaged by the Contractor shall be reestablished by a licensed surveyor at the Contractor's expense. Any property corners found during the course of construction which were not shown on the drawings, shall be replaced by the County if disturbed during construction.

(f) **Discovery Of Historical Objects** - Whenever historical objects and burial sites of archaeological or paleontological value are encountered during the course of construction, such objects shall not be disturbed. Work shall be stopped and rescheduled in such a manner as to avoid the objects and the Engineer notified immediately. The Engineer will arrange for an evaluation by the appropriate authorities and for the ultimate disposition of the objects.

(g) **Protection Of Existing Landscape Features** - Special attention shall be given to the landscape features of the Work and special care taken to protect the natural surroundings unless otherwise noted on the Drawings. The Contractor shall not deface, damage, destroy, remove or cut trees or shrubs without special authority. The roots of trees or shrubbery which are not to be cleared, shall not be cut and no heavy equipment of any type shall be allowed to stand under such trees or shrubbery.

(h) **Removal Of Trees, Roots And Stumps** - Selected trees within the right-of-way or construction strip, which in the opinion of the Engineer can be saved, shall be protected by the Contractor with boards or planks so that they will not be defaced, bruised, or damaged by the Contractor's equipment or operation. Unless otherwise indicated in the Contract Documents, all trees may be felled in the rights-of-way, utility or drainage easements and construction strips. Trees marked on the Drawings to be protected in the right-of-way or construction strip shall be protected in the manner described above. Stumps, roots, branches and other debris shall be removed from the site unless otherwise noted or directed by the Engineer.

GC-7.12 LAND, AIR AND WATER POLLUTION

(a) The Contractor shall incorporate all permanent sediment and erosion control features into the Work at the earliest practicable time as required by the Contract Documents. Temporary pollution control measures will be used by the Contractor to correct conditions that develop during construction that were not foreseen during design; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the Project.

(b) The Contractor's attention is directed to the fact that temporary pollution control may include control measures outside the right-of way or project site where such work is necessary as a direct result of project construction. The Engineer shall be kept advised of all such off-site control measures taken by the Contractor. This shall not relieve the Contractor of the basic responsibilities for such work.

(c) In case of failure on the part of the Contractor to control erosion, pollution, or siltation, the Engineer reserves the right to employ outside assistance or to use its own forces to provide the necessary corrective measures. All expenses incurred by the Engineer or the County in the performance of such duties for the Contractor will be the responsibility of the Contractor and may be withheld from monies due to the Contractor.

(d) Contractors and suppliers must submit evidence to the County that the governing Federal, State, and local air pollution criteria will be met. This evidence and related documents will be retained by the County for on-site evaluation.

GC-7.13 INDEMNIFICATION AND INSURANCE

(a) **Indemnification**

(1) The Contractor shall be responsible for all damage to life and property due to its activities or those of its subcontractors, agents or employees, in connection with the services required under this contract.

Further, to the extent permitted by law, the Contractor shall indemnify, defend and hold harmless the County, its officials, agents, employees, successors and assigns against and with respect to any and all losses, damages, suits, claims, judgments and expenses whatsoever ("losses"), including without limitation costs of investigation, litigation and attorney's fees, arising directly or indirectly from performance of this contract by the Contractor, its officers, employees, agents, or subcontractors, or otherwise arising directly or indirectly from the work, except only when such losses are attributable to and proximately caused by the negligence of the County or its officials, employees or agents with no negligence on the part of the Contractor, its officers, employees, agents or subcontractors. The foregoing shall apply, without limitation, to losses of all types including destruction or degradation of the environment and all clean-up costs, fines, penalties and other pollution-related items. This indemnification is not to be deemed as a waiver of any immunity which may exist in any action against Howard County, MD.

(2) In any and all claims against the County or any of its agents or employees or any employee of the Contractor, or any subcontractor, or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under subsection 1 above shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under workers' compensation laws, disability benefits acts, or other employee benefits.

(3) Unless otherwise stated within this Agreement, any property or work to be provided by the Contractor under this Contract will remain at the Contractor's risk until written acceptance by the County. Until that time, the Contractor will replace, at contractor's expense, all property or work damaged or destroyed by any cause

whatsoever.

(4) The Contractor shall not disclose any work product created by the Contractor under this Contract to any other parties except as may be authorized in writing by the County as required or permitted by public law.

(5) The Contractor shall be considered for all purposes of this Agreement as an independent contractor, shall not be an agent of the County and shall have no right or authority to enter into any agreements or otherwise bind the County or create any obligations on behalf of the County with other parties whatsoever.

(b) **Insurance Requirements**

(1) **Insurance Coverage Required:**

Unless otherwise stated in the Special Provisions, the Contractor shall purchase and maintain during the term of the Contract, the following coverages:

(A) Workers' Compensation Insurance with limits of coverage as follows:

(1) Coverage A: Statutory, covering Maryland jurisdiction.

(2) Coverage B: $100,000

In cases where work is subcontracted, the Contractor shall require all subcontractors to provide evidence that all of its employees are covered under Maryland workers' compensation insurance prior to the commencement of work.

(B) Automobile Liability Insurance with limits of liability of at least $1,000,000 combined single limit per occurrence. Coverage for hired and non-owned vehicles shall be added by endorsement. If transportation of hazardous waste is required under this Contract, the Contractor must include the MCS-90 endorsement to the Automobile Liability Insurance and minimum coverage shall be $5,000,000.

(C) Commercial General Liability Insurance combined single limits of $5,000,000 per occurrence, naming Howard County, Maryland as an additional insured. At the discretion of the County, an aggregate limit greater than the occurrence limit may be required. As appropriate to the job and as deemed necessary by the County, the policy shall contain, but not be limited to, the following coverage endorsements:

Contractual Liability, including Subcontractors

Personal Injury
Advertising Injury
Products and Completed Operations
Broad Form Property Coverage
Fire Legal Liability
Explosion, Collapse, and Underground Hazards (XCU) - required if such exposure exists due to the nature of the construction site.

(D) Builders' Risk Insurance with a limit of coverage equal to the construction cost on a replacement cost basis, and written on an all-risk policy form. Insurance shall be maintained until the entire project is fully and finally accepted by the County. The Builders' Risk Policy shall include the County as an additional insured.

(1) The County is not responsible for any damage or loss of materials stored on or within County-owned facilities. The Contractor shall provide necessary insurance coverage for such losses or shall assume full risk for replacement cost for its own materials and those of all subcontractors.

(E) If the Contract includes the installation of a boiler or heating, ventilating or air conditional equipment, the Contractor shall purchase and maintain from the point of delivery of such equipment onto the site until the project is accepted by the County, a Boiler and Machinery Insurance policy at a limit of not less than the purchase price of such equipment, covering all equipment not covered by the Builders' Risk Insurance described in (D) before.

(F) IF ANY ARCHITECTURAL, ENGINEERING, DESIGN, INSPECTION OR PLANNING SERVICES ARE RENDERED, INCLUDING APPROVAL OF SUCH ACTIVITIES OF OTHERS, the following insurance is also required: Professional Liability\Errors and Omissions coverage appropriate to the profession with limits of at least $1,000,000.00 per occurrence. Such coverage shall contain a retroactive date not later than the effective date of the Consultant's services in relation to this Agreement and shall contain, an agreement to maintain identical insurance, covering incidents occurring or claims made, for a period of three (3) years after substantial completion of the project.

2. **General Insurance Provisions:**

(A) All policies of insurance shall be underwritten by companies licensed to do business in the State of Maryland.

(B) The Contractor shall assure that all subcontractors carry

identical coverage as shown above, either individually or as an additional insured on the policies of the Contractor. Exceptions may be made only with the approval of the County.

(C) The Contractor and all subcontractors not named on the policies of the Contractor shall purchase commercial insurance for the coverages listed above. Approval for deductibles higher than $100,000 for the liability policies must be obtained from the County.

(D) The purchase of insurance does not relieve the Contractor of any obligations assumed under this Contract.

(E) Monies to become due the Contractor under this Contract may be retained by the County as may be considered necessary until all suits or claims for damages have been settled or until Contractor furnishes to the County satisfactory evidence of insurance coverage with respect to such suits or claims.

(F) The Contractor shall not commence work under the Contract until satisfactory evidence of all required coverage is received by the County. Further, the Contractor shall not reduce or cancel or change any of the required coverages without 60 days notice of such change to the County. Failure to maintain required insurance shall be viewed as a material breach of the Contract by the Contractor. Upon notification by the County that required coverage has lapsed for the Contractor or any of its subcontractors, the County shall have the right to purchase such insurance and the Contractor shall be responsible for the payment of any applicable insurance premiums.

GC-7.14 USE AND POSSESSION PRIOR TO COMPLETION

(a) The County shall have the right to take possession of or use any completed or partially completed part of the Work. Such possession of or use shall not be deemed an acceptance of any work not completed in accordance with the Contract. While the County is in such possession, the Contractor shall be relieved of the responsibility for loss or damage to that portion of the work in possession of the County, other than that resulting from the Contractor's fault or negligence. If such prior possession or use by the County will delay the progress of the work or causes additional expense to the Contractor, the Contractor shall proceed in accordance with GC-4.06 for an equitable adjustment.

(b) At the option of the Engineer, certain completed sections of the work may be opened to traffic or made available for use. In such cases, the completed section will be inspected, tentatively accepted in writing, and the same turned over to the County for

maintenance. Such action shall not in any way be construed as Final Acceptance of the Work, or any part of it. No such action shall be construed as a waiver of any of the provisions of these Specifications or the Contract. Upon written authorization by the Engineer, the Contractor may open the Road to traffic and will be relieved of further maintenance of barriers and lights on that portion of the Road.

(c) In the event that the Contractor, with written authorization from the Engineer, suspends work for prolonged periods of time, as a result of winter weather or other reasons, the County, upon written notification by the Engineer, may open a section or sections of a Road in advance of completion or in advance of the Contractor turning the section or sections over to the County for maintenance. Such actions may be taken either for the convenience of the traveling public, or during the winter season, while the work is suspended. The Contractor shall restore the shoulder areas, surfacing, or any portion of the Work which might be disturbed or damaged by use. The restoration work shall be performed at the respective contract unit prices for the items involved. Where unit prices have not been provided for, the work shall be performed in accordance with GC-4.06.

(d) Builder's Risk Insurance - The Contractor shall provide "All Risks" Builder's Risk Insurance on the Project, as provided in GC-7.13.

GC-7.15 CONTRACTOR'S RESPONSIBILITY FOR WORK

(a) Except as otherwise provided in the Contract Documents, until Final Acceptance, the Contractor shall have the charge and care of the Work and shall take every reasonable precaution against injury or damage to any part of the Work or other property by the action of the elements, or from any other cause, whether rising from the execution or from the non-execution of the Work. The Contractor, except as herein elsewhere provided, shall rebuild, repair, restore, and make good all injuries or damages to any portion of the Work or other property occasioned by any of the above causes before Final Acceptance and shall bear the expense thereof. Material lost or structures damaged as a result of faulty temporary drainage during construction or the action of the elements shall be replaced or repaired by the Contractor at no cost to the County. The Contractor shall make good or replace at its own expense and as required any County furnished material which may be broken, lost through fire, theft, or otherwise damaged, or in any way made useless for the purpose and use intended subsequent to delivery to the Contractor by the County and prior to Final Acceptance of the Work even though such breakage, damage, loss, or uselessness may result from causes beyond the control of the Contractor.

(b) In case of suspension of the Work for any cause whatever, the Contractor shall be responsible for the Project and shall take such precautions as may be necessary to prevent damage to the Work, provide for normal drainage and shall erect any necessary temporary structures, signs, or other facilities at its expense. During such period of suspension of Work, the Contractor shall properly and continuously maintain in an

acceptable growing condition all living material in newly established plantings, seedings, and soddings furnished under this Contract, and shall take adequate precautions to protect new growth and other important vegetative growth against injury.

(c) The Contractor shall be responsible to the County for the acts and omissions of all its employees and all Subcontractors, their agents and employees, and all other persons performing any of the Work under a contract with the Contractor.

(d) The Contractor shall supervise and direct the Work, using its best skill and attention. It shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract Documents.

GC-7.16 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES

(a) At points where the Contractor's operations are adjacent to properties of railway, telegraph, telephone, and power companies, or are adjacent to other property, damage to which might result in expense, loss or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made by the Contractor.

(b) The Contractor shall cooperate with the owners of any underground or overhead utility lines in their removal and rearrangement operations in order that these operations may progress in a reasonable manner, that duplication or rearrangement work may be reduced to a minimum and that services rendered by those parties will not be unnecessarily interrupted.

(c) In the event of interruption to utility services as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with the said authority in the restoration of service. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority.

GC-7.17 PERSONAL LIABILITY OF PUBLIC OFFICIALS

In carrying out any of the provisions of the Contract Documents, or in exercising any power or authority granted by the County to the Engineer and other authorized representatives by or within the scope of the Contract Documents, there shall be no liability upon the County’s authorized representatives either personally or as officials of the County, it being understood that in all such matters they act solely as agents and representatives of the County.

GC-7.18 NOTICES AND WAIVER OF LEGAL RIGHTS

(a) The County shall not be precluded or stopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the Work and payment therefore, from showing the true amount and character of the Work, nor from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor from showing that the Work does not in fact conform to the Contract Documents. The County shall not be precluded or stopped, notwithstanding any such measurement, estimate or certificate and payment in accordance therewith, from recovering from the Contractor or the surety, or both, such damage as it may sustain by reason of the Contractor's failure to comply with the terms of the Contract Documents. Neither the acceptance by the County, or any representative of the County, nor any payment for or acceptance of the whole or any part of the Work, nor any extension of time, nor any possession taken by the County, shall operate as a waiver of any portion of the Contract Documents or of any power herein reserved, or of any right to damages.

(b) A failure to provide a required notice or to submit a claim or appeal within the time prescribed in the Contract Documents shall operate as a waiver of any such claim regardless of whether the County incurred or demonstrates any prejudice by the failure to give such notice or to submit such claim or appeal.

(c) The waiver of any breach of the Contract Documents shall not be held to be a waiver of any other or subsequent breach. Any waiver by the County of a requirement of the Contract Documents, including without limitation a requirement that a notice be made in writing or a submission be made within a certain time, shall not operate as a waiver of the same or any other requirement of the Contract Documents in any other circumstance or at any other time. The County need not incur or demonstrate prejudice in order to assert that a waiver of the Contractor's rights or claims results from the Contractor's failure to comply with any provision of the Contract Documents when the Contract Documents provide for such waiver of any right or claim.

GC-7.19 CHOICE OF LAW, FORUM

The Parties hereby agree that:

(a) This Contract was made and entered into in Maryland, and under the laws of Maryland.

(b) The law of Maryland (exclusive of its choice of laws rules) shall govern the resolution of any issue arising in connection with this Contract, including, but not limited to, all questions concerning the validity of this Contract; the capacity of the parties to enter therein; any modification or amendment thereto; and the rights and obligations of the parties hereunder.

(c) The exclusive venue and jurisdiction for any litigation arising out of or related to the Contract Documents is the Circuit Court for Howard County, Maryland.

Prior to commencing litigation, the Contractor must exhaust all remedies and appeals applicable to the claim or dispute as provided in the Contract Documents as a condition precedent to proceeding with litigation. The Contractor's failure to exhaust all remedies and appeals applicable to the claim or dispute will operate as a waiver of said claim or dispute and will forever bar said claim or dispute, regardless of whether the County incurred or demonstrates any prejudice by the failure to exhaust the remedies and appeals.

(d) Notwithstanding anything in these General Conditions to the contrary, all appeals or litigation arising out of or related to the Contract Documents must be commenced within 14 days after the County's final decision giving rise to the Contractor's claim. The failure of the Contractor to timely file any appeal or litigation shall forever bar and waive the claim regardless of whether the County incurred or demonstrates any prejudice resulting from the Contractor's failure to timely file the appeal or litigation.

GC-7.20 AUDIT AND RETENTION OF RECORDS

(a) The Contractor and its subcontractors and suppliers at any tier shall retain and maintain all records and documents relating to this contract, including, but not limited to, estimates, cost or pricing data, payrolls, reports, and inspections, relating to this Contract for three years after Final Acceptance, and shall make such documents available for inspection and audit by authorized representatives of the County, including the Engineer or its designee, at all reasonable times, including during the time of performance of the Contract as may be necessary for any purpose including pricing and cost verification of any Contractor claim.

(b) In the event a claim is initiated by the County, or by the Contractor, Contractor and its subcontractors or suppliers at any tier shall retain the records set forth in (a) above until the expiration of the aforesaid three-year period or until final, unappealable resolution of the claim, whichever is later.

(c) The Contractor shall include the provisions of paragraph (a) in every Subcontract for the Work.

(d) If Contractor, or its subcontractors or suppliers, fail to retain the records set forth herein for the period of time required by this Section, Contractor shall be entitled to no damages, compensation or equitable adjustment (including time extensions) for any claims based upon information available from or which might be verified by records that have not been retained.

GC 7.21 USE OF EXPLOSIVES

(a) The use of explosives will not be permitted adjacent to or on any existing structures unless authorized in writing by the Engineer. When the use of explosives is

permitted, the Contractor shall use the utmost care so as not to endanger life or property. It shall exercise extreme caution with the number and size of the charges. The Contractor shall provide for the safeguarding of the traveling public and adjacent properties during dynamiting operations. Such precautions shall include, but not be limited to, a sufficient number of watchpersons, flagpersons, signs, etc., to warn motorists during periods of blasting. All explosives shall be stored in a secure manner, and all such storage places shall be marked clearly--"Dangerous Explosives"--and shall be in care of competent watchpersons at all times. Explosives shall be stored and handled in conformity with the provisions of the statutes of the State Of Maryland and local laws and ordinances.

(b) **Notifications** - The Contractor shall notify each public utility company having structures in proximity to the site of the Work of its intention to use explosives, and such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from damage. Such notice shall not relieve the Contractor of its responsibility for any damage resulting from its blasting operations. The Contractor shall notify the Engineer of its intention to use explosives, in sufficient time for that agency to schedule its operations.

(c) **Licensed Employees -** Expert powder men licensed by the State Fire Marshall shall be employed by the Contractor for the handling and use of explosives, and all their work shall conform to the requirements of the State Fire Marshall. The authorization by the Engineer for the use of explosives shall not relieve the Contractor of its full responsibility for damages that may occur.

GC-SECTION 8
PROSECUTION AND PROGRESS

GC-8.01 SUBCONTRACTING

(a) The Contractor shall incorporate by reference or otherwise include these General Conditions in every subcontract issued pursuant to or under the Contract.

(b) The Subcontractors who are named in the Bid Form and approved by the County and those approved when subsequently submitted shall perform the portions of the Work for which approval has been given by the County. Requests for permission to sublet, assign or otherwise dispose of any portion of the Contract shall be in writing and include the item number or numbers, the dollar value, and the percentage of the original contract value. Each request for permission to sublet, assign or otherwise dispose of any portion of the Contract must be accompanied by written consent from the Contractor's Surety. The Contractor shall give assurance that the minimum wage for labor, as stated in its Bid, shall apply to labor performed on all work sublet, assigned or otherwise disposed of in any way.

(c) The County will not approve subletting portions of items except in the

case of specialty items such as the erection of structural steel, painting, or such portions of items that are distinct and identifiable and that have been approved by the Engineer.

(d) Once a Subcontractor has been approved by the County and Surety for the performance of certain contract items of Work, the Contractor shall not substitute another Subcontractor, unless the Contractor requests a change in writing giving the reasons the change is sought and the substitute proposed. If a Subcontractor does not perform to the satisfaction of the Contractor, the Contractor may perform the Work with its own forces or request that another Subcontractor, mentioned by name, be substituted. The County will approve the change if the County determines that the change is in the best interest of the County.

(e) Roadside production of materials shall be considered as "subcontracting", unless performed by the Contractor. This is construed to include the production of crushed stone, gravel and/or other materials by means of portable or semi-portable crushing, screening or washing plants, established or reopened in the vicinity of the Work, for the purpose of supplying materials to be incorporated into the Work on a designated project or projects.

(f) **Anti-Kickback Regulations**

(1) The Anti-Kickback Regulations issued by any department, agency, or branch of the federal, state or local government are applicable to this Contract. The Contractor shall comply with these regulations, and any amendments or modifications thereof and shall cause appropriate provisions to be inserted in subcontracts to ensure compliance therewith by all Subcontractors, and shall be responsible thereunder, except as the applicable department, agency, or branch may specifically provide for reasonable limitations, variations, tolerances and exemptions from the requirements thereof. In lieu of mailing affidavits required by the Anti-Kickback Regulations to the department, agency, or branch furnishing financial aid on this Project, the Contractor shall submit all such affidavits promptly, as specified, to the County or to a representative designated by the County.

(2) The County, or its representative, may withhold or cause to be withheld from the Contractor so much of the accrued payments or advance as may be considered necessary to pay laborers and mechanics employed by the Contractor or any Subcontractor on the work the full amount of wages to which they are entitled under their contracts of employment. In the event of failure to pay any laborer or mechanic employed or working on the site of the Work, all or part of the wage to which it is entitled under this contract of employment, the County, or its representative, may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payroll records shall contain the information and be preserved as required by the Anti-Kickback Regulations. The Contractor shall make its employment records available for inspection by authorized representatives of any federal, state, or local

government and shall permit such representatives to interview employees during working hours on the job.

(4) The Contractor shall insert in each of its subcontracts the provisions set forth in the foregoing clauses and such other stipulations as any federal, state, or local government may require by appropriate instructions.

(5) A breach of stipulations (1) through (4) may be grounds for termination of the Contract.

(g) The Contractor shall not require as a condition to any executory agreement to provide labor and/or materials to the Project, that a Subcontractor waive the right to sue on or collect from the Payment Bond. The Contractor shall prohibit its Subcontractor from requiring, as a condition to any executory agreement to provide labor and/or materials to the Project, that any lower tier Subcontractor waive the right to sue on or collect from any Subcontractor's bond and/or the Payment Bond. The parties expressly intend for all Subcontractors to be third party beneficiaries of this subsection (i) and all Subcontractors can enforce this provision in any appropriate proceedings.

GC-8.02 NOTICE TO PROCEED

After the Contract has been executed, the County will issue to the Contractor a "Notice to Proceed, which will stipulate when the Contractor is expected to begin work. The specified Contract Time shall begin on the date stipulated in the Notice to Proceed or, if an earlier start is authorized in the Notice to Proceed, on the day work (other than the erection of the inspection office, construction stakeouts, and/or mobilization) actually starts. Work done prior to receipt of the Notice to Proceed, including erection of traffic control, is unauthorized and will not be measured, inspected, or paid for.

GC-8.03 PROSECUTION OF THE WORK - COMMENCEMENT - TIME

(a) The Contractor shall begin work promptly within the time specified by the Engineer and shall notify the Engineer at least 5 days before starting work.

(b) After the Work has been started, it shall be prosecuted continuously on all acceptable working days without stoppage until Final Acceptance.

(c) Should the prosecution of the Work for any reason be discontinued, the Contractor shall notify the Engineer of its intention to stop and shall also notify the Engineer at least 24 hours in advance of resuming operations. Said notification shall be confirmed in writing.

(d) The Contractor shall do all the work and furnish all the labor, materials, tools and appliances necessary or proper for performing the Work, in the manner called for

by the Contract Documents within the Contract Time; except such as are hereinafter specified as being furnished by the County. It shall complete the entire Work, including any work included in Change Orders, at the prices established therefore, to the satisfaction of the Engineer, in accordance with the Contract Documents.

(e) The Contractor shall complete the Work contracted for in an acceptable manner within the number of working days or calendar days as stated in the Contract Documents.

(f) The Engineer will make available to the Contractor each week a record showing the number of days charged to the Contract for the preceding week and the number of days specified for completion of the Contract. The Contractor will be allowed one week in which to protest and 30 days in which to file a written statement, setting forth in what respects the time charged by the Engineer is incorrect for the week in question. Otherwise, the record will be deemed to have been accepted by the Contractor.

(g) The number of days for performance allowed in the Contract as awarded is based on the Bid quantities. If satisfactory fulfillment of the Contract with extensions and increases authorized under the Contract Documents shall require the performance of work in greater quantities than those set forth in the Bid, the Contract Time allowed for performance shall be adjusted in an equitable manner based on the quantities, costs and the nature of the work involved pursuant to the procedures in GC-4.06.

(h) Under certain conditions, the Contractor may be granted permission or ordered to suspend operations as noted in Section GC-8.07. During such periods, if the Contractor elects and is permitted to do any work, the time charged shall bear the same ratio to the total time allowed for the completion of the Work, as the value of the work done during such time bears to the total value of the original Contract value. However, the resultant number of days to be charged for any particular month will not exceed the number of calendar days for that month, excluding Saturdays, Sundays or official holidays on which no work was performed by the Contractor.

(i) Time used in performing work of an emergency nature ordered by the Engineer for the convenience of the traveling public or for the production or delivery of materials for storage, if performed during the period of suspension, will not be charged as working days against the Contract Time.

(j) An exception to GC-8.09(b) will be those landscaping items on which work is restricted to specified seasons. When Final Acceptance is being deferred pending completion of those landscaping items on which work is not permissible at the time because such work is currently out of season, and for no other reason, no time will be charged against the Contractor until such time as it is again permissible to proceed with such work.

GC-8.04 PROGRESS SCHEDULE

(a) Within 15 days after Notice to Proceed, the Contractor shall furnish the Engineer for review and acceptance a "Progress Schedule" in the form required by the Contract Documents showing the proposed order of work and indicating the time required for the completion of the Work. Said progress schedule shall be used to establish major construction operations and to check on the progress of the Work. The Engineer's acceptance of any schedule shall not be deemed to modify any time requirements in the Contract Documents. The Contractor shall submit revised progress schedules on a monthly basis thereafter. If the Engineer does not accept the submitted progress schedule, the Contractor, within 10 days of receipt of written notice of non-acceptance, shall submit a revised progress schedule for review and acceptance.

(b) If the Contractor fails to submit the progress schedule or revised progress schedule within the required time or if the progress schedule is not accepted, the Engineer may withhold approval of progress payment estimates until such time as the Contractor submits the required progress schedules or may terminate the Contract for default.

(c) If, in the opinion of the Engineer, the Contractor falls significantly behind the approved progress schedule, the Contractor shall take any and all steps necessary to improve its progress. This may require the Contractor to increase the number of shifts, initiate or increase overtime operations, increase days of work in the work week, or increase the amount of construction plants, or all of them. The Engineer may also require the Contractor to submit for approval supplemental progress schedules detailing the specific operational changes to be instituted to regain the approved schedule, all without additional cost to the County.

(d) Failure of the Contractor to comply with the requirements of the Engineer under this provision shall be grounds for determination by the Engineer that the Contractor is not prosecuting the Work with such diligence as will insure completion within the time specified. Upon such determination, the Engineer may terminate the Contractor's right to proceed with the Work, or any separable part thereof, in accordance with GC-8.08.

(e) Acceptance by the County of a progress schedule showing completion of the Work on an accelerated basis shall not be construed as a waiver of the Contract time specified in the Contract Documents. Any accelerated progress schedule accepted by the County shall not form the basis of a delay or acceleration claim by the Contractor.

GC-8.05 LIMITATIONS OF OPERATION

(a) **Sequence Of Work** - The Contractor shall conduct the Work at all times in such a manner and in such sequence as will assure the least interference with the public. The Contractor shall begin work at such points as may be specified in the Contract Documents and shall thereafter prosecute the Work at such points and in such order as may be prescribed therein.

(b) **No Work Without Inspection** - No work requiring the presence of an Inspector will be permitted on Sunday or on legal holidays, except in cases of emergency, without written permission of the Engineer.

(c) **Work On Legal Holidays** - If the Contractor desires to work upon any Sunday or legal holiday it shall provide written notification to the Engineer at least two (2) working days in advance. It shall indicate the nature of the work and the location where the work will be conducted.

(d) **Emergency Work** - In the event of an emergency, the Contractor may work provided verbal consent is obtained from the Engineer prior to performing the work.

GC-8.06 CHARACTER OF WORKMEN, METHODS AND EQUIPMENT

(a) The Contractor shall employ sufficient labor and equipment for prosecuting the several classes of Work to full completion in the manner and time required by the Contract.

(b) Workmen must have sufficient skill and experience to perform properly the work assigned to them. All workmen engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform all work properly and satisfactorily.

(c) Any person employed by the Contractor or by any Subcontractor who, in the opinion of the Engineer, does not perform his/her work in a proper manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or Subcontractor employing such person, and shall not be employed again in any portion of the Work without the approval of the Engineer.

(d) Should the Contractor fail to remove such person or persons as required above, or fail to furnish suitable and sufficient personnel for the proper prosecution of the Work, the Engineer may withhold requests for payment that are or may become due on the Contract until a satisfactory understanding has been reached.

(e) Equipment to be used on the Work shall meet the requirements of the Work and produce a satisfactory product in conformity with the Contract Documents. The Engineer may order the removal and require replacement of any unsatisfactory equipment.

(f) When the methods and equipment to be used by the Contractor in accomplishing the Work are not prescribed in the Contract Documents, the Contractor is free to use any methods or equipment that it demonstrates to the satisfaction of the Engineer will accomplish the Work in conformity with the Contract Documents.

(g) When the Contract Documents specify that the construction be performed by the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the Engineer in writing. If the Contractor desires to use a method or type of equipment other than those specified in the Contract, it may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed to be used and an explanation of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing construction work in conformity with Contract Documents. If, after trial use of the substituted methods or equipment, the Engineer determines that the work produced does not meet Contract Documents, the Contractor shall discontinue the use of the substituted method or equipment and shall complete the remaining construction with the specified methods and equipment. The Contractor shall remove all deficient work and replace it with work of specified quality, or take such other corrective action as the Engineer may direct. Unless approved under GC-4.11, no equitable adjustment to the Contract will be made as the result of authorizing a change in methods or equipment under these provisions.

GC-8.07 SUSPENSION OF WORK

(a) The Engineer unilaterally may order the Contractor in writing to suspend, delay, or interrupt all or any part of the Work for a period of time as it may determine to be appropriate for the convenience of the County.

(b) If the performance of all or any part of the Work is for an unreasonable period of time suspended, delayed, or interrupted by an act of the Engineer or the County, or by a failure of the Engineer or County to act within the time specified in this Contract (or if no time is specified, within a reasonable time), subject to the provisions of GC-4.06 and 4.07 an adjustment shall be made for any increase in the cost of performance of this Contract necessarily caused by an unreasonable suspension, delay, or interruption. However, no adjustment shall be made under this provision for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor.

(c) By issuance of a written notice of suspension of work, the Engineer may order the Contractor to suspend, delay, or interrupt any part of the Work as a result of code violations or deviation from the Contract Documents. Should the violation or deviation persist, the Engineer may extend the suspension to all Work. The Engineer will enforce the suspension until such time as the Contractor completes the necessary correction. No equitable adjustment in the Contract Documents will be allowed for actions by the Engineer under this provision.

(d) If it should become necessary to suspend, delay, or interrupt all or part of the Work for an indefinite period, the Contractor shall store all materials in such manner that they will not obstruct or impede the traveling public unnecessarily nor become damaged in any way. The Contractor shall take every precaution to prevent damage or

deterioration of the work performed, provide suitable drainage by opening ditches, shoulder drain, etc., and erect temporary structures where necessary.

GC-8.08 TERMINATION FOR DEFAULT-DAMAGES FOR DELAY- TIME EXTENSIONS

(a) If the Contractor refuses or fails to prosecute the Work, or any separable part thereof, with such diligence as shall ensure its completion within the Contract Time, or any extension thereof, or if the Contractor fails to complete said Work within the Contract Time, persistently fails to comply with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, or otherwise materially breaches any of its obligations under the Contract Documents, the County may, in its sole discretion and without prejudice to any right or remedy against the Contractor and the Surety, by written notice to the Contractor, terminate for default the Contractor's right to proceed with the Work, or the part of the Work as to which there has been delay. In this event the County may take over the Work and prosecute the same to completion, by Contract or otherwise, and may take possession of and utilize in completing the Work the materials, appliances, and plant as may be on the site of the work and necessary therefore.

(b) Liquidated damages as set forth in GC-8.09 are not intended to compensate the County after the Contractor's default for any additional expenses to complete the Work in accordance with the Contract Documents. If the County terminates the Contractor's right to proceed for default, the Contractor and the Surety are liable to the County and will pay within 30 days after demand by the County all additional costs incurred in completing the Work in excess of the Contract Sum (as modified by approved Change Orders) together with liquidated damages assessed in accordance with GC-8.09.

(c) If liquidated damages are provided in the Contract and if the County does not so terminate the Contractor's right to proceed under subsection (a) above, the resulting damage shall consist of the liquidated damages as outlined elsewhere in the in the Contract Documents.

(d) The Contractor's right to proceed may not be terminated nor the Contractor charged with resulting damages if:

(1) The delay in the completion of the Work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the County in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine, restrictions, strikes, freight embargoes, unusually severe weather, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence in whole or in part of either the Contractor or the subcontractors or suppliers; and,

(2) The Contractor, within 10 days from the beginning of any such

delay (unless the Engineer grants in writing a further period of time before the date of final payment under the Contract), notifies the Engineer in writing of the causes of delay. The Engineer shall ascertain the facts and the extent of the delay and extend the time for completing the Work when, in its judgment, the findings of fact justify such an extension, and its findings of fact shall be final and conclusive on the parties, subject only to appeal as provided in GC-5.13.

(e) If, after notice of termination for default, it is determined for any reason that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to GC-8.10.

(f) The rights and remedies of the County provided in this provision are in addition to any other rights and remedies provided by law or under this Contract.

(g) As used in paragraph (d)(1) of this provision, the term "subcontractors or suppliers" means subcontractors or suppliers at any tier.

GC-8.09 LIQUIDATED DAMAGES

(a) Time is an essential element of the Contract and it is important that the Work be vigorously prosecuted until Final Acceptance. The Contractor understands and agrees that the County and the general public will suffer financial loss and/or inconvenience if the Project is not substantially complete on the date set forth in the Contract Documents. The County and the Contractor agree that the amount of financial loss and/or inconvenience is not subject to accurate estimation and the actual damages are not easily ascertained. Therefore, the County and the Contractor agree that the amount of liquidated damages set forth in the Contract Documents is a reasonable forecast of the just and fair compensation for the harm that would result from the Contractor's failure to timely complete the Work.

(b) For each day that the Work shall remain uncompleted beyond the Contract Time, the Contractor and/or the Surety shall be liable for liquidated damages in the amount provided for in the Contract Documents, provided, however, that due account shall be taken of any adjustment of the Contract Time for completion of work as granted by approved equitable adjustments.

GC-8.10 TERMINATION FOR THE CONVENIENCE OF THE COUNTY

(a) The performance of Work may be terminated by the County in accordance with this provision in whole, or from time to time in part, whenever the Engineer shall determine that such termination is in the best interest of the County. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which performance of the Work is terminated, and the date upon

which such termination becomes effective.

(b) After receipt of Notice of Termination, and except as otherwise directed by the Engineer, the Contractor shall:

(1) Stop the Work on the date and to the extent specified in the Notice of Termination;

(2) Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of the portion of the Work as is not terminated;

(3) Terminate all orders and subcontracts to the extent that they relate to the performance of the Portion of the Work terminated by Notice of Termination;

(4) Assign to the County in the manner, at the times, and to the extent directed by the Engineer, all of the right, title, and interest of the Contractor under the orders and subcontracts so terminated, in which case the County shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

(5) Settle all outstanding liabilities and all claims arising out of the termination of orders and subcontracts, with the approval or ratification of the Engineer, to the extent it may require, which approval or ratification shall be final for all the purposes of this provision;

(6) Transfer title and deliver to the County, in the manner, at the times and to the extent, if any, directed by the Engineer, (a) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced as a part of, or acquired in connection with the performance of the Work terminated by the Notice of Termination, and (b) the completed or partially completed, drawings, information, warranties, and other property which, if the Contract had been completed, would have been required to be furnished to the County;

(7) Use its best effort to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the Engineer, any property of the types referred to in (6) above; provided, however, that the Contractor (a) may not be required to extend credit to any purchaser, and (b) may acquire any such property under the conditions prescribed by and at a price or prices approved by the Engineer; and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the County to the Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by this Contract or paid in such other manner as the Engineer may direct;

(8) Complete performance of such part of the Work as may not have been terminated by the Notice of Termination; and

(9) Take any action that may be necessary, or as the Engineer may direct, for the protection and preservation of the property related to this Contract that is in the possession of the Contractor and in which the County has or may acquire an interest. The Contractor shall submit to the Engineer a list, certified as to quantity and quality, of any or all items of termination inventory not previously disposed of, exclusive of items the disposition of which has been directed or authorized by the Engineer, and may request the County to remove such items or enter into a storage agreement covering them. Not later than 15 days thereafter, the County shall accept title to such items and remove them or enter into a storage agreement covering the same; provided, that the list submitted shall be subject to verification by the Engineer upon removal of the items, or if the items are stored, within 45 days from the date of submission of the list, and any necessary adjustment to correct the list as submitted shall be made prior to final settlement.

(c) After receipt of a Notice of Termination, the Contractor shall submit to the Engineer its termination claim, in the form and with the certification required under GC-4.06 required under or as otherwise prescribed by the Engineer. This claim shall be submitted promptly but in no event later than ninety (90) days from the effective date of termination, unless one or more extensions in writing are granted by the Engineer, upon request of the Contractor made in writing within the ninety (90) day period or authorized extension thereof. Failure to submit the claim within the time specified herein shall operate as a waiver of claim regardless of whether the County incurred or demonstrates any prejudice by the failure to timely submit the claim. However, if the Engineer determines that the facts justify such action, it may receive and act upon any such termination claim at any time after the ninety (90) day period or any extension thereof. Upon failure of the Contractor to submit its termination claim within the time allowed or any extension thereof, the Engineer may determine, on the basis of information available to it, the amount, if any, due to the Contractor by reason of the termination and shall thereupon pay to the Contractor the amount, if any, so determined.

(d) Subject to the provisions of paragraph (c), the Contractor and the Engineer may agree upon the whole or any part of the amount or amounts to be paid to the Contractor by reason of the total or partial termination of the Work pursuant to this provision, which amount or amounts may include a reasonable allowance for profit on work done; provided, that such agreed amount or amounts, exclusive of settlement costs, shall not exceed the total Contract price as reduced by the amount of payments otherwise made and as further reduced by the price of work not terminated. The Contract shall be amended accordingly pursuant to GC-4.06. Nothing in paragraph (e) of this provision, prescribing the amount to be paid to the Contractor in the event of failure of the Contractor and the Engineer to agree upon the whole amount to be paid to the Contractor by reason of the termination of work pursuant to this provision, shall be deemed to limit, restrict, or otherwise determine or affect the amount or amounts that may be agreed upon to be paid to the Contractor pursuant to this paragraph.

(e) In the event of the failure of the Contractor and the Engineer to agree as provided in paragraph (d), upon the whole amount to be paid to the Contractor by

reason of the termination of work pursuant to this provision, the Engineer shall pay to the Contractor the amounts determined by the Engineer as follows, but without duplication of any amounts agreed upon in accordance with paragraph (d):

(1) For completed supplies or services accepted by the County (or sold or acquired as provided in paragraph (b)(7) above) and for which payment has not theretofore been made, a sum equivalent to the aggregate price for the supplies or services computed in accordance with the price or prices specified in the Contract, appropriately adjusted for any saving of freight or other charges;

(2) The total of:

(a) The costs incurred in the performance of the terminated portion of the Work, including initial costs and preparatory expense allocable thereto, but exclusive of any costs attributable to supplies or services paid or to be paid for under paragraph (e)(1) hereof;

(b) The cost of settling and paying claims arising out of the termination of work under subcontracts or orders, as provided in paragraph (b)(5) above, which are properly chargeable to the termination portion of the Contract (exclusive of amounts paid or payable on account of supplies or materials delivered or services furnished by subcontractors or vendors before the effective date of the Notice of Termination, which amounts shall be included in the costs payable under (a) above); and

(c) A sum, as profit on (a) above, determined by the Engineer to be fair and reasonable; provided, however, that if it appears that the Contractor would have sustained a loss on the entire Contract had it been completed, no profit shall be included or allowed under this subdivision (c) and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss; and

(d) The reasonable cost of settlement accounting, legal, clerical, and other expenses reasonably necessary for the preparation of settlement claims and supporting data with respect to the terminated portion of the Work and for the termination and settlement of subcontracts thereunder, together with reasonable storage, transportation, and other costs incurred in connection with the protection or disposition of property allocable to this Contract; but

(e) No payment shall be allowed for any anticipated profit or overhead on work not performed.

(3) The total sum to be paid to the Contractor under (1) and (2) of this paragraph shall not exceed the total Contract price as reduced by the amount of payments otherwise made and as further reduced by the Contract price of work not terminated. Except for normal spoilage, and except to the extent that the County shall have otherwise

expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor as provided in (e)(1) and (a) above, the fair value, as determined by the Engineer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the County or to a buyer pursuant to paragraph (b)(7).

(f) Costs claimed, agreed to, or determined pursuant to this provision must also be allowable, reasonable, lawful, and allocable to the Work and accounted for in accordance with generally accepted accounting principles. Guidance for any determination of whether the costs allowable, reasonable, lawful, allocable, will be provided by the Contract Cost Principles and Procedures of the Code of Maryland Regulations currently in effect, which as of January 1, 1996 were located at COMAR 21.09.01.

(g) The Contractor shall have the right of appeal under GC-5.13 from any determination made by the Engineer under paragraph (c), (e), or (i) hereof, except that if the Contractor has failed to submit its claim within the time provided in paragraph (c) or (i) hereof, and has failed to request extension of such time, it shall have no such right of appeal. In any case where the Engineer has made a determination of the amount due under paragraph (d), (e), or (i) hereof, the County shall pay to the Contractor the following:

(1) If there is no right of appeal hereunder or if no timely appeal has been taken, the amount so determined by the Engineer; or,

(2) If an appeal has been taken, the amount finally determined on such appeal.

(h) In arriving at the amount due the Contractor under this provision there shall be deducted:

(1) All unliquidated advance or other payments on account theretofore made to the Contractor, applicable to the terminated portion of this Contract;

(2) Any claim that the County may have against the Contractor in connection with this Contract; and

(3) The agreed price for, or the proceeds of sale of, any materials, supplies, or other things acquired by the Contractor or sold, pursuant to this provision, and not otherwise recovered by or credited to the County.

(i) If the termination hereunder is partial, the Contractor may file with the Engineer a claim for an equitable adjustment of the price or prices specified in the Contract relating to the continued portion of the Contract (the portion not terminated by the Notice of Termination), within the time limits and under the procedures set forth in GC-4.06.

(j) The County may, from time to time, under such terms and conditions as it

may prescribe, make partial payments and payments on account against costs incurred by the Contractor in connection with the terminated portion of this Contract whenever, in the opinion of the Engineer, the aggregate of such payments shall be within the amount to which the Contractor shall be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this provision, such excess shall be payable by the Contractor to the County upon demand, together with interest computed at the prime rate established by the County Department of Finance for the period from the date such excess payment is received by the Contractor to the date on which the excess is repaid to the County; provided, however, that no interest shall be charged with respect to any such excess payment attributable to a reduction in the Contractor' s claim by reason of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date as determined by the Engineer by reason of the circumstances.

(k) Unless otherwise provided for in this Contract, or by applicable statute, the Contractor shall, from the effective date of termination until the expiration of three years after final settlement (including the expiration and conclusion of all appeals and rights of appeal) under this Contract, preserve and make available to the County at all reasonable times at the office of the Contractor but without direct charge to the County, all its books, records, documents and other evidence bearing on the costs and expenses of the Contractor under this Contract and relating to the Work terminated hereunder, or, to the extent approved by the Engineer, photographs, microphotographs, or other authentic reproductions thereof.

GC-8.11 SUCCESSFUL TERMINATION OF CONTRACTOR'S RESPONSIBILITY

(a) A Contract will be considered as successfully fulfilled when all of the following conditions have occurred: (1) the Work has been completed in accordance with the terms of the Contract; (2) Final Acceptance has occurred; (3) final payment has been authorized; (4) all of the obligations of the Contractor and the Surety have been complied with; and (5) final payment has been made. Nothing herein will relieve the Contractor and the Surety from any future obligation such as a warranty, guarantee, guarantee bond, or indemnity obligation, or from responsibility for repair of latent defects discovered or appearing after final payment.

GC-SECTION 9
PAYMENT

GC-9.01 SCOPE OF PAYMENT

(a) If so identified in the Contract, payment to the Contractor will be made for the actual quantities of Contract items performed in accordance with the Contract

Documents and if, upon completion of the Work, these actual quantities show either an increase or decrease from the quantities given in the Bid form, the Contract unit prices will still prevail, except as provided in GC-4.04 Variations in Estimated Quantities.

(b) The payment of any partial estimate or of any retained percentage, except by and under the approved final estimate and voucher, in no way shall affect the obligation of the Contractor and the Surety to repair or renew any defective parts of the construction or to be responsible for all damages due to such defects.

(c) When requested in writing by the Contractor and approved by the Engineer, payment allowance will be made for nonperishable material to be incorporated in the Work delivered and stockpiled at the work site or other approved site. The Contractor must submit with the request a list of all such materials and their location. The Contractor shall submit back-up invoices, bills of lading, title documents, or such other documentation, satisfactory to the County, as will establish the County=s title to the materials upon payment to the Contractor under the request. The Contractor must submit with the request proof of insurance in the amount of the payment requested to be maintained on the materials until such time as the materials are incorporated into the Work. Only those materials for which the Contractor can transfer clear title to the County will be qualified for payment. Payment for stored materials will be made in accordance with paragraph (d) below.

(d) When the Contractor requests payment allowance for stored materials under (c) above, the following terms and conditions will apply:

(1) For superstructure members delivered on the Project site, an allowance of 100 percent of the material cost plus freight charges as invoiced may be made provided, however, that all such material will have been tested by the County and found to have met the Specifications or have been accepted under an approved certification program prior to such an allowance. The allowance will be based upon validated invoices or bills for such material including freight charges, and a copy thereof shall be made a part of the documented records for the Project.

(2) For reinforcing steel, piling, pipe, traffic barriers, signs and sign assemblies, and other nonperishable material in storage on the Project, but excluding aggregates, cement, seed, plants, fertilizer or other perishable items, an allowance of 100 percent of the invoiced cost of the material plus freight charges to the Contractor may be made when such material is delivered and stockpiled at the Project site, provided, however, that all such material will have been tested by the County and found to have met the Specifications or have been accepted under an approved certification program prior to such an allowance.

(3) No allowance will be made for fuels, form lumber, falsework, temporary structures or other materials of any kind which will not become an integral part of the finished construction.

(4) Material for which an allowance is requested shall be stored in an approved manner in areas where damage is not likely to occur. If any of the stored materials are lost, stolen, or become damaged in any manner, the Contractor shall be responsible for repairing or replacing of such damaged materials. The Contractor expressly agrees to assume and bear the risk of all loss, theft, or damage to the materials. The value of the lost, stolen, or damaged material will be deducted from the Contractor's subsequent requests for payment until replacement has been accomplished.

(5) When it is considered impractical to store materials on the actual project, the Engineer may approve storage areas in the vicinity of the actual project that will be considered at the Project site.

(6) When storage of the materials within Howard County is not practical, written approval must be obtained from the Construction Inspection Division for storage elsewhere. Storage of materials outside of Howard County will be subject to the conditions set forth in this provision and, limited to materials exceeding twenty-five thousand dollars ($25,000), which are designed and fabricated exclusively for use on a specific project.

(7) The request for allowances for any materials stored on property outside of Howard County shall be accompanied by a release and waiver from the owner and/or tenant of such property agreeing to permit verification by the Inspector that the material is stored at the approved location, to allow the removal of the material from the property without cost to Howard County, and waiving to the fullest extent possible any lien in favor of the owner and/or tenant for payment of any fees for access, storage, care, handling, or the like.

(8) Material for which payment has been made, either wholly or partially, shall not be removed from the approved location until such time that it is to be incorporated into the Work, unless authorized by the Engineer.

(9) The following prerequisites must also accompany the written request for payment:

(A) consent of Surety specifying the material type and the Item(s) in which the material is to be used;

(B) validated invoices showing that payment for the material has been made by the Contractor;

(C) a notarized statement from the Contractor attesting that the invoices, as submitted do not include charges and/or fees for placing, handling, erecting or any other charges and/or markups other than the actual material cost, sales tax(es), if applicable, and freight charges;

(D) bills of lading showing delivery of the material; and

(E) inspection test reports, certifications and/or a written statement from the Inspector attesting to the inspection and approval of the material.

(10) Upon receipt of the above by the Engineer and verification by the Inspector that the material is stored at the approved location, the Engineer may authorize payment by a unit of measure based upon the receipted invoices under the appropriate existing items of the Contract. A ratio will be established by the Engineer between the dollar amount of the material as invoiced and the quantity the material represents from the appropriate Bid Items.

(11) Copies of all pertinent data shall be made and distributed to the Inspector for retention as part of the documented records for the Project.

(12) No payment will be made for stored materials when it is anticipated they will be incorporated into the Work within 30 days of receipt by the Engineer of the written request.

(13) Unless otherwise stated by the Engineer in writing, payment on account of a request for payment for stored materials transfers title to the County but does not constitute an acceptance by the Engineer or the County of the materials nor does it constitute an agreement that the materials conform to the Contract Documents. Notwithstanding the fact that payment has been made on account of the request for payment for stored materials, the Contractor and the Surety continue to be responsible to ensure at all times that the materials are in full conformance with the Contract Documents and are free from defect. Moreover, payment on account of a request for payment for stored materials does not begin the running of any applicable warranty or guaranty.

(14) Final payment shall be made only for materials actually incorporated in the Work and, upon final acceptance, title to all materials remaining for which advanced payment have been made shall revert to the Contractor, unless otherwise agreed, and the payments made for these items shall be deducted from the final payment due to the Contractor for the Work.

(15) The Contractor agrees to indemnify and save harmless the County and all of its representatives from all suits, actions, or claims of any character brought on account of or arising out of the storage of materials for which the County has made payment on account of a request for payment for stored materials, including any claims of a warehouseman's or garageman's lien for cost of storage of the equipment and for claims arising out of damage or injury caused by the materials and their shipping and handling.

(e) Contractor shall indicate its Federal Tax Identification or Social Security Number on the face of each invoice billed to the County.

(f) Along with each request for payment, the Contractor shall furnish the following certification signed by an officer or principal of the Contractor, or payment shall not be made:

I hereby certify, to the best of my knowledge and belief, that -

(1) The amounts requested are only for performance in accordance with the Specifications, terms, and conditions of the Contract Documents;

(2) Payments to all subcontractors and suppliers have been made from previous payments received under the Contract, and timely payments will be made from the proceeds of the payment covered by this certification; and

(3) This request for progress payments does not include any amounts that the Contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract.

_____
(Name)

_____
(Title)

_____
(Date)

GC-9.02 FORCE ACCOUNT WORK

When the Contractor is required to perform work as a result of additions or changes to the Contract for which there are no applicable unit prices in the Contract, the County and Contractor shall make every effort to come to an agreed upon price for the performance of such work. If an agreement cannot be reached, the County may require the Contractor to do such work on a force account basis to be compensated in accordance with the following:

(a) **Labor** - For all labor and for foremen in direct charge of the specific operations, the Contractor shall receive the actual wages for each and every hour that labor and foremen are actually engaged in the force account work.

(b) **Materials -** For materials accepted by the Engineer and used, the Contractor shall receive the actual cost of such materials delivered on the force account work, including transportation charges paid by him (exclusive of machinery rentals as hereinafter set forth).

(c) **Equipment.**

(1) For any machinery or special equipment (other than small tools, whether rented or owned), the use of which has been authorized by the Engineer, the Contractor shall receive the rates agreed upon in writing before such work is begun, or the Contractor shall receive those rates which may be specified elsewhere in the Contract Documents. For the purpose of definition, equipment with a new cost of $500 or less will be considered small tools.

(2) In the event no agreement is reached and if the Contract Documents do not indicate the applicable rate(s), the Contractor shall use the current rental rates recommended in the Rental Rate Blue Book for Construction Equipment published by Data Quest, Inc. using the applicable Blue Book rate adjustment tables in effect at the time of the authorization of the force account work for the use of any machinery or special equipment authorized by the Engineer. Rental rates must be agreed upon in writing before work is begun, except in those cases where the Engineer finds that an emergency exists. Payment will be made for the actual number of hours the equipment is required to work at the site. The maximum number of hours allowed for each working day will be eight (8) or the number of hours in operation, whichever is greater. The rate to be paid per hour will be computed by dividing the monthly rate by 176. Premium rates shall not be allowed.

(3) Approved transportation charges will be paid from and to the nearest source if the equipment is brought to the Project specifically for use on the force account work and is not used on any other work.

(4) The rental rate will consist of the sum of the following:

(A) the rate for the basic piece of equipment;

(B) the rate for attachments (where applicable); and

(C) the estimated hourly operating cost (where applicable).

(5) These component parts of the rate are to be obtained from the Rental Rate Blue Book when listed in that book. If a piece of equipment is not listed in the Rental Rate Blue Book, then the rate will be the prevailing rate being paid in the area where the force account work is being performed. When equipment is used in excess of eight hours per day or 40 hours per week, the excess time will be considered as overtime. The rental rates for this overtime will be the sum of (A), 50 percent of (B) and 100 percent of (C) above.

(6) Whenever equipment is ordered by the Engineer to be held on the Project on a standby basis, or when the County is obligated for other reasons to pay for idle equipment, then the rate will be 75 percent of the monthly rental rate with no

allowance for operating costs calculated as set forth in Paragraph (c)(2) above. Standby or idle time cannot exceed eight hours per day and will not be allowed for Saturday and Sunday. Non-operating time for equipment required for force account work is not considered standby or idle time if the equipment is operated and used at least once during each working day.

(d) **Materials and Supplies Not Incorporated in the Work**. For materials and supplies expended in the performance of the force account work (excluding those required for rented equipment) and approved by the Engineer, the Contractor shall receive the actual cost of such materials and supplies used. The Contractor shall receive a reasonable allowance for materials used but not expended in the performance of the force account work.

(e) **Subcontractors.** The Contractor shall receive the actual cost of the force account work performed by a subcontractor. Subcontractor's cost is to be determined as in (a), (b), (c), and (d) above, plus the fixed fee for overhead and profit allowance computed as in (g).

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

(g) **Contractor's Fixed Fee.** The Engineer and the Contractor shall negotiate a fixed fee for force account work performed pursuant to this GC-9.02 by its forces and by its subcontractors, as compensation for overhead and profit for the work performed. Failure of the Contractor and the Engineer to negotiate a fixed fee, shall be treated as a claim pursuant to GC-5.13 and the Contractor shall proceed diligently with the performance of the force account work to completion. The Contractor's fixed fee shall include, but not be limited to the following:

(1) Compensation for all costs paid to, or in behalf of, workmen by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits or other benefits that may be required by collective bargaining agreement or other employment contract generally applicable to the classes of labor employed in the work.

(2) Bond premiums, property damage, liability and workmen's compensation insurance premiums, unemployment insurance contributions and Social Security taxes on the force account work.

(h) **Compensation.** The compensation as set forth above shall be received by the Contractor as payment in full for change order work done on a force account basis. At the end of each day, the Supervisor and the Engineer shall compare records of the cost of work as ordered on a force account basis.

(i) **Statements.** No payment will be made for work performed on a force

account basis until the Contractor furnishes the Engineer duplicate itemized statements of the cost of such force account work detailed as to the following:

(1) Name, classification, date, daily hours, total hours, rate, and extension for such laborer or foreman.

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

(3) Quantities of materials, prices and extensions.

(4) Transportation of materials.

(5) Payments of items under (i)(1) shall be accomplished by copies of certified payrolls. Under (i)(2) original receipted invoices for rentals must be provided if requested by the Engineer. Paragraphs (i)(3) and (i)(4) shall be accompanied by original receipted invoices for materials used and transportation charges. If, however, the materials used in the force account work are not specifically purchased for such work but are taken from the Contractor's stock, then in lieu of the original invoices the statements shall contain or be accompanied by an affidavit of the Contractor which shall certify that such materials were taken from its stock, that the quantity claimed was actually used and that the price and transportation of the material as claimed represent actual cost. Any request for payment under this provision shall be submitted in the order outlined by the above.

(j) Costs claimed, agreed to, or determined pursuant to this provision must also be allowable, reasonable, lawful, and allocable to the Work and accounted for in accordance with generally accepted accounting principles. Guidance for any determination of whether the costs allowable, reasonable, lawful, allocable, will be provided by the Contract Cost Principles and Procedures of the Code of Maryland Regulations currently in effect, which as of January 1, 1994 were located at COMAR 21.09.01.

GC-9.03 PROGRESS PAYMENTS

(a) Within ten (10) calendar days after the Notice to Proceed and prior to commencing work, the Contractor shall submit a breakdown of all lump sum items (a "Schedule of Values") within the Bid for review and approval by the Engineer. No partial payments will be made for lump sum items if the Contractor fails to provide a Schedule of Values. If the Engineer does not approve the Schedule of Values submitted by the Contractor, within 10 days of receipt of written notice of disapproval, the Contractor shall submit a revised breakdown for review and approval.

(b) **Monthly Estimates.** Each month the County will pay the Contractor for the Contract value of the work satisfactorily performed as determined from the approved

Schedule of Values during the preceding calendar month, including authorized extras and additions less five percent, if the Contractor submits by the 7th day of the month a request for payment on the form approved by the County. Unless otherwise reduced in the discretion of the Engineer, the five percent of the total Contract value retained by the County will not be released until final payment (unless partially released in a semi-final payment). Current estimates will be based upon the Engineer's estimate of quantity (including materials and equipment complete in place) satisfactorily performed for each item contained in the Contractor's approved Schedule of Values. In the instance of lump sum items, the Engineer's estimate shall be the proper fraction of the lump sum items satisfactorily performed during the preceding month. All quantities, estimates and fractions will be reasonably accurate approximations and are subject to correction (a) in subsequent current estimates, (b) in any semi-final estimate and, (c) in final payment. Should either the Engineer or the Contractor be of the opinion that any estimates, quantities and/or fractions (either as to an individual current estimate or accumulations thereof) do not represent a reasonably accurate approximation of actual work, then details questioned shall be reviewed and then any corrections adjusted for in the next current estimate.

(c) The Engineer may decline to approve a monthly request for payment and may withhold its semi-final approval in whole or in part, to the extent reasonably necessary to protect the County, from loss because of:

(1) defective work not remedied;

(2) third party claims filed or reasonable evidence indicating the probability of filing of such claims;

(3) failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;

(4) reasonable doubt that the Work can be completed for the unpaid balance of the Contract Sum;

(5) damage to another contractor;

(6) reasonable indication that the Work will not be completed within the Contract Time; or

(7) unsatisfactory prosecution of the Work by the Contractor.

(d) Progress payments requesting more than 75% of scheduled values in Mechanical and Electrical Trades will be reduced to include only 75% on the Mechanical and Electrical line items if the Contractor fails to submit preliminary Maintenance Manuals with contents specified by Contract Documents and of quality acceptable to the County.

(e) The Contractor shall, within 7 days of the receipt of a progress payment, make payment to all Subcontractors in the amount for which payment has been received by the Contractor for the portion of the Work performed by the Subcontractor as reflected on the Request for Payment. The Contractor shall require all Subcontractors to make payment to any further Subcontractors within 7 days of the Subcontractor's receipt of payment from the Contractor for the portion of the Work performed by the lower tier Subcontractor. The parties expressly intend for all Subcontractors to be third party beneficiaries of this provision and all Subcontractors can enforce this provision in any appropriate proceedings.

GC-9.04 SUBSTANTIAL COMPLETION AND FINAL PAYMENT

(a) **Verification of Final Quantities**

(1) When the Contractor has completed the Work, and it has been accepted as substantially complete, the Engineer will proceed:

(A) To make any necessary final surveys;

(B) To complete any necessary computation of quantities; and

(C) To submit to the Contractor, within 30 days after final completion and acceptance of the Work by the Engineer for maintenance, for its consideration, a tabulation of the proposed final quantities. This tabulation shall be accompanied by a statement setting forth: (a) the additional work performed under change orders and/or supplemental agreements; (b) the authorized extension of time; (c) the number of days that have been charged against the Contractor as having been used to complete the Contract, and (d) any deductions, charges or liquidated damages that have been made or imposed.

(2) The Contractor shall then have a period of 10 calendar days, dating from the date upon which it received the aforementioned tabulation from the County, in which:

(A) To decide whether or not it will accept final payment upon such a basis; and

(B) To notify the County, in writing, of its decision. The Contractor may request an additional period up to 10 calendar days in which to notify the County of its decision. In the event the Contractor notifies the County that he protests final payment on such a basis, that notification

shall outline the reason(s) for said protest.

(3) Upon receipt of a notification of acceptance as provided for in paragraph (a)(2) above, the County shall prepare the final estimate and final payment forms and submit them to the Contractor. These forms shall show all data noted in paragraph (a)(1) above, together with deductions for all prior payments. The Contractor shall execute these forms and return them to the County within 30 calendar days from the date they are received for execution and payment. If such signed forms are not received by the County within the specified time, the County will prepare duplicate forms for execution and payment. Such action by the County shall be deemed to constitute acceptance and final payment.

(4) In the event the Contractor does not accept the data submitted to him as described in paragraph (a)(1) above and/or has outstanding a claim filed in accordance with GC-5.13, the Engineer and the Contractor shall confer at mutually convenient times and endeavor to reconcile all points of disagreement expeditiously. If such reconciliation is accomplished, the County will promptly proceed with acceptance and final payment on the reconciled basis and in accordance with the provisions of paragraph (a)(3) above. If reconciliation is not accomplished within 30 days, the decision of the Engineer is deemed to be the final action. The Engineer shall promptly furnish a copy of the final decision to the Contractor by certified mail, return receipt requested. This decision may be appealed by the Contractor as set forth in GC-5.13.

(5) All prior partial estimates and payments shall be subject to correction at the time of acceptance and final payment and if the Contractor has been previously overpaid, the amount of such overpayment shall be set forth in the Final Payment forms and the Contractor hereby agrees that it will reimburse the County for such overpayment within 30 days of receipt of such advice.

(6) Payment for the full apparent value of the Contract shall become due and payable to the Contractor within ninety (90) days after determination of final quantities under this section. As a condition precedent to final payment, the Contractor shall be required to execute a general release of all claims against the County arising out of, or in any way connected with, this Contract.

(b) **Substantial Completion**

(1) Substantial completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the County can occupy or utilize the Work for its intended use.

(2) When the Contractor considers that the Work, or a portion thereof which the County agrees to accept separately, is substantially complete, the Engineer shall prepare and submit to the Contractor a comprehensive list of items to be completed or corrected. The Contractor shall proceed promptly to complete and correct items on the

list. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Upon receipt of the Contractor's list, the Engineer will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Engineer's inspection discloses any item, whether or not included on the Contractor's list, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Engineer. The Contractor shall then submit a request for another inspection by the Engineer to determine Substantial Completion. When the Work or designated portion thereof is substantially complete, the Engineer will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the County and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate.

(3) Upon issuance of the Certificate of Substantial Completion, the Engineer shall determine a reasonable sum of money for completion of the items on the list accompanying the Certificate. The County, upon application by the Contractor for a substantial completion payment for the apparent estimated final value of the Contract, deducting the total of all amounts previously paid to the Contractor as current estimates and sums deemed chargeable against the Contractor properly deductible, including liquidated damages and the amount determined by the Engineer as a reasonable cost of completing the items on the list accompanying the Certificate of Substantial Completion, and as a retainage a sum not less than 5% of the total value of the Contract.

(4) **Partial Acceptance for Maintenance.** If at any time during the performance of the Work the Contractor substantially completes a unit or portion of the Work, it may request the Engineer to make final inspection of that unit. If the Engineer finds upon inspection that the unit has been satisfactorily completed in compliance with the Contract, it may accept that unit as being completed and the Contractor may be relieved of further maintenance responsibility for that unit. Generally, partial acceptance for maintenance will only be considered when the County feels that such action is in the public interest. Such partial acceptance for maintenance shall in no way void or alter any of the terms of the Contract.

(c) **Final Completion, Final Acceptance and Final Payment**

(1) Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Engineer will promptly make such inspection and, when the Engineer finds the Work acceptable under the Contract Documents and the Contract fully performed, the Engineer will promptly issue a Certificate of Final Completion stating that to the best of the Engineer's knowledge, information and belief, the Work has been completed in accordance with terms and conditions of the Contract Documents. After the Certificate of Final Completion has been issued by the Engineer, the County will assume

responsibility for maintenance of the Work except as expressly provided elsewhere in the Contract Documents. The Contractor shall then submit a final payment requisition to the Engineer, along with the items set forth in subparagraph (c)(2).

(2) Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Engineer (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the County, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of Surety, if any, to final payment and (5), if required by the County, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the County.

(3) If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Engineer so confirms, the County shall, upon application by the Contractor and certification by the Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of Surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Engineer prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

(d) The making of final payment shall constitute a waiver of all claims by the County except those arising from:

(1) any indemnity obligations of the Contractor;
(2) faulty or defective Work appearing after Substantial Completion;
(3) failure of the Work to comply with the requirements of the Contract Documents;
(4) terms of any special guarantees required by the Contract Documents; or
(5) failure of the Contractor to procure or maintain any insurance required by the Contract Documents.

(e) The acceptance of final payment shall constitute a waiver of all claims by the Contractor.

GC-9.05 MEASUREMENTS OF QUANTITIES

(a) **Measurement Of Quantities By The Engineer -** With the exception of those items of work to be paid by lump sum, after the Work is completed and before final payment is made therefore, the Engineer will make final measurements to determine the quantities of various items of work performed as the basis for final settlement for all items of work. In the case of unit price items, the Contractor will be paid for the actual amount of work performed and for the actual amount of materials in place, in accordance with the Specifications as shown by the Engineer's final measurements. All work completed under the Contract will be measured by the Engineer according to the standards of weights and measures recognized by the National Bureau of Standards.

(b) **Longitudinal/Transverse Measurements -** All longitudinal measurements for area will be made along the actual surface and not horizontally, and no deductions will be made for individual fixtures in the pavement having an area of nine (9) square feet or less. For all transverse measurements for area of base course and pavements, the dimensions to be used in calculating the pay area will be the neat dimensions shown on the as-built Plans or ordered in writing by the Engineer.

(c) **Structures -** Structures will be measured according to neat lines shown on the Plans or as ordered in writing, unless otherwise provided for elsewhere in the Contract Documents.

(d) **Measurements by Volume -** Volumes of excavation, tamped fill, and borrow pits will be calculated from the cross section and the use of average end area formulae. Volumes of other work such as masonry, removal of masonry, etc. will be calculated by using arithmetic formulae. Where the volume is bounded by varying dimensions and there is no simple volumetric formulae applicable, frequent cross sections will be taken and the volume computed from average end area formulae.

(e) **Cement -** Cement will be measured by weight in hundredweight (cwt) units.

(f) **Measurements By The Linear Foot -** All items which are measured by the linear foot, such as pipe culverts, traffic barriers, underdrains, etc., will be measured parallel to the base or foundation upon which such structures are placed, unless otherwise shown on the Plans.

(g) **Measurements By Gage -** The term “gage” when used in connection with the measurement of uncoated steel sheet and light plates shall mean the U. S. Standard Gage, except that when reference is made to the measurements of galvanized or aluminum sheets used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing, the term gage shall mean that specified in AASHTO M 36, M 167, M 196, or M 197. When the term gage refers to the measurement of wire, it shall mean the wire gage specified in AASHTO M 32.

(h) **Measurements By The Ton -** The term "ton" shall mean the short ton consisting of 2,000 pounds avoirdupois. All materials that are specified for measurement by the ton shall be weighed on accurate, approved scales meeting the requirements of National Bureau of standards Handbook 44. A digital recorder and printout shall be required on all truck scales. The digital recorder shall produce a printed record of the gross, tare, net weights, the time, date, truck identification and project number. Provisions shall be made so that the scales may not be manually manipulated during the printing process. The system shall be interlocked so as to allow printing only when the scale has come to rest. Except for computer operated scales, all weights shall be certified by a bonded weighperson supplied by the Contractor, producer, or supplier. The security bond shall be one hundred thousand dollars ($100,000). If material is shipped by rail, the car weight may be accepted but the payment will be limited to the actual weight of material. Car weights will not be acceptable for material to be passed through mixing plants.

(i) **Measurements By The Cubic Yard -** All materials for which measurements are obtained by the cubic yard, loose measurement or measured in the vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. No allowance will be made for the settlement of material in transit. Approved vehicles for this purpose shall be of any size or type acceptable to the Engineer, provided that the body is of such shape that the actual contents may be readily and accurately determined. Unless all approved vehicles are of uniform capacity, each approved vehicle must bear a plainly legible identification mark indicating the specific approved capacity. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.

When requested by the Contractor and approved by the Engineer in writing, material specified to be measured by the cubic yard may be weighed, and such weights will be converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the laboratory and shall be agreed to by the Contractor before such method of measurement of pay quantities will be approved by the Engineer.

(j) **Bituminous Material -** Bituminous material will be measured by volume in the railroad tank car, tank truck, distributor tank or drums in which it is delivered. Each railroad tank, tank truck, drum or distributor tank of bituminous material delivered for the Project will be measured. The measurements will be taken when the bituminous material is of a uniform temperature and free from air bubbles, and the temperature of the material will be recorded. The volumetric measurement of the bituminous material for these Specifications will be based upon temperature of 60 F. Reference is made to ASTM D 1250, Petroleum Measurement Tables, and ASTM D 633, Volume correction Table for Tars. Only the quantity of bituminous material actually placed in the Work and accepted will be considered in determining the amount due the Contractor.

(k) **Timber -** Timber will be measured by the thousand feet board measure (MBM) actually incorporated in the structure. Measurement will be based on nominal

widths and thicknesses and the extreme length of each piece.

(l) **Lump Sum -** The term "lump sum" when used as an item of payment will mean complete payment for the unit of work described. When a complete element, structure or structural unit (in effect, lump sum work) is specified as the unit measurement, the unit will be construed to include all necessary fittings and accessories.

(m) **Equipment Rental -** Rental of equipment will be measured by time in hours of actual working time, moving in and moving out costs, if any, and necessary traveling time of the equipment within the limits of the project except when special conditions make some other method of measurement desirable.

(n) **Sanitary Sewer And Water Mains And Accessories** - Measurement of sanitary sewer and water mains and their accessories shall be as noted elsewhere in the Contract Documents.

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CATEGORY 100 - PRELIMINARY

SECTION 101 — CLEARING, GRUBBING AND EROSION and SEDIMENT CONTROL

101.01 DESCRIPTION. This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

101.02 MATERIALS. Not applicable.

101.03 CONSTRUCTION — EROSION AND SEDIMENT CONTROL.

101.03.01 DESCRIPTION. Install and maintain erosion and sediment control measures to disturbed areas throughout the life of the project to control erosion and to minimize sedimentation in rivers, streams, lakes, reservoirs, bays, and coastal waters. Implement Erosion and Sediment Control Plan and any modifications approved by Howard Soil Conservation District. Identify staging and stockpile areas, and apply erosion and sediment controls measures as approved. Sediment and erosion control devices are to be provided to contain surface drainage from within the construction site, borrow, waste and storage areas where deemed necessary by the Engineer.

Reference is made to the Maryland Standards and Specifications for Soil Erosion and Sediment Control in Developing Areas, adopted by the Howard Soil Conservation District (SCD) and the State of Maryland Department of Environment, Water Resources Administration (MDE).

101.03.01.01 Erosion and Sediment Control Responsible Personnel. Provide a Responsible Personnel to implement the Erosion and Sediment Control (ESC) Plan and to oversee the installation, maintenance and inspection of the ESC controls.

101.03.01.02 Severe Weather Event. A severe weather event occurs when rainfall exceeds 3 in. over a 24-hr period based upon rainfall data obtained from the nearest official National Weather Service (NWS) gauge station to the Site.

General Notes.

(a) Notification. When Erosion and Sediment Control Approval is published, notify the Howard County Bureau of Engineering Construction Inspection Division (CID) prior to the following milestones:

(1) Pre-construction meeting.

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(2) Erosion and sediment control meeting (minimum 7 working days prior to commencing earth disturbing activities).

(3) Installation of initial sediment control measures.

(4) Installation of major sediment control basins/traps.

(5) Removal or modification of any sediment control structures.

(6) Removal of all sediment control devices.

(7) Final acceptance by the County.

(b) Ingress/Egress Controls. Protect all points of construction ingress and egress to prevent the deposition of materials on public roads. Immediately remove all materials deposited on public roads. The flushing of road surfaces is prohibited.

Control all ingress and egress points through the use of a stabilized construction entrance.

(c) Inspection. Inspect all erosion and sediment control measures daily and after storm events. Maintain continuously in an effective operating condition.

(d) Stop Work Order. Total compliance with the approved erosion and sediment control plan is expected at all times. In cases where the Contractor is found to be in non-compliance, the County may take steps to impose partial or total Stop Work Order until the non-compliance satisfactorily corrected.

The County may impose a total or partial SWO if the project may adversely impact the waters of the State.

(e) Record Keeping. Make the project's approval letter, approved erosion and sediment control plans, approved change requests, daily log books and test reports available on-site for inspection by duly authorized officials.

(f) Erosion and Sediment Control Excavation. Place silt removed from control devices in an approved waste site either on or off the project. Material stored on-site may be reused once it is dried and if it conforms to the requirements of suitable material.

(g) Utility Work. Follow these additional best management practices for sediment control for utility construction in areas outside of designed controls:

(1) Call "Miss Utility" at 1-800-257-7777 48 hours prior to the start of work.

(2) Place excavated material on the high side of the trench.

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(3) Backfill, compact and stabilize trenches for utility installations at the end of each working day. When this is not possible, follow **(4)**.

(4) Place temporary silt fences immediately downstream of any disturbed area intended to remain disturbed for more than one day.

(h) Sensitive Areas. No construction activities are allowed within specified sensitive areas of the project without prior notification of the Engineer. Designate a responsible party to monitor all work in these areas to assure that reasonable care is taken in or adjacent to these areas. Areas considered sensitive are defined as: floodplains, wetlands (tidal, nontidal and associated buffers) critical areas, forested areas, archeological sites, historic sites, parkland, and open water.

(i) Standard Stabilization Note. Following initial soil disturbance or re-disturbance, complete permanent or temporary stabilization within 3 calendar days as to the surface of all perimeter controls, dikes, swales, ditches, perimeter slopes, and all slopes greater than 3:1; and 7 days as to all other disturbed or graded areas on the project site.

(j) Site Information (Not for Bidding Purposes).

(1) Total area of site **acres**

(2) Area disturbed **acres**

(3) Area to be roofed or paved **acres**

(4) Total cut **cubic yards**

(5) Total fill **cubic yards**

(6) Off-site waste/borrow area location (if known)

(k) Incremental Stabilization. Refer to the current Maryland Standards and Specifications for Soil Erosion and Sediment Control for the incremental stabilization of cuts and fills.

(l) Disturbed Areas. Place excavated trench material for any storm drain pipe and underdrain pipe installation on the high side of the trench. Backfill, compact, and stabilize trenches for any storm drain pipe and underdrain pipe installations at the end of each working day.

Stabilize all other disturbed areas at the end of the working day. Place silt fence downgrade of any areas that cannot be stabilized at the end of the work day such that all runoff from the disturbed area will be filtered.

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(m) Removal of Controls. Establish permanent stabilization for all contributory disturbed areas and obtain permission from Erosion and Sediment Control Inspector prior to the removal of sediment control measures.

Immediately stabilize any areas disturbed by the removal of sediment control measures.

(n) Notice of Enforcement. Sediment and erosion control regulations will be strictly enforced.

101.03.02 MATERIALS. Materials shall be in accordance with Category 900 of these specifications. Materials shall be including but not limited to the following:

Riprap
4 to 7 in. Stone
Asphalt Mixes
Pipe
Gabion Wire
Steel Plate
Welding Material
Fence Fabric for Super Silt Fence
Compost
Soil Amendments
Fertilizer
Mulch
Soil Stabilization Matting
Seed
Geotextile, Woven and Non-Woven
Geotextile, Woven Slit Film
2 to 3 in. Stone
3/4 to 1-1/2 in. Stone
No. 57 Stone

101.03.03 CONSTRUCTION.

101.03.03.01 Permits. The Sediment Control Permit will be issued at the preconstruction conference or an on-site meeting arranged by the Engineer of Record and attended by a Sediment Control Inspector.

101.03.03.02 Contractor Responsibilities. Prior to beginning any earth disturbing activity, complete the following:

(a) The Contractor shall obtain all necessary permits and approvals from the appropriate governmental agencies, including those located outside of Howard County, for any offsite work as applicable for waste or spoil areas and borrow

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pits. Copies of all permits or approvals shall be provided to the Engineer prior to starting any work covered by the permits or approvals.

In the event of conflict between these requirements and pollution control laws, rules or regulations of other Federal, state or local agencies, the more restrictive laws, rules or regulations shall apply.

The Engineer shall have the right to inspect erosion control measures in off-site borrow pits and waste areas and to report violations of permit requirements to the County agencies.

(b) The Contractor shall notify the Howard County Construction Inspection Division on at least 48 hours before commencing work on the project. The site, work materials, plans specifications and permits shall be available on-site at all times during working hours for inspection by the County representatives.

(c) Clear only those areas that are so designated on the Plans. The Limit of Disturbance (LOD) will be strictly enforced. Where possible, maintain a vegetative buffer zone between the disturbed working area and any watercourse.

(d) Demarcate all wetlands, wetland buffers, floodplains, waters of the United States, tree protection areas, and the Limit of Disturbance (LOD) according to Section 107. Ensure the demarcations are inspected and approved.

(e) Construct erosion and sediment control measures according to 101.04.03.04. Ensure that controls are inspected and approved.

(f) Ensure that all runoff is directed from disturbed areas to the sediment control measures.

(g) Do not remove any erosion or sediment control measure without approval from the CID. Refer to GC-7.12 for unforeseen conditions.

(h) Ensure that dewatering practices do not cause any visible change to stream clarity.

101.03.03.03 Schedule. If requested by the county, Within 14 days after the Notice of Award, submit an Erosion and Sediment Control Schedule to implement the ESC Plan. Ensure the schedule indicates the sequence of construction, implementation and maintenance of controls, temporary and permanent stabilization, and the various stages of earth disturbance. Changes to the Plan must be approved prior to implementation. Include the following on the submitted plans:

(a) Demarcation of all wetlands, wetland buffers, jurisdictional waters, floodplains, tree protection areas, and the LOD prior to any earth disturbing activity.

(b) Clearing and grubbing of areas necessary for installation of perimeter controls

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specified in the Contract Documents.

(c) Construction of perimeter controls specified in the Contract Documents.

(d) Remaining clearing and grubbing.

(e) Roadway grading including off-site work.

(f) If applicable, utility installation and whether storm drains will be used or blocked during construction.

(g) Final grading, landscaping, and stabilization.

(h) Removal of perimeter controls.

Work is prohibited on-site and off-site until the Erosion and Sediment Control schedules and methods of operation have been accepted by the Administration.

101.03.03.04 Standards and Specifications. Construct and maintain the erosion and sediment control measures and devices in accordance with the latest Howard Soil Conservation District (HSCD) requirements, Maryland Department of the Environment (MDE) Erosion and Sediment Control and Stormwater Management regulations, "Maryland Standards and Specifications for Soil Erosion and Sediment Control", "Maryland Stormwater Design Manual, Volumes I and II", "SHA Field Guide for Erosion and Sediment Control", and as specified in the Contract Documents. Keep a copy of the latest "Maryland Standards and Specifications for Soil Erosion and Sediment Control" on the site at all times.

101.03.03.05 Erosion and Sediment Control Plan (ESC Plan) and Sequence of Construction. Implement the Howard Soil Conservation District's approved ESC Plan and Sequence of Construction.

Minor modifications to the approved erosion and sediment control plans can be made through CID as field revisions. These modifications are limited to practices authorized by the HSCD for approval by CID inspector. A request for a field revisions shall be provided in writing to the CID inspector and require his/her approval prior implementation.

Major modifications (redline revisions) shall be drawn on the original plans for formal submittal to HSCD. The revised plans can only be constructed after they are approved by HSCD and provided to CID inspector.

101.03.03.06 Responsible Personnel. At least 10 days prior to beginning any work, assign and submit the name and credentials for approval a Responsible Personnel. Ensure that the Responsible Personnel is experienced in all aspects of construction and have

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satisfactorily completed Erosion and Sediment Control Training Program either conducted by or authorized by the Maryland Department of the Environment (MDE) pursuant to the appropriate article published in the Annotated Code for the State of Maryland. The Responsible Personnel shall have the primary responsibility and sufficient authority for the implementation of the approved erosion and sediment control schedules and methods of operation, including both onsite and off-site activities. No work may proceed without the Responsible Personnel in place. Any substitutes for the Responsible Personnel will be subject to approval. The County reserves the right to require a reassignment of the Responsible Personnel duties to another individual for any reason.

The Responsible Personnel's duties include:

(a) Attend the Pre-Construction Erosion and Sediment Control Field Meeting and periodic field Erosion and Sediment Control Meetings to evaluate the effectiveness of measures already installed, and to plan for the implementation of necessary controls proposed for succeeding areas of soil disturbance.

(b) Inspection of the erosion and sediment controls on a daily basis to ensure that all controls are in place at all times and to develop a list of activities and schedules to ensure compliance with the Contract Documents.

(c) Maintenance of a daily log of these inspections, including actions taken, and submit a written report at the end of the work day.

(d) Accompanied by the Engineer, conducting after storm inspections both during and beyond normal working hours and submitting a written report.

(e) Having the authority to mobilize crews to make immediate repairs to the controls during working and nonworking hours.

(f) When requested, accompanying the Engineer during ESC Inspections and inspections made by the regulating agencies.

(g) Coordination with the Engineer to ensure that all corrections are made immediately and that the project is in compliance with the approved plan at all times.

101.03.03.07 Severe Weather Event. Maintain, repair, or replace any damaged erosion and sediment control devices within 48 hours of a severe weather event occurrence.

101.03.03.08 Preconstruction Meeting. Present a general overview at the Preconstruction Meeting of how erosion and sediment control measures will be implemented on the project.

101.03.03.09 Stockpile Areas. Locate and size Stockpile Areas. Obtain any necessary permits or modifications for non-specified stockpile areas. Protect excavated material from being eroded into any waters or onto any adjacent lands. Stockpile excavated

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material on the high side of excavated areas

101.03.03.10 Initial Controls. Install all perimeter controls such as silt fence, earth dikes/swales, check dams, traps, and basins, prior to the grubbing operation.

If it is determined that the clearing area has been disturbed and a potential for sediment runoff or erosion exists, install the controls at that time as directed.

101.03.03.11 Erosion Control. Provide erosion control measures such as, earth dike or other diversion devices that will safely convey runoff through disturbed areas to prevent scour or gully erosion. When possible, runoff shall be diverted in a safe manner around disturbed areas using pipes with headwalls and protected outlets, or other approved methods.

101.03.03.12 Maintenance and repairs. Maintain erosion and sediment control devices at all times whether the project is active or inactive. Maintain access to all erosion and sediment controls until the controls are removed. All erosion and sediment control devices that are disturbed during the construction operations shall be fully repaired by the end of the day on which they are disturbed. All erosion and sediment control devices shall be maintained for the winter season and during other times when the project is closed down.

Inspect controls immediately following storm events. Clean out as necessary and repair all damage as the first order of business after the storm event.

101.03.03.13 Stabilization Requirements. Following initial soil disturbance, complete permanent or temporary stabilization within:

(a) Three calendar days for the surface of all perimeter dikes, swales, ditches, perimeter slopes, and all slopes steeper than 3 horizontal to 1 vertical (3:1); and

(b) Seven calendar days as to all other disturbed or graded areas on the project site not under active grading.

When the excavation or embankment reaches the bottom of the subgrade, those areas in which paving will be placed are exempt from the stabilization requirements. Areas between temporary berms, except median areas, need not be stabilized during incremental stabilization.

Sensitive areas may require less than three or seven day stabilization. Maintain as necessary to ensure continued stabilization.

Track slopes within two days of establishment according to 701.03.

101.03.03.14 Waste Areas. Off-site waste areas on State or Federal property require MDE approval. Off-site waste areas in the county must be approved and permitted by

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Howard Soil Conservation District prior to receiving fill. Protect waste areas and stockpile areas with erosion and sediment control measures within the three or seven day stabilization requirement.

101.03.03.15 Howard County DPW Inspections. Work is subject to field inspections by CID Inspectors. If noncompliance with erosion and sediment control provisions is determined, the Responsible Personnel will be immediately notified relative to corrective action. This corrective action may require a shutdown of construction activities until the noncompliance is satisfactorily corrected.

101.03.03.16 Stabilized Construction Entrance. Construct stabilized construction entrances at the specified locations.

Rehabilitate stabilized construction entrance consists of periodic top dressing with additional aggregate, replacement of pipe, or other repairs to the entrance and sediment trapping devices.

Place wash racks as directed to prevent tracking of mud and sediment from disturbed areas.

101.03.03.17 Side or Berm Ditches and Culverts. Construct side ditches in fill areas and berm ditches in cuts, including lining. Protect these linings from sediment deposits. Place silt fence along the banks of existing streams as shown in the Contract Documents prior to placing any culverts. To avoid sedimentation during construction, divert the streams; in accordance with Maryland Standards and Specifications for Soil ESC for stream diversion, around the location of the culvert until the proposed culvert and channel are stabilized.

101.03.03.18 Erosion and Sediment Control Original Excavation. Excavate, construct embankments, grade, and backfill for sediment traps, sediment basins, and other sediment controls in accordance with contract drawings and current Maryland Standards and Specifications for Soil ESC.

Ensure that excavation and embankments meet the dimensions for each sediment control as specified. Stockpile excavated material and use for backfill when the sediment controls are removed.

Stockpiles. Protect excavated material from being eroded into any waters or onto any adjacent lands. Stockpile excavated material on the high side of excavated areas

101.03.03.19 Erosion and Sediment Control Cleanout Excavation. Remove accumulated sediment from sediment controls or other areas during routine maintenance of sediment controls, or as directed.

Clean out sediment traps as necessary to ensure that at least 50 percent of the wet storage capacity is available at all times. Ensure that riprap outlet sediment traps have at least 75

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percent of the wet storage capacity available at all times. Remove sediment from silt fence, super silt fence, stone outlet structures, and stone check dams, when it reaches 25 percent of the height of the device.

Place removed sediment in an approved waste site. Material stored on-site may be reused once it is dried and it meets embankment requirements.

101.03.03.20 Pipe Slope Drain. Pipe slope drains shall be provided to carry runoff from cuts and embankments. The pipe slope drains may be of flexible or rigid construction but shall be capable of being readily shortened or extended as the cut or fill advances. Pipe end sections with stabilized aprons shall be provided at the entrance to temporary slope drains. Where necessary, energy dissipaters shall be provided at the outlet. In all cases, temporary slope drains shall be outlet to either to a stabilized area or a sediment control measure. All connections shall be water tight. When slope drains are placed on grade, construct interceptor berms to direct flow into the flared end section.

101.03.03.21 Super Silt Fence. Construct as specified with the following exception:

Run a 7 gage top tension wire continuously between posts.

101.03.03.22 Filter Bag. Determine the bag dimensions necessary to provide the required storage volume. Determine pump and hose sizes.

101.03.03.23 Stone Outlet Structure. Stabilize the area immediately after removal of the structure.

101.03.03.24 Temporary Gabion Outlet Structure. As specified in Section 313. Grade and stabilize the area beneath the structure, immediately upon removal.

101.03.03.25 Portable Sediment Tank. Determine the dimensions necessary to provide the required storage volume per Maryland Standards and Specification for Soil ESC.

101.03.03.26 Dewatering. Dewater only when conditions allow. Ensure that dewatering activities do not cause any visible change to stream clarity. If a sediment plume is visible, immediately cease the dewatering activity. Direct any pumping activity, including dewatering sediment traps and basins, through an approved dewatering device.

101.03.03.27 Sediment Traps. Excavate sediment traps to the specified length, width, and depth.

At sites where filtration or infiltration devices are used for the control of storm water, prevent runoff from unstabilized areas from entering the infiltration devices. Ensure that bottom elevations of sediment control devices are at least 2 ft higher than the finish grade bottom elevation of the filtration or infiltration device. When converting a sediment trap to a permanent stormwater facility, remove and dispose of all accumulated sediment prior to final grading of the device.

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When grading and paving operations are complete and vegetation is established on the slopes and channels to the satisfaction of the Engineer, refill the sediment traps with suitable materials, and shape and treat them as specified.

101.03.03.28 Stone for Sediment Control. Place No. 57 stone, 3/4 to 1-1/2 in. stone, 2 to 3 in. stone, 4 to 7 in. stone, and riprap for sediment control as specified.

101.03.03.29 Water Resources Permits And Channel Construction. Streams large enough to require the placement of a work area within the stream channel will require a Water Resources Administration permit. When utilizing a stream diversion flume within a large stream that requires a working area to be constructed in the stream, the initial diversion shall be constructed of non-erodible materials such as stone, sandbag, wood planking, or soil protected with stone or sandbags and shall be placed upstream prior to constructing the working area. All soil used in the stream crossing shall be protected from the forces of the water in the channel with non-erodible materials approved by the Engineer and MDE. After completing the crossing, remove all materials associated with the construction.

101.03.03.30 Maintenance of Stream Flow. Maintain the continuous flow of waterways during operations as specified or directed.

(a) Implement the approved plan included in the Contract Documents. Any changes to the approved plan require approval from the appropriate regulatory authorities.

(b) A different plan for maintenance of stream flow may be submitted, but approval from the Engineer and the appropriate approval authority will be required.

(c) If the stream diversion system as shown is not capable of blocking the flow of water through the soil beneath the system, design and provide an effective means of diverting the water away from the designated areas.

(d) Ensure that all excavation performed within the diverted stream is performed in a dewatered condition, which may require additional pumps, sheeting, shoring, cofferdams, etc.

(e) If the proposed system does not perform satisfactorily or additional material and equipment is required to dewater the site and excavated areas, adjust the stream diversion system and obtain approvals.

(f) Securely anchor the stream diversion system in place to prevent movement during high water events. Submit the proposed method of anchoring for approval. Do not install anchors beyond the limits of disturbance or infringe on the channel area available for stream flow.

(g) Upon completion of construction and after temporary drainage devices have

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served their purpose, remove and dispose of the devices in an acceptable manner.

101.03.03.31 Drainage. The Contractor shall shape the graded area in a manner as to permit the run-off of precipitation and shall construct earth berms along the top edges of embankments to intercept runoff water. Earth berms shall be compacted to the satisfaction of the Engineer.

101.03.03.32 Cut Slopes. Cut slopes shall be dressed, prepared and seeded as the work progresses in accordance with Maryland Standards and Specification for Soil ESC incremental slope stabilization requirements with the following sequence:

(a) Slopes with a vertical height of 15 feet or greater shall be seeded in fifteen foot increments of height.
(b) Slopes with a vertical height of 15 feet or less may be seeded in one operation.

The dressing, preparing and seeding of slopes shall be performed immediately following the completion of each increment of height stated and immediately following the suspension of grading operations

101.03.03.33 Fill Slopes. Fill slopes shall be dressed, prepared and seeded as the embankment proceeds.

101.03.03.34 Work Site. The Engineer will limit the area of excavation and embankment operations in progress commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding and other pollution control measures current in accordance with the accepted schedule. Should seasonal limitations make coordination unrealistic, erosion control measures shall be taken immediately. All construction shall be confined to the minimum area necessary to accommodate the Contractor, equipment and work force engaged in his work.

101.03.03.35 Grading Unit. A grading unit is defined as The maximum contiguous area of disturbed earth on a site allowed to be graded at a given time and it is limited to 20 acres or less. The contractor shall be prepared to dress and seed behind each grading unit as defined above.

101.03.03.36 Contractor Compliance. In the event that erosion and pollution control measures are required due to the Contractor's negligence, carelessness or failure to install permanent control as part of the scheduled work, the Engineer may order the work to be performed by the Contractor at his own expense.

Erosion and pollution control work required which is not attributed to the contractor's negligence, carelessness or failure to install permanent controls shall be performed as ordered by the Engineer. Where the work to be performed is not attributed to the Contractor's negligence, carelessness or failure to install permanent controls and falls within the Specifications for a work item that has a Contract price, the units of work shall be paid for at the proper Contract price.

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101.03.03.37 Work Suspension. The Contractor shall comply with the requirements specified herein and as shown on the Plans. Any violation of these requirements may result in the issuance of a written Notice of Suspension of the Work. The suspension of work will not be lifted until the Contractor has completely corrected the violation. Time extensions requested as a result of delays occasioned by such suspensions will not be considered.

101.03.03.38 Revisions. Should conditions arise in the field that render the Erosion and Sediment Control Plans inadequate or inappropriate for work included in the Contract, the Contractor shall immediately notify the Engineer and the Howard Soil Conservation District. Where necessary, additional plans or modifications will be furnished by the County and will become a condition of the Sediment Control Permit.

101.03.03.39 Removal of Controls. Do not remove erosion and sediment control measures until all previously disturbed areas are vegetated with at least a 3 in. growth of grass, and the removal has been approved by Erosion and Sediment Inspector. Backfill, grade, and stabilize.

101.03.03.40 Vegetation. The Engineer will designate and mark trees, shrubbery, and plants that are to remain in place. Protect them from any damage, as specified in GC-7.11. Cut and properly trim the branches of trees overhanging the roadway to maintain a vertical clearance of 16 ft. Employ a tree expert licensed by the State of Maryland to supervise all trimming operations. Perform all trimming and repair of cuts and scars as specified in Section 712.

101.03.03.41 Fences.
This section intentionally left blank.

101.03.03.42 Mailboxes.
This section intentionally left blank.

101.03.03.43 Grubbing.
This section intentionally left blank.

101.03.03.44 Stream and Channel Changes.
This section intentionally left blank.

101.03.03.45 Disposal.

(a) Burning. No burning shall be allowed.

(b) Disposal Locations. Materials, debris and perishable materials shall be removed from the right-of-way and disposed of by the Contractor. The Contractor shall make all necessary arrangements to obtain suitable disposal locations and shall furnish the Engineer with a copy of resulting agreements.

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Delete the paragraph, "(c) Wood Disposal".

101.04 MEASUREMENT AND PAYMENT.

Clearing and Grubbing will not be measured but will be paid for at the Contract lump sum price. The payment will be full compensation for the removal and disposal of fences, removal and resetting of mailboxes, selective tree trimming and scar repair, repair or replacement of damaged trees, restoration measures for damaged or destroyed protected resources, repair to other damaged properties, removal and disposal of existing buildings when not covered as a specific pay item in the Contract Documents, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Erosion and Sediment Control payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work. The maintenance, repair, resetting, and final removal of all erosion and sediment control devices will not be measured, but the cost will be incidental to the Contract price to construct the device unless otherwise specified in the Contract Documents.

101.04.01 Excavation of sediment basins, sediment traps, temporary ditches and Cleaning as required will be measured as Class 2 Excavation, unless the work is to be classified under a separate item as otherwise provided.

101.04.02 Pipe slope drains and temporary sediment pipe installed in connection with sediment basins will be measured by the linear foot. Payment includes all materials , placement, maintenance, adjustment and removal. All material to be the property of the Contractor.

101.04.03 Soil stabilization Matting will be measured on the basis of the number of square yards in place in accordance with Section 709.04. The price shall include the cost of all labor, equipment and materials necessary to satisfactorily complete the work as specified.

101.04.04 Excavation of sediment basins, sediment traps, temporary ditches and cleaning as required will be paid for as Class 2 Excavation, unless the work is to be classified under a separate item as otherwise provided.

101.04.05 All costs of temporary berm shall be incidental to the excavation items and will not be measured. Temporary slope drains will be paid for on a linear foot basis. The price shall include materials, placement, maintenance, adjustment and removal. All material to be the property of the Contractor. Should the work not be comparable to the project work under the applicable Contract items, the Contractor will be ordered to perform the work on a force account basis or by agreed unit prices.

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101.04.06 Wherever rock excavation is available for place or spreading over the lower region of embankments in the immediate vicinity of stream crossings, the excavation placing and spreading of the work shall be included in the cost of Class I Excavation for utilizing all suitable materials from excavation in the construction of fills throughout the entire length of the project.

Wherever rock excavation is available to rip rap ditches, channels and other drainage ways, the rip rap shall be constructed and paid for in accordance with the Plans and Section 901.

101.04.07 In case of repeated failures on the part of the Contractor to control erosion, pollution and/or siltation, the Engineer reserves the right to employ outside assistance or to use his own forces to provide the necessary corrective measures. The incurred direct costs plus project engineering costs will be charged to the Contractor and appropriate deductions made from the Contractor's monthly progress payment.

101.04.08 No payment will be made for work under this section as a result of the Contractor's failure to prosecute the work in a timely manner.

SECTION 102 — REMOVAL AND DISPOSAL OF EXISTING BUILDINGS

102.01 DESCRIPTION. Remove and dispose of existing buildings, including foundations, footings, or any part thereof, and backfill as specified. Locations of buildings included in the work will be designated in the Contract Documents by the circled numbers 1, 2, 3 etc. No removal or disposal shall take place until the contractor has obtained all appropriate permit(s).

102.02 MATERIALS. Not applicable.

102.03 CONSTRUCTION. Schedule the removal, razing, or occupation of buildings and appurtenances as one of the first items of work. Post and protect the buildings from vandalism and theft.

Salvaged materials shall become the property of the Contractor. Selling of merchantable material and removal by the purchaser shall be done only during daylight working hours and accompanied by a Contractor's representative.

102.04 MEASUREMENT AND PAYMENT. Removal and Disposal of Existing Buildings will not be measured but will be paid for at the Contract lump sum price. The

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payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work. Buildings not designated for removal and disposal in the Contract Documents will not be measured but the cost will be incidental to Section 101. The Administration reserves the right to eliminate from this item any or all buildings or structures. For each building eliminated from this item, the item will be credited to the extent of the cost eliminated, which will be determined from a breakdown submitted by the Contractor showing the tabulation of individual unit costs used in arriving at the Contract price for this item. Submit a breakdown of the Contract lump sum price for Removal and Disposal of Existing Buildings to the Engineer prior to beginning work.

SECTION 103 — ENGINEERS OFFICE

103.01 DESCRIPTION. Furnish, clean, and maintain in good condition an Engineers office at an approved location within the immediate vicinity of the project. The office shall be separate from any offices used by the Contractor, and it and all items therein shall be for the exclusive use of the Administration's Engineers and Inspectors. Rented properties that conform to the type of office specified in the Contract Documents will be acceptable.

103.02 MATERIALS. Not applicable.

103.03 CONSTRUCTION. Set up, equip, and make the office ready for use at least five days prior to commencement of other work on the project. Leave the office and appurtenances in place until all field records are complete. Upon removal of the office, restore the location to a condition acceptable to the Engineer.

Unless otherwise specified, the office and all furnished equipment and accessories shall become the property of the Contractor at the completion of the project.

103.03.01 Mobile Housing Unit. Provide a mobile housing unit having floor space of at least 100 ft2 and window area of at least 10 ft2. Ensure it is entirely enclosed and waterproofed and has a door that locks. Provide a table 36 x 48 x 40 in. high and one closet equipped with a lock. Furnish two keys for each lock. Provide satisfactory heating and cooling. Relocate the unit as directed.

103.03.02 Handicap Accessibility. When handicap accessibility is necessary, comply with the Federal Register-Volume 56 No. 144-Americans with Disability Act (ADA) Accessibility Guidelines for Buildings and Facilities.

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103.03.03 Mobile Office Trailers. Anchor in accordance with the manufacturer's recommendations. Office trailers, as defined under the Industrial Building and Mobile Act of Maryland, shall be approved by the Maryland Department of Housing and Community Development and bear the Maryland Certification Insignia in the interior of the office.

103.03.04 Quality Control Laboratory. Section 915.

103.03.05 Construction Requirements for all Offices.

(a) Entirely enclosed, waterproofed, and completely insulated to at least an R11 rating.

(b) Double thick floor with building paper placed in between the floor layers.

(c) Finished inside and outside as approved.

(d) A ceiling height of at least 7 ft, a pitched roof, and a ventilating louver in each gable.

(e) A 4 x 1 ft sign with the message "ENGINEERS OFFICE – HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS" attached to or mounted in front of the office. The sign shall have a black background and have white lettering at least 3 in. high.

(f) A 5 x 7 in. no smoking sign posted on the outside of each entrance to the office, plant laboratory, and mobile housing unit.

(g) Interior and exterior doors equipped with different key locks. Interior doors keyed alike. Exterior doors keyed alike. An additional dead bolt lock for each exterior door. Four keys for each interior and exterior lock.

(h) Windows capable of being opened and closed. Equip with latches, screens, and venetian blinds or shades.

(i) Electrified in accordance with national and State electrical codes with satisfactory artificial lighting and lighting services. Ensure an illumination level of at least 75 ft-c. Provide a minimum of four 110-volt duplex electric convenience outlets, at least one on each wall.

(j) Equipment capable of heating the office to at least 70 F and cooling to at least 78 F.

(k) A restroom facility in accordance with the State Department of Health and Mental Hygiene or other authorities having jurisdiction. Connect to water and sewage or a well and septic system. Provide a pressurized water system capable of maintaining at least 20 psi. Furnish a wash basin, water closet, soap holder, paper towel holder, and mirror.

(l) Maintain the facilities in a clean and sanitary condition. Sweep the floor and remove the trash daily. Damp mop and wax the floor biweekly. Clean the

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interior and exterior of all windows monthly. Perform all work on an as needed basis and when requested

(m) Protect the Administration and Administration employees from any loss or damage to their property stored in the Engineers Office. Provide protection in the amount of twenty thousand dollars ($20 000), nondeductible, per each occurrence, for any loss or damage due to fire, theft, vandalism, storms, or floods. Complete the reimbursement, replacement, or repair within 30 days from the date the Engineer reports the loss.

(n) A parking area for the exclusive use of Administration employees. Provide the specified number of spaces. Post signs to designate the assigned parking areas. Stabilize the parking area as directed.

(o) Fire extinguishers of a dry chemical or multi-purpose ABC type (at least 10 lb), equipped with a visual air pressure gauge, and maintained in accordance with OSHA standards.

(p) A 24 unit first aid kit furnished and maintained as described in the Code of Federal Regulations, Title 29 Subpart D, Section 1926.50(d)2.

(q) A 4 x 8 ft waterproof bulletin board. Place in an easily accessible area within the project limits and conspicuously displayed to all employees. Post and maintain all pertinent and required notices for the duration of the project.

(r) Touch-tone telephones equipped with an answering device capable of answering, recording, storing, and playing back incoming messages at least 5 minutes in length per message with 30minutes minimum total storage capacity, recording outgoing messages up to 15 seconds in length. The device shall be voice activated, beeperless, record as long as the speaker speaks, and play back recorded messages without dial tone or pauses.

Replace stolen equipment and equipment that becomes defective or for any other reason does not function as intended. Provide an equal or better unit within eight hours after notification. Replacement shall be at no additional cost to the Administration. Post emergency telephone numbers at a conspicuous location.

(s) One 12 ft^3 electric refrigerator.

(t) An approved cassette player/recorder with cassettes or digital recording device.

(u) One paper copier machine, with automatic document feed capable of printing at least 15 copies per minute and documents of up to 11 x 17 in. Supply paper and provide service as needed

(v) One sanitary electric water cooler, including bottled water and disposable cups.

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(w) One paper shredder capable of shredding at least 10 sheets (20 lb bond) at a time. Throat width of at least 12 in. Speed of at least 20 feet per minute. Auto reverse or auto stop for paper jams. Power of at least 115 v.

103.03.06 Microcomputer System for All Offices

Microcomputer System for All Offices shall be in accordance with the Special Provisions.

103.03.07 Facsimile (FAX) Transceiver for All Offices

Facsimile (FAX) Transceiver for All Offices shall be in accordance with the Special Provisions.

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103.03.08 Specific Field Office Requirements.

Engineers Office – Unless otherwise noted on the Contract Documents, standard office trailer will be a minimum of 400 ft^2 of floor area located under one roof, in accordance with Engineers Office "B" Specific Requirements as shown in Table 103.

ENGINEERS OFFICE				ITEM
A	B	C	D	
–	1	2	–	Inner Offices–100 ft^2 each
–	1	1	–	General office area
–	–	–	4	Inner Offices–120 ft^2 each
–	–	–	1	Conference room–240 ft^2
	–	–	1	Storeroom with shelves–120 ft^2
1	1	1	2	Restroom, 30 ft^2
–	1	1	1	Inner office ingress and egress to the other rooms
3	4	4	5	32 x 60 in. Executive type desks with center drawers
3	4	4	5	Swivel chairs, padded with arm rests
1	1	1	1	30 x 72 in. slant top drafting table and stool, approximately 40 in. high at the front edge
1	2	3	6	30 x 72 in. folding utility table, 30 in. high
–	–	–	1	12-person conference table with padded chairs
2	6	10	12	Additional padded chairs
1	2	2	3	Plan racks
1	1	1	2	Coat racks
1	1	1	1	3 x 6 ft blackboard or whiteboard
1	2	3	3	Electronic desk calculators with memory and tape readout (including manuals, and tapes as needed)
1	1	2	6	Legal size steel filing cabinets, 4 drawer fire resistant (D label) with locks
–	2	2	2	Standard size steel filing cabinets, 4 drawer with locks
1	1	1	5	Bookcases having four shelves 36 x 12 in.
1	2	2	2	Closets, full height, measuring at least 24 x 30 in., equipped with locks, and at least two shelves in each
1	1	1	–	Utility cabinet with 3 adjustable shelves
1	1	1	–	Overhead cabinet at least 8 ft long, 15 in. deep, and 18 in. high
1	1	1	2	Fire extinguisher as specified in 103.03.05
1	2	2	4	Telephones with separate lines, as specified in 103.03.05
2	2	2	2	Battery-operated smoke detectors
4	8	10	15	Designated parking spaces

103.03.09 Recycling. Recycling of recyclable paper (bond, newsprint, cardboard, mixed paper, packaging material and packaging), bottles (glass and plastic), and aluminum cans will be required at the Engineer's Office and the Contractor's facilities for the project.

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Furnish approved containers, and remove the material from the site on an approved schedule or as directed. All material shall be taken to an authorized recycling facility. Maintain a log for the duration of the project documenting the type of materials recycled. The log shall include the types of material, date, time, location of facility, and signature line. Furnish a copy of the log at the completion of the project and upon request.

The Contractor shall be considered the owner of any profit and be responsible for all incurred costs.

SECTION 104 — MAINTENANCE OF TRAFFIC

104.00 GENERAL. This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

104.02.03 CONSTRUCTION

Add the following.

(h) Steel Plates.

Whenever steel plates are utilized, the following provisions will apply:

The Bureau of Engineering shall be notified at least 48 hours in advance of any steel plates being placed in roadway. Steel plates shall not be left in the roadway longer than seven (7) calendar days without permission from the Bureau of Engineering. The plates must be monitored twice a day, seven (7) days a week, by the contractor until the plates are removed from the project.

All Steel Plates shall be A-36 Grade Steel, at least 1 inch thick, and designed by the Contractor's Engineer to effectively carry traffic with a maximum of one (1) inch of deflection. Steel plates must be recessed and securely fastened in the road surface so the top of the steel plate is the same elevation as the top of the existing roadway and large enough to allow a minimum of two feet (2') bearing on at least three sides of the trench. The plates shall be pinned with spikes securely fastening inside all four corners to prevent movement.

Bituminous concrete cold mix must be used on all edges of the steel plate to minimize hazard to the traveling public. Cold mix must fill any gaps between the top of the steel plate and the existing road surface. Gaps caused by milling the existing pavement to recess steel plates shall not exceed one inch in depth and three inches in length (1"x3") along the vertical edge of the steel plate.

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Tight Sheeting shall be required where the excavation is within the roadway pavement and where the excavation off the roadside edge is a distance less than the depth of the excavation. The roadside face shall be tightly sheeted and braced securely against skeleton sheeting on the opposite or far side of the excavation. When in the opinion of the County, field conditions dictate, tight sheeting shall be required. Tight sheeting shall be installed in accordance with all MOSHA regulations. All wood sheeting shall be left in place and cut-off two feet (2') below the finished grade. Steel sheeting systems may be used with prior approval, and removed only as tamped fill progresses. If the excavation is to be left open, it shall be tight sheeted and the Contractor shall notify the County. A trench box support may be used with the prior approval of the Bureau of Engineering.

From Oct. 1st to April 1st all steel plates are to be marked with cones for Identification during snow events. The Contractor shall provide cones painted INTERNATIONAL ORANGE and place them at the steel plates, visible to the traveling public. The markers shall be placed two feet (2') beyond the face of curb or edge of shoulder, with one marker adjacent at the leading edge and one marker at the trailing edge of the steel plates.

All equipment and material shall be removed from the road right-of-way or located a minimum of 30 feet from the edge of the existing travel lane pavement during non-working hours and when not being used in daily construction operations. Material shall be stored in a way which: does not reduce driver sight distance, interfere with roadway drainage, or jeopardize motorist and pedestrian safety in any way.

When placing multiple plates one of the following methods shall be used:

Two plates or more shall be welded together. This consists of placing three we1ds twelve inches (12") in length on each abutting plate: one weld placed one foot from each edge and one weld placed in the center of the plate.

Two plates or more shall be held together with steel plate blocks. This consists of placing six steel plate blocks, eight-inch by twelve-inch by one-inch (8"x12"x1") to one of the plates. All six blocks are to be placed on one plate, three on the bottom and three on top. The four outside blocks are to be placed twenty-seven inches (27") from each edge and two remaining blocks are to be placed in the center of the plate. Note that plates on top are chamfered to remove right angle edges from impact in the direction of travel.

Should an emergency condition occur that Howard County forces must correct, the Contractor will be charged for any and all costs, including but not limited to: labor, equipment, overtime, overhead, inspection, etc., associated with restoring the roadway to a safe and acceptable level. The Contractor shall provide a contact when notifying the Bureau of Engineering prior to placing any steel plates in roadway.

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When steel plates are used to bridge open cut excavations within roadway pavement areas, signs shall be placed in advance of the steel plates. Signs shall conform to MUTCD specifications. A W95-5(1) "Steel Plates" sign (in accordance with the latest edition of MSHA's Standard Sign Book) shall be placed for each direction of traffic approaching the steel plates, approximately 500 feet in advance of the steel plates. Location and spacing of signs will depend on field conditions, and are subject to approval of the County.

104.02.04 MEASUREMENT AND PAYMENT

Add the following.

(e) The installation and/or removal of steel plates, working around working around or protecting the utilities, removal of temporary materials from the adjusted utilities prior to placement of the proposed hot mix asphalt, and cooperation with the owners of the utilities and with other Contractors will not be measured, and the cost will be incidental to the items specified in the Contract Documents.

SECTION 107 — CONSTRUCTION STAKEOUT

107.01 DESCRIPTION. This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

107.02 MATERIALS.

Delete SHA in "SHA WETLAND".

107.03.01 Line and Grade.

Replace section with the following:

Survey benchmarks and traverse point locations are provided on the contract documents, along with the corresponding elevations and coordinate locations. The Engineer shall provide a stakeout table on the contract documents, providing coordinate locations of the various components of the proposed facilities/utility. The Contractor shall protect the benchmarks and traverse points during construction of the facility.

The Contractor shall provide a stakeout of the proposed facilities as indicated in the contract documents and prepare all necessary cut sheets. The stakeout and cut sheets shall be provided at a maximum spacing of 50-foot intervals. Stakeout and cut sheets along curved alignments shall be provided at a maximum spacing of 25 foot. Cut sheets

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shall be prepared based on the lines and grades shown on the contract drawings; any modifications required to comply with approved laying schedules shall be the responsibility of the Contractor. Copies of the cut sheets shall be provided to the Engineer a minimum of 2 days prior to their use.

The Contractor shall preserve and maintain in proper position all stakes, grade-boards and lines until authorized to remove them. In case any are disturbed, the Contractor shall reset those so disturbed at his expense.

Any work done without cut sheets, lines, levels and instructions having been given by a Licensed Surveyor, or without the supervision of the inspector, shall not be estimated or paid for except when such work is authorized by the Engineer. Work so done may be ordered removed and replaced at the Contractor's cost.

Finished surfaces, in all cases, shall conform to the lines and grades as shown on the approved plans. Manhole frames, valves, boxes, etc. shall be set to conform with the finished grade of the street, or as shown on the drawings. The Contractor shall define the right-of-way, easement line or limits of disturbance (L.O.D.) of the project promptly upon request.

107.03.02 Equipment and Personnel

Replace section with the following:

The Contractor shall perform construction stakeout using the services of a Professional Land Surveyor or Property Line Surveyor licensed in the State of Maryland (Licensed Surveyor). The Contractor shall provide all necessary lines, grades and elevations for the proposed construction and conform his work thereto. The Contractor shall furnish all necessary materials, labor, and equipment for the setting of all stakes, grade-boards, lines, forms, etc., which may be required for the proper construction of the work.

107.03.03 Control Markers.

*Delete the words, "*set by the Engineer*" from the sentence that begins, "*Preserve the center line…*"*

107.03.05 Layout.

*Delete the word, "*Engineer's*" from the sentence,* "Before any actual construction begins…*"*

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SECTION 109 — CRITICAL PATH METHOD PROJECT SCHEDULE (CPM)

109.01 DESCRIPTION. This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

Add the following paragraphs after the "Scheduling Representative" section:

Coordination. When there are separate contractors working concurrently on adjoining or overlapping work that must interface or be coordinated with the Work of Contractor, Contractor shall coordinate his activities of the separate contractors and shall, prior to the submission of his ICPM, obtain written approval of his Construction Schedule by the separate contractors. If Contractor is unable to obtain such written approval by the separate contractors after his best efforts to do so, or if a conflict occurs that cannot be resolved by mutual agreement between Contractor and any separate contractor, the Chief Engineer shall make a determination of the schedule which will be binding upon Contractor and the separate contractors.

The Contractor acknowledges and agrees that his Construction Schedule must be flexible in order to accommodate and allow for his coordination with the operations of the County and the work of separate contractors. The County will review the Contractor's Construction Schedule for compatibility with County operations and the work of separate contractors. Contractor agrees to hold meeting with the County and separate contractors to resolve any conflicts between Contractor's Construction Schedule and the operations of the County or work of separate contractors. Contractor agrees to fully cooperate with County and separate contractors to resolve such conflicts and to revise his Construction Schedule as reasonably required.

Initial Critical Path Method Project Schedule (ICPM).

Delete the two paragraphs that outline the deadlines for Contractor submission and Engineer's review of the ICPM. Replace with the following:

Deadline requirements for the Contractor's submission and any resubmission of the ICPM and the Engineer's review of such submissions shall be in accordance with the County's Standard General Conditions, Section GC-8.04 Progress Schedule.

Add the following section immediately before the "CPM Updates" section:

Schedule of Values. Within ten (10) calendar days after completion of the ICPM, the Contractor shall submit to the Engineer a Schedule of Values for review, allocating a dollar value for the activities on the ICPM. The dollar value for the activity shall be the cost of the work of the activity including labor, materials, and pro rata contribution of General Conditions requirements, overhead and profit. The sum of all activity costs shall

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equal the Total Contract Sum. The Contractor shall revise the Schedule of Values as necessary to gain the approval of the Engineer.

The activity cost for the Schedule of Values shall be coded with a cost code corresponding to the trade, subcontractor or supplier performing the work so that subtotals for each division of the work can be prepared.

The Schedule of Values shall, in the best judgment of the Contractor, represent a fair, reasonable and equitable dollar (cost) allocation for each activity on the ICPM.

SECTION 110 — ACTIVITIES CHART PROJECT SCHEDULE

This section shall be deleted in its entirety.

SECTION 120 — TREE PRESERVATION

120.01 DESCRIPTION. This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials or the latest edition of the Howard County Forest Conservation Manual, whichever is more stringent.

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SECTION 130 — FIXED PRICE CONTINGENT ITEMS

130.01 DESCRIPTION. Fixed price contingent items have been established and are included in the contract Proposal. The County hereby reserves the right to unlimited increases or decreases to the quantities of the fixed price items without unit price increases for the duration of this contract.

These items are only applicable to the work when they are included in the Proposal with prices stipulated prior to bidding. In the absence of this, they will be cared for as described elsewhere in the Contract Specifications for Extra Work or as regular bid items.

The following fixed price contingent items shall be utilized only if and as directed by the Engineer.

Work completed under the following fixed price contingent items shall include and cover the furnishing of all labor, materials, tools, equipment and incidentals necessary, and shall include temporary excavation support, support of existing utilities, bracing, dewatering, excavation, furnishing and placing backfill, compaction, hauling, disposal of excess or unsuitable material, erecting and removing concrete forms, placing reinforcing, installing sleeves, pouring concrete, and surface restorations, as necessary, and all related work required to satisfactorily complete the work as specified or as directed by the Engineer.

Item 1: Class 1A Excavation
Item 2: Crusher Run Aggregate CR-6 for Maintenance of Traffic
Item 3: Hot Mix Asphalt (HMA) for Maintenance of Traffic
Item 4: Mix No. 3 Concrete for Curbs, Sidewalks and Steps
Item 5: Mix No. 3 Concrete for Miscellaneous Drainage Structures
Item 6a: Common Borrow
Item 6b: Select Borrow
Item 7: Class 3 Excavation
Item 8a: Selected Backfill Using Crusher Run CR-6 Aggregate
Item 8b: Selected Backfill Using No. 57 Aggregate
Item 9: Excavation Support Systems Left In-Place
Item 10: Calcium Chloride for Dust Control
Item 11: Mix No. 1 Concrete
Item 12: Test Pit Excavation
Item 13: Patching Existing Pavement with Hot Mix Asphalt (HMA)
Item 14: Patching Existing Pavement with Portland Cement Concrete
Item 15: Silt Fence
Item 16: Super Silt Fence
Item 17: Straw Bale Dike
Item 18: Stone Outlet Sediment Trap
Item 19: Temporary Seeding and Mulching

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130.02 MATERIALS. Materials shall be in accordance with Category 900 of these specifications.

130.03 CONSTRUCTION. Construction methods are described in the specification section(s) referenced for each item under 130.04.

130.04 MEASUREMENT AND PAYMENT.

Item 1: Class 1A Excavation

a. This item of work shall consist of Class 1A Excavation, as described in Section 201 Roadway Excavation, of all unsuitable material below subgrade, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual volume of material excavated, in cubic yards measured in place, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 2: Crusher Run Aggregate CR-6 for Maintenance of Traffic

a. This item of work shall consist of furnishing and placing complete, Crusher Run Aggregate CR-6 for Maintenance of Traffic, as described in Section 105 Aggregate for Maintenance of Traffic, Section 501 Aggregate Base and Subbase Courses, and the Standard Details, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place quantity of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per ton.

c. A delivery ticket system shall be provided for accurately determining the amount of material delivered to the work. The tickets shall be serially numbered and show date of delivery, gross weight, tare weight and net weight of the material and the number of the truck. One copy of the ticket shall be given to the Engineer on the work site.

Item 3: Hot Mix Asphalt (HMA) for Maintenance of Traffic

a. This item of work shall consist of furnishing and placing complete, Hot Mix Asphalt (HMA) for Maintenance of Traffic, as described in Section

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106 Hot Mix Asphalt (HMA) for Maintenance of Traffic, Section 504 Hot Mix Asphalt Pavement, and the Standard Details, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place quantity of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per ton.

c. A delivery ticket system shall be provided for accurately determining the amount of material delivered to the work. The tickets shall be serially numbered and show date of delivery, gross weight, tare weight and net weight of the material and the number of the truck. One copy of the ticket shall be given to the Engineer on the work site.

Item 4: Mix No. 3 Concrete for Curbs, Sidewalks and Steps

a. This item of work shall consist of furnishing and placing complete, Mix No. 3 Concrete for Curbs, Sidewalks and Steps, as described in Section 602 Curb, Combination Curb and Gutter, and Monolithic Medium, Section 603 Sidewalks, and the Standard Details, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place volume of concrete satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 5: Mix No. 3 Concrete for Miscellaneous Drainage Structures

a. This item of work shall consist of furnishing and placing complete, Mix No. 3 Concrete for Miscellaneous Drainage Structures, as described in Section 305 Miscellaneous Structures, and the Standard Details, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place volume of concrete satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 6a: Common Borrow

a. This item of work shall consist of furnishing and placing complete, Common Borrow material, as described in Section 203 Borrow

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Excavation, Section 1000 General Requirements for Water Main, Sanitary Sewer, and Storm Drain Construction, and the Standard Details, in addition to that shown on the Drawings, specified, or as included in other Bid Items, or in the event that sufficient suitable material is not available from the required excavations on site, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place cubic yard volume of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 6b: Select Borrow

a. This item of work shall consist of furnishing and placing complete, Select Borrow material, as described in Section 203 Borrow Excavation, Section 1000 General Requirements for Water Main, Sanitary Sewer, and Storm Drain Construction, and the Standard Details, in addition to that shown on the Drawings, specified, or as included in other Bid Items, or in the event that sufficient suitable material is not available from the required excavations on site, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place cubic yard volume of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 7: Class 3 Excavation

a. This item of work shall consist of Class 3 Excavation, as described in Section 1000 General Requirements for Water Main, Sanitary Sewer, and Storm Drain Construction, and the Standard Details, of all unsuitable material below subgrade, or of all material in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual volume of material excavated, in cubic yards measured in-place, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 8a: Selected Backfill Using Crusher Run CR-6 Aggregate

a. This item of work shall consist of furnishing and placing complete, Selected Backfill Using Crusher Run CR-6 Aggregate, as described in

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Section 302 Selected Backfill, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place cubic yard volume of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 8b: Selected Backfill Using No. 57 Aggregate

a. This item of work shall consist of furnishing and placing complete, Selected Backfill Using No. 57 Aggregate, as described in Section 302 Selected Backfill, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place cubic yard volume of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 9: Excavation Support Systems Left In-Place

a. This item of work shall consist of furnishing and placing complete, Excavation Support Systems Left In-Place, as described in Section 402 Structure Excavation, Section 1000 General Requirements for Water Main, Sanitary Sewer, and Storm Drain Construction, and the Standard Details, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer. Excavation Support Systems to be left in-place shall be cut off 2 feet below subgrade, or as directed by the Engineer. Material cut off or material used in wale construction will not be measured, but will be considered incidental to this item. Measurement for excavation and refill will not be made, but will be included in other Bid Items. No measurement will be made for support systems that may be withdrawn as directed by the Engineer, or that may be left in-place at the Contractor's request, or that shall have to be left in-place through default or negligence on the part of the Contractor.

b. Measurement under this item will be made on the basis of the actual number of square feet (SF) measure of Excavation Support Systems satisfactorily left in-place, as directed by the Engineer. Payment will be made at the fixed unit price per square feet (SF).

Item 10: Calcium Chloride for Dust Control

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a. This item of work shall consist of furnishing and placing complete, Calcium Chloride for Dust Control, as described in Section 501 Aggregate Base Courses, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place quantity of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per ton.

Item 11: Mix No. 1 Concrete

a. This item of work shall consist of furnishing and placing complete, Mix No. 1 Concrete for buttresses, anchorages, cradles, or encasements, or for other purposes, as described in Section 305 Miscellaneous Structures, and the Standard Details, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place cubic yard volume of concrete satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 12: Test Pit Excavation

a. This item of work shall consist of Test Pit Excavation, whether mechanically dug or hand dug, and backfilling, as described in Section 205 Test Pit Excavation, and in accordance with the written direction of the Engineer. Work does not include test pits associated with locating any existing utilities shown on the Drawings.

b. Measurement under this item will be made on the basis of the actual volume of material excavated, in cubic yards measured in place, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 13: Patching Existing Pavement with Hot Mix Asphalt (HMA)

a. This item of work shall consist of furnishing and placing complete, Hot Mix Asphalt (HMA) for patching existing pavement, as described in Section 504 Hot Mix Asphalt Pavement, Section 505 Hot Mix Asphalt Patches, and the Standard Details, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

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b. Measurement under this item will be made on the basis of the actual in-place quantity of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per ton.

Item 14: Patching Existing Pavement with Portland Cement Concrete

a. This item of work shall consist of furnishing and placing complete, Portland Cement Concrete for patching existing pavement, as described in Section 520 Plain and Reinforced Portland Cement Concrete Pavements, Section 521 Continuously Reinforced Portland Cement Concrete Pavement, Section 522 Portland Cement Concrete Pavement Repairs, and the Standard Details, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place cubic yard volume of concrete satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per cubic yard.

Item 15: Silt Fence

a. This item of work shall consist of furnishing and placing complete, Silt Fence, as described in Section 308 Erosion and Sediment Control, and the Standard Detail (E-15-3), in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place linear foot quantity of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per linear foot.

Item 16: Super Silt Fence

a. This item of work shall consist of furnishing and placing complete, Super Silt Fence, as described in Section 308 Erosion and Sediment Control, and the Standard Detail (H-26-3), in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place linear foot quantity of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per linear foot.

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Item 17: Straw Bale Dike

a. This item of work shall consist of furnishing and placing complete, Straw Bale Dike, as described in Section 308 Erosion and Sediment Control, and the Standard Detail (H-25-2), in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place linear foot quantity of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per linear foot.

Item 18: Stone Outlet Sediment Trap

a. This item of work shall consist of furnishing and placing complete, Stone Outlet Sediment Trap, as described in Section 308 Erosion and Sediment Control, and the Standard Detail (C-9-10), in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place linear foot quantity of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per linear foot.

Item 19: Temporary Seeding and Mulching

a. This item of work shall consist of furnishing and placing complete, Temporary Seeding and Mulching, as described in Section 308 Erosion and Sediment Control, in addition to that shown on the Drawings, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer.

b. Measurement under this item will be made on the basis of the actual in-place square yard quantity of material satisfactorily furnished and placed, as directed by the Engineer. Payment will be made at the fixed unit price per square yard.

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CATEGORY 200 - GRADING

SECTION 201 — ROADWAY EXCAVATION
(Class 1, Class 1-A, Class 2)

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

201.01 DESCRIPTION. Excavate and grade for roadways and appurtenances to the lines and grades specified.

201.01.01 Classification.

CLASS 1 — All excavation where the width of the bottom of the cut is 15 ft or more.

CLASS 1-A — All excavation of unsuitable material below the lowest excavation limits established.

CLASS 2 — All excavation where the width of the bottom of the cut is less than 15 ft. Excavation for flumes, ditches outside cut or fill slopes, and stream and channel changes are included in this classification unless otherwise specified.

201.01.02 Excavation. Excavation includes the following:

(a) Cut areas within the boundary faces of the typical cross sections specified, including ditches within the cut sections, entrances, approach roads, streets, intersections, gutters, ditches, berm ditches, and flumes.

(b) Topsoil salvaged within the specified limits of excavation or as directed.

(c) The removal and disposal of existing pavement, sidewalks, curb, and combination curb and gutter, when within the limits of Class 1 or Class 2 excavation. Perform this work as specified in Section 206.

(d) The removal and disposal of below grade structures other than as specified in Sections 102 and 207.

201.03 CONSTRUCTION.

201.03.01 Grading Units. Each unit is the surface area of erodible earth that can be exposed to construction operations without undue erosion or sedimentation. Refer to 101.03.01 for the size and number of units that can be opened at one time.

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201.03.02 Use of Excavated Material.

Delete "TC-3.03 and" in the first statement. Add the following paragraphs, at the end of the section.

All suitable excavated material shall be available for use in replacing unsuitable material which may be excavated elsewhere within the limits of the work. All surplus materials not used therein shall be removed and disposed of in such a manner and at such point or points as shall be approved or directed.

Suitable material removed from the excavation shall be reused in the grading, filling, backfilling and preparation of subgrade for pavements, structures, and trenches and at such other places as directed, to the extent required to complete the work. The Contractor shall properly store or stockpile and protect in approved manner, all materials that are to be reused in the work.

Material unsuitable for reuse in excavation, including excess excavation, shall become the property of the Contractor and shall be salvaged or removed from the site by the contractor's forces and disposed of on an approved spoil site or waste area provided by the Contractor.

All unsuitable or excess material removed from the excavation shall be removed from the site and disposed of by the Contractor, at no additional expense to the Owner, except where disposal on the site is specifically provided for and approved in writing by the Engineer.

The Contractor shall be responsible for obtaining all necessary permits and approvals from the appropriate governmental agencies, including agencies outside of Howard County, as applicable, for any off-site work which includes waste or spoil areas for disposal of unsuitable materials, or borrow site and treatment of these areas. Copies of all permits or approvals shall be provided to the Engineer prior to starting any work covered by these permits or approvals. The cost associated with this work is to be included in the several items bid for the Contract.

Insert the following sub-section:

201.03.12 Use of Explosives.

On projects where the use of explosives is allowed, the use of explosives shall be governed by sub-section 201.03.04 Rock Excavation and the following requirements.

(a) Rules and Regulations. Blasting, transportation and on-site storage of blasting materials must conform to the rules and regulations of the Annotated Code of Maryland and COMAR - Code of MD Regulations.

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(b) Notification. The MD State Fire Marshal, the Howard County, MD Department of Public Works and Central Alarm and any agencies, utility companies, railroads, property owners or occupants that may be affected by blasting shall be notified by the Contractor 14 days prior to any blasting being performed.

(c) Blasting Plan. Prior to performing any blasting the Contractor must submit a blasting plan to the Engineer that must, as a minimum, contain the following.

(1) Comments and/or directives from the Fire Marshal and agencies, utility companies, railroad and property owners that may be affected by the proposed blasting.

(2) Blasting methods proposed including addressing whether test blasting, monitoring, instrumentation or high speed video recordings of structures adjacent to the blasting zone will be required.

(3) Documentation of time and date of notification or attempt of notification of owners and/or occupants affected by blasting operations.

(4) Photographs of interiors and exteriors of any structures adjacent to blasting zone that may be affected. Any structures that cannot be fully photographed due to non-cooperation of the owners or occupants shall be identified.

(5) Location by test pitting of existing underground utilities in the blasting zone and methods for protecting these utilities from damage during blasting.

(6) Methods for controlling dust, rock, soil or other debris dislodged by blasting, as well as noise, vibration and shock, as described in (e) Blasting Methods.

(7) Methods for controlling traffic during actual performance of blasting.

(8) Methods for notifying adjacent property owners, business, etc. of scheduled blasting times.

(9) Copies of the current license for the firm or company that will perform the blasting along with copies of blast permit cards for personnel who will actually perform the blasting work.

(10) Verifications that the firms or personnel performing blast monitoring or instrumentation are approved by the Fire Marshal along with copies of the calibration records of instruments.

(11) Provisions for the on-site storage of explosives.

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(d) On-Site Pre-Blast Meeting. After the submission of the blasting plan and prior to performing any blasting the Contractor shall schedule an on-site pre-blast meeting and notify all the affected parties.

The purpose of the On-Site Pre-Blast Meeting is to review the blasting plan and develop any comments that may cause modifications of the plan to better suit on-site conditions.

The Contractor shall prepare minutes of the meeting for distribution to all attendees, which also shall include any modifications to the Blasting Plan developed as a result of the meeting.

(e) Blasting Methods.

(1) Instrumentation. A direct velocity-recording seismograph capable of recording the continuous wave form of the three mutually perpendicular components of motion, in terms of particle velocity, shall be used. Each seismograph shall have a frequency response from 2 to 150 Hertz or greater and a velocity range from 0.0 to 2.0 inches per second or greater.

All field seismographs shall be capable of internal dynamic calibration and shall be calibrated according to the manufacturer's specifications at least once per year.

Competent individuals trained in the correct use of seismographs shall operate all seismographs. Seismograph records shall be analyzed and interpreted by an independent third party approved by the State Fire Marshal.

(2) Ground Vibration. This section shall provide for limiting ground vibrations at structures. Table A and Table B, referenced below, are located at the end. When blasting operations are to be conducted within 200 feet of a pipeline or high voltage transmission line, the contractor shall take additional precautionary measures and shall notify the owner of the line or the owner's agent, that blasting operations are intended.

Charge Weight Per Delay Dependent on Distance Method, Table A. When a seismograph is not used to record vibration effects, the explosive charge weight per delay (8 milliseconds or greater) may not exceed the limits shown in Table A that follows. For distances over 60 feet, the weight of explosives per delay in Table A is based on the formula W= distance raised to the 1.5 power divided by 90. When charge weights per delay on any single delay period exceed 520 pounds, then ground vibration limits for structures shall comply with the *Monitoring Method* and *Peak Particle Velocity Dependent on Distance Method* that follow.

Monitoring Method. When a blaster determines that the charge weights per delay given in Table A are too conservative, he may choose to monitor each

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blast at the closest conventional structure with an approved seismograph and meet the following standard specified for *Peak Particle Velocity Dependent on Distance Method*. When starting to monitor at a new blasting operation with instrumentation, the initial blasts shall contain explosive charge weights per delay close to the limits established in Table A. From this point onward, the explosive charge weight per delay may be increased but the vibration levels for the *Peak Particle Velocity Dependent on Distance Method* may not be exceeded.

Peak Particle Velocity Dependent on Distance Method, Table B. The Peak particle velocity is defined as the maximum component of the three mutually perpendicular components of motion as recorded at the closest structure, as shown in Table B that follows.

(3) Air Blast. Air blast from blasting shall be controlled so that the maximum allowable air blast conforms to the following when measured over a range of at least 6 to 200 Hertz:

a. At an inhabited building, the noise resulting from blasting shall not exceed 130 decibels.

b. At an uninhabited building, the noise resulting from blasting shall not exceed 140 decibels.

(f) Blasting Operations. The Contractor must conduct his blasting operations in accordance with his plan as modified by the On-Site Pre-Blast Meeting. If previously unknown on-site conditions require revisions in his plan, he must notify the Fire Marshal and the Engineer immediately and not proceed further until his plan is revised.

Prior to any blasting the Contractor shall perform the following:

(1) Have all warning signs and traffic controls in place.

(2) Provide at least four hours notice to the Fire Marshal, Engineer and affected property owners, business establishments, etc. of the time or times that blasting is to occur.

(3) Have blasting mats available on-site.

(4) Have instrumentation for noise and vibration in place.

(g) Records. A record of each blast shall be kept, including seismograph reports, and shall include the following:

(1) Name of company or contractor;

(2) Location, date and time of blast;

(3) Name, signature, and social security number of blaster in charge;

(4) Type of material blasted;

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(5) Number of holes, depth of earth overburden and spacing;

(6) Diameter and depth of holes;

(7) Type of explosives used;

(8) Total amount of explosives used;

(9) Maximum amount of explosives per delay period of 8 milliseconds or greater;

(10) Method of firing and type of circuit;

(11) Direction and distance in feet to nearest dwelling, house, public building, school, church, commercial or institutional building neither owned nor leased by the person conducting the blasting;

(12) Weather conditions including such factors as wind direction, etc.;

(13) Height or length of stemming;

(14) If mats or other protection to prevent flyrock were used;

(15) Type of detonators used and delay period used;

(16) Seismograph records, including seismograph readings when required, shall contain:

a. Name and signature of individual operating the seismograph,
b. Name of individual analyzing the seismograph,
c. Seismograph reading.

(17) The maximum number of holes per delay period of 8 milliseconds or greater.

The person taking the seismograph reading shall accurately indicate the exact location of the seismograph, if used, and shall also show the distance of the seismograph from the blast.

One bound copy of this data shall be submitted to the Engineer within 10 calendar days after completion of blasting.

(h) Non-Explosive Demolition Agents. Patented and/or proprietary non-explosive demolition agents will be used in lieu of explosives at locations indicated on the plans, as specified in accordance with the Special Provisions or at the option of the Contractor. These materials must be used and disposed of in accordance with the manufacturer's recommendations and instructions.

(i) Responsibility for Damages. Concurrence with the Contractor's blasting plan by the County and the Engineer will not relieve the Contractor from the responsibility for any damages or claims for damages caused by blasting.

(j) Measurement and Payment. This item will not be measured for payment. The cost shall be included in the unit price bid for other appropriate contract pay items.

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Table A
Charge Weight Per Delay Dependent on Distance Method

Distance to a Building		Charge Weight of Explosive per Delay	Distance to a Building		Charge Weight of Explosive per Delay
Feet over	Feet not over	Pounds	Feet over	Feet not over	Pounds
0	to 5	¼	250	to 260	45
5	to 10	½	260	to 280	49
10	to 15	¾	280	to 300	55
15	to 60	*	300	to 325	61
60	to 70	6	325	to 350	69
70	to 80	7 ¼	350	to 375	79
80	to 90	9	375	to 400	85
90	to 100	10 ½	400	to 450	98
100	to 110	12	450	to 500	115
110	to 120	13 ¾	500	to 550	135
120	to 130	15 ½	550	to 600	155
130	to 140	17 ½	600	to 650	175
140	to 150	19 ½	650	to 700	195
150	to 160	21 ½	700	to 750	220
160	to 170	23 ¼	750	to 800	240
170	to 180	25	800	to 850	263
180	to 190	28	50	to 900	288
190	to 200	30 ½	900	to 950	313
200	to 220	34	950	to 1000	340
220	to 240	39	1000	to 1100	375
240	to 250	42	1100	to 1200	435
			1200	to 1300	493

* 1/10 of a pound of explosive per foot of distance to a building

Table B
Peak Particle Velocity Dependent on Distance Method

Distance		Peak Particle Velocity of any one Component**
Feet over	Feet not over	Inches per second
0	to 100	2.00
100	to 500	1.50
500	to 1000	1.00
over 1000		0.75

** The instrument's transducer shall be firmly coupled to the ground.

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203.04 MEASUREMENT AND PAYMENT.

*Replace "TC-**7.0**"at the end of the second paragraph with "GC-9.01"*

SECTION 204 — EMBANKMENT AND SUBGRADE

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

204.02 MATERIALS.

Insert the following paragraphs after the last paragraph, "Soils and soil aggregate …in Section 916.":

Fill and backfill material shall be suitable material from on-site excavations or from other sources. The material shall be clean earth. The material shall be free from vegetable matter, organic material, sludge, grit, trash, debris, muck, swamp muck, roots, root mat, logs, stumps, tree stumps, brush, frozen material or other deleterious substances. Rubber, ashes, cinders and other miscellaneous inorganic fill substances removed from required excavations within the project and which in the judgment of the Engineer will decompose, consolidate further, or shrink appreciably within the fill may not be incorporated in the fill. Rubble and construction debris shall not be used in the work (unless otherwise noted on the contract drawings).

204.02.01 Rock.

Insert the following paragraph after the last paragraph, "Rock may be…of the Engineer.":

Except as otherwise specified or approved, the material shall not contain rocks, gravel or lumps larger than 6 inches in greatest dimension. No rocks, gravel or lumps larger than 3 inches in greatest dimension will be permitted in fill or backfill within 2 feet of subgrade, or within 1 foot of pipes in all directions, or within 2 feet of any structure during backfill. All rock shall be placed in a sufficient matrix of soils to avoid point to point contact.

204.02.02 Frozen Material.

Insert the following paragraph after the last paragraph, "Refer to …it has thawed.":

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Do not place, spread or compact backfill material while it is frozen or thawing. Do not place backfill upon frozen or thawing subgrade or during inclement weather conditions. A compacted layer that has been previously frozen, shall be either removed or reworked and recompacted after thawing before the next layer is placed thereon.

Insert the following Sub-Section:

204.02.04 Suitable and Unsuitable Material.

Suitable material is any material meeting the quality requirements specified above, for the particular location and application specified, which is not frozen and which has a moisture content at the time it is placed that enables the material to be compacted to the density specified. Unsuitable material is any excess excavated material or any material not meeting all the requirements for suitable material. Excavated material that is above the optimum moisture level and otherwise suitable will not be considered as unsuitable material.

204.03.01 Embankment Foundation.

(a) Foundation Material.

Insert the following paragraph after the paragraph, "The Engineer will inspect…depth directed."

Before depositing fill material, the surface of the ground shall be prepared by clearing of all refuse, rubble, and other debris. All organic matter, mud, muck, sludge and unsuitable soils shall be removed from the surfaces upon which fills are to be placed and the surface shall be leveled. Openings, animal burrows, stump holes, old pipes and other holes and depressions shall be eliminated, filled or cleaned as required.

(c) Test Rolling.

Replace this section with the following.

When test rolling is specified in the contract documents or directed by the Engineer, areas shall be proof rolled with a minimum of three (3) slow passes. The proof roll vehicle shall be a fully loaded single axle (H20-44) or double axle (MSHA Type 3), minimum 40,000lb/65,000lb gross vehicle weight, respectively, and shall be acceptable to the County. The Engineer shall be provided with certifications of the load weight and the contractor shall facilitate visual inspection of the load. Three proof roll passes for a two lane, two-way, roadway are defined as follows: the loaded vehicle will traverse once along each of the two

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directions of travel on the roadway, and the third pass will be traverse once down the middle of the roadway as directed by the Engineer.

Insert the following Sub-Section:

(d) Unsuitable Subgrade Conditions. Where, in the opinion of the Engineer, unsuitable subgrade conditions are encountered under foundations, slabs, footings, pavements, structures, or utilities, a determination will first be made by the Engineer whether the condition is due to the in-situ condition, or is caused by the Contractor's construction methods.

(1) Unsuitable foundation materials, which in the judgment of the Engineer are due to in-situ conditions, shall be corrected by the Contractor to the satisfaction of the Engineer, based on one of the following:

a. When ordered in writing by the Engineer, the Contractor shall excavate the unsuitable foundation materials to the extent directed by the Engineer. All unsuitable material shall be removed to a firm bottom below subgrade elevations. The excavation below subgrade shall be refilled and compacted using suitable material. Under these conditions, payment for excavation below subgrade and backfill will be made in accordance with the applicable unit price or contingent item included in the Proposal.

b. The Contractor may submit, to the County for approval, recommendations for improving the unsuitable material using Cement Modified Soils (CMS) in accordance with Section 502. Under these conditions, payment for improving the unsuitable material below subgrade will be made in accordance with the applicable unit price items included in the Proposal.

(2) Unsuitable foundation conditions or areas disturbed or rendered unstable, which in the judgment of the Engineer are caused by the Contractor's construction methods or equipment, shall be corrected by the Contractor to the satisfaction of the Engineer, at no additional expense to the County. These corrections shall include the necessary excavations and backfills, as described above.

(3) Where excavations are made to a depth below the subgrade elevations shown on the Contract Documents or specified, without authorization, the excess excavation or over-excavation shall be filled to the required level, as described above, at no additional expense to the County.

204.03.02 Placing and Spreading.

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Insert the following after the first sentence, "Place the material…of the embankment.":

Spread each layer uniformly and evenly. Thoroughly mix each lift before compaction to assure uniform distribution of moisture content. Distribute rocks of permissible sizes through the backfill materials.

Prior to placing and compacting the material as fill and backfill, the moisture content shall be brought to the specified moisture content by either aerating the material if it is too wet, or spraying the material if it is too dry. Materials containing free water or having a moisture content higher than specified shall not be deposited upon the fill or backfill until after they have been dried to the specified moisture content. Excavated material that is above the optimum moisture level and otherwise suitable will not be considered as unsuitable material. The material shall by thoroughly mixed before compaction for uniform distribution of moisture content. The Contractor shall replace, at his own expense, material that was suitable when excavated, which has subsequently become unsuitable because of careless, neglectful, wasteful or unprotected storage.

Insert the following after the last sentence "Maintain side slopes … of the work.":

The fill or backfill surface shall be sealed by rolling at the completion of each day or prior to rain.

~~*Insert the following Sub-Section:*~~

~~**(d) Structure Backfill.** Fill and backfill material within 5 feet of structures shall be placed in approximately horizontal layers that, before compaction, shall not exceed 6 inches in thickness.~~

204.03.03 Benching.

Insert "and scarify" into the first sentence after "…continuously bench…".

204.03.04 Compaction.

Insert the following paragraphs after the second paragraph "Compact the material 1 ft below…points of optimum":

Within all road rights-of-way, for embankment fills, trench backfills, and cuts, material below the top 2 feet of final subgrade shall meet the requirements of suitable material, and shall be compacted to not less than 92% of the maximum dry density as specified in T 180. Material within the top 2 feet of final subgrade shall meet the requirements of select borrow, and shall be compacted to not less than 97% of the maximum dry density. Test rolling shall be performed per section 204.03.01 (c) on all embankment fills, and

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trench backfill within road right of way prior to installation of GAB. See section 501.03.10

204.03.05 Stability of Embankments.

Insert the following paragraph after the first paragraph "Remove and replace…of the construction operations.":

All fill and backfill material must be stable upon the application of compaction effort. If instability of the fill or backfill material is observed, and the instability is a result of excess moisture in the material, even though the in-situ moisture content is within the moisture content range established for the material by the moisture density curve at the specified degree of compaction, then the material must either be removed and replaced with drier material or dried to a moisture content where the material is stable upon the application of compaction effort.

204.03.06 Protection of Structures and Utilities During Construction.

Insert the following sentence to the end of the paragraph "Protect all structures …refer to Section 210.":

Compaction by heavy rollers or other heavy equipment is prohibited within 5 feet of any structure.

Insert the following Sub-Section:

204.03.09 Restoration.

After the completion of backfilling, all roads, sidewalks, and other places intersecting with or adjacent to the line of work shall be left free, clean, and in good order.

SECTION 205 — TEST PIT EXCAVATION

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

205.03 CONSTRUCTION.

In the first paragraph, "Determine the location…to excavation operations.", Delete the words "…test pit excavation…", and Insert the words "…Test Pit Excavation…".

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In the second paragraph, "Excavate test pits …in Section 210.", Delete the word "…authorized…", and Insert the word "…approved…".

205.04 MEASUREMENT AND PAYMENT.

In the second sentence, "The payment will…complete the work.", after the word "…excavation…", and after the comma, Insert the words "… either machine dug or hand dug, …".

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CATEGORY 300 - DRAINAGE

SECTION 301 — CLASS 3 EXCAVATION FOR INCIDENTAL CONSTRUCTION

301.01 DESCRIPTION. Excavate below the planned elevation as directed.

301.02 MATERIALS. Not applicable.

301.03 CONSTRUCTION. Excavate the area to the size, depth, and location as authorized. Backfill as specified in Section 302. For excavated material, refer to 402.03.01.

301.04 MEASUREMENT AND PAYMENT. Class 3 Excavation for Incidental Construction will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Backfill. Backfill will be measured and paid for as specified in 302.04.

SECTION 302 — SELECTED BACKFILL

302.01 DESCRIPTION. Place selected backfill material as directed.

302.02 MATERIALS.

No. 57 Aggregate	901.01
Crusher Run Aggregate	CR-6 901.01

302.03 CONSTRUCTION. Replace unsuitable foundation material as directed. Refer to Section 210 for compaction.

302.04 MEASUREMENT AND PAYMENT. Selected Backfill using No. 57 Aggregate or Selected Backfill using Crusher Run Aggregate CR-6 will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for compaction and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

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SECTION 303 — PIPE CULVERTS

303.01 DESCRIPTION.

Delete paragraph and replace with:

This work shall consist of placing pipe on firm pipe bedding to the specified line and grade, make connection to existing pipes, inlets, end walls, or manholes and clean the existing pipes. The pipe shall be the size and type as specified in the Contract Documents or as directed by the Engineer.

303.02 MATERIALS.

Delete section and insert the following:

(a) Selected Backfill	302.02
(b) Concrete Mix No. 2	902.10.03
(c) Pipe Materials	905
(d) Flowable Backfill	314.02
(e) Brick	903.03
(f) Mortar	903.06
(g) Selected Borrow	916.01

303.03 CONSTRUCTION. Verify pipe lengths and gradients and obtain approval before installation.

303.03.01 Excavation. When a pipe is to be laid on existing ground, or within compacted fill areas on or under fill, embankment shall be constructed to a height of at least 9 in., but not more than 3 ft above the proposed top of the pipe. The trench shall then be excavated to receive the pipe.

The width of trench shall be sufficient to permit thorough tamping of the backfill under the haunches and around the pipe. See Standard Details.

Where soil does not meet the classification specified as suitable backfill, remove to a depth of 4 inches below the bottom of the pipe elevation. Remove rock, boulders, or other hard, lumpy, or unyielding material to a depth of 12 inches below the bottom of the pipe elevation. Remove muck or other soft material to a depth necessary to establish a firm foundation. Where the soils permit, ensure that the trench sides are vertical up to at least the midpoint of the pipe.

When rock is encountered, remove and replaced it with at least 8 in. of selected backfill.

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When unsuitable foundation material is encountered, remove and replace it with selected backfill for the full width of the trench.

303.03.02 Bedding. Place earth for bedding meeting the requirements of M 145, A-1, A-2-4, A-2-5 or A-3. The maximum particle size is 1.25 in. Do not use organic material, stones larger than 1.5 in., or frozen lumps. Ensure that moisture content is in the range of optimum content to permit thorough compaction. Selected Backfill may be used.

Where bottom of trench at subgrade is in rock, excavation shall be carried at least 6 inches below the specified subgrade with a minimum of 4 inches under the pipe bells. The trench bottom shall be restored to subgrade with earth or granular material as approved by the Engineer.

Where unstable or unsuitable foundation material is encountered, excavation for the full width of the trench shall be carried to such depth as ordered by the Engineer. The trench shall be restored to subgrade with select backfill.

Place bedding for culverts 48 in. or more in nominal horizontal diameter in an approved foundation, shaped using a template that supports the pipe for at least 10 percent of its overall height.

303.03.03 Installation. Lay pipes with hubs upgrade. A single lay hole through the shell of concrete pipe is permitted with an approved lifting device. Cast the lay hole in the pipe during fabrication or core it without damaging or exposing any reinforcement. After installation, permanently seal the lay hole by filling with mortar, rubber plug, or other approved means. Wood plugs are unacceptable. Lay holes that expose any reinforcement may not be used. Do not lay pipe in standing water or when weather conditions are deemed unsuitable by the Engineer.

303.03.04 Joints. Pipe joints shall be sealed in a manner appropriate to the pipe material as recommended by the manufacturer.

Reinforced Concrete Pipe. Seal circular pipe joints using rubber gaskets meeting C 443. Seal elliptical pipe joints using preformed flexible joint sealants meeting C 990.

Metal Pipe. Use Bell and spigot joints with integral rubber gaskets or butt pipes and seal using rubber gaskets with an approved coupling band meeting 905.01.

Plastic Pipe. Use integral bell and spigot joints with flexible elastomeric seals meeting F477.

303.03.05 Pipe Connections. Pipe connections may be either prefabricated or constructed in the field. A field pipe connection into Reinforced Concrete Pipe shall include cutting a hole in one pipe, inserting and trimming the connecting pipe and placing a concrete Mix #2 collar using concrete at the connection. Finish the connection to provide smooth surface.

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303.03.06 Pipe Encasement. When specified in the contract documents, encase pipes using Concrete Mix No. 2.

303.03.07 Backfill. When specified or directed, use material meeting the requirements for Select Borrow, Selected Backfill or Flowable Backfill. Large lumps, clods, frozen material or rocks are not acceptable. For plastic pipe installations, use backfill materials meeting the requirements of M 145, A-1, A-2-4, A-2-5 or A-3. Place backfill along the side of the pipe for the full width of the trench in layers not exceeding an uncompacted depth of 6 in. Compact each layer simultaneously on both sides of the pipe using an approved mechanical tamper. Refer to Section210. Compact thoroughly under the haunches of the pipe. Continue this method of filling and compaction until the backfill is completed to at least 9 in., 12 in. for plastic pipe, above the top of pipe. Protect all pipes from damage due to construction equipment or other vehicular traffic.

Backfill may be placed immediately after laying the pipe, provided that all joints have been sealed.

303.03.08 Removal of Existing Pipe Culverts. When specified, remove and dispose of existing pipe culverts. Backfill as specified herein.

303.03.09 Relaying Existing Pipe. When specified, remove, salvage, and relay culverts according to these Specifications relating to new pipe.

303.03.10 Abandoned Pipes. When specified, plug abandoned pipes using Concrete Mix No. 2 or brick masonry. When specified, fill pipes with Flowable Backfill. Refer to Section 314 and 463.

303.03.11 Clean Existing Pipes. When specified, clean existing pipes of all sediment and debris without damaging to the pipe and drainage structures. Remove and dispose of sediment and debris a specified in Section 308.

303.03.12 Inspection and Acceptance. No sooner than 30 days after installation visually inspect all new pipe in the presence of the Engineer. Any cracks, differential movement, efflorence, rust stains, spalls, exposed reinforcement, slabing, dents, buckling, holes, damaged coating, obstructions, improperly engaged joints, improper gasket placement, excessive joint gaps, misaligned joints, excessive deflection, or undue horizontal or vertical misalignment will be cause for repair or replacement at no cost to the County. Ensure that thermoplastic pipe deflection does not exceed 5 percent. When specified in the contract documents, video inspect pipe which cannot be physically accessed by a person for inspection.

303.04 MEASUREMENT AND PAYMENT. The payment for the items specified in the Contract Documents will be full compensation for all applicable excavation, sheeting, shoring, dewatering, hauling, invert paving, storing, re-handling of material, removal and disposal of excess and unsuitable material, tamped fill, forming bed or foundation,

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bedding, backfill, compaction, inspection, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

303.04.01 New pipe culverts will be measured complete in place and paid for at the Contract unit price per linear foot. When a new pipe is to be installed at the same location as an existing pipe, the cost of removal and disposal of the existing pipe, including end walls and end sections, will not be measured but the cost will be incidental to the Contract price of new pipe.

303.04.02 Pipe Connections and Elbows will be measured and paid for at the Contract unit price per each. No deduction from the pipe measurement will be made for pipe connections. Connections to drainage structures containing prefabricated holes in which the pipe will be connected with grout or mortar will not be measured, but the cost will be incidental to the pertinent Pipe item.

303.04.03 Excavation required below the planned elevation will be measured and paid for as specified in 301.04.

303.04.04 Removal of Existing Pipe will be measured and paid for per the total number of linear feet removed, regardless of the condition. When a multiple pipe installation is removed, each pipe will be measured and paid for. End walls, end sections, etc. removed with the pipe will not be measured but the cost will be incidental to the Contract price.

303.04.05 Selected backfill will be measured and paid for as specified in Section 302.

303.04.06 Flowable Backfill will be measured and paid for as specified in Section 314.

303.04.07 Select Borrow will be measured and paid for as specified in Section 203.

303.04.08 Relaid Existing Pipe Culverts-Any Size will be measured and paid for as specified in 303.04.01 unless otherwise specified in the Contract Documents.

303.04.09 New end walls, end sections, etc., will be measured and paid for as specified in Section 305.

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303.04.10 Removal of existing headwalls, end sections, etc., that are not incidental to the Contract price for the respective pipe items will be measured and paid for as specified in Section 207.

303.04.11 Encasement concrete, and concrete or brick masonry to plug existing pipes will be measured and paid for at the Contract price for the pertinent Concrete Mix No. 2 for Miscellaneous Structures, or Brick Masonry for Miscellaneous Structures item.

303.04.12 Clean Existing Pipe Any Size will be measured and paid for at the Contract unit price per linear foot. Removal of construction debris and sediment will not be measured for payment.

SECTION 304 — STRUCTURAL PLATE PIPE AND STRUCTURAL PLATE PIPE ARCH CULVERTS

304.01 DESCRIPTION. Furnish and install structural plate pipe and structural plate pipe arch culverts.

304.02 MATERIALS.

Selected Backfill	302.02
Concrete Mix No. 2	902.10
Structural Plate for Pipe and Pipe Arches	905

304.03 CONSTRUCTION.

304.03.01 Fabrication. Submit working drawings, including erection diagrams and strutting tables for approval. Include proposed lengths and lifting locations of preassembled sections in the erection diagrams. Upon approval, shop fabricate the plates, including required holes, to the required dimensions. Ship the plates complete, with proper markings and all necessary connection devices.

The plate configurations shall have radii and curvature according to AASHTO Standard Specifications for Highway Bridges. When bottom plates of circular pipes are specified to be thicker than top and side plates, cover at least 25 percent of the periphery of the circle with the thicker plate. For pipe arches, the thicker plates shall include corner plates as well as bottom plates. Lay these culverts on a firm bed, true to the specified line and grade.

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Along those edges of the plates that will form longitudinal seams in the finished structure, stagger bolt holes in rows 2 in. apart, with one row in the valley and one in the crest of the corrugations, unless otherwise specified. Along those edges of the plates that will form circumferential seams in the finished structure, provide a bolt spacing of not more than 12 in. The diameter of the bolt holes in the longitudinal seams shall not exceed the diameter of the bolt by more than 1/8 in.

Shop cut all edges to line and grade, and keep them free from oxide and burrs. Stagger connections so that no more than three plates come together at any one point. Form plates to provide lap joints.

304.03.02 Excavation. When a structural plate pipe or structural plate pipe arch is to be laid on existing ground, on or under fill, construct embankment to a height of at least 18 in., but not more than 3 ft above the proposed top of the pipe. Then excavate the trench to a width of twice the outside diameter of the pipe or the outside diameter plus 18 in. on each side, whichever is less. For excavated material, refer to 402.03.01.

304.03.03 Foundation Preparation. Provide bedding as specified in 303.03.02. Set rails and then screed the foundation to the exact shape of the bottom plates, immediately prior to erection.

304.03.04 Erection. When strutting is required, it shall be uniform from end to end. Keep struts in place until backfills are completed. Tighten nuts and bolts to between 100 and 200 ft·lb of torque.

When washers are specified, place them under the turned element. Distribute bolts over the section being assembled. Align holes by shifting the plates. For bottom plates, place the nuts inside the structure. Do not draw the nuts tight until the section is assembled. Before backfilling, tighten all nuts and test to ensure compliance with torque requirements.

304.03.05 Backfill. Earth for backfill shall be free from large lumps, clods, frozen material and rocks. Place it along the side of the pipe for the full width of the trench in layers not exceeding an uncompacted depth of 6 in. Compact each layer simultaneously on both sides of the pipe using an approved mechanical tamper. Refer to Section 210. Compact the backfill thoroughly under the haunches of the pipe.

Elevate the backfill uniformly along each side of the structure to a height of at least 18 in. above the top of the structure. For structures without headwalls, start backfill in the center of the structure. If the structure includes headwalls or spandrel walls, start backfilling operations at one wall and work toward the opposite side. When batteries or multicell installations are specified, elevate backfill between cells equally on each side of each cell.

Do not run trucks and construction equipment over any part of a structural plate pipe structure until the backfill has been completed and tamped up to a height of at least 18 in. above the structure.

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304.03.06 Concrete Invert. When specified, pave the invert using Concrete Mix No. 2. Place and cure the concrete as specified in Section 420.

304.03.07 End Treatment. Shop fabricate the ends of structural plate pipes and structural plate pipe arches on a bevel to fit and be flush with the slope and alignment of the surface through which they protrude, except that where an end wall or masonry slope protection is specified, shop fabricate the ends to fit that construction. The ends of all structural plate pipes and structural plate pipe arches that require an end treatment (end wall or slope protection) shall contain hook bolts for anchorage into the concrete.

Headwalls for structural plate pipes and pipe arches shall meet Section 305. Unless otherwise specified, constructed them parallel to the proposed outer edge of the roadway shoulder.

304.04 MEASUREMENT AND PAYMENT. The payment for the items specified in the Contract Documents will be full compensation for all applicable fabrication, assembly, excavation, sheeting, shoring, strutting, dewatering, hauling, invert paving, storing, rehandling of material, removal and disposal of excess and unsuitable material, tamped fill, foundation preparation, backfill, compaction and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

304.04.01 Structural Plate Pipe and Structural Plate Pipe Arch Culverts will be measured and paid for at the Contract unit price per linear foot. Measurement will be as follows: measure the top length and the bottom length and average. The average length will be the pay length for each pipe in the structure. For multiple pipes, the length will be totaled to obtain the total pay length.

304.04.02 Excavation required below the planned elevation will be measured and paid for as specified in 301.04.

304.04.03 Selected backfill will be measured and paid for as specified in Section 302.

304.04.04 Headwalls will be measured and paid for as specified in Section 305.

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SECTION 305 — MISCELLANEOUS STRUCTURES

305.01 DESCRIPTION. Construct miscellaneous cast-in-place concrete or masonry structures, install precast concrete structures, and clean existing inlets.

305.02 MATERIALS.

Mortar Sand	901.01
Curing Materials	902.07
Concrete Mix No. 2, No. 3 or No. 6	902.10
Grout	902.11
Brick	903.02
Pipe	905
Reinforcement Steel	908
Steel	909.02
Castings for Frames, Covers, Gratings and Steps	909.04
Zinc Coating	A 153
Stone	M 43 Size no. 57
Precast Concrete End walls, Inlets, and Manholes	M 199

305.03 CONSTRUCTION. Refer to Section 420 for portland cement concrete, Section 463 for brick masonry, and 402.03.01 for excavated material.

305.03.01 Construction Sequence. Complete the underground drainage structures before placing the roadway surfacing. Manholes, catch basins, and inlets shall not be completed to final grade until the grading has been finished and all necessary arrangements have been made to ensure suitable connections and tie-ins at proper grade and alignment with pavements, gutters, and curbs.

305.03.02 Castings. Set frames for grates and covers for inlets and manholes, in full beds of mortar and rigidly secure them in place to the specified grade and alignment.

305.03.03 Pipe Connections. Set or cut inlet and outlet pipes flush with the inside face of the structure Extend them a sufficient distance beyond the outside face of these walls to provide for making proper connections. Completely and neatly close the joint around the pipe in the structure wall with mortar or other specified materials.

305.03.04 Inverts. When drainage structures contain two or more pipes, construct channeled inverts conforming to the Contract Documents.

305.03.05 Drainage Structures. Inlets and manholes shall contain two 8 in. minimum diameter underdrain stubs for future connection of underdrains or for erosion control.

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The area outside of drainage structures shall be backfilled with No. 57 aggregate for a width of 1.5 ft outside of the structure and extend from 6 inches below the bottom of the structure to the subgrade. Stone backfill and knockouts for underdrain are not required for precast manholes unless otherwise shown on the Plans or directed by the Engineer.

305.03.06 Precast Drainage Structures. Precast drainage structures shall conform to M 199 and/or the Contract Documents, whichever is the more restrictive. Shop drawings for structures in the Contract Documents shall be submitted to and approved by the Engineer of Record prior to fabrication. Precast inlet structures shall have two precast knockouts as shown on the Standard Details for the underdrain stubs where underdrain pipes are specified in contract document. Designs for precast drainage structures that vary in dimension or reinforcement from that shown on the Standard Details shall be submitted along with supporting design calculations to the Engineer for approval. The submission shall be signed and sealed by a Professional Engineer registered in the State of Maryland. Include the name and address of the manufacturer, the type of structure, the identification number, the date of manufacture, the date of shipment, a statement indicating conformance with the Specifications, and the signature of the quality control manager. Mark the unit with the station number and designation, the identification number, the name or trademark of the manufacturer, the date manufactured, and stamp indicating conformance with the Specifications.

Place and consolidate at least 6 in. of No. 57 aggregate bedding under the unit.

Certification from the manufacturer for each shipment of precast units shall be required. Each unit shall be marked showing designation, the date of manufacture, the name or trademark of the manufacturer (this information shall be noted on the unit, near the top inside), and include a certification which shall contain a copy of the actual test results indicating that the inlet conforms to the Contract Documents.

Do not ship any precast unit without complete documentation showing that all materials meet specifications per 305.02 or the Contract Documents; or without complete identification markings per Sections 440, 905 and 915.

305.03.07 Clean Existing Inlets. Clean existing inlets and dispose of the material. Reset and anchor existing grates as directed.

305.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all excavation, concrete, masonry, special or precast units, reinforcement, ladder rungs, drip stones, No. 57 aggregate, underdrain stubs, frames, grates and covers, grade and slope adjustments, backfill, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

305.04.01 Standard Inlets and Manholes will be measured and paid for at the Contract unit price per each. When a structure exceeds the standard minimum depth an additional

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payment will be made for the excess depth at the Contract unit price per linear foot for the pertinent Vertical Depth item.

305.04.02 Standard End Walls, Headwalls, End Sections, and Special Structures will be measured and paid for at the Contract unit price per each.

305.04.03 Nonstandard End Walls and other miscellaneous structures such as steps, spring boxes, and junction boxes, constructed using brick masonry or concrete will be measured and paid for at the Contract unit price per cubic yard, unless otherwise specified.

305.04.04 Stormwater Management Risers will be measured and paid for at the Contract unit price per cubic yard of Concrete Mix 3 which includes gasket, watertight seals, trash racks, orifice plates, low flow and dewatering pipe stubs and safety rails.

305.04.05 No separate or additional measurement will be made for any precast concrete units, metal, or castings used in the construction of any of the items noted above.

305.04.06 Cleaning Existing Inlets will be measured and paid for at the Contract unit price per each, regardless of type, size, or depth of the inlet.

305.04.07 When an existing drainage structure is to be removed and replaced with a new drainage structure in the same location, the cost to remove the existing drainage structure and a section of the existing pipe will be incidental to the cost of the new drainage structure.

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SECTION 306 — UNDERDRAINS, SUBGRADE DRAINS AND SPRING CONTROL

306.01 DESCRIPTION. Construct underdrains, subgrade drains, underdrain for spring control, underdrain pipe outlets, and blind drains using pipe, geotextile, and granular material. Clean existing underdrain outlets.

306.02 MATERIALS.

Aggregate	901.01, Table 901 A
Pipe Materials	905
Geotextile, Class as specified	921.09
Securing Pins or Staples	921.09.03

306.03 CONSTRUCTION. Coordinate the field installation of traffic barrier, signs, lighting, and landscaping with the Engineer to avoid any damage to the underdrains, subgrade drains, or outlet pipes. Correct any damage to the underdrains, subgrade drains, or outlet pipes.

306.03.01 Excavation. Excavate trenches to the specified dimensions and grade. Ensure that the sides and bottom of trenches are smooth and uniform to prevent tearing of the geotextile when backfilling. For excavated material, refer to 402.03.01.

306.03.02 Geotextile. Place geotextile when specified. Place it with the machine direction parallel to the longitudinal direction of the trench. Ensure that it is of sufficient width to completely enclose the underdrain trench, including specified overlaps.

Place the geotextile tightly against the underdrain trench to eliminate voids beneath the geotextile. Avoid wrinkles and folds. Maintain at least a 24 in. overlap at joint ends or breaks. Pin joints and overlaps to securely hold the geotextile in place until placement of the cover material. Pin longitudinal joints, overlaps, and edges no more than 50 ft on center.

Replace or repair damaged geotextile.

306.03.03 Pipe Placement. Slope the underdrain pipe to maintain positive drainage toward the outlet. Place perforated pipes with the perforations down and arranged symmetrically about the vertical axis. Plug the ends of trunk lines, wyes, tees, or ells as directed. Make joints and connections in accordance with the manufacturer's recommendations.

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306.03.04 Outlets. Outlets shall be constructed in the same manner as underdrains or as specified in the Contract Documents. All pipe used shall be as specified in Section 905. Flexible tube type PE or PVC pipe is prohibited. Geotextile shall not be used and the entire depth of the trench shall be backfilled in conformance with the requirements of Section 210. The ends of trunk lines, wye, tee, or all laterals shall be plugged as directed by the Engineer. All outlet joints or connections shall be formed in conformance with the manufacturer's recommendations.

306.03.05 Backfill. Backfill trenches to the specified dimensions and grades. Backfill underdrain and outlet trenches as the work progresses.

(a) Underdrain. Lightly tamp aggregate backfill, and screed or rake to provide proper thickness and grade.

(b) Outlets. Backfill per Section 210.

Replace geotextile, underdrain pipe, and outlet pipe damaged by excessive tamping.

Cover longitudinal underdrain with the next pavement layer within 72 hours. Cover all other underdrain within 48 hours. Protect underdrain, including the geotextile, from contamination by soil fines. Replace or repair clogged geotextile and any underdrain trench that becomes contaminated.

306.03.06 Cleaning Existing Outlets. Clean existing underdrain pipe outlets and dispose of the material. Remove and replace existing rodent screens. Where there are no screens, install them as directed.

306.03.07 Permanent Subgrade Drains. Construct permanent subgrade drains when specified. Subgrade drains consist of trenches excavated through the shoulder and roadside grading from the edges of the road pavement to a side ditch, embankment slope, or other approved outlet and filled with aggregate. Locate subgrade drains at low points, and space them at 25 ft intervals for a distance of 125 ft on each side of the low point, then at intervals of 100 ft to within 125 ft of the high point. Before placing the road pavement and before completion of the shoulder paving or final roadside grading areas, cut and shape trenches to a width of 24 in. Place No. 57 aggregate to the underside of the shoulder material and to the underside of the specified topsoil thickness in the roadside grading area. The portion of the trench within the roadside grading area shall be completely wrapped in geotextile. The bottom of the trench at the end adjacent to the road pavement shall be at least 2 in. below the subgrade

306.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all excavation, pipe, coupling bands, aggregate, backfill, geotextile, video inspection, and all material, labor, equipment, tools, and incidentals necessary to complete the work.

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306.04.01 Underdrains, Underdrain Pipe Outlets, Subgrade Drains, and Underdrain Pipe for Spring Control will be measured and paid for at the Contract unit price per linear foot.

Slope headwalls, rodent screens, and marker posts will not be measured but will be incidental to the cost of the Underdrain Outlet.

306.04.05 Cleaning Existing Underdrain Outlets will be measured and paid for at the Contract unit price per each. The payment will be full compensation for locating outlets, removing and replacing the existing rodent screens, removal and disposal of material removed from the pipe, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 307 — PREFABRICATED EDGE DRAINS

307.01 DESCRIPTION. Construct prefabricated edge drain systems and underdrain pipe outlets.

307.02 MATERIALS.

Outlet Pipe	905
Select Borrow	916
Prefabricated Edge Drain and Fittings	922

307.03 CONSTRUCTION. Install prefabricated edge drains according to the manufacturer's recommendations. For drains with support on only one side, place the support side away from the pavement edge. For excavated material, refer to 402.03.01.

307.03.01 Trenches for Prefabricated Edge Drains. Excavate using a trencher. Make the trenches as narrow as possible, but no more than 10 in. Ensure that the drain is in direct contact with the pavement. Perform the excavation of the trench, placement of the edge drain, and placement of the first lift of backfill in a single continuous operation.

307.03.02 Splices. Make splices prior to placement in the trench; in accordance with the manufacturer's recommendations and as approved by the Engineer.

Solid Central Cores (unconnected two sided flow). Use crossover couplings at all splices and at 200 ft intervals.

307.03.03 Connections to Outlets. Use fittings recommended by the manufacturer.

Space outlets at 200 ft intervals and at the lowest elevation on all vertical curves. Construct outlets in accordance with 306.03.04.

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307.03.04 Backfilling of Trenches. Unless otherwise specified, use approved material generated from the trenching operation. Use Select Borrow whenever additional backfill material is needed.

Backfill in two layers, with the first layer being placed simultaneously with the drain, holding the drain flush against the side of the pavement. Use a vibratory shoe compactor.

307.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for excavation, backfill, compaction, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

307.04.01 Prefabricated Edge Drains and Outlet Pipe will be measured and paid for at the Contract unit price per linear foot.

307.04.02 Additional backfill material authorized by the Engineer will be measured and paid for at the Contract unit price per cubic yard for Select Borrow Excavation.

SECTION 308 — EROSION AND SEDIMENT CONTROL

Refer to Section 101.03 Erosion and Sediment Control

SECTION 309 — CONCRETE DITCHES

309.01 DESCRIPTION. Construct concrete ditches and incidental toe walls.

309.02 MATERIALS.

Crusher Run Aggregate CR-6	901.01
No. 57 Aggregate	901.01
Curing Materials	902.07
Form Release Compounds	902.08
Concrete Mix No. 2	902.10
Joint Sealer	911.01
Preformed Joint Filler	911.02
Borrow	916
Soil Stabilization Matting	920.06

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309.03 CONSTRUCTION.

309.03.01 Excavation. Excavate and prepare the subgrade per Section 602. For excavated material, refer to 402.03.01.

309.03.02 Forms. Use steel or wooden forms meeting Section 603.

309.03.03 Concrete. Mix and place according to Section 603.

309.03.04 Joints. Place joints no more than 15 ft apart. Use either bulkhead or weakened plane construction joints. Either tool or saw weakened plane joints to a depth of at least 3/4 in. Place expansion joints no more than 90 ft apart and seal.

309.03.05 Cold Weather Construction and Curing. Refer to 520.03.02 for cold weather construction and to 520.03.12 for concrete curing.

309.03.06 Backfill. After the forms have been removed, place and compact the backfill.

309.03.07 When the existing concrete ditch is removed but not replaced, regrade and stabilize the area as directed.

309.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all concrete, excavation, forms, backfill, curing, disposal of excess or unsuitable material, toe walls, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

309.04.01 Concrete Ditches will be measured and paid for at the Contract unit price per square yard.

309.04.02 The removal and disposal of unsuitable material below the subgrade will be measured and paid for at the Contract unit price per cubic yard for Class 2 Excavation.

309.04.03 When Borrow or Selected Backfill using No. 57 Aggregate or Selected Backfill using Crusher Run Aggregate CR-6 is approved by the Engineer as replacement material for the Class 2 Excavation, it will be measured and paid for at the Contract unit price per cubic yard for the pertinent items as specified in the Contract Documents.

309.04.04 Concrete Ditches removed but not replaced will be paid for at the Contract unit price per square yard. The payment will include the cost to dispose of the material, regrading, topsoil, and soil stabilization matting.

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SECTION 310 — CONCRETE SLOPE AND CHANNEL PROTECTION

310.01 DESCRIPTION. Protect slopes and channels with cast-in-place concrete and cutoff walls.

310.02 MATERIALS.

Crusher Run Aggregate CR-6	901.01
No. 57 Aggregate	901.01
Curing Materials	902.07
Form Release Compound	902.08
Concrete Mix No. 2	902.10
Welded Steel Wire Fabric	908.05
Joint Sealer	911.01
Preformed Joint Fillers	911.02
Roofing Paper	911.07
Borrow	916

310.03 CONSTRUCTION.

310.03.01 Excavation. Excavate, including excavation for cutoff walls, according to Section 602. Refer to 402.03.01 for excavated material.

310.03.02 Cast-In-Place Concrete. Construct cast-in-place concrete slope protection in alternate strips so that construction joints are all in one direction and that tooled joints run perpendicular to the construction joints. The result shall be a checkerboard pattern having squares of at least 3 ft but not more than 5 ft. The Engineer will determine the size of the squares and the size of squares around curved surfaces. Construct joints and cutoff walls as specified.

310.03.03 Forms. As specified in Section 603.

310.03.04 Concreting. Mix concrete as specified in 915.03.04. Volumetric batching and continuous mixing will be permitted. Prior to placing the concrete, use acceptable methods to dewater areas that are subject to the infiltration of water. Spread and tamp, or otherwise consolidate the concrete. Strike it off with an approved screed, and give the surface a broomed finish. Do not plaster the surface. Use a 1/4 in. edging tool on all edges and joints.

310.30.05 Cold Weather Construction and Curing. Refer to 520.03.02 and .12 respectively.

310.03.06 Backfill. After removing the forms, place and compact the backfill.

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310.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all concrete, forms, excavation, curing, joint sealer and filler, backfill, compaction, disposal of excess or unsuitable material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

310.04.01 Concrete Slope and Channel Protection and Concrete Slope Protection for Streams will be measured and paid for at the Contract unit price per square yard of finished surface.

310.04.02 Cutoff Walls will be measured and paid for at the Contract unit price per linear foot.

310.04.03 The removal and disposal of unsuitable material below the subgrade will be measured and paid for at the Contract unit price per cubic yard for Class 2 Excavation.

310.04.04 When Borrow or Selected Backfill using No. 57 Aggregate or Selected Backfill using Crusher Run Aggregate CR-6 is approved by the Engineer as replacement material for the Class 2 Excavation, it will be measured and paid for at the Contract unit price per cubic yard for the pertinent item specified in the Contract Documents.

SECTION 311 — RIPRAP DITCHES

311.01 DESCRIPTION. Construct riprap ditches and riprap ditches with capping.

311.02 MATERIALS.

Riprap	901.02 and .03
Geotextile, Class as specified	921.09
2 to 4 in. Stone	M43, No.1

311.03 CONSTRUCTION.

311.03.01 Excavation. Excavate to the specified line and grade. Ensure that ditch sides and bottom are smooth and firm, free from protruding objects that would damage the geotextile, and constructed in an acceptable manner. For excavated material, refer to 402.03.01.

311.03.02 Geotextile Placement. Place the geotextile on the prepared subgrade with the adjacent edges overlapped at least 2 ft. Replace or repair damaged geotextile as directed.

311.03.03 Riprap Placement. Place stones by mechanical or other acceptable methods to produce a reasonably graded mass of stone. Methods that cause extensive segregation are unacceptable. Place the riprap to the specified depth.

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311.03.04 Backfill. Backfill any excavation voids existing along the edges and ends of the placed riprap. Use suitable material to blend in with contiguous slopes, ditch lines, and existing ground. Cap riprap placed in the clear recovery area with a layer of 2 to 4 in. stone.

311.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all excavation, geotextile, stone, backfill, disposal of excess material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

311.04.01 Riprap Ditches and Riprap Ditches with Capping will be measured and paid for at the Contract unit price per square yard of finished surface.

311.04.02 Bottom Cutoff Walls and Side Cutoff Walls will be measured and paid for at the Contract unit price per linear foot.

SECTION 312 — RIPRAP SLOPE AND CHANNEL PROTECTION

312.01 DESCRIPTION. Protect slopes and channels with a covering of geotextile and stone or an aggregate filter blanket.

312.02 MATERIALS.

Aggregate Filter Blanket	
Crusher Run Aggregate CR-6	901.01
Stone	901.02
Geotextile, Class as specified	921.09

312.03 CONSTRUCTION.

312.03.01 Excavation. Excavate for riprap and cutoff walls to the specified lines and grades. Ensure that the subgrade is smooth and firm, free from protruding objects that would damage the geotextile, and constructed in an acceptable manner. For excavated material, refer to 402.03.01.

312.03.02 Geotextile. Place the geotextile on the prepared subgrade with the adjacent edges overlapping at least 2 ft. Replace or repair damaged geotextile as directed.

312.03.03 Aggregate Filter Blanket. When an aggregate filter blanket is specified, construct it to the specified lines and grades and compact it in an acceptable manner.

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312.03.04 Riprap Placement. Ensure that the underlying surface is free of brush, trees, and stumps, and is acceptable to the Engineer.

Place the first section of riprap consisting of at least 5 tons, which will be inspected by the Engineer for conformance to gradation and placement requirements. If approved, this section will be used to evaluate quality control for the remainder of the project. If the material is rejected, remove it from the project and place additional sections, each at least 5 tons.

Begin the placement of the riprap with the bottom cutoff walls or toe sections. Place the larger stones in the cutoff walls and along the outside edges of the limits of slope and channel protection. Place the riprap with equipment that produces a uniformly graded mass of stones.

Ensure that the surface elevation of completed riprap installations is flush with adjacent channel bed or bank slope elevations, and does not create an obstacle to the flow. Ensure that the outer riprap surfaces are even and present a generally neat appearance. The plus or minus tolerance of the surface of the finished riprap installation is 3 in. for Class I Riprap and 6 in. for Class II and III Riprap from the lines and grades shown on the Contract Documents when measured perpendicular to the exterior surface of the stonework.

Place and distribute the stone so the resulting layer will contain a minimum of voids and there will be no pockets of same size material. Place the stone to its full course thickness in one operation in a manner that the underlying material is not be displaced or worked into the course of riprap being placed. When an aggregate filter blanket is used, proceed with the placement of the riprap in a controlled manner to avoid disruption or damage to the layer of bedding material.

312.03.05 Backfill. Backfill any excavation voids existing along the edges of the completed slope and channel protection, and compact it in an acceptable manner.

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312.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all excavation, geotextile, stone, backfill, compaction, disposal of excess material, prewashing when required, preparation of quality control section, and for all material, labor, equipment, tools and incidentals necessary to complete the work.

312.04.01 Riprap Slope and Channel Protection will be measured and paid for at the Contract unit price per square yard. Area measurements will be actual surface measurements.

312.04.02 Cutoff Walls will be measured and paid for at the Contract unit price per linear foot.

312.04.03 Riprap for Scour Protection will be measured and paid for at the Contract unit price per ton for the item Class II Riprap For Scour Protection.

312.04.04 Aggregate Filter Blanket will be measured and paid for at the Contract unit price per square yard for the depth specified.

SECTION 313 — GABIONS

313.01 DESCRIPTION. Protect slopes and channels by placing stone filled wire baskets.

313.02 MATERIALS.

Stone	901.05
Wire for Gabions	906.01
Geotextile, Class as specified	921.09

313.03 CONSTRUCTION.

313.03.01 Excavation. Excavate, including excavation for cutoff walls, to the specified lines and grades. Ensure that the subgrade is smooth, firm, and free from protruding objects or voids that would affect the proper placement of the wire baskets or damage the geotextile. For excavated material, refer to 402.03.01.

313.03.02 Geotextile. Place geotextile on the prepared subgrade. Overlap adjacent strips at least 2 ft. Replace or repair geotextile damaged during placement of the wire baskets.

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313.03.03 Wire Baskets. Begin placement with the cutoff walls. Set the empty units on the geotextile and bind the vertical ends together with wire ties or interlocking fasteners spaced to permit stretching of the units to remove kinks. Use stretching methods that do not damage the baskets. Use stakes, pins, or other approved methods to ensure proper alignment.

313.03.04 Stone. Carefully fill the basket units with stone placed by hand or machine to ensure good alignment with a minimum of voids between stones. Avoid bulging of the mesh. Do not drop the stone from a height greater than 36 in. Place the stone to provide a minimum of two courses. Place the top layer of stone to a uniform surface. Avoid any bulging of the lid mesh. After a basket unit is filled, bend the lid over until it meets the ends of the unit. Secure the lid to the sides and ends with wire ties or interlocking fasteners. When a complete basket unit cannot be installed because of space limitations, cut the basket unit to fit as directed.

313.03.05 Backfill. Backfill any excavation voids existing along the edges of the completed gabions and compact in an acceptable manner.

313.04 MEASUREMENT AND PAYMENT. Gabions, including cutoff walls will be measured and paid for at the Contract unit price per cubic yard of stone filled wire baskets complete in place. The payment will be full compensation for all excavation, geotextile, stone, ties or fasteners, backfill, compaction, disposal of excess material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 314 — FLOWABLE BACKFILL

314.01 DESCRIPTION. Furnish, haul, and place flowable cement stabilized backfill material. When specified, use for utility cut backfill, pipe backfill, or for filling abandoned pipes.

314.02 MATERIALS.

Controlled Low Strength Material 902.16

314.02.01 Fillers. When required, fillers shall be natural aggregates with a maximum size of 3/4 in. and may include sands. Bottom ash shall not be used as filler.

314.02.02 Components. Toxic and deleterious components shall not be used in the backfill mixture. The mixture shall have a 28 day, unconfined compressive strength of at least 100 psi based on the manufacturer's certification. Certification shall include the actual test data for each mixture to be used.

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314.02.03 Analysis. Chemical analysis of the fly ash used in the mixture shall conform to U.S. EPA EP Toxicity Standards. Whenever the coal source is changed or replenished, and when fly ash from a different source is used, conduct an analysis of the fly ash from each stockpile. Submit the results of the analysis to the Engineer for approval prior to using the mixture.

314.03 CONSTRUCTION. Place the material according to the manufacturer's recommendations or as directed by the Engineer. Backfill utility trenches full depth to the top of the subgrade. Fill all voids during the backfill operation.

Protect the backfilled utility cut from freezing and traffic for 24 hours. Wait at least 24 hours after backfilling is complete and approved by the Engineer before beginning the paving operations.

Fill abandoned pipes with backfill after each end of the pipe has been properly plugged. Refer to 3030.03.10. Cut two holes into the plug at the upstream end and pump backfill into the pipe through one of the holes until the pipe is completely filled.

Keep and submit detailed records of all flowable backfill placed. Include the source of the fly ash, the date placed, the location, depth, and the quantity used.

314.04 MEASUREMENT AND PAYMENT. Flowable Backfill will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 315 — INFILTRATION TRENCHES

315.01 DESCRIPTION. Install infiltration trenches as specified.

315.02 MATERIALS.

Class I Riprap	901.02
Geotextile, Class as specified	921.09
PVC Pipe, Schedule 40	D 1785
Stone	M 43 No. 2

315.03 CONSTRUCTION. Do not place infiltration trenches in service until all of the contributing drainage area has been stabilized and approved. Restrict heavy equipment and traffic from the proposed infiltration trench location.

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315.03.01 Excavation. Remove excavated material from the trench site. Ensure that trench walls and bottom are free of protruding objects that could damage the geotextile. When necessary, slope the trench walls. Ensure that the bottom dimensions and stone depth are as specified. Roughen the side walls of the trench. Grade the bottom of the trench flat. For excavated material, refer to 402.03.01.

315.03.02 Installation. Place geotextile on the sides of the trench and the top of the No. 2 stone. Do not cover the bottom of the trench. The geotextile for the sides of the trench shall overlap the top geotextile by 6 to 8 in. Extend the top geotextile the full width and length of the trench. All longitudinal joints in the top geotextile shall overlap at least 6 in. The upstream roll shall overlap the downstream roll by at least 2 ft, for a shingled effect.

Place an observation well vertically in the longitudinal center of each infiltration trench. Use 6 in. diameter perforated PVC pipe, Schedule 40. Place the pipe on a base plate at the bottom of the trench. Cap the well using a threaded PVC fitting and a vandal proof sewer cap. Set the cap 6 in. above ground, and mark the depth of the trench on the cap. Provide a plastic collar with ribs to prevent rotation of the well when removing the cap. When soil capping is used, construct the observation well using perforated PVC pipe within the No. 2 stone and non-perforated pipe through the soil capping.

All stone shall be clean and free of all soil and fines. Place the No. 2 stone in 12 in. lifts with no compaction. Avoid any intermixing of the soil and fines with the stone aggregate. Remove and replace contaminated aggregate. Cap the trench with at least 12 in. of stone or soil as specified.

315.04 MEASUREMENT AND PAYMENT. Infiltration Trenches will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for all excavation, stone, capping, riprap, geotextile, PVC pipe, fittings, cap, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 316 - ENVIRONMENTAL PROTECTION AND RESTORATION

316.01 DESCRIPTION. This work shall consist of the protection of the environment and natural resources. It includes cleanup and restoration of the construction site to prevent accidents involving any person, to protect all work in place, to restore all disturbed areas, removal of all evidence of construction activities, and to effect completion of the contract in an orderly manner.

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316.02 ENVIRONMENTAL REQUIREMENTS.

316.02.01 General. The General Assembly of the State of Maryland has determined that the lands and waters comprising the watersheds of the State are great natural assets and resources; that as a result of erosion and sediment deposition on lands and in waters within the watersheds of the State, the waters are being polluted and despoiled to such a degree that fish, marine life, and recreational use of the waters are being adversely affected. In order to protect the natural resources of the State, the Secretary of Natural Resources directed the adoption of criteria and procedures to be used by the counties and the local soil conservation districts to implement soil and shore erosion control programs

316.02.02 Erosion and Sediment Control.

See Section 101.03 for Erosion and Sediment Control requirements.

316.02.03 Preservation of Natural Resources. Land Disturbance is defined as any earth movement and land changes including but not limited to tilling, clearing, grading, excavating, stripping, filling and related activities. All land disturbance resulting from construction operations, contract work, clean-up and the condition of the adjacent terrain upon completion of the work shall fully comply with all applicable regulations and laws concerning the preservation of natural resources.

316.02.04 Contractor's Responsibility. The Contractor shall be responsible for furnishing all necessary items for fulfilling the work described herein for Environmental Protection including prevention and control of erosion and sedimentation that results directly or indirectly from the project as set forth in Section 101.03 or these Specifications.

316.03 PREVENTION OF WATER POLLUTION.

316.03.01 The Contractor shall take all such precautions in the conduct of his operations as may be necessary to avoid contaminating the water in adjacent watercourses or water storage areas including wells whether natural or man-made.

316.03.02 All earthwork, moving of equipment, water control of excavations, and other operations likely to create silting, shall be conducted so as to prevent pollution of watercourses or water storage areas.

316.03.03 Water used during the Contract work, which has become contaminated with oil, bitumen's, harmful or objectionable chemicals, sewage, or other pollutants, shall be disposed of so as to avoid affecting all nearby waters and lands. Under no circumstances shall the Contractor discharge pollutants into a watercourse or water storage area. Water used in aggregate processing, concrete curing, foundation and concrete lift cleanup or any other waste shall not be permitted to enter a stream. When water from adjacent sources is

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used in the contract work, intake methods shall be such as to avoid contaminating the source of supply or becoming a source of erosion.

316.04 DUST CONTROL. Throughout the entire construction period, maintain dust control by use of water sprinklers or chemical dust control binder as may be approved by the Engineer.

316.05 RESTORATION

316.05.01 Cleanup. Construction cleanup shall proceed as construction progresses and shall consist of the removal of all mud, oil, soil, gravel, trash, debris and any other materials that are unsightly.

316.05.02 Disturbed Areas. All areas disturbed by the Contractor's operations, including staging and stockpiling areas, construction strips, access roads, stream crossing sites and areas within the acquired right-of-way shall be restored and restabilized as specified in these specifications.

316.05.03 Tree Protection. Tree protection, repair and replacement shall be performed in accordance with Title 8, Subtitle 07, Chapter 02, Department of Natural Resources, Roadside Tree Care.

316.05.04 Restabilization. Unless otherwise indicated, provide sod on all disturbed areas which supported a previously established stand of turf. Install soil stabilization matting or sod on slopes of 2:1 and steeper and as otherwise directed by the Engineer. Provide seeding on all other disturbed and filled areas. Restabilization shall be done in accordance with Section 700 of these Specifications.

316.05.05 Signs, Markers, Etc. Preserve public and private signs, markers, guardrails and fences and maintain in their original condition unless written permission is obtained for their removal and replacement. Remove and properly store such items when in conflict with grading and properly store such items when in conflict with grading operations. Store in a manner to kept them clean and dry and re-erect as such new locations to prevent damage to underground or overhead public utility structures. Such items lost or damaged as a result of the Contractor's failure to properly protect or store them will result in replacement by the County with cost deducted from the Contractor's retainage.

316.05.06 Gravel Surface And Shoulders. Gravel surface and shoulders shall be restored equal to or better than their original condition. Do not reuse shoulder material if contaminated by foreign material. In such case, replace with new material of equal quality and gradation. Material and methods of construction shall be in accordance with these Specifications and applicable permits secured for this Contract.

316.05.07 Final Restoration. Final restoration and restabilization including seeding, sodding and paving when season permits, shall proceed immediately after construction activity is completed in a given area. The contractor shall tear down, remove all

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temporary construction facilities constructed by him, and leave the site in an orderly condition.

316.05.08 Disposal Of Waste Materials. Construction water materials shall be disposed of in an authorized County disposal area or in an area covered by a current grading or sediment control permit. Waste material disposed of in an unauthorized area shall be removed by the contractor and the area shall be restored to its original condition, at no cost to the County.

316.05.09 Private Agreements. Separate agreements between the Contractor and property owners for storage of materials or grading, cleanup, seeding, sodding, tree removal or replacement shall be executed and copies submitted in writing to the Engineer prior to commencement of the work. All arrangements for access through private property to borrow areas, spoil areas, storage sites, etc. shall include standards for sediment and erosion control and environmental protection as set forth in these specifications. Agreements shall include restoration and restabilization of disturbed areas using standards that meet or exceed those required for county rights-of-way.

Any arrangements involving private agreements between the Contractor and property owners beyond those set forth in the contract documents shall not involve the County and shall be at the Contractor's expense. The contractor shall be responsible for obtaining all of the appropriate permits.

316.06 METHOD OF MEASUREMENT. Measurement for the work addressed under this section will be in accordance with the appropriate sections of these specifications as referenced in the contract documents. Where no such reference is made, no measurement will be made for this work.

316.07 BASIS OF PAYMENT. Work performed under the requirements of this section will be paid for as measured above in accordance with the appropriate sections of these specifications or as otherwise set forth in the contract documents.

Where no such measurement is provided for and where no bid item is set forth in the contract, the work shall be considered incidental to the several bid items required to construct the project.

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SECTION 317 — STORMWATER MANAGEMENT (SWM) FILTRATION FACILITIES

317.01 DESCRIPTION. Construct stormwater management (SWM) filtration facilities as specified.

SWM Filtration Facilities Identification. SWM filtration facilities are identified by unique six-digit inventory numbers and include the following designations.

(a) Bioretention.

(b) Micro-Bioretention.

(c) Organic Filters.

(d) Surface Sand Filters.

(e) Submerged Gravel Wetlands.

(f) Landscape Infiltration.

(g) Rain Gardens.

(h) Infiltration Berms.

(i) Bio-swales.

317.02 MATERIALS.

No. 57 Aggregate	901.01
No. 7 Aggregate	901.01
No. 2 Aggregate	M-43, No. 2
Concrete	902.10
Topsoil	920.01.01 and 920.01.02
Bioretention Soil Mix (BSM)	920.01.05
Coarse Sand	920.01.05(a) (1)
Fertilizer	920.03.01
Shredded Hardwood Bark (SHB) Mulch	920.04.03
Soil Stabilization Matting (SSM)	920.05
Seed and Turfgrass Sod	920.06
Plant Materials	920.07
Water	920.09.01
Geotextile, Class PE, Type III	921.09
Securing Pins or Staples	921.09

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Aggregate. Ensure aggregate has been adequately washed and is free of soil and fines.

Subdrain Pipe, Fittings and Geotextile Sock. Perforated and solid-wall polyvinyl chloride profile wall drain pipe (PPWP) meeting M-304 or corrugated polyethylene drainage pipe (CPP) meeting M-252, Type S and Type SP. Perforated pipe shall have two rows of slotted perforations with an opening area of 20 cm2/m to 21 cm2/m. When specified, use the geotextile sock recommended and supplied by the subdrain pipe manufacturer.

317.03 CONSTRUCTION.

317.03.01 Site Protection. Prior to constructing SWM filtration facilities, ensure that the SWM facility site areas are protected from vehicular traffic and is not used for erosion and sediment controls, stockpiles or equipment storage.

317.03.02 Site Preparation. Unless facilities are off-line and will receive no runoff, construct facilities only after all surrounding and adjacent areas are permanently stabilized. Divert flow from entering the SWM filtration facility areas unless same-day stabilization is specified for the SWM filtration facility location. Prevent trash, debris and sediment from entering SWM filtration facilities during construction.

317.03.03 Schedule. Perform SWM filtration facility activities during dry weather and when soil moisture conditions are suitable and unless the facility is off-line or flow diversions are in place. Only work with soil that is friable and not in a muddy or frozen condition. Cease operations when soil and overall conditions are otherwise unsuitable.

317.03.04 Excavation. Use methods of excavation that minimize compaction of the underlying soils. Where feasible, operate equipment from locations adjacent to SWM filtration facilities rather than within the facility area. Use only wide-track or marsh-track equipment, or light equipment with turf-type tires to excavate, grade, and place materials. Do not use equipment with narrow tracks or narrow tires, rubber tires with large lugs, or high-pressure tires.

317.03.05 Excavation Area Bottom Preparation. Only work with soil that is friable and not in a muddy or frozen condition. When present, remove any standing water from the excavation area. Prepare the bottom of the excavated area as follows.

(a) Submerged Gravel Wetlands. Rake surface to loosen soil.

(b) All Other SWM Filtration Facilities. Till to a minimum depth of 8 in. to loosen soil.

317.04.06 Geotextile. Place tightly against the vertical sides of the excavation area, pulling tight to eliminate wrinkles and folds and pin securely. Eliminate any voids

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between the geotextile and the underlying soil and avoid wrinkling and folding the geotextile. Maintain a minimum 12 in. overlap at the geotextile joint ends or breaks. Pin longitudinal joints, overlaps and edges securely with pins spaced no greater than 10 ft on center. Do not place geotextile on the bottom of the excavated area.

317.03.07 Miscellaneous Structures. Furnish and install according to Section 305.

317.03.08 Aggregate. Place aggregate in layers as specified. Prevent soil, fines, and other debris from contaminating the aggregate. Remove contaminated aggregate and replace with clean aggregate.

317.03.09 Subdrain Pipe. Cap the ends of all subdrain pipe not terminating in a cleanout, vent, or drainage structure unless otherwise specified. Ensure perforations are placed on the bottom of the horizontal subdrain pipe runs.

(a) Cleanouts. Install solid-wall pipe vertically and connect to horizontal subdrain with approved manufactured connections. Provide a counter-sunk screw cap on the exposed ends.

(b) Vents. Install solid-wall pipe vertically and connect to the horizontal subdrain with approved manufactured connections. Provide a ventilated screw cap on the exposed ends. Ventilation holes or slots shall be no larger than 1/4 in. in diameter or width. The sum total area of the openings shall be no less than 1 in2. Ensure that the ventilation openings are above the maximum specified water surface elevation.

(c) Observation Wells. Use perforated and solid-wall pipe. Place the geotextile sock over the perforated pipe portion and secure at both ends. Provide a screw cap on the exposed end extending 2 in. above the surface. When a concrete collar is specified, ensure the top of the well is flush with the surface of the concrete collar.

317.03.10 Coarse Sand. Place coarse sand in horizontal layers not exceeding 12 in. After each lift, spread the course sand to provide a uniform surface then spray or sprinkle water to saturate the lift until water flows from the subdrain outlet. Use an appropriate sediment control device to capture any discharged sediment-laden water from the subdrain outlet. Place, spread, and water course sand to uniform surface true to depth, line, cross section and elevation to ensure the completed work is as specified after settlement. Prevent soil, fines and other debris from contaminating the coarse sand. Remove contaminated coarse sand and replace with clean coarse sand.

317.03.11 Bioretention Soil Mix (BSM). Place BSM in horizontal layers not exceeding 12 in. After each lift, spread the BSM to provide a uniform surface and spray or sprinkle water to saturate the entire area of BSM until water flows from the subdrain outlet. Use an approved sediment control device to capture any discharge sediment-laden water. Place, spread, and water BSM to uniform surface true to depth, line, cross section and

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elevation to ensure the completed work is as specified after settlement. Prevent soil, fines, and other debris from contaminating the BSM. Remove contaminated BSM and replace with uncontaminated BSM.

317.03.12 Topsoil. Place topsoil as specified. Do not blend topsoil into BSM when topsoil is placed on top of BSM.

317.03.13 Check Dams.

(a) Topsoil Check Dams. Construct topsoil check dams to the dimensions, grades, and depths specified.

(b) Concrete Check Dams. Furnish and install concrete check dams as specified and according to Section 305.

317.03.14 Soil Stabilization Matting (SSM). As specified in Section 709.

317.03.15 Vegetation Installation and Establishment. Unless facilities are off-line or flow diversions are in place, , install seed, sod, trees, shrubs, perennials, and annuals within SWM filtration facility areas immediately after final grading. In the event that vegetation cannot be installed and established due to time-of-year or weather restrictions, keep diversion controls in place until such time that permanent vegetation may be established. Do not use machinery other than hand held within the BSM footprint.

(a) Turfgrass Establishment. As specified in Section 705.

(b) Meadow Establishment and Wildflower Seeding. As specified in Section 707.

(c) Turfgrass Sod Establishment. As specified in Section 708.

(d) Tree, Shrubs and Perennial Installation and Establishment. As specified in Section 710.

(e) Annuals & Bulb Installation and Establishment. As specified in Section 711.

317.03.16 Soil Amendments and Fertilizer. Apply according to Section 705, 706, 707, 708, 710, or as specified. Use the following for plant materials installed in BSM.

(a) Non-Vegetated BSM. Do not apply compost, other soil amendments, or fertilizer to non-vegetated BSM.

(b) Trees, Shrub, and Perennials in BSM. Do not apply compost or other soil amendments to backfill soil or to planting beds.

Apply fertilizer to each planting pit per 710.03.04 when trees, shrubs, perennials, perennial plugs, or other plant materials are installed in BSM per Section 710.

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(c) Seeded or Sodded BSM. Do not apply compost or other soil amendments.

Uniformly apply either of the fertilizers in Table 1 at the rate specified over the installed surface of the BSM when BSM will be permanently vegetated with Turfgrass Establishment, Shrub Seeding Establishment, Meadow Establishment, Turfgrass Sod Establishment, or other seeded or sodded vegetation establishment as specified.

BIORETENTION SOIL MIX

TABLE 1 - FERTILIZER APPLICATION RATES		
	FERTILIZER LB PER SY	FERTILIZER LB PER ACRE
20-16-12 (83% UF with MAP and SOP)	0.052	200
14-14-14 polymer coated or granular	0.062	275

(d) Nutrient Management Reporting. Record the fertilizer analysis, the square yards covered, and the pounds of fertilizer applied on the Nutrient Management Reporting Form. Submit the Form within 24 hours after applying fertilizer.

(e) Fertilizer. Refer to (b). Rake fertilizer that is broadcast over the surface of the BSM for seeding or sodding to a depth of 1/8 to 1/2 in. Raking may be performed as part of seeding or sodding operations. Complete raking before soil stabilization matting or sod is installed.

317.03.17 Shredded Hardwood Bark (SHB) Mulch. As specified in 710.03.13.

317.03.18 Inspection and SWM Facility As-Built Certification. Inspect and document each step of construction of SWM filtration facilities and complete the applicable checklists and furnish the SWM facility as-built certification as specified.

317.04 MEASUREMENT AND PAYMENT. Payment will be full compensation for all control of discharge from subdrain pipe, geotextile, watering, sheeting, shoring, dewatering, hauling, storing, re-handling of material, removal and disposal of excess and unsuitable material, tilling, grading and slope adjustments and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Excavation. Excavation will be measured and paid for as specified in Section 201.

Miscellaneous Structures. Miscellaneous Structures will be measured and paid for per cubic yard of the specified mix concrete.

Aggregate. Aggregate will be measured and paid for at the Contract unit price for one or more of the following.

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(a) No. 2 Aggregate for Stormwater Management Facilities per cubic yard.

(b) No. 7 Aggregate for Stormwater Management Facilities per cubic yard.

(c) No. 57 Aggregate for Stormwater Management Facilities per cubic yard.

Removal of contaminated aggregate and replacement with clean aggregate will be at no additional cost to the Administration.

Geotextile. Geotextile will not be measured but the cost will be incidental to the excavation.

Subdrain Pipe. Perforated and solid-wall subdrain pipe will be measured and paid for at the Contract unit price per linear foot for the specified size of subdrain pipe. Fittings, caps, geotextile sock, cleanouts, vents, observation wells, and other incidentals will not be measured but the cost will be incidental to the subdrain pipe.

Coarse Sand. Coarse Sand will be measured and paid for at the Contract unit price per cubic yard for Coarse Sand for Stormwater Management Facilities.

Removal of contaminated coarse sand and replacement with uncontaminated coarse sand will be at no additional cost to the Administration.

Check Dams. Check dams will be measured and paid for at the Contract unit price for one or more of the following.

(a) Topsoil Check Dams per each.

(b) Concrete Check Dams per each.

Bioretention Soil Mixture (BSM). BSM will be measured and paid for at the Contract unit price per cubic yard.

Removal of contaminated BSM and replacement with clean BSM will be at no additional cost to the Administration.

Water. Water used for saturation of coarse sand and BSM will not be measured but the cost will be incidental to the pertinent items.

Shredded Hardwood Bark (SHB) Mulch. SHB Mulch will be measured and paid for at the Contract unit price per square yard for Shredded Hardwood Bark Mulching, 3 in. depth.

Sediment Control for Discharge from Subdrain Pipe Outlets. Control for any sediment-laden discharge from subdrain pipe outlets will not be measured but will be incidental to the pertinent Erosion and Sediment Control items.

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Topsoil. As specified in 701.04.

Vegetation Installation and Establishment. Vegetation installation and establishment will be measured and paid for at the Contact unit price for the pertinent landscaping items as specified in 705.04, 707.04, 708.04, 710.04 and 711.04.

Soil Stabilization Matting. As specified in 709.04.

Stormwater Management (SWM) Facility As-Built Certification. As specified.

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CATEGORY 400 - STRUCTURES

SECTION 402 — STRUCTURE EXCAVATION (Class 3)

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

402.03.03 Footing Foundations.

Delete the references to TC-4.01 and falsework details and use General Conditions Section GC-5.14. Delete "The experience specified in TC-4.01 will be waived."

SECTION 405 — REMOVAL OF EXISTING STRUCTURES

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

405.03.01 Removal of Bridge Deck Slabs.

Delete the underclearance specified in TC-6.12 and use 14'-6" minimum unless otherwise authorized by the Engineer. Delete the reference to TC-4.01 and use General Conditions Section GC-5.14.

SECTION 420 — PORTLAND CEMENT CONCRETE STRUCTURES

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

420.03.02 Forms.

(b) *Delete the reference to TC-4.01 and use General Conditions Section GC5.14.*

(d) *Delete the reference to TC-4.01 and use General Conditions Section GC-5.14.*

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SECTION 430— METAL STRUCTURES

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

430.03.19 Welding.

Delete the section in its entirety and replace with the following:

Shop and field welding of structures shall conform to the AWS Bridge Welding Code D1.5 unless otherwise noted. Welders will be approved based on Qualification Testing meeting the requirements of the AWS Bridge Welding Code D1.5. All field welders shall have their AWS Welders Certification card available for inspection by the Engineer.

Only submerged metal arc welding will be allowed on primary stress members unless otherwise authorized by the Engineer in writing. Transverse flange welds will not be permitted under any circumstances. Subsequent to fabrication, no welding will be permitted on tension flanges except for the attachment of steel stud shear developers.

430.03.20 Inspection of Fabricated Metal Structures.

Delete the section in its entirety and replace with the following:

Fabricated metal structures shall conform to the requirements of the AWS Bridge Welding Code D1.5, the AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" and the AISC "Code of Standard Practice for Steel Buildings and Bridges". The Contractor will be responsible for quality control inspection.

The Contractor shall prepare a quality control plan for approval by the Engineer. The plan shall indicate the frequency and method of inspection and documentation. The inspection frequency shall be at least the minimum as specified in AWS D1.5. The Contractor shall keep all inspection records which shall be available to the Engineer at all times. All documentation pertaining to the quality control testing and inspection of fabricated metal structures shall be submitted to the Engineer following the completion of all work.

430.03.28 Falsework.

Delete the reference to TC-4.01 and use General Conditions Section GC-5.14. Delete the reference to GP-5.08 and use General Conditions Section GC-5.08.

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430.03.33 Safety Hazards.

Delete the reference to TC-3.04 and use General Conditions Section GC-7.06.

SECTION 440 — PRESTRESSED CONCRETE BEAMS AND SLAB PANELS

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

440.03.18 Marking, Handling, Shipping and Storage.

Delete the reference to GP-5.10 and use General Conditions Section GC-5.10.

SECTION 455 — NOISE BARRIERS

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

Architectural treatment for Noise Barriers shall be in accordance with Section 456.

SECTION 499 — WORKING DRAWINGS

This section shall not apply. Refer to General Conditions Section GP-5.14.

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CATEGORY 500 – PAVING

SECTION 501 — AGGREGATE BASE COURSES

501.01 DESCRIPTION. Construct base courses using one of the following:

(a) Graded aggregate without a stabilizing agent.

(b) Plant mixed graded aggregate with a Portland cement stabilizing agent.

(c) Bank run gravel.

(d) Sand aggregate.

501.02 MATERIALS.

Graded Aggregate for Base Course	901.01
Bank Run Gravel for Base Course	901.01
Sand Aggregate Base Course	
Coarse Aggregate, Size No. 57	901.01
Fine Aggregate	916.01.01
Portland Cement, Type I or IA	902
Emulsified Asphalt	904.03
Production Plant	915
Water	921.01
Moisture and Dust Control Agents	921.02

501.03 CONSTRUCTION. At least 30 days prior to the start of constructing the base course, submit the proposed plants, equipment, and material sources for approval.

Protect the subgrade and base against damage from all causes. Repair or replace damaged areas.

Limit excavation for widening to an area that can be backfilled the same working day using graded aggregate base. Refer to Standard No. 104.01-28 for the area to be backfilled. Maintain the temporary graded aggregate base wedge with a 4:1 or flatter fill slope. Compact the material as directed. Leave the graded aggregate base wedge in place until placement of the hot mix asphalt base.

501.03.01 Equipment. All equipment, including the production plant and on-site equipment, is subject to approval. Have the plant ready for inspection at least 48 hours prior to the start of construction operations.

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501.03.02 Weather Restrictions.

(a) Temperature and Surface Conditions. Place graded aggregate stabilized with portland cement when the ambient air and surface temperatures are at least 40 F and rising. Place graded aggregate, bank run gravel, and sand aggregate base when the ambient air and surface temperatures are at least 32 F and rising. Do not place material on a frozen subgrade.

(b) Cold Weather Protection. Protect the plant mixed graded aggregate stabilized base from freezing during the seven-day curing period.

(c) Precipitation. Do not place material during precipitation. When precipitation has occurred during the previous 24 hours, the Engineer will determine if the subgrade is sufficiently dry. If precipitation occurs during placement, placement of material enroute from the plant to the job site shall be at the Contractor's risk.

501.03.03 Subgrade Preparation. Before beginning base course construction, complete the approved subgrade to final line and grade at least 500 ft ahead. Construct the foundation as specified in Sections 204 and 208. If traffic, including construction equipment, is allowed to use the subgrade foundation or preceding layer, distribute the loading over the entire width of the course to aid in obtaining uniform and thorough compaction. Remove rutting by reshaping and recompacting the affected area as specified in Section 204.

501.03.04 Stabilized Graded Aggregate Base Mix. Use the amount of portland cement determined per MSMT 321.

501.03.05 Bank Run Gravel Base Mix. Mixing or blending of materials using approved chemical additives will be permitted.

501.03.06 Sand Aggregate Base Mix. Provide a mixture containing 35 to 40 percent coarse material as measured by dry weight of the total mix.

501.03.07 Transportation. Handle and transport mixed base materials in a manner that minimizes segregation and loss of moisture. Cover all loads in accordance with State laws unless hauling is off road and is approved. Unless approved, do not dump material into piles, haul over the completed base course, or stockpile the material on the job site.

501.03.08 Spreading. Spread the base material uniformly and in layers of approximately equal thickness, to provide the specified planned depth. Avoid segregation of coarse and fine particles. Build shoulders or berms at least 2 ft wide on each side of the base and to the top elevation of each uncompacted layer, except when placing the base against concrete curbs or gutters.

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501.03.09 Grade or Finished Surface Control. Shape the surface of the base material to the specified line, grade, and cross section. Set grades longitudinally and transversely with fixed controls spaced no greater than 25 ft. Compact and smooth the surface over its full width using a smooth faced steel-wheeled roller, or if rolling is not feasible, by mechanical tampers and vibratory compactors, as approved. Maintain the finished grade within 1/2 in. from the established grade.

501.03.10 Compaction. Immediately after placement, compact the material to the required density. During compaction operations, maintain the moisture content of the material to within 2 percent of optimum moisture. Determine the optimum moisture content and maximum dry density as follows:

(a) Sand Aggregate Base and Bank Run Gravel Base per T 180.

(b) Graded Aggregate Base and Graded Stabilized Aggregate Base per MSMT 321.

Compact graded aggregate base, bank run gravel base, and sand aggregate base to at least 97 percent of the maximum dry density. Compact graded stabilized aggregate base to at least 95 percent of the maximum dry density. Measure in place density per MSMT 350 or 352.

Begin compaction operations, except on super elevated curves, at the sides of the course. Overlap the shoulder or berm at least 1 ft and progress toward the center parallel to the center line of the roadway. On super elevated curves, begin compaction at the low side and progress toward the high side. Continue compaction operations until all compaction marks are removed.
Perform test rolling on Aggregate Base Course per section 204.03.01, prior to paving.

501.03.11 Graded Stabilized Aggregate Base Protection and Curing. Complete the spreading, compacting, and shaping within three hours after the mixing water, cement, and aggregate come in contact. Reconstruct any section not conforming to these requirements. Maintain the surface in a moist condition until the emulsified asphalt seal coat is applied. Apply the emulsified asphalt using distributing equipment as specified in 503.03.01 at the rate of 0.2 gal/yd2. Avoid ponding of the emulsified asphalt. If ponding occurs, use a sand blotter or an equivalent method as approved.

Allow the material to cure for a period of seven days. During this period, close the base course to all traffic. Repair damaged portions of the base course seal coat.

501.03.12 Moisture and Dust Control Agents. When specified, add calcium or magnesium chloride at the plant or apply it to the surface of the material at the project site. Apply calcium chloride at the rate of 1 lb/yd2. Apply magnesium chloride at the rate of 1 lb/yd2 or as a solution at the rate of 1/2 gal/yd2.

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501.03.13 Maintenance. During construction and after completion of the base course, maintain the base until the surface course is placed. When unacceptable work cannot be repaired, replace it for the full depth of the base.

501.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all aggregate, furnishing, hauling, placing, curing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

501.04.01 Graded Aggregate Base Course, Graded Aggregate Base Course Stabilized with Cement, Bank Run Gravel Base Course, and Sand Aggregate Base Course will be measured and paid for at the Contract unit price per square yard. Surface area measurements will be based on the specified width of the base and the actual length measured along the center line of the base surface.

The temporary graded aggregate base wedge constructed in conformance with Standard No. MD 104.01-28, maintaining the 4:1 or flatter slope, compaction, and removal of the material, will not be measured but the cost will be incidental to the Graded Aggregate Base Course item.

501.04.02 The portland cement stabilizing agent and the emulsified asphalt for seal coat will not be measured but the cost will be incidental to the Graded Aggregate Base Course Stabilized with Cement item.

501.04.03 Bank Run Gravel Base. Material manipulation or addition of chemical additives will not be measured but the cost will be incidental to the Bank Run Gravel Base Course item.

501.04.04 Calcium or Magnesium Chloride will be measured and paid for at the Contract unit price per square yard or per ton as specified.

SECTION 502 — CEMENT MODIFIED SOILS (CMS)

Replace this section entirely and replace with the following:

502.01 DESCRIPTION. This work shall consist of treating the subgrade by scarifying, addition of cement, and mixing and compacting the material to the required density as specified herein. This work applies to the subgrade, embankment, or existing pavement structure and shall be constructed as specified herein and in conformity with the typical sections, lines and grades as shown on the plans, or as established by the Engineer of Record.

502.01.02 Submittal. On Developer Projects the Engineer of Record is responsible for the design, quality control monitoring, and certification of the CMS. The Developer is responsible for selecting, with County approval, and paying the Contractor who is

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responsible for carrying out the Engineer of Record's CMS design. Prior to any construction activity, all submittals and all CMS designs will be reviewed and approved through Howard County's Construction Inspection Division Chief's office to assure compliance with County Standards. The CMS shall be designed by a Professional Engineer licensed to practice in the State of Maryland. The Developer, and his Contractor, shall have a cover letter accompanying the CMS submittal agreeing to follow the Engineer of Record's design mix for construction, subject to County approval.

The Engineer of Record shall design the cement percentage for the mix as determined by laboratory testing and the following recommended criteria. It is recommended that the design be sufficient to increase the California Bearing Ratio (CBR), ASTM D1883, to a minimum of 3 or greater for all soils and to reduce the Plasticity Index (P1), ASTM D4318, to 12 or less for cohesive soils. Cohesive soils are defined as fine grained soils with greater than 35 percent by weight passing the No. 200 sieve as per ASTM D421 and D422. Pavement sections for subgrades with a CBR greater than 3 are shown on Standard Details R-2.01 and R-2.02. A minimum 4% by weight cement factor, based on the maximum dry density of the unmodified soils, shall be required for all mix designs. The Engineer of Record shall determine the method of testing to achieve the required moisture and compaction, as described in Section 502.03.04 Compaction. The maximum CBR value for subgrade soils used in selecting typical paving sections is 7 (Refer to Details R-2.01 and R-2.02 for Typical Paving Sections).

The Contractor's name, address and telephone number along with field and office contact references shall be submitted to the County prior to the start of work. The Contractor shall submit a construction sequence. The Contractor shall notify Howard County Construction Inspection Division at least 48 hours prior to CMS construction.

The Developer shall provide a Geotechnical Technician onsite full-time for quality control and monitoring. The Geotechnical Technician's quality control and monitoring shall consist of:

(a) Monitoring the Contractor's submitted construction sequence.

(b) Reviewing subgrade for soft areas. Under the direction of the Engineer of Record and the County, overly soft areas shall be undercut, removed, and replaced with controlled, compacted fill or evaluated for additional cement dosage.

(c) Performing moisture content tests at subgrade. Regulating subgrade moistures to achieve the designed moisture content in the soil cement mix. Subgrade moistures shall be managed to achieve the required compaction in the CMS.

(d) Verifying cement percentages mixed into the soil meet the design percentage, ASTM D558 and D559. After cement is spread, a sample three foot square area of cement shall be weighed onsite to verify cement percentage prior to mixing.

(e) Monitoring the Contractor's uniform mixing and compaction of the CMS.

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(f) Performing Nuclear Gauge testing of in-situ or in-place density/ moisture, ASTM D2922 and D3017. One-point Standard Proctors, ASTM D698, may be used to verify field compaction percentages.

(g) Verifying that compacted CMS thickness has been achieved. Prepare field samples for three, seven and twenty-eight day laboratory unconfined compression tests. Three samples for each testing period shall be made. Testing shall be in accordance with ASTM D-1633, Method A. Samples shall be properly cured and prepared in a split mold. Prior to CMS placement, design of unconfined compressive testing results shall be submitted to the County.

(h) Verifying appropriate measures are taken to provide traffic protection of the CMS subgrade and a thorough curing period.

(i) Monitoring proof rolling of the CMS prior to aggregate base and bituminous pavement placement.

(j) Performing CBR test after completion of the CMS installation to verify the higher CBR is achieved.

(k) Providing, the developer and Howard County, a Geotechnical Report summarizing the design, construction procedures, laboratory results, and observations. A letter certifying that CMS were constructed as designed shall accompany the report.

502.02 MATERIALS.

502.02.01 Soil. Soil shall consist of approved material free from vegetation or other objectionable matter encountered in the subgrade. Soil may consist of (l) any combination of gravel, stone, sand, silt, and clay; (2) high quality crushed stone and gravel base course aggregates; or (3) old stone and gravel base course materials including recycled bituminous surface. The CMS design and depth processed for construction shall not contain material retained on a 3-inch (75- mm) sieve nor any material deleterious to its reaction with cement. Any material retained on a 3-inch sieve or larger that cannot be broken down to meet the requirements of Sub-Section 502.03.03 “Mixing and Placing” shall be removed from the CMS mixture.

502.02.02 Portland Cement. Portland cement shall be ASTM C 150, Type I or II Portland Cement. The contractor shall use bulk cement. All apparatus for handling, weighing and spreading the cement shall be approved by the Engineer of Record in writing. Cement weighing and distribution equipment shall be as specified.

502.02.03 Water. Water shall be free from substances deleterious to the hydration of the cement treatment and shall be approved by the Engineer.

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502.03 CONSTRUCTION.

502.03.01 Equipment. The machinery, tools and equipment necessary for proper execution of the work shall be on the project and approved by the Engineer of Record prior to the start of the construction operations and shall be maintained in good working order. CMS shall be constructed with equipment that will produce completed CMS meeting the requirements for soil pulveration, cement and water application, mixing, transporting, placing, compacting, finishing and curing.

(a) Mixing Methods. Mixing shall be accomplished in place with a minimum till depth of 10-inches below finished roadway subgrade. The pulverizer or pulver mixer blades shall be evenly spaced, self mechanical operation capable of turning over a full 10-inch depth of soil in a pass. The evenly spaced blades shall pulverize the soil and CMS while blading the surface after each pass.

(b) Cement. Cement shall be stored and handled in closed weatherproof containers prior to immediate distribution on the subgrade. The cement spreader for in-place mixing shall be capable of uniformly distributing the cement at the specified design rates. Design rates are based on the laboratory design mixture and correlated to a weight per square area. Spreader bars for distributing dry cement shall be as close to the ground as practical and no greater than 18 inches (450 mm) above the ground. Spreader bars shall be clean and in good working order so as to produce a consistent and even distribution of the cement on the subgrade. Cement furnished in trucks shall have the net weight of the cement certified.

(c) Application of Water. Water shall be applied through water trucks equipped with pressure-spray bars or can be directly applied through spray bars in the power mixer. Water application shall be a uniform distribution and dispersed evenly on each pass. CMS must be pulverized and mixed before water application.

(d) Slurry Cement. Slurry trucks shall be equipped with dispersion plates or suitable means for distributing the cement slurry. Slurry distribution shall be a uniform distribution and dispersed evenly on each pass.

(e) Compaction. CMS shall be compacted with one or a combination of the following: a vibratory smooth drum roller, pneumatic-tire roller, or vibratory sheepsfoot roller. The compaction equipment shall complete the required numbered of passes necessary to achieve the required compaction. The compaction equipment shall be capable of exerting a dynamic force of ten tons.

502.03.02 Preparation of Subgrade. Before CMS processing begins, the area to be modified shall be graded and shaped to final CMS lines and grades as shown in the plans or as directed by the Engineer of Record. Under the direction of the Engineer, overly soft areas may require either undercut, removal and replacement with controlled, compacted fills or evaluated for an additional cement dosage. The Contractor shall ensure that the

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scarifying machine is cutting uniformly, and the secondary grade is an even surface over the entire width of roadway. The machine shall be of such design that a visible indication is given to the Engineer of Record and County at all times that the machine is cutting uniformly. If the cutting depth is not satisfactory to the Engineer of Record and County, the Contractor shall make adjustments to his equipment to meet these requirements. The soil shall be damp at the time of scarifying to reduce the amount of dust and to aid in pulverization. Pulverization and cutting depth of the soil shall be satisfactory to the Engineer of Record and County before any cement or additive is added to the soil.

502.03.03 Mixing and Placing. CMS shall not be mixed when the soil subgrade is frozen, or when the air temperature is below 40°F (4°C). Moisture in the soil at the time of cement application shall permit a uniform and intimate mixture of the soil and cement during mixing operations. The CMS moisture shall be such that the required compaction can be achieved. The section for cement application, mixing, spreading, compacting, and finishing shall be continuous and completed within the same working day. CMS mixture and placement shall not be unattended for more than three hours before compaction. CMS mixture has to be placed and compacted in the same working day. The application and mixing of cement with the subgrade material shall be accomplished by either method herein described as "Dry Placing" or "Slurry Placing."

(a) Dry Placing. The cement shall be spread at the design rate shown on the plans or as directed by the Engineer of Record. The design rate is laboratory determined and stated as cement to soil percentage and weight of cement to area of soil distribution. The cement shall be distributed at a uniform rate and in such a manner as to reduce the blowing of cement by wind. Cement shall not be applied when wind conditions, in the opinion of the Engineer of Record and the County, are such that blowing cement becomes hazardous to traffic or objectionable to adjacent property owners. A motor grader shall not be used to spread the cement.

(b) Slurry Placing. Where slurry placement is to be used, the cement shall be mixed with water to form a slurry of the solids content designated by the Engineer of Record. The solids content are laboratory determined and stated as a weight of cement to volume of water. This solids content is based on a soil mix design of weight of cement to area of soil. The distribution truck may be equipped with an agitator which will keep the cement and water in a homogeneous suspension.

The mixing procedure shall be the same for "Dry Placing" or "Slurry Placing". The material and cement shall be thoroughly mixed by soil tillers or other approved equipment, and the mixing shall continue until, in the opinion of the Engineer of Record and the County, a homogenous, friable mixture of material and cement is obtained, free from all clods or lumps. Materials shall be mixed as thoroughly as possible at the time of the cement application and brought to the proper moisture content. The material shall be kept moist as directed by the Engineer of Record.

If the CMS mixture contains clods, they shall be reduced in size by raking, blading, discing, harrowing, scarifying, or the use of other approved pulverization methods. If, in

the opinion of the County, the CMS has excessive clods CMS pulverization shall meet the following criteria; 100% passing a 1-inch (25 mm) sieve and a minimum 60% passing a No. 4 (4.75 mm) sieve.

502.03.04 Compaction. Compaction of the CMS shall begin immediately after mixing. The material shall be aerated or watered as necessary to provide the optimum moisture content. Compaction shall be thorough and uniform for the entire depth of mixture. Compaction shall be in 10-inch (250 mm) loose lifts for CMS mixed in place. Additional lifts to be placed and compacted shall be in 8-inch (200 mm) loose lifts or as directed by the Engineer of Record.

Moisture content of the CMS shall be greater than the optimum moisture content, but not more than 4% over the optimum moisture content for the material during compaction. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to not less than 97% of maximum dry density. Optimum moisture content and maximum dry density shall be determined by the Modified Proctor ASTM D1557.

Nuclear Density tests, ASTM D2922 and D30l7, shall be performed with a minimum of one test per lane per 250 linear feet of paving. The suitability of the stabilization as constructed shall be confirmed by CBR testing for all soils and by Atterberg Limits for cohesive soils, as may be required by the Engineer of Record's design, at the rate of one test per 2500 cubic yards of processed material. An unconfined compression test shall be performed for three, seven and twenty-eight day intervals. The unconfined compression test breaks will be used to verify the Engineer of Record's design strength. The County reserves the right to conduct any laboratory or field tests to verify the Engineer of Record's testing. The County also reserves the right to waive any testing required of the Engineer of Record.

In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests as necessary will be performed by the Engineer of Record. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. Repulverization and addition of cement may be necessary to meet the density requirements.

Throughout this entire operation the shape of the CMS shall be maintained by blading. The surface upon completion shall be smooth and in conformity with the typical section shown on the plans and to the established lines and grades. Should the material, due to any reason or cause, lose the required stability, density and finish before the next course is placed or the work is accepted, it shall be recompacted or remixed and refinished at no additional cost to Howard County.

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502.03.05 Finishing. After the final lift of CMS has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling as directed with a pneumatic tire or other suitable roller sufficiently light to prevent cracking. The CMS shall be cured a minimum 24 hours before proof rolling of the CMS for pavement construction. The curing procedure is keeping the CMS surface and open sides covered with moisture to allow the steady hydration of the cement. The contractor shall use water spreading by truck, as necessary, as part of the curing procedure. The Engineer of Record and County shall witness test roll prior to aggregate base placement and prior to bituminous pavement construction. Any defective CMS not passing the test roll shall be repaired before either aggregate base placement or bituminous pavement construction. Test rolling shall be performed per section 204.03.01 (c).

502.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for furnishing, hauling, mixing, placing, compacting, watering, and for all material, labor, equipment, tools, and incidentals, necessary to complete the work.

502.04.01 Cement Modified Soils (CMS) will be measured and paid for at the Contract unit price per square yard.

502.04.02 Portland Cement for Cement Modified Soils (CMS) will be measured and paid for at the Contract unit price per ton.

SECTION 503 — CHIP SEAL SURFACE TREATMENT

503.01 DESCRIPTION. Apply one or two seal coats or a prime coat followed by one or two seal coats as specified. The seal coat consists of emulsified asphalt followed by an application of aggregate. The prime coat, when required, consists of preparing and treating an existing surface with emulsified asphalt.

503.02 MATERIALS.

MATERIAL	SECTION	APPLICATION	SIZE OR GRADE	SPREAD RATE lb/yd^2	SPRAY TEMP F	SPRAY RATE SINGLE COAT OR FIRST COAT gal/yd^2	SPRAY RATE FOR SECOND COAT (Double) gal/yd^2
Aggregate	901	Single or First Coat	No. 7	25 – 50	—	—	—
		Second (Double Coat)	No. 8	20 - 25	—	—	—
Emulsified Asphalts	904.03	Seal Coat	CRS-1	—	70-140	0.3-0.5	0.2-0.4
			CRS-2	—	140-160	0.3-0.5	0.2-0.4
			RS-1	—	70-140	0.3-0.5	0.2-0.4
			RS-2	—	140-160	0.3-0.5	0.2-0.4

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503.03 CONSTRUCTION. Protect the treated pavement against damage from all causes. Repair or replace damaged areas as directed.

503.03.01 Equipment. All equipment is subject to approval.

(a) A calibration chart showing the total capacity in gallons of the distributor tank, and the fractional capacity for each 1/4 in. of tank depth, shall be carried in the unit. The unit shall be capable of uniformly applying the specified material on variable widths of surface at the rates specified in 503.02. In addition, the equipment shall include the following:

(1) A fifth wheel tachometer for maintaining uniform speed.

(2) A thermometer graduated in 2 F increments to determine the specified temperature ranges.

(3) Heaters for uniformly heating the materials to the proper temperatures.

(4) Full circulation spray bars that are laterally and vertically adjustable, plus a hand spray.

(5) A calibrated tank to determine the quantity of asphalt in each load and the amount used.

(6) A valve or petcock built into the equipment for sampling the asphalt.

(7) A motor driven pump with pressure gauges to deliver the material to the spray bars. When a variable speed pump and metering system is used, provide charts prepared by the manufacturer for selecting the proper pump speed for each application.

(b) Aggregate Spreader. Use equipment that is either self-propelled or attached to a truck tailgate.

(c) Rollers. Refer to 504.03.01(c).

503.03.02 Weather Restrictions. Place when the ambient air and surface temperatures are at least 50 F and rising and the pavement is clean and dry. When weather conditions differ from these limits, placement of material en route from the plant to the job site shall be at the Contractor's risk. When the Engineer stops placement of the material, dispose of all material en route at no additional cost to the County.

503.030.3 Foundation Preparation. Construct the foundation as specified. When paving over existing pavement, repair ruts and potholes to provide a smooth surface for the application of the chip seal surface treatment.

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503.03.04 Prime Coat. Prior to the application, clean the surface of all loose and foreign materials. Uniformly apply the prime coat to the surface at the application rate specified in 503.02. Remove pooled material before applying the next coat.

503.03.05 First Seal Coat.

(a) No sooner than 24 hours after the application of the prime coat, spray emulsified asphalt on the surface at the application rate specified in 503.02.

(b) Immediately following this asphalt application, spread a dry, dust free aggregate on the surface at the application rate specified in 503.02. Remove excess aggregate, and correct all areas containing insufficient aggregate.

503.03.06 Rolling. Immediately following the aggregate application, roll the surface until the aggregate is uniformly embedded into the asphalt. Discontinue rolling if the aggregate begins to crush.

503.03.07 Second Seal Coat. When specified, after the first seal coat has cured at least 24 hours, apply a second seal coat to the surface, omitting the prime coat. Apply emulsified asphalt and aggregate at the application rate specified in 503.02. Remove excess aggregate and correct all areas containing insufficient aggregate. Roll the surface as specified in 503.03.06.

503.03.08 Traffic. Close completed sections to traffic until the final seal coat has completely cured. Maintain the treated surface after it has been opened to traffic until final acceptance.

503.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for the foundation preparation, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Chip Seal Surface Treatment will be measured and paid for at the Contract unit price for one or more of the items listed below.

503.04.01 No. 7 Aggregate for Single Coat Chip Seal Surface Treatment per ton.

503.04.02 No. 8 Aggregate for Second Coat Chip Seal Surface Treatment per ton.

503.04.03 Emulsified Asphalt for Seal Coat per gallon.

The actual number of gallons of emulsified asphalt distributed will be corrected to the corresponding volume at 60 F as determined by use of conversion tables furnished by the Administration.

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SECTION 504 — ASPHALT PAVEMENT

504.01 DESCRIPTION. Construct Asphalt Pavement.

504.02 MATERIALS.

Performance Graded Asphalt Binders	904.02
Tack Coat	904.03
Asphalt Mixes	904.04
Crack Filler	911.01
Production Plants	915

504.03 CONSTRUCTION.

Pre-Paving Meeting
A pre-paving meeting shall be held on site before any paving is begun. The Contractor shall make the request sufficiently ahead of time to schedule the pre-paving meeting. The Inspector, the Paving Foreman, Paving Superintendent and a representative from testing agency shall be in attendance at this meeting. When requesting to schedule the pre-paving meeting the contractor shall submit the following to the Inspector.

(a) Name and location of asphalt production plants,

(b) Laboratory and field personnel qualifications, who will be responsible for coring and testing asphalt samples.

(c) Approximate quantities and paving schedule of asphalt for each mix.

(d) Final road construction plans that include Soils Evaluation and Pavement Design Report if there are different from approved construction drawings.

Paving Section
The Engineer of Record shall submit, for approval, the Final Road Construction Plans, which specify the road classification, zoning district, and pavement section, as shown in the Typical Sections in the Standard Details of this Design Manual. It is preferred that the Soils Evaluation and Pavement Design Report is performed during the design phase of the project and submitted with the plans. If the soils evaluation and report is to be performed after construction begins, the plans shall include the following note:

"Construction of road base pavement is not permitted until DPW approves the pavement design recommendations submitted in the Soils Evaluation and Pavement Design Report required in Section 2.4 of the Design Manual Volume III."

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The report shall contain the results of the following required tests that a Geotechnical Engineer has performed on each of the predominant soil types to be used in the road construction:

1. California Bearing Ratio (CBR) Test (AASHTO T-193)
2. Sieve Analysis (AASHTO T-88)
3. Liquid Limit & Plasticity Index of Soils (AASHTO T-89 & T-90)
4. Modified Proctor (AASHTO T-180)
5. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM-D-2488-84)

The report shall identify the CBR used for the pavement design. The maximum CBR value for subgrade soils used in selecting typical paving sections is 7 (Refer to Details R-2.01 and R-2.02). The CBR test shall be the soaked test at 95% compaction.

The report shall identify micaceous soils used for the pavement subgrade. The description and identification of soils shall include the estimated percentage of mica content. Soils estimated to have a mica content in excess of five percent (trace amount) of the total volume, shall be considered to be micaceous. Micaceous soil subgrades require the use of aggregate base in the pavement section.

The report shall include pavement design recommendations, based on the results of the soils analyses, based on an assumed 20-year pavement life expectancy, and based on the expected Equivalent Single Axle Loads (ESALs). The ESALs used for design shall account for construction loading and phase construction. The Geotechnical Engineer may recommend a pavement design based on one of the following:

1. If the top 2 feet of subgrade soil has a CBR greater than 3, and meets the material requirements for unit weight and plasticity indices, the Geotechnical Engineer may recommend a pavement section by selecting from the Standard Details.

2. If the top 2 feet of subgrade soil has a CBR less than 3, or does not meet the material requirements for unit weight and plasticity indices, the Geotechnical Engineer may recommend removing the unsuitable material and replacing it with suitable material, and may recommend a pavement section by selecting from the Standard Details.

3. If the top 2 feet of subgrade soil has a CBR less than 3, or does not meet the material requirements for unit weight and plasticity indices, the Geotechnical Engineer may recommend improving the unsuitable material using Cement Modified Soil, and may recommend a pavement section by selecting from the Standard Details. Refer to Section 501 for Cement Modified Soil.

Records. The Contractor shall maintain and make available to the Engineer upon request complete records of sampling, testing, actions taken to correct problems, and quality control inspection results.

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Quality Assurance (QA). The Department of Public Works, at its discretion, will perform independent QA sampling, testing and inspections. QA consists of the following:

(a) Periodically observe the performance of Quality Control (QC) or QA testing,
(b) Directing the sampling of cores taken from the compacted pavement,
(c) Monitoring conformance with the approved QCP(s),
(d) Quality control sampling and testing procedures and quality control sampling and testing equipment will be evaluated per the Independent Assurance (IA) program.

Any deviation from the approved quality control plan not approved by the DPW shall be cause for immediate suspension of the production and paving operations. The Engineer's approval will be required prior to resuming production and paving operations.

The Contractor shall protect the pavement against all damage from all causes. Any part of the pavement that is damaged shall be repaired or replaced by the Contractor at no additional cost to the County.

504.03.01 Equipment. All production and paving equipment will subject to approval.

Hauling Units. Refer to 915.02(f).

Pavers. Pavers shall be equipped with a means of preventing the segregation of the coarse aggregate particles when moving the mix to the paver augers. The means and methods used may consist of chain curtains, deflector plates, or other such devices, or any combination of these per the manufacturer's recommendations. Demonstrate that modifications to the paving equipment have been implemented on all pavers prior to use on the project.

Use a self-contained, self-propelled unit for mainline paving. Inspection and approval will be based upon the manufacturer's recommendations. The paver shall:

(a) Produce a finished surface of the required smoothness and texture without tearing, shoving, or gouging the mix.

(b) Be operated in a manner which delivers a homogeneous mix the full width of the pavement.

(c) Have automatic controls capable of maintaining the grade and transverse slope within the required tolerances set forth in the contract documents.

(d) Use auger extensions to maintain a distance no greater than 18 in. from the end of the auger to the end gate when screed extensions are used.

Provide reference lines or other approved markings to control the horizontal alignment.

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Manual operation will be permitted to make grade changes for constructing irregularly shaped and minor areas.

The equipment may be operated manually for the remainder of the workday if a malfunction of any automatic control occurs, as directed.

Rollers. Rollers shall be self-propelled, reversible, and steel wheeled or pneumatic tired. Inspect all rollers and present them for approval before use. Rollers shall be operated:

(a) In conformance with the manufacturer's recommendations.
(b) In a manner that does not damage the pavement.
(c) In a manner that delivers the optimal combination of density and ride requirements.
(d) In a manner that protects bridge decks. Do not use rollers in vibratory mode when paving bridge decks.

504.03.02 Weather Restrictions. Place mixes used as the final surface when the ambient air and surface temperatures are at least 40 F. Ensure that surfaces to be paved are clean and dry before paving, as approved.

(a) Place mixes used as intermediate and base layers when the ambient air and surface temperatures are at least 32 F.

(b) Place polymer-modified surface mixes when the ambient air and surface temperatures are at least 50 F.

(c) When it begins raining while the work is underway, material en route from the plant may be used at risk.

(d) The County reserves the right to perform any testing necessary to ensure the quality of the pavement.

(e) All additional testing and associated costs, including maintenance of traffic, will be at no cost.

If material placement is halted due to weather conditions, waste all material en route at no additional cost.

Do not place asphalt on a frozen graded aggregate base.

504.03.03 Foundation Preparation. Construct the foundation as specified prior to paving. Remove all excess crack filler and patch material before paving over existing pavement. All spalls and potholes shall be cleaned, tack coated, filled with asphalt, and tamped before paving. Adjust to grade manholes, valve boxes, inlets, and other construction appurtenances within the area to be paved as directed.

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504.03.04 Tack Coat. Ensure the surface is dry and clear of all loose and foreign materials prior to application. Apply the tack coat uniformly across the surface using an application rate of 0.01 to 0.05 gal/yd2 as directed.

504.03.05 Non-Tracking Tack Coat (NTTC). The Manufacturer shall supply a QCP for the NTTC detailing the handling and application procedures per AASHTO PPP71-11, and test results from an independent, accredited laboratory for shear and tensile strength.

(a) Sample the NTTC as directed and submit to DPW Bureau of Engineering. Samples will be tested at discretion of DPW Bureau of Engineering against the manufacturer's specifications. Material out of compliance will not be accepted for use.

(b) Use equipment to heat and apply the NTTC at an application temperature range that conforms to the manufacturer's recommendations. Apply the NTTC in accordance with 504.03.02 and as directed.

(c) Apply the NTTC uniformly with a pressure distributor. Use hand spraying equipment only in areas inaccessible to the pressure distributor. Apply the NTTC using an application rate of 0.05 to 0.10 gal/yd2 and do not dilute with water. The quantity, rate of application, temperature, and areas to be tacked shall be approved prior to application.

(d) Do not clean or discharge the tack coat distributor into ditches, onto shoulders or along the right of way. Park the distributor so the spray bar will not drip NTTC onto the surface of the traveled pavement.

(e) Exclude all traffic from sections treated with NTTC until the tack has cured and will no longer track onto adjacent non-treated areas. Adjacent pavement surfaces shall show minimal visible evidence and pavement markings shall show no visible evidence of tracking.

504.03.06 Asphalt Placement. Delivery and placement of the asphalt should be continuous. Place the asphalt while the temperature is at least 225 F, or as specified in the Special Specification. Place the asphalt with a paver used that conforms to 504.03.01. Do not broadcast loose mix over the new surface.

504.03.07 Compaction. Roll the asphalt immediately after placement and compact to the proper in-place density and ride smoothness. Use steel wheel rollers for the first rolling of all joints and edges, the initial breakdown rolling, and the finish rolling. Use a power driven trench roller when base widening is too narrow to permit the use of conventional rollers.

Construct an earth berm or shoulder against the loose asphalt as soon as it is placed. The trench must be excavated wider than the proposed width. Roll and compact the two materials simultaneously.

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No traffic is permitted on the pavement after rolling until it has cooled to less than 140 F. Roller marks shall not be visible after rolling operations.

504.03.08 Joints. Construct joints as directed and as follows:

(a) Stagger longitudinal and transverse joints in successive courses so that one is not directly above the other.

(b) Stagger transverse joints by the length of the paver.

(c) Stagger longitudinal joints at least 6 in. and arrange so that the longitudinal joint in the top course is within 6 in. of the line dividing the traffic lanes.

(d) Construct joints in a manner that provides a continuous bond between the old and new surfaces.

(e) Overlap the existing pavement 1 to 1.5 in. when constructing longitudinal joints adjacent to existing asphalt pavements.

(f) The initial longitudinal roller pass shall be on the uncompacted hot mat and 6 in. to 1 ft from the joint. The successive roller pass shall compact the overlapped material and the 6 in. to 1 ft material simultaneously.

(g) Apply tack coat to joints as directed. Cut back the edge of the existing pavement for its full depth at transverse joints when placing a surface course, and apply tack coat material as directed.

(h) Apply tack coat to all contact surfaces before placing the mix against curbs, gutters, headers, manholes, etc.

504.03.09 Edge Drop-off. When paving roads carrying traffic:

(a) Match all compacted pavement courses exceeding 2-1/2 in. in depth with the abutting lane or shoulder on the same working day.

(b) For compacted pavement courses of 2-1/2 in. or less are placed, use the option of paving the abutting lane or shoulder on alternate days.

(c) Pave all abutting lanes or shoulders prior to weekends and temporary shutdowns.

(d) Place advance warning traffic control devices per Section 104 where uneven pavement joints.

504.03.10 Tie-In. When paving roads carrying traffic:

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(a) Construct a temporary tie-in at least 4 ft in length for each 1 in. of pavement depth when the posted speed ≤ 40 mph.

(b) Construct a temporary tie-in at least 10 ft in length for each 1 in. of pavement depth when the posted speed >40 mph.

(c) Construct temporary tie-ins before traffic is allowed to cross the transverse joint.

(d) Construct temporary tie-ins 10 ft or greater using a paver meeting 504.03.01.

(e) Remove a transverse portion of the existing pavement at the final tie-in point to maintain the design thickness of the final surface course.

(f) Construct the final tie-in to a length equal to the posted speed per 1 in. depth of the design thickness of the final course, with a length of at least 25 ft per 1 in. depth and a maximum length of 50 ft per 1 in. depth.

504.03.11 Sampling & Testing for Density Determination.

Nuclear Gauge
Density test shall be performed by using Asphalt nuclear gauge per ASTM D2950 to establish the proper rolling effort and pattern during placement and compaction of the base, intermediate and surface courses. Density readings obtained by the nuclear gauge shall not be used in calculating the average density of the pavement section.

Core Method for Determination of the Density (for Base and Intermediate Courses)
When paving, a density lot is defined as a day's paving per mix. Randomly selected core samples taken from the roadway are used to determine acceptance of the mixture and placement of the asphalt pavement. Random core sampling locations will be selected for each density lot. Minimum 3 sets of core test shall be taken from the base course for each density lot. Each set of cores contain one QC core and one QA core. Take core samples from locations discussed and accepted by the inspector in his/her presence. Cut four or six inch cores for mixes smaller than 25 mm. Cut then extract all cores before the roadway is open to traffic. Place the cores in a container suitable for transporting. Core sheets must be signed by Engineer of Record performing the task Protect cores from light and heat until tested to ensure the accuracy of the test results. The Inspector will take possession of the QA cores.

Density test samples are not required on contracts of less than 60 tons, where bituminous concrete is used in non-traffic-bearing areas, or on resurfaced bridge decks.

(a) **Quality Control for Density**. The density of the core samples will be expressed as a percentage of the maximum theoretical specific gravity of the mixture. The core's percent density will be expressed to the nearest 0.1 percent. The maximum

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specific gravity of the asphalt mixture will be determined in accordance with T 209. The maximum specific gravity of the mixture can be obtained from the asphalt manufacturer's accredited lab determined in accordance with T 209 for individual mixtures per day. If agreed at the pre-paving meeting the cores may be taken after the intermediate course is placed and compacted. If the cores are taken through base and intermediate layers, density of each layer shall be determined individually by separating the layers, and using the corresponding specific of gravity. Each layer shall meet the acceptance requirement described in paragraph (c). The contractor is responsible for repairs to areas from which samples are taken.

If more than one mix sample is obtained per day's placement, an average of all maximum specific gravity tests for the day will be used for the determination of percent density of each core sample. The plant report for the asphalt mix used shall be provided to DPW Bureau of Engineering as soon as it is available. The QC Laboratory will make results of individual days paving available to the DPW Bureau of Engineering and the Contractor no later than the next working day. Retain core samples until notified of the results.

(b) Quality Assurance for Density. DPW Bureau of Engineering will take possession of the QA core samples at the job site, and perform density tests at its discretion. The density of the core samples will be expressed as a percentage of the maximum specific gravity of the mixture for each lot's placement. The maximum specific gravity will be determined in accordance with T 209 and the core's percent density will be expressed to the nearest 0.1 percent.

(c) Acceptance. Each asphalt density lot will be evaluated for compliance using the Contractor's core test data and the DPW Bureau of Engineering's test data, if available. The QC and QA core specific gravity data will be averaged to determine the density. Statistical outliers will be determined per MSMT 734. Outlier values shall be excluded from calculating the average density. The in place average density shall be 92.0 to 97.0 percent. Density lots with average density smaller than 92.0% or larger than 97.0% shall be removed and re paved at no cost to the County.

504.03.12 Thin Lifts and Wedge/Level Courses.

Refer to the requirements specified in the Contract Documents.

504.03.13 Curbs, Gutters, Etc. Construct permanent curbs, gutters, edges, and other supports as shown and as specified, then backfill prior to placing the asphalt.

504.03.14 Shoulders. Construct shoulders as specified. Shoulders abutting the asphalt surface course of any two-lane pavement being used by traffic shall be completed as soon as possible after placement of the surface course on that lane.

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504.03.15 Pavement Profile. Refer to the Pavement Surface Profile requirements specified in the Contract Documents.

504.04 MEASUREMENT AND PAYMENT. Asphalt pavement will be measured and paid for at the Contract unit price per ton. The payment will be full compensation for furnishing, hauling, placing all materials including anti-stripping additive, tack coat, control strip, pot hole and spall repairs, setting of lines and grades where specified, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Temporary Tie-Ins. Placement and removal of the temporary tie-in where asphalt is being applied to the traveled way carrying traffic will not be measured but the cost will be incidental to the pertinent asphalt item.

Removal of the existing pavement or structure for the final tie-in will be measured and paid for at the Contract unit price for the pertinent items used. The asphalt for the final tie-in will be measured and paid for at the Contract unit price for the pertinent Asphalt item.

Adjustments. Adjustment of existing visible manholes, valve boxes, inlets, or other structures will not be measured but the cost will be incidental to the asphalt item. Adjustment of existing manholes, valve boxes, inlets, or other structures that are encountered below the existing grade will be considered for payment in conformance with GP-4.07.

Removal of Existing Raised/Recessed Pavement Markers. Removal of existing raised/recessed pavement markers will not be measured but the cost will be incidental to the asphalt item. Removal of existing raised/recessed pavement markers that are encountered below the existing pavement will be considered for payment in conformance with GC-4.07.

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SECTION 505 — ASPHALT PATCHES

505.01 DESCRIPTION. Repair rigid, flexible, or composite pavements by removing part or all of the section of the existing pavement and replace with asphalt paving material. The locations and extent of the repairs will be as specified or as directed.

Partial Depth Patching (PDP). PDP consists of removing areas of unsound pavement up to 50 percent of the pavement thickness and replacing with an asphalt mix. The pavement thickness is defined as the thickness of all bound materials in the pavement structure including asphalt mix, portland cement concrete (PCC), and any other asphalt or cement modified material.

Full Depth Patching (FDP). FDP consists removing the full thickness of the pavement sections to the top of the aggregate base and replacing with an asphalt mix. Perform FDP whenever more than 50 percent of the pavement thickness requires repair.

505.02 MATERIALS.

Graded Aggregate Base	901.01
Aggregates for Asphalt Mixes	901.01
Performance Graded Asphalt Binders and Asphalt Mixes	904
Crack Filler	911.01
Production Plants	915
Cold Patch Material	924

505.03 CONSTRUCTION. Keep disturbance of the base material to a minimum. The faces of the remaining pavement shall be square and vertical without ragged edges. Do not use equipment that could damage the existing pavement.

505.03.01 Weather Restrictions. Refer to 504.03.02.

505.03.02 Existing Pavement. Complete all repairs on the same day in which excavation is completed. Do not leave open excavated areas at the end of the workday.

505.03.03 Removal of Pavement for PDP. Remove existing pavement by milling, grinding, or saw cutting to the specified depth. Maintain square vertical faces after removal.

(a) If concrete is encountered during removal, limit the depth of the patch to the top elevation of the PCC.

(b) For PDP of composite pavements, protect the PCC from damage during removal of the HMA.

(c) When the material at the bottom of the PDP is determined to be unsuitable, remove the unsuitable material until sound material is encountered.

(d) When PCC present in a composite pavement is determined to be unsuitable, follow the removal and replacement procedures for a FDP.

(e) Remove all loose and foreign materials before placing the patch, then treat all spalled cracks and joints by tack coating, filling and tamping with asphalt.

505.03.04 Removal of Pavement for FDP. Make a perpendicular saw cut full depth around the perimeter and remove the existing pavement to the top of the aggregate base. Refer to 522.03.03 for the concrete portion of a composite pavement. Maintain square vertical faces after saw cutting.

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505.03.05 Base and Subgrade Preparation. The aggregate base of the FDP area will be evaluated to determine its suitability.

(a) When the aggregate base is determined to be unstable, compact it as specified in 501.03.10.

(b) When no aggregate base is present, construct the subgrade foundation per Section 208 or as directed.

(c) Removal of Unsuitable Material:

(1) When the aggregate base or subgrade material is unsuitable, remove and dispose of the unsuitable material.

(2) Replace the unsuitable material with graded aggregate base conforming to Section 501.

(3) Compact the replacement material in layers no greater than 4 in. depth.

(4) Protect the aggregate base or subgrade after placement.

(5) Remove and replace any aggregate base or subgrade damaged due to lack of protection at no additional cost.

505.03.06 Subgrade Drains. Refer to Section 306. The construction of subgrade drains may be required in areas of wet underlying subgrade or in areas where future drainage problems may be a concern, as determined.

505.03.07 Emergency Filler. Have sufficient approved cold patch material readily available to fill the void of the repair area. Place and compact the material as directed. Completely remove the material at the beginning of the next workday.

505.03.08 Steel Plates. Ensure an ample supply of 12 x 14 ft by 1 in. thick steel plates are available on site to cover the emergency filler.

505.03.09 Patch Construction. Refer to Section 504. Furnish equipment and perform placement, compaction, and quality control procedures as specified. Manual placement of the asphalt patches is permissible, as directed.

505.03.10 Patch Placement. Thoroughly clean and tack the exposed vertical surface of adjacent pavement prior to placing the asphalt patch per 504.03.04. Spread the asphalt with a shovel, rake, or by other approved methods. Do not place asphalt patches on a frozen base.

Maintain lift thickness in conformance with the following:

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ASPHALT LIFT THICKNESS		
MIX DESIGNATION (mm)	**MINIMUM (in.)**	**MAXIMUM (in.)**
9.5	1.5	2.0
12.5	1.5	3.0
19.0	2.0	4.0
25.0	3.0	5.0
37.5	4.0	6.0

505.04 MEASUREMENT AND PAYMENT. Refer to 504.03.10 and MSMT 735. Payment will be full compensation for saw cutting, milling, grinding, removal, disposal, trimming of the existing pavement, subgrade preparation, placing all materials including tack coat, steel plates, emergency filler, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. After removal, steel plates and emergency filler will remain the property of the Contractor.

505.04.01 Partial Depth Patching and Full Depth Patching. Payment will be measured and paid for at the Contract unit price per square yard or per ton as specified. The payment will be full compensation for furnishing, hauling, placing all material, additional removal of pavement above the aggregate base, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

505.04.02 Removal of Unsuitable Material. Payment will be measured and paid for at the Contract unit price per cubic yard. The payment will also include excavation and disposal of unsuitable material, backfilling with aggregate, and compaction.

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SECTION 506 — GAP-GRADED STONE MATRIX ASPHALT

506.01 DESCRIPTION. Place gap-graded stone matrix asphalt surface (GGSMA) as specified. GGSMA shall conform to Section 504, except as specified herein.

506.02 MATERIALS.

Gap-Graded Stone Matrix Asphalt	904.05
Production Plant	915

506.03 CONSTRUCTION.

506.03.01 Hauling Units. Dry soap powder, as approved by the Engineer, may be used with the release agent specified in 915.02(f). Truck beds shall be raised to drain excess water before being loaded with GGSMA.

A light dusting of No. 10 aggregate coated with 1 percent asphalt may be used in lieu of the liquid release agent.

The time between plant mixing and shipment shall not exceed one hour (storage time may vary depending upon gradation, type of binder and/or stabilizer. Storage material shall consistently have results of no less quality than mixtures discharged directly into hauling vehicles). Each load shall be completely covered with a full tarp extending a minimum of 6 in. over each side of the truck body and securely fastened.

506.03.02 Weather Restrictions. Placement of GGSMA will be permitted only when the ambient and surface temperatures are at least 50 F and in accordance with 504.03.02.

506.03.03 Material Transfer Vehicle (MTV). When the Contractor elects to use a MTV to apply the final surface course, the MTV shall perform additional mixing of the gap-graded material and then deposit the mixture into the paver at a uniform temperature and consistency.

506.03.04 Mix Temperature. The minimum temperature of the mixture at the time of placement shall be established during the mix design procedure.

506.03.05 Pavement Thickness. The thickness of the pavement shall be as specified in the Contract Documents. Thin Lift specification 504.03.12 is not applicable to GGSMA.

506.03.06 Tack Coat. Refer to 504.03.04 except that, the resulting coating shall be residual asphalt applied at a rate of 0.03 to 0.05 gal/yd2.

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506.03.07 Compaction. Compaction shall be performed using a minimum of three steel-wheeled rollers, each weighing 10 to12 tons. The rollers shall follow the paver within 500 ft. or roll as approved in the QC Plan. Rolling shall start immediately after placement. In place density shall conform to 504.03.11 (c), except that the density shall be 94 to 97 percent of maximum density. Sampling and testing shall be performed as specified in 504.03.11.

The rollers shall be equipped with a watering or soapy watering system that prevents material from sticking to the rollers.

506.03.09 Pavement Profile. Refer to the Pavement Surface Profile requirements specified in the Contract Documents.

506.03.10 Sampling and Testing for Density. For sampling and testing for density and mixture refer to 504.03.10 .

506.04 MEASUREMENT AND PAYMENT. Gap-Graded Stone Matrix Asphalt will be measured and paid for at the Contract unit price per ton, complete and in place. The payment will be full compensation for furnishing, hauling, placing all materials, material transfer vehicle, antistripping additive, tack coat, control strips, setting of lines and guides where specified, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Material produced for the demonstration will not be measured but the cost will be incidental to the item GGSMA.

SECTION 507 — This section intentionally left blank.

SECTION 508 — MILLING ASPHALT PAVEMENT

508.01 DESCRIPTION. Mill hot mix asphalt (HMA) pavement.

508.02 MATERIALS.

Asphalt Mixes	904

508.03 CONSTRUCTION. Perform roadway patching before the milling operation. Additional roadway patching may be required after the milling operation. Refer to Section 505.

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508.03.01 Equipment. Use a power operated planing machine or grinder capable of removing, in one pass, a layer of asphalt pavement at the specified depth and at least half the lane width. The machine shall be capable of accurately establishing profile grade control and have a positive means for controlling slope elevation. The machine shall be capable of preventing dust from escaping into the atmosphere. The resultant surface shall be true to the established grade and be skid resistant. Furnish an approved 10 ft straightedge for testing the transverse and longitudinal surface after milling operations. Maintain a tolerance of ±1/8 in.

508.03.02 Pavement Milling. Mill one lane at a time. If the milling depth exceeds 2-1/2 in. on highways carrying traffic, mill the abutting lane or shoulder on the same day. Mill the abutting lane or shoulder, regardless of depth, prior to weekends or temporary shutdowns. Otherwise, if the milling depth is 2-1/2 in. or less, the abutting lane or shoulder may be milled on alternate days. Where uneven pavement joints exist, provide adequate advance warning devices in conformance with the Contract Documents.

When HMA paving is being applied to the traveled way carrying traffic with a posted speed ≤ 40 mph, construct a temporary tie-in at least 4 ft in length for each 1 in. of pavement depth. When HMA paving is being applied to the traveled way carrying traffic with a posted speed >40 mph, construct a temporary tie-in at least 10 ft in length for each 1 in. of pavement depth. Construct temporary tie-ins before traffic is allowed to cross the transverse joint. Construct temporary tie-ins 10ft or greater using a paver meeting the requirements of section 504.03.01.

In addition to any other equipment required to remove debris from behind the milling operation, use a vacuum equipped street sweeper to remove the dust prior to returning the area to traffic.

After the milling operation is complete, fill all depressions, potholes, and other irregularities using HMA. Construct an HMA wedge at existing water valves, meters, manhole covers, etc.

508.04 MEASUREMENT AND PAYMENT.

508.04.01 Milling Asphalt Pavement will be measured and paid for at the Contract unit price per square yard. The square yard measurement will be computed from the actual width and length measurements of the milled area. The payment will be full compensation for milling, the disposal of milled material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

508.04.02 Hot mix asphalt for filling depressions and potholes, and for wedging manholes, valve boxes, inlets, or other structures, will be measured and paid for as specified in 106.04.

508.04.03 Asphalt patches will be measured and paid for as specified in 505.04

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SECTION 509 – GRINDING ASPHALT PAVEMENT

509.01 DESCRIPTION. Grind asphalt pavement.

509.02 MATERIALS.

Asphalt Pavement	904

509.03 CONSTRUCTION. Perform roadway patching before the grinding operation. Additional roadway patching may be required after the grinding operation. Refer to Section 505.

509.03.01 Equipment. Use grinding equipment that has a cutting mandrel with carbide tipped cutting teeth and designed specifically for grinding asphalt surfaces to close tolerances. The equipment shall accurately establish slope elevations and profile grade controls.

Follow immediately behind the grinding machine with a vacuum equipped street sweeper, capable of removing all loose material from the roadway without causing dust to escape into the air.

Provide a final pavement surface with a transverse pattern of 0.2 in. center to center of each strike area and with the difference between the high and low of the matted surface not exceeding 1/16 in.

509.03.02 Pavement Grinding. Use the same procedures, settings, speed, and requirements as those used in the control strip.

When necessary to maintain an adequate cross slope for drainage, grind the pavement adjacent to the ground pavement. Grinding will not be required on bridge decks.

Grind one lane at a time. If the grinding depth exceeds 2-1/2 in. on highways carrying traffic, grind the abutting lane or shoulder on the same day. Grind the abutting lane or shoulder, regardless of depth, prior to weekends or temporary shutdowns. Otherwise, if the grinding depth is 2- 1/2 in. or less, the abutting lane or shoulder may be ground on alternate days. Where uneven pavement joints exist, provide adequate advance warning devices in conformance with the Contract Documents.

Furnish an approved 10 ft straightedge for testing the transverse and longitudinal surface after grinding operations. Correct all areas showing high spots greater than 1/8 in. within 10 ft by additional grinding at no additional cost to the Administration. Straightedge requirements apply to areas across joints and repaired cracks but are not applicable to areas outside the ground area.

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After the grinding operation is complete, fill all depressions, potholes, and other irregularities using HMA. Construct an HMA wedge at existing water valves, meters, manhole covers, etc.

509.04 MEASUREMENT AND PAYMENT. Grinding Hot Mix Asphalt Pavement will be measured and paid for at the pertinent Contract unit price per square yard. The square yard measurement will be computed from the actual width and length measurements of the area that has been ground. The payment will be full compensation for grinding, removal and disposal of ground material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

509.04.01 Hot mix asphalt for filling depressions and potholes, and for wedging manholes, valve boxes, inlets, or other structures will be measured and paid for as specified in 106.04.

509.04.02 Hot mix asphalt patches will be measured and paid for as specified in 505.04.

SECTION 510 — FILLING CRACKS IN ASPHALT PAVEMENTS

510.01 DESCRIPTION. Clean and fill cracks 1/8 to 1-3/4 in. wide. Cracks less than 1/8 in. wide do not need to be filled. Repair distressed areas as specified herein. Cracks more than 1-3/4 in. wide and map, edge, or alligator cracks requiring major repairs are not included in this work (Section 505).

510.02 MATERIALS.

Performance Graded Asphalt Binders and Asphalt	904.04
Crack Filler	911.01
Aggregate	M 43, No. 10
Tack Coat	M 140

Ensure that all materials for crack filling are inspected, tested, and approved before incorporating them into the work.

510.03 CONSTRUCTION. All cracks to be filled will be designated by the Engineer.

Crack Cleaning and Preparation. Remove existing deteriorated filler using equipment capable of removing the material to the required depth without damaging the sides of the pavement within the crack. Do not use equipment that creates a “V” shaped groove. Repair damage done to sound pavement resulting from construction operations.

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Clean cracks by using high pressure water blasting, abrasive blasting, oil free air blowing, a heat lance, or a combination thereof, as approved. The Engineer may suspend operations when weather conditions might create a hazard to the traveling public.

Before filling, completely dry the cracks using an approved method.

The Engineer will inspect the prepared cracks for debris, adherent dust, and dryness prior to filling. Reclean and dry cracks as directed.

Cracks varying in width up to 1-3/4 in. shall be divided into segments for repair. Portions of cracks having widths ranging from over 1 in. and up to 1-3/4 in. shall be sawn to the full depth of the crack and 1/8 in. wider than the maximum width of the crack. Clean the crack of all debris as specified above, and apply tack coat to the sides of the crack. Repair the crack as specified in Section 505 using an approved surface mix. Select an appropriate asphalt content and mixing temperature.

Crack Filling. Perform crack filling when the ambient and pavement surface temperatures are least 45 F and rising, unless otherwise recommended by the manufacturer and approved by the Engineer.

For cracks from 1/8 to 1 in. in width, heat the hot applied filler material as recommended by the manufacturer, in a double boiler, indirect heating kettle using oil as a heat transfer medium, or other approved equipment. The kettle shall have a mechanically operated agitator, recirculation pumps, and a positive thermostatic temperature control. Insulate the applicator wand and all connecting hoses. Do not overheat the filler or apply direct heating.

Withdraw and waste all filler that has been overheated, heated more than four hours, or that remains in the applicator at the end of the day's operation. Prior to the start of each day's operation, withdraw and waste at least 1 gallon of filler through the applicator wand.

Fill prepared and approved cracks until the material is 1/16 in. below or level with the pavement surface. If after two hours any filled crack is not in conformance with this requirement, refill the crack as directed.

If cracks can not be filled due to filler drainage into a large void, repair the crack by plugging the void with HMA Superpave 4.75 mm or other approved material. Complete filling the crack as specified above.

Remove excess filler from the surface of the pavement.

Fill cracks the same day they are prepared. If cracks are not filled on the same day they are prepared, reclean and dry them prior to filling.

Do not allow traffic on the filled pavement until the crack filler has cured.

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Filler that pulls loose within 96 hours after opening the pavement to traffic shall be repaired at no additional cost to the Administration.

510.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for furnishing, hauling, and placing of all materials, crack shaping, crack filling, the removal and disposal of old filler and debris, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. Payment will not be made for wasted material.

510.04.01 Filler Removal, Saw Cutting, Crack Shaping, and Crack Filler will be measured and paid for at the Contract unit price per linear foot.

510.04.02 Patching Material for Cracks will be measured and paid for per linear foot regardless of the width or depth of the crack.

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

SECTION 511 THRU 521 –RESERVED

SECTION 522 — PORTLAND CEMENT CONCRETE PAVEMENT REPAIRS

522.01 DESCRIPTION. Repair plain, conventionally reinforced, or continuously reinforced portland cement concrete pavement. Repairs are either Type I, 6 ft to less than 15 ft in length; or Type II, 15 ft and greater in length.

522.02 MATERIALS.

Refer to 520.02 except as follows:

Graded Aggregate for Base Course	901.01
Crusher Run Aggregate CR-6	901.01
Concrete Mix No. 9	902.10
Nonshrink Grout	902.11(c)
Epoxy Grout	902.11(d)
Epoxy Adhesive	921.04

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522.02.01 Polyester Grout. A polyester grout may be used in lieu of epoxy grout, provided the grout conforms to 902.11(d). Identify cartridge type systems by batch or lot number.

522.02.02 Epoxy Adhesives. Refer to 921.04. Use water insensitive materials classified as Type IV, Grade 3, Class B and C.

522.02.03 Reinforcement. Section 908 for reinforcement, including load transfer assemblies, tie bars, deformed steel bars, and longitudinal tie devices, except all material shall be epoxy coated.

522.03 CONSTRUCTION. The Engineer will determine the areas to be repaired and the type of repair. Prior to the start of repairs, submit a proposed repair plan, including equipment, methods, and procedures. Protect the repair area against damage from all causes. Repair or replace any part of the repaired pavement that is damaged. Make repairs in only one lane at a time for each roadway.

522.03.01 Equipment. Refer to 520.03.01.

522.03.02 Weather Restrictions. As specified in 520.03.02, except perform this work only during the months of April through October, unless otherwise permitted in writing. When the range in daily temperature is expected to exceed 15 F, concrete may be placed in the late afternoon after the existing pavement has achieved its maximum expansion, unless otherwise directed.

Cold weather protection shall conform to 520.03.12, except use insulated blankets when the ambient air temperature is less than 70 F.

522.03.03 Saw Cuts and Removal of Existing Pavement. Make all saw cuts perpendicular using a diamond saw blade. Remove concrete slabs by the lift out method in large sections. No other method of slab removal shall be used unless approved. Complete all repairs within the same working day on which the pavement is removed.

Repair adjacent slab damage caused by the removal operations. Perform saw cutting and pavement removal as follows:

(a) Plain and Conventionally Reinforced Portland Cement Concrete Pavement. Make full depth sawcuts for the full slab width and at least 2 in. from and parallel to longitudinal joints. When the repair is on only one side of an existing transverse joint, extend removal into the adjacent slab a sufficient distance to remove existing dowels. Remove the concrete slab within one week after making the saw cuts. Complete the repairs in a continuous operation.

(b) Continuously Reinforced Portland Cement Concrete Pavement. Locate the boundaries of the repair at least 18 in. from the nearest transverse tight crack for

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normally spaced tight cracks, and at least 6 in. from the nearest transverse crack when they are closely spaced. Make at least a 2 in. depth saw cut for the full width of the lane at the boundaries of the repair. Do not cut the steel reinforcement. Make a full depth saw cut across the full width of the slab at least 22 in. inside each boundary saw cut. Make additional full depth saw cuts along all longitudinal edges not bounded by construction joints. Remove the concrete to its full depth within the boundaries of the repair area within 72 hours after making the saw cuts. Do not bend existing reinforcement bars.

Use no more than a 60 lb jackhammer and hand tools to remove concrete in the areas between each 2 in. and full depth saw cut. Trim the existing pavement edge neatly and vertical. Leave at least 22 in. of reinforcement exposed on each side of the repair. The Engineer will require the removal of any pavement breaking equipment from the project that could damage the adjacent concrete pavement.

When saw cuts close due to temperature, make narrowly spaced, full depth, and full width saw cuts to relieve the pressure. Remove the material between the narrowly spaced saw cuts and between the longitudinal joint and the 2 in. minimum offset longitudinal cut using the equipment specified above. Cut tie bars protruding from the longitudinal offset flush with the existing concrete. Remove all waste material immediately from the repair site. Seal any saw cuts that extend into adjacent slabs, curbs, or gutters as specified in Section 523.

522.03.04 Base and Subgrade Preparation. Refer to 505.03.03, except moisten the subgrade for all types of repairs.

522.03.05 Subgrade Drains. If directed, construct subgrade drains as specified in section 306.

522.03.06 Forms. Use forms conforming to 520.03.04. Overlap existing pavement at least 1 ft on each side of the patch and securely fasten to prevent movement. Excavate the adjacent shoulder the width of the form plus 6 in. to provide space for the forms. After removing the form, repair the excavated shoulder area using the same type of material as used in the original shoulder.

522.03.07 Reinforcement. Refer to 520.03.06 and as specified herein. Place the doweled joint at the slab face closest to the original doweled joint location.

Drill holes 1/4 in. larger than the dowels, load transfer tie bars, and longitudinal tie devices into the face of the existing slab at mid depth. Blowout the holes and allow to dry. Grout or epoxy the dowels, load transfer tie bars, and longitudinal tie devices into place. Align reinforcement in the direction of the pavement and parallel to the surface.

Place a plastic grout retention disk, conforming to the Contract Documents, on each dowel to prevent loss of the bonding material.

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For continuously reinforced portland cement concrete pavement, use reinforcement steel bars of the same size and spacing as the existing bars. Splice the reinforcement to the existing steel by lapping, welding, or approved mechanical device. For lap splices, lap at least 22 in. and secure using tie wires. Place the longitudinal steel reinforcement bars continuous for the full length of the repair. Place an amount of steel at least equal to the amount of steel in the existing pavement. Support the reinforcement steel bars on chairs or as approved.

For plain and conventionally reinforced pavement, coat the protruding ends of the dowel bars with an approved water insoluble lubricant.

522.03.08 Joints. Refer to 520.03.14. Seal all joints as specified in Section 523.

522.03.09 Concrete Placement. Refer to 520.03.07. Prior to placing concrete, clean the adjacent vertical surfaces.

For weather requirements refer to 520.03.02. The temperature of the concrete at placement shall be 50 to 90 F.

The air temperature shall be at least 40 F and rising. When the range in daily temperature is expected to exceed 15 F, concrete may be placed in the late afternoon after the existing pavement has achieved maximum expansion, unless otherwise directed.

Construct both plain and continuously reinforced concrete pavement repairs in one full depth operation. Construct conventionally reinforced concrete pavement repairs by placing two equal lifts with the wire mesh laid on the surface of the first lift. Vibrate all concrete.

522.03.10 Finishing. Following concrete placement, strike off the surface to the finished grade using an adjustable steel or wooden template and float the surface. Screed the repair longitudinally to provide uniformity of ride to adjacent pavement. Match the contour of the existing roadway. Perform surface checks as specified in 520.03.10.

522.03.11 Curing. Cure the concrete as specified in 520.03.12, except continue curing for 12 hours after concrete placement or until the repair is put into service.

522.03.12 Emergency Filler. Have sufficient crusher run aggregate CR-6 readily available to fill the void of the repair area. Place and compact the material, and cover it with a steel plate. At the beginning of the next day's work, completely remove the material using procedures that will not disturb the subgrade, dowels, load transfer tie bars, load transfer assemblies, or reinforcement placed previously.

522.03.13 Steel Plates. Have an ample supply of 12 x 14 ft x 1 in. thick steel plates available on the project to cover emergency filler and to protect the patch area until the concrete has developed sufficient strength to carry traffic.

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522.03.14 Unacceptable Repairs. Remove and replace repairs that are not in conformance with the Contract Documents and repairs damaged by traffic or other causes.

522.04 MEASUREMENT AND PAYMENT. Portland cement concrete pavement repairs will be measured in place and paid for at the Contract unit price per square yard for the pertinent type Plain Portland Cement Concrete Pavement Repair, Conventionally Reinforced Portland Cement Concrete Pavement Repair, and Continuously Reinforce Portland Cement Concrete Pavement Repair item. The payment will be full compensation for saw cuts, furnishing, hauling, placing of all materials, removal and disposal of old concrete, grout, drilled holes, chairs, all tie devices, reinforcement, epoxy coating, steel plates, emergency filler, joint sealing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Emergency filler and steel plates will remain the property of the contractor at the completion of the project.

522.04.01 Removal of Unsuitable Material and Refill per cubic yard. The payment will also include excavation and disposal of unsuitable material, backfilling with aggregate, and compaction.

522.04.02 Subgrade drains will be measured and paid for as specified in the applicable portions of Section 306.

522.04.03 Shoulder Repairs per square yard. Repairs to existing shoulders necessitated by the placement of forms are also included

SECTION 523 — JOINT SEALING OF PORTLAND CEMENT CONCRETE PAVEMENTS

523.01 DESCRIPTION. Clean and seal portland cement concrete pavement joints.

523.02 MATERIALS.

Joint Sealers	911.01
Preformed Joint Fillers	911.02

Backer Rod. Use backer rod that is flexible, compressible, nonshrinkable, has a surface that will not bond with the joint sealer, and is capable of uniformly containing the sealer within the desired shape factor. Do not use hard rubber or materials that swell when wet or deform at sealer application temperatures.

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523.03 CONSTRUCTION. Seal joints the same day they are shaped and prepared, and complete the joints prior to opening the roadway to traffic, unless otherwise directed. If joints are not sealed the same working day, reclean and dry the joints as specified in 523.03.02 prior to sealing.

523.03.01 Joint Construction. As specified in 520.03.14. If the joint is tooled, do not use preformed joint fillers.

523.03.02 Joint Preparation. Clean joints by one of the following methods as approved:

(a) High pressure water blasting.

(b) Abrasive blasting.

(c) Oil free air blowing at a minimum of 90 psi.

Ensure that all joint walls and surfaces to which the joint material is to adhere are dry prior to installing the joint filler.

Ensure that all prepared joints are inspected and approved prior to sealing.

523.03.03 Sealing. Install preformed joint filler in conformance with the manufacturer's recommendations and the Contract Documents. Insert the backer rod as specified.

Install silicone sealer in conformance with the manufacturer's recommendations.

Backer rods are not required in longitudinal joints.

Apply sealer when the ambient air and pavement temperatures are at least 45 F and rising.

Heat hot applied sealer in accordance with the manufacturer's recommendations in a kettle or other equipment acceptable to the Engineer. Use kettles that have mechanically operated agitators, recirculation pumps, and positive thermostatic temperature controls. The applicator wand and all connecting hoses shall be insulated. Do not overheat or apply direct heat to the sealer.

Withdraw and waste all filler that has been overheated, heated more than four hours, or that remains in the applicator at the end of the day's operation. Prior to the start of each day's operation, withdraw and waste at least 1 gallon of filler through the applicator wand.

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Fill joints with sufficient material that the final surface of the sealer is recessed 1/4 in. below the pavement surface. Reseal the joint if within two hours after sealing, the sealer is recessed more than 5/16 in. below the pavement surface.

Use an approved tool to apply a parabolic shape to the surface of the sealer. Ensure that the deepest point at the center of the joint is 5/16 in. below the pavement surface. Remove any excess sealer from the surface of the pavement.

Curing time for silicone material varies with temperature and humidity, and may delay opening the pavement to traffic. Traffic is not allowed on the pavement surface until the sealer has cured. Refer to the manufacturer's recommendations for curing time.

Any sealer that pulls loose from the joint or shows excessive bubbling within one week after opening the pavement to traffic shall be replaced.

523.04 MEASUREMENT AND PAYMENT. Joint Sealing of Portland Cement Concrete Pavement will be measured and paid for at the Contract unit price per linear foot of joint unless otherwise specified. The payment will be full compensation for cleaning existing joints, furnishing, hauling, placing all materials including preformed joint filler, joint sealer, backer rod, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Joint construction and sealing will not be measured but the cost will be incidental to the Contract unit price for the pertinent Portland Cement Concrete Pavement item

SECTION 524 THRU 548 - RESERVED

SECTION 549 — PAVEMENT MARKINGS

549.01 DESCRIPTION. Apply durable and nondurable pavement markings (line markings, letters, numbers, arrows and symbols) to various surfaces at locations and patterns as specified or as directed.

549.02 MATERIALS. Durable and Nondurable Pavement Markings: Refer to Contract Documents.

549.03 CONSTRUCTION.

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549.03.01 Quality Control/Quality Assurance. At least 30 days prior to the prestriping meeting, submit in writing a proposed Quality Control Plan (QCP).

Address procedures for random sampling as specified in MSMT 729, and show how the equipment and material will be controlled to ensure conformance with the Specifications. Include the material manufacturer's application recommendations, personnel certifications, inspection and record keeping procedures, and minimum frequencies of sampling and testing as specified in MSMT 729. Detail when and how corrective action will be taken for unsatisfactory construction practices and deviations from the Specifications. Any deviation from the QCP shall be cause for immediate suspension of the marking operation. Operations shall not resume without approval.

(a) Placement. Do not begin placement operations until the QCP is approved and a walkthrough has been performed to approve the layout with the Engineer, Contractor, and pavement marking foreman.

Widths. The traveled way lane widths and width of longitudinal lines shall be as specified. Lane widths shall be measured from center to center of the lane lines once a control line is established for the lane configuration of the roadway. When measurements are taken from existing longitudinal lines, the point of reference shall be the center of the single line or the center of the space between dual lines. The traveled way lane widths are in compliance when they have an acceptable appearance and are within 2 in. from the proposed lane width.

Alignment. Place markings in a straight and uniform manner. Lane lines are in compliance when they have an acceptable appearance and are visually in alignment, with no more than a 3/8 in. variation in any 40 ft section of traveled way. Maintain longitudinal alignment through all intersections and breaks, even though the lines themselves may discontinue. Do not apply pavement line markings over longitudinal joints; Offset the markings 2 in.

Layout Markings. Remove layout markings that detract from the overall appearance or function of the final markings as determined by the Engineer at no additional cost to the County.

(b) Certified Technicians. Provide the certified technicians to perform quality control testing and sampling. The technicians shall demonstrate that they have a thorough knowledge of sampling and testing procedures as specified in MSMT 729. Perform quality control during the marking operations in conformance with the approved QCP. Identify the location of quality control tests. Should a certified technician be delinquent in any of their duties (i.e., fail to have all the proper test equipment on the site, fail to perform tests, fail to submit documents to the Engineer at the end of the day, report information that varies substantially from the County's results, etc.), then the technician's certification shall become invalid and a recertification shall be required. All pavement marking operations

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shall be suspended until the Contractor provides a certified replacement technician.

(c) Records. Maintain complete records of quality control inspection results, including actions taken to correct problems. Submit a copy of the QC results, signed by the certified technician, daily. Identify the location of the following quality control tests:

(1) Ambient temperature.

(2) Pavement surface temperature.

(3) Material temperature.

(4) Material thickness.

(5) Retroreflectivity.

(6) Alignment.

(7) Color.

(d) Quality Assurance. The County will provide quality assurance by:

(1) Conducting independent sampling and testing.

(2) Periodically observing testing performed by the Contractor.

(3) Directing the Contractor to take additional samples and perform additional tests at any time and at any location.

(4) Monitoring Contractor conformance with the Quality Control Plan.

(5) Evaluation of quality control results and testing performed by the County will provide the basis for final acceptance.

The Administration will perform independent assurance audits to confirm and assure that both the quality control personnel's test methods and quality control test equipment are in reasonable conformity with Administration specifications.

549.03.02 Cleaning Pavement Surfaces. Pavement surfaces shall be dry and free of oil, dirt, grease, and other contaminants prior to application of pavement markings. Clean nonconforming surfaces to a width 4 to 6 in. wider than the markings.

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549.03.03 Marking Removal. Remove existing pavement markings that conflict with new or altered traffic patterns. Use an approved method and ensure that the pavement surface in not damaged by the process. Repair or replace damaged pavement at no additional cost to the County. Refer to section 565.

549.03.04 Curing. Protect the markings until dry or cured by placing warning devices as specified in the MdMUTCD and as approved. If a vehicle damages uncured markings, reapply the markings and remove marks left on the pavement by the vehicle at no additional cost to the County.

549.03.05 Observation Period. The Contractor shall be responsible for any defects in materials and workmanship of the pavement markings for a period of 180 days for durable and 60 days for nondurable materials from the date the pavement is opened to traffic.

Time charges will not be assessed during the observation period provided all other work on the Contract is complete. At the end of the observation period, the Engineer will inspect the pavement markings for durability, color, and retro reflectivity, and inform the Contractor of pavement markings that have failed and that require corrective action. Pavement markings will be failed for any of the following conditions:

(a) More than 5 percent of the substrate is exposed in any 2000 ft section of longitudinal marking.

(b) Retroreflectance values have dropped below the minimum retroreflectivity specified.

(c) Marking is discolored when compared visually with the color chips.

Remove and replace all failed markings within 30 days of receiving written notification from the Engineer.

549.04 MEASUREMENT AND PAYMENT. The payment for furnishing and applying the pavement marking (line markings, letters, numbers, arrows and symbols) will be made under the pertinent pavement markings items. Quality control will not be measured but the cost will be incidental to the other pertinent items specified.

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549.04.01 Removal, Replacement, or Corrective Actions. Corrective actions for markings unsatisfactorily installed as determined by the Engineer or that fail during the observation period, shall be at no additional cost (including Maintenance of Traffic) to the County. In addition, the current road user fee will be applied when traffic disruption occurs during corrective actions.

SECTION 550 — PAVEMENT MARKING PAINT

550.01 DESCRIPTION. Furnish and apply nontoxic lead free waterborne pavement marking paint to pavement surfaces as specified in the Contract Documents or as directed by the Engineer. These markings includes lines (striping), legends (letters and numbers) and symbols.

550.02 MATERIALS. Paint is a nontoxic lead free waterborne pavement marking and is a non-durable material. All Paint Pavement Marking material shall be selected from the Qualified Products List.

Nontoxic Lead Free Waterborne Pavement Marking Material	951.01

550.03 CONSTRUCTION.

550.03.01 Quality Control / Quality Assurance. Refer to Section 549.

550.03.02 Application. The location, width, and type of marking shall be as specified in the Contract Documents or as directed by the Engineer.

(a) Temperature. The markings shall be applied when the paint, ambient and surface temperature, and relative humidity conform to the manufacturer's recommendations.

(b) Glass Beads. The Contractor shall apply the Maryland Blend gradation of glass beads uniformly across the surface of the stripe, at the rate of 7 to 9 lb/gal of paints.

(c) Thickness. The paint shall be applied at a wet film thickness of 18 ± 1 mils.

(d) Color. The color of the dry markings shall match Federal Standard 595 (38907 - yellow or 37925 - white). The Contractor shall make available the specified color chips for the Engineer's use to visually determine that the waterborne material matches the specified color.

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(e) No-Track. The paint shall conform to 60 second no-track requirements. The no track condition shall be determined by passing over the applied line at approximately 30 degrees with a standard passenger car or pickup truck. When viewed from a distance of 50 ft, the pavement surface shall show no evidence of the paint being picked up and redeposited on the pavement by the vehicle.

(f) Retro reflectance. The minimum retro reflectance shall be 150 millicandelas/lux/square meter for yellow and 250 millicandelas/lux/square meter for white as determined in conformance with MSMT 729.

550.03.03 Application Equipment. The equipment used for application of the paint shall be approved by the Engineer prior to start of work, and shall be capable of applying waterborne traffic paint that has been approved by the County. The Contractor shall provide access to the paint application equipment for inspection by the Engineer.

The paint carriage on the left side of the paint truck shall have three paint and bead guns. The paint carriage on the right side of the paint truck shall have two paint and bead guns.

All 10 in. lines shall be applied using two paint and bead guns. Raising the paint carriage in order to paint these lines with one paint gun and bead gun is prohibited.

The footage counters used to measure pavement markings shall be calibrated, and a notarized certification shall be submitted to the Engineer as part of the Quality Control Plan.

Temperature gauges shall be calibrated every six months and a copy of the calibration certification shall be submitted to the Engineer as part of the Quality Control Plan.

The applicator shall apply the surface dressing beads to the wet paint marking by means of a pressurized bead dispenser or other mechanical conveying method not dependent upon gravity for uniform application. The bead dispenser shall be equipped with an automatic cutoff system that will stop the flow of the paint material whenever there is a disruption in the application of the beads so that all markings placed shall be covered with a uniform layer of surface dressing beads.

Application equipment shall be capable of applying the markings at multiple width settings ranging from 4 to 12 in.

The applicator shall provide a method for cleanly cutting off stripe ends and shall be capable of applying all longitudinal pavement markings.

The equipment shall be mobile and maneuverable to the extent that straight lines can be followed and all standard curves can be made in true arcs.

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All parts of the equipment shall be thoroughly cleaned of foreign material or different colored material prior to the introduction of a new batch of material.

550.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. Refer to 549.04.

Pavement Marking Paint will be measured and paid for at the Contract unit price for one or more of the following items:

(a) Pavement Marking Paint lines (striping) will be measured and paid for at the Contract unit price per linear foot for the color and width specified.

(b) Pavement Marking Paint Legends (letters and numbers) and Symbols will be measured and paid for at the Contract unit price per square foot. The square foot pay quantity for Legends (letters and numbers) and Symbols will be as specified in the The Countys Standard Details.

SECTION 551 - Reserved

SECTION 552 — EPOXY PAVEMENT MARKING

552.01 DESCRIPTION. Furnish and apply lead-free two component epoxy white or yellow pavement markings with large and standard glass beads. The locations and patterns shall be as specified in the Contract Documents or as directed by the Engineer.

552.02 MATERIALS.

Lead Free Two Component
Epoxy Pavement Marking Materials 951.08

Epoxy is a durable pavement marking material.

552.03 CONSTRUCTION.

552.03.01 Quality Assurance/Quality Control. Section 549.

552.03.02 Application. The location, width, and type of marking, shall be as specified in the Contract Documents or as directed by the Engineer.

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Placing pavement marking material over longitudinal joints is prohibited; they shall be offset 2 in. or as directed by the Engineer.

Epoxy pavement markings shall conform to the following:

(a) Temperature. The markings shall be applied when the epoxy, ambient, and surface temperatures, and the relative humidity conform to the manufacturer's recommendations.

(b) Thickness. The epoxy pavement marking material shall be applied at a thickness of 20 ± 1 mils.

(c) Glass Beads. The Contractor shall apply a double-drop of large and standard glass beads uniformly across the surface of the stripe, at the rate of 11 to 13 lb/gal with a maximum total application of 25 lb/gal. The bead guns shall be calibrated in conformance with MSMT 729.

(d) Color. The color of the dry markings shall match Federal Standard 595 (13538 - yellow or 17886 - white). The Contractor shall make available the specified color chips for the Engineer's use to visually determine that the epoxy material matches the specified color.

(e) Retroreflectance. The minimum retroreflectance shall be 200 millicandelas/lux/square meter for yellow and 275 millicandelas/lux/square meter for white as determined in conformance with MSMT 729.

552.03.03 Application Equipment. The equipment used for application of the epoxy shall be approved by the Engineer prior to start of work, and shall be capable of applying material that has been approved by the The County. The Contractor shall provide access to the application equipment for inspection by the Engineer.

The gun carriage on the left side of the striping truck shall have three epoxy and bead guns. The gun carriage on the right side of the truck shall have two epoxy and bead guns.

All 10 in. lines shall be applied using two epoxy and bead guns. Raising the gun carriage in order to stripe these lines with one epoxy gun and one bead gun is prohibited.

The footage counters used to measure pavement markings shall be calibrated and a notarized certification shall be submitted to the Engineer prior to application as part of the Quality Control Plan.

Temperature gauges shall be calibrated every six months and a copy of the calibration certification shall be submitted to the Engineer, as part of the Quality Control Plan.

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The applicator shall apply the surface dressing beads to the epoxy marking by means of a pressurized bead dispenser or other mechanical conveying method not dependent upon gravity for uniform application. The bead dispenser shall be equipped with an automatic cutoff system that will stop the flow of the epoxy material whenever there is a disruption in the application of the beads so that all markings placed shall be covered with a uniform layer of surface dressing beads.

Application equipment shall be capable of applying the markings at multiple width settings ranging from 4 to 12 in. as specified in the Contract Documents.

The applicator shall provide a method for cleanly cutting off stripe ends and shall be capable of applying all longitudinal pavement markings.

The equipment shall be mobile and maneuverable to the extent that straight lines can be followed and all standard curves can be made in true arcs.

All parts of the equipment shall be thoroughly cleaned of foreign material or different colored material prior to the introduction of a new batch of material.

Testing performed by the The County will provide the basis for final acceptance.

552.04 MEASUREMENT AND PAYMENT. Epoxy Pavement Marking will be measured and paid for at the Contract unit price per linear foot for the color and width specified. The payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

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SECTION 553 — LEAD FREE REFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS

553.01 DESCRIPTION. Prepare and apply lead free reflective thermoplastic pavement markings to roadway surfaces as specified in the Contract Documents or as directed by the Engineer.

553.02 MATERIALS.

Lead Free Reflective Thermoplastic Pavement Markings 951.02

553.03 CONSTRUCTION.

553.03.01 Quality Assurance/Quality Control. Refer to 549.03.01.

553.03.02 Application Equipment. An oil or air jacketed kettle shall be utilized for uniform melting and heating of the thermoplastic material. The kettle shall provide continuous mixing and agitation of the material. The kettle and the applicator shall be equipped with an automatic thermostatic device to provide positive temperature control.

The equipment shall be constructed so that all mixing and conveying parts, up to and including the application apparatus, maintains the material at the specified temperature. Conveying parts of the applicator between the reservoir and the application apparatus shall be constructed to prevent clogging and accumulation. The applicator shall be capable of containing a minimum of 600 lb of molten thermoplastic material.

The kettle and applicator shall be constructed and arranged to conform to the requirements of the National Board of Fire Underwriters (NBFU), the National Fire Protection Association (NFPA), and State and local authorities.

Temperature gauges shall be calibrated every six months and a copy of the calibration certification shall be submitted to the Engineer.

The applicator shall apply the surface dressing beads to the molten thermoplastic marking by means of a pressurized bead dispenser or other mechanical conveying method not dependent upon gravity for uniform application. The bead dispenser shall be equipped with an automatic cutoff system that will stop the flow of the thermoplastic material whenever there is a disruption in the application of the beads so that all markings placed shall be covered with a uniform layer of surface dressing beads.

Application equipment shall be capable of applying the markings at multiple width settings ranging from 4 to 12 in. as specified in the Contract Documents.

The applicator shall provide a method for cleanly cutting off stripe ends and shall be capable of applying all longitudinal pavement markings.

The equipment shall be mobile and maneuverable to the extent that straight lines can be followed and all standard curves can be made in true arcs.

All parts of the equipment shall be thoroughly cleaned of foreign material or different colored material prior to the introduction of a new batch of thermoplastic material.

553.03.03 Cleaning Pavement Surfaces. Refer to 549.03.02.

553.03.04 Application. The ambient and surface temperatures shall be at least 50 F and rising at the time of application.

Thermoplastic pavement markings shall be sprayed onto the pavement surface. Only the spray method of application shall be permitted. Gore areas, crosswalks, small

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intersections, roundabouts, and other areas which preclude the application of the markings with truck mounted equipment will be exempt from the spray application requirement.

Thermoplastic pavement markings shall conform to the following:

(a) Temperature. The molten material temperature shall be between 400 and 440 F unless otherwise recommended by the manufacturer, and approved by the Engineer.

(b) Primer. A primer shall be used if thermoplastic is applied to portland cement concrete. Any primer used shall be compatible with the thermoplastic material.

(c) Thickness. The pavement markings shall yield a solid thickness range of 80 to 95 mils above the roadway surface across the middle two-thirds of the line width when tested as specified in MSMT 729. Variation from this range will be used for the price adjustment specified in 553.04.01.

(d) Glass Beads. Glass beads shall be uniformly applied to the surface of the molten thermoplastic at the minimum rate of 7 to 9 lb/100 ft2, as specified in MSMT 729.

(e) Color. The color of the dry markings shall match Federal Standard 595 (13538 - yellow or 17886 - white). The Contractor shall supply the specified color chips for the Engineer's use to visually determine that the thermoplastic material matches the specified color.

(f) Retroreflectance. Refer to MSMT 729. The millicandellas/lux/square meter values taken anytime within the first 30 days shall conform to the following:

RETROREFLECTANCE

COLOR	RETROREFLECTIVITY	CORRECTIVE ACTION
White	equal to or greater than 250	None
Yellow	equal to or greater than 150	
White	less than 250	Necessary corrective actions, including grinding if necessary, and re-tracing
Yellow	less than 150	

(g) Width. Refer to 549.03.01(a).

(h) Alignment. Refer to 549.03.01(a).

(i) Layout Markings. Refer to 549.03.01(a).

553.03.05 Quality Control Test Strip. Refer to 549.03.03.

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553.03.06 Responsibility. Section 549.

553.03.07 Observation Period. Section 549.

553.04 MEASUREMENT AND PAYMENT. Refer to 549.04. The reflectometer will become the property of the Contractor at the completion of the project.

553.04.01 Price Adjustment for Film Thickness. The unit price for Lead Free Reflective Thermoplastic Pavement Markings will be per striped linear foot based on MSMT 729 calculations for thickness, and will be adjusted in conformance with the following:

MIL THICKNESS	PERCENT OF PAYMENT - UNIT PRICE
80 – 95 (a)(b)	100
75 – 79	90
70 – 74	88
65 – 69	82
60 – 64	72
Less than 60	Retrace to achieve a thickness of 80 to 95 mils. Retrace thickness shall be 30 mils min (b).

(a) The Engineer may require the Contractor to remove excess material thickness.
(b) Removal of excess material and retracing pavement markings shall be performed at no additional cost to the The County.

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SECTION 554-555 - Reserved

SECTION 556 — PREFORMED THERMOPLASTIC PAVEMENT MARKINGS

556.01 DESCRIPTION. Furnish and install heat applied preformed thermoplastic pavement marking symbols, legends, and lines as specified in the Contract Documents or as directed by the Engineer.

556.02 MATERIALS. Preformed Thermoplastic is a durable pavement marking material. All Preformed Thermoplastic Pavement Marking material shall be selected from the Qualified Products List.

Heat Applied Permanent Preformed
Thermoplastic Pavement Marking Material 951.06

556.03 CONSTRUCTION.

556.03.01 Quality Assurance/Quality Control. Section 549.

556.03.02 Application. The location, width, and type of marking, shall be as specified in the Contract Documents or as directed by the Engineer.

Applying pavement markings over longitudinal joints is prohibited; they shall preferably be offset 2 in. from them.

Thermoplastic Pavement Marking shall conform to the following:

(a) Temperature. The markings shall be applied when the thermoplastic, ambient, and surface temperature, and relative humidity conform to the manufacturer's recommendations.

(b) Color. The color of the dry markings shall match Federal Standard 595 (13538 - yellow or 17886 - white). The Contractor shall supply the specified color chips for the Engineer's use to visually determine that the thermoplastic material matches the specified color.

(b) **Primer.** When specified by the manufacturer, a primer shall be used if thermoplastic is applied to Portland cement concrete.

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(d) Retroreflectance. The minimum retroreflectance shall be 150 millicandelas/lux/square meter for yellow and 250 millicandelas/lux/square meter for white as determined in conformance with 549.03.

556.03.05 Packaging. The material shall be handled for shipping, unloading and storage as recommended by the manufacturer. Each shipping package shall be marked with the following information:

(a) Manufacturer's name.

(b) Description of item.

(c) Date of manufacture.

(d) Contractor's name.

(e) Purchase order number.

(f) Lot number.

(g) Color.

556.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Preformed Thermoplastic Pavement Marking Legends (letters and numbers) and Symbols will be measured and paid for at the Contract unit price per square foot. The square foot pay quantity for Legends (letters and numbers) and Symbols will be as specified in the The Countys Standard Details

Preformed Thermoplastic Pavement Marking lines will be measured and paid for at the Contract unit price per linear foot for the color and width specified.

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SECTION 557 — SNOWPLOWABLE RAISED PAVEMENT MARKERS

557.01 DESCRIPTION. Furnish and install new Snowplowable Raised Pavement Markers (SRPM) and replacement components as specified in the Contract Documents or as directed by the Engineer.

557.02 MATERIALS.

Castings	Qualified Products List / 951.05
Pavement Marker Reflector Lenses	Qualified Products List / 951.05
Epoxy	951.05

Snowplowable Raised Pavement Markers are durable materials.

557.03 CONSTRUCTION.

Casting. Recycled iron castings are prohibited.

Placement. Snowplowable Raised Pavement Markers shall be installed and located as specified in the Contract Documents and in conformance with the Maryland Manual of Uniform Traffic Control Devices (MdMUTCD).

General Installation Requirements.

(a) The Contractor shall install the SRPM no later than two weeks after the completion of the final surface or as directed by the Engineer.

(a) At the time of installation, the road surface and ambient temperature shall be as specified in the manufacturers' recommendations. Installing markers on wet pavement surfaces as determined in MSMT 729 is prohibited.

(b) At the time of installation, the Contractor shall have on the jobsite all the materials necessary to complete the installation.

(c) The quality control test strip containing a minimum of 10 groove cuts spaced as specified in the Contract Document shall be constructed to verify the accuracy and ability of the equipment and personnel. The contractor shall replace at no additional cost to the The County any incorrect groove cuts and any incorrect casting placements within the test strip.

(d) At the time of installation, SRPM castings delivered with Pavement Marker Reflector Lens affixed should be free of dirt, dust, oil, grease, rust, moisture, or any foreign matter that will impair adhesion to the pavement. Any residual material that inhibits retroreflectivity of the reflector lens shall be removed without damage to the lens surface. It shall be the contractor's responsibility to clean each contaminated casting by sand blasting, wire brushing or other procedure approved by the Engineer to remove all foreign matter prior to installation. The use of chemicals to remove rust from the castings is prohibited.

(e) The contractor shall replace at no additional cost to the The County any incorrect groove cut and any incorrect casting placement. An additional test strip may be required by the Engineer in the event of incorrect installations. Incorrect

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installations, as determined by the Engineer, shall be corrected and repaired by the contractor at no additional cost to the The County.

Pavement Marker Reflector Lens. Reflector lenses for pavement markers shall be the same color as the adjacent pavement marking except the back side shall be as follows;

(a) One-Way Applications: The backside for One-Way Markers shall be red or blank as specified in the Contract Documents or as directed by the Engineer.

(b) Two-Way Applications: The backside for Two-Way Markers shall be the same color as the adjacent pavement marking.

The pavement marker reflector lens shall be imprinted with the model/batch number and the manufacturers' name.

Castings. The casting shall be imprinted with the model number and the manufacturer's name.

New Installation.

(a) The SRPM shall be installed in accordance with manufacturer's recommendations and D 4383. The installed height shall not exceed 0.25 in. above the road surface. The surface of the keel and web shall be free of scale, dirt, oil, grease or any other contaminant which may reduce its bond to the epoxy adhesive. All requirements of the manufacturer's installation instructions shall be met.

(b) The groove cut for the casting shall be the appropriate dimensions to allow 0.125 in. movement side to side of the casting. All leveling lugs on the casting must contact the pavement. The leading and trailing edges of the casting must lie below the pavement surface and the casting properly seated. All other requirements of the manufacturer's installation instructions shall be met.

(c) Lenses used shall be of a type specifically manufactured and approved for use as SRPM reflector lenses. Lenses that are manufactured exclusively for recessed pavement markers are not permitted as substitutes for SRPM reflector lenses.

Replacement.

(a) Casting Replacement. The re-use of damaged or removed castings is prohibited.

(b) Pavement Marker Reflector Lens Replacement. The Contractor shall remove and dispose of any damaged reflector lens and replace with a new lens. Previously installed undamaged castings which are missing a reflector lens shall have a new reflector lens installed. The replacement lenses shall be installed per manufacturer's written instructions.

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(c) Casting Groove Cut Replacement and Accuracy. The re-use of existing groove cuts is prohibited; castings shall only be installed in new groove cuts. Previously used groove cuts shall be permanently patched in accordance with applicable sections of 504, 505 and 522 or as directed by the Engineer. The location of the replacement groove cut shall be within 10 percent longitudinally in front (with the direction of traffic) and no lateral deviation exceeding 1½ in.

Casting Adhesive. The epoxy adhesive used to fasten the castings to the pavement surface shall conform to D 4383-05 Table X1.1.

Reflector Lens Adhesive in Casting. The adhesive used to fasten the reflector lens to the casting shall meet the manufacturers' recommendations.

Quality Assurance/Quality Control. Section 549.

Observation Period. The Contractor shall replace at no additional cost to the The County, any SRPM or Pavement Marker Reflector Lenses found to be damaged, non-retroreflective or missing due to improper installation or manufacturing defects within 180 days after opening to traffic.

557.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all pavement preparation, furnishing and placement of SRPM's, testing, removal, groove cutting, repair and all materials, labor, equipment, tools and all incidentals necessary to complete the work.

(a) Snowplowable Raised Pavement Markers will be paid for at the Contract unit price per each. Furnishing and installing SRPM includes the casting, reflector, adhesive and grooving.

(b) Removal of existing Castings, excluding any incorrect installation by the Contractor, and repair of Groove Cuts will be paid for at the Contract unit price per each.

Replacement of Pavement Marker Reflector Lenses will be paid for at the Contract unit price per each.

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SECTION 558 – RECESSED PAVEMENT MARKERS

558.01 DESCRIPTION. Furnish and install Recessed Pavement Markers (RPM) as specified in the Contract Documents, and or as directed by the Engineer.

558.02 MATERIALS.

Pavement Marker Reflector Lens	Qualified Products List / 951.05
Epoxy Adhesive	M237 Type II / 951.05

Recessed Pavement Markers are durable materials.

558.03 CONSTRUCTION.

Placement. Recessed Pavement Markers shall be installed and located as directed by the Contract Documents and in conformance with the Maryland Manual of Uniform Traffic Control Devices (MdMUTCD).

General Installation Requirements.

(a) The Contractor shall install the Recessed Pavement Markers no later than two weeks after the completion of the final surface or as directed by the Engineer.

(b) At the time of installation, the road surface and ambient temperature shall meet the manufacturers' recommendations for installation of the markers. Installing markers on wet pavement surfaces as determined in MSMT 729 is prohibited.

(c) At the time of installation, the Contractor shall have on the jobsite all the materials necessary to complete the installation.

(d) A test strip containing a minimum of 10 groove cuts spaced as specified in the Contract Document shall be constructed to verify the accuracy and ability of the equipment and personnel. The contractor shall replace at no additional cost to the The County any incorrect groove cut, including test strip cuts.

(e) At the time of installation, the Recessed Pavement Markers should be free of dirt, dust, oil, grease, rust, moisture, or any foreign matter that will impair adhesion to the pavement. It shall be the contractor's responsibility to clean each contaminated Recessed Pavement Marker to remove all foreign matter without damaging the reflective surface prior to installation.

Pavement Marker Reflectors. Pavement Marker Reflector lenses for pavement markers shall be the same color as the adjacent pavement marking except the back side shall be as follows:

(a) One-Way Applications: The backside for One-Way Markers shall be red or blank as specified in the Contract Documents or as directed by the Engineer.

(b) Two-Way Applications: The backside for Two-Way Markers shall be the same color as the adjacent pavement marking.

The pavement marker reflector lens shall be imprinted with the model/batch number and the manufacturers' name.

New Installation.

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(a) Recessed Marker Reflector Lenses shall be installed in accordance with D 4383 (the top of the marker shall be 0.06 in. below the pavement surface) or as directed by the Engineer. Lenses used shall be of a type specifically manufactured and approved for use as Recessed Marker Reflector lenses. Lenses that are manufactured exclusively for Snow Plowable Raised Pavement Markers are not permitted as substitutes for recessed lenses.

(b) The groove cut for mono-directional recessed marker reflectors lenses shall be the appropriate dimensions to properly seat one reflector lens in conformance with the manufacturer's recommendations and D 4383.

(c) The groove cut for bi-directional recessed marker reflectors lenses shall be the appropriate dimensions to properly seat two reflectors lenses, one on each end, in conformance with the manufacturer's recommendations and D 4383.

Replacement.

(a) Reflector Lens Replacement. The Contractor shall remove and dispose of any damaged reflector lens and replace with a new lens. The replacement reflector lens shall conform to the same requirements as the original reflector lens unless specified by the Contract Documents or as directed by the Engineer. The replacement lenses shall be installed per manufacturer's recommendations.

(b) Groove Cut. Existing groove cuts may be reused when they are in compliance with D 4383.

(c) Damaged Groove Cut Repair and Accuracy. Damaged groove cuts shall be repaired in accordance with applicable Sections of 504, 505, 522, and as directed by the Engineer. The location of the replacement groove cut shall be within one foot longitudinally in front (with the direction of traffic) and no lateral deviation exceeding 1-1/2 in.

Assurance/Quality Control. Section 549.

Observation Period. The Contractor shall replace at no additional cost to the The County, any Pavement Marker Reflector Lenses found to be damaged, non-retroreflective or missing due to improper installation or manufacturing defects within 180 days after opening to traffic.

558.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all pavement preparation, furnishing and placement of pavement markers, testing, removal, groove cutting, repair and all materials, labor, equipment, tools and all incidentals necessary to complete the work.

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SECTION 559 — PERMANENT PREFORMED PATTERNED REFLECTIVE PAVEMENT MARKINGS

559.01 DESCRIPTION. Furnish and apply permanent preformed patterned reflective pavement (PPPRP) markings.

559.02 MATERIALS.

Permanent Preformed Patterned Reflective Pavement Marking Materials	951.07

559.03 CONSTRUCTION.

559.03.01 General. PPPRP markings shall be applied in conformance with the manufacturer's recommendations or as directed by the Engineer.

On new hot mix asphalt projects, the PPPRP markings shall be inlaid into the hot surface of the top course of pavement. No top course paving shall be permitted unless the stripping crew and marking materials are at the project site.

When the Contract Documents specifies the use of PPPRP markings on concrete pavements or existing asphalt pavements, the Contractor shall use heat, solvent, or other type of adhesive primer in conformance with the manufacturer's recommendations.

Preformed legends and symbols shall conform to the applicable shape and sizes as specified in the MdMUTCD, and Contract Documents.

PPPRP markings shall conform to pavement contours and be resistant to deformation by traffic and damage from snow removal equipment. Surface preparation, use of solvents and primers and equipment used in the application of PPPRP markings shall conform with the manufacturer's recommendations and be approved by the Engineer. After PPPRP markings are applied, they shall be immediately ready for traffic.

559.03.02 Quality Assurance/Quality Control. Refer to 549.03.01.

559.03.03 Cleaning Pavement Surfaces. Refer to 549.03.02.

553.03.04 Application. Refer to 549.03.03 and the following:

(a) Manufacturer's Recommendations. The Contractor shall provide a copy of the manufacturer's recommendations to the Engineer, and shall follow them for the installation of the line markings.

(b) Adherence. Adherence of PPPRP markings shall be randomly checked by using a paint scraper or another approved tool, which shall be held nearly parallel with the highway surface, so there is no dislodging of the tape.

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(c) Thickness. The finished thickness of the PPPRP markings shall have a minimum caliper of 0.060 in. at the thickest portion of the patterned cross section, and a minimum caliper of 0.020 in. at the thinnest portion of the cross section. Measurements shall be made from the top of finished pavement surface.

(d) Color. The color of the markings shall match Federal Standard 595 (33538 - yellow, 37886 – white, or 37038 - black). The Contractor shall supply the specified color chips for the Engineer's use to visually determine that the PPPRP markings match the specified color.

(e) Retroreflectance. Refer to MSMT 729 and the following:

MINIMUM RETROREFLECTANCE

COLOR	RETROREFLECTIVITY	CORRECTIVE ACTION
White	350 or higher	None
Yellow	250 or higher	
White	less than 350	Necessary corrective actions, removal, replacement
Yellow	less than 250	

(f) Width. Refer to 549.03.01(a).

(g) Alignment. Refer to 549.03.01(a).

(h) Layout Markings. Refer to 549.03.01(a).

559.03.05 Responsibility. Section 549.

559.03.06 Observation Period. The Contractor shall be responsible for any defects in materials and workmanship of the PPPRP markings for a period of 180 days from the date the markings are applied and under traffic.

The Engineer will not assess time charges during the observation period provided all other work on the Contract is complete. At the end of the observation period, the Engineer will inspect the pavement marking for durability, color, reflectivity, and inform the Contractor of all pavement markings that have failed and require replacement. The pavement marking will be considered failed for any of the following conditions:

(a) More than five percent of the substrate is exposed in any 2000 ft section of longitudinal pavement marking line.

(b) Retroreflectance values have dropped below 300 mcd/L/m2 for white or 220 mcd/L/m2 for yellow.

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(c) Marking is discolored on a visual comparison with the color chips.

The Contractor shall remove and replace all failed PPPRP markings within 30 days of receiving written notification from the Engineer at no additional cost to the The County. Work shall be in conformance with the manufacturer's recommendation and as approved by the Engineer before the project is accepted. The replacement markings shall conform to the same requirements as the original markings. If the work is not completed in this period, the Engineer will resume time charges until this work is completed.

At the end of the observation period, the Engineer will accept the work and terminate the Contractor's responsibilities upon satisfactory inspection of the PPPRP markings.

559.04 MEASUREMENT AND PAYMENT. Measurement and payment for the pertinent Permanent Preformed Patterned Reflective Pavement Marking items will be as specified in 549.04. The reflectometer will become the property of the Contractor at the completion of the project.

(a) Pavement Marker Reflector Lenses will be paid for at the Contract unit price per each. Furnishing and installing the Recessed Marker includes the reflector and adhesive.

(b) Groove Cuts will be paid for at the Contract unit price per each.

Repair of Damaged Existing Groove Cuts will be paid for at the Contract unit price per each.

SECTION 560 THRU 564 RESERVED

SECTION 565 — REMOVAL OF EXISTING PAVEMENT MARKINGS

565.01 DESCRIPTION. Remove existing pavement markings (lines, letters, numbers, arrows, and symbols) during temporary or permanent traffic shifts, and repairing any roadway areas damaged during the removal process. This Specification does not apply to raised or recessed pavement markers. Temporary blackout tape shall be applied when existing pavement markings will require salvaging for reuse after completion of temporary traffic shifts necessary to perform work specified in the Contract Documents. Refer to 104.11.02.

565.02 MATERIALS. Not applicable.

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565.03 CONSTRUCTION. The Contractor shall layout and apply all new pavement markings (temporary or permanent) as specified in Section 549 before any removal of existing pavement markings begin.

565.03.01 Quality Control/Quality Assurance. At least two weeks prior to the start of pavement markings removal, the Contractor shall submit a Quality Control Plan (QCP) to the Engineer for review. The QCP shall contain (as a minimum) the following information:

(a) How the Contractor proposes to perform the work while ensuring conformance with the Specifications.

(b) Proposed method of removal based on road conditions, type and number of equipment to be used, manpower expectations, and time frame to complete the work based on maintenance of traffic (MOT) restrictions.

(c) Location and quantity of markings to be removed.

(d) Protective shielding plan and containment system, particularly in the case of markings that may contain toxic materials.

The QCP shall also detail when, how, and what corrective actions will be taken for unsatisfactory construction practices and deviations from the Contract Documents. Any deviation from the QCP shall be cause for immediate suspension of work. Operations shall not resume without the Engineer's approval.

565.03.02 Quality Control Test Strip. Prior to the beginning of work, the Contractor shall demonstrate the removal method to the Engineer for approval. A minimum of 100 ft of existing pavement markings shall be removed as a test strip at a location determined by the Engineer. If the method does not work or shows signs of damaging the road surface, then another method shall be tried. Additional control strips will be required. The preferred method is that which least damages the roadway and completely removes the markings.

565.03.03 Methods of Removal. The following removal methods are based on the pavement condition and type of marking material:

(a) Manual. A scraper or putty knife shall be used to lift tape from the pavement surface. Open flame for tape removal is prohibited.

(b) High Pressure Water Blasting. A high pressure water blast shall be used to break the bond between the marking material and the pavement surface. The water blast may contain fine grit.

(c) Alternate Methods. Abrasive blasting or grinding methods shall be submitted for approval to the Office of Materials Technology prior to use.

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565.03.04 Cleaning Pavement Surfaces. Immediately behind the removal operation, a vacuum equipped street sweeper capable of removing all loose material shall be used to remove all dust and debris generated by the removal process prior to returning the area to traffic. The Contractor shall prevent debris from draining into inlets and waterways, and all debris shall be collected and disposed of on an approved spoil area or landfill.

565.03.05 Alignment. Removal shall be performed in a straight and uniform manner, and shall follow the longitudinal alignment of the markings with a lateral deviation of no more than 1 in. in any 10 ft section. Affected area shall not exceed 1/2 in. on either side of the existing marking. The depth shall be uniform throughout, 1/8 in. or less, with no gouge areas in the pavement surface. If a second pass is necessary to completely remove the markings, the edges of the groove shall be feathered to a width of 1.25 in. on each side for every additional 1/8 in. of depth.

565.03.06 Corrective Action. Any pavement surface damaged beyond the requirements specified herein by the Contractor's operations shall be repaired or repaved as determined by the Engineer at no additional cost to The County.

565.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for the removal of the markings, pavement clean up, test strips, protective shielding, containment, disposal of marking material and pavement debris, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Removal of the existing pavement markings will be measured and paid for at the Contract unit price for one or more of the following items:

(a) Removal of Existing Pavement Marking Lines per linear foot, any width.

Removal of Existing Pavement Marking Letters, Symbols, Arrows, and Numbers per square foot.

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CATEGORY 600 - SHOULDERS

SECTION 601 — EARTH SHOULDERS

601.01 DESCRIPTION. Construct shoulders using earth.

601.02 MATERIALS. Section 204**.**

No rock will be permitted within the top six inches of earth shoulders below the finish road grade.

601.03 CONSTRUCTION. Refer to 204.03 and 208.03.

601.04 MEASUREMENT AND PAYMENT. Earth shoulders will not be measured but the cost will be incidental to the Contract unit price for the pertinent Excavation item.

SECTION 602 — CURB, COMBINATION CURB AND GUTTER, AND MONOLITHIC MEDIAN

602.01 DESCRIPTION. Construct concrete curb, concrete combination curb and gutter, concrete curb openings, concrete monolithic median, and hot mix asphalt (HMA) curb.

602.02 MATERIALS.

Aggregate	901.01
Curing Materials	902.07
Form Release Compound	902.08
Concrete Mix No. 3	902.10
Hot Mix Asphalt	904
Tack Coat	904.03
Reinforcement Steel	908.01
Joint Sealer	911.01
Preformed Joint Filler	911.02
Borrow Excavation	916.01

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602.03 CONSTRUCTION.

602.03.01 Concrete Curb, Combination Curb and Gutter, and Monolithic Median.

(a) Excavation. Excavate to the specified depth and to the width required to install and brace the forms. Compact the subgrade to 92 percent density per T 180, Method C, and trim to the proper shape and required grade. Remove all soft and unsuitable material and replace with approved material.

(b) Forms.

(1) Fixed Form Method. Ensure that all forms are properly designed and acceptable. Use full depth steel forms that are at least 10 ft in length. When installing forms where the radius of the curb face is less than 200 ft, use flexible or curved steel or wooden forms that are no more than 6 ft in length. Securely fasten and brace forms to prevent buckling, warping, or any other movement during the placing of concrete. Place the forms to a tolerance in grade and alignment of 1/4 in. in 10 ft. Thoroughly clean and coat the forms with a form release compound each time they are used.

(2) Slip-Form Method. Refer to 603.03.01(b)(2).

(c) Concreting. Mix according to 915.03.04. Volumetric batching and continuous mixing will be permitted. Before placing concrete, moisten the subgrade with as much water as it can absorb. Consolidate the concrete in the forms by spading or other approved method. Remove curb face forms as soon as the concrete will retain its shape. Keep other forms in place for at least 12 hours.

(d) Depressed Curbs. Construct depressed curbs at entrances and sidewalk ramps.

(e) Openings. Provide an outlet for rainspouts and other drainage by constructing insert openings within the curb.

Construct curb openings as specified.

(f) Finishing. Strike off the concrete to the specified cross section. finish, float, and apply a broom finish. For matching adjacent concrete surfaces, other methods of finishing may be permitted. Do not use plastering. Use a 1 in. radius edging tool on the face edge of the curb. Finish all other exposed edges with a 1/4 in. edging tool. Limit any deviation from grade and alignment of the face and top surface of curbs and medians to no more than 1/4 in. in 10 ft. Immediately after removal of the forms, repair all honeycombed and damaged areas.

(g) Joints.

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(1) Fixed Form Method. Use 10 ft spacing between joints, except where a lesser spacing is necessary for closures and for matching expansion and contraction joints in contiguous concrete pavements. Do not use joint spacings less than 4 ft. Form the joints by using plate steel templates 1/8 to 3/16 in. thick that have a width and depth equal to the unit cross section. Do not use intermediate templates or sections of templates. Set the templates perpendicular to the line and grade of the unit. At stationary structures such as bridges and inlets, construct an expansion joint using 1/2 in. preformed expansion joint filler. Construct expansion joints at points of curves, tangents, at locations coinciding with adjoining pavement joints, and as specified or as directed. Extend the expansion joint material to the full depth of the unit cross section. Apply sealer to the entire gutter portion and 1 in. up the face of all joints. In addition, seal the entire expansion joint of monolithic medians.

(2) Slip-Form Method. Refer to 604.03.01(b), except use 602.03.01(g)(1) for joint spacing.

(h) Cold Weather Construction and Curing. Refer to 520.03.02 and .12.

(i) Backfill. After curing for at least 72 hours, use approved material to backfill the front and back of the curb, combination curb and gutter, and median to the required elevations. Complete the backfilling before rolling the adjacent roadway.

602.03.02 HMA Curb. Unless otherwise approved, use a self-propelled machine to place HMA curb. The machine shall form curbing that is uniform in texture, shape, and density, and to the specified template.

Place the curb on a clean, dry, and stable base. Apply tack coat using asphalt of the type and amount as directed.

When required, backfill the curb after it has sufficiently hardened to prevent damage. Consolidate the backfill by tamping or rolling.

602.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all concrete, hot mix asphalt, forms, excavation, backfill, disposal of excess material, drainage openings, joint sealer, tack coat, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The removal and disposal of unsuitable material will be measured and paid for at the Contract unit price for Class 2 Excavation, which price includes the cost of using suitable excavation as replacement material. When Borrow or Selected Backfill is authorized as replacement material, payment will be made at the Contract unit price bid for the respective items.

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When existing curb or combination curb and gutter is removed and replaced with new curb or combination curb and gutter, the cost of the removal will be incidental to the Contract unit price for the new item.

602.04.01 Curb, Combination Curb and Gutter, and Monolithic Median will be measured and paid for at the Contract unit price per linear foot. Hot Mix Asphalt Curbs, Concrete Curbs, and Concrete Combination Curb and Gutter will be measured along the front face of the curb. Monolithic Concrete Median will be measured along the center line of the finished top of median.

602.04.02 Concrete Curb Opening and Curb Opening for Concrete Combination Curb and Gutter will be measured and paid for at the Contract unit price per each.

SECTION 603 — SIDEWALKS

603.01 DESCRIPTION. This work shall consist of constructing hot mix asphalt (HMA), concrete or brick sidewalks and sidewalk ramps as specified in the Contract Documents or as directed by the Engineer.

603.02 MATERIALS.

Curing Materials	902.07
Form Release Compound	902.08
Concrete Mix No. 3	902.10
Hot Mix Asphalt (HMA)	904
Welded Wire Fabric	908.05
Joint Sealer	911.01
Preformed Joint Fillers	911.02

(a) Brick Pavers. Brick pavers shall conform to ASTM Paving Brick C902 (Class SX, Type 1, Application PX) and C67 for freeze and thaw. Color of brick pavers shall be a blended red-brown range. Dimensions of brick pavers shall be 2¼"x 4"x 8" With square edges, 12,500 psi minimum compressive strength and below 6% cold water absorption. Pavers shall be obtained from a single source. Contractor shall submit sample of pavers for approval.

(b) Mortar Setting Bed. Setting bed material shall conform to C 270, Type M field-mixed Portland Cement-Lime mortar. Use of masonry cement in mortar/grout mixes shall not be accepted.

(c) Sand. Sand for joint filler shall be in conformance with Type M24 Mortar Sand. The moisture content shall not exceed 12%. The joint-fill shall be free of contaminants that would cause efflorescence or staining.

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603.03 CONSTRUCTION.

603.03.01 Concrete Sidewalks.

(a) Excavation. Refer to 602.03.01(a).

(b) Forms.

(1) **Fixed Form Method.** Use full depth steel or wood forms. Use forms that are straight, free from warp, and of sufficient strength to resist the pressure of the concrete. Brace and stake the forms so that they remain in both horizontal and vertical alignment. Thoroughly clean and coat forms with form release compound each time they are used. Allow the concrete to set for at least 12 hours before removing the forms.

(2) **Slip-Form Method**. Refer to 604.03.01(b), except use 603.03.01(e) for joint construction.

(c) Concreting. Before placing concrete, moisten the subgrade with as much water as it can absorb. Mix the concrete according to 915.03.04. Volumetric batching and continuous mixing will be permitted. Deposit the concrete on the prepared subgrade in successive batches to the full width of the sidewalk. Thoroughly spade along the edges and tamp the entire surface area to eliminate voids. Strike off and screed the concrete to the top of the forms.

(d) Finishing. Float the surface and apply a broom finish. Do not plaster the surface. Use a 1/4 in. edging tool on all outside edges and all joints.

(e) Joints. Place joints as specified. Tool or saw dummy joints a minimum of 3/4 in. deep.

Match adjacent joints in curb or pavement. Place expansion joint material to the full depth of the concrete.

(f) Cold Weather Protection and Curing. Refer to 520.03.02 and .12. Do not allow pedestrian and vehicular traffic during the curing period.

(g) Expansion Joint Sealing. Prior to sealing, clear dirt and other foreign material from the expansion joints. Ensure that joint walls and all surfaces to which the sealing material is to adhere are surface dry for at least three hours prior to sealing. Do not seal the joints until they are acceptable to the Engineer. Ensure that the surface of the sealing compound is not more than 1/8 in. below the sidewalk surface.

603.03.02 HMA Sidewalks.

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(a) Excavation. Complete excavation, subgrade preparation, and form placement when required, as specified in 603.03.01(a) and (b).

(b) Placement. Place HMA as specified in 504.03.05. When the sidewalk is not placed in forms, use acceptable backfill material to form an 18 in. wide shoulder for the HMA or as specified.

(c) Compaction. Use an approved roller. In areas inaccessible to a roller, a vibrating plate compactor or hand tamping may be used. In any case, the HMA shall be uniformly compacted. Start compactive effort as soon as the HMA can be compacted without displacement and continue until the material is thoroughly compacted and all marks have been removed.

603.03.03 Backfill. After the forms have been stripped and repairs are satisfactorily completed, backfill the spaces in front and back of the sidewalk to the required elevations using approved material.

603.03.04 Brick Sidewalks.

(a) General. Install unreinforced concrete base in accordance with Section 520 of the Standard Specifications. Pre-molded expansion joints one-half (½") inch wide shall be provided through the concrete base at intervals not greater than ten (10) feet perpendicular to curb, by fifteen (15) feet parallel to curb and shall be located to coincide with the joints in the contiguous concrete curb and gutter, wherever possible.

(b) Excavation. Excavation shall be made in close conformity with the lines and/or grades shown on the plans. Unsuitable, unstable, or unconsolidated subgrade material shall be excavated at the discretion of the Engineer. Where material has been removed from the subgrade it shall be backfilled with graded aggregate and the entire subgrade shall be compacted.

(c) Preparation. Care shall be taken so that no damage occurs to the unit pavers during handling. All pavers shall be free of foreign matter before installation. Pavers, mortar, concrete base, and joint material shall not be installed during rain or snowfall. Frozen material shall not be used. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.

(d) Placement of Brick Pavers. Install aggregate subbase course, thoroughly compacted to pass a 95 percent compaction test and graded evenly to proper elevations. The base shall extend a minimum of six (6”) inches beyond the edge of pavement where not bounded by curbs.

Pour and level concrete base for pavers.

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Spread and screed setting bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades and thickness as indicated on the Plans. Mix and place only the amount which can be covered with pavers prior to initial set. Cut back, bevel edge, remove and discard setting bed material which has reached initial set prior to placing pavers.

Wet pavers several hours before laying. Do not lay pavers with free moisture on the surface.

Place the pavers before initial set of mortar bed occurs, leaving 1/8 in. space between the pavers to form joints for sand. Installation shall start from corner or straight edge and proceed forward over the undisturbed setting bed. String lines shall be used to hold the pattern true. Where required, paving bricks shall be cut with an approved cutter to fit accurately, neatly, and without damaged edges.

Carefully tamp pavers to level and embed them in setting bed. Embed and level each paver in single operation, prior to initial set of cement bed; do not return to areas already set and disturb pavers for leveling purposes.

Sand joint filler shall be swept into the 1/8 inch joints and vibrated into the joints until the joints are filled. Lightly fog surface with water. Sweep joints again with sand until joints are filled to the surface. Excess filler material shall be removed from the surface.

(e) Submittals. The Contractor shall supply the following submittals for approval by the Engineer:

(1) Samples. Submit full size samples of finish and color range of Brick pavers.

(2) Certificates. Submit certificate signed by supplier that brick pavers comply with specified requirements.

(3) Qualification Data. Submit installer qualifications verifying years of experience; include list of completed projects having similar scope of work identified by name, locations, date, reference names and phone numbers.

(f) Delivery, Storage, and Handling. Delivery, store, handle and project products in accordance with manufacturer's instruction. Store pavers in protected and dry areas in manufacturer's protective shipping crates or packaging.

Contents of all packages delivered to the site shall be examined immediately upon delivery and any units damaged during shipping will be subject to rejection. Contractor shall inspect the shipment to assure that all items are complete.

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603.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all excavation, backfill, disposal of excess or unsuitable material, forms, reinforcement when specified, joints, sealer,compaction, curing, finishing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The removal and disposal of unsuitable material will be measured and paid for at the Contract unit price for Class 2 Excavation, which price includes the cost of using suitable excavation as replacement material. When Borrow or Selected Backfill is authorized as replacement material, payment will be made at the Contract unit price bid for the respective items.

When the existing sidewalk is removed and replaced with a new sidewalk, the cost to remove the existing sidewalk will be incidental to the Contract unit price for sidewalk.

603.04.01 Concrete Sidewalks will be measured and paid for at the Contract unit price per square foot of finished surface including sidewalk ramps.

603.04.02 Hot Mix Asphalt Sidewalks will be measured and paid for at the Contract unit price per ton for the mixture placed.

603.04.03 Brick pavers for sidewalk shall be measured and paid for at the Contract unit price per square foot, complete and installed. The payment shall be full compensation for; excavation, compacted aggregate subbase, concrete base, mortar setting bed, brick pavers, sand joint filler, expansion joint material, and for all materials, equipment, labor, tools, and incidentals necessary to complete the work.

SECTION 604 — CONCRETE TRAFFIC BARRIERS

604.01 DESCRIPTION. Construct concrete traffic barriers.

604.02 MATERIALS.

Crusher Run Aggregate CR-6	901.01
Aggregate	901.01, Size No. 57
Curing Materials	902.07
Form Release Compound	902.08
Concrete Mix No. 3	902.10
Concrete Mix No. 6	902.10
PVC Pipe	905
Reinforcement Steel	908
Preformed Joint Fillers	911.02
Borrow Excavation	916.01
Geotextile	921.09
Reflective Delineators	QPL

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Use concrete mix No. 6 to construct all concrete traffic barriers, end transitions, and footers unless otherwise specified.

604.03 CONSTRUCTION. Use cast-in-place construction. Excavate to the required depth and to a width that will permit the installation and bracing of forms where necessary. Remove all soft and unsuitable material, and replace it with suitable material. Properly shape the subgrade and compact it as specified in Section 208.

604.03.01 Concrete Barriers. Forming of the footer or concrete barrier may be by either the fixed form or the slip-form method. Do not construct the footer and the barrier section monolithically.

(a) Fixed Form Method. Use steel forms with a tolerance in grade and alignment of 1/4 in. in 10 ft. For bifurcated and transition sections, other forming materials may be used as directed.

Thoroughly clean and coat the forms with form release compound each time they are used.

Mix and place concrete as specified in 915.03.04 and Section 420, respectively. Volumetric batching and continuous mixing will be permitted. Vibrate concrete using an approved immersion type mechanical vibrator.

Saw or form construction and contraction joints at 20 ft intervals with a minimum of 10 ft. For saw time requirements, refer to 520. 03.14(c)(1). Place expansion joints where specified or as directed. Ensure that all joints in footers and walls align. Finish concrete as specified in 604.03.03 except apply a broom finish to the surface when forms are stripped in less than 24 hours. Remove the face forms for finishing as soon as the concrete can retain its shape.

After removing the forms, immediately repair all honeycombed and damaged areas.

(b) Slip-form Method. Use approved slip-form equipment. The equipment shall have internal vibrating capability and automatic guidance controls to follow line and grade references. On vertical and horizontal curves, set an additional intermediate support in the field to establish an acceptable reference line. Do not use ski or shoe sensors. This method shall not be used within 5 ft. of either side of a utility junction box. Use the fixed form method.

Mix concrete as specified in 915.03.04. Ensure that the consistency of the concrete after extrusion will maintain the shape of the barrier without support. Provide surfaces that are free of pits larger than 3/16 in. diameter and that require no further finishing other than a broomed finish.

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Whenever a tear occurs during the operation of the slip-form equipment, repair it immediately or remove and replace as directed.

Saw or form construction and contraction joints at 20 ft intervals in the barrier and footer with a minimum of 10 ft, except in the area of miscellaneous structures 6 ft will be permitted. Saw the joints 1/8 in. wide and at least 2 in. deep. Place expansion joints as specified or as directed.

604.03.02 Curing. Cure and protect concrete as specified in Section 420.

604.03.03 Finished Surface. Finish concrete as specified in Section 420. The completed barriers shall be within 1/4 in. in 10 ft from the specified horizontal and vertical lines. The barrier shall present a smooth, uniform appearance.

604.03.04 Reflective Delineators. Install reflective delineators on the concrete traffic barrier as specified.

604.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all test panels, excavation, removal of existing hot mix asphalt, disposal of excess or unsuitable material, reinforcement, drilled holes, drainage appurtenances, geotextile, No. 57 aggregate, conduit, boxes and fittings, backfilling, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The removal and disposal of unsuitable material will be measured and paid for at the Contract unit price for Class 2 Excavation, which price includes the cost of using suitable excavation as replacement material. When Borrow or Selected Backfill is authorized as replacement material, payment will be made at the Contract unit price for the respective items.

The removal of existing concrete traffic barriers will not be measured unless specified elsewhere in the Contract Documents.

604.04.01 Concrete Traffic Barriers will be measured and paid for at the Contract unit price per linear foot. Measurement will be along the center line of the top of the barrier.

604.04.02 Concrete Traffic Barrier End Transitions will be measured and paid for at the Contract unit price per each.

604.04.03 Reflective Delineators will be measured and paid for at the Contract unit price per each.

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SECTION 605 — METAL TRAFFIC BARRIERS

605.01 DESCRIPTION. Construct metal traffic barriers.

605.02 MATERIALS. Refer to 701.02, 705.02, 708.02, 709.02, and the following:

Crusher Run Aggregate CR-6	901.01
Brown Polyester Coating	465.03.02 (b)
W Beam/Thrie Beam	918.01
Metal Posts	918.02
Traffic Barrier Hardware	918.03
Timber Posts	918.04
Wood Offset Blocks	918.04
Wire Rope	918.05
Salvaged Topsoil	920.01.01
Furnished Topsoil	920.01.02
Salvaged Topsoil	920.01.03
Furnished Topsoil	920.01.04
Asphalt Millings or Grindings	Size of individual particles shall be less than 2 in. as determined visually
Rub Rail	A 36, Galvanized, A 123
Thrie Beam	M 180, Class A, Type 2
Reflective Delineators	As approved by the Office of Traffic and Safety
Recycled Composite Material Offset Blocks	As specified by the manufacturer

605.03 CONSTRUCTION.

605.03.01 Post Installation. Drive all posts, unless otherwise approved. Use a method of driving that will not batter or distort the posts. If posts are not driven, set them in holes of sufficient diameter to allow tamping of the backfill. Backfill with approved material. Place backfill in horizontal layers not exceeding 6 in. loose depth and thoroughly compact. When it is necessary to place posts in existing paving, remove all loose material and replace the paving. Prior to installing rail or cable elements, properly align the posts to within 1/4 in. of line and grade. Install all posts plumb.

When rock is encountered at a depth less than the specified footing depth, drill a 12 in. diameter hole 20 in. into the rock or to the planned footing depth, whichever is less. If the 20 in. depth is reached prior to the planned depth, cut the post to the appropriate length. Paint the cut edge with approved galvanizing repair paint. Set the post and backfill with an approved material. Do not use concrete or grout material. Place the backfill in horizontal layers not exceeding 6 in. loose depth and thoroughly compact.

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605.03.02 Rail Assembly. Furnish rail elements as specified. Ensure a smooth continuous installation, with laps in the direction of traffic flow. Ensure that all bolts are drawn tight.

605.03.03 Offset Blocks. When installing new traffic barrier W beam, use either wood or recycled composite offset blocks. Do not mix different types of manufactured composite blocks or mix composite and wood blocks. All offset blocks shall be routed or grooved to prevent them from rotating.

When an existing steel offset bracket is damaged, replace it with a steel bracket.

605.03.04 Brown Polyester Coated Traffic Barrier W Beam Using 6 Foot Post or 8 Foot Post. Apply polyester powder as specified in 465.03.02(b). Ensure that all components are padded and handled with nylon slings during loading, unloading, and installation.

Preserve the integrity of the polyester coating. If the polyester coating is chipped, scratched, blistered, or otherwise separated from the base metal, repair the damaged areas using the manufacturer's repair kit. Complete all repairs to the satisfaction of the Engineer or replace the damaged material at no additional cost to the Administration.

605.03.05 W Beam Barrier Reflective Delineators. Install reflective delineators as specified.

605.03.06 Remove and Reset Existing Traffic Barrier. Replace severely corroded or damaged individual w-beam panels as directed. When removing and resetting an entire run or a portion of a run of traffic barrier, replace the metal offset brackets with either wood or recycled composite offset blocks. When removing and resetting an entire run, use 8 in. offset blocks. When removing and resetting only a portion of a run, use 6 in. offset blocks. Ensure that the holes in the blocks match the holes in the existing posts. Move the posts at least 1 ft in either direction from the existing location. When resetting the rail, measure the height of the rail to ensure that it conforms to the current height shown on the Standards. Unless otherwise directed, maintain the existing offset distance from the edge of the roadway.

After replacing w-beam panels, backfill disturbed areas with topsoil per Section 701, or crusher run aggregate CR-6, or asphalt millings or grindings, to restore grades in designated areas as specified or as directed.

In areas where more than 8 in. depth of topsoil is required, place subsoil per Section 701 and place 2 in. or 4 in. topsoil over the subsoil as specified or as directed. Immediately after placing topsoil, either perform Turfgrass Sod Establishment per Section 708, or perform Turfgrass Establishment and install Type A or Type E Soil Stabilization Matting per Section 709 over the seeded areas.

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605.03.07 Remove and Reset Existing Median Traffic Barrier W Beam. Refer to 605.03.06.

605.03.08 End Treatments. Section 606.

605.03.09 Remove and Dispose of Existing Traffic Barrier. Assume all responsibility and make every effort to recycle or stockpile for noncontract use, all existing metal components of traffic barrier. Written certification (including date, time, materials, measurement and other pertinent information) shall be submitted to the Administration upon completion and upon request. Certification of material recycled or stockpiled shall be required prior to payment for this item or as otherwise directed. All cost associated with these activities are incidental to the item.

605.03.10 Removal and Disposal of Traffic Barrier W-Beam. After removal and disposal of traffic barrier, backfill disturbed areas with topsoil per Section 701, or crusher run aggregate CR-6, or asphalt millings or grindings, to restore grades in designated areas as specified or as directed.

In areas where more than 8 in. depth of topsoil is required, place subsoil per Section 701 and place 2 in. or 4 in. topsoil over the subsoil as specified or as directed. Immediately after placing topsoil, either perform Turfgrass Sod Establishment per Section 708, or perform Turfgrass Establishment per Section 705 and install Type A or Type E Soil Stabilization Matting per Section 709 over the seeded areas.

605.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all rock excavation, restoration of grassed or paved areas, drilled post holes and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

605.04.01 Traffic Barrier W Beam Using 6 Foot Post or 8 Foot Post will be measured and paid for at the Contract unit price per linear foot. When a bottom W beam panel is specified for the Traffic Barrier W Beam item it will be measured and paid for at the Contract unit price per linear foot for Traffic Barrier W Beam Panel.

605.04.02 Traffic Barrier W Beam Median Barrier will be measured and paid for at the Contract unit price per linear foot.

605.04.03 Traffic Barrier Thrie Beam will be measured and paid for at the Contract unit price per linear foot.

605.04.04 Replacing 6 or 8 foot posts, installing additional 6 or 8 foot posts, splice joints, and replacing W beam panels will be measured and paid for at the Contract unit price as specified in the Contract Documents.

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605.04.05 Removal and Disposal of Existing Traffic Barriers and any end treatments will be measured and paid for at the Contract unit price per linear foot. A written certification as specified in 605.03.09 will be required.

Landscaping construction and materials, as specified in Sections 701, 705, 708, and 709 will not be measured but the cost will be incidental to the item.

605.04.06 Remove and Reset Existing Traffic Barrier will be measured and paid for at the Contract unit price per linear foot. Offset blocks will not be measured but the cost will be incidental to the item. Landscaping construction and materials, as specified in Sections 701, 705, 708, and 709 will not be measured but the cost will be incidental to the item.

605.04.07 Remove and Reset Existing Median Traffic Barrier W Beam will be measured and paid for at the Contract unit price per linear foot. Offset blocks will not be measured but the cost will be incidental to the item. Landscaping construction and materials, as specified in Sections 701, 705, 708, and 709 will not be measured but the cost will be incidental to the item.

605.04.08 Traffic Barrier W Beam Median Barrier with Bottom Panel will be measured and paid for at the Contract unit price per linear foot.

605.04.09 Remove and Reset Existing Median Traffic Barrier W Beam with Bottom Panel will be measured and paid for at the Contract unit price per linear foot.

605.04.10 W Beam Barrier Reflective Delineators will be measured and paid for at the Contract unit price per each.

605.04.11 The application of fusion bonded brown polyester coating to Traffic Barrier W Beam, as well as all special handling and touch up will not be measured but the cost will be incidental to the item to which the coating is applied.

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SECTION 606 — PERMANENT TRAFFIC BARRIER END TREATMENTS

606.01 DESCRIPTION. Furnish, and install permanent traffic barrier end treatments.

606.02 MATERIALS. Refer to 605.02, 701.02, 705.02, 708.02, 709.02 and the following:

End Treatments and Spare Parts Packages	As specified by the manufacturer
Antifreeze Agent	As approved
Reflectorization	950.03
Plastic Barrels (Yellow)	QPL
Crusher Run Aggregate CR-6	901.01
Sand	901.01
Concrete Mix 2 and 6	902.10
Salvaged Topsoil	920.01.01
Furnished Topsoil	920.01.02
Asphalt Millings or Grindings	Size of individual particles shall be less than 2 in. as determined visually

606.03 CONSTRUCTION.

606.03.01 End Treatments.

(a) Type A System. Bury the ends of the traffic barrier, the end anchorage terminal, and the rub rail when required, in a cut slope. Excavate the slope to install these components. Upon installation, backfill the area with topsoil installed per Section 701 to match the adjacent slope, perform Turfgrass Sod Establishment per Section 708, or perform Turfgrass Establishment per Section 705 and immediately cover with Type A or Type E Soil Stabilization Matting per Section 709 as specified or as directed.

For single rail systems, use 6 ft posts throughout the entire end treatment. For double rail systems, use 8 ft posts, except for the last three posts buried in the cut slope.

Construct the end anchorage terminal using either option 1 or 2 from the Book of Standards.

Install traffic barrier W beam as specified in 605.03.

(b) Type B System. Install according to the manufacturer's recommendations.

(c) Type C, D, E, and F, G, H, J, K, and L. Install these systems in a straight line, unless otherwise specified by the manufacturer and approved by the Engineer. Refer to the manufacturer's recommendations for installation methods and procedures.

(d) Nose Section. Reflectorize as approved by the Office of Traffic and Safety.

(e) Finish Coat. Traffic barrier end treatments shall have the same finish coat as the W beam traffic barrier to which they are attached. Refer to Section 605. If end treatments are designated to be powder coated, coater shall contact the

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manufacturer of the end treatment for recommendations as to areas that can be coated without having an effect on the NCHRP or MASH crash rating.

606.03.02 Surface Adjustment. When surface adjustment is required for installation of Type B, C, D, E, F, G, H, J, K, and L end treatments, use topsoil for the surface adjustment, or crusher run aggregate CR-6, or asphalt millings or grindings, as follows.

(a) Topsoil. Complete the surface adjustments with topsoil installed per Section 701. Immediately after placing topsoil, perform Turfgrass Sod Establishment per Section 708, or perform Turfgrass Establishment per Section 705 and immediately install Type A or Type E Soil Stabilization Matting per Section 709, by the end of the day as specified or as directed prior to opening to traffic.

(b) CR-6 Aggregate or Asphalt Millings and Grindings. Complete the surface adjustment with crusher run aggregate CR-6, or asphalt millings or grindings, in designated areas as specified or as directed within 24 hours.

606.03.03 Transitions to Existing Structures. When transitions to existing structures or traffic barriers are required, perform the work as recommended by the manufacturer.

606.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all excavation, removal of the existing end treatment to be replaced, fabrication of all component parts, transitions to barriers, reflectorization, backfill, compaction, topsoil, restoration of turfgrass or paved areas, CR-6 crusher run aggregate, asphalt millings or grindings, and for all material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

606.04.01 Type A End Anchorage Terminal Either Option will be measured and paid for at the Contract unit price per each.

606.04.02 Type B C, D, E, F, G, H, J, K, and L Traffic Barrier End Treatments will be measured and paid for at the Contract unit price per each.

606.04.03 Placing Salvaged Topsoil for Grading Adjustment, or Placing Furnished Topsoil for Grading Adjustment, for Types B, C, D, E, F, G, H, J, K, and L end treatments, will be measured and paid for at the Contract unit price per square yard, or as specified. The payment will also include full compensation for furnishing, adjusting, and compacting embankment or aggregate material.

606.04.04 Turfgrass Sod Establishment or Turfgrass Establishment will be measured and paid for at the Contract unit price per square yard.

606.04.05 Type A Soil Stabilization Matting or Type E Soil Stabilization Matting will be measured and paid for at the Contract unit price per square yard.

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606.04.06 Surface adjustment for types B, C, D, E, F, G, H, J, K, and L end treatments using CR-6 crusher run aggregate, or asphalt millings or grindings, will be measured and paid for at the Contract unit price per square yard, or per ton, or as specified. The payment will also include full compensation for furnishing, adjusting, and compacting embankment or aggregate material.

606.04.07 Permanent Crash Cushion Sand Filled Plastic Barrels will be measured and paid for at the Contract unit price per barrel. The payment will also include full compensation for furnishing and placing sand and antifreeze agent.

606.04.08 Repairs.

(a) Traffic Barrier End Treatment Spare Parts Package furnished and installed will be measured and paid for at the Contract unit price per each for the type specified. The payment will also include full compensation for the clearing and removal of debris and damaged unsalvageable parts, and for restoring damaged topsoil, turfgrass or aggregate.

(b) When spare parts packages are furnished by the Administration, Repairing Traffic Barrier End Treatments will be measured and paid for at the Contract unit price per each for the type specified. The payment will also include full compensation for all transportation, reconnection to fixed objects where necessary, and clearing and removal of debris and damaged unsalvageable parts, and for restoring damaged topsoil, turfgrass or aggregate.

(c) Payment will not be made for spare parts packages used for end treatments damaged due to the Contractor's operations.

606.04.09 The application of fusion bonded brown polyester coating, as well as all special handling, will not be measured but the cost will be incidental to the item to which the coating is applied.

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SECTION 607 — CHAIN LINK FENCE

607.01 DESCRIPTION. Construct chain link fence.

607.02 MATERIALS.

Concrete Mix No. 2	902.10
Fence Fabric	914.01
Tie Wires, Line Post Clips, Tension Wires and Tension Wire Clips	914.02
Posts, Braces, Fittings and Hardware	914.03
Gates	914.04
Barbed Wire	914.05

607.02.01 Type. Install the height and type of fence specified. When the type of fence is not specified, one of the following types may be used:

(a) Galvanized steel and malleable iron components.

(b) Galvanized steel fabric utilizing galvanized steel posts or aluminum line posts.

(c) Aluminum coated steel fabric utilizing galvanized steel line posts.

(d) Aluminum coated steel fabric utilizing aluminum line posts.

(e) Bonded vinyl coated fabric utilizing galvanized steel or galvanized bonded vinyl coated steel line posts and fittings.

(f) Bonded vinyl coated fabric utilizing aluminum line posts.

607.03 CONSTRUCTION.

607.03.01 General Requirements. Confine all activities and operations to the area immediately adjacent to the right-of-way lines and within the right-of-way. The Engineer may grant permission to perform normal construction activities through lands owned by or under control of the Administration.

In areas where privately owned fence or other property is within the Administration's right-of-way, remove the items and place them on the owner's property as directed by the Engineer. The Contractor shall be responsible for any damage to privately owned items removed.

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Fence lines specified in the Contract Documents are only a guide. The exact location of the fence will be determined in the field by the Engineer.

Install all posts plumb. Maintain, as uniform as practicable, the spacing specified, with a tolerance of minus 2 ft.

Use post lengths that accommodate the fabricated width of the fence fabric without stretching or compressing the fabric and that provide the required spacing below the bottom of the fabric.

Install terminal posts at all ends, abrupt changes in grade, and at changes in horizontal alignment greater than 15 degrees. Install terminal posts at a spacing not exceeding 500 ft.

Install horizontal brace rails with diagonal truss rods and turn buckles at all terminal posts. Supply sufficient braces to provide complete bracing of each terminal post to the adjacent line posts.

Install post caps on all round line, terminal, and corner posts.

Place the bottom of the fabric approximately 1 in. above the groundline. A maximum clearance of 6 in. will be permitted for a maximum horizontal distance of 8 ft, except for special conditions specified in the Contract Documents.

Any excavation or backfill required to comply with the above clearance will require approval. Place fence fabric on the side of the post nearest to the roadway. For storm water management ponds, place the fabric on the side farthest from the pond. The fence shall be true and taut.

Run a tension wire continuously between terminal posts near the top and bottom of the fabric. Attach the wire to the fabric with hog ring fasteners at 18 in. intervals.

Tie the fabric to the brace rails at intervals not exceeding 2 ft and to posts at intervals not exceeding 12 in. Attach stretcher bars to terminal posts by connectors equally spaced at not more than 16 in. centers. Place top and bottom connectors as close as possible to the ends of the fabric.

607.03.02 Anchorage for Line Posts and Terminal Posts. Where rock is encountered at a depth less than that specified for the footing, drill a hole 1 in. larger than the greatest dimension of the post to a depth of 12 in. or the planned footing depth, whichever is less. After the post has been set, fill the remainder of the drilled hole with grout composed of one part portland cement and two parts mortar sand by dry loose volume. Fill the space above the rock with concrete. Do not use the drive anchor method in rock areas.

Select the type of anchorage system from the following, except use the concrete method in rock areas.

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Concrete Method. Place posts in the center of concrete footings. Thoroughly compact the concrete around the post by rodding or vibrating. Trowel the top surface to a smooth finish slightly above the groundline and uniformly sloped to drain away from the post. Do not disturb the post within the 72 hours after the individual post footing is completed. Do not use hand mixed concrete unless approved. When permitted, limit the size of the hand mixed batch to 1/2 yd^3.

Drive Anchor Blade Method. A drive anchor blade unit consists of two steel blades driven diagonally through galvanized steel fittings attached to opposite sides of the post. The drive anchor unit shall hold the post rigidly upright. Ensure that the spread of the blades at their full depth is approximately 39 in. Install the device so that its top is at least 3 in. below the finished grade. The anchor unit device and procedure shall be as approved.

Anchor each line post using one of these units. Anchor each terminal post using two units spaced approximately 6 in. apart. At terminal posts, drive each anchor blade unit in the direction that offsets the stresses caused by the tension of the fence.

607.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work. The removal of privately owned fence or other property from within the Administration's right-of-way will not be measured but the cost will be incidental to the Contract lump sum price for Clearing and Grubbing.

When an item for Clearing and Grubbing is not specified in the Contract Documents, clearing and grubbing will not be measured but the cost will be incidental to the Contract unit price for the pertinent Chain Link Fence item.

607.04.01 Chain Link Fence will be measured and paid for at the Contract unit price per linear foot for the actual number of linear feet measured to centers of end posts.

607.04.02 Terminal Posts (End, Pull, and Corner Post) will be measured and paid for at the Contract unit price per each for the size and type specified.

607.04.03 Gates will be measured and paid for at the Contract unit price per each as complete units of the size and type specified.

SECTION 608 — WHEEL STOPS

608.01 DESCRIPTION. Furnish and install preformed wheel stops.

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608.02 MATERIALS.

Concrete Mix No. 2	902.10
Reinforcement Steel	908.01
Recycled Composite Material	
Wheel Stops	As specified by the manufacturer

Recycled Composite Material. Wheel stops manufactured of recycled composite material shall be as specified by the manufacturer and be insect resistant.

The manufacturer shall furnish certification as specified in TC-1.03.

608.03 CONSTRUCTION. Locate and secure wheel stops in place as specified. Only one type of wheel stop is permitted for each project.

608.04 MEASUREMENT AND PAYMENT. Wheel Stops will be measured and paid for at the Contract unit price per each. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 609 — SHOULDER EDGE DROP OFF GRADING ADJUSTMENT

609.01 DESCRIPTION. Construct the area adjacent to the outside edge of the shoulder to eliminate the shoulder edge drop off.

609.02 MATERIALS. Refer to 605.02, 701.02, 705.02, 708.02, 709.02, and the following:

Crusher Run Aggregate CR-6	901.01
Salvaged Topsoil	920.01.01
Furnished Topsoil	920.01.02
Asphalt Millings or Grindings	Size of individual particles shall be less than 2 in. as determined visually.

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609.03 CONSTRUCTION. When the outside edge of the pavement exceeds 1 in. in height above the existing groundline, the wedge shaped area shall be filled and graded to a slope of 4:1 or flatter. The material shall be compacted as directed by the Engineer. This grading adjustment shall be completed prior to opening to traffic.

Immediately after grading topsoil, perform either of the following as specified or as directed:

(a) Perform Turfgrass Establishment per Section 705 and immediately install Type A or Type E Soil Stabilization Matting per Section 709.

(b) Perform Turfgrass Sod Establishment per Section 708.

Complete the grading adjustment and install all materials by the end of the day that the drop off is created and prior to opening to traffic. The material, lines and grades, and the cross section shall be as specified.

609.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all material, labor, equipment, tools, disposal fees and incidentals necessary to complete the work.

609.04.01 Placing Salvaged Topsoil for Grading Adjustment or Placing Furnished Topsoil for Grading Adjustment will be measured and paid for at the Contract unit price per square yard, or as specified.

609.04.02 Crusher Run Aggregate CR-6 or Asphalt Millings or Grindings for Shoulder Edge Drop Off will be measured and paid for at the Contract unit price per square yard, or per ton.

609.04.03 Turfgrass Sod Establishment or Turfgrass Establishment will be measured and paid for at the Contract unit price per square yard.

609.04.04 Type A Soil Stabilization Matting or Type E Soil Stabilization Matting will be measured and paid for at the Contract unit price per square yard.

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

SECTION 610 — SHOULDER RUMBLE STRIPS

610.01 DESCRIPTION. Grind or mill depressions into existing hot mix asphalt or portland cement concrete to form rumble strips.

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610.02 MATERIALS. Not applicable.

610.03 CONSTRUCTION. Place rumble strips as specified.

Grind or mill the rumble strips into hot mix asphalt (HMA) at a rate of at least 4000 strips per hour. Grind into portland cement concrete at a rate of at least 1000 strips per hour.

Equipment. The equipment shall have rotary type cutting heads with a length of 16 in. and an outside diameter not greater than 24 in. The cutting heads shall have the cutting tips arranged in a pattern providing a relatively smooth cut (approximately 1/16 in. between peaks and valleys).

The cutting heads shall be mounted on their own suspension, independent of the power unit, to allow the tool to self-align with the slope of the shoulder and any irregularities in the shoulder surface.

The cutting tool shall be equipped with guides to provide consistent alignment of each cut in relation to the roadway and to provide uniformity throughout the project. The Engineer will randomly check the pattern edge alignment.

Control Strip. Grind a control strip at least 100 ft. in length to demonstrate that the speed of operation, dimensions, and texture are acceptable.

Clean up. Sweep or vacuum the work area before reopening the roadway to traffic. Do not sweep the material to the side of the road.

610.04 MEASUREMENT AND PAYMENT. Rumble Strips will be measured and paid for at the Contract unit price per linear foot as measured along the shoulder or center line where the rumble strips are actually placed. Payment will be full compensation for all installation of rumble strips, cleaning and disposal of waste material, control strips, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 611 — DETECTABLE WARNING SURFACES

611.01 DESCRIPTION. Furnish and install detectable warning surfaces. Ensure that the detectable warning surface is in accordance with the most recent accessibility guidelines of the Americans with Disabilities Act (ADA).

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611.02 MATERIALS.

The Contractor shall submit the proposed source of supply, specific product, and manufacturer to the Engineer for approval.

611.03 CONSTRUCTION. The detectable warning system may be either surface applied or cast in place. However, use only Type I, III, or IV detectable warning systems for new or replacement concrete installations. Install the system according to the manufacturer's recommendations. Unless specifically addressed in the manufacturer's recommendations, remove the existing surface texturing by grinding or other means. At a minimum, prepare the concrete surface in accordance with SSPC-SP 13. Remove all old adhesives and sealants.

The detectable warning surface shall be 24 in. wide in the direction of pedestrian travel and installed for the full width of the curb ramp, landing, or blended transition. Do not bridge or overhang cracks or expansion joints.

Ensure that the vertical edges of the installed system are not more than 0.50 in. above the adjacent surfaces. Place a 2:1 or flatter bevel on edges that are more than 0.25 in. above the adjacent surface. The same edge requirements apply to cut material.

611.04 MEASUREMENT AND PAYMENT. Detectable Warning Surfaces will be measured and paid for at the Contract unit price per square foot. The payment will be full compensation for removal and disposal of old treatments, including adhesives and sealants, reapplying, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The sidewalk on which the detectable warning surface is placed will be measured and paid for at the Contract price for the pertinent Sidewalk item. This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

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CATEGORY 700 - LANDSCAPING

Add the following Section.

SECTION 700 — ROADSIDE DEVELOPMENT

700.01 DESCRIPTION. The guidelines set forth under this section shall apply to Category 700 as a whole.

700.02 SOIL PREPARATION.

700.02.01 Surface Conditions. All grading and shaping operations shall be completed before seeding or sodding. The area shall be brought to proper grade free of sticks, stones or other foreign matter over one and one-half (1-1/2) inches in diameter to a minimum depth of three (3) inches. All other materials such as clods which are larger than three (3) inches in any dimension shall be removed. The surface shall conform to finish grade and be free of water retaining depressions; the soil shall be friable and of uniformly firm texture. No grading, excavation, spreading of topsoil or composted sewage sludge, fine grading or seeding shall be done when the soil is in a muddy or frozen condition.

700.02.02 Additives. Should a soil analysis indicate the need for approved additives such as composted sewage sludge in designated areas, the material shall be spread at an approved rate to a uniform depth on finished grades and thoroughly incorporated into the top six (6) inches of the finished grade. This material shall be scarified in two directions with subsequent discing in two directions to provide a uniform homogeneous mixture.

700.02.03 Seedbed. A seedbed shall be considered satisfactory and requiring no additional treatment when the area to be seeded or sodded has been recently and thoroughly loosened and worked to the depths specified below of as a result of grading operations.

(a) Median areas flatter than 3:1. Topsoil shall be loose to a depth of 3 inches.

(b) Roadside areas flatter than 3:1. Topsoil shall be loose to a depth of 2 inches.

(c) Slope areas 3:1 and steeper. Subsoil shall be loose to a depth of 1 inch.

In addition, immediately prior to seeding, the top four (4) inches of lawn areas flatter than 3:1 shall be loose, friable and free from clods, rocks, large roots and other undesirable matter as described in 700.02.01 and shaped to within one inch of the required grade.

700.02.04 Existing Turf. When the area to be seeded or sodded is sparsely sodded, weedy, barren and unworked, or packed and hard, any grass and weeds shall be first cut

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or otherwise disposed of satisfactorily, and the soil then scarified or otherwise loosened to a depth of not less than four (4) inches. Clods shall be broken up and the top four (4) inches of soil shall be worked into a satisfactory seedbed, as described in 700.02.03 by discing or by use of cultipacker, rollers, drags, harrows or other approved means.

700.03 LIME.

700.03.01 Requirements. Unless otherwise specified, ground agricultural limestone shall be applied at the rate of 2.5 tons per acre.

700.03.02 Material. Limestone material shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials, Section 920.02 and all Special Provisions Inserts and Special Provisions issued thereto, unless otherwise noted herein.

700.03.03 Application. Lime shall be applied separately and prior to the application of any fertilizer or seed and only on seedbeds which have previously been prepared as per these Specifications. It shall be spread and incorporated in a manner which achieves uniform distribution. Lime shall be worked into a depth of four (4) inches within 24 hours following its application after which the seedbed shall again be properly graded and dressed to a smooth finish.

700.04 FERTILIZER.

700.04.01 Requirements. Fertilizer shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials, Section 920.03 and all Special Provisions Inserts and Special Provisions issued thereto, unless otherwise noted herein. Fertilizer of analysis 5-10-10 shall be applied at a rate of 50 lbs./1,000 sq. ft. to topsoiled areas. If a fertilizer having an analysis other than the above is used, its rate of application shall be adjusted so as to provide not less than the same amount of total nitrogen, available phosphoric acid and total potash per unit as specified above. The Contractor shall submit any variations to the Engineer for approval prior to application.

700.04.02 Non-topsoiled Areas. Unless otherwise specified, 38-0-0 ureaform fertilizer, a slow release synthetic nitrogen fertilizer, shall be applied at the rate of 15 lbs./1,000 sq. ft. to non-topsoiled areas, including serrated cut slopes as an additive to the 5-10-10 fertilizer.

700.04.03 Storage. Fertilizer shall be transported and stored in containers which will insure proper protection and handling.

700.04.04 Application. Fertilizer shall be distributed uniformly and applied at the specified rate with a rotary spreader or as a slurry in hydroseeding operations. Fertilizer

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shall be worked into a depth of four (4) inches within 24 hours following its application after which the seedbed shall again be properly graded and dressed to a smooth finish.

700.04.05 Refertilizing. Refertilizing shall consist of applying 0-20-20 fertilizer and 38-0-0 (ureaform) fertilizer each at the rates specified in the latest edition of the SHA Standard Specifications for Construction and Materials, Section 705.03.01(c) in the months of April or September after seeding.

700.05 COORDINATION. The Contractor shall coordinate seeding and sodding with all other work under this contract to insure that all excavations, backfills, embankment fills, site utilities, roads, walks, grading, and topsoiling are completed and accepted by the Engineer prior to commencing the work covered by this Article.

700.06 MOWING. Mowing shall consist of maintaining vegetation seeded by the Contractor by means of a 5 to 7 ft. rotary or sickle bar tractor mower as directed by the Engineer. All established lawn areas shall be mowed once every other week. All clipping shall be collected and removed. All other areas shall be mowed such that vegetation does not exceed 10 inches in height nor be mowed less than 3 to 4 inches in height.

700.07 MAINTENANCE AND ACCEPTANCE OF TURF. Maintenance shall consist of watering, weeding, fertilizing, liming, disease and insect pest control, aerating, protective spraying, replacement of unacceptable material, and any other procedure consistent with good horticultural practice necessary to insure vigorous and healthy growth of all seeded and sodded areas. Maintenance shall continue until final inspection and acceptance.

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SECTION 701 — TOPSOIL AND SUBSOIL

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

701.03.01(d) Excess.

Delete the section in its entirety.

701.03.02(b) Surface Preparation.

This paragraph, “The Contractor …or subsoil.” , does not apply.

SECTION 704 — TEMPORARY SEEDING AND TEMPORARY WOOD CELLULOSE MULCHING

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

704.04 MEASUREMENT AND PAYMENT.

Add this to the end of the paragraph.

"Repairs due to the Contractor's negligence, as determined by the Engineer, shall be done at the expense of the Contractor."

SECTION 705 — TURF ESTABLISHMENT

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

705.02 MATERIALS.

Add the following sub-sections.

705.02.01 General.

(a) Seed shall be packed 50 lbs. net weight and packed in new, clean, poly woven bags, tightly woven to prevent leaking and contamination.

(b) Each container shall have permanently affixed to it an accurate analysis tag and a certification tag.

(c) All seed lots to be used in this mixture shall have been pretested by the Maryland Seed Laboratory to insure compliance with the Specifications.

(d) A quality control sample of the delivered mixture may be submitted to the Maryland Seed Laboratory for testing prior to payment and any lots found not to comply with the Specifications shall be returned at the Contractor's expense.

(e) The Engineer's representative shall collect all seed certification tags and/or sod certification prior to the beginning of any seed or sod work.

705.02.02 Certification.

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(a) Certified grass seed for roadside development projects shall consist of Tall Fescue mix consisting of 33%, 33%, + 34% of three (3) of the following varieties of improved Tall Fescue:

Adventure, Arid, Bonanza, Apache, Mustang, Olympic, Rebel, Trident.

(b) All seed varieties shall meet the following minimum specifications:

Minimum Purity	Minimum Germination	Maximum Other Crop	Maximum Weed Seed	Noxious Weeds
98%	**85%**	**0.1%**	**0.1%**	**None**
*	**Must be free of ryegrass, timothy, orchardgrass, bentgrass, Canada bluegrass, clover, or any other contaminant which shall be unsightly and uncontrollable.**			
**	**Must be free of dock, cheat, chess, chickweed, crabgrass, plantain, and black magic.**			
***	**Must be free of all Maryland prohibited and restricted noxious weeds as listed in the Maryland Department of the Environment 1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control, or latest edition.**			

(c) Certified grass seed for roadway and median construction shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials.

705.03 CONSTRUCTION.

705.03.01 General.

Add following sentences.

No seeding shall be done during windy weather or when the ground is wet or otherwise untellable.

Seed all areas within the project limits that are not sodded, paved or designated on the drawings to receive special treatment.

705.03.01 (a) Regional Areas.

Delete references to "Regions 1 and 3".

705.03.01 (b) Seeding Seasons and Seed Mixes.

Delete references to "Regions 1 and 3".

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Add the following paragraph after the table.

Extensions beyond the time periods listed may be granted by the Engineer, depending upon weather conditions for the period in question. Any planting outside of this season shall be solely at the Contractor's risk and shall not be subject to compensation until stabilization has been accomplished in accordance with the Specifications.

705.03.05 Application Equipment. 706.03.06 (a)

Add the following sentences.

Mechanical seeding shall be performed by broadcast or rotary spreader. No Brillion type seeders shall be used. Seeding shall be followed by a drag mat or tine harrow to work seed into soil and insure good soil/seed contact and uniform distribution.

Hydroseeding may be used provided that the slurry includes the fertilizer and seed as specified. For each hydroseeding tank, seed, fertilizer (if required), a maximum of one bale of green dyed fiber mulch shall be combined with each 1,200 gallons of water to form a slurry. The slurry shall not be prepared more than two (2) hours before commencement of hydroseeding work.

705.03.06 Application Rates. 705.03.02

Add the following sentence at the beginning of the first paragraph.

Grass seed mixture for roadside development projects shall be applied at the rate of six (6) pounds per 1,000 square feet immediately after fertilizing; rake and/or drag mat fertilizer.

705.03.09 Mulching. 705.03.07

Add following sentences.

Hay mulch shall only be used on non-topsoiled areas. If mulch is displaced before a growth of one (1) inch to one and one-half (1-1/2) inches is obtained, it shall be replaced by the Contractor at no additional expense.

705.03.015 Mowing. 705.03.09 (b) (4)

Delete the paragraph in its entirety. Add following:

Vegetation shall be cut to 3 to 4 in. high before it reaches 10 in. high. Mowing by using Tractor shall not be accepted unless it is specified in contract documents.

705.03.16 Refertilizing. 705.03.09 (c)

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Delete references to "Regions 1 and 3".

705.04 MEASUREMENT AND PAYMENT.

Add the following sentence at the end of first paragraph.

Measurement will be determined by certified delivery tickets or other means acceptable to the Engineer.

705.04.10 Repairing Damaged Areas. 705.04.04

After final acceptance of the project, no additional work at the Contractor's expense will be required, provided that he has completed the seeding and mulching of any area in accordance with the Specifications and to the satisfaction of the Engineer. Subsequent repairs and replacements deemed necessary by the Engineer shall be made by the Contractor and will be paid for at the unit price bid for the items in question.

SECTION 706 — WOODY SHRUB SEEDING

Delete this section in its entirety.

SECTION 707 — WILDFLOWER SEEDING

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

707.01 DESCRIPTION.

Add the following after the first sentence.

This work consists of soil preparation, seeding, fertilizing, mulching, liming as required, overseeding, refertilizing and mowing all areas designated for wildflower establishment as shown on the contract documents and in accordance with the Specifications.

707.03.01 Meadow Establishment - General.

Delete the references to "Regions 1 and 3".

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707.03.02 Pesticide Application/Reports.

The paragraph " Reports. The Contractor shall…using The County forms." does not apply.

707.03.03 Mowing.

Add the following sentences.

No mowing of wildflowers is to be done until fall (after November 15) following the first full growing season. A full growing season is defined as the period between the last killing frost of spring and the first killing frost of autumn.

Add the following sub-section.

707.03.04(d) Mixes and Seeding Rates.

If grass seed is mixed by the dealer, he shall furnish a guarantee statement of composition of mixture and percentages of purity and germination of each variety. If seed is to be mixed at the site, it shall be delivered in original packages bearing the producer's certification of germination and purity. Certification tags shall be provided to the Engineer prior to beginning work.

Add the following sub-section.

707.03.05 Wildflower Bed Markers.

Wildflower beds are to be marked with two (2) inches by two (2) inches by hardwood stakes four (4) feet in length, treated and set in the ground two (2) feet and spaced at a maximum of 25 feet on center. The Contractor shall obtain approval on the staked bed locations from the Engineer prior to the commencement of seeding work.

SECTION 708 — SODDING

708.01 DESCRIPTION. This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

708.01.01 Regional Area.

This paragraph shall not apply. Replace with the following paragraph:

Inspection and Certification: Sod shall be of live, growing grass not less than three (3) years old, of which not less than 96% shall be improved Tall Fescue (Rebel II, Rebel

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Falcon, Olympic) and not more than 4% Kentucky Bluegrass (Victa, Nassau) at the time of installation. It shall have not less than ½ inch of soil firmly attached to the roots. It shall be cut in strips not less than twelve (12) inches nor more than eighteen (18) inches wide.

Sod shall be inspected and certified by the State Board of Agriculture to insure overall high quality and freedom from noxious weed and excess amounts of weed and other crop planting.

708.01.02 Regional Requirements.

This paragraph shall not apply.

708.03 CONSTRUCTION.

708.03.02 General.

Add the following sentences:

The Contractor shall sod all areas indicated on the drawings or as otherwise directed by the Engineer.

All sod shall be protected from drying by exposure to the air and sun and from freezing.

708.03.03 Final Grading.

Add the following sentences:

No sod shall be laid until the requirements of soil preparation and fertilizing are fully met as set forth under Section 701 of these Specifications. The grade to receive the sod shall be brought to 1-1/2 inches below adjacent paved areas. Top dressing may be applied when sod is being laid.

708.03.05 Placing.

Add the following sentences:

No sod shall be placed between June 1 and August 15, without written approval, nor any time when the temperature is below 32 degrees F. No frozen or dried out sod shall be used nor shall it be laid on frozen or dried soil.

708.03.06 Initial Watering.

Add the following sentences:

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The sod and soil directly beneath the sod shall be kept moist, by additional waterings as required by the Engineer, until acceptance or until it has become established.

708.03.10 Sodded Slopes and Drainage Swales.

Add the following paragraph:

Each strip or section of sod placed on slopes or in surface drainage swales or ditches shall be staked securely with at least two (2) stakes spaced not more than two (2) feet apart.

When sodding slopes, sod shall be laid with the long edges parallel to the contour starting at the bottom of the slope. When placing sod in drainage ditches or swales, the length of the strip shall be laid parallel to the direction of the flow of the water.

SECTION 709 — SOIL STABILIZATION MATTING

709.01 DESCRIPTION. This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

709.03.03 Staple and Fastener Lengths.

Delete the references to "Regions 1 and 3".

SECTION 710 — PLANTING TREES, SHRUBS, VINES, AND SEEDLING STOCK

710.01 DESCRIPTION. This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

710.01.02 Pesticide Application

Delete the two sentences "Daily pesticides application reports shall be maintained by the Contractor. A completed form for each day of application shall be provided to the Engineer."

710.03.03 Plantings.

Entirely replace sub-sections **(a) General** *and* **(b) Tree Staking and Guying** *with the following sub-sections.*

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(a) Selection and Placement. When selecting and placing trees the following must be addressed prior to acceptance. All species and sizes shall conform to those indicated in the Howard County Landscape Manual.

(1) Trees shall not be top pruned in any way prior to planting.

(2) All trees shall have been transplanted or root pruned at least once in the past three (3) years.

(3) All trees shall be balled and burlapped (B & B).

(4) Caliber of trees shall be of the size stipulated in the tree list in the proposed form of these specifications as contained in the Howard County Landscape Manual.

(5) Trees shall have straight trunks with a single leader, well-branched, intact, undamaged and uncut. All old abrasions and cuts must be completely calloused over.

(6) All trees shall be measured when their branches are in their normal position. Height and spread dimensions specified refer to the main body of the tree and not branch to branch or root tip to tip.

(7) Unless otherwise noted, trees shall be symmetrical and/or typical for the variety and species and conform to the measurements specified in the tree list.

(8) Where symmetry is required trees shall be matched as nearly as possible.

(9) Trees shall not be bound with rope or wire at any time so as to damage the bark or break branches.

(10) Failure to meet these specifications shall be cause for rejection of the trees.

(b) Trees Planting Procedures.

(1) All plants shall be set straight and plumb in approved locations and set at such a level that after settlement, normal or natural relationship of the crown with the ground will be maintained.

(2) When balled and burlapped (B & B) plants are set, topsoil shall be carefully tamped under and around the base of the root balls to prevent voids. All burlap, rope, wires, etc., shall be cut from the tops of the balls, and folded back. No burlap or wire shall be pulled from underneath the plant. Wire shall be cut so as not to extend above the top half of the root ball.

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(3) All plants shall be treated at time of planting and initial watering with a hydrophilic acrylic polymer "Soil Moist" or equivalent will be applied at a rate of 2 oz. per diameter inch of tree planted.

(4) All trees shall be treated with Mycorrhiza Plant Tabs at time of planting. The rate shall be ten (10) tablets per caliber inch. The Tab shall be planted 1/3 to 1/2 the depth of the root zone system. Soil Moist Plant Tabs are available from: JRM Chemical, 15663 NEO Parkway, Cleveland, Ohio 44125 (1-800-962-4010), or County approved equal.

(5) All pits shall be generally circular in outline with vertical sides. Depth shall be no deeper than the root ball and the diameter shall not be less than twice the diameter of the root ball.

(6) Trees planted within 5 feet of hardscape structures such as sidewalks, curbing and pavements, shall have root control barrier panels placed in the plant pit to prevent structural damage due to root penetration. The Contractor shall install root control barrier panels at locations indicated on the contract documents or as otherwise directed by the Engineer. The root control barrier shall be installed as per the manufacturer's specifications.

710.03.06 Plant Establishment.

(a) Maintenance

Entirely replace sub-sections (1) and (5) with the following text.

(1) Additional Watering of Plants. Maintenance shall include a thorough initial watering by the Contractor with weekly waterings thereafter for the first thirty (30) days. Waterings thereafter shall be on a bi-weekly basis for three months. Watering beyond the three month period shall be at the discretion of the Contractor pursuant to keeping the plants in a live healthy condition. Contractor shall supply the water. During the one year warranty, settled plants shall be reset to proper grade and position, dead material removed and guy wires tightened or repaired.

(2) Tree Support Removal. At the end of the warranty period and prior to the final inspection the Contractor shall remove the guy wires and stakes.

(b) Removal and Replacement. Entirely replace sub-section (c) with the following text. Contractor guarantees all material for a one (1) year period from the date of final acceptance of the work. Any material that is 25% dead, or more, shall be considered dead and shall be replaced by the Contractor with the same size and tree type as the original, with no additional soil additives to be used. A tree shall be considered dead when the main leader has died back, or there is 25% of the crown dead. The Contractor shall be responsible for replacement of all dead trees

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for a period of one year following the dedication date. All trees replaced during the warranty period shall be guaranteed for a period of one year following the date of planting.

SECTION 715 — PLANTING AND REPLACEMENT OF STREET TREES

715.01 SELECTION AND PLACEMENT. When selecting and placing trees, the following must be addressed at the time of dedication.

715.02 SPECIES AND SIZES. All species and sizes shall conform to those indicated in the Howard County Landscape Manual.

(a) Trees shall be sound, healthy, vigorous, free from tree diseases, insect pests, or their eggs and shall have healthy normal top and root systems.

(b) Trees shall be nursery grown stock, freshly dug. No healed-in, cold storage or collected stock will be accepted.

(c) Trees shall have been grown in the same climatic conditions, Hardiness Zone No. 7, as shown on attached Map of Climatic Zones or from a colder zone than the location for the project for at least two (2) years prior to the award of this contract. Trees cut back to meet the requirements of these specifications shall not be acceptable.

(d) Trees shall not be top pruned in any way prior to planting.

(e) All trees shall have been transplanted or root pruned at least once in the past three (3) years.

(f) All trees shall be balled and burlapped (B&B).

(g) All trees shall be in accordance with "U.S.A. Standard for Nursery Stock", latest publication, by the American Association of Nurserymen, Inc.

(h) Caliber of trees shall be of the size stipulated in the tree list in the proposed form of these specifications as contained in the Howard County Landscape Manuel.

(i) Trees shall have straight trunks with a single leader, well-branched, intact, undamaged and uncut. All old abrasions and cuts must be completely calloused over.

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(j) All trees shall be measured when their branches are in their normal position. Height and spread dimensions specified refer to the main body of the tree and not branch to branch or root tip to tip.

(k) Unless otherwise noted, trees shall be symmetrical and/or typical for the variety and species and conform to the measurements specified in the tree list.

(l) Where symmetry is required trees shall be matched as nearly as possible.

(m) Trees shall not be bound with rope or wire at any time so as to damage the bark or break branches.

(n) Failure to meet these specifications shall be cause for rejection of the trees.

715.03 PLANTING PROCEDURES.

(a) All plants shall be set straight and plumb in approved locations and set at such a level that after settlement, normal or natural relationship of the crown with the ground will be maintained.

(b) When balled and burlapped ("B and B") plants are set, topsoil shall be carefully tamped under and around the base of the root balls to prevent voids. All burlap, rope, wires, etc., shall be cut from the tops of the balls, and folded back. No burlap or wire shall be pulled from underneath the plant. Wire shall be cut so as not to extend above the top half of the root ball.

(c) All plants shall be treated at the time of planting and initial watering with a hydrophilic acrylic polymer "Soil Moist" or equivalent to be applied at a rate of 2 oz. per inch diameter of tree planted.

(d) All trees shall be treated with Mycorrhiza Plant Tabs at time of planting. The rate shall be ten (10) tablets per caliber inch. The Tab shall be planted 1/3 to ½ the depth of the root zone system. "Soil Moist & Plant Tabs" available from: JRM Chemical, 15663 NEO Parkway, Cleveland, Ohio 44125 (1-800-962-4010), or County approved equal.

(e) All pits shall be generally circular in outline with vertical sides. Depth shall be no deeper than the root ball and the diameter shall not be less than twice the diameter of the root ball.

715.04 MAINTENANCE.

(a) Maintenance shall include a thorough initial watering by the Contractor with weekly waterings thereafter for the first thirty (30) days. Waterings thereafter

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shall be on a bi-weekly basis for three months. Watering beyond the three month period shall be at the discretion of the Contractor pursuant to keeping the plants in a live healthy condition. Contractor shall supply the water. During the one year warranty, settled plants shall be reset to proper grade and position, dead material removed and guy tightened or repaired.

(b) At the end of the warranty period and prior to the final inspection the Contractor shall remove the guy wires and stakes.

715.05 PLANT GUARANTEE/WARRANTY

(a) Contractor guarantees all material for a one (1) year period from the date of final acceptance of the work. Any material that is 25% dead, or more, shall be considered dead and shall be replaced by the Contractor with the same size and tree type as the original, with no additional soil additives to be used. A tree shall be considered dead when the main leader has died back, or there is 25% of the crown dead.

(b) Replacement. The Developer shall be responsible for replacement of all dead trees for a period of one year following the dedication date. All trees replaced during the warranty period shall be guaranteed for a period of one year following the date of planting.

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CATEGORY 800 - TRAFFIC

SECTION 807 — ELECTRICAL SERVICE EQUIPMENT

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

807.03.07 Utility Connection.

Add the following to the end of this section.

All Specification references to the "Traffic Operations Division", and the "District Utility Engineer" shall be construed as a direct reference to the Department of Public Works.

SECTION 810 — ELECTRICAL CABLE, WIRE, AND CONNECTORS

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

810.02 MATERIALS.

Add the following to the end of this section.

All Specification references to the "Traffic Operations Division", and the "District Utility Engineer" shall be construed as a direct reference to the Department of Public Works.

SECTION 812 — SQUARE PERFORATED TUBULAR STEEL SIGN SUPPORTS

812.01 DESCRIPTION. This work shall consist of furnishing and installing Square Perforated Tubular Steel Sign Supports, consisting of Square Perforated Tubular Steel Posts and Square Perforated Tubular Steel Anchor Bases for mounting traffic signs as specified in the contract documents, or as directed by the Engineer. Signs shall be specified as in Section 813.

812.02 MATERIALS.

Steel Posts	A570 Grade 50
Galvanizing	A653 Designation G-90
Spray Galvanizing Compound	A780

Square Perforated Tubular Steel Posts shall be formed from 14 gauge steel. Square Perforated Tubular Steel Anchor Bases shall be formed from 12 gauge steel. All sides of the tubes shall have 7/16 in. die punched circular holes or perforated knock-outs, at one in. centers along their entire length.

The Tubular Steel Posts shall be two in. square tubes 12 ft. long.

Tubular Steel Anchor Base shall be a 2-½ in. square, 36 in. long, formed from 12 gauge steel.

812.03 CONSTRUCTION. The unit shall be driven into the ground so that one or two rows of holes in the Square Perforated Tubular Steel Anchor Base are exposed. The base shall be driven so that it remains plumb and to provide the final sign assembly with the correct orientation.

Finished length of the Tubular Steel Posts shall be determined by adding the total height of the signs to 8 ft., 2 in. The Tubular Steel Post shall be cut to the correct length, and cold spray galvanizing shall be applied to the cut end. The sign(s) shall be bolted to the top of the post, using tamper-proof bolts or drive rivets. The Tubular Steel Posts shall be lowered 8 in. into the Tubular Steel Anchor Base, and the post secured to the base using two corner bolts designed for this purpose.

A galvanized steel pole cap shall be mounted on top of each Square Perforated Tubular Steel Post.

812.04 MEASUREMENT AND PAYMENT. Square Perforated Tubular Steel Sign Supports will be measured and paid for at the contract unit price per each. The payment will be full compensation for the Steel Sign Post, Steel Anchor Base, steel pole cap, corner bolts, and painting as required, and for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 813 — SIGNS

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

813.02 MATERIALS.

Delete the paragraph, " Provide all hardware ... pole mounted applications."

Add the following sentences: All signs and their mounting hardware shall be supplied and installed by the Contractor. All mounting hardware shall be manufactured from stainless steel.

813.04.02 Delete this section.

SECTION 814 — SIGNAL HEADS

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

Replace the word, "furnishing", with the word "obtaining"..

*Add the following to the end of this section, "*The contractor shall obtain all of the above from the County.*"*.

SECTION 816 — TRAFFIC CONTROL DEVICE CABINETS AND EQUIPMENT

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

816.02 MATERIALS. All Specification references to the "Office of Traffic and Safety" shall be construed as a direct reference to the Department of Public Works.

SECTION 817 — PUSH BUTTON AND PUSH BUTTON SIGNS

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

Replace the word, "furnishing", with the word "obtaining"..

*Add the following to the end of this section, "*The contractor shall obtain all of the above from the County.*"*.

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SECTION 821 — BREAKAWAY BASE SUPPORT SYSTEMS

821.01 DESCRIPTION. This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

821.02 MATERIALS. All Specification references to the "Office of Traffic and Safety" shall be construed as a direct reference to the Department of Public Works.

SECTION 823 — REMOVE AND RELOCATE OR REMOVE AND DISPOSE OF ROADWAY LIGHTING STRUCTURES

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

823.03 CONSTRUCTION. *Replace the reference to* GP-6.02 *with* GC-6.07.

SECTION 826 — COATING NEW GALVANIZED STRUCTURES

826.01 DESCRIPTION. Coat new galvanized steel structures, including exposed anchor bolts, flange bolts, nuts, and washers, as specified in the contract documents or as directed by the Engineer. Color will be as specified in the contract documents.

826.02 MATERIALS. Materials shall conform to one of the systems described below. All coatings in the system shall come from the same manufacturer.

Colors shall conform to the following Federal Standards, or as specified in the contract documents.

Brown	Federal Standard Number 595a-20040
Black	Federal Standard Number 595a-27038

826.02.01 Paint System.

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(a) Primer. Shall be an Epoxy Polyamide meeting the requirements of Section 912.03.02 and must have a dry film thickness of 2 to 5 mils (50 to 125 μm).

(b) Finish Coat. Shall be an Aliphatic Polyurethane meeting the requirements of Section 912.04.02 and must have a dry film thickness of 2 to 4 mils (50 to 100 μm).

826.02.02 Fusion Bonded Polyester Powder System (all Signal & Lighting Structures).

Polyester Powder. Polyester Powder shall meet the requirements of Section 917.

826.03 CONSTRUCTION.

826.03.01 Paint System.

Surface Preparation. Galvanized steel shall not be permitted to have been water or chromate quenched. The surface shall be solvent cleaned per SSPC SP-1 using a non-residue solvent and a lint free cloth. The surface shall also be brush off blasted per SSPC SP-7 using Grit. Any damaged areas shall be repaired according to ASTM A-780. If repair is made using an Organic Zinc Rich primer, the primer shall conform to Section 912.02.03.

Paint Application. Following the brush off blasting and prior to the application of the prime coat, store each item in an environment free of moisture and dust. Apply the primer within twelve (12) hours of brush off blasting and in accordance with the manufactures recommendation.

Once the primer has properly cured, apply the finish coat in accordance with the manufacturers recommendations.

The finished painted surface shall be holiday free when tested with a low voltage holiday detector (minimum 30 volts) similar to a K – D Bird Dog, using regular tap water. If holidays are detected, the coatings could be repaired with additional coatings or they may be stripped and repainted at the Contractor's expense.

826.03.02 Fusion Bonded Polyester Powder System.

Surface Preparation. Prepare **t**he galvanized surface by solvent cleaning conforming to SSPC SP-1, followed by brush off blast cleaning conforming to SSPC SP-7 using grit. The blast profile shall be 2 to 3 mills as determined in conformance with D 4417, method C.

When blast cleaning exposes bare steel, spot prime the bare steel with an Organic Zinc Rich Coating in conformance with A 780. Apply the polyester powder within 24 hours of surface preparation.

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Application. Apply fusion bonded polyester powder per manufacturers recommendations.

826.04 MEASUREMENT AND PAYMENT. Coating New Galvanized Structures will not be measured and paid, but the cost will be incidental to the contract item. The payment will be full compensation for all material, labor, equipment, tools and incidentals necessary to complete the work.

SECTION 827 — EMT CONDUIT WITH FIREHOUSE PRE-EMPTION BUTTON

827.01 DESCRIPTION. Furnish and install conduit, junction boxes and push button for firehouse pre-emption. The push button will activate the pre-emption phase within the traffic signal controller.

827.02 MATERIALS.

EMT Conduit	805
Galvanized Steel Junction Boxes	811
Push Button	817

827.03 CONSTRUCTION. Locate push button in positions as indicated on the Contract Documents and can be activated by firehouse personnel. Furnish and install conduit and junction boxes to feed to the push button from the nearest traffic signal handhole.

Support EMT Conduit in accordance with the National Electric Code. Provide junction boxes as specified in the Contract Documents or as directed by the Engineer.

827.04 MEASUREMENT AND PAYMENT. EMT Conduit with Firehouse Pre-Emption Button will be measured and paid for at the Contract unit price per linear foot measured along the centerline of the EMT conduit from end to end. The payment will be full compensation for all EMT conduit, fittings, pushbutton, pull wire, conduit clamps, mounting hardware, galvanized steel junction boxes and for all materials, labor, equipment, tools and incidentals necessary to complete the work.

Electrical cable for Firehouse Pre-Emption Button will be paid separately per Section 810.

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SECTION 828 — GALVANIZED TRAFFIC SIGNAL PEDESTAL POLES AND TRANSFORMER BASES - AREAWIDE

828.01 DESCRIPTION. Furnish and install or install Administration County furnished galvanized traffic signal pedestal poles and transformer bases at locations specified in the Contract Document or as directed by the Engineer.

828.02 MATERIALS. Design shall meet 2001 edition of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals except as noted in the contract documents. All welding must conform to American Welding Society (AWS) Structural Welding Code D1.1 - Steel, Tubular Structures.

Determine each pedestal poles height by the total height of the pedestal pole including the transformer base.

(a) 10 ft pole height consists of a 103 in. steel shaft with a steel base plate plus a 17 in. transformer base.

(b) 14 ft pole height consists of a 151 in. steel shaft with a steel base plate plus a 17 in. transformer base.

(c) 20 ft pole height consists of a 240 in. steel shaft with a steel base plate plus a 17 in. transformer base.

Furnish pedestal pole consisting of a design from a steel shaft with a steel base plate, transformer base and all miscellaneous hardware.

(a) The pedestal pole shaft shall be fabricated of one length and shall have one longitudinal weld, parallel to the long axis of the pedestal pole shaft, with no transverse welds. The longitudinal weld must be finished to form a smooth outside surface and the wall of the pedestal pole shaft must be uniform in thickness including the welded area. The pedestal pole shaft must be round or multi-sided (less than eight sides not acceptable) in cross section. 14 ft units must be uniformly tapered from butt to tip with a 1 in. reduction in diameter for each 7 ft in length (0.14 in./ ft). 10 ft unit must not be tapered.

(1) 10 ft pedestal pole shaft shall be 4-1/2 in. outside diameter, Schedule 40 pipe, and conform to A 501.

(2) All 14 ft pedestal poles must be 7-1/2 in. outside diameter at the base and be made of 11 gauge (0.119 in.) thickness steel conforming to A 595, Grade A or equivalent.

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(3) All 20 ft pedestal poles must be 7-1/2 in. outside diameter at the base and be made of 3 gauge (0.25 in.) thickness steel conforming to A 595, Grade A or equivalent.

(b) The base plate material shall meet the requirements of A 709, Grade 36. The base plate shall be secured to the lower end of the pedestal pole shaft by two continuous electric arc welds. The base plate shall telescope the pedestal pole shaft with one weld on the inside of the base plate at the end of the pedestal pole shaft. The remaining weld shall be located on the outside of the base plate at the top of the pedestal pole shaft. The weld connection shall develop the full strength of the adjacent pedestal pole shaft to resist bending action. All bases plate shall be fabricated with the holes for anchor bolts to the size and location dimensions as shown in MD-818.16 and 818.17.

(c) 14 ft pedestal poles shall be furnished with entrance ways for cable as noted in the contract documents. These holes must be factory drilled and a straight tapped coupling, conforming to Underwriters Laboratory's UL-6 Specification, for 2 in. rigid conduits, must be installed for each hole. A nipple with a unitized hexagonal fitting and integral inside radius on one end must then be installed and fully seated on the interior side of the coupling. Location and installation of the coupling shall be as shown in MD-818.17.

(d) All pedestal poles and hardware, except materials manufactured from stainless steel or cast aluminum, shall be hot dipped galvanized. The galvanized coating shall conform to the thickness, adherence and quality requirements of A 123 and A 153 for hardware. Threaded components must be chased and cleaned after galvanizing. All internally threaded components shall be tapped oversize the minimum amount required to permit assembly on the coated externally threaded fastener. Internally threaded components shall be provided with a lubricant which shall be clean and dry to the touch.

(e) Each pedestal pole shall be furnished with a removable domed cap, fabricated from cast aluminum, circumferentially attached to the side of the pole with three hex head type 304 stainless steel bolts (1/4 in. - 20 UNC).

(f) Each pedestal pole shall have an identification plate mechanically attached 6 in. above the pedestal pole base plate and oriented so that the identification plate may be read from a ground observation position.

(g) Recessed hub type, galvanized malleable iron plugs shall be inserted flush into all couplings.

Breakaway Bases.

(a) All breakaway bases must be approved by FHWA as meeting breakaway under NCHRP 350.

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(b) Each transformer base shall be furnished with four hex head bolts, four hex head nuts and all associated hardware as shown on the appropriate detail for fastening the pedestal pole base plate to the top of the transformer base. All bolts must conform to A 325 specifications and must be galvanized.

Anchor Bolts.

(a) Each pedestal pole anchor bolt shall be made of steel conforming to M 314, Grade 55 S1.

(b) Anchor bolt threads shall be of cut thread design with a minimum 6 in. of threads at the top.

(c) The template and anchor plates shall be as shown on MD 801.01.

(d) The diameter of the anchor bolt shall be stamped into the top of the threaded end of each anchor bolt.

(e) Each anchor bolt shall be provided with two attached heavy hex nuts and two attached flat washers.

(1) Anchor bolt nuts shall conform to A 194, grade 2 or 2H, or A 563, D or DH.

(2) All nuts shall be tapped oversize the minimum amount required to permit assembly on the coated externally threaded fastener.

(3) Washers shall conform to F 436.

(f) All nuts, washers, and the top 12 in. of all anchor bolts shall be hot dipped or mechanically galvanized. The galvanized coating shall conform to the thickness, adherence and quality requirements of A 123 or A 153 for hardware.

All high strength bolts (of a given length), nuts (of a given size) and washers (of a given diameter) shall be from the same manufacturing lot per each requisition of materials. The use of foreign made fasteners is prohibited.

828.03 CONSTRUCTION. Refer to 818.03.

828.04 MEASUREMENT AND PAYMENT. Breakaway pedestal poles will be measured and paid for at the contract unit price per each.

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Breakaway Pedestal Pole, Any Size. This work shall include furnishing and installing pedestal poles in the heights specified, breakaway base, concrete foundation as per Section 801 specifications, and a ground rod per Section 804 specifications in the nearest handhole. The payment will be full compensation for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Install Breakaway Pedestal Pole, Any Size. This work shall include installing Administration County furnished pedestal poles in the heights specified, furnishing and installing breakaway base, furnishing and installing concrete foundation as per Section 801 specifications, and furnishing and installing a ground rod per Section 804 specification in the nearest handhole. The payment will be full compensation for all materials, labor, equipment, tools, pick-up of materials and incidentals necessary to complete the work.

Anchor bolts will be measured and paid for as specified in Section 801.

Tag Detail.

Mfg: [1] Contract #: [2]

Pole Diameter: [3] Height: [4] Gauge: [5]

Anchor Bolts: [6] Bolt Circle: [7]

Tag Reference.

[1] Name of the manufacturer of the pedestal pole.

[2] Administration Contract Number of the pedestal pole.

[3] Pole outside diameter at the base: 4-1/2 in. O.D. or 7-1/2 in. O.D.

[4] Pole height[1]: 10 ft, 14 ft, 20 ft.

[5] Pole gauge: Schedule 40 or 11 GA.

[6] Anchor bolt size: 1 in. Dia. x 40 in. Length.

[7] Bolt circle diameter: 11 in. Dia.

[1]Pole height includes the height of the pedestal pole and transformer base. Typically, the transformer base is 17 in. in height which corresponds to 10 ft pole (cut to 8 ft) having a height of 103 in.; and a 14 ft having a height of 151 in.

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SECTION 829 — GALVANIZED TRAFFIC SIGNAL STRAIN POLES — AREAWIDE

829.01 DESCRIPTION. Furnish and install or install Administration County furnished galvanized traffic signal strain poles at locations specified in the Contract Document or as directed by the Engineer.

829.02 MATERIALS. Design shall meet the 2001 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, except as noted. All welding shall be in accordance with the American Welding Society (AWS) Structural Welding Code D1.1 - Steel, Tubular Structures.

Furnish each strain pole consisting of a design from a steel shaft with a steel base plate, four anchor bolts and miscellaneous hardware.

(a) Manufacture the strain pole shaft from steel tubing conforming to A 595 Grade A or equal. Each strain pole shaft shall be fabricated of one length and shall have one longitudinal weld, parallel to the long axis of the strain pole shaft, with no transverse welds. Finish longitudinal welds to form a smooth outside surface and the wall of the strain pole shaft shall be uniform in thickness including the welded area. The strain pole shaft shall be round or multi-sided (eight sides or more) in cross section and be uniformly tapered from butt to tip with approximately a one in. reduction in diameter for each seven ft in length (0.14 in./ ft).

(1) All 30 ft strain poles shall be 12 in. outside diameter at the base plate and made of zero gauge (0.312 in.) thickness steel.

(2) All 32 ft strain poles shall be either 12 in. or 14 in. outside diameter at the base plate and made of double zero gauge (0.625 in.) thickness steel.

(b) Furnish all strain poles with a base plate with a minimum 10 in. opening. The material shall meet the requirements of A 709, Grade 36 and of sufficient size and strength. Secure the base plate the lower end of the strain pole shaft by two continuous electric arc welds. The base plate shall telescope the strain pole shaft with one weld on the inside of the base plate at the end of the strain pole shaft. The remaining weld shall be located on the outside of the base plate around the circumference of the strain pole shaft. The weld connection shall develop the full strength of the adjacent strain pole shaft to resist bending action. Fabricate all base plates with the holes for anchor bolts to the size and location dimensions as shown on the appropriate detail.

(c) Weld access hole frames into the strain pole as detailed in MD 818.11. A galvanized steel cover, conforming to A 709, Grade 36 shall cover the access hole

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frame. Secure the access hole covers top to the access hole frame by a hinge fabricated from 0.063 in. stainless steel using a 0.120 in. diameter stainless steel hinge pin. Secure the hinge to the access hole frame by two ¼ in.- 20 UNC hex head stainless steel bolts. Secure the hinge to the access hole cover by two 1/4 in.- 20 UNC hex head stainless steel bolts and lock nuts. Provide a slotted opening at the bottom of the access hole cover to allow for attachment of a furnished 1/4 in.- 20 UNC hex head stainless steel bolt into the access hole frame face.

(d) A 3/8 in. diameter X 1 in. stud copper servit post for two #6 AWG stranded wire shall be furnished into the bottom of the access hole frame.

(e) Furnish strain poles with entrance ways for cable as detailed in MD 818.15. These holes shall be factory drilled and a straight tapped coupling, conforming to Underwriters Laboratory's UL-6 Specification, for 3 in. rigid conduits, shall be installed for each hole. A nipple with a unitized hexagonal fitting and integral inside radius on one end shall then be installed and fully seated on the interior side of the coupling. Location and installation of the coupling shall be as shown in the details.

(f) Weld a "J" hook near the top of the strain pole shaft for cable support.

(g) All strain poles, access hole frame and hardware, except materials manufactured from stainless steel or cast aluminum, shall be hot dipped galvanized. The galvanized coating shall conform to the thickness, adherence and quality requirements of A 123 or A 153 for hardware. Clean and chase all threaded components after galvanizing. Tap all internally threaded components oversize the minimum amount required to permit assembly on the coated externally threaded fastener. Provide internally threaded components with a lubricant which shall be clean and dry to the touch.

(h) Furnish each strain pole with four removable ornamental anchor bolt covers made of cast aluminum. Bolt holes for attaching the bolt covers to the base plate shall be drilled at the location obtained by following the diagonal line of the base plate until it intersects the bolt circle diameter, then proceeding tangentially from the bolt circle diameter a distance equal to the Anchor Bolt Center to Bolt Slot Center Distance as detailed in MD 818.14. Attach to the base using hex head stainless steel bolts (1/4 in.- 20 UNC).

(i) Furnish each strain pole with a removable domed cap, fabricated from cast aluminum, circumferentially attached to the inside or outside of the pole shaft with three hex head stainless steel bolts (1/4 in. – 20 UNC).

(j) Each strain pole shall have an identification plate mechanically attached, oriented such that the identification plate may be read from a ground observation position.

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(k) Insert recessed hub type, galvanized malleable iron plugs flush into all strain pole couplings.

Anchor Bolts.

(a) Make each strain pole anchor bolt of steel and conforming to F1554, Grade 55 S1.

(b) Anchor bolt threads shall be of cut thread design with a minimum 9 in. of threads at the top and bottom.

(c) The template and anchor plates shall be as shown on MD 801.01.

(d) Stamp the diameter of the anchor bolt into the top of the threaded end of each anchor bolt.

(e) Provide each anchor bolt with two anchor bolt nuts and two flat washers.

(f) Anchor bolt nuts shall conform to A 194 grade 2 or 2H or A 563 D or DH.

(g) Tap all nuts oversize the minimum amount required to permit assembly on the coated externally threaded fastener.

(h) Washers shall conform to F436.

(i) Hot dip or mechanically galvanize all nuts, washers and the top 12 in. of all anchor bolts. The galvanized coating shall conform to the thickness, adherence and quality requirements of A 123 or A 153 for hardware. All high strength bolts (of a given length), nuts (of a given size) and washers (of a given diameter) shall be from the same manufacturing lot per each requisition of materials. The use of foreign made fasteners is prohibited.

Alternate Design. Alternate strain pole designs will be considered provided the following qualifications are observed:

(a) Alternate strain pole designs shall be of two piece construction.

(b) Two piece construction shall have a minimum of 18 in. of overlap with 1 watertight transverse weld, smoothed to be inconspicuous.

(c) Bolt circle diameters shall be followed.

(d) Alternate strain pole designs shall have a base plate diameter equal to those values shown on the typicals.

(e) Single straight pipe sections are not acceptable.

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(f) All alternate designs shall be structurally equivalent to the physical requirements of this specification and as approved by the Engineer.

829.03 CONSTRUCTION. Refer to 818.03.

829.04 MEASUREMENT AND PAYMENT. Galvanized Traffic Signal Strain poles will be measured and paid for at the contract unit price per each.

Strain Poles. This shall include furnishing and installing the Strain poles in the heights and size specified, including furnishing and installing concrete foundation as per Section 801 specifications, and furnishing and installing a ground rod per Section 804 specifications in the nearest handhole. The payment will be full compensation for furnishing & installing all materials including labor, equipment, tools and incidentals necessary to complete the work.

Install Strain Pole, Any Size. This shall include installing Administration County furnished Strain Poles, furnishing and installing concrete foundation as per Section 801 specifications, and furnishing and installing a ground rod per Section 804 specifications in the nearest handhole. The payment will be full compensation for all materials, labor, equipment, tools, pick-up of materials and incidentals necessary to complete the work.

Anchor bolts will be measured and paid for as specified in Section 801.

Tag Detail.

Mfg: [1]	**contract #** [2]
Pole Diameter: [3] **Height:** [4]	**Gauge:** [5]
Anchor Bolts: [6] **Bolt Circle**: [7]	

Tag Reference.

[1] Name of the manufacturer of the strain pole.

[2] County Purchase Order Administration Contract Number of the strain pole.

[3] Pole outside diameter at the base: 12 in. O.D. or 14 in. O.D.

[4] Pole height: 30 ft or 32 ft.

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[5] Pole gauge: 0 GA or 00 GA.

[6] Anchor bolt size: 1-3/4 in. Dia. x 66 in. Length or 2-1/4 in. Dia. x 72 in. Length.

[7] Bolt circle diameter: 16 in. Dia. or 22 in. Dia.

SECTION 830 — MAST ARMS AND MAST ARM POLES — SINGLE, TWIN AND TRIPLE — AREAWIDE

830.01 DESCRIPTION. Furnish and install galvanized traffic signal mast arms and mast arm poles or install Administration County furnished galvanized traffic signal mast arms and mast arm poles at locations specified in the Contract Document or as directed by the Engineer.

830.02 MATERIALS. Design shall meet the 2001 edition of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, except as noted. All welding shall conform to American Welding Society (AWS) Structural Welding Code D1.1 - Steel, Tubular Structures.

Each mast arm(s) and mast arm pole structure furnished shall consist of a design from a steel pole shaft with a steel base plate and flange plate, steel mast arm shaft(s) with steel flange plate(s), four flange bolts per mast arm, four anchor bolts and miscellaneous hardware.

(a) Manufacture the mast arms and mast arm poles from steel tubing conforming to A 595 Grade A or equal. Each mast arm and mast arm pole shall be fabricated of one length and shall have one longitudinal weld, parallel to the long axis of the mast arm or mast arm pole, with no transverse welds. Finish the longitudinal weld to form a smooth outside surface and the wall of the mast arms and mast arm poles shall be of uniform thickness including the welded area. The mast arms and mast arm poles shall be round or multi-sided (8 sides or more) in cross section and be uniformly tapered from butt to tip with a 1 in. reduction in diameter for each 7 ft in length (0.14 in./ ft). Mast arms shall be of two piece design for all mast arms 50 ft and 60 ft in length. Mast arms shall be of three piece design for all mast arms 70 ft in length. Any combination of two piece of 50 ft and 60 ft arms of the same butt diameter shall fit together and any combination of two or three piece of 60 ft and 70 ft mast arms in sequence shall fit together. The bolted splice for two or three piece mast arms shall be as specified in the Contract Document.

(1) 50 ft mast arms shall have a butt section 30 ft in length.

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(2) 60 ft and 70 ft mast arms shall have a butt section of 35 ft in length.

(3) 38 ft single piece mast arms shall be 9 in. outside diameter at the flange plate and made of 7 gauge (0.179 in.) thickness steel.

(4) 50 ft two piece mast arm butt sections shall be 10 in. outside diameter at the flange plate and made of 3 gauge (0.250 in.) thickness steel.

(5) 60 ft two piece and 70 ft three piece mast arm butt sections shall be 12.5 in. outside diameter at the flange plate and made of 3 gauge (0. 250 in.) thickness steel.

(6) All extension sections of two and three piece mast arms shall be made of 7 gauge (0.179 in.) thickness steel.

(7) Single 27 ft mast arm pole designed with a 38 ft mast arm length shall be 12 in. outside diameter at the base plate and made of 7 gauge (0.179 in.) thickness steel.

(8) Single 27 ft mast arm pole designed with a 50 ft mast arm length shall be 13 in. outside diameter at the base plate and made of 3 gauge (0.250 in.) thickness steel.

(9) Single 27 ft mast arm pole designed with 60 ft or 70 ft mast arm lengths shall be 15 in. outside diameter at the base plate and made of zero gauge (0.312 in.) thickness steel.

(10) Twin 27 ft mast arm poles designed with 50 ft mast arm lengths shall be 13 in. outside diameter at the base plate base and made of 3 gauge (0.250 in.) thickness steel.

(11) Twin 27 ft mast arm poles designed with mast arm lengths for one mast arm of 50 ft and the remaining mast arm of 60 ft or 70 ft shall be 15 in. outside diameter at the base plate and made of zero gauge (0.312 in.) thickness steel.

(12) Triple 27 ft mast arm pole designed with mast arm lengths for one mast arm of 38 ft, second mast arm of 60 or 70 ft and the third mast arm of 50 ft shall have 15 in. outside diameter at the base plate and made of zero gauge (0.312 in.) thickness steel.

(b) The material for mast arm pole base plate shall conform to A 709, Grade 36 and shall be of sufficient size and strength. Secure the base plate to the lower end of the mast arm pole by two continuous electric arc welds. The base plate must telescope the mast arm pole with one weld on the inside of the base plate at the end of the mast arm pole shaft. Locate the remaining weld on the outside of the

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base plate, around the circumference of the mast arm pole. The weld connection shall develop the full strength of the adjacent mast arm pole shaft to resist bending action. Fabricate all base plates with the holes for anchor bolts to the size and location dimensions as shown on the appropriate detail.

(c) All mast arms and mast arm poles must be furnished with flange plate(s) as noted in the details. Connect these attachments, including the bolts, in such a manner as to develop he minimum guaranteed yield and ultimate tensile strength for the mast arm and mast arm pole. This assembly shall be capable of transferring the maximum moment being carried by the mast arm without distortion or rotation of the mast arm or the attachment. Connect flange plate(s) by the use of 4 bolts. The size of the plates and bolts shall be as shown in the details. Furnish four (1-1/2 in. O.D.) rubber grommets for each mast arm to accommodate signal heads wiring access.

(d) Secure the mast arm flange plate to the lower end of the mast arm pole by two continuous electric arc welds. The mast arm flange plate shall telescope the mast arm with one weld located on the inside of the flange plate at the end of the mast arm. Locate the remaining weld on the outside surface of the flange plate around the circumference of the mast arm pole. The weld connections shall develop the full strength of the adjacent mast arm to resist bending action.

(e) Mast arm flange plates and mast arm pole flange plates surfaces shall be plane to within 1/16 in. and shall be free of any buildup of galvanizing (drips, runs, etc.) which would prevent intimate contact between the connecting surfaces.

(f) Weld access hole frames into the mast arm pole as detailed in MD 818.11. A galvanized steel cover, conforming to A 709, Grade 36 shall cover the access hole frame. Secure the access hole covers top to the access hole frame by a hinge fabricated from 0.063 in. stainless steel using a 0.120 in. diameter stainless steel hinge pin. Secure the hinge to the access hole frame with 2 (1/4 in. – 20 UNC) hex head stainless steel bolts. Secure the hinge access hole cover by 2 (1/4 in. – 20 UNC) hex head stainless steel bolts and lock nuts. Provide a slotted opening at the bottom of the access hole cover to allow for attachment of a furnished (1/4 in. – 20 UNC) hex head stainless steel bolt into the access hole frame face.

(g) A 3/8 in. diameter X 1 in. stud copper servit post for two #6 AWG stranded wire shall be furnished into the bottom of the access hole frame.

(h) Provide mast arm poles with entrance ways for cable as noted on the appropriate detail. These holes shall be factory drilled and a straight tapped coupling, conforming to Underwriters Laboratory's UL-6 Specification, for 3 in. rigid conduits, shall be installed for each hole. A nipple with a unitized hexagonal fitting and integral inside radius on one end shall then be installed and fully seated on the interior side of the coupling. Location and installation of the coupling shall be as shown in the details.

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(i) Install "J" hooks as follows, located 1 ft above the highest mast arm T dimension.

(1) Weld a single "J" hook inside the pole for single mast arm poles.

(2) Weld two "J" hooks inside the pole for twin mast arm poles and triple mast arm poles.

(j) Hot dip galvanize all mast arms, mast arm poles, access hole frames and hardware, except materials manufactured from stainless steel or cast aluminum. The galvanized coating shall conform to the thickness, adherence and quality requirements of A 123 or A 153 for hardware. Chase and clean threaded components after galvanizing. Tap all internally threaded components the minimum amount required to permit assembly on the coated externally threaded fastener. Provide internally threaded components with a lubricant which shall be clean and dry to the touch.

(k) Furnish each mast arm pole with four removable ornamental anchor bolt covers made of cast aluminum. Bolt holes for attaching the bolt covers to the base plate shall be drilled at the location obtained by following the diagonal line of the base plate until it intersects the bolt circle diameter, then proceeding tangentially from the bolt circle diameter a distance equal to the Anchor Bolt Center to Bolt Slot Center Distance as provided in the MD 818.14. Attachment to the base shall be made using hex head stainless steel bolts (1/4 in.- 20 UNC).

(l) Furnish each mast arm extension section and mast arm pole with a removable domed cap, fabricated from cast aluminum, circumferentially attached to the outside of the pole shaft or mast arm end with 3 hex head stainless steel bolts (1/4 in.- 20 UNC). All mast arm caps shall have inside diameter one in. larger than the outside diameter of mast arm end.

(m) Each mast arm and mast arm pole shall have an identification plate mechanically attached, oriented such that the identification plate may be read from a ground observation position.

(1) Single piece mast arms and the butt section of two and three piece mast arms shall have the identification plate attached 6 in. above the flange plate.

(2) Each extension section of two and three piece mast arms shall have the identification plate attached 6 in. from the larger diameter end.

(3) Poles shall have the identification plate attached 6 in. above the bottom flange plate.

(n) Insert recessed hub type, galvanized malleable iron plugs flush into all mast arm pole couplings.

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Anchor Bolts.

(a) Make each mast arm pole anchor bolt of steel in accordance with F1554, Grade 55 S1.

(b) Anchor bolt threads shall be of cut thread design with a minimum 9 in. of threads at the top and bottom.

(c) The template and anchor plates shall be as shown the contract documents.

(d) Stamp the diameter of the anchor bolt into the top of the threaded end of each anchor bolt.

(e) Provide each anchor bolt with two anchor bolt nuts and two flat washers.

(1) Anchor bolt nuts shall conform to A 194 grade 2 or 2H or A 563 D or DH.

(2) Tap all nuts oversize the minimum amount required to permit assembly on the coated externally threaded fastener.

(3) Washers shall conform to F436.

(f) Hot dip or mechanically galvanize all nuts, washers and the top 12 in. of all anchor bolts. The galvanized coating shall conform to the thickness, adherence and quality requirements of A 123 or A 153 for hardware.

All high strength bolts (of a given length), nuts (of a given size) and washers (of a given diameter) shall be from the same manufacturing lot per each requisition of materials. The use of foreign made fasteners is prohibited!

Alternate Design. Alternate mast arm and mast arm pole designs will be considered provided the following qualifications are observed:

(a) Alternate mast arm designs may use sectional construction provided each section has a minimum length of 30 ft except for the outer most section.

(b) Overlap between sections shall be a minimum 18 in.

(c) Bolt circle diameters shall be as specified in the Contract Document.

(d) Alternate post designs may be straight (not tapered) sections and shall have a base diameter equal to, or no greater than 1 in. more than, those values shown on the typicals.

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(e) All alternate design must be structurally equivalent to the original design and as approved by the Engineer.

830.03 CONSTRUCTION. Refer to 818.03.

830.04 MEASUREMENT AND PAYMENT. Mast Arm(s) and Mast Arm Pole(s) will be measured and paid for at the contract unit price per each type of pole(s) and mast arm(s) size as specified in the Contract Document.

Single, Twin or Triple Mast Arm Pole and Mast Arm(s). This work shall include furnishing and installing traffic signal structures in the "T" dimensions, heights, and lengths specified, furnishing and installing concrete foundation as per 801 specifications, and furnish and installing a ground rod per 804 specifications in the nearest handhole. The payment will be full compensation for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Install Single, Twin or Triple Mast Arm Pole and Mast Arm(s). This work shall include installing County Administration furnished poles and mast arms as specified, furnishing and installing concrete foundation as per 801 specifications, and furnishing and installing a ground rod per 804 specifications in the nearest handhole. The payment will be full compensation for all materials, labor, equipment, tools, pick-up of materials and incidentals necessary to complete the work.

Anchor bolts will be measured and paid for as specified in section 801.

Tag Details.

Single Mast Arm Pole

Mfg: [1] Contract. #: [2]

Pole Height: [3]

Arm Sizes: [4]

Anchor Bolts: [5] Bolt Circle: [8]

Flange Bolts: [7]

One Piece Mast Arm

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Mfg: [1] Contract #: [2]

Arm Length: [6]

Flange Bolts: [7]

Two or three Piece Mast Arm - Butt Section

Mfg: [1] Contract #: [2]

Butt For Arms: [4]

Flange Bolts: [7]

Connection Bolt: [9]

Two or three Piece Mast Arm – Extension Section

Mfg: [1] Contract #: [2]

Extension Arm: [6]

Connection Bolt: [9]

Twin Mast Arm Pole
(Identical Size Flange Plates)

Mfg: [1] Contract #: [2]

Pole Height: [3]

Arm Sizes: [4]

Anchor Bolts: [5] Bolt Circle: [8]

Flange Bolts: [7]

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Twin Mast Arm Pole
(Different Size Flange Plates)

Mfg: [1] Contract #: [2]

Pole Height: [3]

Left Arm Sizes: [4]

Right Arm Sizes: [4]

Anchor Bolts: [5] Bolt Circle: [8]

Left Arm Flange Bolts: [7]

Right Arm Flange Bolts: [7]

Pole Type [10]

Triple Mast Arm Pole
(Different Size Flange Plates)

Mfg: [1] Contract #: [2]

Pole Height: [3]

Left Arm Sizes: [4]

Center Arm Sizes: [4]

Right Arm Sizes: [4]

Anchor Bolts: [5] Bolt Circle: [8]

Left Arm Flange Bolts: [7]

Center Arm Flange Bolts: [7]

Right Arm Flange Bolts: [7]

Tag Reference.

[1] Name of the manufacturer of the mast arm or mast arm pole.

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[2] Administration Contract County Purchase Order Number of the mast arm or mast arm pole.

[3] 27 ft height.

[4] Mast Arm Size and Orientation[1].

Pole Gauge Size	Indicate
7 GA	38 ft
3 GA	50 ft
0 GA	60 ft or 70 ft

[5] Anchor Bolts.

Pole Gauge Size	Indicate
7 GA	1-½ in. x 54 in. & 2 Washers
3 GA	1-¾ in. x 66 in. & 2 washers
0 GA	2 in. x 72 in. & 2 washers

[6] Mast Arm Length.

Constructed Extension for arm length	Indicate
50 ft	50 ft
60 ft	60 ft-70 ft
70 ft	70 ft

[7] Flange Bolt Size[2].

[1]For twin mast arm poles with identical size flange plates, indicate **L & R** preceding the 50 ft mast arm size; for twin mast arm poles with different size flange plates, indicate either 50 ft or 60 ft-70 ft mast arm sizes in the corresponding Left Arm Size or Right Arm Size as oriented by the line bisecting the acute angle formed by the two mast arm pole flange plates. For triple mast arm poles with different size flange plates, indicate either 50 ft, 60 ft-70 ft or 38 ft mast arm sizes in the corresponding Left Arm Size, Center Arm Size or Right Arm Size as oriented by the centerline of the mast arm pole center flange plate.

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Pole Gauge Size	Indicate
7 GA	1-¼ in. x 4 in. & washer
3 GA	1-½ in. x 5 in. & washer
0 GA	1-¼ in. x 6-½ in. & 2 flat washers & lock washer

[8] Bolt Circle.

Pole Gauge Size	Indicate
7 GA	16 in. Dia.
3 GA	18 in. Dia.
0 GA	22 in. Dia.

[9] Connection Bolt Size.

Two or three Piece Arm Size	Indicate[3]
50 ft	5/8 in. x Var.
60 ft	5/8 in. x Var.
70 ft	5/8 in. x Var.

[10] Standard or Alternate Twin.

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[2]For twin mast arm poles with identical size flange plates, indicate **L & R** preceding the 1-½ in. x 5 in. & washer Flange Bolt Size; for twin mast arm poles with different size flange plates, indicate either 1-½ in. x 5 in. & washer or 1-¼ in. x 6-½ in. & 2 flat washers & lock washer flange bolt sizes in the corresponding Left Flange Bolt Size or Right Flange Bolt Size as oriented by the line bisecting the acute angle formed by the two mast arm pole flange plates. For triple mast arm poles with different size flange plates, indicate either 1-½ in. x 5 in. & washer, 1-¼ in. x 6-½ in. & 2 flat washers & lock washer or 1-¼ in. x 4 in. & washer flange bolt sizes in the corresponding Left Flange Bolt Size, Center Flange Bolt Size or Right Flange Bolt size as oriented by the centerline of the mast arm pole center flange plate.

[3]Length to be determined by the successful bidder.

SECTION 831 — PAINTING WEATHERED GALVANIZED STRUCTURES

831.01 DESCRIPTION. Paint weathered galvanized steel structures including exposed anchor bolts, flange bolts, nuts, and washers as specified in the Contract Documents or as directed by the Engineer. Provide colors as specified in the Contract Documents.

831.02 MATERIALS. Materials shall conform to the requirements described below. All coatings in the system shall come from the same manufacturer. The Manufacturer shall be on the "Approved List of Manufacturers" maintained by the Office of Materials and Technology, Metals, Coatings and Structural Materials Team.

Organic Zinc Rich Primer	Section 912.02.03.
Polyamide Epoxy	Section 912.03.02.
Aliphatic Polyurethane	Section 912.04.02.

Colors shall conform to the following federal standards or as specified in the Contract Documents.

Brown	Federal Standard Number 595a-20040
Black	Federal Standard Number 595a-27038
Green	Federal Standard Number 595a-24108

831.03 CONSTRUCTION.

Surface Preparation. Inspect each structure prior to the application of any coating to ascertain the condition and thickness of the weathered zinc coating. This inspection shall determine the required surface preparation. Any or all of the following may exist on any given structure. The following are the possible surface conditions and their required surface preparation:

(a) When a structure exhibits only bright galvanizing, thickness readings are required to insure that 2.5 mils minimum galvanizing remains. Surface preparation shall be SSPC SP-1 (Solvent Cleaning), followed by either SSPC SP-2 (Hand Tool Cleaning) or SSPC SP-7 (Brush Off Blast Cleaning). A minimum of 1 mil. surface profile shall be obtained.

(b) When a structure exhibits a dull gray finish, take thickness readings in the dull gray areas to insure a minimum of 2.5 mils galvanizing remains. Surface preparation shall be SSPC SP-1 (Solvent Cleaning), followed by Power Washing using a pressure washer with the pressure not to exceed 1450 psi at the nozzle.

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(c) When a structure exhibits areas of white powder coating, surface preparation shall be SSPC SP-1 (Solvent Cleaning) followed by SSPC SP-2 (Hand Tool Cleaning). After the white powder has been removed, take thickness readings to insure a minimum 2.5 mils galvanizing remains. A minimum of 1 mil surface profile must be obtained.

(d) When a structure exhibits areas of red rust, take thickness readings to see if any galvanizing remains. Surface preparation shall be SSPC SP-1 (Solvent Cleaning), followed by SSPC SP-11 (Power Tool Cleaning to Near White). A minimum surface profile of 1 mil shall be obtained.

Painting. Paint the structures using the following materials.

(a) Spot prime areas where there is less than 2.5 mils of galvanizing using Organic Zinc Primer at the manufacturers recommended thickness.

(b) Apply a full coat of Polyamide Epoxy to the entire structure at the manufacturer's recommended thickness. There may be a recoat window for this material.

(c) Apply a finish coat of Aliphatic Polyurethane to the entire structure at the manufacturers recommended thickness.

The finished painted surface must be holiday free when tested with a low voltage holiday detector (minimum 30 volts) similar to a K–D Bird Dog, using regular tap water. If holidays are detected, the coatings could be repaired with additional coatings or they may be stripped and repainted at the coaters' expense.

Apply all coatings in accordance with manufacturers recommendations.

Paint all structures within 24 hours after surface preparation. If this time is exceeded, re-inspection will be necessary to insure no contamination of the cleaned surface has occurred prior to painting. Additional surface preparation may then be necessary.

831.04 MEASUREMENT AND PAYMENT. Painting of Weathered Galvanized Structures will be measured and paid for at the Contract unit price per structure. The payment will be full compensation for all material, labor, equipment, tools and incidentals necessary to complete the work.

SECTION 832 — REPAINTING PREVIOUSLY PAINTED GALVANIZED STRUCTURES

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832.01 DESCRIPTION. Re-paint previously painted galvanized steel structures including exposed anchor bolts, flange bolts, nuts, and washers as specified in the Contract Documents or as directed by the Engineer. Colors shall be as specified in the contract documents.

832.02 MATERIALS. Provide materials that conform to the requirements described below. All coatings in the system shall come from the same manufacturer. The Manufacturer shall be on the "Approved List of Manufacturers" maintained by the Office of Materials and Technology, Metals, Coatings and Structural Materials Team.

Organic Zinc Rich Primer	912.02.03.
Polyamide Epoxy	912.03.02.
Aliphatic Polyurethane	912.04.02.

Colors shall conform to the following Federal Standards, or as specified in the Contract Documents.

Brown	Federal Standard Number 595a-20040
Black	Federal Standard Number 595a-27038
Green	Federal Standard Number 595a-24108

832.03 CONSTRUCTION.

Surface Preparation. Clean all existing painted structures to insure that all paint is removed to either galvanized surface or bare metal. All cleaned surfaces shall be approved by the Office of Materials and Technology. Prior to the application of any coating, inspect each structure to ascertain the condition and thickness of the weathered zinc coating. This inspection shall determine the required surface preparation. Any or all of the following may exist on any given structure. The following are the possible surface conditions and their required surface preparation.

(a) When a structure exhibits only bright galvanizing, thickness readings are required to insure that 2.5 mils minimum galvanizing remains. Surface preparation shall be SSPC SP-1 (Solvent Cleaning), followed by either SSPC SP-2 (Hand Tool Cleaning) or SSPC SP-7 (Brush Off Blast Cleaning). A minimum of 1 mil surface profile shall be obtained.

(b) When a structure exhibits a dull gray finish, take thickness readings in the dull gray areas to insure a minimum of 2.5 mils galvanizing remains. Surface preparation shall be SSPC SP-1 (Solvent Cleaning), followed by Power Washing using a pressure washer with the pressure not to exceed 1450 psi at the nozzle.

(c) When a structure exhibits areas of white powder coating, surface preparation shall be SSPC SP-1 (Solvent Cleaning) followed by SSPC SP-2 (Hand Tool Cleaning).

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After the white powder has been removed, take thickness readings to insure a minimum 2.5 mils galvanizing remains. A minimum 1 mil surface profile must be obtained.

(d) When a structure exhibits areas of red rust, take thickness readings to see if any galvanizing remains. Surface preparation shall be SSPC SP-1 (Solvent Cleaning), followed by SSPC SP-11 (Power Tool Cleaning to Near White). A minimum surface profile of 1 mil shall be obtained.

Painting. Paint the structures using the following materials.

(a) Spot prime areas where there is less than 2.5 mils of galvanizing using Organic Zinc Primer at the manufacturers recommended thickness.

(b) Apply a full coat of Polyamide Epoxy to the entire structure at the manufacturers recommended thickness. There may be a recoat window for this material.

(c) Apply a finish coat of Aliphatic Polyurethane to the entire structure at the manufacturers recommended thickness.

The finished painted surface shall be holiday free when tested with a low voltage holiday detector (minimum 30 volts) similar to a K – D Bird Dog, using regular tap water. If holidays are detected, the coatings could be repaired with additional coatings or they may be stripped and repainted at the coaters' expense.

Apply all coatings in accordance with manufacturers recommendations.

Paint all structures within twenty-four (24) hours after surface preparation. If this time is exceeded, re-inspection will be necessary to ensure no contamination of the cleaned surface has occurred prior to painting. Additional surface preparation may then be necessary.

832.04 MEASUREMENT AND PAYMENT. Re-Painting Previously Painted Galvanized Structures will be measured and paid for at the Contract unit price per structure. The payment will be full compensation for all material, labor, equipment, tools and incidentals necessary to complete the work.

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SECTION 833 — WOOD POLES - CLASS II

833.01 DESCRIPTION. Furnish and install Class II wood poles as specified in the contract documents or as directed by the Engineer.

833.02 MATERIALS.

General.

Wood Poles	ANSI 05.1 Latest Revisions
Poles Conditioning	AWPA (American Wood-Preservers Association) Cl-79, latest Revision
Pole Preservatives	AWPA P8 or AWPA P9. Latest Revisions
Pole Branding	AWPA M6, latest revision
Steel Span Wire	950.09
Steel Guy Rod (Single Thimble Eye)	Diameter min. 1/2 in. - 5/8 in. 3 Bolt Clamp

Provide wood poles that are Southern Pine, Treatment Group C (steam conditioned) or treatment Group D (kiln-drying).

Provide flat roofed poles.

Perform surfacing and trimming prior to treatment.

Season the poles by air-seasoning, kiln-drying, steaming, heating in the preservative, or a combination of methods. Boulton drying is not permitted.

Shaving of all poles shall be full-length machine-shaved. The depth of cut shall not be more than necessary to remove inner bark.

There shall be no abrupt changes in the contour of the pole surface between the groundline and above the ground sections.

The lower 2 ft of poles may be trimmed to remove wood fibers causing butt flare, provided sufficient sapwood remains to obtain the minimum penetration requirements.

The following defects are prohibited:

(a) Cross Breaks (cracks).

(b) Decay, except as permitted under "decayed knots".

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(c) Dead streaks.

(d) Holes, open or plugged, except holes for test purposes, which shall be plugged.

(e) Hollow butts or tops, except as permitted under hollow pith centers and defective butts.

(f) Marine borer damage.

(g) Nails, spikes, and other metal not specifically authorized by this specification. All other foreign material is prohibited.

(h) Ring knots, a ring of knots consisting of four or more knots in a 3 in. section of the pole

(i) Bark knots, a knot that is undergrown and partially encased with outer bark, in excess of 3 in. diameter.

(j) Knot cluster, two or more knots grouped together as a unit with the fibers of the wood deflected around the entire unit

(k) Decayed Knots -Type II "decayed Knots" where depth of decay exceeds 1/2 in.

(l) Short Crook - A localized deviation from straightness which, within any section 5 ft or less in length, is more than 1/4 the mean diameter of the crooked section.

(m) Pole Sweep. A straight line joining the surface of the pole at the top and ground line, shall not be separated from the surface of the pole by more than 1 in. for each ten ft of pole length.

(n) Indentations, attributed to loading or handling slings, that are 1/4 in. or more deep over 20 percent or more of the pole circumference, or indentations which result from careless handling more than 1/2 in. deep at any point.

(o) Spiral grain (twist grain) exceeds one complete twist in any 20 ft.

Pole Preservative Treatment. Poles may be heated in oil-type preservatives at atmospheric pressure to facilitate penetration of preservative.

Poles to be impregnated with the preservative by application of the standard empty cell (Rueping) process shall be performed in accordance with the standard "Poles - Preservative Treatment by Pressure Processes" (AWPA C4, latest revision).

No material other than poles shall be treated with poles.

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The minimum net retention of Pentachlorophenol, as determined from 20 boring samples taken from any charge, shall not be less than the following.

Minimum Retention:	(lbs. Penta/cu. ft.)
Zone Assayed	0.5 - 2.0 in.
Retention	0.45

Retention of Pentachlorophenol shall be determined by AWPA A5, latest revision.

833.03 CONSTRUCTION. The following marking and code letter information shall be legibly and permanently burn branded with characters not less than 5/8 in. high. The markings shall be placed squarely on the face of the pole at 10 ft above the pole butt end and in the butt end of each pole in the following order:

(1) Suppliers Brand.

(2) Plant Designation.

(3) Month and Year of Treatment.

(4) Code Letters; "SP" denoting Southern Pine and the preservative code, such as "P" for Pentachlorophenol in Petroleum (AWPA M-6).

(5) Retention and Assay, such as "45-A".

(6) Class and Length.

833.04 MEASUREMENT AND PAYMENT. Class II Wood Poles shall be measured and paid for at the contract unit price per each. The payment will be full compensation for the poles, anchors and guy rods all guy cables and connectors, labor, tools, materials, and incidentals necessary to complete this work.

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CATEGORY 900

SECTION 900 — MATERIALS

900.01 GENERAL

This section shall be in accordance with the latest edition of the SHA Standard Specifications for Construction and Materials except as noted.

Delete the last two sentences of the first paragraph.

Delete the second and third paragraphs in their entirety.

Add the following:

The Engineer will inspect all materials before, during and after installation to ensure compliance with the Contract Documents. When specific tests of materials are called for in the referenced standards and specifications, the Engineer has the option of requiring that any or all of these tests be performed for the specified materials.

900.02 MANUFACTURERS. Certain materials specified herein are based on manufacturers that the County has approved for use. These approved manufacturers are listed in the County's Approved Product List document that is issued separately from these specifications. Use of materials specified in this Category are subject to compliance with the Approved Products List.

900.03 RECYCLED MATERIAL

Use of all recycled or re-handled material in the county requires submission of testing, certifications and approval of the county to ensure compliance with all State and local regulations.

SECTION 901 — AGGREGATES

901.01 AGGREGATES TABLES. This Section includes the material details, quality requirements, and test methods applicable to aggregates. Grading requirements are outlined in Tables 901 A and 901 C; physical properties in 901 B and 901 D. Force drying may be used in the preparation of samples for grading tests conducted in the field.

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TABLE 901 A
AGGREGATE GRADING REQUIREMENTS
TEST METHOD T 27

MATERIAL		SIEVE SIZE															
		2-1/2"	2"	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 10	No. 16	No. 30	No. 40	No. 50	No. 100	No. 200
		63 mm	50 mm	37.5 mm	25 mm	19 mm	12.5 mm	9.5 mm	4.75 mm	2.36 mm	2.0 mm	1.18 mm	600 µm	425 µm	300 µm	150 µm	75 µm
CRUSHER RUN AGGREGATE CR -6 (f)(g)		—	100	90–100	—	60–90	—	—	30–60	—	—	—	—	—	—	—	0–15
BANK RUN GRAVEL — SUBBASE		100	—	—	90–100	—	60–100	—	—	—	35–90	—	—	20–55	—	—	5–25
GRADED AGGREGATE — BASE DESIGN RANGE (a)		—	100	95–100	—	70–92	—	50–70	35–55	—	—	—	12–25	—	—	—	0–8
TOLERANCE (b)		—	–2	±5	—	±8	—	±8	±8	—	—	—	±5	—	—	—	±3(c)
BANK RUN GRAVEL — BASE		100	—	—	85–100	—	60–100	—	—	—	35–75	—	—	20–50	—	—	3–20
COARSE AGGREGATE - PORTLAND CEMENT CONCRETE	57 and UNDERDRAIN (h)	—	—	100	95–100	—	25–60	—	0–10	0–5	—	—	—	—	—	—	—
	67	—	—	—	100	90–100	—	20–55	0–10	0–5	—	—	—	—	—	—	—
	7	—	—	—	—	100	90–100	40–70	0–15	0–5	—	—	—	—	—	—	—
FINE AGGREGATE — PORTLAND CEMENT CONCRETE, UNDERDRAIN, and PNEUMATIC MORTAR (d)		—	—	—	—	—	—	100	95–100	—	—	45–85	—	—	5–30	0–10	—
COARSE AGGREGATE — LIGHTWEIGHT PORTLAND CEMENT CONCRETE		—	—	—	100	90–100	—	10–50	0–15	—	—	—	—	—	—	—	—
FINE AGGREGATE — LIGHTWEIGHT PORTLAND CEMENT CONCRETE (d)		—	—	—	—	—	—	100	85–100	—	—	40–80	—	—	10–35	5–25	—
FINE AGGREGATE/SAND MORTAR and EPOXIES (d)		—	—	—	—	—	—	—	100	95–100	—	—	—	—	—	0–25	0–10
MINERAL FILLER		—	—	—	—	—	—	—	—	—	—	—	100	—	95–100	—	70–100

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(a) To establish target values for design.
(b) Production tolerance.
(c) ±2 for field grading (omitting T 11).
(d) Fine aggregate includes natural or manufactured sand.
(e) Crushed glass shall not contain more than one percent contaminants by weight.
(f) Not to be used in the structural part of any Administration project.
(g) Recycled asphalt pavement may be used as a component not to exceed 15 percent and is not subject to aggregate physical property requirements in TABLE 901 B.
(h) Recycled concrete is prohibited in drainage applications.

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TABLE 901 B

AGGREGATE PHYSICAL PROPERTY REQUIREMENTS

MATERIAL	TEST METHOD				
	SPECIFICATION	T 90	T 11	T 96	T 104
		PI	MATERIAL FINER THAN No. 200 SIEVE	LOS ANGELES ABRASION	SODIUM SULFATE SOUNDNESS
		max	% max	% max	% max
CRUSHER RUN AGGREGATE CR-6	D 1241(a)	6	—	50	—
BANK RUN GRAVEL — SUBBASE	D 1241	6	—	50	—
GRADED AGGREGATE — BASE	D 1241	6	—	50	—
BANK RUN GRAVEL — BASE	D 1241	6	—	50	—
COARSE AGGREGATE — PCC (b)	M 80 CLASS A	—	1.0(c)	50	12
FINE AGGREGATE — PCC (b)(d)	M 6 CLASS B	—	4.0(e)	—	10
COARSE AGGREGATE — LIGHTWEIGHT PCC	M 195	—	—	—	—
FINE AGGREGATE — LIGHTWEIGHT PCC (f)	M 195	—	—	—	—
FINE AGGREGATE/SAND MORTAR and EPOXIES	M 45	—	—	—	10
MINERAL FILLER (g)	M 17	4	—	—	—
GLASS CULLET (h)	M 318	—	—	—	—

(a) Other approved inert materials of similar characteristics may be used provided they meet these provisions. For crushed reclaimed concrete, the soundness loss shall not exceed 18 percent after magnesium sulfate testing as specified in T 104.
(b) Test coarse and fine aggregate for PCC for alkali silica reactivity (ASR) per MSMT 212.
(c) 1.5 if material passing No. 200 sieve is dust of fracture, free of clay or shale.
(d) In areas exposed to traffic, manufactured sand shall have a minimum ultimate Dynamic Friction Value (DFV) of 40, based on the parent rock.
(e) 5.0 for concrete not subject to surface abrasion.
(f) Fine aggregate meeting M 6 may be used if the lightweight concrete does not exceed the maximum unit weight specified in the Contract Documents.
(g) Fly ash shall not exceed 12 percent loss on ignition.
(h) For use as a granular road base material. Not intended for use in locations where surfacing will not be placed over the base.

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TABLE 901 C

ASPHALT MIXES

AGGREGATE GRADING REQUIREMENTS, % PASSING FOR MIX DESIGN

TEST METHOD T 27

MATERIAL		SIEVE SIZE									
		3/4in.	1/2in.	3/8in.	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
		19.0 mm	12.5 mm	9.5 mm	4.75 mm	2.36 mm	1.18 mm	600 µm	300 µm	150 µm	75 µm
GAP GRADED STONE MATRIX ASPHALT MIX - 9.5mm		100	100	75–90	30–50	20–30	—	—	—	—	8–13
GAP GRADED STONE MATRIX ASPHALT MIX - 12.5mm		100	90–99	70–85	28–40	18–30	—	—	—	—	8–11
GAP GRADED STONE MATRIX ASPHALT MIX - 19.0mm		100	82–88	60 max	22–30	14–20	—	—	—	—	9–11
OPEN GRADED FRICTION COURSE – 9.5mm (a)		—	100	85–100	20–40	5–10	—	—	—	—	2–4
OPEN GRADED FRICTION COURSE – 12.5 mm (a)		100	85–100	55–75	15–25	5–10	—	—	—	—	2–4
OPEN GRADED FRICTION COURSE – 12.5mm (b)		100	80–100	35–60	10–25	5–10	—	—	—	—	1–4
SLURRY SEAL (SS) AND MICRO -SURFACING (MS)	TYPE II	—	—	100	90–100	65–90	45–70	30–50	18–30	10–21	5–15
	TYPE III	—	—	100	70–95	45–70	28–50	19–34	12–25	7–18	5–15
CHIP SEAL SURFACE TREATMENT	7	100	90–100	40–70	0–15	0–5	—	—	—	—	—
	8	—	100	85–100	10–30	0–10	0–5	—	—	—	—

(a) Less than Design Level 4 (ESAL)
(b) Porous European Mix (PEM) – Design Level 4 (ESAL)

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TABLE 901 D

AGGREGATE PHYSICAL PROPERTY REQUIREMENTS FOR ASPHALT MIXES

MATERIAL	SPECIFICATION	TEST METHOD					
		T 11	T 96	T 104	D 4791	MSMT 216	T 279
		MATERIAL FINER THAN No. 200 SIEVE	LOS ANGELES ABRASION (LA)	SODIUM SULFATE SOUNDNESS	FLAT and ELONGATED (a)	DYNAMIC FRICTION VALUE (DFV) (b) (c)	BRITISH PENDULUM NUMBER (BPN) (c)
		% max	% max	% max	% max	min	min
SURFACE COURSE 4.75mm, 9.5mm, 12.5mm, and 19.0mm	M323	—	45	12	10	25	—
SURFACE COURSE — HIGH DFV 4.75mm, 9.5mm, 12.5mm, and 19.0mm	M323	—	45	12	10	40 (e)	—
BASE COURSE 19.0mm, 25.0mm and 37.5mm	M323	—	45	12	10	—	—
GAP GRADED STONE MATRIX ASPHALT 9.5mm, 12.5mm, and 19.0mm	M323	—	30	12	20/5 (g)	40 (e)	—
OPEN GRADED FRICTION COURSE 9.5 mm, 12.5 mm, 12.5 mm PEM (h)	MSMT 409	0.5	30	12	20/5 (g)	40 (e)	—
SLURRY SEAL (SS) and MICRO-SURFACING (MS)	—	—	—	12	—	40 (f)	30
CHIP SEAL SURFACE TREATMENT	M 80, CLASS A	1.0 (d)	45	—	—	—	—

(a) Testing for flat and elongated particles shall be conducted on the blended aggregates. Dimensional ratio of calipers shall be 5:1.
(b) The minimum Dynamic Friction Value (DFV) shall be based on a single aggregate source or a blend of aggregates used. Determine proportions of blended aggregates using MSMT 416.
(c) DFV and British Pendulum Number (BPN) determined on parent rock. Reclaimed asphalt pavement (RAP) shall have a DFV of 30.0.
(d) 1.0 for samples taken at the point of production. Samples taken at any point after shipment shall have no more than 1.5 percent finer than 0.075 mm sieve.
(e) Carbonate rock shall have a minimum of 25 percent insoluble residue retained on the 0.075 mm sieve.
(f) No blending allowed.
(g) Testing conducted on particles retained on the 4.75 mm sieve. . Dimensional ratio of calipers shall be 3:1/5:1.
(h) Porous European Mix

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901.01.01 Steel Slag. Steel slag may be used for chip seal surface treatment, but not for any other aggregate.

901.02 STONE FOR RIPRAP, CHANNELS, DITCHES, SLOPES, AND GABIONS. Use field or quarry stone of approved quality. Stone may be certified from a source previously approved. Ensure that maximum dimension does not exceed four times the minimum dimension.

901.02.01 Stone for Riprap. Ensure that stone for riprap is uniformly graded from the smallest to the largest pieces as specified in the Contract Documents. The stone will be accepted upon visual inspection at the point of usage, as follows:

CLASS OF RIPRAP	SIZE	PERCENT OF TOTAL by weight
0	Heavier than 33 lb Heavier than 10 lb Less than 1 lb	0 50 10 max
I	Heavier than 150 lb Heavier than 40 lb Less than 2 lb	0 50 10 max
II	Heavier than 700 lb Heavier than 200 lb Less than 20 lb	0 50 10 max
III	Heavier than 2000 lb Heavier than 600 lb Less than 40 lb	0 50 10 max

Note: Optimum gradation is 50 percent of the stone being above and 50 percent below the midsize. Reasonable visual tolerances will apply.

901.02.02. Stone for Channels and Ditches. Meet the size requirements of Class I Riprap and the following:

QUALITY REQUIREMENTS	
TEST AND METHOD	**SPECIFICATION LIMITS**
Apparent Specific Gravity T 85, min	2.50
Absorption T 85, % max	3.0
Sodium Sulphate Soundness - 5 cycles, 2-1/2 to 1-1/2 in. Aggregate T 104, % loss max	20

901.02.03 Stone for Slopes. M 43, size number 1 omitting T 11. The stone shall also meet the quality requirements specified in 901.03.

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901.02.04 Stone for Gabions. Meet the quality requirements specified in 901.03 and the following except that the loss by sodium sulfate shall be greater than 12 percent:

DEPTH OF BASKET in.	SIZE OF INDIVIDUAL PIECES * in.
6	3 – 6
9	4 – 7
12	4 – 7
18	4 – 7
36	4 –12

*Size of pieces will be determined visually.

SECTION 902 — PORTLAND CEMENT CONCRETE AND RELATED PRODUCTS

Replace all references to TC-1.03 with General Conditions Section GC-6.05.

902.01 STORAGE. Storage of materials shall conform to the Contract Documents and as directed by the Engineer.

902.02 CERTIFICATION OF PORTLAND CEMENT AND BLENDED HYDRAULIC CEMENT. The manufacturer shall furnish certification as specified in TC-1.03. The certification shall also include:

(a) The mill shall report its quality control procedures, and submit a new report whenever there is a procedural change.

(b) The mill's control laboratory shall be inspected by the Cement and Concrete Reference Laboratory of the National Institute of Standards and Technology on their regularly scheduled visits. The Engineer shall be provided with copies of the reports of these inspections along with an account of the action taken to correct cited deficiencies.

(c) Records of data accumulated by the quality control procedures shall be produced upon request.

(d) A certified document shall accompany each shipment stating that the contents conform to all applicable requirements. Additionally, the document shall show the producer's name, mill location, carrier number, date loaded, weight contained in carrier, silo number, consignee, destination, Contract number, and type of cement. The signature and title of the signer shall be shown on the document.

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(e) The mill shall, upon request, supply certified chemical and physical test values that can be associated with any sample representing cement drawn from a particular silo on a given date.

(f) Acceptance of cement by certification will be terminated if test results differ from mill results by more than the precision limits given in the test method. The acceptance procedure will then revert to storage testing and approval prior to shipment.

902.03 HYDRAULIC CEMENT.

902.03.01 Portland Cement. M 85, with the fineness and the time of setting determined using T 153 and T 131, respectively.

902.03.02 Ground Iron Blast Furnace Slag. M 302, Grade 100 or 120. The Contractor may request to substitute a maximum of 50 percent of the weight of cement with ground iron blast furnace slag. When ground iron blast furnace slag is used, the minimum cement factor and water/cement ratio will be determined on the basis of the combined weight of the portland cement and ground iron blast furnace slag. When ground iron blast furnace slag is used to control alkali silica reactivity, see Table 902 B for percentage.

902.04 BLENDED HYDRAULIC CEMENT. M 240, Type I (PM) or a Type IP containing 15 to 25 percent pozzolan by weight of cement. Maximum loss on ignition is 3.0 percent. Do not use ground iron blast furnace slag for blending. The requirement for a manufacturer's written statement of the chemical composition is waived.

902.05 MASONRY CEMENT. C 91, except the water retention and staining tests are waived.

902.06 CONCRETE ADMIXTURES. Do not use concrete admixtures that contribute more than 200 ppm of chlorides based on the cement content when tested per MSMT 610. Use only prequalified admixtures.

Do not use pozzolan and Type I (PM) or Type IP cement in the same mix. Since the strength gains are delayed with these materials, a longer period of time may be required for curing and form removal.

902.06.01 Air Entraining Admixtures. M 154.

902.06.02 Chemical Admixtures. M 194, Type A, D, or nonchloride C.

902.06.03 High Range Water Reducing Admixtures. M 194, except that it shall be a liquid, the water content shall be a maximum of 85 percent of that of the control, and the

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durability factor shall be a minimum of 90. Use Type F for early strength, which shall produce a minimum compressive strength in 12 hours of 180 percent of that of the control. Use Type G when early strength is not specified. The manufacturer shall furnish certification as specified in TC-1.03. The certification shall include curves indicating the fluid ounces of admixture per 100 lb of cement as related to water reduction and strength gain for 12 hours when used with a minimum cement factor of 700 lb.

902.06.04 Pozzolans. The use of pozzolans may be requested to control alkali silica reactivity or for other reasons. When a pozzolan is used, determine the minimum cement factor and water/cement ratio on the basis of the combined weight cement and pozzolan. See Table 902 B for percentage of fly ash, and microsilica.

(a) Fly Ash. M 295, pozzolan Class C or F, except that the maximum permissible moisture content shall be 1.0 percent, and when used in concrete Mix Nos. 3 and 6 the maximum loss on ignition 3.0 percent.

(b) Microsilica. C 1240, except that the oversize requirement is waived.

902.06.05 Corrosion Inhibitors. Corrosion inhibitors shall be calcium nitrite based and contain a minimum of 30 percent active ingredients by mass. The gallonage of corrosion inhibitor used in the concrete mixture shall be included as water when determining the water/cementitious materials ratio.

902.07 PORTLAND CEMENT CONCRETE CURING MATERIALS. Use burlap cloth, sheet materials, liquid membrane forming compounds, or cotton mats.

902.07.01 Burlap. M 182, Class 1, 2, or 3.

902.07.02 Sheet Materials. M 171 with the following exceptions:

(a) White Opaque Burlap Polyethylene Sheeting. Tensile strength and elongation requirements are waived. Use sheeting having a finished product weight of not less than 10 oz/yd^2.

(b) White Opaque Polyethylene Backed Nonwoven Fabric. 902.07.02(a), with the thickness requirement waived. Use material having a finished product weight of not less than 5 oz/yd^2.

(c) White Opaque Polyethylene Film. Tensile strength and elongation requirements are waived.

902.07.03 Liquid Membrane. C309. Field control testing of the white pigmented curing compounds is on the basis of weight per gallon. The samples shall not deviate more than ± 0.3 lb/gal from the original source sample.

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902.07.04 Cotton Mats. Cotton mats consist of a filling material of cotton bats or bats covered with unsized cloth and tufted or stitched to maintain the shape and stability of the unit under job conditions of handling.

Use coverings of either cotton cloth, burlap or jute having the following properties:

(a) Cotton cloth covering shall weigh not less than 6.0 oz/yd^2 and have an average of not less than 32 threads/in. of warp and not less than 28 threads/in. of filling. Use raw cotton, cotton comber waste, cotton card strip waste, or combinations thereof as the raw material used in the manufacture of the cotton cloth.

(b) Burlap or jute covering for cotton mats shall weigh not less than 6.4 oz/yd^2 and shall have not less than of 8 threads/in. of warp and not less than 8 threads/in. of filling. Use the grade known commercially as "firsts" and they shall be free from avoidable imperfections in manufacture and from defects or blemishes affecting the serviceability.

Use a cotton bat, or bats made of raw cotton, cotton waste, cotton linters, or combinations thereof, as the filling material for the mats. Mats shall weigh not less than 12 oz/yd^2.

902.08 FORM RELEASE COMPOUNDS. Use form release compounds that effectively prevent the bond of the concrete to the forms. Form release compounds shall not cause discoloration of the concrete or adversely affect the quality or rate of hardening at the interface of the forms.

The flash point of the form release compound shall not be less than 100 F when tested per T 73.

902.09 PARAFFIN WAX. Use clear paraffin wax for use as a bond breaker for concrete. The flash point shall not be less than 380 F when tested under D 92.

902.10 PORTLAND CEMENT CONCRETE. Section 915 and as specified herein.

902.10.01 Proportioning. Prior to the start of construction, submit to the AME the source and proportions of materials to be used for each concrete mix. The mixture shall meet 902.10.03.

The concrete, with the exception of water and chemical admixtures, shall be proportioned by weight. Water and chemical admixtures may be proportioned by volume or weight. The mix shall be uniform and workable.

902.10.02 Materials.

Coarse Aggregate	901.01
Fine Aggregate	901.01

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Cement	902.03 and 902.04
Concrete Admixtures	902.06
Synthetic Fibers	902.15
Water	921.01

902.10.03 Portland Cement Concrete Mixtures.

The concrete mixes shall conform to the following:

TABLE 902 A

PORTLAND CEMENT CONCRETE MIXTURES

MIX NO.	28 DAY SPECIFIED COMPRESSIVE STRENGTH psi	STANDARD DEVIATION psi	CRITICAL VALUE psi	MIN CEMENT FACTOR lb/yd³	COARSE AGGREGATE SIZE M 43 / M 195	MAX WATER/ CEMENT RATIO by wt	SLUMP RANGE in.	TOTAL AIR CONTENT %	CONCRETE TEMPERATURE F
1	2500	375	2430	455	57, 67	0.55	2 — 5	5 — 8	70 ± 20
2	3000	450	3010	530	57, 67	0.50	2 — 5	5 — 8	70 ± 20
3	3500	525	3600	580	57, 67	0.50	2 — 5	5 — 8	70 ± 20
4	3500	525	3600	615	57, 67	0.55	4 — 8	N/A	70 ± 20
5	3500	525	3600	580	7	0.50	2 — 5	5 — 8	70 ± 20
6	4500	675	4770	615	57, 67	0.45	2 — 5	5 — 8	65 ± 15
7	4200	630	4420	580	57	0.50	1½ — 3	5 — 8	70 ± 20
8	4000	600	4180	750	7	0.42	2 — 5	5 — 8	65 ± 15
9	3000 (a)	N/A	N/A	800	57, 67	0.45	4 — 8	5 — 8	70 ± 20
10	4500	675	4770	700	¾" – No. 4	0.45	2 — 5	6 — 9	65 ± 15
11	4200	630	4420	—	57, 67	0.45	2 — 5	5 — 8	65 ± 15
12	4200	630	4420	—	¾" – No. 4	0.45	2 — 5	6 — 9	65 ± 15

Note 1: When concrete is exposed to water exceeding 15,000 ppm sodium chloride content, Type II cement shall be used. In lieu ofType II cement, a Type I cement may be used in combined form with an amount of up to 50 percent replacement with ground iron blast furnace slag, or an amount of up to 25 percent replacement with Class F fly ash. The Contractor shall submit to the Engineer the proposed mix proportions and satisfactory test results per C 1012 showing a sulfate resistance expansion not exceeding 0.10 percent at 180 days

Note 2: The temperature of Mix No. 6 when used for other than superstructure work as defined in TC-1.03 shall be 70 ± 20 F.

Note 3: Type A or D admixture shall be added to bridge, box culvert, and retaining wall concrete.

Note 4: Nonchloride Type C admixtures may be used when approved by the Engineer.

Note 5: Other Slump Requirements:

When a high range water reducing admixture Type F or Type G is specified, the slump shall be 4 to 8 in.
When synthetic fibers are specified, the slump shall be 5 in. maximum.
When concrete is to be placed by the slip form method, the slump shall be 2-1/2 in. maximum.
When the absorption of the coarse aggregate is greater than 10 percent, the slump shall be 3 in. maximum.

Note 6: Mix 9 shall contain a Type F high range water reducing admixture.

Note 7: Mix 10 and 12 shall be proportioned as specified in 211.2 of the ACI's Recommended Practices for Selection Proportions for. Structural Lightweight Concrete. The maximum average Density of Cured Concrete shall be 118 lb/ft3. Control testing for Density of Cured Concrete shall be two companion cylinders for each 100 yd3, or fraction thereof, as specified in M 195.

Note 8: Mix 11 and 12 shall also conform to all requirements as specified in Table 902 C.

(a) Acceptance will be based on a minimum compressive strength of 3000 psi in 24 hours. Design approval will be given based on trial batch obtaining a minimum compressive strength of 2500 psi in 12 hours. Testing shall conform to 902.10.08 except that cylinders shall remain in the molds until tests are conducted.

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Coarse and fine aggregate having an expansion up to 0.10 percent when tested for alkali silica reactivity (ASR) MSMT 212 may be used without restriction. Aggregates having an expansion greater than 0.10 but less than 0.35 percent are considered reactive and may only be used when one of the options in table 902 B are employed. Those having an expansion of 0.35 percent and greater are prohibited.

TABLE 902 B

OPTION	ALKALI CONTENT OF CEMENT % max	REPLACE CEMENT WITH		SPECIFICATION
		MATERIAL	% BY WEIGHT	
1	1.50	Class F Fly Ash	15 – 25	M 295
2	1.50	Ground Iron Blast Furnace Slag	25 – 50	M 302 Grade 100 or 120
3	1.50	Microsilica	5 – 7	C 1240
4	—	Blended Cement (a)	100	M 240
5	0.60 (b)	Low Alkali Cement	100	M 85

(a) Pozzolan content of 15 – 25 percent by weight of cement
(b) For mix 9 used for Portland cement concrete pavement repairs; the maximum allowable percentage of alkalies in Portland cement shall be 0.70.

When reactive aggregate is used, designate which option will be used to control the formation of the ASR gel. If an option other than option 5 in Table 902 B above is chosen, conduct tests per MSMT 212 using the reactive aggregate and the proposed cementitious material. The expansion test results shall not be greater than 0.10 percent. When more than one reactive aggregate is used in a concrete mix, each shall be tested individually and the maximum amount of pozzolan required to reduce the expansion of all the aggregates to 0.10 percent or less shall be used. Submit the aggregate source, test results, and the percent and type of replacement cement to the Engineer. The Engineer may withhold source approval pending verification testing.

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TABLE 902 C

MIX PHYSICAL PROPERTIES		
TEST PROPERTY	**TEST METHOD**	**SPECIFICATION LIMITS**
Minimum Cementitious Materials Factor, lb/yd^3	—	580
Maximum Content of Portland Cement, lb/yd^3	—	550
Water/Cementitious Materials Ratio by Wt.	—	0.45
Corrosion Inhibitor, gal/yd^3	902.06.05	2.0
Synthetic Fibers, lb/yd^3	902.15	1.5
Permeability of Field Concrete, moving average of three tests, coulombs max	T 277 Modified	2500
Permeability of Field Concrete, individual test, coulombs max	T 277 Modified	3000
Shrinkage at 28 days, microstrains	C 157	400

Note 1: Only Type I or II Portland cement shall be used.

Note 2: Mixes shall contain ground iron blast furnace slag, fly ash or microsilica.

Note 3: The water to cement ratio shall be based upon the total water to cementitious materials ratio.
The gallonage of the corrosion inhibitor shall be included in the water/cementitious materials ratio.

Note 4: The permeability test value of field concrete shall be the average of two test specimens representing production concrete. Test specimens shall be molded on the project site in 4 x 8 in. molds conforming to M 205. Test specimens shall be handled under same conditions as compressive strength test specimens in conformance with C 31 for the first seven days. When seven days old, they shall be cured in a 100 F water bath for the remainder of the 28 day curing. The 28 day rapid chloride permeability of the specimens will be determined in conformance with T 277. Test for the geometry of test specimens will be waived.

Note 5: Shrinkage tests will be performed on trial mixes only.

Note 6: High range water reducing admixture may be used except the water reducing requirements will be waived.

Note 7: A sealer conforming to 902.12 shall be used on the finished surface.

902.10.04 Trial Batch. A trial batch shall be prepared to certify that each mix meets 902.10.05 and 902.10.06. Approval will be given when the test results meets the minimum required average strength.

Make arrangements with the AME at least two weeks in advance, to have an authorized representative present during the batching and testing. Each trial batch shall consist of at least 3 yd^3 of concrete. Supply all equipment, and labor required to produce the trial batches and conduct the required tests at no additional cost to the Administration.

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The AME may waive the requirement for a trial batch when past performance records show that the required average strength requirement has been met.

902.10.05 Design Required Average Strength.

Specified compressive strength, f_c', psi	Required average compressive strength, f_{cr}', psi
$f_c' \leq 5000$	Use the larger value computed from Eq. (A-1) and (A-2) $f_{cr}' = f_c' + 1.34s$ (A-1) $f_{cr}' = f_c' + 2.33s - 500$ (A-2)
Over 5000	Use the larger value computed from Eq. (A-1) and (A-3) $f_{cr}' = f_c' + 1.34s$ (A-1) $f_{cr}' = 0.90 f_c' + 2.33s$ (A-3)

where:

f_c' = the 28 day specified compressive strength.
s = the standard deviation as specified in 902.10.06.

A test is defined as the average strength of two companion cylinders.

902.10.06 Standard Deviation.

(a) When past performance records are available, a standard deviation will be established from documented performance records of the producer consisting of a minimum of 15 consecutive 28 day compressive strength tests obtained within the last 12 months.

The standard deviation will be established as the product of the calculated standard deviation and multiplier.

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NUMBER OF TESTS	MULTIPLIER FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

Interpolate for intermediate number of tests.

(b) When past performance records are not available, the required average strength shall meet to the following:

Specified compressive strength, f_c', psi	Required average compressive strength, f_{cr}', psi
$f_c' < 3000$	$f_{cr}' = f_c' + 1000$
$3000 \leq f_c' \leq 5000$	$f_{cr}' = f_c' + 1200$
$f_c' > 5000$	$f_{cr}' = 1.10 f_c' + 700$

902.10.07 Standard of Control. The average of all sets of three consecutive strength tests shall equal or exceed the critical value as specified in 902.10.03 which shall be computed using the following formula:

Critical Value = fc' + (1.14 X S) – 500

Failure to conform to this criteria shall be cause for immediate investigation and remedial action up to and including suspension of production. A design standard deviation equal to 15 percent of the specified strength shall be used for calculation until a minimum of 15 test results are obtained.

The actual average strength and standard deviation shall be computed upon the availability of 28 day strength data comprising a minimum of 15 tests. Should this determination indicate an excessive margin of safety, the concrete mix may be modified to produce lower average strength as approved by the Engineer. If these calculations indicate a coefficient of variation greater than 15, the quality of the concrete and testing will be evaluated.

902.10.08 Testing. Sampling per T 141. Testing as follows:

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TEST	METHOD	MINIMUM TEST FREQUENCY	RESPONSIBILITY
Temperature (e)	T 309	1 PER 50 YD^3 (OR FRACTION THEREOF)	PROJECT ENGINEER
Slump (a)(e)	T 119	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Air Content (a)(e)	T 152 T 196	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Compression (b)(c)(d)	T 23	1 per 50 yd^3 (or fraction thereof)	Project Engineer
Compression (b)(c)(d) Mix No. 7 Only	T 23	3 per Day	Project Engineer

(a) A second test will be made when the first slump or air content test fails. Acceptance or rejection will be based on the results of the second test.
(b) Compressive strength tests are defined as the average of two companion cylinders.
(c) The Contractor shall be responsible for the making of all early break cylinders and furnishing the molds, stripping, curing/delivery of all cylinders, including 28 day cylinders, to the testing laboratory.
(d) The Project Engineer will be responsible for making, numbering and signing the 28 day cylinders.
(e) When constructing plain and reinforced concrete pavements, the testing frequency for slump, air content, and temperature shall be 1 per 100 yd^3 or fraction thereof.

902.10.09 Acceptance. Concrete will be acceptable if both of the following requirements are met:

(a) The average of all sets of three consecutive strength tests equal or exceed the specified design strength.

(b) No individual strength test (average of two companion cylinders) falls below the specified design strength by more than 500 psi.

902.10.10 Price Adjustment. A price adjustment will be based on the Contract unit price per cubic yard of concrete. If the unit is a lump sum item, the price per cubic yard for the concrete will be determined by dividing the cubic yards into the Contract lump sum price.

(a) Test Results More Than 500 psi Below the Specified Design Strength. Failing strength tests will be considered individually with a price adjustment being applied on the percentage basis as shown below.

(Price per yd^3) X (quantity of yd^3 represented by the failing concrete strength) X (percent of failure).

Example:

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$400.00 per yd^3 X 50 yd^3 X [1-(3600/ 4500 psi)] = $4,000.00

No payment will be allowed when the test results fall below 50 percent of the specified design strength for structural concrete or 40 percent for incidental concrete.

The Engineer will determine when the strength of the concrete represented by the failing tests is sufficient to remain in place or whether it must be removed and replaced with Specification concrete.

(b) Test Results 500 psi or Less than the Specified Design Strength. Strength failures 500 psi or less than the specified design strength will be averaged with the next two consecutive tests. If those two tests include a failure greater than 500 psi, those tests will be evaluated as in 902.10.10(a) and replaced with the next consecutive test. If the resulting average falls below the specified design strength, a price adjustment will be applied as specified in the table below. Any failure will only be included in one grouping.

STRENGTH BELOW THE SPECIFIED (avg of 3 tests) DESIGN LEVEL, psi	**ADJUSTMENT FACTOR**
MIX NO. 1 THRU MIX NO. 7	
1 – 100	0.005
101 – 200	0.01
201 – 300	0.02
301 – 400	0.04
401 – 500	0.08

Adjustment price equals (price per yd^3) X (quantity of yd^3 represented by the failing cylinders) X (the adjustment factor).

Example:

$400.00 per yd^3 X 50 yd^3 X 0.01 = $200.00

902.11 MORTAR FOR GROUT. Mortar used for grouting anchor bolts, pipe, handrail posts, and miscellaneous items shall be composed in accordance with one of the following:

(a) One part Portland cement or blended hydraulic cement and one part mortar sand by dry loose volume.

(b) Prepared bag mixes consisting of Portland cement or blended hydraulic cement and mortar sand. The prepared mixes shall produce a mortar meeting the strength requirements specified in the Contract Documents.

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(c) Use nonshrink grout when specified. The grout shall have a minimum compressive strength of 5000 psi in seven days when tested as specified per T 106, except that the cube molds shall remain intact with a top firmly attached throughout the curing period. The nonshrink grout shall have a minimum expansion of 0.0 percent after seven days when tested as specified per T 160.

(d) Epoxy grout shall consist of sand and epoxy mixed by volume in per the manufacturer's recommendations. The grout shall be capable of developing a minimum compressive strength of 6500 psi in 72 hours when tested per MSMT 501. Sand for epoxy grout as specified in 901.01.

(e) An epoxy or polyester anchoring system may be used when approved by the Engineer in accordance with the manufacturer's recommendations. Strength values shall be as specified in the Contract Documents.

902.12 LINSEED OIL. Shall consist of a 50-50 mixture (by volume) of boiled linseed oil meeting Federal Specification TT-L-190 and kerosene per D 3699.

902.13 LATEX MODIFIED CONCRETE. Portland cement concrete containing prequalified Laboratory approved styrene butadiene latex emulsion is defined as Latex Modified Concrete (LMC).

Latex emulsion shall have a minimum of 90 percent of the nonvolatiles as styrene butadiene polymers. The latex emulsion as specified in Table 902.13 A. The material shall be stored in suitable containers and be protected from freezing and exposure to temperatures in excess of 85 F.

LMC shall be proportioned using volumetric mixing and designed as follows:

LATEX MODIFIED CONCRETE	
MATERIAL	**SPECIFICATION LIMITS**
Portland Cement, CWT/yd^3, min	6.6
Latex Emulsion/Cement Ratio	0.31 – 0.34
Water/Cement Ratio, max	0.22
Entrained Air, %	6.0 ± 3
Slump, in.	5 ± 1

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The physical properties of LMC shall conform to Table 902.13 B. The Contractor shall furnish the necessary 3 X 6 in. molds per M 205 to be used for the fabrication of compressive strength cylinders.

Control and Acceptance Sampling.

(a) Submit a two qt minimum sample, of the styrene butadiene latex emulsion to the AME daily for each lot of material used in a day's production.

(b) A batch for LMC is defined as the capacity of the equipment being used on the project. Slump and air samples will be taken and tested before the placement of a batch is permitted. The slump shall be measured four to five minutes after discharge from the mixer. The test material shall be deposited off the deck and not be disturbed during this waiting period. One additional sample for slump and air will be taken randomly during the placement of each batch. For seven day compressive strength, two tests each per batch are required. A test is defined as consisting of two companion cylinders. The samples for these tests will be taken at random while the placement is in progress.

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TABLE 902.13 A
REQUIREMENTS FOR CHEMICAL PROPERTIES OF LATEX EMULSION MATERIALS

PROPERTY	SPECIFICATIONS		QUALITY ASSURANCE TESTS	
	LIMITS	TOLERANCE	PREQUALIFICATION TESTS	CONTROL AND ACCEPTANCE
Color	White	—	X	X
pH	9.0 – 11.0	—	X	X
Weight, lb/gal	8.40 – 8.47	—	X	X
Solids Content, %	46 – 53	—	X	X
*Butadiene Content, % of polymer	30 – 40	—	—	—
Viscosity @ 10 rpm-cps	Match Original	± 20	X	X
*Surface Tension, dynes/cm max	50	—	—	—
*Mean Particle Size, polymer – Å	1400 – 2500	—	—	—
Coagulum, % max	0.10	—	X	X
*Freeze-Thaw Stability, coagulum, % max	0.10	—	X	X
Infrared Spectra of Latex Film	Match Original	—	X	X
Infrared of Alcohol, Soluble Portion of Latex	Match Original	—	X	X
Shelf Life, min	1 yr	—	X	—

Note 1: Quality assurance tests shall be conducted as specified in MSMT 612 except those denoted by an * shall be conducted as specified in FHWA RD – 78-35.

Note 2: The original or prequalification sample shall be accompanied by the producer's certification on all of the tests and properties noted above and as specified in TC-1.03. The certification shall contain actual test values of the product and the infrared spectrograph.

Note 3: A separate certification is required for each lot of material. The certification shall note the date of manufacture, lot size, and whether or not the material is identical to the formulation of the original sample.

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TABLE 902.13 B

LATEX MODIFIED CONCRETE PHYSICAL PROPERTIES			
TEST PROPERTY	TEST VALUES	QUALITY ASSURANCE TESTS	
		PREQUALIFIED TESTS	CONTROL AND ACCEPTANCE
7 Day Compressive Strength, psi min	3000	X	X
28 Day Compressive Strength, psi min	3500	X	—
42 Day Compressive Strength, psi min	3500	X	—
7 Day Flexural Strength, psi min	550	X	—
28 Day Flexural Strength, psi min	650	X	—
42 Day Shear Bond Strength, psi min	2000	X	—
Durability Factor, 300 cycles, % min	85	X	—
Chloride Permeability, Ppm max	510	X	—
Scaling Resistance, 50 cycles, max	3	X	—

Note 1: Quality assurance tests shall be conducted as specified in MSMT 721.

Note 2: Seven Day Compressive Strength Test will be used for Control & Acceptance of the material. The minimum specified design strength is 3000 psi at seven days. The mix design approval and acceptance will be based on a coefficient of variation of 10 percent with a probability of 1 in 10 tests falling below the specified strength. Only test values 80% or greater than the specified strength will be accepted

902.14 RAPID HARDENING CEMENTITIOUS MATERIALS FOR CONCRETE PAVEMENT REPAIRS. Materials shall be a dry, packaged cementitious mortar having less than 5 percent by weight of aggregate retained on the 3/8 in. sieve and meet the following requirements:

Classification.

Class I — For use at ambient temperatures below 50 F.
Class II — For use at ambient temperatures of 50 to 90 F.
Class III — For use at ambient temperatures above 90 F.

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Chemical Requirements. C 928 except that no organic compounds such as epoxy resins or polyesters as the principal binder.

Physical Requirements. Meet the following when tested per MSMT 725:

COMPRESSIVE STRENGTH, psi min				
CLASSIFICATION	**< 2 hr**	**2-6 hr**	**6 hr**	**28 days**
Type I — Slow	—	—	2000	4500
Type II — Rapid	—	2000	—	4500
Type III — Very Rapid	2500	—	—	4500

TEST RESULTS	
TEST PROPERTY	**LIMITS**
Bond Strength, 7 days, psi min	2000
Length Change, increase after 28 days in water, based on length at 3 hr, % max	+ 0.15
Length Change, decrease after 28 days, % max	- 0.15
Freeze Thaw, loss after 25 cycles in 10% $CaCl_2$ solution, % max	8
Initial Setting Time, minutes min	10

Marking. All packages delivered to the project shall be marked with the following information:

(a) Date material was packaged.

(b) Approximate setting time.

(c) Recommended dosage of water or liquid component.

(d) Mixing instructions.

(e) Class or temperature range.

Certification. The manufacturer shall furnish certification as specified in TC-1.03 showing the actual test results for each class and type of material submitted to the Laboratory.

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902.15 SYNTHETIC FIBERS. When synthetic fibers are specified in the Contract Documents, the fibers shall be 1/2 to 1-1/2 in. long and conform to C 1116, Type III. The manufacturer shall furnish certification as specified in TC-1.03. The quantity of fibers used and their point of introduction into the mix shall conform to the fiber manufacturer's recommendations.

902.16 CONTROLLED LOW STRENGTH MATERIAL.

902.16.01 Usage. Controlled Low Strength Material (CLSM) shall consist of the types described below:

TYPE A – Used where future excavation of the CLSM may be necessary (e.g. utility trenches, pipe trenches, bridge abutments, and around box culverts).

TYPE B – Used where future excavation of the CLSM is not anticipated (e.g. filling abandoned conduits, pipes, tunnels, mines, etc. and replacing unsuitable soils below roadway and structure foundations where extra strength is required).

902.16.02 Materials.

Coarse Aggregate	901.01*
Fine Aggregate	901.01
Cement	902.03 and 902.04
Concrete Admixtures	902.06
Fly Ash	902.06.04
Water	921.01

*maximum size of 3/4 in.

Produce CLSM in conformance with the applicable portions of Section 915 and the following:

902.16.03 Proportioning. Submit the sources and proportions of materials, and test data for each CLSM mixture prior to construction. CLSM shall be proportioned, on the basis of field experience and/or laboratory trial mixtures, to produce a flowable and self-compacting mixture meeting the requirements of 902.16.04.

CLSM shall be proportioned by weight; with the exception of water and chemical admixtures. Water and chemical admixtures may be proportioned by volume or weight.

902.16.04 CLSM Mixtures. Proportion CLSM with sufficient amounts of Portland cement, fly ash, or ground granulated blast furnace slag; individually or in combination, to produce a cohesive, non-segregating mixture that conforms to the physical properties in the following table:

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CLSM Mix	28 Day Compressive Strength, (psi) ASTM D4832	Flow Consistency, (in.) ASTM D6103
Type A	50 - 200	8 min.
Type B	500 min.	8 min.

SECTION 904 — PERFORMANCE GRADED ASPHALT BINDERS AND HOT MIX ASPHALT

Performance Graded Asphalt Binders and Hot Mix Asphalt shall be in accordance with SHA Section 904 unless otherwise noted herein.

Delete all references to TC-1.03 and use General Conditions Section GC-6.05.

SECTION 905 — PIPE

All pipe for similar installation (e.g. water or sewer) on any one contract shall be of the same material and from the same manufacturer unless otherwise noted on the plans or specifications. Each pipe length shall clearly be marked with the manufacturer's name and trademark.

Pipe and fitting materials specified herein shall be subject to compliance with requirements set forth in Category 1000.

During installation, Contractor shall provide watertight night bulkheads to suit pipe materials in order to keep pipe clear of dirt, debris, water and animals.

905.01 POLYVINYL CHLORIDE (PVC) PIPE.

905.01.01 PVC Pipe And Fittings For Roadway Projects.

(a) PVC pipe on bridges shall meet the requirements of AASHTO Bridge Section 18PVC Ribbed Pipe.

(b) Underdrain outlet pipe shall meet the requirements of AASHTO M278.

(c) Perforated underdrains shall meet the requirements of AASHTO M278.

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(d) PVC Profile Wall Pipe shall meet the requirements of AASHTO M304 for sizes 4-inch to 48-inch.

905.01.02 PVC Pipe And Fittings For Sanitary Sewers.

PVC gravity sewer pipe shall meet or exceed the requirements of:

(a) ASTM D3034 "Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings", minimum SDR 35.

(b) ASTM F794 "Standard Specification for Polyvinyl Chloride (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter". [Pipe 15-inch through 30-inch]

(c) Pipe with blisters, bubbles, cuts or scrapes on inside or outside surfaces, which appreciably damage the wall thickness, or other imperfections which impair the performance or life of the pipe, will be rejected.

(d) Pipe shall be made of PVC plastic having a cell classification of 12364-B as defined in ASTM D1784.

(e) The pipe shall be made and joined with an integral bell, bell and spigot rubber gasket joint. Each integral bell joint shall consist of a formed bell complete with a single rubber gasket. Gaskets shall conform to ASTM F477 and shall meet ASTM D3312 .

(f) Pipe shall be supplied in the sizes noted on the plans and shall be furnished in standard laying lengths of 13 and 20 feet.

(g) Each piece of pipe shall have the material, size, pressure class designation, dimension ratio, manufacturer's name and production record code conspicuously painted on it as near as possible to the flanged or bell end of the pipe and these designations shall be clearly legible.

(h) All pipe sections between two manholes or two structures shall be of the same material, size, and of the same manufacturer.

(i) PVC wye branches, laterals, pipe stoppers, and other fittings shall be manufactured in accordance with the same specifications, and have the same thickness, depth of socket, and annular space as the pipe. Wye branches shall be complete pipe sections. Saddles will not be permitted for new construction. Gaskets shall conform to ASTM F477. All PVC fittings shall be SDR 35.

(j) Elastomeric couplings may be used, with the approval of the Department of Public Works, for joining sections of gravity sewer for purposes of connection or repair. The couplings may be used for size to size (standard), material to material

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(transition), or varying size (reducing) connections. Couplings shall meet the requirements of ASTM C 1173, ASTM D 5926, and ASTM CSA B602. Couplings shall be made from flexible PVC, shall have stainless steel shear ring of no less than .012 inch thickness, and shall be supplied with stainless steel worm gear clamps.

(j) Elastomeric couplings may be used, with the approval of the Department of Public Works, for joining sections of gravity sewer for purposes of connection or repair. The couplings may be used for size to size (standard), material to material (transition), or varying size (reducing) connections. Couplings shall meet the requirements of ASTM C 1173, ASTM D 5926, and ASTM CSA B602.
Couplings shall be made from flexible PVC, shall have stainless steel shear ring of no less than .012 inch thickness, and shall be supplied with stainless steel worm gear clamps.

905.01.03 PVC Pipe and Fittings for Storm Water Management

PVC pipe and fittings used in Environmental Site Design features shall be in accordance with the requirements of AASHTO M304.

905.01.04 PVC Pressure Pipe.

All PVC pressure pipe shall be unplasticized polyvinyl chloride normal impact type in conformance with ASTM D1784.

(a) Pressure Pipe Less Than 2-Inch. All PVC pressure pipe less than 2-inch shall be solvent welded. All solvent welded pipe shall be schedule 40 and meet the requirements of ASTM D1785. Solvent cement shall be purchased from the pipe manufacturer. It shall be compounded to conform with the socket fit, weather conditions at the time of installation and make a joint of maximum strength. Solvent cement shall meet the requirements of ASTM D2564. Primer shall meet ASTM F656.

PVC fittings shall be Schedule 80 in accordance with ASTM D2466.

(b) Pressure Pipe from 2-inch to less than 4-inch. All pressure PVC pipe shall be gasketed pipe, conforming to the requirements of ASTM D2241 and have a minimum SDR of 21. Gaskets shall conform to the requirements of ASTM F477.

All fittings and pipe shall be manufactured in one piece of injection molded PVC compound meeting ASTM D1784. Fittings shall be Class 200 and shall be designed to withstand a minimum of 630 psi quick burst pressure at 73 degrees F., tested in accordance with ASTM D1599.

(c) Pressure Pipe 4-Inch and Greater

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(1) Pipe, Fittings, and Joints

All polyvinyl chloride (PVC) pipe, fabricated fittings, and couplings shall be manufactured and tested in accordance with AWWA C900, minimum DR18, for 4-inch through 12-inch diameter pipe and AWWA C905, minimum DR18 for 14-inch through 30-inch diameter pipe. Third-party certification (listing) by Underwriters Laboratory (UL) shall also be required for all PVC pipe. PVC pipe manufactured more than one year prior to work being installed will not be accepted.

All products shall be homogeneous throughout and free from visible cracks, bubbles, blisters, holes, foreign inclusions, cuts, or scrapes on inside or outside surfaces, or other imperfections, which may impair the performance or life of the pipeline. Each pipe shall be straight to within 1¼ inch per 20-foot length of pipe when uniformly supported along its entire length, and shall have a true circular cross-section to within +/- 1/64 inch.

All tee fittings for use with PVC mains shall be ductile iron, in accordance with Section 905.10 and shall be exterior epoxy coated in accordance with AWWA C116, or PVC. PVC fittings shall have push on rubber gasketed joints, be injection-molded meeting AWWA C907 (4-inch through 12-inch), Pressure Class 150 or higher; or fabricated meeting AWWA C900 (4-inch through 12-inch), Pressure Class 200, or fabricated meeting AWWA C905 (14-inch through 48-inch), Pressure Class 150 or higher. Pipe joints shall be in accordance with the standards specified for the pipe and fittings.

All metallic fittings and appurtenances used with PVC water piping meeting the requirements of AWWA C-900 or AWWA C-905 shall be cathodically protected. Anodes shall be sized for the intended application by a NACE certified corrosion engineer and installed in accordance with the specifications. Generally zinc anodes shall be installed on stainless steel fittings and appurtenances, magnesium anodes shall be installed on ferrous fittings and appurtenances.

All 4-inch and larger PVC pipe shall be manufactured with integral bell and spigot joints which shall utilize elastomeric gaskets conforming to ASTM F477. All pipe ends shall be beveled to accept the gasketed fittings. Gaskets for push on joints and mechanical joints for joint connections between pipe and metal fittings, valves and other accessories shall be as specified in AWWA C111/A21.11 for push on joints and mechanical joints. All PVC pressure pipe shall be factory marked on the spigot end for depth of insertion into the bell and factory tested in accordance with AWWA C900.

All records for Quality Control and Qualification Test Requirements noted in Section 5.1 of the AWWA Standard C900 for PVC pressure pipe shall be submitted with the pipe material certifications or shop drawings prior to

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approval of the material for use on PVC water mains. The test records shall be for the pipe to be installed on the specified project. All PVC pipe shall contain markings to allow cross referencing of the pipe supplied to the test records received.

PVC 5-degree sweeps and PVC high-deflection couplings may be used to facilitate changes in direction on 8-inch and smaller PVC water mains. PVC 5-degree sweeps and PVC high-deflection couplings may be used on 12-inch PVC water mains with the approval of the Department of Public Works. Where 5-degree sweeps or high defection couplings are permitted for use, bell stops shall be used to prevent over insertion of the spigot into the bell. PVC 5-degree sweeps shall be bell by spigot, rated for a minimum 225 psi, DR18 meeting the requirements of AWWA C900. PVC high deflection couplings shall be rated for a minimum 200 psi meeting the requirements of AWWA C900, shall have a minimum lay length of 9inches and shall have center stops. The bell stop shall be manufactured of ductile iron and incorporate an expansion retention spring to allow for pipe expansion and contraction for C905. Pipe, gaskets, and lubricant shall be suitable for potable water systems and shall meet National Sanitation Foundation (NSF) 61.

(2) Restrained Joints

(i) All joint restraint devices shall be coated to provide corrosion resistance. All coatings shall be impact and UV resistant.

(ii) In restrained joints, PVC pipe shall not be deflected. If deflection is required in a restrained joint, a wide-angle sweep or fitting shall be used with approved restraints, or use ductile iron pipe fittings with restraints.

(iii) Where a restrained joint is required between PVC pipe and a fitting (or valve), the fitting shall be ductile iron mechanical joint. Joint restraint devices shall be Factory Mutual (FM) or Underwriter Laboratories (UL) approved and shall met meet ASTM F1674. Joint restraint shall be mechanical joint restraint gland. The restraint mechanism shall consist of a plurality of individually activated gripping surfaces to maximize restraint capability. Glands shall be manufactured of ductile iron conforming to ASTM A536. The gland shall be such that it can replace the standard mechanical joint gland and be used with a standard mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53. Twist off nuts, sized same as t-head bolts, shall be used to insure proper actuating of the restraining device. The restraining gland shall be pressure rated equal to that of the pipe on which it is used. The restraining glands shall have been tested to and meet the requirements of ASTM F1674.

(iv) Where a restrained joint is required for PVC push-on joint, the joint restraint shall be split serrated restraint harness on both side. It shall be comprised of

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two split serrated restraint rings; one on the plain end or spigot of pipe and the other behind the bell. The two rings shall be connected by multiple tie bolts with threaded ends and retaining nuts. Components shall be constructed of ASTM A536 ductile iron. The harness shall have a minimum working pressure rating equivalent to the pipe.

(d) Pipeline Detection System

(1) Tracer Wire

Tracer wire shall be insulated 6-gage, stranded continuous copper wire with a 45mil polyethylene insulation. The wire shall be blue, have "UL" markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connections with a water proof binder and underground electrical tape.

(2) Continuity Test Station

Continuity test stations shall be located adjacent to each fire hydrant within the public easement for locating PVC water mains. The test station shall be housed in a standard Howard County 18-inch diameter meter vault with an 18x12-inch metal frame and cover labeled as “Test Station”. A 1-inch diameter by 30-inch long copper grounding rod imbedded a minimum of 12 inches into the ground shall be used for the attachment of the tracer wire. The tracer wire shall be fastened to the copper rod using two copper clamps.

(e) Connection to PVC waterlines

(1) Connections to PVC waterlines shall be by using fittings, such as tees, indicated on the Contract Documents.

(2) Saddles for 2-inch and smaller house connections shall be as specified in paragraph 961.08.09.

(3) Tapping sleeves for PVC pipe larger than 2-inches shall be as specified in paragraph 961.05.

905.01.06 Submittals for PVC Piping

The following items shall be submitted for review and approval prior to installation. Materials not approved will not be accepted.

(a) PVC Pipe:

Submit manufacturer's literature and certificates of compliance for PVC pipe along with the manufacturer's identification codes for nominal size, dimension

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ratio, pressure class, production record code and date of manufacture. Submit manufacturer's written transcript of test results, for sustained pressure, pipe dimension, burst pressure, flattening resistance, and extrusion quality test. Frequency of performing the tests and the methods of selecting test specimens shall be in accordance with AWWA C900.

(b) PVC Pipe Fittings:

Submit manufacturer's literature and certificates of compliance for PVC pipe fittings along with the manufacturer's identification codes for nominal size, pressure class, production record code and date of manufacture. Submit manufacturer's written transcript of results for accelerated-regression test, burst pressure and heat-reversion test in accordance with AWWA C900 or C907.

(c) Miscellaneous for PVC pipe:

Submit manufacturer's literature and certificates of compliance, for joint restraint devices, pipe couplings, tracer wire, wire connector splice kits, detection tape, and service saddles.

(d) Installation:

Submit manufacturer's installation instructions for PVC pipe and fittings, joint restraint devices, pipe couplings, wire connector splice kits, service saddles, and manufacturer's instructions for tapping pipe.

905.02 HIGH DENSITY POLYETHYLENE (HDPE) PIPE.

905.02.01 HDPE Pipe for Storm Drains.

HDPE pipe shall meet the requirements of AASHTO M 252 (Standard Specification for Corrugated Polyethylene Drainage Pipe 3-inch to 10-inch diameter) or M 294 (Standard Specification for Corrugated Polyethylene Pipe 12- to 60-in diameter). Maximum diameter for HDPE drainage pipe and fittings shall be 48-in. HDPE pipe shall have connections limited to bell and spigot or bell/bell couplings with gaskets. Couplings must be interchangeable with different manufacturer's pipe and provide a soil tight connection. Installation shall conform to ASTM D2321. Corrugated HDPE pipe shall be used for perforated underdrain and underdrain outlet pipes. HDPE end sections shall conform to the same material qualities as the HDPE pipe. Maximum diameter HDPE end section shall be 24-inch.

905.02.02 HDPE Pipe for Water Mains and Sanitary Force Mains.

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HDPE pipe and fittings shall be supplied in accordance with AWWA C906. The pipe and fittings shall be from the same manufacturer. Directionally drilled pipe shall be installed in conformance with the requirements in Section 1016.

The high density polyethylene pipe and fittings shall be made of Extra High Molecular Weight (EHMW) high density polyethylene with a standard thermoplastic material designation code of PE 3408/3608. The pipe shall conform to ASTM 3350 with a cell classification of 345464C. The manufacturer shall certify that all materials used to manufacture the pipe and fittings have been evaluated, tested and certified for conformance in accordance with NSF 61. All HDPE water pipe shall be manufactured with three equally spaced pairs of blue stripes. Pipe and fittings shall be manufactured to ductile iron outside diameter requirements and shall be minimum DR11 rated at 160 psig.

All joints shall be subject to requirements delineated in Section 1002. All HDPE fittings shall be of the type indicated on the Contract Documents or specified. They shall be of the same material and fully pressure rated to meet or exceed the pressure rating of the pipe.

HDPE mechanical joint adapters for making connections to mechanical joint fittings and valves shall be acceptable. The adapter shall provide for a restrained joint. The adapter shall be suitable for connecting to any ANSI/AWWA C153 ductile iron fitting or valve and comply with AWWA 906.

Service connections 2-inch and smaller shall be by service tapping saddles made with electrofusion fittings as manufactured in accordance with ASTM F1055.

905.02.03 Submittals for HDPE Piping.

The following items shall be submitted for review and approval prior to installation. Materials not approved will not be accepted.

(a) HDPE Pipe

Submit manufacturer's literature and certificates of compliance for HDPE pipe along with the manufacturer's identification codes for nominal size, dimension ratio, pressure class, production record code and date of manufacture. Submit manufacturer's written transcript of test results, for bend-back, sustained pressure, pipe dimension, quick burst pressure, and melt-flow index. Frequency of performing the tests and the methods of selecting test specimens shall be in accordance with AWWA C906.

(b) HDPE Pipe Fittings:

Submit manufacturer's literature and certificates of compliance for HDPE pipe fittings along with the manufacturer's identification codes for nominal size, pressure class, production record code and date of manufacture. Submit

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manufacturer's written transcript of results for burst pressure and melt-index tests in accordance with AWWA C906.

(c) Miscellaneous for HDPE pipe:

Submit manufacturer's literature and certificates of compliance, for joint restraint devices, pipe couplings, tracer wire, wire connector splice kits, detection tape, and service saddles.

(d) Installation

Submit manufacturers' installation instructions for HDPE pipe and fittings, joint restraint devices, pipe couplings, wire connector splice kits, service saddles, and manufacturer's instructions for tapping pipe.

905.03 NON-REINFORCED CONCRETE PIPE. Non-Reinforced Concrete Pipe Shall Only Be Used On Roadway Projects And Shall Conform To The Requirements Of AASHTO M86, Class 3.

905.04 REINFORCED CONCRETE PIPE (RCP).

905.04.01 RCP and Fittings for Storm Drains.

RCP and fittings shall meet the requirements of ASTM C76 and C361. The fabrication of y-laterals, tees, and bends shall be to the angle shown. The interior shall permit smooth and even flow of liquid. Concrete end sections shall conform to AASHTO M170.

905.04.02 Pre-stressed Concrete Cylinder Pipe (PCCP) for Water Mains.

All concrete pressure pipe furnished shall be pre-stressed concrete cylinder pipe, manufactured, tested and installed in accordance with the latest revisions of AWWA C301, AWWA C304, AWWA Manual M9, and as specified herein. The pipe shall be furnished complete with gaskets, grout bands, and lubricant as required for proper installation and completion of the line. Pipe shall be designed for a combination of internal working pressure with a surge allowance, and earth covers as shown on the Contract Documents or as specified in the Special Provisions. It shall be the Contractor's responsibility to verify dimensions of all pipes, valves, special castings and fittings so that all of the pipe work performed will fit together properly, and will conform to the arrangements shown on the Contract Documents.

(a) Submittals

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(1) PCCP water mains shall be designed by a certified Professional Engineer licensed in the State of Maryland and employed and paid for by the pipe manufacturer. Manufacturer's design calculations for all pipe and material furnished under this section shall be submitted to the Engineer. Calculations will be submitted for information only.

(2) Certified design drawings and pipe lay schedules for the PCCP water mains shall be submitted. Drawings signed and sealed by the Manufacturer's Professional Engineer shall be submitted for information only. The design drawings must maintain horizontal and vertical alignments as established on the Contract Documents. Curves using bevels will be considered in the layout submittal. Design drawings shall indicate deviations or other differences in alignment from the Contract Documents. Lay schedules shall include the following:

(i) Quantities and laying lengths of each piece.

(ii) Centerline stations and offsets with respect to the Project baseline at each change in horizontal or vertical geometry.

(iii) Centerline elevation with respect to horizontal between each change of elevation.

(iv) Centerline elevation referenced to Project vertical datum at each change in horizontal geometry and grade.

(3) Marking Schedule: Marks to be used on the finished materials to identify pipes, fittings, specials, and accessories shown on shop drawings and laying schedules.

(4) Affidavit of Compliance: Furnish affidavit described in AWWA C301.

(5) Quality Assurance Reports:

(i) Mill certificates and physical property test reports for cylinder and joint ring steel.

(ii) Hydrostatic test reports for each cylinder/joint ring assembly.

(iii) Mill certificates and physical property test reports for prestressing wire and splices. Include certificates or reports for tension, torsion and splitting tests for wire.

(iv) Mill certificates and Physical and Chemical properties (ASTM C150) for each shipment of cement.

(v) Compressive strength test reports for concrete.

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(vi) Concrete slump tests (ASTM C143) and temperature tests for 1st batch placed each day and every 100 cubic yards for each class of concrete.

(vii) Absorption test reports for mortar coating.

(viii) Physical property test reports for rubber gasket material.

(ix) Final inspection report for finished pipe.

(x) Test Specimens: Furnished from steel for cylinders, joint rings, and prestressing wire and from rubber cord for gaskets when requested by the Engineer.

(b) Materials:

All materials shall be new.

(1) Portland Cement: ASTM C150, Type II.

(2) Coarse and Fine Aggregate: ASTM C33 containing no more than trace amounts of limestone.

(3) Natural pozzolan, fly ash, or silica fume shall not be allowed for use.

(4) Where required or shown, the Contractor shall provide specials. Specials shall in general consist of spool pieces, closure, less than standard lengths of flanged, spigot end, or bell end pipe, or combination of ends, and non-standard fittings. The specials shall conform in material, thickness and finish to the pipe in which they are installed.

(5) Restrained Joints:

Restrained joints shall be provided where shown on the Contract Documents and required by the pipe design. Their design, application and layout shall be performed by Contractor in conformance with the criteria set forth in the Contract Documents and AWWA Manual M9. Restrained joints shall be capable of resisting the thrust forces developed and based on test pressures identified on the Contract Documents or in the Special Provisions. Welded type joints shall not be allowed. Contractor shall submit design calculations in accordance with submittals subparagraph above.

Threaded fasteners which are to be surrounded by grout bands and totally encased in cement grout shall be zinc plated. Threaded fasteners not so surrounded and encased shall be stainless steel conforming to ASTM F593 and F594, Type 316 or 316L.

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Joints subjected to thrust due to internal pressure or installation of pipe on steep slopes shall not transmit force to concrete core. Thrust shall be transmitted through the steel cylinder and across restrained joints.

(6) Outlets shall be installed where shown on the Contract Documents. All outlets shall be located in full or short lengths of pipe, not in beveled sections of pipe. The outlet shall be integrally connected to the pipeline section during the manufacturing of the pipe section and terminate in a plain end or joint type consistent with the type of pipe connecting to the PCCP, as shown on the Contract Documents or required to complete the work. Outlets shall be sized as shown on the Contract Documents.

(7) "Follower Ring" type closures shall be used in non-harnessed sections and field welded closures shall be used in restrained joint sections, unless otherwise authorized by the Engineer, and shall be located in straight runs. Closure pieces shall be fabricated by the pipe manufacturer based on exact field measurements.

(8) Protective Coatings:

(i) All exposed steel materials in contact with potable water shall be cleaned in accordance with SSPC-SP 6 Commercial Blast Cleaning and coated with two coats of manufacturer's standard epoxy paint with 24 mil DFT (12 mil each coat). Paint shall be suitable for contact with potable water and in accordance with NSF Standard 61.

(ii) Internal pipe joints shall be grouted.

(c) Tests, Examinations, and Inspections

(1) All tests and fabrication shall be witnessed and certified by an independent, qualified, engineering inspection firm that is approved by the Howard County Department of Public Works. The firm's representative providing the certification shall be under the direct supervision of an engineer registered in the State of Maryland and shall be on-site at all times during testing of materials and fabrication of all the pipe to be supplied for the project. The engineering inspection firm's services shall be provided by the Contractor at no additional cost to the County but the firm shall report directly to the County.

(2) Materials and items previously checked with equipment found to be out of calibration or adjustment shall be considered unacceptable until it can be determined that all applicable requirements have been met.

(3) The manufacturer shall maintain records of all required tests and inspections. These records shall include documents such as records of

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materials, manufacturing, examination, repairs, and test data taken before and during fabrication. The Engineer reserves the right to request specific data be included in a report which may not otherwise be included. Whenever tests and examinations are performed on a pipe element or pipe, the appropriate identification number shall be shown on the report. Copies of all reports of tests by the manufacturer, independent laboratory, or material suppliers shall be given to the Engineer in such forms as to be appropriate for permanent records. The Engineer shall have access to all records of tests and inspections related to pipe manufactured for use in the Contract.

(4) Calibration of test equipment: Calibrate test equipment not later than the beginning of the manufacture of the pipe in this Contract and not more than at each 12 month interval or whenever the accuracy of the test equipment is suspect.

(5) Certification of Materials

Prior to acceptance of finished pipe, the manufacturer shall submit for the Engineer's information only, Certified Material Test Reports for the following materials: aggregates; cement; admixtures; wire mesh; reinforcing rod; prestress wire; steel sheet, plate and shapes; joint rings; bolts; lugs and gaskets. The Certified Material Test Reports shall show the actual results of all required chemical analyses, physical tests, examinations and heat treatments, including times and temperatures.

(6) Concrete and Mortar Mix Design

The manufacturer shall submit concrete and mortar mix designs for the permanent records of the Engineer, prior to fabrication of pipe.

(7) Fabrication Testing and Examination

In addition to AWWA C301, manufacturer shall perform tests and inspections as identified herein.

Prestressing wire tests

The PCCP manufacturer shall certify the Annual Qualification Testing of ASTM A648 prestressing wire has been successfully performed before pipe manufacturing may begin.

Perform physical testing on one (1) out of five (5) coils for tension, torsion and splitting in conformance with ASTM A648.

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No pipe shall contain more than one wire splice in addition to the splice joining the end of one wire reel to the next wire reel. No pipe shall be wrapped with more than one size of wire.

Protective Coatings: Check application rate and resulting dry film thickness daily.

(8) Final Inspection

After placement and curing of the concrete, the completed pipe shall be subject to inspection by the Manufacturer. This examination shall include, but not be limited to:

(i) Joint ring dimensions and roundness (manufacturer shall provide templates, if necessary).

(ii) Cracks, delaminations, dents, chips, voids, unbonded areas, spalls, joint depth, inside diameter, or other irregularities etc. needing repair.

(iii) Marking and identification provided in accordance with AWWA C301.

(iv) Test the pipe in accordance with the Proof of Design Test specified in AWWA C301. Test caps or plugs shall be attached to the sample pipes using standard rubber gaskets. At the conclusion of the test, there shall be no visible cracks in the mortar coatings, no indication of seepage through the pipe wall, and no visible leakage at pipe joints. Should any of the test pieces fail, the Engineer shall be notified, in writing, of such failure, within 24 hours. Once notified, the Engineer may at his option elect to increase the frequency of testing and/or reject any previously manufactured pipe.

(v) Final Inspection: Each finished pipe, fitting, and special shall be inspected and tested to the requirements identified herein and AWWA C301. Only those items that are in compliance shall be marked "Approved for Shipment". Pipe found to be defective shall be rejected.

(9) After shipment to the job site and prior to installation, the pipe shall be inspected by the Engineer for cracks, delaminations, spalls or other defects. In addition, the coating will be "sounded" using a ball peen hammer having a head weight of not more than one pound, over its entire exterior surface at the spacing of approximately one foot both circumferentially and longitudinally to locate any hollow or dummy areas which would indicate a delamination or void. In the opinion of the Engineer, pipe found to be defective shall be rejected and shall be removed from the job site.

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905.04.03 Reinforced Concrete Arch Pipe.

Reinforced concrete arch pipe shall meet the requirements of AASHTO M206.

905.04.04 Reinforced Concrete Elliptical Pipe.

Reinforced concrete elliptical pipe shall meet the requirements of AASHTO M207.

905.05 CORRUGATED METAL PIPE. Corrugated metal pipe shall meet the requirements of AASHTO M36 and shall only be used for driveway culverts.

905.06 POLYETHYLENE PRE-COATED CORRUGATED STEEL PIPE. Polyethylene pre-coated corrugated steel pipe shall meet the requirements of AASHTO M245 and M246, except that the coating shall have a minimum thickness of 10 mil on each of the surfaces.

905.07 ALUMINIZED CORRUGATED METAL PIPE. Aluminized corrugated metal pipe (ACMP) shall meet the requirements of AASHTO M274. The minimum allowable gauge under County roadways shall be 14 except under entrances where 16 is allowable provided that the appropriate support data is submitted. All piping shall be supported using the Ph/Resistivity test described in the Volume I Design Manual. The use of 12 gauge or thicker ACMP will preclude the need for support data. Pipe shall have a maximum diameter of 48-inches. ACMP shall only be used on enclosed storm drain systems.

905.08 CORRUGATED ALUMINUM ALLOY PIPE. Corrugated aluminum alloy pipe shall meet the requirements of AASHTO M196. This pipe shall only be allowed on a case by case basis as described in the Volume I Design Manual.

905.09 STRUCTURAL PLATE FOR PIPE, PIPE ARCHES AND ARCHES. Structural plate for pipe, pipe arches and arches shall meet the requirements of AASHTO M167.

905.10 DUCTILE IRON PIPE AND FITTINGS (WATER MAINS)

(a) Ductile Iron Pipe (D.I.P.) shall be for 4-inch diameter and larger. Pipe shall be in accordance with all the requirements of ANSI/AWWA C151/A21.51 except that

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the metal thickness shall be as described herein. Pipe nominal lengths may be 16 feet through 20 feet. All pipe and fittings shall be designed and constructed to withstand all external pressure caused by overburden, as indicated on the profile, and traffic loads to which the pipe may be subjected. All D.I.P. shall have a minimum of 150 psi working pressure. The special thickness class shall be Class 54 or as shown on the Contract Documents or in the Special Provisions. Pipe shall be bituminous coated outside with double cement lining inside. Flanged building piping shall be in accordance with Section 960 Pumping Station Equipment.

(b) Joints on pipe shall be mechanical or push-on. Joints on fittings shall be mechanical joint only. All joints shall be in accordance with AWWA C111. Push-on joints vary by manufacturer, see the County's Approved Products List for acceptable configurations.

(c) Mechanical joint restraints shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when activated, imparts a multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and Tee-head bolts conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 or latest revision. Twist off nuts shall be used to insure proper activating of the restraining devices. The mechanical joint restraint device shall have a working pressure of a minimum of 350 psi in 4-inch to 12-inch and 250 psi in 14-inch to 48-inch with a minimum safety factor of 2:1.

(d) Push-on joint restraints shall be boltless and shall compatible with the supplied push-on joints. Restraints shall consist of additional gaskets and welded-on retainer rings to provide thrust restraint. Push-on joint restraints vary by manufacturer, see the County's Approved Products List for acceptable configurations.

(e) Pipe joints for directional drill applications shall be the restrained joints specified above, with a maximum allowable deflection of 5 degrees for 4 to 12 inch, and minimum operating pressure of 250 psi. Larger diameters (larger than 12 inch) shall have maximum deflections in accordance with manufacturer's recommendations.

(f) All fittings shall be in accordance with AWWA C110 and C111 for sizes 30-inch and larger and AWWA C153, for size 4-inch through 24-inch. They shall be designed and constructed to withstand a pressure not less than that for the adjacent pipe. Fittings 4-inch through 24-inch shall have a pressure rating of 350 psi. Those 30-inch and larger shall have a pressure rating of 250 psi. Caps and

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plugs 4-inch through 24-inch shall have a pressure rating of 350 psi, 30-inch and larger shall have a pressure rating of 250 psi.

(g) All pipe and fittings shall be cement lined in accordance with ANSI/AWWA C104/A21.4, double thickness. This lining shall be sealed with a bituminous seal coat. The outside surface shall be bituminous coated. Miscellaneous fittings such as sleeves shall not be cement lined.

(h) Submittals

The following items shall be submitted for review and approval prior to installation. Materials not approved will not be accepted.

(1) DIP Pipe

Submit manufacturer's literature and certificates of compliance for DIP pipe along with the manufacturer's identification codes for nominal size, pressure class, production record code and date of manufacture. Submit manufacturer's written transcript of test results, for hydrostatic test, pipe dimension, and acceptance tests. Frequency of performing the tests and the methods of selecting test specimens shall be in accordance with A WW A C151.

(2) DIP Pipe Fittings

Submit manufacturer's literature and certificates of compliance for DIP pipe fittings along with the manufacturer's identification codes for nominal size, pressure class, production record code and date of manufacture. Submit manufacturer's written transcript of results for acceptance tests in accordance with AWWA C110.

(3) Miscellaneous for DIP pipe

Submit manufacturer’s literature and certificates of compliance, for joint restraint devices, pipe couplings, service saddles, and other appurtenances.

(4) Installation

Submit manufacturer’s installation instructions for DIP pipe and fittings, joint restraint devices, pipe couplings, service saddles, and manufacturer's instructions for tapping pipe.

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905.11 DUCTILE IRON PIPE AND FITTINGS FOR SANITARY SEWERS AND FORCE MAINS. All ductile iron pipe and fittings for sanitary sewers and force mains shall be in accordance with Section 905.12, Ductile Iron Pipe and Fittings (Water Mains) except that:

(a) The special thickness class for gravity sewers shall be Class 52 or as shown on the Contract Documents, or in the Special Provisions. Force mains shall be minimum Class 53.

(b) Ductile iron pipe special thickness Class 50 may be substituted for those applications where PVC pipe is acceptable.

(c) The minimum working pressure will not apply for pipe used as gravity sewers.

(d) Coating:

(1) All pipe and fittings shall be double cement-lined in accordance with the latest revision of ANSI/AWWA C104/A21.4.

(2) Where required by Department of Public Works, specialized linings shall be one of the following:

i) A calcium aluminate mortar made of fused calcium aluminate cement and fused calcium aluminate aggregates. Lining thickness shall meet double thickness requirement.

ii) A fusion bonded epoxy (FBE) coating that complies with AWWA C116.

(3) The lining quality: cracks, other than closed hairline cracks and/or fine crazing, shall not be acceptable.

905.12 STEEL PIPE FOR CASINGS AND SLEEVES. Steel pipe for casings and sleeves shall be in accordance with Section 963 and Section 1012.

905.13 STEEL PIPE AND FITTINGS (WATER MAINS). The steel pipe and appurtenances specified herein shall be considered minimum design requirements. Design of steel pipe shall be evaluated on a case by case basis for conditions outlined in AWWA Manual M11 such as surge pressures, external pressures, etc. Project specific pipe design shall be approved by the County.

905.13.01 Pipe.

(a) Steel Pipe shall conform to AWWA C200, AWWA Manual M11, and ASTM Al39, Grade C or D. Unless otherwise shown on the Contract Documents, the minimum wall thickness of buried steel pipe shall be 0.3125-inch. The interior of

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the pipe and fittings shall be cement mortar lined in accordance with AWWA C205. The pipe exterior shall be coated using multilayer cold tape as described in Section 967 entitled "Corrosion Control".

(b) Pipe manufactured under AWWA Standard C200 shall be fabricated from sheet conforming to the requirements of ASTM A 139 (Grade C or D). All longitudinal and girth seams, shall be butt welded using an electric fusion-weld process.

(c) All steel used for the fabrication of pipe shall have a maximum carbon content of 0.25% and shall have a minimum elongation of 22 percent in a 2-inch gage length.

(d) After the joint configuration is completed, and prior to lining with cement-mortar, each length of each diameter shall be tested at a pressure of at least 75 percent of the specified yield strength of the pipe steel.

(e) Pipe is to be furnished principally in up to 40-foot laying lengths with special lengths, field trim pieces and closure pieces as required to meet the required lines and grades shown on the Plans, as well as for pipe fittings and appurtenances. The pipe fabricator shall prepare a pipe laying schedule showing the location of each piece by mark number with station and invert elevation at each bell end.

905.13.02 Fittings.

(a) Fittings shall be fabricated in accordance with AWWA C200 Section 4 from pipe conforming to the above standards. Fittings fabricated from previously hydrostatically tested straight pipe shall require testing of only those welded seams that were not previously hydrostatically tested in the straight pipe. This testing shall be by the dye penetrant or magnetic particle method.

(b) Fittings shall conform to the dimensions of AWWA C208 or may be fabricated into standard or special pipe lengths. Fittings shall be of the same material and minimum thickness as the pipe. Fittings shall be equal in pressure and design strength and shall have the same lining and coating as the abutting pipe. Elbows over 0 degrees through 22-1/2 degrees shall be two piece; over 23 degrees through 45 degrees shall be three piece; over 45 degrees through 67-1/2 degrees shall be four piece; and over 67-1/2 degrees through 90 degrees shall be five piece. Elbows shall have a minimum radius of 2-1/2 times the pipe O.D. All tees, laterals and outlets shall be reinforced in accordance with AWWA M11.

905.13.03 Joints.

(a) The joint shall provide a permanent seal against exfiltration or infiltration. The gasket shall be the only element depended upon to make the joint flexible and watertight.

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(b) Joint shall be bell and spigot with rubber gasket, mechanically coupled, flanged or welded joints as shown on the Contract Documents. The joints furnished shall have the same or higher pressure rating as the abutting pipe.

(c) Restrained joints shall be used for restraining horizontal and vertical bends, and other appurtenances. The cost of furnishing and installing restrained joints shall be included in the applicable unit prices bid.

(d) The bell and spigot 0-ring type joints shall consist of a bell and spigot end formed integrally on the pipe by swaging, expanding or by welding on an approved Carnegie section. The gasket shall be retained on the spigot end by a groove formed by rolling with dies. At no point on the spigot end shall the clear inside diameter of the pipe be less than the nominal inside diameter of the pipe barrel. The inside of the bell end and the outside of the spigot end shall be smoothed by grinding as necessary and shall be free of raised bumps and scratches. The gasket for a joint shall be a continuous 0-ring gasket made of a special rubber composition of such size and cross section as to provide a watertight joint for a pressure of at least 250 psi. The gasket shall conform to gasket material requirements set forth in AWWA Standard C200. Each gasket shall be checked for diameter, cut length, soundness, curing and splices and certification of such tests shall be furnished to the Engineer. The manufacturer shall furnish all joint materials including rubber gaskets and lubricant compatible with potable water.

(e) Pipe and fittings for field welded joints shall be butt welded or lap joints prepared for field welding and shall be in accordance with the requirements of AWWA Standard C200.

The method used to form, shape and size bell ends shall be such that the physical properties of the steel are not substantially altered. Unless otherwise approved by the Engineer, bell ends shall be formed by expanding with segmental dies. If approved by the Engineer, bell ends formed by a rolling process shall be accomplished in not more than 6 passes (revolutions) over the bell surface and any resulting radius shall be not less than 15 times the thickness of the material being formed.

Shop-applied exterior coatings shall be held back a minimum of 4 1/4" from the point at which the weld is to be made. Minimum lap shall be 1-1/2 inch for lap welded joints.

For lap-joint pipe prepared for field welding, both bell and spigot ends shall be sized to provide a difference in circumferential measurement between the outside circumference of the spigot and the inside circumference of the bell of not more than 0.40" for pipe diameter 24" through 54".

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905.13.04 Flanges.

(a) Flanges shall be in accordance with AWWA C207 Class D for pressures to 175 psi on 4 inch through 12 inch diameter, and 150 psi on diameters over 12 inches. Flanges shall be AWWA C207 Class E for pressures over 150 psi to 275 psi when mating steel to steel; or shall be AWWA C207 Class F for pressures to 300 psi (drilling matches ANSI B16.5 Class 250). Shop lining and coating shall be continuous to end of the pipe or back of flange. Flange faces shall be shop coated with a soluble rust preventive compound.

(b) Gaskets shall be 1/8 inch thick of the rubber type per AWWA C207 unless otherwise specified.

(c) Bolts and Nuts for Flanges

(1) Bolts and nuts for flanges located indoors and in enclosed vaults and structures shall be carbon steel, ASTM A307, Grade B.

(2) Bolts and nuts for buried and submerged flanges and flanges located outdoors above ground or in open vaults in structures shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts, and ASTM A194, Grade B7. Nuts shall comply with ASTM Al 94, Grade 2H.

(d) Provide specially drilled flanges when required for connection to existing piping or special equipment.

905.13.05 Mechanical Couplings.

(a) Mechanical couplings shall have ASTM A53 black or A512 carbon steel sleeves with ASTM A536 ductile iron followers, alloy steel bolts and nuts, and Buna-N gaskets. Couplings shall have fusion bonded epoxy coatings.

(b) Insulating mechanical couplings where indicated on the plans or required shall be similar in construction to couplings specified in paragraph (a) above with the addition of an insulating boot that stops the flow of electrical current.

(c) Couplings for buried service shall have all metal parts painted with Epoxy paint conforming to AWWA C210 or C213 and shall have a pressure rating equal to that of the pipe.

(d) Where tied joints are required, mechanical couplings shall be harnessed for the maximum pressure (250 psi) in accordance with AWWA M11 Par. 13.10 and Table 13-5.

(e) Pipe ends for mechanical couplings shall conform to AWWA C200 Section 3.6. The shop applied outside coating shall be held back as required for field assembly

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of the mechanical coupling or to harness lugs or rings. Harness lugs or rings and pipe ends shall be painted with one shop coat of primer compatible with exterior coating and field Joint coating materials. The inside lining shall be continuous to the end of the pipe.

905.13.06 Cement-Mortar Lining

(a) Except as otherwise provided in AWWA Standard C205, interior surfaces of all steel pipe, fittings and specials shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with AWWA Standard C205. Thickness shall be 3/8-inch for 24-inch to 36-inch pipe and ½-inch for pipe larger than 36-inch diameter as specified in AWWA C205. The lining machines shall be of the type that has been used successfully for similar work and shall be approved by the Engineer. Every precaution shall be taken to prevent damage to the lining. If the lining is damaged or found faulty at the delivery site, the damaged or unsatisfactory portions shall be replaced with lining conforming to these Specifications.

(b) The pipe shall be left bare where field joints occur as shown on the Contract Documents. Ends of the linings shall be left square and uniform. Feathered or uneven edges will not be permitted.

(c) Defective linings, as determined by the Engineer, shall be removed from the pipe wall and shall be replaced to the full thickness required. Defective linings shall be cut back to a square shoulder in order to avoid feather edged joints.

(d) The progress of the application of mortar shall be regulated in order that all hand work, including the repair of defective areas and the removal of outlet stoppers and covers, shall be completed and cured in accordance with AWWA C205. Cement-mortar for patching shall be the same materials as the mortar for machine lining, except that a finer grading of sand and mortar richer in cement shall be used when field inspection indicates that such mix will improve the finished lining of the pipe.

905.13.07 Submittals for Steel Piping

(a) Submit shop drawings with a tabulated layout schedule showing the location of each piece, by mark number, for the entire job, method of manufacture and installation of pipe, joint details, fittings and any specials. Design calculations shall be submitted with the shop drawings and shall include all formulas used in the calculations, all values of constants used in the formulas in accordance with AWWA C200 and AWWA M11 based on internal pressure, deflection and external loads. Design calculations shall be signed and sealed by a Registered Professional Engineer licensed to practice in the State of Maryland. Submit anticipated production and delivery schedule.

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(b) Design specification data sheets listing all parameters used in the pipe design, including but not limited to the ASTM Designation and grade of the steel, thickness and diameter of the pipe, pressure class and test pressure of the pipe, lining thickness and constituents, pipe coating, and joint welds.

(c) Prior to shipment of pipe, submit certified test reports that the pipe for the Contract was manufactured and tested in accordance with AWWA standards. Provide statement of NSF approval of all materials in contact with the potable water being conveyed.

905.14 COPPER PIPE AND FITTINGS. Copper pipe shall meet the requirements of Federal specification WW-T-799, Type K. Fittings shall meet ASTM B62 and AWWA C800.

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SECTION 908 — REINFORCEMENT STEEL

Reinforcement Steel shall be in accordance with SHA Section 908 unless otherwise noted herein.

Replace all references to TC-1.03 with General Conditions Section GC-6.05.

SECTION 909 — METALS

Metals shall be in accordance with SHA Section 909 unless otherwise noted herein.

Delete all references to TC-1.03 and use General Conditions Section GC-6.05.

SECTION 910 — BEARINGS

Bearings shall be in accordance with SHA Section 910 unless otherwise noted herein.

Replace all references to TC-1.03 with General Conditions Section GC-6.05.

SECTION 911 — JOINTS

Joints shall be in accordance with SHA Section 911 unless otherwise noted herein.

Delete all references to TC-1.03 and use General Conditions Section GC-6.05.

SECTION 912 — COATING SYSTEMS FOR STRUCTURAL STEEL

Coating Systems for Structural Steel shall be in accordance with Section 912 unless otherwise noted herein.

Delete all references to TC-1.03 and use General Conditions Section GC-6.05.

SECTION 913 — WATERPROOFING

Waterproofing shall be in accordance with SHA Section 913 unless otherwise noted herein.

Delete all references to TC-1.03 and use General Conditions Section GC-6.05.

SECTION 914 — CHAIN LINK FENCE

Chain Link Fence shall be in accordance with Standard Details and SHA Section 914.

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914.06 TENSILE WIRES. Tensile wire shall conform to ASTM A 854/A 854M-86. The galvanized coating shall have a minimum weight of 1.2 oz/square foot.

SECTION 915 — PRODUCTION PLANTS

Production Plants shall be in accordance with SHA Section 915 unless otherwise noted herein.

Delete all references to TC-1.03 and use General Conditions Section GC-6.05.

SECTION 916 — SOIL AND SOIL-AGGREGATE BORROW

916.01 BORROW EXCAVATION. A soil or soil aggregate mixture meeting the following:

Maximum dry density and optimum moisture content of the material per T 180, Method C unless the material has more than 35 percent retained on the No. 4 sieve, in which case Method D shall be used. Material with a maximum dry density of less than 100 lb/ft^3 is unsatisfactory and shall not be used in embankments. Potentially expansive materials, such as steel slag, are prohibited.

Refer to the Recycled Materials Special Provisions located elsewhere in the Contract Documents.

BORROW REQUIREMENTS						
Class Borrow	**Max Dry Density Minimum P.C.F. T 180**	**LL Maximum T 89**	**PI Maximum T 90**	**Gradation Requirements T 88**	**Reference MSMT Soil Classification**	**Reference AASHTO Classification**
Select Borrow	105	34	7	30% max passing No. 200 sieve	A-2,A-3, A-2-4	A-1-a, A-1-b, A-3, A-2-4
Common Borrow	100	N/A	N/A	N/A	N/A	N/A

SECTION 917 — MISCELLANEOUS PROTECTIVE COATINGS

This section shall be in accordance with SHA Special Provision Insert "Section 917 Miscellaneous Protective Coatings" updated 05/03/2011 or later, unless otherwise noted herein.

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Delete all references to TC-1.02 and use General Conditions Section GC-6.05.

SECTION 920 — LANDSCAPING

Landscaping Materials shall be in accordance with SHA Section 920 unless otherwise noted herein.

920.01.02 Furnished Topsoil.

Delete the sentence "A copy of the soil test report shall be forwarded to the Administration at the following address:

Office of Materials & Technology
Soils & Aggregates Laboratory
2323 West Joppa Road
Lutherville, MD 21093"

Delete the following paragraphs:

"After the Soils & Aggregates Laboratory has reviewed the soil test report, the need for Administration testing will be determined. If approved by the Regional Engineer, a secondary sample will be obtained by the Engineer for verification testing and final recommendations. The producer shall be responsible for quality control of the stockpile so the material conforms to Specifications.

A producer's certification conforming to TC-1.02 shall accompany each shipment of topsoil. A copy of the certification shall be delivered to the Engineer."

920.01.04 Furnished Subsoil.

Delete the sentences "The Contractor shall submit a source of supply for the material to the Administration for approval, prior to use. Material shall conform to Section 916 with the following exceptions:"

And Add:

Furnished Subsoil shall conform to the following:

920.04.01 Seed.

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Delete the sentences "Seed will be sampled and tested by an inspector from the Turf and Seed Section, Maryland Department of Agriculture (MDA), Annapolis, Maryland. All seed containers shall be tagged with a MDA supervised mix program seed tab."

920.04.01 Seed Mixes.

Delete the sentences "The Contractor or seed supplier shall notify the Turf and Seed Section, Maryland Department of Agriculture, Annapolis, Maryland, at least 10 days prior to the mixing date as to the hour, date, and location of the mixing operation. The Contractor or seed supplier shall assume charges for seed inspections and seed testing service."

(a) Permanent Seed Mix.

Change the Permanent Seed Mix to read:

(1) 85% Tall Fescue (Certified Seed Only)
5% Kentucky Bluegrass (Certified Seed Only)
10% Perennial Rye grass (Certified Seed Only)

(2) Permanent Seed Mixes as listed in Section G of the 1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control, Maryland Department of the Environment, Water Management Administration (latest edition.)

(b) Special Purpose Seed Mix.

Delete this seed mix in its entirety.

(c) Temporary Seed Mix.

Change the Temporary Seed Mix to read:

Temporary Seed Mixes as listed in Section G of the 1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control, Maryland Department of the Environment, Water Management Administration (latest edition).

(d) Cover Companion Seed Mix.

Delete this seed mix in its entirety.

(e) Woody Shrub Seed Mix.

Delete this seed mix in its entirety.

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(f) Wildflower Seed Mix.

Delete the references to "Regions 1 and 3".

920.05.04 Wood Cellulose Fiber.

Delete the reference to "TC-1.02".

920.06 SOIL STABILIZATION MATTING.

Delete the sentence "The material shall be selected from the Administration's Office of Materials and Technology Prequalified Materials List for the use specified."

920.08.03 Peat Humus.

Delete the sentence "Samples of peat humus will be taken by the Engineer and will be tested for conformance to Federal Specification Q-P-166."

SECTION 921 — MISCELLANEOUS

Moisture for Dust Controls Agents shall be in accordance with SHA Section 914.02 unless otherwise noted herein.

Epoxy Adhesives shall be in accordance with SHA Section 914.04 unless otherwise noted herein.

Delete all references to TC-1.02 and use General Conditions Section GC-6.05.

Structural Timber and Lumber shall be in accordance with SHA Section 914.05 unless otherwise noted herein.

Delete all references to TC-1.02 and use General Conditions Section GC-6.05.

Conduits shall be in accordance with SHA Section 914.07 unless otherwise noted herein.

Delete all references to TC-1.02 and use General Conditions Section GC-6.05.

Geotextiles shall be in accordance with SHA Section 914.09 unless otherwise noted herein.

Polyethylene (PE) Manholes shall be in accordance with SHA Section 914.10 unless otherwise noted herein.

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Delete all references to TC-1.02 and use General Conditions Section GC-6.05.

SECTION 922 — PREFABRICATED EDGE DRAINS

Prefabricated Edge Drains shall be in accordance with SHA Section 922 unless otherwise noted herein.

Delete all references to TC-1.02 and use General Conditions Section GC-6.05.

922.02 PREFABRICATED EDGE DRAINS.

Drainage Core.

Test method for crushed sheet and post type cores shall be in accordance with ASTM D 1621.

SECTION 925 — DETECTABLE WARNING SURFACES

Detectable Warning Surfaces shall be in accordance with SHA Section 925 unless otherwise noted herein.

Delete all references to TC-1.02 and use General Conditions Section GC-6.05.

925.01 GENERAL.

Delete the first paragraph and Insert with the following:

The detectable warning surface shall conform to the most recent accessibility guidelines of the Americans with Disabilities Act (ADA). The Contractor shall submit the proposed source of supply, and specific product, to the Engineer, for approval.

925.02 COMPOSITION.

Delete the first paragraph and Insert with the following:

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The surface shall be either flexible or rigid.

SECTION 951 — PAVEMENT MARKING MATERIALS

Pavement Marking Materials shall be in accordance with SHA Section 951 unless otherwise noted herein.

Delete all references to TC-1.02 and use General Conditions Section GC-6.05.

SECTION 960 — PUMP STATION EQUIPMENT

Pump station equipment shall be in accordance with Design Manual Volume II, Water and Sewer.

960.01 FLANGED DUCTILE IRON PIPE

960.01.01 Pipe

Flanged ductile iron pipe shall be used for interior piping and shall meet the requirements of paragraph 905.10 or 905.11 except that the wall thickness shall conform to special class 53 and exterior pipe coating shall be an epoxy based system.

960.01.02 Fittings

Flanged ductile iron fittings shall meet the requirements of ANSI/AWWA C110/A21.10. Where required or shown, ductile iron specials shall be provided. In general, specials shall consist of spool pieces, less than standard lengths of flanged pipe, or combination of ends, and nonstandard fittings. The specials shall conform in material, thickness and finish to the pipe in which they are installed. Tapped reinforced bosses shall be provided as an integral part of fittings, when shown or otherwise required.

960.01.03 Flanges

Flanges may be cast integrally with the ductile iron pipe, or screwed on type flanges may be used. Threaded flanges shall be the same material as the pipe. Field installation of threaded flanges or the use of "uniflanges" shall not be permitted. Flanges shall be faced after the flange is installed on the pipe. As a minimum flanges shall be drilled and faced for ANSI B16.1, Class 125 suitable for 150 psig operating pressure.

960.01.04 Hardware

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(a) All gaskets for flanged pipe, valve and fitting joints shall be a minimum 1/8-inch thick full face or rubber ring gasket in accordance with ANSI/AWWA C115/A21.15 Appendix A. As a minimum, gaskets shall be suitable for 150 psig operating pressure.

(b) Flange nuts and bolts shall be in accordance with ANSI/AWWA C115/A21.15 Appendix A. Nuts and bolts shall be suitable for a minimum of 150 psig operating pressure. Bolts, nuts and washers shall be of mild steel, with sound well fitting threads; the nuts shall be cold punched, hexagonal, trimmed and chamfered. Heads, nuts and threads shall be U.S. Standard sizes. Bolts shall be of such length as to project 1/4 inch beyond the nut when the flanged joint with gasket is assembled. All hardware shall be galvanized. For exterior, exposed flanged joints, bolts and nuts shall be minimum 18 8 stainless steel. The flange joint system (bolts, nuts, gaskets and installation) are to be suitable for the intended service and have a minimum pressure rating of 150 psi.

960.01.05 Mechanical Couplings

(a) Mechanical couplings shall be designed and constructed to withstand an internal line pressure equal to that of the pipeline in which it is to be installed. The various mechanical couplings shall be suitable for the class and size of ductile iron pipe as required at the various locations, and shall be without pipe stops. The Contractor shall provide and install mechanical couplings in addition to those shown, as required, for flexibility in installing the various piping systems. Locations of additional couplings shall be as directed by the Engineer.

(b) Harnesses shall be provided across all mechanical couplings unless otherwise specifically noted on the drawings to be omitted. Harnesses shall be as shown on the Standard Details.

960.02 RESILIENT SEATED GATE VALVES. Interior, non-buried resilient seated gate valves shall be as specified in Section 961.01 except that the valves shall have flanged ends conforming to ANSI B16.1 Class 125 and that non-buried valves shall be "counter-clockwise" to open (Open Left). Valves shall be provided with handwheel marked with an open arrow. Where valves are installed 6-feet or higher above the floor, chainwheel operators shall be provided with chains that extend down to the floor, unless otherwise shown on the Contract Documents.

960.03 PUMP CHECK SERVICE VALVES.

960.03.01 General

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Each pump shall have a hydraulically operated, time adjustable pump check service valve or a swing check valve to prevent backflow through inoperative pumps. In accordance with Volume II criteria for water hammer control, pump check service valves shall be of the type and strength required to eliminate water hammer damage. Spring type, oil cushioned elbow surge relief valves, when required, shall be provided on the discharge header of the station and be piped to the wet well.

960.03.02 Swing Check

Swing check valves shall be constructed in accordance with AWWA C508 and shall be rated for a minimum of 150 psig service. Valve shall have cast iron body, dampened swing arm, rubber faced cast iron clapper with stainless steel shaft rotating in bronze plugs, replaceable bronze seats, and ANSI B16.1 Class 125 flanges.

960.03.03 Pump Check Service Valves

(a) Pump check service valves shall be "Y" pattern pump control type with cast iron body, Class 125 flanged ends and be solenoid controlled. Control appurtenances shall include valve stem indicator with dual limit switches, 4-way solenoid control valve (with manual operator and valve actuator) opening and closing speed needle valves, control filter, cover plug and cock valve. Control valve shall be of the double chamber actuator style.

(b) Materials:

(1) Main Valve & Actuator

i.	Body, Cover, Separating Partition:	Cast Iron – ASTM A 126, Class B Fusion Bonded Epoxy Coated
ii.	Shaft, Spring, Nuts:	Stainless Steel – SAE 303
iii.	Seat, Seal Disc Washer:	Cast Bronze – ASTM B 62
iv.	Bearing:	Brass – ASTM B 21
v.	Diaphragm Washers, Seal Disc:	Carbon Steel – SAE 1015 Nylon Coated

(2) Pilot Controls

i.	Body, Cover:	Brass – ASTM B21
ii.	Trim and Seat:	Stainless Steel – SAE 303
iii.	Spring:	Carbon Steel – SAE 1065 Zinc Plated
iv.	Diaphragm:	Buna – N w/Nylon Reinforced Fabric

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(3) Solenoid valve shall provide standard main valve normally open control service; therefore, solenoid valve is (normally closed) and will open main valve when energized. Solenoid shall be suitable for electrical service and for mounting locations shown on Contract Documents.

(4) Limit switches shall be suitable for electrical service and for mounting locations shown on Contract Documents.

(5) All internal steel or cast iron surfaces, except finished or bearing surfaces, shall be shop-painted with two coats of fusion bonded epoxy conforming to AWWA C550. Unless otherwise noted on Contract Documents, all exterior steel or cast iron surfaces shall be shop prime painted with manufacturer's standard finish.

960.04 WASTEWATER PUMPS. Use of the pumps specified herein shall conform to design requirements outlined in Volume II of the Design Manual.

960.04.01 General.

Wastewater pump suction and discharge connections shall be a 4-inch minimum diameter. All wastewater pumps shall rotate clockwise as viewed from the motor end. Wastewater pumps shall be centrifugal non-clog solids handling pumps capable of passing a 3-inch sphere. The pump bearings shall have a minimum 100,000 hours ABMA B-10 bearing life. Unless otherwise noted on Contract Documents, the pump motors shall operate at a synchronous speed no higher than 1800 rpm. The pump motor horsepower shall be sufficient to prevent motor overload under all operating conditions. The pumps shall meet the vibration performance specifications of the Hydraulic Institute (HI). All wastewater pumps shall be factory witness tested and approved prior to shipment. All wastewater pumps must pass an on-site vibration test performed by an independent vibration testing company prior to acceptance. Wastewater pumps and motors shall be suitable for continuous duty.

960.04.02 Dry-Pit Submersible Pumps.

(a) The pump casing/volute, impeller, support base, suction elbow, seal housing/motor adapter and motor housing shall be of cast iron construction. The pump's casing and impeller shall be fitted with replaceable hardened stainless steel wear rings to maintain sealing efficiency between the volute and the impeller. At the option of the County other pump materials may be required to suit a particular application. Each pump discharge volute casing and suction elbow shall be provided with an inspection and clean out opening.

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(b) Dry Pit submersible wastewater pumps shall be designed for continuous operation in air for application in a dry well. The motors for dry pit applications shall be capable of a minimum of eight (8) starts per hour in air. The pumps/motors shall also be designed to function continuously in a submerged condition should the dry well become flooded. Motor cooling shall be via cooling water jacket, submersible-rated air-over motor cooling fan or positively forced oil cooling.

(c) Additional features:

(1) One piece backhead and motor adapter with impeller adjustment cap screws

(2) Solid full diameter stainless steel shaft with no shaft sleeve or solid large diameter high strength alloy steel shaft with stainless steel shaft sleeve having a tapered end with a keyway to receive the impeller

(3) Double mechanical shaft seals cooled and lubricated by potable water through a cleanable seal filter assembly and provided with a mechanical seal vent with petcock

(4) Premium Efficiency motors shall be specified for all three-phase pump motors

960.04.03 Wet Well Submersible Pumps

The pump volute, impeller, and motor housing shall be of cast iron construction. The pump volute casing and impeller shall be fitted with replaceable hardened stainless steel wear rings to maintain sealing efficiency between the volute and the impeller. At the option of County, other pump materials may be required to suit a particular application. The motor shaft shall be a single piece heat treated high strength alloy steel or high strength stainless steel having a tapered end with keyway to receive the impeller. All nuts, bolts and screws shall be stainless steel. The motor shall be Class F insulated (minimum) and sealed from the pump by independent double mechanical seals. The upper and lower mechanical seals shall run in an oil chamber. The upper seal shall have a stationary tungsten-carbide face with rotating carbon face. The lower seal shall have stationary and rotating tungsten-carbide faces. All mating surfaces where watertight sealing is required shall be machined and fitted with a rubber o-ring. The machining of mating surfaces shall provide metal to metal bearing on sealing surfaces without crushing the o-ring.

960.04.04 Suction Lift Pumps.

The pump volute, impeller, and motor housing shall be of cast iron construction. The pump volute casing and impeller shall be fitted with replaceable hardened stainless steel wear rings to maintain sealing efficiency between the volute and the impeller. At the option of County, other pump materials may be required to suit a particular application. All nuts, bolts and screws shall be stainless steel. Both vacuum prime and self-priming

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suction lift pump styles are acceptable. Suction lifts greater than 18-feet or multiple stage pumping is not acceptable.

960.05 WATER PUMPS.

(a) All water pumps shall rotate clockwise as viewed from the motor end. Pump bearings shall have a minimum 100,000 hours ABMA B-10 bearing life. Unless otherwise noted on Contract Documents, pump motors shall operate at a speed no higher than 1780 rpm. Pump motor horsepower shall be sufficient to prevent motor overload under all operation conditions. Water pumps and motors shall be suitable for continuous duty. All pumps shall be factory witness tested and approved prior to shipment. Water pumps shall meet the requirements of the Hydraulic Institute for vibration. Vibration tests shall be performed on site by an independent laboratory and the results submitted to the Department of Public Works for approval. Pumps shall be one of the following types:

(1) In-Line Split Case Centrifugal (Horizontal)

(2) End Suction Centrifugal (Horizontal)

(b) The pump casing/volute, impeller, seal housing and motor housing shall be of cast iron construction. Impeller shall be cast iron or bronze. The pump's casing and impeller shall be fitted with replaceable hardened bronze or stainless steel wear rings to maintain sealing efficiency between the volute and the impeller. At the County option, other pump materials may be required to suit a particular application.

(c) Pumps shall have the following additional features:

(1) Stainless Steel Shaft

(2) NSF approved fusion bonded epoxy coating

(3) Flexible, gear-type shaft coupling and removable OSHA-compliant shaft guard

(4) Mechanical shaft seals cooled and lubricated by the pumped fluid

(5) Premium efficiency motors for all three phase motors

960.06 FLOWMETERS.

960.06.01 Wastewater.

All wastewater pumping stations shall have polyurethane lined magnetic type flow meters with a replacement spool piece or bypass line provided to enable the pumping

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station to operate when the meter is being serviced. Magnetic flow meters shall be provided with grounding rings and isolation valves. Accuracy shall be to within 0.5% of flow. All flow meters shall have an adequate straight run of pipe both upstream and downstream of the meter in accordance with the manufacturer's recommendations.

960.06.02 Water.

(a) All water pumping stations shall have a venturi type flow meter utilizing differential pressure for reading flow. Accuracy shall be within 0.5% of flow range. Magnetic flow meters may also be used with the approval of the County, where adequate straight runs of pipe are unavailable for installation of a venturi flow meter. All flow meters shall have an adequate straight run of pipe both upstream and downstream of the meter in accordance with the manufacturer's recommendations.

(b) At the County's option, pressure reducing valves with integral flow metering devices shall be provided as specified in paragraph 961.04.03.

960.07 COATINGS. All exposed pump equipment and valves shall have manufacturer's standard fusion bonded epoxy primer. Factory primed components shall be painted in the field with epoxy finishes. All interior walls of pumping stations that are above grade shall be painted. Dry well walls or walls below grade shall not be painted. All pumping station floors shall have floor hardeners. Wet well walls shall be painted with epoxy coatings that are corrosion resistant. Painting systems and colors shall be submitted to County for approval.

960.08 INSTRUMENTATION.

960.08.01 Pressure Gauges.

Pressure gauges shall be oil-filled, bourdon tube type with a minimum 4 ½ -inch diameter face and be equipped with pressure snubbers and shutoff cocks. Gauges for wastewater shall be equipped with diaphragm seals. Diaphragm seals shall be Teflon coated stainless steel with silicone fill and shall be factory calibrated with the pressure gauge as a complete unit. Gauge accuracy shall be to within 0.5% of pressure. Pressure gauges shall have a range such that the normal operating pressure is near the middle of the gauge.

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960.08.02 Level Measurement System.

Unless otherwise noted on the Contract Documents, level measurement shall be the non-contact ultrasonic type. The system shall consist of a remote mounted transducer, wall-mounted transmitter, and interconnecting twisted-pair, shielded cable.

(a) The transducer shall be non-contact, echo time measuring type providing a 4-20 mA output signal proportional to level. The sensor wetted parts shall be of kynar. The sensor shall be rated at a minimum of NEMA 4X. Wastewater applications shall use NEMA 7 components suitable for location in a Class I, Division 1, Groups C and D environment. The sensor shall be powered by the transmitter, and shall be connected by the twisted pair, shielded cable. The sensor shall have an integral temperature probe to compensate for errors in measurement due to variations in temperature. The sensor shall have the capabilities to operate within an ambient temperature range of -40 to + 203 degrees F.

(b) The transmitter shall be housed in a minimum NEMA 4 enclosure, suitable for wall mounting. It shall operate on 115 VAC, 60 Hz service, and produce an isolated 4-20 mA signal proportional to level. The transmitter shall accommodate level ranges as indicated on the drawings, and shall be capable of operating within an ambient temperature range of –5 to +122 deg F. The transmitter shall be accurate to better than 0.25% of full span over the specified temperature range. It shall have a LCD display to indicate level in a scalable display (feet of liquid). It shall have multiple Alarm Setpoints and alarm display capability.

960.09 CONTROLS HARDWARE. Controls hardware such as programmable logic controllers (PLCs), variable frequency drives (VFDs), and other similar hardware shall be in accordance with the County's Approved Product List.

SECTION 961 — VALVES, HYDRANTS & APPURTENANCES

961.01 4-INCH TO 36-INCH RESILIENT SEATED GATE VALVES. All resilient seated gate valves shall have manufacturer's standard fusion-bonded epoxy coating conforming to AWWA C550.

961.01.01 4-inch to 12-inch VALVES.

All valves shall conform to the requirements of the latest revision of AWWA C509 for Resilient Seated Gate Valves. Valves shall be cast iron or ductile iron body, wedge type, non-rising stem, nut operated, with minimum working pressure of 250 psi. All valves

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shall have mechanical joint ends, except where indicated on the Contract Documents to be flanged. The valves shall be "clockwise turning" to open (open right).

961.01.02 14-inch to 36-inch VALVES.

All valves shall conform to the latest revision of AWWA C515. Valves shall be ductile iron body, wedge type, non-rising stem, and nut operated. Valves 14-inch to 20-inch shall have 250 psi working pressure. Valves 24-inch and larger shall have 200 psi working pressure. All valves shall have mechanical joint ends, except where indicated on the Contract Documents to be flanged. The valves shall be "clockwise" turning to open (open right). Provide geared operators on valves 14-inch and larger.

961.02 BUTTERFLY VALVES 30 INCHES THROUGH 48 INCHES.

(a) Butterfly valves shall be suitable for buried water service and shall conform in all respects to AWWA C504 latest revision, and as modified herein.

(b) The valve shall be designed to provide tight shut off at a pressure differential of 150 psi upstream and 0 psi downstream in either direction.

(c) The valve body shall be in compliance with AWWA Specifications C504, Class 150B, and have mechanical joint ends meeting the requirements of AWWA C111/ANSI A21.1l. The valve body shall be cast iron conforming to the requirements of ASTM A126, Class B or ASTM A48, Class 40.

(d) The valve shaft shall be either a "through shaft" or "stub shaft" type, stainless steel meeting the requirements of ASTM A276, Type 304, stainless steel. After installation of the valve, the shaft shall be horizontal unless otherwise noted on the Contract Documents.

(e) The valve disc shall provide a full 360 degree seating and be constructed of ductile iron in accordance with ASTM A536, grade 65-45-12.

(f) The valve seats shall be of natural or synthetic rubber conforming to AWWA C504. The seats shall be mechanically retained on the valve disc edge or in the valve body. The mating seat surface shall be ASTM A-276, Type 304 stainless steel. The rubber seat shall be so designed as to provide replacement and adjustment in the field without removing the valve from the line.

(g) The valve shall be furnished with permanent sleeve type self lubricating bearings. The valve assembly shall be furnished with a thrust bearing designed to center the disc in the valve at all times. The shaft seals shall be of the "0" ring type and shall allow for replacement without removing the valve shaft.

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(h) The valve operator shall be suitable for buried service and shall be a manual worm gear type with alloy steel ground worm and bronze worm gear, anti-friction bearings and integral splined shaft adapter. The gearing shall be such as to locate the operating nut in the vertical position. The input shaft shall be stainless steel with bronze bushings at the output drive sleeve and shall also be equipped with the adjustable mechanical stops to prevent over travel of the valve disc in the open and closed positions. An AWWA stop limiting device shall be provided on the input shaft to the operator for open and closed positions, and all operator components between the input and these stops shall be designed to withstand without damage an input torque of 300 foot-pounds. All external bolts or fasteners shall be stainless steel. The valve operator shall have a spur gear attachment complete with a 2 inch square AWWA operating nut and shall require a minimum of 50 turns to close the valve from its full open position. Valves shall be "clockwise" turning to open (open right).

(i) Gearing provided on the valve shall be such as to provide operation with a maximum 50 foot-pounds input torque.

(j) The valve shall be provided with an extension stem, 2 inch square AWWA operating nut, and roadway valve box as per Section 961.06 of these Specifications and the Standard Details.

(k) A metal tag shall be securely attached to the operator on which shall be embossed or stamped the direction to open and close the valves and the number of turns required to fully open and close the valve. The valves shall be "clockwise turning" to open (open right).

(l) All internal and external steel or iron surfaces shall have two coats of fusion bonded epoxy coating meeting the requirements of AWWA C550 latest revision.

961.03 AIR/VACUUM VALVES AND AIR RELEASE VALVES.

961.03.01 Sewage.

(a) Provide sewage air/vacuum and air release valves at locations designated on the Contract Documents and as shown on the Standard Details. Valves shall be supplied by the same manufacturer.

(b) Sewage air/vacuum valves shall be designed to permit the unrestricted passage of air from pressure sewers and sanitary force mains during filling and pressurizing, and the unrestricted entry of air into pressure sewers and sanitary force mains under vacuum conditions. The sewage air release valve shall be designed to release small amounts of air under pressure.

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(c) Sewage air/vacuum and air release valves shall be rated for service up to 150 psi.

(d) Sewage air/vacuum valve shall have two stainless steel floats connected together by a stainless steel float guide. The bottom float shall operate the valve and the upper float shall be used to seat against the inlet/outlet port seat. Air release valve float, float guide and internals shall be stainless steel. Stainless steel materials shall meet the requirements of ASTM A240.

(e) An internal baffle shall be provided in the air/vacuum valve to protect the upper float from direct air flow and shall retain the inlet/outlet port seat in place without distortion, for tight shut-off, but permit easy removal and replacement of the seat. The seat of the air/vacuum valve and needle of the air release valve shall be of BUNA-N material.

(f) All valve bodies and covers shall be gray iron meeting the requirements of ASTM A48 Class 30 and be the short body pattern for shallow installation. The exterior of the valves shall be painted with a rust inhibitor.

(g) All internal brass parts shall meet the requirements of ASTM B16. All internal acetal parts shall meet the requirements of ASTM D2133.

(h) Air release and air/vacuum valves shall be provided with a complete set of manufacturer furnished and attached backwash accessories. This shall include a ½-inch diameter inlet with shut-off valve and quick disconnect coupling, a 1-inch diameter blowoff outlet with shut-off valve, a quick disconnect coupling at the air release vent outlet and a minimum of five feet of back flushing hose with quick disconnect couplings.

961.03.02 Water Air/Vacuum Valves.

(a) The air/vacuum valve shall be of the type that automatically releases to atmosphere large amounts of air found in pipe lines during filling cycle and allows air into a line when it is being drained or when a vacuum occurs. Valves shall conform to latest requirements of AWWA C512.

(b) The air/vacuum valve shall have a cast iron body and cast iron cover. The internal compound lever mechanism shall be stainless steel and all other internals including float shall be stainless steel to avoid galvanic action. The stainless steel float shall withstand a minimum pressure of 1,000 psi.

(c) All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

(1) Body and Cover	Cast Iron ASTM A48, Class 30
(2) Internal Linkage	Stainless Steel Series 316

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(3) Float & Internals	Stainless Steel Series 316
(4) Seat	Buna-N
(5) Exterior Paint	Fusion Bonded Epoxy, AWWA C550

(d) All internals shall be easily removed through the top cover without removing the main valve from the lines.

(e) An isolating valve shall be installed between water main and air/vacuum release valve for maintenance.

(f) Air/Vacuum Valves 4-inch and larger shall have flanged connections conforming to ANSI B16.1, Class 125.

961.04 4-INCH AND LARGER PRESSURE REDUCING VALVES (PRV) FOR WATER SERVICE.

961.04.01 The pressure reducing valve shall be a hydraulically operated, single diaphragm-actuated, globe pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed, and the diaphragm assembly. The valve shall automatically reduce higher inlet pressures to a constant lower outlet pressure regardless of changing flow rate and/or varying inlet pressure without causing water hammer or discharging water into the atmosphere.

961.04.02 Main Valve Body

(a) The main valve shall be of the globe design and consist of a ductile iron body with stainless steel trim. The valve shall come fully assembled and the manufacturer shall supply all appurtenances, including required hydraulic pilot valves, needle valves, and interconnecting piping.

(b) The flanges shall be ANSI B 16.42, Class 150 rated to 250 psi working pressures. Flanged assemblies shall conform to AWWA standards for flange thickness and wall thickness of body and caps.

(c) The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert.

(d) The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place.

(e) The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks, and shall have straight edge sides and a radius at the

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top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface.

(f) The diaphragm assembly shall contain a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures and shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off.

(g) The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary.

(h) The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating inlet (operating) pressure from outlet pressure.

(i) The flexible, non-wicking, NSF approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid.

(j) The center hole for the main valve stem shall be sealed by the vulcanized process or a rubber grommet shall be provided to seal the center stem hole from the operating pressure.

(k) The diaphragm shall withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface.

(l) The diaphragm shall be fully supported in the valve body and cover by machined surfaces, which support no less than one-half of the total surface area of the diaphragm in either the fully opened or fully closed position.

(m) The main valve seat and the stem bearing in the valve cover shall be removable.

(n) The valve seat shall be retained by flat head machine screws for ease of maintenance.

(o) The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits.

(p) To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip.

(q) Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline.

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(r) Valve shall have two coats of manufacturer's standard fusion-bonded epoxy conforming to AWWA C550.

961.04.02 Pilot Control System

(a) The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when outlet pressure is less than the spring setting.

(b) The pilot control shall be held open by the force of the compression on the spring above the diaphragm and it closes when the outlet pressure acting on the underside of the diaphragm exceeds the spring setting.

(c) The pilot control system shall include a fixed orifice. The pilot system shall include opening and closing speed controls. Pilot control piping shall be Type K copper tubing.

(d) The pilot control shall have a second downstream sensing port, which can be utilized to install a pressure gauge.

(e) Pilot system shall include following:

(1) 3-way NEMA 4 solenoid valve to open/close the main valve independent of pressure control. Solenoid shall include manual control.

(2) Limit switches as required by Contract Documents to provide main valve position status.

961.04.03 Flow Metering Device

Where required by the Contract Documents or as directed by the County, the pressure reducing valve shall come equipped to provide flow metering capability with an electronic 4-20 mA valve position transmitter, 4-20 mA differential pressure transmitter with sensing line piped to the main valve, and remote mount electronic controller panel.

(f) The controller shall be 120 volt AC in a NEMA 4X enclosure with an internal low voltage loop power supply to power valve mounted devices. The controller shall be wired to the valve position transmitter and the differential pressure transmitter. The controller shall monitor both signals to compute the flow as the valve modulates to maintain the downstream pressure. The flow signal shall be a passive signal for monitoring purposes only and shall have no effect on valve operation. The controller shall provide a 4-20ma output signal proportional to flow (engineering units of GPM) for local and remote monitoring.

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(g) The differential pressure and PRV position transmitters shall be provided with NEMA 4X enclosures. The differential pressure and PRV position transmitters shall be provided with standard manufacturer's calibration hardware and software, with documentation and instructions for calibrating transmitters.

961.05 TAPPING SLEEVES AND VALVES.

(a) Tapping sleeves for DIP, PVC C-900 and PVC C-905 pipe shall be flanged outlet. All tapping sleeves shall be furnished with an outlet for testing. The Contractor shall provide facilities for and shall test the tapping sleeve and valve prior to making tap. Tapping sleeve shall be stainless steel. Cast iron tapping sleeve will be permitted only with approval from Department of Public Works. Tapping sleeves for PVC pipe shall be specifically designed for AWWA C900 and C905 piping. Only core cutting type tapping machines shall be used for PVC pipe.

(b) Tapping sleeves for HDPE pipe shall be either the stainless steel strap-on type or the HDPE electrofusion type. Strap-on saddles shall be stainless steel conforming to ASTM A240 and shall have flanged outlet. Sleeves shall be furnished with testing outlet. Stainless steel sleeves shall have stainless steel hardware and spring-type washers. Sleeves shall be limited to services under 150 psig and an operating temperature range of 32-degree to 85 degree F.

(c) Electrofusion saddles shall be molded HDPE conforming to ASTM D3350, PE3408 with cell classification 345464C and shall have integral terminal plugs for electrofusion equipment connection. Saddles shall be suitable for HDPE piping 3-inch through 20-inch diameter with 2-inch diameter threaded pipe outlet. Corporation stops shall be used in lieu of gate valves.

(d) Valves for tapping service shall meet all the requirements for resilient seated gate valves. In addition, the body seat rings shall have adequate clearance to pass a cutter of full diameter and nominal size of the tapping valve. All tapping valves shall be flanged by mechanical joint.

(e) Tapping sleeves for PCCP shall be furnished and installed in accordance with the requirements of the manufacturer, and by a County approved tapping firm.

961.06 ROADWAY VALVE BOXES. Roadway valve boxes shall be round head, sliding type and adjustable with a 3-foot to 4-foot extension with 5-1/4 inch diameter shaft complete with cover marked "Water" for water applications and "Sewer" for sewer applications. Valve boxes in paving shall be provided with locked adjustment risers to set box cover flush with finished grade. Deep set valves shall have extension stems and valve boxes as shown on the Standard Details.

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961.07 FIRE HYDRANT.

(a) All fire hydrants shall conform to the requirements of AWWA C502 for Dry Barrel Fire Hydrants. The quality and bury length shall be as specified. The fire hydrants shall be furnished with two (2) 2-1/2-inch outlet nozzles (National Standard Fire Hose Coupling Screw Threads) and one (1) 4-1/2-inch outlet nozzle (City of Baltimore Standard and Howard County Detail W1.14). Fire hydrants shall have a nominal 5-1/4-inch main valve opening.

(b) The inlet connection shall be a 6-inch mechanical joint connection; the hydrants shall open counterclockwise; and the color of the finish paint for the top section shall be a County approved, non-lead based, Safety Orange. Hydrant shall not experience excessive vibration or cavitation noise at any position of the main valve.

(c) The following design features are supplementary specifications in accordance with AWWA C502. The fire hydrants shall be the compression type opening against the pressure. The interior of the shoe plus the iron cap nut and main valve bottom plate shall be epoxy coated in accordance with AWWA C550 for Protective Interior Coatings for valves and hydrants. Bronze-to-bronze threads shall be used for main valve assembly removal. Hydrants shall have frangible sections near the ground line. Caps shall be secured to the hydrant barrel by chains having links made from stock not less than 3/16-inches in diameter. Cables of equivalent strength are not acceptable. There shall be two drain outlets provided in the base, barrel, or between the base and barrel. The opening between the operating nut and the top of the bonnet shall be protected by skirting the operating nut. Dual 0-ring stem seals shall be used.

(d) Hydrants shall be a "Traffic Model" design having a ground line breakaway feature to prevent or minimize damage to nozzle section and standpipe in the event of traffic collision. The main valve shall remain closed and reasonably tight against leakage.

(e) The operating nut and outlet nozzle cap nuts shall be Pentagon, measuring 1-1/2-inch from point to flat base.

(f) Hydrants shall be prime coated and painted in accordance with AWWA Standard Specifications, color as noted in Paragraph b above.

(g) Hydrants shall be provided with grade extensions as necessary. Extensions shall be provided in 6-inch increments. Only one extension shall be used per hydrant. Extensions shall be by the same manufacturer as the hydrant.

(h) All exterior hardware shall be stainless steel.

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961.08 WATER HOUSE SERVICES AND APPURTENANCES FOR 5/8-INCH THROUGH 2-INCH PIPE.

961.08.01 Copper tubing shall comply with the latest standard specifications for seamless copper water tube, ASTM B88 soft temper, type k unless otherwise shown or directed.

961.08.02 Unions, couplings and other fittings for copper tubing shall-be the copper service thread type. Three part unions shall be used. All unions, couplings and other fittings shall be for flared end or compression end with grip joints unless otherwise approved by the County. All brass fittings shall be of the "No-Lead" type and marked with manufacturer's designations.

961.08.03 Corporation stops for use on copper base services shall be the ballcorp style with full port opening and 300 psi rating, taper thread inlet with either flared end or compression end with grip joint outlets. Corporation stops shall be manufactured in accordance with AWWA C800.

961.08.04 Curb Stops shall be full port ¼ turn valves, 300 psi rating, with either flared end or compression fittings with grip joints. Curb stops shall be heavy cast bronze body that conforms to material requirements of AWWA C800.

961.08.05 Outside Meter Settings 1-inch and Smaller.

Outside meter settings 1-inch and smaller shall be the angle yoke style with vertical inlet and outlet. Yokes settings shall have inlet and outlet angle key valves with bleeders.

961.08.06 Twin Services.

For twin services inside meter vaults, t-bar setters shall be used. Yokes shall be as specified in 961.08.05.

961.08.07 ¾-inch and 1-inch Inside Meter Setting.

¾-inch and 1-inch inside meter settings shall be vertical inlet and outlet with ends for flared copper or compression end with grip joints. Settings shall be manufactured in accordance with AWWA C800.

¾-inch and 1-inch inside meter settings shall be vertical inlet and outlet with ends for flared copper or compression end with grip joints. Settings shall be manufactured in accordance with AWWA C800

961.08.08 1 ½ -inch and 2-inch Copper Water Meter Settings

1 ½ 1-1/2-inch and 2-inch copper water meter settings shall be horizontal inlet and outlet, high bypass option, and ends for flared copper or compression end with grip joints. Settings shall be constructed of brass conforming to AWWA C800 and copper tubing.

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961.08.09 Service Saddles.

(a) Service Saddles For Metallic Pipe: Service saddles for metallic pipe shall be ductile iron body in accordance with ASTM A395 or ASTM A536 double strap type meeting the requirements of AWWA C-800. Straps shall have a flat pipe bearing surface and shall be 5/8-inch AISI C1010, ASTM A510 steel, zinc plated with trivalent seal.

(b) Service Saddles For Non Metallic Pipe: Service saddles for non metallic pipe shall be ductile iron body meeting ASTM A395 or ASTM A536 with a single 3¼ -inch minimum width or double 1½-inch minimum width 18-8 type 304 stainless steel band(s), be epoxy or nylon coated and meet the requirements of AWWA C800. Saddles and straps shall be formed to meet the curvature of the pipe, provide full support around the circumference of the main and shall not distort, scratch or damage the pipe when tightened. Saddles shall be manufactured for underground service and shall be rated for a minimum service of 200 psi. Saddles shall have water tight rubber gaskets meeting ASTM D2000 around the tap hole. Service saddles shall be used for 2-inch and smaller water house connections on nonmetallic pipe. Saddles for use on PVC water mains shall be manufactured specifically for use on AWWA C900 PVC pressure pipe. Only core-cutting type tapping machines shall be used with service saddles on non-metallic pipe.

961.08.10 Curb Stop Boxes.

Cover shall be cast iron or poly-iron. Curb Service Box shall be injection molded and commercially manufactured utilizing a compound manufactured per ASTM D-2853-70, Class 1212. Material shall be a rigid combination of polyolefin with fibrous inorganic component reinforcing and UV stabilizer additives to assure resistance to material degradation from ultraviolet light. The box shall be telescoping two-piece (screw style) with polycarbonate ring, pentagon bolt and cover. Upper section shall be locatable electronically and magnetically with ring riveted to the top piece. Lower section shall be a full threaded shaft of 2.35" ID over a Buffalo style arch, 4" wide by 7" high and saddle, 3-1/3" wide by 4" high.

961.08.11 Meter Boxes.

Meter boxes for 2-inch and smaller meters shall be the pre-cast concrete type with cast iron cover and frame. In high groundwater locations, round prefabricated (polyethylene) plastic water meter vaults shall be used in lieu of pre-cast concrete. Meter boxes for 1-inch and smaller meters shall be in accordance with Standard Details W3.27 through W3.32. Boxes for 1 ½" and 2" meters shall be in accordance with Standard Detail W3.34. Meter box cover and frame shall be in accordance with Standard Detail W3.12.

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961.09 METER VAULTS.

Unless otherwise noted on the Contract Documents, meter vaults for meters 3-inch and larger shall be pre-cast concrete structures and shall have configurations as shown on the Standard Details. Where required by the County, vaults and all components within the structure shall be prefabricated and assembled in shop conditions. Individual components such as pipe, fittings, valves, and other appurtenances shall comply with requirements set forth elsewhere in this Category.

961.10 BLOW-OFF HYDRANTS

(a) Blow-off hydrants shall be for purposes of water main flushing only.

(b) Blow-off hydrants shall be for traffic installation with Howard County modified 2½ -inch steamer cap and stainless steel nuts and bolts. The hydrant barrel shall be 3 inches in diameter and made of Schedule 80 PVC or Class 52 DIP. Unless otherwise specified, the bury length shall be 4.0 feet.

(c) The meter box shall be high density polyethylene 18-inch diameter, tapered to 24-inches at the bottom.

(d) The frame and cover for the meter box shall be ductile iron with anchor lugs. The cover lettering shall be "Water Blow-Off".

961.11 PUMPS, VALVES AND APPURTENANCES FOR LOW PRESSURE SEWER SYSTEMS.

961.11.01 Grinder Pump.

Grinder pumps shall be the semi-positive displacement type packaged grinder pump. Pump package shall include grinder pumps suitably mounted in fiberglass or HDPE basin; electrical quick disconnect; necessary power and control wiring; pump removal system; shut-off valve, anti-siphon valve, and check valve assembled within the basin. Where required by the Contract Documents, above-grade electrical control panels shall be provided to house electrical disconnects and alarm features.

961.11.02 Union Ball Valves.

(a) Valves shall be rated for 150 psi pressure with a tight shut-off at 70°F and shall have the full port configuration in all sizes. The port through the ball and valve interior shall be constant in diameter and shape for a straight through flow pattern.

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There shall be no obstruction to flow through the valve interior. Valves shall be suitable for the conveyance of raw sewage.

(b) Valves shall have quarter-turn operation and shall be equipped for buried service and operation through a 5¼-inch inside diameter valve box. Each valve shall be equipped with a single piece tee operating head, 5/8 inch thick measuring one inch high and with a length equal to the diameter of the valve head or a minimum of two inches as shown on the Standard Details. The operating tee head and adapter shall be designed to withstand the opening and closing torques up to the full pressure rating of the valve without damage to the operating tee head, adapter, or valve. The operating tee head shall be positioned on the valve so the position of the valve port, open or closed, can be determined by viewing from the top of the valve. In the closed position, the operating tee head shall be perpendicular to the direction of flow. Tee head and adaptor pin shall be of aluminum, brass, stainless steel, or bronze, and shall be supplied by manufacturer of valve.

(c) End connections shall be as shown on the Standard Details with adapters provided that are compatible with PVC pipe. Unions shall be integral with the valve and permit easy removal of both union nuts.

(d) Seats shall be of permanently lubricated Teflon and the O-ring seal shall be of Buna-N rubber.

(e) Ball valves shall have the minimum CV values for the valve sizes listed below:

Size	**gpm at one psi pressure drop**
1¼ inch	77
1½ inch	116
2 inch	159

961.11.03 Check Valves.

Check valves shall be gravity-operated, flapper type suitable for buried service in horizontal position and the sizes shown on the Contract Documents. Internal parts shall be made of stainless steel, PVC, and/or synthetic elastomer to insure corrosion resistance. Valves shall be manufactured for at least 150 psi service rating and shall be compatible for use with the SDR-21, solvent cement, or push-on PVC pipe. Each check valve shall provide full-ported passageway when open and flapper or seat to assure tight seating at low back pressure. Valve body shall be manufactured from PVC. Valve shall be provided with unions on either side to facilitate removal of the check valve.

961.11.04 Connection Appurtenances.

(a) Service saddles with clamps and service sleeves shall provide full support around the circumference of the pipe and shall not distort, scratch, or damage the pipe

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when tightened. Saddles, service clamps, and sleeves shall be manufactured for underground service, shall be rated for a minimum service of 150 psi and shall be of bronze, brass, stainless steel, malleable iron, PVC or polypropylene with watertight gaskets around the tap hole. Saddles with clamps, and sleeves shall be formed at the factory to match the outer diameter of the pipe on which they will be used. Outlet shall be compatible with corporation stop or piping to be used by Contractor. Service clamps shall be double strap. Outlet diameter shall be 1¼ inch minimum.

(b) Tees shall be in accordance with requirements for PVC pressure pipe and fittings of Section 905.01.05 PVC pressure pipe.

(c) Corporation stops shall be in accordance with Section 961.08.03 except that threaded inlets and outlets shall be compatible with service saddles, service sleeves, piping, and fittings. Minimum size shall be 1¼-inch diameter or as indicated on the Contract Documents.

SECTION 962 — SANITARY SEWER MANHOLES

962.01 MANHOLES.

(a) Unless otherwise specified, the Contractor shall install precast manholes. Precast manholes shall meet the requirements of ASTM C478. Precast manholes shall be constructed at the locations and to the elevations shown on the plans or as directed by the Engineer. Installation shall be in accordance with the manufacturer's instructions.

(b) Joints between precast manhole pipe sections shall be a rubber gasket meeting the requirements in ASTM C-443. When assembled the gasket shall be self-centering and make a uniform watertight joint. Rubber gasket joint shall be "O-ring" gasket.

(c) The flexible pipe to manhole seal shall conform to ASTM C- 923. The pipe to manhole seal shall consist of either an integrally cast rubber gasket into the manhole wall or a rubber gasket with stainless steel internal expansion band and external pipe clamp. All connectors shall be designed to allow adequate deflection for all pipe slopes entering and exiting manhole structures.

(d) For sewer connections into existing manholes, a mechanical wedge-in-place type connector shall be installed within the cored opening.

(e) All exterior surfaces of manholes shall receive a minimum two coat application of coal tar protective coating. Surfaces shall be prepared in accordance with the manufacturer’s instructions and coatings applied in the factory in a manner

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acceptable to the Engineer. Manhole coatings damaged from handling and installation shall be repaired by the Contractor.

(f) Provide benched flow channels in all manholes as indicated on the Contract Documents. Precast concrete flow channels shall be allowed in lieu of brick flow channels subject to the approval of the Engineer. Flow channels shall be benched to the crown of the pipe.

962.02 MANHOLE BRICK AND MORTAR FOR SEWAGE SERVICE. All manhole brick shall conform to ASTM C-32, Grade SM, except that the maximum absorption for the average of five bricks shall not exceed 10%; and the individual brick maximum shall not exceed 14%.

Cement for mortar shall be in accordance with ASTM C150 for Type II.

962.03 MANHOLE FRAMES AND COVERS. Frames and covers shall be heavy duty traffic type cast iron in accordance with ASTM designation A-48 for Class No. 35B.

962.04 MANHOLE STEPS. Manhole steps shall meet one of the following specifications, or approved equal, and comply with the Standard Details.

(a) Type I (brick manhole): Cast iron meeting the requirements of ASTM A-48, class 35.
(b) Type II (precast concrete manhole): Steel Reinforced Polypropylene plastic step. Steel shall meet ASTM A-615 and polypropylene shall meet ASTM D-414.

Manhole steps within any given manhole shall not vary in type and detail without the written approval of the Engineer.

962.05 MANHOLE GRADE ADJUSTMENT RINGS AND RISERS. Manholes shall be adjusted to finished grade as shown on the Contract Documents in accordance with the Standard Specifications. Grade adjustments for manholes shall be either concrete or brick. All concrete grade rings shall conform to ASTM C-478. All sewer brick shall be as specified in section 962.02 of this Specification.

Manhole risers for adjustment of finished grade for existing manholes shall consist of a split steel ring to be inserted into the existing manhole frame as necessary to provide the vertical adjustment of the frame and cover without disturbing the existing pavement. All vertical adjustments shall be made with only one vertical riser installed per manhole. All risers shall have a stainless steel locking mechanism to secure the riser against the existing manhole frame.

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962.06 MANHOLE INTERIOR LINER. Interior manhole liners are only required where indicated on the Contract Documents.

All manhole liners shall be a PVC or HDPE sheet liner with continuous locking extensions in the manhole and auxiliary structures to protect the exposed manhole surface from corrosion.

All liners must be continuous and free of pinholes across the joints and in the liner itself, shall have a minimum design life of 50 years in sewage conditions, and shall have been in use for a minimum of 3 years.

SECTION 963 — JACK AND BORE, AND TUNNELING

963.01 CARRIER PIPE. Carrier pipes shall meet requirements as specified in their respective sections of this Specification.

963.02 CASING PIPE. The casing pipe size for jack and bore installations shall be as indicated on the Contract Documents.

963.02.01 Steel Casing Pipe.

For water and sewer carrier pipelines, the minimum steel casing pipe diameter shall be 36 inches with a minimum wall thickness of ½-inch.

The casing pipe shall be smooth-walled steel pipe, and shall have a minimum yield strength of 36,000 psi (ASTM A-570 Grade 36). Joints shall be fully welded around the circumference of the pipe with a complete penetration weld. Pipe shall conform to AWWA C-200. Paint the outside of pipe with 2 coats of coal tar protective coating.

963.02.02 Reinforced Concrete Casing Pipe.

Reinforced concrete casing pipe shall be in accordance with the requirements of Section 905.04.02 except that it shall have a minimum strength of Class V and a minimum thickness of Wall B.

963.03 CASING END SEALS. See the County's Approved Products List. Approved manufacturers shall have a minimum 5 years of fabricating casing end seals in the United States.

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963.04 CASING SPACER/INSULATORS. See the County's Approved Products List. Approved manufacturers shall have a minimum 5 years of fabricating casing spacer/insulators in the United States. Casing spacer/insulators shall be fabricated items capable of providing position, support and insulation of water and sewer carrier pipes inside casings or tunnels.

Spacer/insulators shall be virtually corrosion proof and resistant to salt spray and acids, shall provide dielectric insulation for the carrier pipe, and shall hold the carrier secure. Spacer/insulators shall be used to allow for future access by eliminating the need to fill the casing/tunnel annulus with sand, grout or pea gravel, which acts as an electrolyte and can introduce unwanted current to a steel or ductile iron carrier pipeline.

963.04.01 Position.

Spacer/insulators must provide the ability to position the carrier pipe within the casing/tunnel using one of the basic centering positions described below, and in accordance with the requirements of the Standard Detail and Contract Documents:

(a) ***Standard Centering:*** Places spacer/insulators at the bottom of the casing/tunnel but provides no restraint against movement caused from flotation or surge pressure buckling.

(b) ***Standard Restrained Centering:*** *Places spacer/insulators at the bottom of the casing/tunnel and provides restraint against movement.*

(c) ***Concentric Centering:*** *Places spacer/insulators at the center of the casing/tunnel and provides restraint against movement.*

Spacer/insulators must be capable of grade adjustment:

(a) To allow for design flexibility.

(b) To position a gravity sewer to its required grade alignment within a casing/tunnel of a different grade alignment.

(c) To maintain the required carrier pipe grade alignment by adjusting for irregularities in the casing/tunnel alignment.

Spacer/insulators shall be injection molded high density virgin polyethylene or an ultra high molecular weight polymer. The carrier pipe must be able to slide into the casing/tunnel with minimum pushing force. The bearing surfaces or runners of the spacer/insulators must have high resistance to wear and abrasion, high impact strength, low deflection under compression, and a low coefficient of friction, so they will glide over rough spots, deflections, ridges, or uneven surfaces.

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963.04.02 Support.

The first spacer/insulator shall be placed not more than 2 feet from each end of the casing/tunnel. Spacer/insulator width and subsequent placement intervals shall be to maintain joint stability during and after installation, to maintain the height of separation between carrier and casing/tunnel, and to maintain the required grade adjustments, and shall be in accordance with the manufacturer's recommendations and specifications, depending on the support required for the carrier pipe diameter, type, live load or weight, and pipe stiffness or rigidity. In no case, however, shall there be less than 3 spacer/insulators per pipe length.

963.04.03 Insulation.

Spacers/insulators must provide optimum dielectric and thermal insulation for cathodic protection from a possible electrical shorting between the carrier pipe and casing/tunnel.

Spacer/insulators must provide excellent electrical resistance and low moisture absorption for minimal electrical current loss and no impairment of cathodic protection.

963.04.04 Components and Materials:

Spacer/insulator components may consist of a shell, risers, fasteners, liners, and runners. Materials may be T-304 Stainless Steel, Carbon Steel, PVC, injection molded high density virgin polyethylene, or an ultra high molecular weight polymer.

Runners should be securely attached mechanically to riser support structures at appropriate positions to properly support the carrier pipe.

All welds and metal surfaces shall be chemically passivated.

963.05 GROUT.

(a) The cement used for grout shall be in accordance with the latest "Standard Specifications for Portland Cement" ASTM Designation C150 for Type I or Type II. Certified mill tests shall be furnished for all cement used for grout. The sand used for grout shall be in accordance with ASTM C404 Size No. 1 Fine Aggregate, or ASTM C33 Fine Aggregate.

(b) Water shall be free from sulfates and other objectionable quantities of silt, organic matter and other impurities.

(c) Design mix for grout shall have a minimum compressive strength of 100 psi attained within 24 hours. Grout shall be fluid enough to inject through the grout

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fittings and to fill voids. However, it shall set promptly enough to keep grout flow under control and to keep grout from flowing into the new annular space after the next advance.

963.06 TUNNEL BULKHEADS. Tunnel bulkheads shall be 8-inch thick brick and mortar, at each end, with 2-inch diameter PVC drain pipes.

963.07 TUNNEL LINER PLATES.

(a) Material and Forming. All materials shall be new and steel liner plates shall conform to requirements of ASTM A569 and AASHTO M167. Liner plate steel shall have the minimum mechanical properties of flat plate before cold forming as follows:

Tensile strength	= 42,000 psi, min.
Yield strength	= 28,000 psi, min.
Elongation in 2 inches	= 30 %

The liner plate thickness shall be as shown on the Contract Documents or heavier, but never less than the approved design thickness. Thickness of the liner plates shall be no less than specified. If the tunnel method of construction includes a procedure to use installed liner plate for jacking purposes, liner plate thickness shall be increased to withstand the jacking pressure to be imposed.

Fabricate similar segments with such accuracy and uniformity in dimensions that segments will be entirely interchangeable not only in individual rings but with similar segments of other rings. All plates shall be punched for bolting on both longitudinal and circumferential seams or joints and shall be so fabricated as to permit complete erection from the inside of the tunnel. In 2-flange plates, the longitudinal lapped seams shall be punched for four bolts per foot. To provide four bolts per foot, holes along the edge of the plate that will form the longitudinal seams in the finished structure shall be staggered in rows two inches apart with holes in one row in the valleys and holes in the other row in the crests of the corrugations. Space holes accurately so two rings may be bolted in any relative position with same size bolts in every bolt hole. Tolerance of diameter to bolt holes shall be plus or minus 0.02 inch from the specified diameter. Any segment which does not comply with the tolerances indicated shall be replaced.

Unless otherwise specified, liner plate grouting rings shall be located longitudinally at 48-inch or 54-inch intervals, depending on plate size. Liner plate grouting rings shall have a minimum of two grout holes in each grouting ring. Grout holes shall be 1-1/2 or 2-inch diameter standard pipe half couplings welded to the liner plate.

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(b) Coating. Where the annular space between the carrier pipe and liner plates is not filled and is to be maintained, the liner plates are to be coated, inside and out, as follows:

(1) Liner plates shall be hot-dipped galvanized using prime western spelter, or equal, after forming in accordance with AASHTO M167. In no case shall the weight of the coating be less than 2 oz./sq. ft. If the average spelter coating as determined from the required samples is less than 2 oz./sq. ft., or if any one sample shows a deficiency of 0.2 oz., the entire lot shall be rejected. Spelter coating shall be of first class commercial quality free from defects such as blisters, flux and uncoated spots.

(2) Liner plates shall be bituminous coated in accordance with AASHTO M190, Type A pipe.

963.08 TUNNEL LINER PLATE BOLTS AND NUTS.

(a) Material. Bolts and nuts used with 4-flange plates shall be not less than 1/2 inch in diameter for plate thicknesses less than, or equal to, 0.179 inch (7 ga.), and not less than 5/8 inch in diameter for plate thicknesses greater than 0.179 inch (greater than 7 ga.).

(1) Bolts shall have quick-acting coarse threads meeting the requirements of ASTM A 307.

(2) Nuts shall have quick-acting coarse threads meeting the requirements of ASTM A 307, Grade A.

(b) Coating. Bolts and nuts shall be hot-dip galvanized in accordance with ASTM A 153 (AASHTO M 232).

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SECTION 964 — SANITARY SEWER REHABILITATION

964.01 CURED IN-PLACE (CIP) PIPELINE SLIP LINER.

964.01.01 General

(a) The CIP liner shall generally consist of a corrosion resistant polyester, vinyl ester, or epoxy thermosetting resin, or approved equal impregnated flexible polyester felt or fiberglass fiber. The liner shall meet the requirements of ASTM F1216 and shall be constructed to withstand inversion pressures, have sufficient strength to bridge missing pipe, stretch to fit irregular pipe sections, and shall invert smoothly around bends. The liner shall fit tightly to the internal circumference of the existing pipe, and a membrane integrally bonded to the internal circumference of the felt, thus forming a smooth, chemically inert internal flow surface. The membrane shall be a minimum of 0.25-mm +5% and shall not be considered to impart any structural strength of the liner.

(b) The wall color of the interior pipe surface of the cured-in-place pipe after installation shall be a light reflective color so that a clear detail examination with closed circuit television inspection equipment may be made.

(c) Flow Capacity: Maintenance of flow capacity of existing pipes is essential. Rehabilitated pipe shall have no reduction in capacity.

(d) The Contractor shall verify that installed thickness of the CIP is within minus 5 percent and plus 10 percent of the specified thickness. The Contractor shall take samples to determine the installed liner thickness. The results of the liner thickness measurements shall be submitted to the Engineer. Samples shall be taken from each liner thickness at each liner insertion. The costs for thickness testing shall be included in the bid price for rehabilitation. Additional testing requirements are addressed in the 1013.07.10 in this specification

(e) Resin Content: The resin content of the liner shall be 10-15% by volume greater than the volume of felt in the liner bag. All resin shall be specifically blended for use with the inversion process and be chemically stable and resistant to concentrations of acids, alkalis, and organics found in normal sewage.

(f) Length: The length of the liner shall be that which is deemed necessary by the Contractor to effectively carry out the insertion and seal the liner at the inlet and outlet of the manhole. Individual inversion runs may be made over one or more manhole to manhole sections as recommended by the manufacturer.

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(g) The Contractor shall provide a liner exhibiting the previously described properties. Prior approval of shop drawings related to any or all materials or methods of installation shall not relieve the Contractor of this responsibility.

(h) The resin used shall not contain fillers, except those required for viscosity control, fire retardance, or as required to obtain the necessary pot life. Thixotropic agents, which will not interfere with visual inspection, may be added for viscosity control. Resins may contain pigments, dyes or colors which will not interfere with visual inspection of the cured liner. However, the types and quantities of fillers and pigments added shall have prior approval of the Engineer.

(i) The Contractor shall deliver the uncured resin impregnated liner bag to the site. The bag may not be impregnated at the site. The liner bag shall be stored out of direct sunlight at a temperature of less than 39º F. The Contractor shall provide all appropriate transport, handling and protection equipment including refrigerated, or otherwise suitably cooled, transport equipment.

964.01.02 Design Parameters

(a) The required structural CIP wall thickness shall be designed in accordance with the guidelines in Appendix X1 of ASTM F-1216. In the absence of site specific information, the following design parameters shall be used for the design of the structural liner.

Common Design Parameters	
Modulus of Soil Elasticity	700 psi
Soil Density	120 pcf

(b) All designs shall have a factor of safety of 2.0 and shall assume fully deteriorated pipeline conditions.

(c) The Contractor shall provide calculations supporting recommended liner thickness. The calculations shall be sealed by a Professional Engineer Registered in the State of Maryland.

(d) The Contractor shall estimate the ovality by viewing the video media and other information provided by the County. If video media is not available, the Contractor shall assume an ovality of 3%. In cases where the ovality exceeds 10%, the Contractor may consider employing alternative design methods (such as beam design methods) to determine the pipe thickness.

(e) CIP subjected to traffic live loads shall be calculated by AASHTO Standard Specifications for Highway Bridges, HS-20-44 Highway Loading.

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(f) Thickness specified (designed by the Contractor and approved by the Engineer) is the final, in-ground thickness required. Measured sample thickness will not include polyurethane or polyethylene coatings, any layer of the tube not fully and verifiably impregnated with resin, or any portion of the tube not deemed by the Engineer to be a structural component of the composite.

(g) The Contractor must consider any factors necessary to ensure the final; cured-in-place pipe thickness is not less than specified (designed by the Contractor and approved by the Engineer) above. These factors include any stress applied to the material during transportation, handling, installation and cure; the host pipe's material type, condition, and configuration; weather (including ambient temperature conditions); and any other factors which are reasonably expected to be found in existing sanitary sewer systems.

(h) Design thickness provided by the Contractor shall be evaluated by the Engineer prior to beginning work.

964.01.03 Manufacturer Information

(a) It shall be necessary for the Contractor to obtain the County's prior approval for all materials or processes and the County shall have the power at any time to order the Contractor to modify or discontinue any practice. All such orders shall be given in writing.

(b) All fabricating and Contractor testing shall be carried out under cover and no materials shall be exposed to the weather until they are ready to be inserted. All materials should be protected from the weather and exposure to ultra-violet light as practicable during the manufacture and installation process.

(c) Each liner shall be accompanied by a certificate of conformity.

(d) The product proposed for the cured-in-place rehabilitation of sewers must have been in use for at least three years. All cured in place rehabilitations shall be installed only by an experienced Contractor having installed at least five similar projects involving the same material, equal size, and comparable length. The Contractor shall submit a comprehensive list of experience presenting similar experience involving cured in place liners within the past three (3) years. Information to be submitted shall include but not be limited to: date and duration of work, location, pipe information (i.e., length, diameter, material, etc.); utility Owner information (i.e., name, address, telephone number, contact person); and pipeline use.

964.02 POLYETHYLENE SLIP LINER.

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(a) Polyethylene sewer liner pipe and fittings shall be manufactured from a polyethylene compound conforming to ASTM D1248 and meeting the materials requirements for Type III, Class C, Grade Category 5.

(1) Pipe made from this compound must have a long-term hydrostatic strength rating of 1600 psi or more, in accordance with ASTM D2837.

(2) When the environmental stress crack resistance (ESCR) of the compound is measured in accordance with ASTM D 1693, Condition C, the compound shall withstand not less than 1,000 hours in 100% solution Igepal CO-630 at 100°F before reaching a 20% failure point (F20).

(b) The liner pipe shall be manufactured in accordance with ASTM D3035 or ASTM F 714.

(c) The same manufacturer information referenced in 964.01.03 for the CIP slip liner is required for the Polyethylene slip liner.

964.03 SEWER POINT REPAIR.

964.03.01 Cured In Place Liner

(a) The tube shall consist of one or more layers of flexible needled felt material capable of carrying resin and withstanding installation pressures and curing temperatures. The felt tubular material shall be lined on one side with a translucent waterproof coating such as polyurethane, polyethylene, or polyvinyl chloride (PVC), and be fully impregnated with a liquid thermosetting polyester or vinylester resin and catalyst system compatible with the inversion process. The resin must be able to cure in the presence of water and the initialization temperature for cure shall be less than 180^{o} F (82.2^{o} C). The tubing shall be properly sized to the diameter of the sewer pipe and the length of the sewer pipe to be point repaired and to be able to stretch to fit irregular pipe sections.

(b) Resin/Catalyst: The liquid thermosetting resin used to impregnate the tube shall produce a properly cured tube, which will be resistant to abrasion due to solids, grit and sand. The cured tube shall be resistant to corrosion due to acids and gases such as sulfuric acid, carbonic acid, hydrogen sulfide, methane and carbon monoxide. The resin selected shall have proven resistance to normal municipal sewage.

(c) Packaging, handling and shipping shall be performed in accordance with the manufacturer's instructions.

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(d) Tests for compliance with this specification shall be made according to ASTM F-1216. Upon request, the manufacturer, at no additional cost to the County shall provide a certificate of compliance with this specification to the County.

(e) The product proposed for the rehabilitation of the sewers must have been in use for at least three years for pipeline diameters of similar size to the contract documents. The Contractor may be required to provide up to 6 references and/or demonstrate the product prior to approval by the Engineer.

(f) The Contractor shall issue a one year Installer Warranty Certificate covering all materials used, installation and structural strength, smooth hydraulic transition, and assurance against any visible deformation during the warranty period. The Warranty Certificate is to state that the Contractor shall repair all above listed defects at the Contractor's expense within 30 days of notification of the defect.

(g) The manufacturer of the CIP Point Repair System shall issue a 10-year Material Warranty Certificate for supply of CIP Point Repair System materials of the latest design for any defective point repair identified during the warranty period. The Warranty Certificate is to state that the manufacturer shall supply replacement parts at the manufacturer's expense within 60 days of notification of the defect.

964.03.02 Chemical Sealing of Pipe Joints

(a) General

(1) The intent of this item is to define the properties a sealing material shall have to perform effectively in the intended application and under expected field conditions.

(2) Generic chemical sealing materials currently used are listed with the basic properties, performance standards, and mix ratios which have previously given acceptable performance.

(3) It is recognized that new and improved chemical sealing materials may become available. Sources, manufacturers, and product names of chemical sealing materials will change and therefore specific sources, manufacturers, and product names are not referred to in this specification.

(4) Sealing materials shall contain a root inhibitor.

(b) All chemical sealing materials used in performance of the work specified shall have the following properties and characteristics:

(1) While being injected, the chemical sealant shall be able to react/perform in the presence of water.

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(2) The cured material shall be capable of withstanding submergence in water without degradation.

(3) The resultant sealant formation shall prevent passage of water.

(4) The sealant, after curing, shall be flexible as opposed to brittle or rigid.

(5) In place, the resultant sealant formation shall be able to withstand freeze/thaw and wet/dry cycles without adversely affecting the seal.

(6) The sealant formation shall not be biodegradable. Additives may be used to meet this requirement.

(7) The cured sealant shall be chemically stable and resistant to concentrations of acids, alkalis, and organics found in sewage.

(8) Packaging of component materials shall be compatible with field storage and handling requirements. Packaging shall provide for worker safety and minimize spillage during handling.

(9) Mixing of component materials shall be compatible with field operations and not require precise measurements.

(10) Cleanup shall be done without excessive use of flammable or hazardous chemicals.

(11) Residual sealing materials shall be removable from the sewer after injection to insure no flow reduction, restriction, or blockage of sewage flows.

(c) The following chemical sealing materials shall be acceptable.

(1) Acrylamide base gel

(2) Urethane base foam

(3) Urethane base

964.04 MANHOLE REHABILITATION.

964.04.01 Manhole Rehabilitation through Chemical Sealant Coating.

The Contractor may use the following products in conjunction with the coating material to facilitate manhole rehabilitation. Material compatibility of the products must be verified prior to commencement of work.

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(a) Patching Mix: A quick-setting cementitious material shall be used as a patching mix and is to be mixed and applied according to manufacturer's recommendations. The cementitious material shall be suitable for topcoating with an epoxy coating, and shall also have the following minimum requirements:

Compressive Strength	ASTM C-109	6 hr 1,400 psi
Shrinkage	ASTM C-596	0% at 90% relative humidity
Bond	ASTM C-321	28 day 150 psi
Cement		Sulfate resistant
Density, when applied		105 ±5 pcf

(b) Infiltration Control Mix: A rapid-setting cementitious product specifically formulated for leak control shall be used to stop minor water infiltration and shall be mixed and applied according to manufacturer's recommendations. The control mix shall be suitable for topcoating with an epoxy coating. The control mix shall also have the following minimum requirements:

Compressive Strength	ASTM C-109	1 hr	600 psi
Compressive Strength	ASTM C-579 B	24 hr	1,000 psi
Bond	ASTM C-321	1 hr	30 psi
Bond	ASTM C-321	24 hr	80 psi

(c) Grouting Mix

(1) A cementitious grout shall be used for stopping very active infiltration and filling voids and shall be mixed and applied according to manufacturer's recommendations. The grouting mix shall be suitable for topcoating with an epoxy coating. The cementitious grout shall be volume stable and have a minimum 28 day compressive strength of 250 psi and a 1 day strength of 50 psi.

(2) Chemical grouts may be used for stopping very active infiltration and shall be mixed and applied per manufacturer's recommendations.

(d) Water shall be potable

(e) Epoxy Coating

(1) The monolithic high-build epoxy coating shall consist of a 100% solids epoxy formulated with exceptionally high physical strengths and broad range chemical resistance. The coating system coverage shall be a minimum of 100 mils and shall be determined by the manufacturer. The manufacturer shall provide documentation for the recommended thickness.

(2) The epoxy coating shall have a one-year labor and materials, non-prorated warranty to stop infiltration and further deterioration of the structure.

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(3) The epoxy coating shall have the following minimum requirements:

Test	Property	Results
ASTM-D-790	Flexural Strength	12,443 psi
ASTM-D-695	Compressive Strength, Yield	12,870 psi
ASTM-D-638	Tensile Strength	6,640 psi
ASTM-D-638	% Elongation @ Max Load	1.53%
ASTM-D-2240	Hardness, Shore D	80
ASTM-D-256	Impact, IZOD	0.345 ft. lb/in of notch

(4) The epoxy coating shall have the following minimum requirements after seven day curing:

Test	Property	Results
ASTM-D2240	Hardness	82 Shore D
ASTM-63860	Ultimate Elongation	6%

(5) Chemical Resistance: The corrosion resistance of the epoxy coating shall be tested by the coating manufacturer in accordance with ASTM D543 and shall be resistant to acids, alkalis, and organics found in normal sewage.

(f) Product Certification: The manufacturer shall warrant that the products are produced in conformity with its standard specifications or formulations within recognized tolerances, free of adulteration or contamination, and that the product will perform in accordance with representations in the manufacturer's literature and technical data sheets when properly applied in strict conformance with the printed instructions on container and prescribed in technical data instructions and when applied to a properly prepared surface.

964.04.02 Manhole Rehabilitation with Interior Liner.

964.04.02.01 Epoxy Liners

Epoxy liners shall be two or three part epoxy to protect concrete and steel from chemical attack. The minimum thickness for liners shall be 60 mils for spray on and 125 mils for rotary spray.

Epoxy liners shall have a minimum tensile strength of 2,500 psi per ASTM C307, minimum flexural strength of 4,600 psi per ASTM C 580, and a 30 minute working time and initial setup of 17 hours at 70 degrees F.

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SECTION 965 — RECLAIMED WATER SYSTEMS

Material selection for reclaimed water systems shall be in accordance with Section 1019. Material requirements shall be in accordance with specifications specified herein. All materials shall be clearly identified for reclaimed water service. Exposed piping, valves and appurtenances shall have purple paint coatings along with legible stenciled text: "RECLAIMED WATER". Hose bibs, hydrants, sprinklers or other above ground connection points shall have signage clearly stating "Reclaimed Water – Do Not Drink". Valves, meters, valve boxes, meter boxes, and other components shall have the words "Reclaimed Water" embossed on the cover and/or body. Application of reclaimed water systems shall be in accordance with the latest restrictions of the Maryland Department of the Environment and State regulations (COMAR).

SECTION 966 — SHARED SEPTIC SYSTEMS

Shared septic systems shall be in accordance with Section 1018 of these specifications and as noted herein.

966.01 GRINDER PUMPS. Grinder pumps shall be the semi-positive displacement type packaged grinder pump. Pump package shall include grinder pumps suitably mounted in fiberglass or HDPE basin; electrical quick disconnect; necessary power and control wiring; pump removal system; shut-off valve, anti-siphon valve, and check valve assembled within the basin. Where required by the Contract Documents, above-grade electrical control panels shall be provided to house electrical disconnects and alarm features.

966.02 SIMPLEX PUMP CONTROL PANEL. Control panel shall be a fiberglass, UL listed, NEMA 4X enclosure with lockable hasp and UV stabilized construction. All metal parts shall be stainless steel. All external wiring between pump and panel shall be in conduit.

966.02.01 Control Panel Positioning

(a) Control panel shall be mounted on the house so that a clear line of vision is maintained between the control panel and the pump chamber.

(b) Minimum height to the bottom of the panel shall be 46" above final grade.

(c) Five foot clearance from obstructions such as equipment and landscaping shall be maintained.

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966.02.02 Control Panel Components

The control panel shall include the following:

(a) "Touch-safe" interior or a dead front interior shield

(b) External audible alarm (minimum 100 decibels) with accessible silencer button or pad

(c) External red flashing high water alarm light

(d) Magnetic contactor with one auxiliary contact.

(e) Hand / Off / Auto switch shall be three position type with maintained contact in both the Off and Auto position and spring return to center in the Hand position.

(f) Terminal strip shall be six point minimum and rated to 15 amp

(g) Double-pole pump circuit breaker.

(h) Single-pole alarm circuit breaker.

(i) GFI convenience receptacle.

(j) Pump run-time meter.

966.02.03 Control Panel Labeling

Control panel sign shall be adhesive back, non-fading; 3" X 5" and shall read:

HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS
SEWAGE PUMP CONTROLS
IN CASE OF ALARM CALL 410-313-4900
DO NOT OPEN PANEL

966.02.04 Control Panel Conduit Seal

Conduit Seal shall be installed in conduit between control panel and pump chamber, sealed to comply with the National Electric Code.

966.03 GRINDER PUMP CHAMBER

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966.03.01 Grinder Pump Chamber Construction

Grinder pump chamber shall be of fiberglass or composition plastic construction. The chamber shall have a green polyethylene domed lid closed with ¼" pan head drilled spanner tamper proof bolts. The chamber shall have a precast reinforced concrete access riser, minimum 24" ID. The base of the chamber shall be a maximum depth of 10' below the finished grade. Chamber shall rest on 6" of compacted AASHTO #57 aggregate. The inlet, outlet and baffle shall be connected with watertight seal boots. The grinder pump shall rest on a stainless steel support stand.

966.03.02 Grinder Pump Chamber Valves.

The chamber shall contain a PVC true union isolation ball valve and quick disconnect coupling, 24" maximum from riser access.

966.03.03 Grinder Pump Chamber Level Control

Pump level control shall be accomplished by non-fouling means and shall be one of the following devices:

(a) Pump control shall be accomplished by monitoring the pressure change in an integral air column connected to a pressure switch.

OR

(b) Pump control shall be accomplished through the use of low-voltage, solid state probes.

966.03.04 Grinder Pump Chamber Service Accessories

(a) Braided nylon pull rope (1/2" minimum diameter) to remove pump for servicing

(b) Stainless steel eyelet to fasten service rope to inside of riser

(c) 3/8" stainless steel clip to fasten service rope to pump

966.03.05 Grinder Pump Chamber Electrical Connection

Power and control connections to chamber shall be accomplished through a NEMA 6P electrical quick disconnect.

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966.04 GRAVITY STUBS TO HOUSE AND CLEANOUTS. Gravity stubs to house and cleanouts shall be as shown on the Standard Details.

966.05 PIPING AND VALVE COMPONENTS

(a) Sewer pipe shall be PVC as specified in paragraph 905.01.02. Pressure pipe shall be PVC as specified in paragraph 905.01.05.

(b) Pipe support shall be 316 stainless steel split ring.

(c) Isolation valves shall be brass ball valves as specified in paragraph 961.11.02.

(d) Connection appurtenances shall be as specified in paragraph 961.11.04.

966.06 COLLECTION SYSTEM. The sewerage collection system shall conform to the standards in Category 1000:

(a) Section 1000 – General Requirements Water Main, Sanitary Sewer & Storm Drain Construction

(b) Section 1009 – Sanitary Sewer Mains and Sewer House Connections

(c) Section 1010 – Sanitary Sewer Manholes

(d) Section 1011 – Sanitary Sewer Force Mains

(e) Section 1012 – Jack and Bore, and Tunneling Installations

966.08 PUMPING STATIONS. All pumping stations shall conform to "Chapter 6: Wastewater Pumping Station Design" in the Howard County Design Manual Volume II: Water and Sewer.

966.09 HEADWORKS FACILITY.

966.09.01 Transition manhole. Transition manhole per Standard Details and Section 962.

966.09.02 Isolation gate valve(s). Isolation gate valve(s) per Standard Details and Section 961.01.

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966.09.03 Septic Tank(s). All septic tank(s) shall be per Volume II design requirements.

966.09.04 Distribution Box(es). All distribution box(es) shall be per Volume II design requirements.

966.09.05 Absorption trenches

(a) All absorption trenches shall be per Volume II design requirements.

(b) All distribution lateral terminations shall have standpipes, turf boxes and cleanouts per Volume II design requirements.

966.09.06 Roadway.

Access roadway shall be paved per Volume II design requirements.

966.09.07 Utility Storage Building

(a) 8’ x 12’ vinyl sided storage building

(b) High wall barn style with 6’ side walls

(c) One double door on end of building

(d) Doors and frame to be reinforce

(e) Door hinges must be “T” type or strap type; 3 hinges per door side. Piano hinges are not acceptable

(f) No windows

(g) 10’ ridge vent

(h) 4’ x 4’ pressure treated skids

(i) 2’ x 4’ floor joist 16” on center

(j) 5/8” plywood floor sheathing

(k) 2” x 4” studs 16” on center

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(l) All walls to be plated at bottom and double plated at the top

(m) ½" roof sheathing

(n) 240 pound asphalt 20 years shingles

(o) Locks are to be keyed alike

(p) Almond colored vinyl siding and trim

(q) Brown colored roof shingles

966.09.08 Fencing and gate

Fencing and access gate per Section 914 and the Standard Details

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SECTION 967 — CORROSION CONTROL MATERIALS

967.01 REFERENCE STANDARDS. The following is a list of the publications referenced in this Section.

(a) American Society for Testing and Materials (ASTM)

(1)	ASTM A48	Specification for Gray Iron Castings
(2)	ASTM B418	Specification for Cast and Wrought Galvanic Zinc Anodes
(3)	ASTM C31	Test Methods for Making and Curing Concrete Test Specimens in the Field
(4)	ASTM C39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
(5)	ASTM C94	Specification for Ready-Mixed Concrete

(b) American Water Works Association (AWWA)

(1)	AWWA C210	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
(2)	AWWA C214	Tape Coating Systems for the Exterior of Steel Water Pipelines

(c) NSF International

(1)	NSF-61	Drinking Water System Components - Health Effects

(d) US Department of Transportation

(1)	US DOT H-20	Roadway Delineation Practices Handbook

967.02 SUBMITTALS.

(a) Catalog cuts of all materials to be installed shall be required and shall be submitted for approval.

(b) Pipe coating, handling and testing procedures, and quality assurance procedures shall be required and shall be submitted for approval.

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967.03 EXTERNAL COATING SYSTEM FOR STEEL PIPE.

(a) General

(1) All components of the coating system shall be manufactured by a single supplier to assure compatibility of individual components.

(2) All products comprising completed coating system to be compatible and the same products to be used throughout the project. Pipe surfaces that will come in contact with potable water inside the pipeline (e.g. spigot ends of bell and spigot joints) shall be coated with materials having NSF-61 certification.

(3) The external coating for the steel pipe shall be one of the following coating systems as determined to be appropriate for the specific project requirements:

a) 100 percent solids polyurethane.

b) Three layer tape wrap system that conforms to the performance requirements of AWWA C214.

c) Polyolefin (extruded butyl rubber adhesive with polyethylene top coat).

967.04 EXTERNAL COATING SYSTEM FOR PRESTRESSED CONCRETE PIPE. The external coating for the prestressed concrete cylinder pipe shall be a polyamide epoxy-coal tar, minimum 20 mils thickness. The coating shall be a high-build corrosion resistant coating that provides one coat protection for concrete or steel in underground conditions. The coating shall conform to the p**erformance requirements of AWWA C210.**

967.05 SHOP APPLIED MATERIALS FOR VALVES, ELBOWS, AND FITTINGS. The external coating for valves, elbows and fittings installed with steel and prestressed concrete piping shall be compatible with the coating materials used to coat the piping.

967.06 FIELD APPLIED MATERIALS FOR COATING REPAIRS. The field applied repair coatings shall be as recommended by the shop applied coating manufacturer and shall be entirely compatible with the original coating system. The field coating repairs shall be performed in accordance with all recommendations of the coating manufacturer.

967.07 FIELD APPLIED MATERIALS FOR COATING NON-WELDED STEEL PIPE JOINTS. Non-welded steel pipe joints shall be coated with a two component

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extruded tape consisting of polyethylene and butyl rubber adhesive. The tape shall contain stabilizers and inhibitors to resist the destructive effects of ultra-violet light.

967.08 FIELD APPLIED MATERIALS FOR COATING WELDED JOINTS OF STEEL PIPE. Welded steel pipe joints shall be coated with a four component tape system specially formulated for application to steel pipe joints prior to internal welding of the pipe joint. The four component coating system shall consist of a primer, anti-corrosion joint wrap tape, mechanical outer wrap joint wrap tape, and rockshield pipe protection microfoam polypropylene foam cushioning combined with a layer of high tensile strength polyolefin film.

967.09 FIELD APPLIED MATERIALS FOR COATING INSULATING FLANGES, Insulating Couplings, Mechanical Joints, and Insulating Corporation Stops. Insulating flanges, insulating couplings, mechanical joints, and insulating corporation stops shall be field coated with a four component coating system. All four components shall be manufactured by a single supplier to assure compatibility of individual components. The four components of the coating system shall be as follows:

(a) Primer: A soft brown primer containing moisture displacing corrosion inhibiting compounds for application by stiff brush or gloved hand at normal ambient temperature. The primer shall have the following properties:

(1) Solids content: >98%.

(2) Specific gravity: 1.08.

(3) Specific volume: 56 cu in/lb.

(b) Filler Mastic: A cold applied self-supporting molding mastic. It shall be a petrolatum compound containing beads of closed cell cellular polymer and flow control additives. Filler mastic shall be used at irregular surfaces to provide a smooth surface for the application of the innerwrap and outerwrap. The filler mastic shall have the following properties:

(1) Solids content: 100%.

(2) Specific gravity: 0.605.

(3) Specific volume: 45.9 cu in/lb.

(c) Innerwrap: A non-woven synthetic fabric carrier, fully impregnated with a neutral compound based on saturated petrolatum and inert siliceous fillers. The inner tape shall have the following properties:

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(1) Thickness: 46 mils.

(2) Breaking strength: 22.5 lb/ sq. ft.

(3) Water vapor transmission: 0.006 perms avg.

(4) Resistance to cathodic disbonding: 0.28 sq. in. avg.

(5) Tape width: 8 or 12 inches.

(d) Outerwrap: A plasticized polyvinyl chloride sheeting coated on one side with a rubber resin, pressure sensitive adhesive. The outerwrap shall have the following properties:

(1) Thickness: 10 mils.

(2) Breaking strength: 25 lb/ sq. ft.

(3) Tape width: 6 inches.

967.10 PREPACKAGED MAGNESIUM ANODES.

(a) Magnesium anodes shall be sized by the Engineer in accordance with the specific project requirements. The composition of the anode shall be as follows:

Aluminum	0.010% Maximum
Manganese	0.50 to 1.30%
Copper	0.02% Maximum
Nickel	0.001% Maximum
Zinc	0.05% Maximum
Iron	0.03% Maximum
Silicon	0.05% Maximum
Other	0.05% each
Magnesium	Remainder

(b) The magnesium anodes shall be vibratory packaged by the anode manufacturer in permeable cotton bags or cardboard boxes containing special low resistance backfill material. The backfill material shall have the following composition:

Hydrated Gypsum	75%
Bentonite	20%
Sodium Sulfate	5%

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(c) The anode and backfill shall be prepackaged into a single unit, in a vibrated cardboard box or cotton bag as described above. The box shall contain centering devices to maintain the anode in a centered position surrounded fully by the special backfill. Centering devices are not required for the bagged anodes. A minimum of 20 feet of AWG No. 12 solid copper wire with TW insulation (black) shall be attached to the anode. Wire to anode attachment shall be by silver solder and sealed to prevent any moisture penetration.

967.11 MAGNESIUM RIBBON ANODES. Magnesium ribbon anodes shall be sized by the Engineer in accordance with the specific project requirements. The composition of the anode shall be as follows:

Aluminum	0.010% Maximum
Manganese	0.50 to 1.30%
Copper	0.02% Maximum
Nickel	0.001% Maximum
Zinc	0.05% Maximum
Iron	0.03% Maximum
Silicon	0.05% Maximum
Other	0.05% each or 0.30% Maximum Total
Magnesium	Remainder

967.12 PREPACKAGED ZINC ANODES.

(a) Zinc anodes shall be sized by the Engineer in accordance with the specific project requirements. The zinc alloy shall meet the requirements of ASTM B418, Type II with a minimum potential of 1.10 volts to a copper/copper sulfate reference electrode. The anode shall conform to the following composition:

Aluminum	0.005% Maximum
Cadmium	0.003% Maximum
Copper	0.002% Maximum
Iron	0.0014% Maximum
Lead	0.003% Maximum
Other	0.001% Maximum total for all others
Zinc	Remainder

(b) The zinc anodes shall be vibratory packaged by the anode manufacturer in permeable cotton bags or cardboard boxes containing special low resistance backfill material. The backfill material shall have the following composition:

Hydrated Gypsum	75%
Bentonite	20%
Sodium Sulfate	5%

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(c) The anode and backfill shall be prepackaged into a single unit, in a vibrated cardboard box or cotton bag as described above. The box shall contain centering devices to maintain the anode in a centered position surrounded fully by the special backfill. Centering devices are not required for the bagged anodes. A minimum of 20 feet of AWG No. 12 solid copper wire with TW insulation (black) shall be attached to the anode. Wire to anode attachment shall be by silver solder and sealed to prevent any moisture penetration.

967.13 ZINC RIBBON ANODES. Zinc ribbon anodes shall be sized by the Engineer in accordance with the specific project requirements. The anode shall be continuously extruded over a steel wire core of 0.13 inch centrally located in the zinc alloy. The zinc alloy shall meet the requirements of ASTM B418, Type II.

967.14 TEST STATIONS. The flush mount test station shall consist of a nonconductive terminal board mounted in a locking cast iron lid and collar (suitable for placement in heavy traffic areas) and a plastic shaft. The test station shall pass U.S. DOT H-20 roadway load test. The cast iron of the lid and collar shall meet or exceed ASTM A48 Class 25 specification. The test station lid to be made of cast iron with HC CP TEST cast into the lid design and the entire lid shall be painted yellow. The lid shall feature a cast-in pentagonal bolt to lock into the cast iron cover. The cast iron collar to be at least 2.75 inches high with lugs cast inside to accept the locking lid and to accept a 1 inch cast iron repaving adapter with original lid. The plastic shaft is to be made of ABS (acrylonitrile butadiene styrene), 18 inches long with a flared bottom to resist sinking in soil. The plastic shaft shall have a 5 inch inner diameter. The plastic shaft is to be riveted to the cast iron collar. The test block shall be made of nonconductive PVC (polyvinyl chloride) plastic. The terminal board shall contain a minimum of seven terminals, using 0.25 inch by 20 thread nickel-plated machine screws and nuts. The terminal board shall fit into the lid using hangers cast inside the lid.

967.15 TEST STATION CONCRETE. Poured concrete for the flush-mounted test station slabs shall be ready-mix conforming to ASTM C94. Minimum allowable 28-day compressive field strength shall be 3,000 psi when cured and tested in conformance with ASTM C31 and ASTM C39. Portland cement shall be Type 1.

967.16 TEST STATION TERMINAL LUGS. Test station terminal lugs shall be one-hole, compression terminal lugs for 0.25 inch bolt size.

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967.17 CURRENT MEASURING SHUNT. Test station shunts shall be constructed to fit the terminal posts for the specified test station. The resistance shall be 0.01 ohm with a current capacity of 8 amperes.

967.18 COMPRESSION CONNECTORS. Compression connectors shall be specifically manufactured for splicing copper cables together. The connectors shall be copper and shall be Type YC-C.

967.19 ELECTRICAL TAPE. Conformable vinyl tape with a water tight sealant having a dielectric strength not less than 15kV for a 1/8-inch thick layer. Conformable rubber tape with a water tight sealant having a dielectric strength not less than 15kV for a 1/8-inch thick layer.

967.20 COPPER/COPPER SULFATE REFERENCE ELECTRODES. The reference electrode shall be a permanent saturated gelled copper/copper sulfate reference electrode designed for a minimum 30 year life. The electrode shall have a PVC housing 10 inches long, and a minimum overall package size of 8 inches in diameter by 16 inches long. The reference electrode shall be prepackaged in a permeable cloth bag with special copper/copper sulfate reference electrode backfill. Lead wire shall be a minimum of 25 feet long. The lead wire shall be AWG No. 14 stranded copper wire with HMWPE insulation. The wire insulation shall be black. The lead wire shall be attached to the electrode core with the manufacturer's standard connection. The connection shall be stronger than the wire.

967.21 SILVER/SILVER CHLORIDE REFERENCE ELECTRODES. The reference electrode shall be a permanent saturated gelled silver/silver chloride reference electrode designed for a minimum 30 year life. The electrode shall have a PVC housing 10 inches long, and a minimum overall package size of 8 inches in diameter by 16 inches long. The reference electrode shall be prepackaged in a permeable cloth bag with special silver/silver chloride reference electrode backfill. Lead wire shall be a minimum of 25 feet long. The lead wire shall be AWG No. 14 stranded copper wire with HMWPE insulation. The wire insulation shall be black. The lead wire shall be attached to the electrode core with the manufacturer's standard connection. The connection shall be stronger than the wire.

967.22 CORROSION RATE PROBES. Corrosion rate probes shall be specified by the Engineer to meet the specific application requirements of the project.

967.23 WIRE.

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(a) All wiring, excluding wire provided with the anodes or reference electrodes, shall be stranded copper wire of the AWG wire size and color shown on the Contract Documents.

(b) Wire for bonded joints shall be single conductor, stranded copper with high molecular weight polyethylene (HMWPE) insulation (black). Wire size shall be AWG No. 2 for piping larger than 36 inches in diameter, AWG No. 4 for piping 16 to 36 inches in diameter, and AWG No. 6 for piping 12 inches and smaller in diameter.

(c) Wire for test lead connections to the piping shall be single conductor, stranded copper wire with 600-volt THWN insulation. The wire colors and sizes shall be as shown on the Contract Documents.

(d) Wire for anode header cables shall be single conductor, stranded copper with high molecular weight polyethylene (HMWPE) insulation (black). Wire size shall be AWG No. 8.

967.24 THERMITE WELD EQUIPMENT. Thermite weld molds and charges shall be suitable for the sizes and types of materials and shapes encountered. Adapter sleeves shall be utilized for all thermite welds. All components of the thermite weld equipment shall be manufactured by a single supplier to assure compatibility of individual components.

967.25 COATING FOR THERMITE WELDS.

(a) Thermite welds to ductile iron and/or steel pipe are to be coated with a prefabricated assembly specially designed for covering cathodic protection wire connections to piping and fittings. The prefabricated assembly shall consist of the following components:

(1) top plastic sheet formed with an igloo shaped dome and entry tunnel for the lead wire;

(2) a special elastomeric compound in the plastic dome firm enough to resist flow at normally encountered application and operating temperatures, but soft enough to mold itself around and completely cover the irregular welded profile;

(3) a double row of parallel, flexible serrations on either side of the dome to assist with conforming around small diameter pipe;

(4) a base of black unbacked elastomeric tape with exceptional adhesive properties for bonding firmly to a surface when used with the appropriate primer.

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(5) The appropriate primer as required by the elastomeric cap manufacturer shall be used.

(b) Thermite welds to PCCP shall be coated with a brush applied mastic (10 mils minimum thickness) and embedded in the concrete mortar.

967.26 INSULATING FLANGES. Insulating materials shall include an insulating gasket, insulating sleeves and insulating washers. The insulating sealing gaskets shall be full face and shall contain an elastomer sealing element. The specific materials of the insulating gasket, insulating sleeves, and insulating washers shall be as required to meet the specific requirements of the projects. Insulating washers shall be installed on both sides of the flange. Steel washers shall also be used between the insulating washers and the bolts and nuts. The pressure rating for the insulating flange materials shall be greater than the design pressure of the piping.

967.27 INSULATING COUPLINGS. The insulating materials shall include an insulating gasket and a "full boot" plastic tubular insulator inside the middle ring to prevent contact of pipe-ends isolated from one another. Insulation shall be provided to both ends of the coupling.

967.28 INSULATING CORPORATION STOPS. The insulator corporation stops for the water services shall consist of a brass fitting with a nylon insulator.

967.29 MASTIC. The field applied external coating shall be a cold applied, dielectric mastic material.

967.30 LINKED RUBBER SEAL. The linked rubber seal shall consist of a belt of interconnected rubber links connected together with zinc plated carbon steel hardware.

967.31 INSULATED CASING SPACERS. Casing insulators (spacers) shall be fusion coated with glass reinforced runners. Casing insulators shall be sized for the specific requirements of the project.

967.32 SEPARATOR MESH FOR FOREIGN LINE CROSSINGS. The separator mesh shall be a medium density flexible polyethylene webbing pad (mesh pattern), nominal thickness 0.156 inch.

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CATEGORY 1000 - UTILITY CONSTRUCTION

SECTION 1000 — GENERAL REQUIREMENTS WATER MAIN, SANITARY SEWER, AND STORM DRAIN CONSTRUCTION

1000.01 DESCRIPTION. The Specifications under this section cover the general requirements for water main, sanitary sewer, and storm drain construction.

1000.02 MATERIALS. Materials shall be in accordance with Category 900 of these specifications.

1000.02.01 Backfill Material.

Backfill Material shall be in accordance with Section 204 of these specifications.

1000.02.02 Borrow Backfill Material.

Borrow Backfill Material shall be in accordance with Sections 201, 203, and 204 of these specifications.

1000.02.03 Selected Backfill Material.

Selected Backfill Material shall be in accordance with Section 302 of these specifications.

1000.03 CONSTRUCTION.

1000.03.01 Job Conditions.

(a) Ground Profiles. The ground profiles shown in the Contract Documents represent the elevations along the centerline of the street for all work in streets and along the centerline of trenches for work not in streets, unless otherwise noted in the Contract Documents. Should the actual ground elevations differ from those shown, the Contractor shall not be entitled to additional compensation in excess of the lump sum bid or unit price bid per linear foot of pipe.

(b) Subsurface Investigations. If the County has performed a subsurface investigation, boring logs or reports will be included in the Contract Documents, and will be for informational purposes to the Contractor. The Contractor shall be responsible for making any interpretations or conclusions drawn from the

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information contained therein. Neither the Engineer nor the County will be responsible for the conclusions drawn by the Contractor from the information presented or implied.

If boring samples are stored by the County, they may be reviewed by the Contractor at a time acceptable to the County and the Engineer.

The Contractor shall be responsible for reading the boring logs, and shall become familiar with the site and the subsurface conditions. Ignorance of conditions will not be accepted as a basis of claim for additional compensation. The County does not warrant or guarantee that the conditions actually encountered in the prosecution of the work under this Contract will be the same as the conditions indicated by the boring logs. No additional compensation will be allowed the Contractor because of subsurface conditions actually encountered in the work.

The Contractor shall determine to its own satisfaction the ground water conditions and character and type of soil, decomposed rock, rock and other material to be encountered in the work to be done under this Contract.

If the Bidder determines, after visiting the site and reviewing the geotechnical information, that the data is not sufficient for bid preparation, the bidder may make its own investigation and tests, at a time acceptable to the County. All government and private approvals and/or permits shall be obtained in writing by the Contractor prior to performing any investigations or tests.

1000.03.01 Existing Utilities.

(a) Verification. The existing utilities shown in the Contract Documents are from available records and field surveys. The Contractor shall verify all information to its own satisfaction, and shall notify the Engineer of any impact to the work. The Contractor shall test pit existing utilities that impact construction, at no additional expense to the County. These test pits shall be performed two weeks in advance of excavation and are considered to be part of the unit prices bid. The County reserves the right to designate the utilities that are to be test pitted by non-destructive methods in pavement and destructive methods in unpaved areas.

(b) Test Pit Excavation and Backfill. Test Pit Excavation and Backfill shall be in accordance with Section 205 of these specifications.

(c) Protection. Water mains, storm drains, sanitary sewers, gas mains and other utilities are shown in the Contract Documents for the information of the Contractor in accordance with the best information available. The County assumes no responsibility for accuracy or completeness of information shown. During all times, the Contractor shall uncover, support, and protect all utilities within the trench limits at his expense as part of the Contract. Any damage to existing utilities shall immediately be brought to the attention of the Engineer.

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Any utility lines damaged in the course of construction operations shall be repaired or replaced immediately at the Contractors expense.

All repair work on damaged County owned utilities shall be performed using new materials consistent with the standards as provided in these specifications. All repair work for non-County owned utilities shall be performed by the utility owner, at the Contractor's expense.

Should uncharted piping or other utilities be encountered during excavation, the Contractor shall notify the Engineer and the utility owner immediately. The Contractor shall cooperate with the Engineer and the utility owner in keeping services and facilities in operation.

Utilities designated to remain in place or which serve adjacent structures are to be protected and maintained at all times during construction.

To protect against accidental clogging, sanitary sewer channels in existing manholes shall be covered, as directed by the Engineer, prior to any grubbing or grading operations. Any manholes which have been disturbed by the Contractor's operations shall be repaired at his expense, and any debris which has entered the sanitary manhole shall be removed by the Contractor under the County's supervision. This will not be a separate pay item but shall be included in the cost of other bid items.

For County Capital projects, utility companies are contacted and arrangements are made for the relocation, bracing or other protection of their facilities as indicated in the Contract Documents. This work is performed at no cost to the Contractor. In the event the Contractor's work requires the bracing of additional poles beyond those indicated in the Contract Documents, any cost incurred shall be deducted from money owed the Contractor. The Contractor shall coordinate with the utility companies to schedule the relocation, bracing or protection of the utility companies' facilities.

For developer financed projects, all coordination for protection of existing structures, poles, or utilities shall be the responsibility of the developer at no cost to the County.

(d) Removal of Obstructions. The Contractor shall demolish and completely remove from the site all existing County owned utilities that are designated to be removed. Any relocation of existing County owned utilities performed by the Contractor shall only be performed using new materials meeting the standards described in these specifications and shall be done as part of the bid price for the Contract.

For County Capital projects, if the Engineer determines that any pole, pipe, conduit or other structure is required to be removed, realigned, or changed, all

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such modifications will be done by the owner of the obstruction at no cost to the Contractor. The Contractor is not entitled to any claim for damage nor extra compensation on account of the presence of the structure or on account of any delay in its removal or rearrangement by the County.

For developer financed projects, all coordination for and removal or realignment of structures shall be the responsibility of the developer at no cost to the County.

(e) Utility Adjustments. All adjustments to non-County owned utilities shall be performed by the utility owners. The adjustment of County owned facilities shall be performed in accordance with Section 1001, Adjusting Existing Utility Appurtenances to Finished Grade.

It shall be the Contractor's responsibility to obtain all permits necessary for the performance of the following work:

(1) Adjustments to water services between the property line and the main (within the County right-of-way) shall be performed by a qualified underground utility contractor.

(2) Adjustments to water services between the property line and the house (outside of the County right-of-way) shall be performed under the supervision of a Registered Master Plumber, with a valid plumbing permit.

(3) Adjustments to sanitary sewers between the property line and the main (within the County right-of-way) shall be performed by a qualified underground utility contractor.

(4) Adjustments to sanitary sewers between the property line and the house (outside of the County right-of-way) shall be performed under the supervision of a Registered Master Plumber, with a valid plumbing permit.

(f) Leaving a Gap. If obstructions would delay the work of laying pipe, the Contractor may leave a gap with the approval of the Engineer, and return to fill the gap after the obstructions have been removed.

(g) Non-Interference. The Contractor shall not interfere with the County or any persons, firms, or corporations in protecting, removing, changing or replacing their pipes, conduits, poles or other structures. He shall allow the County or these persons, firms, or corporations to take all measures they deem necessary or advisable for the purposes aforesaid. The Contractor is, in no way, relieved of any of his responsibilities under the Contract.

1000.03.03 General Construction Requirements.

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(a) Access to Project. For inspection purposes, the Contractor shall permit free access to all parts of the project at all times by representatives of all permitting and inspection agencies. The Contractor shall provide access for inspection during all stages of Construction, including if defective work must be remedied by the County.

(b) Removal and Storage of Surface Material. The Contractor shall grub and clear the surface and remove all surface materials, of whatever nature, within the limits of the Contract, and shall store, guard and preserve the materials as may be required for use in backfilling, resurfacing, repaving, or for other purposes. All surface materials removed for reuse, together with all material taken from the limits of the Contract, shall be stored at an approved location by and at the expense of the Contractor.

The Contractor is responsible for any loss or damage resulting from careless removal, neglectful or wasteful storage, wrongful disposal, or use of material. Items included in this responsibility include but are not limited to: curb, gutter, and paving material.

The Contractor shall remove the paving for such width as is necessary for the excavation of the trench, as shown in the Standard Details. The County may retain from monies due, or to become due the Contractor, the cost of permanent replacement of paving under the following circumstances**:**

(1) removing the paving for a greater width than is deemed necessary by the Engineer;

(2) removing or disturbing paving as a result of settlement, slides or caves; or;

(3) removing or disturbing paving as a result of excavation outside the lines of the work without written direction from the Engineer.

The Contractor is responsible for the cost of replacing paving and resurfacing of roadbeds that have failed or have been damaged at any time before the termination of the Contract maintenance period as a result of work done by him. The Contractor shall also bear the expense of resurfacing or repaving over any utility trench or tunnel excavation that settles.

The curbs, gutters, sidewalks, roadbeds and paving shall be restored to a condition similar and equal to that existing before the damage was done. All repair materials and procedures shall be submitted to the Engineer for approval prior to making any corrections. Patching of concrete pavement squares is not allowed. The Contractor shall replace whole new squares that have been damaged. If the Contractor fails to do such replacing or repairing of paving, surfacing, roadway, curbs, gutters and sidewalks in a proper manner or make provisions for having this work done, the County shall perform the work or make provisions for doing it

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after due notice. The County shall retain the expense thereof out of any monies due or to become due the Contractor under the Contract.

(c) Submittals for Dewatering Systems and Excavation Support Systems. For all excavations requiring dewatering systems and excavation support systems, as described elsewhere in this section, the Contractor shall submit working drawings and calculations for the design of the systems. The working drawings and calculations shall be performed by an engineer obtained and paid for by the Contractor. The Contractor's engineer shall be a professional engineer, engaged in such practice and licensed in the State of Maryland, and shall sign and seal all drawings and calculations. Signed and sealed drawings and calculations submitted to the Engineer will be for information only.

The working drawings and calculations for the dewatering systems shall include the following information:

(1) Planned method of dewatering.

(2) Excavation plan.

(3) Location of the water table before and during dewatering.

(4) Location and capacity of such facilities as dewatering wells, well points, sumps, collection and discharge lines, proposed standby unit, and protective fills and ditches required for control of ground water and surface water.

The Contractor shall obtain and submit copies of all permits that may be required for installation of well points and dewatering wells.

The Contractor shall be responsible for determining the existing subsurface conditions for the excavation support systems and dewatering systems. The County does not guarantee or warrant the conditions actually encountered on this project. The County will not be held responsible for the basis of claims by the Contractor or any other parties in the execution of these systems. The Contractor's submittals of the excavation support systems and dewatering systems, prepared by the Contractor's engineer, are for information purposes only.

(d) Dewatering, Drainage and Pumping. Dewatering, Drainage and Pumping shall be in accordance with Section 402 of these specifications.

During construction, the grading operations shall be performed in such a manner that the excavations shall be well drained at all times. Sufficient grading shall be performed during the progress of the work so that no water, at any time, is allowed to flow towards the walls of the structures or trenches. The entire site shall be well drained and free from water pockets. When necessary, sumps shall be provided and pumped continuously. The Contractor shall maintain and keep all

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ditches open and free from soil and debris while in service or until final acceptance of the work and all grading shall be done on neat, regular lines. All work shall be done in proper sequence with all other associated operations. Before any slab or surfacing is placed, all utilities to be covered shall be installed and all drainage facilities shall be installed which are required to permit free and uninterrupted flow of the surface and ground water from the site or to pumping sumps.

The Contractor shall provide and continuously operate and maintain all temporary dewatering, drainage and pumping systems required to satisfactorily perform all work under the Contract. Water shall be controlled to such an extent as may be necessary to keep excavations free from water during construction and to maintain a dry work area a minimum of 12 inches below the bottom of pipes and structures. The Contractor shall be entirely responsible for the design and adequacy of the dewatering system.

Dewatering systems required to perform the work shall be provided, operated and maintained by the Contractor at no additional expense to the County.

The Contractor shall exercise every precaution to prevent flotation of any of the work constructed under this Contract, and the Contractor shall be responsible for all damage due to flotation.

Such grading shall be done as necessary to prevent surface water from flowing into trenches or other utility excavations, and any water accumulating therein shall be continuously removed and properly filtered to remove sediment.

The method of water disposal shall be in accordance with State of Maryland sediment and storm water management requirements, and in compliance with all other erosion and sediment control regulations and regulatory agencies.

Methods of dewatering excavations shall be at the Contractor's discretion. Continuous investigations and checks shall be made by the Contractor to assure that the dewatering system employed is functioning properly, not causing damage or settlement to adjacent surfaces or structures. Temporary pipes or flumes shall be used to carry surface water across open and/or unstabilized construction areas. The system shall be modified as required and repairs for damage caused by the system shall be the responsibility of the Contractor.

Should the Contractor’s dewatering operations affect any existing private water supply well or spring used as a water source, the Contractor shall, at no additional cost to the County, take whatever steps are necessary to provide uninterrupted water service, including the installation of temporary water lines or the installation of permanent wells with treatment systems, if required. Bottled water shall be provided immediately to residents whose private wells are damaged during construction.

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Any dewatering of existing water mains performed under this section shall be done in conformance with the dechlorination procedures established in Section 1007.

Any dewatering of existing sewer facilities must be performed in a manner consistent with current Maryland Department of the Environment standards, with disposal either by permitted septic hauler or by disposal into existing sanitary sewer main, with County approval.

(e) Temporary Excavation Support Systems. Temporary Excavation Support Systems shall be in accordance with Section 402 of these specifications.

The Contractor shall temporarily support the sides and ends of all excavations, where necessary, with braces, sheeting, shoring, stringers or other methods of the type, size and quality required. The Contractor will not necessarily be permitted to use any particular type of excavation support system it selects. The Contractor shall be entirely responsible for the design and adequacy of the excavation support system. There will be no extra compensation to the Contractor for use of the required temporary excavation support systems.

Unless otherwise specified in the Contract Documents or directed by the Engineer, temporary excavation support systems shall be removed as refilling proceeds, in a manner so as not to damage any structures, roadbed, fill or private property. If, in the judgment of the Engineer, removal of temporary excavation support systems will jeopardize any of the work performed under this Contract, or any existing facilities, the Engineer may direct the Contractor to leave all or part of the temporary excavation support systems in place and to cut them off 2 feet below finished grade. Measurement and payment for excavation support systems directed by the Engineer to be left in-place will be in accordance with the fixed price contingent item.

Where specified in the Contract Documents, excavation support systems to be left in-place after backfill has been completed, shall be cut off 2 feet below finished grade. Payment for excavation support systems specified in the Contract Documents to be left in-place shall be included in the Proposal.

Wherever necessary in quicksand or soft ground, for the protection of any structure or property, sheeting shall be driven to such a depth below the bottom of the trench as may be required or directed by the Engineer.

Pile driving hammers or vibratory hammers shall only be used to drive or extract temporary excavation support systems when approved in writing by the Engineer. However, the Contractor shall be responsible for any damage caused by its operations involving vibrations.

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(f) Responsibility for Condition of Excavation. The Contractor shall be entirely responsible for the condition of all excavations performed by the Contractor, for the entire period of the Contract. All slides, caves or other unacceptable conditions shall be promptly corrected whenever they occur, without extra compensation.

The neglect, failure or refusal of the Engineer to order or approve any excavation support system shall not in any way or to any extent relieve the Contractor of any responsibility concerning the conditions of excavations or of any of its obligations under the Contract; nor shall any delay whether caused by an action or want of action on the part of the Contractor or by any action or want of action of the County or its agents or employees, or the Engineer, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve the Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of its obligations under the Contract relating to injury of persons or property nor entitle it to any claim for extra compensation.

(g) Protection of Property, Structures and Utilities. The Contractor shall, at its own risk and at no additional expense to the County, maintain, support-in-place, and protect all pipes, poles, cables, utilities, walls, buildings, and other structures or property in the vicinity of its work, whether above or below ground, or that may appear in the excavation. The Contractor shall at all times have available on site sufficient quantity of timber, planks, beams, chains, ropes, etc., and shall use them as necessary for supporting any structures and utilities that are uncovered, undermined, endangered, threatened or weakened. The Contractor shall be responsible for all damage, shall take all risks, and shall assume all expense for injury or damage, to any person or property of every kind and description, caused directly or indirectly by the Contractor's work, whether such structures or utilities are or are not shown in the Contract Documents. In the event that the Contractor damages any existing utility lines, the Contractor shall notify the Engineer immediately.

1000.03.04 General Installation Requirements.

All pipes shall be placed in accordance with the Contract Documents, these Specifications, and the installation recommendations of the pipe manufacturer.

(a) Lowering Into Trench. Pipe, fittings, and valves shall be carefully handled and lowered into the trench. In laying pipe, special care shall be taken to insure that the ends of pipe shall meet each other in such manner that there shall be no shoulder or unevenness on the inside of the main. No wedging or blocking will be permitted in laying any pipe without written order or permission from the Engineer.

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(b) Foundation. Special care shall be taken to insure that the pipes are well bedded on a solid foundation in accordance with the Standard Details. No pipe shall be brought into position until the preceding length is properly embedded and secured in place. Any defects due to settlement shall be corrected by the Contractor at his own expense. Bell holes shall be dug sufficiently large to insure the making of proper joints and to insure that the pipe is firmly bedded for the full length of the barrel. Special precautions shall be exercised to prevent any pipe from resting on rock.

All excavations shall be kept free from water, with no joints being made under water. Water shall not be allowed to rise in the excavation until the joint material has been set. The pipe shall be protected and water tight joints secured during all stages of installation. Until there is a covering of at least two feet in depth over the top, there shall be no walking on or working over the pipe, except as may be necessary in tamping.

No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when the Engineer shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation.

(c) Tools. Proper and suitable tools and appliances for the safe and convenient handling and laying of pipes and fittings shall be used. Great care shall be taken to prevent the pipe lining and coating from being damaged. Any lining or coating damaged in any way shall be repaired by the Contractor to the satisfaction of the Engineer.

(d) Cleaning. The pipes and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed work. After being thoroughly cleaned, the pipe or fitting shall be carefully lowered into the trench so as to exclude dirt and other foreign substances, and after it has been "homed", the end shall be kept closed with a tight stopper or other protective covers until the next length is laid. This stopper shall be kept in the end of the pipe line at all time when laying is not in actual progress. At the close of work each day, the end of the pipe line shall be tightly closed with an expansion stopper or other protective covering so that no dirt or other foreign substances may enter the line and the stopper shall remain secured in place until pipe laying is again resumed. The Engineer may direct the Contractor to provide end caps for all piping that is laid out along the line of construction if, in the opinion of the Engineer, the piping is subject to collection of debris or damage.

(e) Cutting. Whenever a pipe requires cutting to fit into the line or to bring it to the required location, the work shall be done without additional compensation to the Contractor in a satisfactory manner so as to leave a smooth end. No springing will be permitted at bell and spigot joints to effect a change in direction. Crimping of pipe joints shall be in accordance with the manufacturer's printed recommendation, subject to the approval of the Engineer.

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(f) Pipe and Joint Lubricants. All pipe joint and lubricant compounds used in the pipe assembly shall be non-toxic in any form or amount and shall not impart any taste or odor to the water. The substance shall be non-biodegradable.

(g) Repairs. Prior to placing pipe and specials in the trench, the interior and exterior will be inspected. Any pipe or specials damaged beyond acceptable repair will be rejected, and shall be removed and replaced at the Contractor's expense. Damage that is repairable shall be repaired by the pipe manufacturer in the presence of the Engineer.

(h) Defects. If, at any time before the completion of the Contract, any broken pipes, or any defects, are found in the pipe lines or in any of their appurtenances, the Contractor shall cause the same to be removed and replaced by proper material and workmanship, without extra compensation for the labor and material required, even though such injury or damage may not have been due to any act, default, or negligence on the part of the Contractor; provided however, that should such defective work result from inherent flaws in the material furnished by the County, materials to replace same will be furnished by the County. All materials shall be carefully examined by the Contractor for defects, just before placing, and any found defective shall not be placed in the line.

(i) Testing of Pipe. Testing requirements for water mains shall be in accordance with Sections 1006, 1007, and 1008. Testing requirements for sanitary sewer gravity systems and force mains shall be in accordance with Sections 1009 and 1011, respectively.

The Contractor shall schedule all tests with the Engineer at least 48 hours in advance, and shall conduct all acceptance testing in the presence of the Engineer.

The Contractor shall be responsible for the testing of all pipelines. The Contractor shall furnish all labor, tools, material, including water and equipment, pumps, compressors, stopwatches, mandrels, gauges and meters, subject to the approval of the Engineer for testing in accordance with the Contract Documents and these Specifications. All testing shall be performed at the expense of the Contractor.

If the piping or any section or component thereof fails the tests and/or inspection, the Contractor shall, at his own expense, repair and replace any defective component and retest until all requirements are met. The County will furnish personnel to witness tests a maximum of three times. If additional tests are required, all costs of County personnel and equipment will be deducted from amounts to be paid the Contractor. Any required repairs to the various systems shall be made with new materials. When it is necessary to replace any piece of pipe, fitting, valve, etc., the replacement shall be of the same material and thickness as the defective piece.

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1000.03.05 Excavation and Subgrade Preparation.

(a) Excavation. Excavation for grading, pavements, walls, piers, slabs, footings, structures, trenches, utility systems and their appurtenances shall be unclassified, and shall consist of the excavation of whatever material is encountered to the lines, grades, and sections shown in the Contract Documents and specified, including such excavation as is necessary for all ditches, curbs and other features. No additional compensation will be made for rock excavation. Payment for excavation shall be included in the lump sum or unit prices bid in the Proposal.

Excavation shall be in open cut, except where and to such an extent as the Engineer may permit, authorize or require that the same be done by tunneling. No additional compensation will be allowed for tunneling unless provided for in the bid item or negotiated by the Engineer. With the permission of the Engineer and at no expense to the County, the Contractor may elect to tunnel under trees left standing in rights-of-way in lieu of removing them.

Trenches may be generally excavated and refilled either by hand or by machinery as the Contractor may elect. The Contractor shall have no claims; nor will extra compensation be allowed due to the fact that hand excavation or refill is required to protect adjacent properties or improvements.

(b) Suitable and Unsuitable Material. Suitable and Unsuitable Material shall be in accordance with Sections 201 and 204 of these Specifications.

Should unsuitable material be encountered in the excavation of the trench, the Contractor shall at his own expense remove and dispose of such unsatisfactory materials at a spoil area to be provided by the Contractor as set forth in the Standard Specifications. The Contractor shall procure and substitute approved suitable material and shall be paid for this backfill material under the fixed price contingent item or applicable unit price bid in the proposal. The Contractor will be paid only for such backfill material that is actually delivered and used within the specified trench payment width and determined length of trench. Any unsatisfactory material which is excavated outside the specified payment width of trench shall be removed and disposed of, and approved suitable material shall be substituted at the Contractor's expense.

(c) Length of Open Trench. Not more than three pipe lengths of trench shall be opened at any one time or location in advance of the completed placement of the pipe lines, unless by written permission of the Engineer. The Engineer shall be empowered at any time to require the backfilling of open trenches over completed pipe lines if, in his judgment, such action is necessary. The Contractor shall have no claim for extra compensation, even though to accomplish said filling, he is compelled temporarily to stop excavation, or other work at any place.

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If work is stopped on any trench for any reason except by order of the Engineer, and if, in the opinion of the Engineer, the excavation is left open for an unreasonable length of time in advance of construction, the Contractor shall, if so directed, backfill the trench at no additional cost to the County, and shall not again open the trench until he is ready to complete the construction therein. If the Contractor refuses or fails to backfill the trench completely within twenty-four (24) hours after said notice, the Engineer shall be authorized to have the work done by others, and the County shall charge the cost thereof to the Contractor and retain the same out of any monies due or to become due to the Contractor under the Contract.

In roadway areas, length of open trench shall be limited to only that length sufficient to advance the trench box or sheeting ahead of the pipe construction operation and to provide a minimum safe working distance between the backfilling operation and the pipe construction operation. No trenches are to be left open at night or weekends. Trenches shall be backfilled or plated in such a manner as to not impede pedestrians or vehicles. Plated excavations shall conform to all requirements of the Standard Details and Section 104 of these Specifications.

The excavation of all trenches shall be fully completed in advance of pipe laying, for at least twenty feet in soil, and for at least 25 feet in rock, unless otherwise directed.

(d) Width and Depth of Trench. The trench shall be excavated to the necessary widths and depths as may be shown in the Contract Documents, the Standard Details, and as specified or directed. The maximum clearance between each face of trench and external surface of barrel of pipe or hubs shall not be greater than indicated in the Standard Details or the Contract Documents. The trench width, as indicated in the Standard Details, affects the load bearing capacity of the pipe, and will be strictly adhered to as a maximum. The sides of the trenches shall be vertical to the top of the pipe and practically plumb above this point and under no circumstances will they be permitted to be sloped except with the approval of the Engineer.

The trench subgrade shall be such as to provide a uniform and continuous bearing and support for the pipe and bedding on undisturbed earth for the full length of each pipe, except for that portion under the bell. Bell holes shall be excavated in the bottom and sides of trenches or bedding to permit the proper making of joints, without extra payment therefore. Any part of the bottom of the trench excavated below the specified subgrade shall be corrected with approved, thoroughly compacted material.

The Contractor shall complete excavations in earth as nearly as practicable to the neat lines of the pipelines or structures to be built therein. Whether in earth or rock excavation, all irregularities and cavities in the bottom of trenches or tunnels

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shall be filled to the required level with clean earth or other approved material and firmly compacted before pipe lines are laid therein. No extra compensation will be made for this work unless said cavities have been formed by the removal of unstable material under the direction of the Engineer, in which case this excavation shall be measured and paid for as Class 3 Excavation.

(e) Class 3 Excavation. Class 3 Excavation shall consist of excavation of all unsuitable material below subgrade, or of all material in addition to that shown in the Contract Documents, specified, or included in other Bid Items, and in accordance with the written direction of the Engineer to permit the planned and/or revised construction.

Class 3 Excavation shall consist of unclassified excavation of whatever materials are encountered including rock, segregating into suitable and unsuitable material, removal and disposal of excess and unsuitable material, hauling, storing, handling, depositing, backfilling, and compacting, as well as pumping, bailing, draining, sheeting and shoring, construction of cribs, cofferdams, dewatering devices (temporary pipes, flumes, etc.) and the removal thereof, and for all other labor, equipment, tools, and incidentals necessary to complete the item.

Class 3 Excavation shall include miscellaneous excavation. The Contractor shall do such miscellaneous excavating work as may be necessary or directed. Miscellaneous excavation shall include digging extra width of trench made necessary by change in its locations, or excavation for any special structure outside the trench, that may not be shown in the Contract Documents or described in the specifications where such excavation is done at the direction of the Engineer.

Class 3 Excavation shall include excavation where changes in the pipe grade increase or decrease the amount of cut. Where cut is decreased, the fixed price contingent item shall be used to provide a credit to the County.

Class 3 Excavation shall include excavation below subgrade for pipelines, inlets, manholes, junction chambers, headwalls, wingwalls and vaults. Wherever the character of the material at the bottom of an excavation is such as to require excavation to an additional depth for any purpose, as determined by the Engineer, such additional depth shall be classified as Class 3 Excavation. However, excavation for the construction of a timber foundation, or excavation for the laying of an underdrain, or excavation that may be performed by fault or negligence on the part of the Contractor, shall not be classified as Class 3 Excavation.

Where the bottom of the trench at subgrade is in unstable or unsuitable material, excavation shall be carried to such depth as ordered by the Engineer. Where the bottom of the trench at subgrade is in rock, excavation shall be carried at least 6 inches below the specified subgrade with a minimum of 4 inches under bells. The

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trench bottom shall be backfilled to subgrade with compacted suitable material or with Selected Backfill, as approved by the Engineer. All excavation for removal of unsuitable material or rock, and backfill using compacted on-site suitable material, will be paid for as Class 3 Excavation. Backfill for unsuitable material using Borrow or Selected Backfill will be paid for at the applicable fixed price contingent items, as approved by the Engineer.

(f) Underdrains. Underdrains below pipes shall be in accordance with Section 306 of these specifications.

(g) Change of Trench Location. If the Engineer shall direct that the location of a trench be changed from that shown in the Contract Documents due to the presence of an obstruction or from other cause, or if a changed location shall be authorized upon the Contractor's request, the Contractor shall not be entitled to extra compensation or to a claim for damage provided that the change is made before the excavation is begun.

1000.03.06 Backfill Requirements.

Prior to placing any fill or backfill, notice shall be given the Engineer so that the work may be inspected, and filling or backfilling shall not proceed without the Engineer's approval. Placing, spreading and compacting suitable material for fills and backfills shall be in accordance with Sections 201 and 204 of these specifications.

(a) Borrow Backfill and Selected Backfill. Borrow Backfill and Selected Backfill shall be in accordance with Sections 201, 203, 204 and 302 of these specifications.

In the event that sufficient suitable, on-site, fill or backfill material is not available from the required excavations to perform the work as specified in the Contract Documents or in the Specifications, borrow material, as defined in 1000.02 MATERIALS, shall be furnished by the Contractor from approved off-site sources. Payment will be in accordance with the fixed price contingent item in the Proposal.

The Engineer may direct the use of any additional quantity of borrow and/or aggregate, as specified in 1000.02 MATERIALS, to be used below subgrade or at locations other than as specified in the Contract Documents or in the Specifications. Placement and compaction of these materials shall be in accordance with requirements described elsewhere. Payment will be in accordance with the fixed price contingent item in the Proposal.

(b) Backfilling Against Structures. Backfilling Against Structures shall be in accordance with Sections 204, 210, and 402 of these specifications.

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The Engineer may permit the backfilling around masonry structures sooner than specified elsewhere if traffic or other conditions warrant this. Except in the use of precast materials approved by the Engineer, this operation will not be permitted prior to the third day after the completion of all work.

Subgrade, for appurtenant concrete or masonry structures, shall be defined as the underside of the structure or bedding material as shown in the Contract Documents.

1000.03.07 Trench Backfill.

During backfilling, great care shall be taken not to disturb the pipes by dropping or throwing anything on them from the bank above, or by walking on top or alongside of them.

Trench erosion checks and concrete anchors shall be placed on steep slopes at the locations shown in the Contract Documents, in accordance with the Standard Details, and at the direction of the Engineer.

Backfill around crossing utilities and backfill around connections to existing utilities shall be placed and compacted in accordance with the requirements for Pipe Embedment Zone described below.

(a) Undercut. The Contractor shall undercut below trench subgrade, where in the opinion of the Engineer, soft or unstable material is encountered. Subgrade, for pipe trenches, shall be defined as the bottom of the granular bedding, or the underside of the barrel of the pipe where the pipe is laid on a natural or concrete foundation, or the underside of the ribs or sills where the pipe is laid on a timber foundation. Unsuitable material shall be removed to a firm bottom, and replaced up to trench subgrade using compacted suitable material, as described elsewhere.

When directed by the Engineer, remove the unsuitable material to the extent determined by the Engineer and replace up to trench subgrade using compacted Selected Backfill Using No. 57 Aggregate. The Engineer may direct the use of a nonwoven geotextile placed directly onto the soft material to prevent the movement of fines. Normal bedding and pipe shall be placed directly onto the refill or geotextile.

(b) Pipe Embedment Zone. Pipe Embedment Zone shall be from trench subgrade to above the crown of the pipe, as indicated on the Standard Details for each trench condition. Initial backfill shall be placed in maximum 8-inch layers.

(1) Pipe Bedding. Bedding material shall be Selected Backfill Using No. 57 Aggregate or Fine Aggregate (FA) - Underdrain, as indicated in the Standard Details for each type of trench condition. Bedding material shall be thoroughly compacted by approved hand-operated mechanical tampers or

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approved compaction equipment before laying the pipe, and then properly haunched to provide a uniform and continuous bearing and support for the pipe. Bell holes shall be excavated in the bottom wherever necessary to permit the proper making of joints.

(2) Initial Backfill. Initial backfill material shall be suitable, on-site material excavated from the trench, or borrow material, or Selected Backfill Using No. 57 Aggregate or Fine Aggregate (FA) - Underdrain, as indicated in the Standard Details for each type of trench condition. The material shall be compacted by approved hand-operated mechanical tampers or approved compaction equipment.

(c) Final Backfill Zone. Final Backfill Zone shall be from the initial backfill to finished subgrade, as indicated in the Standard Details for each trench condition. Finished subgrade for areas to receive topsoil is defined as the surface upon which the topsoil is placed. Finished subgrade for pavement is defined as the bottom of the pavement cross-section, in accordance with the Standard Details. Final backfill shall be placed in maximum 8-inch layers. No rock or lump greater than 6 inches in greatest dimension shall be used for final trench backfill.

(1) Improved Areas. Full trench compaction is required within all road rights-of-way, under paved areas, or where specified in the Contract Documents, for all types of pipe and for each trench condition indicated in the Standard Details.

Material below the top 2 feet of final subgrade shall be suitable, on-site material excavated from the trench, or borrow material, and shall be compacted to not less than 92% of the maximum dry density as specified in T 180 and in accordance with Paragraph 1000.03.06 Backfill Requirements. Material within the top 2 feet of final subgrade shall meet the requirements of Select Borrow, and shall be compacted to not less than 97% of the maximum dry density.

(2) Unimproved Areas. Full trench compaction is not required where not specified as above or where not specified in the Contract Documents, for all types of pipe and for each trench condition indicated in the Standard Details.

Material shall be suitable, on-site material excavated from the trench, or borrow material, and shall be compacted to not less than 90% of the maximum dry density.

(3) Wetland Areas. Within the limits of areas designated as wetlands and wetland buffers, excavated material shall be separated and stockpiled at an area outside the wetland limits.

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Material below the top 1 foot of finished grade shall be suitable, on-site material excavated from the trench, and shall be lightly consolidated. Material within the top 1 foot of finished grade shall be salvaged topsoil and shall be loosely placed and uncompacted.

1000.03.08 Restoration.

Upon completion of the work, all streets, driveways, walks, steps, lawns and slopes which have been disturbed shall be restored equal to or better than their original condition unless otherwise expressly indicated in the Contract Documents.

Clean-up and restoration will commence on the next working day following completion of backfilling and shall be done by the Contractor without extra compensation. If he shall fail to do such work within reasonable time after receipt of written notice, the Engineer may have the work done and the cost shall be retained from any monies due, or to become due the Contractor.

(a) Topsoil, Seeding, Mulching and Sodding. Topsoil, Seeding, Mulching and Sodding shall be in accordance with Category 700 of these Specifications.

Payment for restoration of disturbed surfaces, including furnishing and placing topsoil, seeding, mulching, and sodding, shall be included in the unit prices bid for construction of mains for each size of pipe, or in the lump sum bid for other items in the Contract. No measurement or payment will be made for these items in those areas requiring restoration as a result of the Contractor's activities outside of the limits of work. Any damage or repairs outside of the limits of the work shall be corrected by the Contractor at his expense.

(b) Repaving. Crusher Run CR-6 Aggregate shall be furnished, placed and maintained in the repair of openings of existing roadways as shown in the Standard Details.

In the rights-of-way of all state highways, county streets and/or roadways, the trenched areas in existing paving are to be temporarily serviced with 2 inches of cold patch materials and continuously maintained by the Contractor pending permanent repairs.

The dimensions of paving to be replaced as shown in Standard Details are minimum dimensions and nothing shown in the details shall relieve the Contractor of his responsibility to restore existing roadways to at least their original condition.

Payment for repaving shall be included in the unit price bid for construction of mains for each size of pipe, or in the lump sum bid for other items in the Contract. No measurement or payment will be made for temporary cold patch paving or the CR-6 shown in the Standard Details for the top one foot of the trench, unless

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expressly stated within the Special Provisions. No measurement or payment will be made for permanent replacement of paving, as shown in the Standard Details, unless expressly stated within the Special Provisions.

Fixed price contingent items have been established for patching existing hot mix asphalt or portland cement concrete pavement disturbed beyond the construction limits of the normal trench width and for the specified depth indicated in the Standard Details. When directed by the Engineer, these items are for payment to repair roadway damage caused by factors beyond the Contractor's control, as a result of normal construction practices, and not the result of any negligence on the part of the Contractor.

Where double sheeting use is permitted by the Engineer, the applicable fixed price items associated with the top tier shall be based on the standard trench width plus three feet. The granting of permission to utilize double sheeting shall be solely at the discretion of the Engineer, and if the Contractor elects to use this method without written permission, no additional payment width will be allowed.

(c) Maintenance of Backfilled Excavation. The Contractor shall maintain, at his own expense, all refilled excavations in proper condition until the end of the three (3) month period following the date of payment of the final estimate. All depressions appearing in the refilled excavations shall be properly refilled. If the Contractor shall fail to do so within twenty-four (24) hours after receipt of a written notice from the Engineer, the County may refill the depressions and the cost thereof shall be deducted from any monies due or to become due the Contractor under the Contract. In case of emergency, the County may refill any dangerous depression without giving previous notice to the Contractor and the cost of so doing shall be retained from any monies due, or to become due the Contractor.

The Contractor shall be responsible for any injury or damage that may result from improper maintenance of any refilled excavation at any time previous to the end of the above mentioned three-month period.

The Contractor will be required to furnish to the Engineer the names, addresses, and telephone numbers of at least two members of his organization that may be contacted in an emergency.

1000.04 MEASUREMENT AND PAYMENT. Work addressed under this Section of the Specifications but not addressed below will not be measured or paid for as a separate bid item, but shall be included in the various unit and/or lump sum prices bid for construction of the pipelines or appurtenances.

Measurement and payment for the following Fixed Price Contingent Items are described in Section 130.

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Item 1: Class 1A Excavation
Item 2: Crusher Run Aggregate CR-6 for Maintenance of Traffic
Item 3: Hot Mix Asphalt (HMA) for Maintenance of Traffic
Item 4: Mix No. 3 Concrete for Curbs, Sidewalks and Steps
Item 5: Mix No. 3 Concrete for Miscellaneous Drainage Structures
Item 6a: Common Borrow
Item 6b: Select Borrow
Item 7: Class 3 Excavation
Item 8a: Selected Backfill Using Crusher Run CR-6 Aggregate
Item 8b: Selected Backfill Using No. 57 Aggregate
Item 9: Excavation Support Systems Left In-Place
Item 10: Calcium Chloride for Dust Control
Item 11: Mix No. 1 Concrete
Item 12: Test Pit Excavation
Item 13: Patching Existing Pavement with Hot Mix Asphalt (HMA)
Item 14: Patching Existing Pavement with Portland Cement Concrete
Item 15: Silt Fence
Item 16: Super Silt Fence
Item 17: Straw Bale Dike
Item 18: Stone Outlet Sediment Trap
Item 19: Temporary Seeding and Mulching

SECTION 1001 — ADJUSTING EXISTING UTILITY APPURTENANCES TO FINISHED GRADE

1001.01 DESCRIPTION. This item includes the vertical adjustment of existing storm drain inlets and manholes, sanitary sewer manholes and cleanouts, low pressure sanitary sewer and flushing valve manholes, water valve vaults, roadway boxes, meter vaults and water blow-off vaults, to meet finished grade or as directed by the Engineer.

1001.02 MATERIALS.

1001.02.01 Manhole Adjustment Rings and Risers.

Manhole adjustment rings and risers shall conform to Section 962.05 within this Specification

1001.02.02 Valve Box Adjustment Risers.

Valve box adjustment risers shall conform to Section 961.06 within this Specification

1001.02.03 Miscellaneous Materials.

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Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as concrete, masonry, reinforcement and castings.

1001.03 CONSTRUCTION REQUIREMENTS. Work under this Section shall conform to section 1000 and the following. All materials designated for salvage shall be carefully removed, cleaned and stockpiled in areas where such materials or units will not be damaged. All material unfit for reuse in the work shall be stockpiled, to be reclaimed by the Engineer, if desired. The Engineer may, prior to such stockpiling, declare the material unfit for further use and order its disposal beyond the limits of the project. The rejected material shall be disposed of by the contractor. All items which are to be included in the completed work shall be finished in a condition approximate to the original condition. This shall include refinishing and any necessary cleaning as directed by the Engineer. Structures to be adjusted to grade shall have the casting carefully removed and the adjustment shall be made with new materials approved for construction within these specifications. The vertical or horizontal adjustment of valves, blow-off, and/or meter vaults shall be made when required or necessary to accomplish the adjustment of meters and/or valves to finished grade in accordance with the Standard Details. All grade adjustments performed by the Contractor shall be protected by the Contractor throughout the construction period.

The adjustment of both standard and watertight manhole frames and covers shall be performed through the use of locking type adjustment rings. The adjustment of valve boxes shall be performed through the use of valve box adaptors.

1001.04 METHOD OF MEASUREMENT. The adjusting existing utility appurtenances to meet finished grade will be measured on the basis of the count or number of each existing utility appurtenance, regardless of the type of appurtenance or method of vertical adjustment.

1001.05 BASIS OF PAYMENT. Payment for adjusting of existing utility appurtenances will be made at the contract unit price bid per each adjustment regardless of the type of appurtenance or the method of adjustment. Price and payment shall constitute full compensation for all excavation, adjusting of vaults, backfill, compaction, equipment, labor, tools, material and all other incidentals necessary to satisfactorily complete the work.

SECTION 1002 — WATER MAINS

1002.01 DESCRIPTION. This item shall consist of furnishing and installing water mains of the diameter shown on the Contract Documents, laid on a firm bed true to a line

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and grade in accordance with this section and those of sections 1000, 1006, 1007 and 1008.

1002.02 MATERIALS.

1002.02.01 Ductile Iron Pipe.

Ductile iron pipe, fittings and joints shall conform to Section 905.10 for the class of pipe as indicated on the Contract Documents.

1002.02.02 Steel Pipe.

Steel pipe, fittings and joints shall conform to Section 905.13 for the thickness of pipe as indicated on the Contract Documents.

1002.02.03 Prestressed Concrete Cylinder Pipe (PCCP).

Prestressed concrete cylinder pipe, fittings and joints shall conform to Section 905.04.02.

1002.02.04 Polyvinyl Chloride (PVC) Pipe.

Polyvinyl Chloride pipe and joints shall conform to section 905.01.05. PVC pipe for water mains is only allowable under special circumstances when approved by the County.

1002.02.05 High Density Polyethylene (HDPE) Pipe.

High Density Polyethylene pipe and joints shall conform to section 905.02.02. HDPE pipe for water mains is only allowable under special circumstances when approved by the County.

1002.02.06 Tracer Wire and Continuity Test Stations for PVC/HDPE water mains.

Tracer Wire and Continuity Test Stations shall conform to section 905.01.05.

1002.02.07 Miscellaneous Materials.

Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as concrete, masonry, reinforcement and castings.

1002.03 CONSTRUCTION REQUIREMENTS. The following are construction requirements for specific pipe materials. These requirements shall be in addition to the general requirements provided in Section 1000.

1002.03.01 Ductile Iron Pipe.

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Additional construction requirements for installing ductile iron pipe shall be in accordance with the following criteria.

Ductile Iron Pipe shall be installed in accordance with AWWA C600. Tracer wires and test stations shall be installed and tested in accordance with section 1002.03.04 for PVC pipe.

1002.03.02 Steel Pipe.

Additional construction requirements for installing steel pipe shall be in accordance with the following criteria.

(a) Delivery and Storage

(1) Pipe shall be stulled as required to maintain roundness of plus or minus one percent during shipping and handling.

(2) Coated pipe shall be shipped on padded bunks with nylon belt tie down straps or padded banding located approximately over stulling.

(3) Coated pipe shall be stored on padded skids, sand or dirt berms, sand bags, old tires, or other suitable means so that coating will not be damaged.

(4) Coated pipe shall be handled with the wide belt slings. Chains, cables, or other equipment likely to cause damage to the pipe or coating shall not be used.

(5) Prior to shipment, the pipe shall be visually inspected for damage to the coating by the following procedure:

(i) When visual inspection shows a portion of the coating system has sustained physical damage, the area in question may be subjected to an electrical holiday test up to 11,100 volts.

(ii) When the area is tested and there are no holidays or no tearing of the material, (only wrinkling or bruising) then the area shall be noted "OK" and shipped with no patching required.

(iii) All repairs of damaged pipe shall be made in accordance with the manufacturer's recommendations.

(iv) When the damaged area does show damage going clear to steel from either a visual inspection or a jeep from a holiday detector, expose the inner wrap of black polyethylene tape and cut back the damaged layers leaving a smooth surface. The area shall then be wiped clean and dry with a rag and a coat of primer shall be applied to the area. When the primer is

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tacky, apply a patch of polyethylene repair tape of sufficient size to completely cover the damaged area, plus a minimum lap of 4 inches on sound tape in all directions. A second patch of polyethylene repair tape shall then be put over the first patch once again insuring a minimum overlap of 4 inches beyond the first patch on a clean dry surface.

(v) Repair tape and primer shall conform to AWWA C209, and the tape shall be 35 mil high tack polyethylene tape compatible with the original tape system.

(a) Installation

(1) Inspect each pipe and fitting before lowering the buried pipe or fitting into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material similar to the original. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

(2) Handle pipe in a manner to avoid any damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.

(3) Grade the bottom of the trench and place a 6-inch layer of number 57 stone bedding under the pipe. Before laying each section of the pipe, check the grade with a straight edge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of lifting tackle.

(4) At the location of each joint, dig bell (joint) holes of dimensions in the bottom of the trench and at the sides to permit visual inspection of the entire joint.

(b) Closure Pieces. Closure pieces and short sections of steel pipe shall be furnished by the Contractor as found necessary in the field or as required by the Engineer. When closure pieces are required, the Contractor shall make all necessary measurements and shall be responsible for their correctness. The design and construction of closure pieces shall be approved by the Engineer.

(c) Angular Deflections. For curved alignment requiring greater angular deflection at the joints than permitted by forgoing limitations, curves shall be made by joining short sections of steel pipe, bends, or combinations thereof. Curves and angles shall be constructed to dimensions called for and shall be installed at points shown on the Contract Documents.

1002.03.03 PCCP.

Additional construction requirements for installing PCCP pipe shall be in accordance with the following criteria:

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(a) The pipe shall be stored properly and supported on padded wooden blocks to hold the pipe off the ground. All pipe and fittings shall be securely wedged so the pipe cannot roll. Any pipe which has been improperly placed and must be moved longitudinally along the trench shall be moved by such means approved by the Engineer. Any coated pipe shall not be rolled or dragged lengthwise under any conditions, and all skids shall be so arranged as to prevent injury to the coating when the pipe is rolled under them. Any visible damage to the pipe coating shall be repaired to the satisfaction of the Engineer before the pipe is lowered into the trench. Prestressed Concrete Cylinder Pipe and specials shall be unloaded and handled with a crane or backhoe of the proper capacity outfitted with a steel cable sling, belt sling or other attachment specially designed to protect the pipe coating. Delivery of pipe and specials shall be coordinated with installation, and shall be unloaded with proper equipment along the line of work, outside trench, near as practicable to the point of final placement, facing in proper direction and properly wedged secure. The Engineer shall be given at least 24 hours notice of the pipe delivery date and the Contractor's method of unloading.

(b) For all PCCP pipe, the Contractor will incorporate the use of protective 8 Mil polyethylene covers adequately secured to each end of the open pipe by plastic or metal bands or duct tape to prevent dust, dirt or debris from entering the pipe. Fittings for pipe shall receive protective cover regardless of the outlet or branch size. The protective cover shall be installed at the place of pipe manufacturer and not be removed until the pipe is installed. The Contractor shall properly dispose of all protective covers and bindings at an approved disposal site.

1002.03.04 PVC Pipe.

Additional construction requirements for installing PVC pipe shall be in accordance with the following criteria.

(a) **Delivery and Storage**. Loading, unloading, handling, inspection and storage of PVC pipe and fittings shall be in accordance with AWWA C605. PVC pipe shall be supported during storage so that it does not deform or bend. PVC pipe manufactured more than one year prior to work site inspection will not be accepted.

(b) **Installation:** Shall be in accordance with AWWA C605, the manufacturer's installation instructions and recommendations except as modified herein.

Changes in horizontal and vertical alignment and curved alignments shown on the Contract Documents shall be made by using fittings or high-deflection couplings. Deflecting PVC pipe joints or bending PVC pipe will not be permitted.

Whenever a pipe requires cutting, the work shall be done in a manner that leaves

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a smooth, square end. Cut PVC pipe ends shall have burrs removed and the end beveled to match factory bevel. To ensure the proper length of insertion of the spigot into the bell, PVC pipe cut in the field shall be beveled and marked on the spigot end to the dimensions specified by the manufacturer prior to assembly.

Prior to making gasketed joints, both mating pipe ends and the gasket shall be cleaned of all foreign material. The rubber gasket shall then be inserted in or stretched over the clean gasket seat and lubricant applied to the gasket and mating pipe end per the pipe manufacturer's recommendations. The method for inserting the spigot into the bell shall be as recommended by the manufacturer and approved by the County. The pipe ends shall be carefully aligned and pushed together to meet the required manufacturer's insertion depth. Insertion of the spigot end of the pipe shall be made to a point where the factory mark is even with the face of the bell. For connections to mechanical joint fittings and appurtenances, cut the bevel off of the PVC pipe and insert the PVC pipe spigot, in straight alignment, until it contacts the bell taper of the mechanical joint fittings or appurtenance.

The push on joint is assembled by positioning the elastomeric gasket(s) in the annular groove(s) of the bell or coupler and inserting the spigot end of the pipe into the bell compressing the gasket radially to form a positive seal. All PVC pipe shall be factory marked on the spigot end for depth of insertion into the bell. Any pipe that is field cut shall have the spigot end prepared and remarked to the proper dimensions prior to insertion. The gasket and annular groove are designed, sized and shaped so that the gasket will resist displacement. Care shall be taken so that only the correct elastomeric gasket compatible with the annular groove(s) of the bell or coupler is used. Insertion of the elastomeric gasket in the annular groove must be in accordance with the manufacturer's recommendations.

(c) Tracer Wires and Continuity Stations: For locating PVC water mains, continuity test stations shall be located adjacent to each fire hydrant within the public easement, and tracer wire shall be installed continuously along all PVC water mains. See the Standard Details. All tracer wire shall be taped to the top of the pipe with minimum 2-inch wide x 1/2-pipe-circumference long PVC tape every 4 feet along the pipe. The copper wire shall be continuous for the full length of the pipeline including all fire hydrant leads and shall terminate at continuity test stations. Where required, splicing shall be done with direct bury wire splice kit listed and labeled for direct bury, installed as recommended by manufacturer, and taped to the pipe. After backfilling, the Contractor shall test the tracer wire to demonstrate electrical continuity throughout the length of the PVC line installed. All tests shall be performed in the presence of the Engineer. Any discontinuity shall be located, repaired, and retested at the Contractor’s expense until full continuity is achieved.

1002.03.05 HDPE Pipe.

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Additional construction requirements for installing HDPE pipe shall be in accordance with the following criteria.

(a) Delivery and Storage. HDPE pipe shall be delivered and stockpiled in unit pallets. No stacking of pallets above 5' will be allowed. If pipe is stockpiled for more than 30 days prior to installation, it must be suitably covered with reflective material to protect the pipe from ultraviolet rays resulting from sunlight. Plastic sheets shall not be used for protection. Air circulation shall be provided under any covering. HDPE pipe manufactured more than one year prior to work site inspection will not be accepted.

(b) Installation. Bends in HDPE pipe shall not be permitted to occur closer than 10 diameters from any fitting or valve. HDPE pipe that becomes kinked during handling or installation shall not be used, and care should be taken to ensure that kinking does not develop after installation.

(c) Joining. Joints between plain end pipes and fittings shall be made by butt fusion and joints between the main and saddle branch fittings shall be made using saddle fusion in accordance with recommended procedure by pipe and fitting manufacturer. The external & internal beads formed during heat fusion shall not be removed.

Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and not different wall thicknesses by more than one Standard DR. Transition between unlike wall thicknesses greater than one SDR shall be made with transition nipple (a short length of heavier wall pipe with one end machined to lighter wall) or by mechanical means or electrofusion.

Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, (c) MJ Adapters or (d) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.

A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling is used and when connecting plain end HDPE pipe to a mechanical joint pipe, fitting or appurtenance. External clamp and tie rod restraint shall be installed where HDPE pipe is connected to the socket of a mechanical joint pipe, fitting or appurtenance except where an MJ Adapter is used.

(d) Restraint. All connections from HDPE to non-HDPE pipes shall be fully restrained from movement due to thermal expansion/contraction forces.

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(e) Service Connections/Leads Services leads below 4-inch in diameter shall be transitioned to copper at the saddle fitting/corporation, and service leads 4-inch and above in diameter shall be HDPE with below mentioned flanged adapters at meter location.

Service Tapping Saddles (Electrofusion): Service tapping saddles 3/4-inch to 2-inch, may be made with electrofusion fittings.

All service leads 4-inch and above shall be provided with Polyethylene Flange Adapters. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serrations) to provide gasket-less sealing.

(f) Branch Connections: Branch connections to the main shall be made with saddle fitting or tees. Polyethylene saddle fittings shall be saddle fused to the main using Heat Fusion Joining procedures.

(g) Tracer Wires and Test Stations: Tracer wires and test stations shall be installed and tested in accordance with section 1002.03.04 for PVC pipe. For open cut applications, provide detection tape accordance with Section 905.01.05.

1002.04 MINIMUM PIPE COVER AND CLEARANCE. Water mains ten (10) inches and smaller shall have no less than three and one-half (3-1/2) feet of cover measured from the established grade to the top of the pipe except as noted on the Contract Documents. When crossing under subsurface obstructions, the above mentioned minimum cover shall be adjusted to provide clearance as shown on the Standard Details between the top of the pipe and the obstruction.

1002.05 PIPE JOINTS. Prior to making actual pipe joints in the trench, the Contractor shall demonstrate to the Engineer that the methods which he will employ do conform with the Specifications, will secure a watertight joint and that the Contractor's workers are familiar with the requirements of the Specifications. The demonstration shall consist of making a sample joint.

1002.05.01 Ductile Iron Pipe Joints.

(a) Mechanical Joints. All pipes, fittings, fire hydrants and valves with mechanical joints shall be installed by experienced pipe layers, to the satisfaction of the Engineer.

Prior to making up joints, the bells, spigots, and rubber gaskets shall be free from foreign material. A cast iron gland shall be positioned on the spigot end of the pipe, followed by a rubber gasket thoroughly lubricated with its tapered side facing the bell. The spigot shall then be inserted fully into the bell. The rubber gasket shall then be moved into position by hand until it is flush with the face of the bell. The gland shall then be placed against the face of the rubber gasket and the bolts inserted and made finger tight. Bolts shall be drawn up evenly on

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alternate sides beginning at the top, keeping the gland parallel to the face of the bell at all times. All nuts shall be tightened uniformly with a torque of not less than 60 or more than 90 foot-pounds.

(b) Push-On Joints. All pipes with push-on joints shall be installed by experienced pipe layers, to the satisfaction of the Engineer. Jointing shall be done in the manner recommended by the manufacturers, as follows.

Prior to making up joints, gaskets, sockets and spigots shall be free from foreign material. The gasket shall then be inserted in the cleaned gasket seat. Lubricant shall be applied to the inside face of the gasket and outside of the spigot. The pipe shall then be suspended in its relative position in the trench. The suspended pipe spigot shall be pushed away from the bell to the adjacent pipe about 1/4 inch, lined up with the bell and then driven home in a quick movement. The driving leverage methods shall be subject, to the approval of the Engineer.

1002.05.02 PVC Pipe Joints.

(a) Mechanical Joints. All pipes, fittings, fire hydrants and valves with mechanical joints shall be installed by experienced pipe layers, to the satisfaction of the Engineer.

Prior to making up joints, the bells, spigots, and rubber gaskets shall be free from foreign material. Before assembly or insertion, the Contractor shall make sure the pipe spigot end is squarely cut, deburred and given only a slight outer bevel. If the pipe spigot end has the factory bevel, the factory bevel shall be removed or shortened to ensure that when assembled, the gasket will be in full contact with the non-beveled portion of the pipe outside diameter. The mechanical joint shall then be assembled in accordance with the manufacture's recommendations.

(b) Push-On Joints. All pipes with push-on Joints shall be installed by experienced pipe layers, to the satisfaction of the Engineer. Jointing shall be done in the manner recommended by the manufacturers, as follows.

Prior to making up joints, gaskets, sockets and spigots shall be free from foreign material. All gaskets shall be factory installed and shall not be removed. An approved lubricant shall be applied in accordance with the pipe manufacture's recommendations. All spigot ends of pipes shall be inserted to the pre-marked factory insertion line. All field cut pipe spigots shall be marked and beveled to match the manufacturer's insertion line. Pipe to pipe joints shall be inserted only to the insertion line. After assembly, the insertion line shall remain visible and nearly flush with the lip of the adjoining PVC pipe bells. Joints assembled beyond the insertion line will not be accepted.

1002.05.03 HDPE Pipe Joints.

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(a) Joints shall be made either pipe end to pipe end, pipe end to fitting, or between a saddle fitting and pipe by heat-fusion methods. These methods involve preparation of surfaces, heating of the surfaces to proper fusion temperatures, and bringing the surfaces together in a prescribed manner to effect the fusion bond as described in ASTM D2657 and in accordance with the pipe manufacturer's recommendations. Special tools to provide proper heat and alignment shall be used for heat-fusion connections.

(b) Joints for the pipe and fittings shall be by butt fusion joining techniques in accordance with the manufacture's recommendations. Where joining pipe is required within the trench, electrofusion techniques may be used in lieu of butt fusion. Electrofusion couplings and saddles may be used where necessary. All Electrofusion couplings shall be made using a computer controlled automatic electrofusion system. The electrofusion system shall consist of couplings containing an integral heating source which is computer controlled for time, temperature, and, jointing pressure for a consistent joint. Couplings shall be rated for the same working pressure as the pipe and shall have a built in identification feature to automatically set fusion times. The electrofusion system shall include a current monitoring feature. All joints shall be made in accordance with the manufacturer's instructions. The use of mechanical couplings for making HDPE to HDPE joints is prohibited.

1002.05.04 Steel Pipe-Joints.

(a) O-ring joints

(1) Wire brush clean exposed ends of joint surfaces.
(2) Thoroughly lubricate the gasket with material provided by the pipe manufacturer.
(3) Place gasket in the grooved spigot and relieve tension by inserting a dull instrument under the gasket and completing two revolutions around the joint circumference.
(4) Insert joint to full metal-to-metal contact prior to providing the maximum allowable 1/2-inch joint opening for any necessary deflection.
(5) Electrically bond and complete the exterior of the joint.
(6) Complete the interior joint by mortaring the annular space with a stiff mix of non-shrink grout.

(b) Lap field welded joints

(1) Wire brush exposed end of joint surfaces.
(2) Insert the plain end into the expanded bell to provide a minimum overlap of 1-1/2 inches at any location around the joint circumference.
(3) A single full fillet weld if used in lieu of the bell and spigot joint shall be provided by certified welders qualified in accordance with AWS 01.1. Where installed in a casing pipe, or otherwise noted on the plans, joint shall

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be provided with a full fillet weld and a seal weld to allow an air test of the joint through a threaded outlet provided by the pipe manufacturer. This threaded outlet shall be plugged following the successful air test.

(4) Complete the interior joint by mortaring the annular space with a stiff mix of non-shrink grout.

(5) All restrained joints shall be lap welded by certified welders qualified in accordance with AWS 01.1.

(c) Flanged joints

(1) Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe. Clean flanges by wire brush before installing flanged fittings. Clean flange bolts and nuts by wire brushing, lubricate bolts with oil and graphite.

(2) Insert the nuts, and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.

(3) Execute care when tightening joints to prevent undue strain upon valves and other equipment.

(4) If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

(d) Mechanical joints

(1) Thoroughly clean with a wire brush surfaces that will be in contact with the gaskets.

(2) Lubricate the gasket, bell and spigot by washing with soapy water.

(3) Slip the gland and gasket, in that order, over the spigot and insert the spigot into the bell until properly sealed.

(4) Evenly seat the gasket in the bell at all points, center the spigot, and firmly press the gland against the gasket.

(5) Insert the bolts, install the nuts finger tight, and progressively tighten diametrically opposite nuts uniformly around the joint to the proper tension with a torque wrench.

(6) The exact range of torque (as indicated by a torque wrench) and the length of the wrench (if not a torque wrench) shall not exceed:

Range of torque:	60-90 foot pounds.
Length of wrench:	10 inches.

(e) Field Welding

(1) Welding Requirements: All welding procedures used to fabricate pipe shall be qualified under the provision of ANSI/AWS B2.1 or ASME Sec. IX. Welding procedures shall be required for, but not limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

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(2) Welder Qualifications: All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall maintain current qualifications under the provisions of ANSI/AWS B2.1 or ASME Sec. IX. Machines and electrodes similar to those in the work shall be used in qualification tests. The Contractor shall furnish all material and bear the expense of qualifying welders.

(3) During exterior welding the coating shall be protected by draping an 18-in. wide strip of heat resistant material over the top half of the pipe on each side of the coating holdback to avoid damage to the coating by hot weld splatter. No welding ground shall be made on the coated part of the pipe.

(4) Application of protective tape coating or heat shrink wrap shall be in accordance with AWWA C214. The Engineer may require excavation of joints to verify the integrity of the coating at the joints. Excavation of joints to verify coating integrity shall be at no additional cost to the County.

(f) Verifications

(1) Inspections: All pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of ANSI/AWWA C200 and ANSI/AWWA coating and lining standard as supplemented by the requirements herein. The County shall have the right to have any or all piping, fittings or specials inspected at the manufacturing facility during the manufacturing process.

(2) Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of ANSI/AWWA C200 and ANSI/AWWA coating and lining standards.

(3) The Contractor shall perform said material tests at no additional cost to the County. The Engineer shall have the right to witness all testing conducted by the Contractor.

1002.06 CONNECTIONS. Connections to existing work shall be made by the Contractor at such a time and in such manner as the Engineer may direct, with the cost being borne by the Contractor. Upon notification by the Engineer, the Consumers in the area to be affected by the shut-off shall be notified by a County approved door tag placed by the Contractor. All valves on the existing line necessary for this operation will be operated by the Bureau of Utilities and those on the new system are to be operated by the Contractor under the direction of the Engineer. The Contractor shall complete the connections at night when so stated in the Special Provisions or on the Contract Documents and he will be allowed no extra compensation for such work. Where

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necessary to remove existing buttresses in order to make connections, such work shall be done by the Contractor without any additional compensation.

(a) The Contractor shall notify the Department of Public Works, a minimum of 48 hours in advance, prior to making any tie to the existing system.

(b) The Contractor shall not operate any valves on the existing system or new valves placed on existing system.

(c) The Contractor shall notify all customers of the County who will be without service a minimum of 48 hours in advance of the scheduled shutdown. The Contractor will place door hanger notices on each individual residence.

(d) The Contractor shall make necessary arrangements to accommodate businesses affected by the planned shutdown.

(e) For those projects which require extended periods of service interruption, the Contractor shall coordinate with the Engineer and all other agencies involved to provide a temporary water supply for the impacted area. Any such items shall be addressed in the Special Provisions. Where significant impacts to existing services may occur, the Contractor will be required to submit for approval a detailed shutdown and connection sequence to minimize the impacts to the existing system.

1002.07 CROSS CONNECTIONS. When the Contractor has tapped an existing line and crossed over to fill the newly constructed water main, he shall place within the cross connection two (2) check valves to prevent all possible backflow into the existing line.

1002.08 BUTTRESSES AND ANCHORAGES. Unless indicated on the Contract Drawings, buttresses shall be placed behind all caps, horizontal bends, tees and branches. Anchorages shall be placed beneath all vertical bends. Buttresses and anchorages shall be of cast-in-place concrete or cast-in-place concrete and steel as required. They shall extend to solid, undisturbed soil and shall be constructed in accordance with the Standard Details Contract Documents, or as approved by the Engineer. The use of restrained joint pipe in lieu of buttresses shall be permitted only with the approval of the Engineer.

1002.09 METHOD OF MEASUREMENT. Measurement for payment will be made horizontally, on the basis of the linear foot, along the centerline of the pipe through all fittings and valves, except between vertical bends, where measurement will be made along the center of the pipe including all fittings.

The length of fire hydrant connections will be measured from the centerline of main to the bell on the base of the hydrant.

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The list of pipeline appurtenances shown on the Contract Documents is for convenience only; in the case of any discrepancy between the list of pipeline appurtenances and the plans and profiles, the plans and profiles shall govern.

1002.10 BASIS OF PAYMENT. Payment for furnishing and placing water lines, fire hydrant connections, complete, will be made at the contract unit price bid for construction of mains for each size and type of pipe actually installed. No payment will be made under this item for utility lines for which payment is provided under other items in the Proposal. Price and payment shall constitute full compensation for furnishing and placing of all pipe, fittings, together with all appurtenances, jointing materials, concrete anchors and buttresses, tie rods and clamps for anchoring fire hydrant connections, removal of existing concrete, buttresses; all plugging or capping existing pipe, all excavation and refill operations, providing an approved spoil site and disposing of all spoil or excess material, trench bedding and backfill as per Standard Details, temporary paving with cold patch materials in all pavement areas, including removing and disposing of cold patch material together with surplus stone material, sawcut paving and apply permanent paving over disturbed pavement areas; maintenance and repair of trench backfill during warranty period after final acceptance; all environmental, sediment and erosion control work including off site requirements; restoration of all disturbed areas, replace curb, gutter and sidewalk damaged during construction, seeding and/or sodding operations, and all other work necessary for making connections to existing water mains; the sterilization and testing of water lines; and for all other labor, equipment, tools, and incidentals to satisfactorily complete the work.

SECTION 1003 — WATER MAIN AND SANITARY SEWER FORCE MAIN VALVES AND APPURTENANCES

1003.01 DESCRIPTION. This item shall consist of the furnishing and placing of water main and sanitary sewer force main valves, dewatering valves and blow-off valves or assemblies with appurtenant valve vaults or roadway valve boxes at the locations specified on the Contract Documents or as directed by the Engineer in accordance with the Specifications.

1003.02 MATERIALS.

1003.02.01 Valves.

Valves shall be in accordance with section 961.

1003.02.01 Manholes.

Manholes shall be in accordance with sections 962.

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1003.02.02 Miscellaneous Materials.

Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as concrete, masonry, reinforcement and castings. Valve box lids shall be clearly marked as either “water” or “sewer” per the standard details.

1003.03 CONSTRUCTION REQUIREMENTS. Valves shall be placed where indicated on the Contract Documents. Inspect and operate valves to insure proper working order prior to installation.

Buried valves and boxes shall be installed in conformance to AWWA C500 and C504, as applicable, except as specified herein. Valves shall be set with the operating nut vertically aligned in the center. Set valve boxes at right angles to the pipe, centered and plumb over the operating nut of the valve and supported by brick. Support box as required to maintain nut in position for operation with the extended tee wrench operator. Backfill and compact under and around valve boxes to insure no vertical loads are transmitted to the valves or pipe. Set pipe and fittings in arch openings of lower box section so that no part of the box bears on the pipe, fittings and valves.

1003.03.01 Valve Insertions into Existing System.

Where required on the contract documents, valves shall be inserted in existing water and sewer mains and comply with section 961. The contractor shall coordinate with the County for all required shutdowns for all valve insertions.

At the discretion of the Engineer, where continuous operation is required, line stops shall be provided to minimize service interruptions during valve insertions. All fittings, equipment, and work for in-line valve insertions shall be installed only by an experienced Contractor having installed similar projects of the same material, equal size, and scope. The Contractor shall submit a comprehensive list of experience presenting similar experience on at least five (5) similar projects within the past three (3) years. Information to be submitted shall include but not be limited to: date and duration of work, location, pipe information (i.e., length, diameter, material, etc.); utility owner information (i.e., name, address, telephone number, contact person); and pipeline use.

Before ordering a linestop tapping saddle assembly, the following shall be performed:

- **(1)** Clean existing pipe, make circumferential measurement of pipe and check for roundness to verify sleeve will fit.
- **(2)** Repair any damage to existing pipe coating with suitable coating material to original line of coating as directed by pipe manufacturer's technical representative at no additional expense before backfilling.
- **(3)** Submit proposed plan and descriptions outlining all provisions, including blocking and buttressing requirements, and precautions taken by the Contractor regarding linestop operations.

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During the Installation of linestop, the following shall be performed:.

(1) Excavate around existing pipe so as not to disturb thrust blocking.
(2) Clean existing pipe.
(3) Check pipe outside diameter and roundness to verify assembly will fit.
(4) Provide all materials and equipment, to perform installation of linestop.
(5) Provide blocking/support following Contract Documents.
(6) Approved Tapping Equipment Fabricator/Installer to install tapping saddle assembly to pipe and to insert linestop into pipe for line isolation.
(7) After linestop is no longer required, approved Tapping Equipment Fabricator/Installer to remove linestop and install completion plug and blind flange.

1003.04 METHOD OF MEASUREMENT. Valves with appurtenant vaults or roadway boxes will be measured on the basis of the number of each type built as shown on the Contract Documents or as directed by the Engineer.

1003.05 BASIS OF PAYMENT. Payment for furnishing and placing valves, including blow-off assemblies with appurtenant vaults or roadway boxes, will be made at the contract unit price bid for the particular type and size of valve or assembly installed. Price and payment will constitute full compensation for all valves and pitometer corporations within the vault, appurtenant bypass piping and valves; materials including the valve vault, valve box, castings, concrete encasement or pipe supports where required; and for all other labor, equipment, tools, and incidentals necessary to satisfactorily complete the work as indicated on the Contract Documents or by the Standard Details. Payment for furnishing and placing valves on water service connections shall be made in accordance with Section 1004.07.

SECTION 1004 — WATER HOUSE SERVICES AND APPURTENANCES

1004.01 GENERAL. The Contractor shall lay water house services and appurtenances to the lines and grades shown on the Contract Documents or designated by the Engineer. All materials (except water meters) shall be furnished by the Contractor to successfully make the required installations. Water meters, furnished by the County and paid for by the property Owner, shall be installed by the Contractor if so required.

1004.02 MATERIALS.

1004.02.01 Ductile Iron Pipe.

Ductile Iron Pipe and Fittings shall be as specified in Section 905.10.

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1004.02.02 Copper.

Copper Pipe shall be as specified in Section 905.14.

1004.02.03 Miscellaneous Materials.

Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as concrete, masonry, valves, reinforcement and castings:

1004.03 CONSTRUCTION REQUIREMENTS. Work under this section shall conform to Sections 1000, 1006, 1007, and 1008 and the following.

Water house services shall be jacked or bored under paved roads unless otherwise directed by the Engineer. Services installed in areas other than paved roads shall be open cut.

Corporation taps shall be installed in water mains only after the main has been chlorinated and tested in accordance with Sections 1006, 1007, and 1008.

A board will be placed at the end of each water house connection. The board will be placed so as to leave a clearance of 6" to 12" between the 2' tail piece and the board. The board shall have a minimum cross section of 2" X 6". It shall be long enough to extend 3 feet above existing ground and, painted blue. Valve boxes shall be extended 18” above grade during construction, with final adjustments to grade made after final tie-in to the house connection is made.

Water and sewer house services shall be placed in separate trenches with a minimum horizontal distance of five feet from outside of barrel to outside of barrel.

See section 1015 for water house service abandonment procedures.

1004.04 HYDROSTATIC AND LEAKAGE TEST. Completed water house services shall be hydrostatic and leak tested in accordance with section 1006 of these Specifications and no leakage shall be allowed. Test pressure shall be at the water main line pressure.

1004.05 DISINFECTION OF SERVICES. Disinfection of water house services shall be performed by the Contractor as specified and directed in Section 1007 of these Specifications, without additional payment.

Prior to beginning the sterilizing operation, the Contractor will submit to the Engineer for approval a schedule listing details of the sterilizing procedure to be followed.

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1004.06 METHOD OF MEASUREMENT. Measurements of lengths shall be made horizontally on the basis of the linear foot along the center line and no deduction will be made for the lengths of fittings and valves.

1004.07 BASIS OF PAYMENT. Payment for furnishing and placing water house connections shall be made on the contract unit price bid for the linear foot of the particular type and size of service installed.

Price and payment will constitute full compensation for the furnishing of excavation and backfill, crusher run stone, temporary cold patch in all pavement areas, removal and disposal of cold patch material and surplus stone material; permanent pavement repairs, maintenance and repair of trench backfill during warranty period after final acceptance; for boring and jacking water house connections under paved surfaces; 2" X 6" board markers; metal strapping as shown or specified; all pipe, fittings, valves and valve boxes, branch connections; connections to existing water mains; the testing of water lines and house connections, the disinfection of the water house connections and for all other labor, equipment, tools, and incidentals necessary to complete the work as indicated on the Contract Documents or by the Standard Details.

SECTION 1005 — FIRE HYDRANTS

1005.01 DESCRIPTION. This item shall consist of the furnishing and placing of fire hydrants or the relocating of fire hydrants to the locations specified on the Contract Documents or as directed by the Engineer in accordance with these Specifications.

1005.02 MATERIALS.

1005.02.01 Fire Hydrants. Fire Hydrants shall be as specified in Section 961.07.

1005.02.02 Miscellaneous Materials. Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as concrete, masonry, valves, reinforcement and castings.

1005.03 CONSTRUCTION REQUIREMENTS. Construction requirements shall be in accordance with sections 1000, 1002.03 and the following.

Fire hydrants shall be installed as shown on the Standard Details at the locations shown and such elevations indicated on the Contract Documents or as the Engineer may direct. They shall be set on a bed of #57 stone extending the full width of the trench.

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Special care shall be taken to insure that hydrant leads are laid level on a firm foundation to insure that the hydrant will set plumb.

Where hydrants are to be relocated, the Contractor must ascertain whether or not the hydrant valve has been restrained before removing the hydrant to be relocated. If necessary, the lead shall be capped and blocked so that service can be restored to the parent main pending the removal of, or plugging of the mainline tee.

The outside of all fire hydrants shall be painted with an approved County specified paint above the finished grade line and an approved rust preventative paint below the finished grade line.

Prior to fire hydrants being placed in service they shall be clad in black plastic and wrapped outside with yellow three inch wide "CAUTION" tape (minimum three wraps around the hydrant). The purpose of this is to alert the fire department that the hydrant is not in service.

1005.04 ADJUSTING HYDRANTS TO GRADE. New hydrants may be raised to grade through the use of groundline extensions, with a maximum of one (1) extension per hydrant. The groundline extension must be of the same manufacturer as that of the hydrant.

In the event of grade changes at hydrant settings, the hydrant may be extended by the addition of one ground line extension to the appropriate height, with the same limitations as expressed above.

1005.05 METHOD OF MEASUREMENT. Hydrant installations or relocations will be measured on the basis of the number installed or relocated as shown on the Contract Documents or directed by the Engineer, and shall include all piping, valve, and fittings from the water main to the hydrant.

1005.06 BASIS OF PAYMENT. Payment for furnishing and installing fire hydrants will be made at the contract unit price for each installation. Payment for relocating or adjusting fire hydrants will be made, at the contract unit price for each hydrant relocated or adjusted. Payment and price will constitute full compensation for all excavation, removal and disposal of spoil materials; furnishing and placing crushed stone under and around the hydrant; furnishing and installation of the hydrant, drain, bracing, strapping; testing and painting of the complete installation; and for all other labor, equipment, tools and incidentals necessary to complete the work as indicated on the Contract Documents or by the Standard Details.

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SECTION 1006 — HYDROSTATIC AND LEAKAGE TESTING OF WATER MAINS

1006.01 GENERAL. Prior to performing disinfection testing, hydrostatic and leakage testing shall be required. The Contractor shall provide and be responsible for all labor, materials and equipment associated with all such testing.

1006.02 TEST RESTRICTIONS. All hydrostatic tests shall be performed with chlorinated water. Air pressure tests will not be allowed.

Test pressures to be induced at the low point of the test section shall be based on the static gradient within the pressure zone the pipe is to be installed plus the maximum surge pressure given in the following table for the specific pipe diameter. (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge). The minimum test pressure shall be 150 psi for PVC/HDPE and 200 psi for other pipe materials.

MAXIMUM PERMISSIBLE SURGE PRESSURES

Pipeline Diameter in Inches	Surge Pressure in lb/in^2	Pipeline Diameter in Inches	Surge Pressure in lb/in^2
4 to 10	120	20	90
12 to 14	110	24	85
16 to 18	100	30 and above	80

The hydrostatic test pressures for pressure and leak tests shall be stipulated in the Special Provisions of the Contract Specifications.

The hydrostatic test shall be of at least 2 hour duration. Test pressure shall not vary by more than ± 5 psi for the duration of the test. Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure. Contractor shall not test against existing or new valves. For tests at these pressures, the test setup should include a provision, independent of the valve, to reduce line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened if desired. When hydrants are in the test section, the test shall be made against the main valve in the hydrant.

Water mains shall be tested in segments no longer than the distance between isolation valves. For new mains connecting to existing water mains, the new main shall be blocked prior to the final tie in point and hydrostatically tested in accordance with the testing procedures outlined in conformance with the Final Tie-in section 1008.04. After testing is

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complete, the last section of pipe connecting the existing line shall be connected and visually inspected under full line pressure.

1006.03 PROCEDURE.

1006.03.01 Pressurization.

After the pipe has been laid, all newly laid pipe or any valved section thereof, shall be subjected to a hydrostatic pressure. Each valved section of pipe shall be slowly filled with water, and the specified test pressure shall be applied by means of a pump connected to the pipe. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. The system shall be stabilized at the test pressure before conducting the leakage test.

For HDPE lines, the pipeline shall be allowed to contract for a minimum of two hours prior to beginning the hydrostatic test period. During this time, no water shall be added to allow the pipeline to expand under first pressurization.

1006.03.02 Water Supply.

Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate into the newly laid water main. A double check valve shall be installed between all source and test sections. The source water used for pressure testing and disinfection shall be flushed prior to its use to ensure that contaminants or debris are not introduced into the new pipe. Adequate drainage must be provided during flushing. Drainage should take place away from the construction area. During the contact period, the valve isolating the new main from the existing system shall be tagged to prevent unintentional release of the elevated chlorine residual into the existing system.

If available, water shall be supplied from an existing hydrant with water meter. It is the responsibility of the contractor to obtain the water meter from the Bureau of Utilities. If an existing hydrant is not accessible, the following are allowable filling procedures from existing water mains:

(1) Tap existing water main with corporation stop.
(2) Tap new water main with corporation stop.
(3) Install copper line with double check valve from new main to existing main.
(4) When static pressure has been reached, close the corporation stop(s) from existing water main.
(5) Provide independent system to pressurize new main to required test pressure.
(6) After completion of testing, abandon all corporation stops by installing plug with concrete cap.

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1006.03.03 Air Removal.

Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and a plug installed with a concrete cap.

1006.03.04 Examination.

All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until satisfactory results are obtained.

1006.03.05 Leakage Test.

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within ± 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. For the purpose of this test, the allowable leakage rate is zero (0).

1006.03.06 Hydrostatic Test Acceptance.

Acceptance shall be determined on the basis of zero (0) allowable leakage. If any test of laid pipe discloses leakage, repairs or replacements shall be conducted at the discretion of the Howard County Inspector. All leaks must be repaired prior to final acceptance of the work.

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SECTION 1007 — DISINFECTION OF WATER MAINS

1007.01 APPROVAL. Prior to the beginning of the disinfecting operations, the Contractor shall submit to the Engineer for approval a schedule listing details of disinfecting procedures to be followed.

1007.02 CONTRACTOR'S RESPONSIBILITY. Disinfecting of water mains shall be performed by the Contractor as specified herein. The Contractor shall provide and be responsible for all labor, materials, equipment, testing, and required laboratory analysis for the complete disinfecting operations.

1007.03 PROCEDURE.

1007.03.01 Continuous Feed Method.

Disinfecting of water mains shall be done in accordance with AWWA C-651 Standard for Disinfecting Water Mains. The method utilized shall be the continuous Feed Method. The option of placing calcium hypochlorite granules in the main during construction shall not be used. An air gap or a device to prevent backflow of the chlorine solution into the County's water system must be approved by the County and used during the testing procedure.

1007.03.02 Water Supply.

All water for disinfection of water mains shall be supplied from an existing County water main as described in section 1006.03.02.

1007.03.03 Concentration.

At a point not more than 10 feet downstream from the beginning of the new main, water shall be introduced through a corporation cock fed at a constant rate such that, the initial dose of chlorine will not have less than a 25 ppm (mg/l) or more than a 50 ppm (mg/l) free available chlorine concentration. See AWWA C651, Table 4, which gives the amount of chlorine required for each 100 feet of pipe of various diameters. To assure that this concentration is provided and maintained, the County Inspector shall measure the chlorine concentration initially prior to beginning chlorination and at regular intervals using appropriate Chlorine Test Kits. The County Inspector shall document the chlorine concentration. See AWWA C-651, Appendix "A" for information pertaining to Chlorine Test Kits.

1007.03.04 Hypochlorinator System.

The use of a hypochlorinator system will not be allowed for disinfecting a main.

1007.03.05 Protection of Existing System.

During the application of chlorine, in no case shall water from the main being treated be allowed to flow back into water mains in active service.

1007.03.06 Minimum Retention.

The heavily chlorinated water shall be retained in the main for at least a 24 hour period, during which time all valves, fire hydrants and blow off drains in the treated section shall be operated to ensure disinfection of the appurtenances. At the end of this 24-hour period, the treated water in all portions of the main shall have a free residual chlorine concentration of not less than 10 ppm (mg/l). The County Inspector shall measure the chlorine concentration to ensure compliance. If the free residual chlorine concentration

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indicated is less than 10 ppm (mg/l), the water main shall be completely drained and the disinfecting-operation repeated.

1007.03.07 Maximum Retention.

During initial disinfection, repeated disinfection, or prior to final flushing, it is imperative that the heavily chlorinated water shall not be retained in the water main longer than 48 hours. The scheduling of the chlorination and dechlorination must be approved by the Engineer to ensure that a retention time longer than 48 hours will not occur. In order to prevent damage to the pipe lining or corrosion damage to the pipe, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that chlorine level in water leaving the main is no higher than the level in the water obtained from the distribution system for flushing.

1007.03.08 Flushing.

After the 24-hour retention period and the County Inspector has confirmed that the free residual chlorine concentration of not less than 10 ppm (mg/l), the new water main, all water main laterals, and terminal sections of the main shall be flushed. Periodic chlorine residual measurements shall be taken during flushing until the concentration in the water leaving the main and laterals is no higher than that generally prevailing in the existing distribution system or is between 0.5 ppm (mg/l) to 1.5 ppm (mg/l). All flushing shall be performed through existing fire hydrants to pre-approved discharge locations.

State regulations, COMAR 26.08.03.06, require that no chlorine may be added to effluents discharged to Class III, Natural Trout Waters. All effluents discharging to any other water class must be dechlorinated to reduce the total residual chlorine to non-detectable levels. Non-detectable levels are defined as less than 0.1 ppm (mg/l) in the effluent. Any waters used in the disinfection of water mains must not be discharged to Class III streams. Dechlorination of the effluent is acceptable when discharged to Class I and Class IV waters. The manner of dechlorination shall be the option of the Contractor, however the method shall be in accordance with Appendix C of AWWA C651. All post chlorination water will remain in the test section for a minimum of 24 hours prior to bacteriological sampling.

1007.04 MEASUREMENT AND PAYMENT. No measurement will be made for disinfecting and testing of water mains. Payment shall be included in the items bid for furnishing and placing water lines and fire hydrants.

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SECTION 1008 — BACTERIOLOGICAL TESTING OF WATER MAINS

1008.01 GENERAL. After final flushing and before the new water main is placed in service, bacteriological testing shall be required. The Contractor shall provide and be responsible for all labor, materials, equipment testing, and required laboratory analysis for complete bacteriological testing.

1008.02 PROCEDURE.

1008.02.01 Sampling.

Samples shall be taken from a corporation cock with a copper-tube gooseneck assembly located at or near the end of the new segment of the main. A blow-off drain assembly, if installed as part of the Contract Documents, can also be utilized. All water samples shall be drawn by a MDE certified sampler, not less than 24 hours after final flushing is complete after disinfection testing. Sample locations shall be at a minimum one set every 1200 feet along the main, one set at every branch, and one set at the end of the line. Additional sampling locations shall be determined by the Engineer. All sampling shall be witnessed by the Engineer.

1008.02.02 Laboratory Analysis.

Samples from the main shall be sent to a certified laboratory within the state of Maryland and tested for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater. Test results shall show the absence or presence of coliform organisms. A standard plate count may be required at the option of the Engineer.

1008.02.03 Laboratory Results.

The results of the bacteriological testing shall be forwarded to the Contractor from the certified laboratory. The analysis report shall contain the following information: free residual chlorine concentration, coliform organisms absence/presence, and a standard plate count if analyzed. The Contractor shall forward a copy of the laboratory analysis report to the Engineer for approval.

1008.02.04 Resampling.

If the results of the first sampling are not acceptable, the Contractor shall reflush the new water main and resample.

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1008.03 REPEAT DISINFECTION AND TESTING. If the results of the second sampling are not acceptable, the Contractor shall repeat the entire disinfecting operations procedure as set forth in section 1007, Disinfection of Water Mains and the Bacteriological Testing as set forth above.

1008.04 FINAL TIE-IN. No tie-in shall occur until the Engineer has received a copy of bacteriological test results. If the results of the sampling are approved by the Engineer, and all hydraulic pressure testing has been completed and accepted, the final tie-in of the new water main to the existing distribution system can be completed. All final tie-ins must be completed in the presence of the Engineer. Any corporation cock and copper-tube assembly, installed for the sole purpose of a sampling location, shall be removed from the new main and plugged and capped before placing the line in service.

1008.05 MEASUREMENT AND PAYMENT. No measurement will be made for bacteriological testing of water mains. Payment shall be included in the items bid for furnishing and placing water lines and fire hydrants.

SECTION 1009 — SANITARY SEWER MAINS AND SEWER HOUSE CONNECTIONS

1009.01 DESCRIPTION. This item shall consist of furnishing and installing sanitary gravity sewer mains and sewer house connections of the diameter shown on the Contract Documents, in accordance with these Specifications.

1009.02 MATERIALS.

1009.02.01 Ductile Iron Pipe.

Ductile iron pipe, fittings and joints for sanitary sewers shall conform to section 905.10 of these Specifications of the class of pipe as indicated on the Contract Documents.

1009.02.02 Reinforced Concrete Sewer Pipe.

Reinforced concrete sewer pipe, fittings and joints shall conform to Section 908.03 for the class of pipe as indicated on the Contract Documents.

1009.02.03 Polyvinyl Chloride Pipe (PVC).

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Polyvinyl chloride pipe (PVC) shall conform to Section 905.01.02 for pipe, fittings and joints.

1009.02.04 High Density Polyethylene Pipe (HDPE).

HDPE shall conform to Section 905.02.02 for pipe and joints. The use of HDPE for gravity sewer installations is only allowed under special conditions with the approval of the Engineer. All installations must directionally drilled DR-11 HDPE installed in accordance with section 1016 of these Specifications. Directional drills for a gravity sewer will be considered only on sewers with a greater than 2% design slope.

1009.02.05 Miscellaneous Materials.

Reference is also made to Category 900 of these Specifications for the several items entering into the work such as concrete, masonry, reinforcement and castings.

1009.03 CONSTRUCTION REQUIREMENTS.

1009.03.01 General.

Reference is made to section 1000.03.04 for additional information regarding the laying of pipe which is applicable to this work.

PVC gravity sewer pipe shall be installed in accordance with ASTM D2321, applicable manufacturer's installation manuals and UNI-BELL Plastic Pipe Association Recommended Practice for the Installation of PVC Sewer Pipe UNI-B-5.

No PVC Pipe shall be laid unless it is generally straight. Such pipe shall have a maximum ordinate, as measured from the concave side of the pipe, not to exceed 1/16 inch per foot of length. Any pipe which exceeds this requirement will be rejected.

Reinforced concrete sewer pipe shall be installed in accordance with ASTM C1479 and applicable manufacture’s installation manuals.

1009.03.02 Sewer House Connections.

All sewer house connections shall be constructed of the same class of material as the sewer mains to which they are connected.

All sewer house connections shall be laid on a two percent grade unless otherwise noted on the contract documents or directed by the Engineer. All sewer house connection shall be installed up to the property line and within 5 feet of finished grade. A board placement (painted green) shall be placed at the end of the pipe marking its location.

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All single or twin sewer house connections shall be constructed to terminate at an angle perpendicular to the property lines unless otherwise noted on the Contract Documents. The ends of all house connections shall have standpipe brought to within 5 feet of finished grade and shall be marked by a 2" X 6" board painted green.

The ends of all sanitary sewer house connections shall be plugged so that they can withstand 5 psi pressure for the purpose of air testing.

Wye branches shall be located in the position designated by the Engineer or his representative. Short pieces of lateral sewer shall be field-cut to meet this condition. The Contractor shall have on the site, at all times, factory approved equipment to machine and adapt the field-cut end of short pieces of pipe to standard couplings and jointing materials.

Wye branches and tee fittings shall be used for all S.H.C.'s on new sewer construction. The Engineer may approve saddle taps for sanitary sewer house connections into large existing sewers. All house connections connected into existing sewers shall be TV inspected.

The connection of private laterals into the County's sewer house connection, including dry connections, will not be allowed until the County approves the sewer main for service.

1009.03.03 Pipe Joints.

Prior to making the pipe joints in the trench, the Contractor shall demonstrate to the Engineer that the methods which the Contractor proposes to employ conform to the Specifications, will secure a watertight joint, and that the Contractor's workers are familiar with the requirements of the specifications.

1009.03.04 Acceptance Testing.

For general testing requirements, see section 1000.03.04 of this Specification.

All sewers built under the Contract will be tested in accordance with the following test requirements. The Contractor shall cooperate and furnish all assistance necessary to perform the tests as specified herein and as directed by the Engineer. The Contractor must notify the Engineer a minimum of 48 hours for the low pressure test and 24 hours prior to performing the mirror test.

(a) Low Pressure Air Test. Sanitary sewers will be tested with air under low pressure in accordance with the following procedures. The Contractor shall not be permitted to place air under pressure in any sewer under any conditions except those specified herein.

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All sanitary sewers, including manholes, shall be inspected prior to air testing. Any water leakage into the system sufficient to constitute any noticeable trickle or seepage shall be corrected and eliminated prior to undertaking the low pressure air test. No infiltration will be allowed.

The Contractor must complete his backfill operation, including the approval of the compaction testing, before any air test is scheduled.

The procedures for conducting a Low Air Pressure Test are as follows:

(1) Each section of completed sewer shall be tested. The sewers shall be tested from manhole to manhole or from a manhole to the terminus of the sewer if there is no manhole at the other extremity, including house connections laid out of manholes.

(2) The Contractor shall thoroughly clean and remove all debris, silt, earth or other material from the sewer prior to air testing. The pipe may be cleaned with water in a manner accepted by the Engineer. No water or debris shall be allowed to enter the existing sewer.

(3) Test plugs shall be installed by the Contractor within the pipe at each manhole. Each plug shall be security braced as necessary.

(4) The Contractor shall add air slowly to the portion of the pipe under test until the internal air pressure is raised to 5.0 psi gauge. The Contractor shall maintain 5 psi gauge for 4 minutes with no pressure drop.

(5) As a safety precaution, no one shall be allowed in a manhole after the air pressure is increased in the sewer line. If the Engineer suspects that the test plug may be leaking, the pressure shall first be relieved before any adjustments are made to eliminate air leakage at the plug.

(6) The Contractor shall allow the air temperature to stabilize for at least two (2) minutes with the pipe subjected to an internal pressure of 5.0 psi by adding only the amount of air required to maintain this pressure.

(7) After a two (2) minute period, the Contractor shall completely disconnect the hose and compressor from the pipe being tested to assure that no additional air is added therein.

(8) Pipe which fails to maintain the stipulated pressure for the specified holding time shall be deemed to have failed to pass the low pressure air test and is unsatisfactory for acceptance by the County. Any sewer main or house connection that fails to pass the air test shall be repaired by the Contractor at his own expense. Following corrections, the sanitary sewer shall be tested again in accordance with the above procedure.

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(9) The Engineer or other authorized personnel will complete a report on the required form for each section of sewer main and/or sewer house connection tested. This form will be signed by the Engineer or other authorized personnel and the Contractor.

(b) Mirror Test. For all sanitary sewers constructed under the contract, the Engineer will conduct a "Mirror Test" for leakage defects, alignment and grade. The Mirror Test shall consist of reflecting light with mirrors through the complete section of pipe. In order to be accepted, the pipe shall be sufficiently true and straight in alignment to allow for the passage of the reflected light with an image of a "full moon".

All backfill shall be placed, consolidated and dewatering operations ceased 30 days prior to the start of mirror testing. The Contractor is encouraged, but is not required, to perform his own mirror tests prior to final mirror testing by the County.

(c) Television Inspection. Prior to final acceptance of the gravity sanitary sewer system, a TV inspection of the gravity sewer system will be performed to verify no debris has accumulated in the line, that there are no line depressions, and to verify the water tightness of the system. Only mainline sewers will be TV inspected. Laterals only need to be TV inspected in the event the Engineer allows a saddle tap of an existing sewer for a new lateral connection.

All TV inspections will be performed with the system in service. For County Capital projects, all TV inspections will be performed by the County at no cost to the Contractor. For developer projects, all television inspections will be performed by the County, but will be paid for by the Developer.

1009.04 METHOD OF MEASUREMENT.

1009.04.01 Sanitary Sewer Mains.

Measurement for payment will be made horizontally on the basis of the linear foot along the centerline of the pipe through all fittings with the exception of the inner diameter of each manhole and the length of each junction chamber.

1009.04.02 Sanitary Sewer House Connections.

Measurement of Sanitary Sewer House Connections shall be made as follows.

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(a) Horizontally on the basis of the linear foot along the centerline of pipe as measured from inside the bell at the property/right-of-way line to the centerline of the sanitary sewer main. See the Standard Details.

(b) Vertically on the basis of the vertical foot of standpipe for the limits as shown and detailed in the Standard Details.

(c) For each main line tee or wye by applicable size for connection of house service to the sanitary sewer main.

1009.04.03 Concrete Encasement.

Measurement shall be on the basis of the number of linear feet for each size of sanitary sewer pipe shown on the Contract Documents and actually encased in the field.

1009.05 BASIS OF PAYMENT.

1009.05.01 Sanitary Sewer Mains.

Payment for furnishing and placing sanitary sewers will be made at the contract unit price bid per linear foot for the construction of mains for each size and type of pipe actually installed. Price and payment shall constitute full compensation for furnishing and placing of all pipe, fittings, jointing materials, appurtenances necessary for laying the sanitary sewer mains, including connections to existing sewers; all testing; all excavation and backfill operations; providing an approved spoil site, and disposing of all spoil or excess materials; trench backfill in accordance with the Standard Details; temporary paving and maintenance with cold patch materials in all pavement areas, including removing and disposing of cold patch material together with any surplus CR-6 material; maintenance and repair of trench backfill during maintenance period after acceptance, recut paving and apply permanent paving over disturbed pavement areas, all environmental and erosion or sediment control work including off site requirements at spoil storage or borrow sites; restoration of all disturbed areas, replace all curb, gutter and sidewalk damaged during construction, seeding and/or sodding operations; for all appurtenances, and for all other labor, equipment, tools, and incidentals to satisfactorily complete the work.

1009.05.02 Sanitary Sewer House Connections.

Payment for sanitary sewer house connections shall be made at the contract unit price bid per linear foot for horizontal pipe; per vertical foot length of standpipe, and for each fitting (tee, bend or wye) used for sewer house connection installation by size, including patching of pavement.

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Price and payment shall constitute full compensation for furnishing and installing all pipe and fittings as applicable, jointing materials; excavation and backfill, providing an approved spoil site, disposing of all spoil or excess material; trench bedding and backfill in accordance with the Standard Details; temporary paving and maintenance with cold patch materials in all pavement areas, including removing and disposing of cold patch material together with surplus CR-6 material; recut paving and apply permanent paving over disturbed pavement areas, and maintaining and repairing trench for warranty period after final acceptance; all environmental and erosion or sediment control work, including off site requirements at spoil storage or borrow sites: restoration of all disturbed areas, replacing all curb, gutter, and sidewalk, seeding and/or sodding operations, and appurtenances necessary for laying sanitary sewer house connections, including connections to existing house connections; testing; stoppers and/or plugs with blocking at property line; and for all other labor, equipment, tools, and incidentals to satisfactorily complete the work..

In the event that the Engineer approves saddle taps for sanitary sewer house connections for large sanitary sewer main pipe that will facilitate this method no extra measurement nor payment will be made for the saddle or tapping of the sanitary sewer main pipe. The cost shall be included in the various unit prices bid for construction of each size and type of house connection.

1009.05.03 Concrete Encasement.

Concrete cradles and encasements shall be paid for on the basis of measurement set forth above at the contract unit price bid for each size of sanitary sewer pipe actually encased. Price and payment shall constitute full compensation for furnishing and placing the materials and for all other labor, equipment, tools, and incidentals to satisfactorily complete the work.

SECTION 1010 — SANITARY SEWER MANHOLES

1010.01 DESCRIPTION. The work proposed under this Section shall consist of furnishing and installing sanitary sewer manholes and miscellaneous structures of concrete or brick masonry for sanitary sewers built to the shapes and dimensions shown in the Standard Details or on the Contract Documents at the locations indicated on the Contract Documents or as directed by the Engineer. For information regarding adjustment of existing structures to grade see Section 1001 of this Specification.

1010.02 MATERIALS.

1010.02.01 Manhole Steps.

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Manhole steps shall meet specifications section 962 and comply with the Standard Details.

Manhole steps within any given manhole shall not vary in type and detail without the written approval of the Engineer.

1010.02.02 Precast Reinforced Manholes.

Precast reinforced concrete manholes shall meet the requirements of Section 962 of this specification.

1010.02.03 Hydrogen Sulfide Protection Liner.

A protective liner for manholes is only required for conditions as discussed in Section 4.7 of Howard County Design Manual Volume II and shall be provided only where indicated on the contract Documents. Liners installed shall meet the requirements of section 962 of this specification.

1010.02.04 Miscellaneous Materials.

Reference is also made to Category 900 of these Specifications for the several items entering into the work such as castings, steel reinforcing, brick and concrete when such is required. The materials to be used in any particular structure shall be those specified on the Contract Documents, Standard Details or in the Special Provisions.

1010.03 CONSTRUCTION REQUIREMENTS. All work shall be in accordance with Sections 463, 1000 and the following.

1010.03.01 Channels.

Channels for receiving and passing water shall be formed in the bottom of manholes as shown or directed. Channel linings shall conform to the Standard Details. All such channels shall be lined with brick or approved pre-cast channel inverts. Channels shall slope smoothly and evenly from the main pipe entering the manhole to the outlet pipe. Channels for future extensions shall be built into manholes where shown on the Contract Documents or where directed by the Engineer. Channels for "doghouse manholes" shall be brick only.

1010.03.02 Foundations.

Wider and deeper foundations than shown on the Standard Details for manholes shall be built of concrete masonry, wherever directed. Manholes shall be built as pipe laying progresses, and the Engineer may stop work entirely on laying pipe until the manhole just passed has been completed.

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1010.03.03 Frames, Covers And Steps.

Manhole frames, covers and steps shall be furnished by the Contractor and set by him as the work progresses. Frames shall be well bedded in mortar in accordance with the Standard Details.

Manhole frame and cover shall be installed flush with applicable cross slopes in paved roadways. Unless otherwise noted on the Contract Documents, the finished elevation for the tops of all manholes shall be determined in the field. All manhole frame and covers shall be installed and anchored in accordance with the Standard Details.

Steps shall be spaced vertically and aligned as shown on the Standard Details.

1010.03.04 Manhole Adjustment Rings.

Manhole adjustment rings shall be provided in accordance with the Standard Details. Adjustment rings can be provided from either concrete or brick. Only one type of adjustment ring per structure will be permitted.

1010.03.05 Watertight Manhole Frame and Cover.

Water tight frames and covers shall be provided where indicated on the Contract Documents in accordance with the Standard Details.

1010.03.06 Manhole Chimney Seal.

A manhole chimney seal may be installed only with the approval of the Engineer. The manufacturer of the chimney seal must be approved by the Engineer, with all installations made in accordance with the manufacturers recommendations.

1010.03.07 Drop Connections.

Drop connections of the various types in accordance with the Standard Details shall be built by the Contractor where shown on the Contract Documents or where directed by the Engineer. The construction of drop connections of minimum height is more desirable than steeply sloped channels which interfere with rodding.

The use of inside drop connections in lieu of outside drop connections is only allowable in special circumstances when approved by the Engineer, where damage to other utilities is likely because of their proximity to the manhole. Cost or complication of shoring will not be considered as a reason for the allowance of an inside drop connection. In any case, no more than one inside drop per manhole is allowable.

1010.03.08 Connections into Existing System.

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All connections into existing manholes shall be field cored and a flexible connector installed. The interior manhole channel of the existing manhole must be reconstructed to accept the new connection.

Connections of a new sewer house connection into an existing sewer shall be made as discussed in section 1009.03.02.

1010.03.09 Manhole Inspections.

All manholes shall be visually inspected after installation. Manholes having visible leakage or seepage shall be corrected as directed by the Engineer. Caulking or patching of interior manhole surfaces will not be acceptable.

All channel covers used during construction shall be removed by the contractor prior to final acceptance. It is the Contractors responsibility to clean any debris that enters the sanitary sewer system during construction. Any debris within the system must be physically removed. Washing the debris down the line into the existing system will not be permitted.

1010.03.10 Hydrogen Sulfide Protection Liner

(a) Installation of the lining, including preheating of sheets in cold weather and the welding of all joints, shall be done in accordance with the recommendations of the liner manufacturer.

(b) Coverage of the lining shall not be less than the minimum shown on the Contract Documents. The lining is normally installed with the locking extensions running vertically in the structure.

(c) All cut, torn and seriously abraded areas in the lining shall be patched according to manufacturer's instructions.

(d) Hot joint compounds, such as coal tar, shall not be poured or applied to the lining until all liner joints have been completed.

(e) If external ground water is present, de-watering procedures must be continued for a minimum of 24 hours after final installation of mastic.

(f) Lining at joints shall be free of all mortar and other foreign material and shall be clean and dry before joints are made.

(g) The Contractor shall coordinate the supply of the lining to the precast manhole manufacturer.

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(h) Concrete poured against lining shall be vibrated, spaded or compacted in a careful manner so as to protect the lining and produce a dense, homogenous concrete, securely anchoring the locking extensions into the concrete.

(i) In removing forms, care should be taken to protect the lining from damage. Sharp instruments shall not be used to pry forms from lined surfaces. When forms are removed, any nails that remain in the lining shall be pulled, without tearing the lining, and the resulting holes properly repaired.

1010.04 METHOD OF MEASUREMENT. Sanitary sewer manholes will be measured on the basis of the number of each type of unit built to a standard minimum depth of six (6) feet. An additional measurement will be made in vertical feet for the extra vertical depth of any unit in excess of the standard minimum depth on such structures measured from the lowest point of the invert within the structure to the highest external point on the top of the structure.

1010.05 BASIS OF PAYMENT. Sanitary sewer manholes measured as described above will be paid for on the basis of the contract lump sum price bid for each type and size of manhole. An additional payment will be made for the vertical depth in excess of the standard minimum depth of six (6) feet at the contract unit price per vertical foot for each type and size of sanitary sewer manhole.

Payment for building drop connections will be made at the contract unit price bid for each type and size constructed as shown, specified and directed. Payment of such price shall be full compensation for all items necessary to satisfactorily complete the work as specified, including all pipe, fittings, concrete encasement for each pay unit.

Price and payment shall constitute full compensation for all items necessary to satisfactorily complete the work as specified including all masonry, or precast concrete units, waterproofing, interior liners, reinforcing bars, ladder rungs, metal frames, and covers for each pay unit; all testing; all excavation and backfill operations; providing an approved spoil site, and disposing of all spoil or excess materials; bedding and trench backfill in accordance with the Standard Details; temporary paving and maintenance with cold patch materials in all pavement areas, including removing and disposing of cold patch material together with any surplus CR-6 material; recut paving and apply permanent paving over disturbed pavement areas, all environmental and erosion or sediment control work including off site requirements at spoil storage or borrow sites; restoration of all disturbed areas, replace all curb, gutter and sidewalk damaged during construction, seeding and/or sodding operations; for all appurtenances, and for all other labor, equipment, tools, and incidentals to satisfactorily complete the work.

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SECTION 1011 — SANITARY SEWER FORCE MAINS

1011.01 DESCRIPTION. This item shall consist of furnishing and placing sanitary sewer force mains and appurtenances of the sizes shown on the Contract Documents, laid on a firm bed true to line and grade in accordance with these Specifications.

1011.02 MATERIALS SPECIFICATIONS.

1011.02.01 Steel Pipe.

Steel pipe, fittings and joints shall conform to Section 905.13 for the thickness of pipe as indicated on the Contract Documents.

1011.02.02 Ductile Iron Pipe.

Ductile iron pipe, fittings and joints shall conform to Section 905.11 for the class of pipe as indicated on the Contract Documents.

1011.02.03 Polyvinyl Chloride (PVC) Pipe.

Polyvinyl Chloride pipe and joints shall conform to section 905.01.05. PVC pipe for sanitary force mains is only allowable under special circumstances when approved by the County.

1011.02.04 High Density Polyethylene (HDPE) Pipe.

High Density Polyethylene pipe and joints shall conform to section 905.02.02. HDPE pipe for sanitary force mains is only allowable under special circumstances when approved by the County.

1011.02.05 Valves.

Valves and appurtenances shall conform to Section 961.

- **(a)** Wastewater Air and Vacuum Valves
- **(b)** Wastewater Isolation Valves
- **(c)** Valve Boxes

1011.03 CONSTRUCTION REQUIREMENTS. All work under this section shall be in accordance with Section 1000, and shall follow the methods outlined in subsection 1002.03 and 1006.

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1011.04 TESTING. All force mains installed shall be hydrostatically tested in accordance with section 1006 with the exception of the following:

(a) Water used for testing does not need to be chlorinated.
(b) The test pressure at the lowest point in the lines shall be 150 psi or 1.5 times the working pressure, whichever is greater.

1011.05 METHOD OF MEASUREMENT. Measurement for payment will be made horizontally along the center line of the force main through all fittings except between vertical bends where measurement will be made along the center of the pipe including all fittings.

1011.06 BASIS OF PAYMENT. Payment for furnishing and placing force mains will be made at the contract unit price bid per linear foot for the construction of mains for each size and type of pipe actually installed. Price and payment shall constitute full compensation for furnishing and placing of all pipe, fittings, jointing material, appurtenances, concrete anchors, buttresses, connections to existing sewers; all testing; all excavation and backfill operations; providing an approved spoil site, and disposing of all spoil or excess materials; bedding and trench backfill in accordance with the Standard Details; temporary paving and maintenance with cold patch materials in all pavement areas, including removing and disposing of cold patch material together with any surplus CR-6 material; recut paving and apply permanent paving over disturbed pavement areas, maintain and repair trench backfill after final acceptance; all environmental and erosion or sediment control work including off site requirements at spoil storage or borrow sites; restoration of all disturbed areas, replace all curb, gutter and sidewalk damaged during construction, seeding and/or sodding operations; for all appurtenances, and for all other labor, equipment, tools, and incidentals to satisfactorily complete the work.

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SECTION 1012 — JACK AND BORE, AND TUNNELING INSTALLATIONS

1012.01 DESCRIPTION. This work consists of the furnishing of a trenchless installation which serves as a casing or liner for other utilities or as the carrier itself, performed by tunneling or jack and bore methods. The trenchless excavation shall be installed to the lines and grades shown on the Plans by a method chosen by the Contractor unless otherwise specified on the Plans. The Contractor is responsible for selecting a method suitable for the conditions to be encountered and to assure no disturbance to the existing surface. All work shall be in accordance with the Sections of Category 1000 of these Specifications.

1012.01.01 Railroad Crossings.

No work shall begin without a Crossing Agreement between the County and the Railroad. A Crossing Agreement, containing specific and special instructions, will be obtained by the County. The Contractor is required to read and adhere to the requirements of the Crossing Agreement. Materials for the casing or liner plate tunnel, and carrier pipe, shall be as shown on the approved Crossing Agreement, and as specified herein.

1012.01.02 Definitions.

(a) Carrier pipe is the sewer or water pipe.

(b) Casing pipe is the sleeve through which the carrier pipe will be placed.

(c) Casing spacer/insulators are fabricated items used to position, support and insulate water and sewer carrier pipes inside casings or tunnels.

(d) Jacking and boring is a method of installing a casing pipe by means of cutting, hand mining or boring an opening while simultaneously forcing the casing pipe through the opening with hydraulic jacks.

(e) Tunneling is a method of installing rings of a segmental sleeve by means of cutting, hand mining or boring an opening ahead of the previous segments, while protected by a shield that is advanced by hydraulic jacks, then installing additional ring segments to support the excavation.

(f) Tunnel Liner Plates are the modular components of the rings that are assembled to make the segmental sleeve through which the carrier pipe will be placed.

1012.01.03 Design.

The trenchless excavation method shall be designed for the earth, construction, and other loads present plus AASHTO HS25 Highway Live Load increased 30 percent for impact. The Contractor's engineer, or appropriate design professional, who must be registered in the State of Maryland, shall prepare the design for review by the Engineer. Steel Tunnel Liner Plates, if used, shall be designed in accordance with the latest edition of the Standard Specifications for Highway Bridges adopted by the American Association of State Highway and Transportation Officials. All design shall be in accordance with OSHA, MOSH, and all federal, state, and local regulations.

1012.01.04 Working Drawings.

The Contractor shall submit working drawings for review by the Engineer on the trenchless excavation method itself and on any required launching/jacking and receiving pits. The Working Drawings shall be signed and sealed by the Contractor's engineer, or appropriate design professional. The Contractor shall submit six copies of drawings showing typical sections and details of the trenchless excavation method to be used, and any grouting procedures. Working Drawings shall contain certification by the

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Contractor's engineer that the proposed trenchless excavation method and the proposed construction of any launching/jacking and receiving pits have been designed in accordance with these Specifications. It is the intent of these Specifications to specify a performance standard leaving the choice of material and trenchless excavation method of construction to the Contractor. Review of the Working Drawings is to insure preparation of design by a Professional Engineer and shall not relieve the Contractor of the responsibility for the adequacy and accuracy of the Working Drawings when implemented in the field.

1012.01.05 Trenchless Excavation Plan.

After submittal of the Working Drawings and at least two weeks before Construction begins the Contractor shall submit to the Engineer a Trenchless Excavation Plan wherein the Contractor will present his schedule for trenchless excavation operations, and fully describe his proposed methods and operations to be employed. Review of the Trenchless Excavation Plan is for quality control and record keeping purposes and shall not relieve the Contractor of the responsibility for the accuracy and adequacy of the Trenchless Excavation Plan when implemented in the field. If at any time during the progress of the work the method of trenchless excavation does not produce the desired result, the Contractor shall submit a revised Trenchless Excavation Plan until a technique is arrived at that shall produce the desired results. The revised Trenchless Excavation Plan and method shall be performed at no additional cost to the County.

1012.01.06 Preconstruction Survey.

The Contractor shall survey, photograph, and videotape all buildings, structures, and roadways within a horizontal distance of the centerline of the trenchless excavation that is three times the vertical distance from the invert of the trenchless excavation to the finished grade over the trenchless excavation. This survey shall be performed by a company that can show acceptable previous experience to the Engineer. The Survey shall be prepared and submitted to the Engineer and shall be sufficient to document the existing condition of any cracks, settlement, upheaval, spalls, or other existing deficiencies in existing buildings, structures, or roadways. If the trenchless excavation is under wetlands or other surface, the complete condition of the wetlands or other surface which is over the proposed trenchless excavation shall be documented. The Preconstruction Survey shall be made before any trenchless excavation is done in the field.

1012.01.07 Submittals.

The Contractor shall submit the following to the Engineer for review:

(a) Working Drawings, Trenchless Excavation Plan, and Preconstruction Survey, describing in detail the proposed methods, procedures and the entire operation to be used, shall include but not be limited to the following:

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General:
(1) size, capacity and arrangement of equipment
(2) method of dewatering and drainage
(3) method of ground stabilization and materials, if proposed, and evidence of experience and competency
(4) method of detection of ground movement
(5) method of monitoring and controlling line and grade

Jack and Bore:
(1) jacking and receiving pits, backstop, pit base material
(2) method of excavation and removing soils materials, type of cutter head
(3) method of installing the casing pipe
(4) method and procedure for installing the carrier pipe, and casing spacer/insulators, or supports and anchors, to prevent flotation and surge pressure buckling
(5) method of sealing the casing pipe ends

Tunneling:
(1) launching and receiving pits
(2) method of excavation and removing soils materials
(3) method of support of tunnel face and initial supports
(4) method of erecting, placing and operating the tunnel shield
(5) grout and concrete design mix specifications
(6) method and procedure for the placement of gravel pack or grout between the tunnel liner plates and the excavation
(7) method and procedure for installing the carrier pipe, and casing spacer/insulators, or supports and anchors, to prevent flotation and surge pressure buckling
(8) method of bulkheading the tunnel ends

(b) Submittals for Excavation Support Systems and Dewatering Systems shall meet the requirements of Section 1000 of these Specifications.

(c) Certified test reports for liner plates and connectors, and shop drawings and specifications showing sizes, shapes, methods of attachment, connection details and grout hole details, shall be submitted for conformance with the specifications and approved by the Engineer before delivery of materials. Certifications for liner plates shall be in accordance with AASHTO M167, Paragraph 18.

(d) Certified test reports for casing pipe, and shop drawings and specifications showing sizes, joint welds, and coatings, shall be submitted for conformance with the specifications and approved by the Engineer before delivery of materials.

1012.02 MATERIALS.

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1012.02.01 Carrier Pipe.

Carrier pipe shall be in accordance with their respective sections of Category 900 of these Specifications.

1012.02.02 Casing Pipe.

Casing pipe for jack and bore installations shall be in accordance with Section 963 of these Specifications.

1012.02.03 Casing End Seals.

Casing end seals for jack and bore installations shall be in accordance with Section 963 of these Specifications.

1012.02.04 Casing Spacer/Insulators.

Casing spacer/insulators shall be in accordance with Section 963 of these Specifications.

1012.02.05 Grout.

Grout shall be in accordance with Section 963 of these Specifications.

1012.02.06 Tunnel Bulkheads.

Tunnel bulkheads shall be in accordance with Section 963 of these Specifications.

1012.02.07 Tunnel Liner Plates.

Tunnel liner plates shall be in accordance with Section 963 of these Specifications.

1012.02.08 Tunnel Liner Plate Bolts and Nuts.

Bolts and nuts for tunnel liner plates shall be in accordance with Section 963 of these Specifications.

1012.03 CONSTRUCTION.

1012.03.01 Line and Grade.

The Contractor shall be responsible for extending the line, grade, and elevation in the tunnel/casing from the launching/jacking pit. The Contractor shall submit to the Engineer for approval the method it proposes to use for extending controls within the tunnel/casing. No work in these areas will be allowed to be performed prior to such approval. The Engineer may make periodic checks on the lines, grade elevation, etc.,

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established by the Contractor. The Contractor shall maintain line and grade to within a tolerance of 2 inches of that indicated on the Contract Documents.

1012.03.02 Job Conditions.

Blasting is prohibited without the explicit written approval of the Engineer.

Tunneling, or jack and bore construction shall be performed so as not to interfere with, interrupt or endanger surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing pipe. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the casing pipe, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from trenchless operations and shall repair and restore damaged property to its condition prior to being disturbed at no cost to the County or owner of property or additional cost to the Contract.

The Contractor shall comply with applicable ordinances, codes, statutes, rules and regulations of the State of Maryland, MDSHA, applicable County building codes, and applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI A1O.16-81, "Safety Requirements for Construction of Tunnel Shafts and Caissons".

1012.03.03 Soil Stabilization.

If pressure grouting or freezing of the soils prior to beginning the tunneling, or jacking and boring, operation has been required by the Engineer to stabilize the soils, control water, prevent loss of material, or prevent settlement or displacement of embankment, the grout may be cement, chemical, or other special injection material selected to accomplish the necessary stabilization.

The materials to be used and the method of injection shall be in accordance with these Specifications and as approved by the Engineer. The Contractor shall provide evidence of his experience and competency in a submittal to the Engineer prior to the start of any soil stabilization work.

1012.03.04 Excavation Support Systems and Dewatering Systems.

Excavation Support Systems and Dewatering Systems shall meet the requirements of Section 1000 of these Specifications, and the following:

(a) Dewatering. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24-hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Discharge from dewatering operations shall be directed into approved receiving basins in accordance with all applicable regulatory requirements. When

dewatering, the Contractor shall maintain close observation of the highway or railroad to detect any settlement or displacement of the embankment, tracks or other facilities.

Methods of dewatering shall be at the option and responsibility of the Contractor. The Contractor shall maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, the Contractor shall notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.

(b) Protection of Drainage Facilities. If it becomes necessary during construction to block a ditch, pipe or other drainage facility, the Contractor shall install temporary ditches, pipes or other drainage facilities to maintain adequate drainage as approved by the Engineer, or the property owner. The temporary facilities shall be removed and the permanent facilities restored upon completion of the work.

The Contractor shall use soil erosion attenuation methods and materials to protect ditches and other drainage facilities during construction.

(c) Construction of Launching/Jacking and Receiving Pits. Design, construction, maintenance and removal, including any damage attributed to the construction of launching/jacking and receiving pits, is the responsibility of the Contractor.

Launching/jacking and receiving pits shall be constructed in accordance with approved working drawings sealed by a professional engineer registered in the State of Maryland.

Excavation, backfill and grading shall be performed in accordance with Section 1000 of these Specifications and to the requirements specified herein.

The Contractor is responsible for any necessary utility relocations or the supporting of utilities for launching/jacking and receiving pits construction. Utility support and relocations shall be at no additional cost to the Contract.

1012.03.05 Ground Movement Monitoring.

The Contractor shall carry out operations to minimize horizontal displacement, settlement and/or heave of the ground, and shall be responsible for all damage due to displacement, settlement consolidation or heave from any construction related activities.

No horizontal displacement, settlement or heave will be permitted at property structures.

The Contractor shall install and maintain a system of instrumentation to monitor the underground excavation operation and to detect movement in the soil, adjacent structures and utilities.

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Installation of the instrumentation by the Contractor shall not preclude the Engineer, through an independent Contractor or consultant, from installing instrumentation to monitor ground movement in or adjacent to the construction work.

Use benchmarks sufficiently removed from the construction to avoid errors in readings due to ground movement.

The Contractor shall cooperate fully with jurisdictional personnel. Settlement detected shall be corrected by the Contractor at no additional cost to the Contract.

The Contractor shall report any settlement and horizontal movement immediately to the Engineer and take immediate remedial action, at no additional cost to the Contract.

In the event of movement of the ground surface, structure or utility being detected or damage recorded, the Engineer may order that the work be stopped and secured. Before proceeding, the Contractor shall correct any problems causing or resulting from such movement at no additional cost to the Contract. If ground settlement or heave occurs which might affect the accuracy of temporary or permanent benchmarks, it is the Contractor's responsibility to monitor and report such movements to the Engineer.

1012.03.06 Power Supply.

Provide temporary electric lights to properly and safely illuminate all parts of the tunnel construction area including special illumination at the working face. Lighting circuits shall be thoroughly insulated and separated from power circuits, and lights shall be enclosed in wire cages. The Contractor shall secure all necessary electrical permits to prosecute the Work.

Power machinery and tools within the tunnel shall be operated by either electricity, compressed air, diesel with approved scrubber or other approved power. Electrical tools and equipment shall be grounded in accordance with the latest requirements of the National Electrical Code.

1012.03.07 Ventilation and Air Quality.

The Contractor shall provide, operate, and maintain for the duration of the trenchless project a ventilation system suitable for meeting applicable safety requirements for the health of the workers.

1012.03.08 Tunneling Operations.

Tunneling equipment shall be of U.S. Bureau of Mines approved types.

The tunnel face shall be controlled using such support procedures as breasting, poling plates, face jacks, sliding tables, either singly or in combination, spaced as required.

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Excavate in such a manner that voids behind liner plates are held to a minimum. Immediately after each increment of excavation, install one ring of liner plates. Completely fill voids with grout, or gravel pack followed by grout, placed under pressure as specified in this Section.

The use of water or other liquids to facilitate liner plate installation and/or spoil removal is prohibited.

Whenever the tunneling operation is suspended, the face or heading shall be completely bulkheaded or supported by positive means and all completed liner plate rings shall be grouted. The dewatering system shall remain operating. Qualified personnel shall periodically check conditions that might threaten the stability of the work.

Spoil from the work shall be disposed of off site at a permitted facility or location.

(a) Tunnel Shield. The shield shall be of steel construction, designed to support railroad loading in addition to the other loadings that it must sustain. The advancing face shall be provided with a hood extending no less than twenty (20) inches beyond the face, and extending around no less than the upper 240° of the total circumference. It shall be of sufficient length to permit the installation of at least one complete ring of liner plates within the shield before it is advanced for the installation of the next ring of liner plates. The shield shall conform to, and not exceed, the outside diameter of the liner plate tunnel being installed by more than one (1) inch at any point on its periphery unless otherwise approved by the Engineer.

The shield shall be adequately braced and provided with the necessary appurtenances for completely bulkheading the face with horizontal breast boards, and arranged so that the excavation can be benched as necessary. Excavation shall not be advanced beyond the edge of the hood, except in rock.

(b) Installation of Tunnel Lining. The Contractor shall construct tunnel to the line and grade shown on the Contract Documents.

The inside dimensions of the tunnel liner plate ring, measured along the diameter at any location, shall not vary more than three percent of the liner plate diameter.

Liner plates shall be installed in a manner that will not damage the liner plates or coating. Damaged liner plates shall be replaced at no additional cost to the Contract. Coating damage shall be repaired to the satisfaction of the Engineer.

Flanges which will be in contact with each other shall be cleaned of foreign matter, taking care not to damage the coating in the cleaning process. Such surfaces shall be free from material that could interfere with proper bearing and water tightness.

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Bolt liner plates in accordance with liner plate manufacturer's recommendations. Retighten or replace bolts as required.

(c) Gravel Packing. Where approved, gravel packing may be used to fill voids between the earth and tunnel liner. For voids to be filled with gravel, place gravel in the voids behind liner plates by compressed air through a 1-1/2-inch or 2-inch diameter hose.

Fill voids with gravel by proceeding from the bottom grout hole of each ring to the top hole. Vent air through the upper holes. Fill voids in the gravel pack between the earth and the tunnel liner with grout.

(d) Grouting. Cement grout shall be placed under pressure through the grout holes to fill any voids that exist between the liner plates and the undisturbed earth.

Grouting shall be kept as close to the heading as possible, using grout stops behind the liner plates, if necessary. In no case shall more than six (6) lineal feet of tunnel be progressed beyond the grouting. Grouting shall be done:

(1) At more frequent intervals than six (6) feet if conditions warrant;

(2) At the end of the work shift, or when work is interrupted for any reason; or

(3) Progressively with each adjacent set of grout holes.

In general, grouting shall proceed progressively upward from the lowest grout hole of each ring. When going from lower to higher grout holes, do not make connection to the higher holes until grout has completely filled the space below. Continue grouting until grout appears in the next set of grout holes, which shall be kept open during grouting to permit escape of air and water.

A threaded plug shall be installed in each grout hole as the grouting is completed at that hole.

The grout pump and injection system shall be of a type that will deliver the grout in a smooth even flow without surge. The grouting circuit shall contain a return line to allow return of the grout from the nozzle to the supply tanks. The grouting equipment shall be capable of developing a uniform pressure at the grout hole connection sufficient to fill voids without disturbing the liner plates, adjacent utilities, structures or roadways. The equipment shall be equipped with hoses having a minimum inside diameter of 1-1/2 inches and have a minimum capacity of 1/2 cubic yard per minute.

(e) Placement of Invert Concrete. Place concrete fill in invert of tunnels even with edges of liner plate flanges, and to the limits shown on the Contract Documents,

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to facilitate skidding carrier pipe into tunnel. Concrete fill shall not be poured as a level floor.

1012.03.09 Jack and Bore Operations.

The face of the cutting head shall be arranged to provide a reasonable obstruction to the free flow of running sand, or soft or poor soil material.

The auger shall be prevented from leading the pipe so that there will be no unsupported excavation ahead of the pipe.

The use of water or other liquids to facilitate casing installation and/or spoil removal is prohibited.

Whenever the jacking and boring operation is suspended, the face or heading shall be completely bulkheaded or supported by positive means. The dewatering system shall remain operating. Qualified personnel shall periodically check conditions that might threaten the stability of the work.

The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered which stops the forward motion of the operation. If the obstruction cannot be removed without excavation in advance of the pipe, notify the Engineer immediately. When the Engineer determines that it is impossible to advance the bore hole or pipe, the operation shall be discontinued and the completed portion abandoned in place and immediately filled with grout or plugged, unless otherwise directed by the Engineer. A new installation procedure and revised plans shall be submitted to the Engineer for review before work can be resumed.

Weld steel casing pipe for full circumference and grind welds smooth, as required herein. When coating is required, repair coating damage on each side of weld and recoat complete weld area. Coating shall be applied as recommended by the manufacturer.

Jack casing pipe with auger rotating within the pipe to remove spoil. Hand mining is an option for large bore casing pipe provided method is submitted in detail and is acceptable to the Engineer.

Over-cut of cutting head shall not exceed the outside diameter of the casing pipe by more than one (1)-inch. For hand mining no over-cut will be permitted.

If voids should develop, or if the bored hole diameter is greater than the outside diameter of the pipe plus coating (if any), by more than approximately one inch, pressure grouting, as provided for in this Specification Section, or other methods approved by the Engineer shall be implemented to fill the voids immediately upon completion of the jack and bore operation.

Spoil from the work shall be disposed of off site at a permitted facility or location.

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1012.03.10 Timber Tunnels.

Timber tunnels shall be of the cap and leg type. The optional use of mud sills or bottom boards is dependent on the soil conditions and as directed by the Engineer. Care must be exercised to prevent the loss of excess material prior to setting the timbering. To insure the stability of the tunnel structure, excavation must be such that legs must be driven and held firmly in place by their compression against sills and caps only. Nails or scabs must be utilized in caps and sills to prevent the overdriving of legs.

1012.03.11 Installation of Carrier Pipe.

There shall be no direct contact between carrier pipe and casing pipe or tunnel liner. Casing pipe spacer/insulators shall be installed and spaced in accordance with the manufacturer's recommendations, and shall meet the requirements of Section 963 and the Standard Details.

Install carrier pipe as specified in its respective section(s) of this Specification and as shown on the Contract Documents. The carrier pipe shall extend a maximum of two (2) feet beyond each end of the tunnel to the first joint.

Casing end seals or tunnel bulkheads shall be installed in accordance with Section 963 and the Standard Details.

1012.04 MEASUREMENT AND PAYMENT. Measurements for jack and bore, or tunnel, shall be made horizontally along the center line from face of shaft to face of shaft to determine the length actually installed.

Payment for furnishing and constructing the jack and bore or tunnel section will be made at the contract unit price bid per linear foot for the construction, jack and bore or tunnels for each size and type of tunnel actually constructed, and accepted. Price and payment shall constitute full compensation for all unclassified tunnel and shaft excavation, refill, and compaction; the storage and rehandling of excavation, disposal of all excess excavation; replacing sod where disturbed; pumping of other disposal or control of water and sewage; the protection of all structures and utilities and their restoration in case of damage; the furnishing and placing of sheeting, shoring and bracing; the furnishing and placing of casing pipe or tunnel liner; the furnishing and placing of the pipe in the sleeve; the grouting of voids outside the tunnel liner; the furnishing and placing of concrete or sand fill or brick bulkheads; the furnishing and placing of the utility pipe in the tunnel; and for all other labor, equipment, tools, and incidentals to satisfactorily complete the tunnel section as shown, specified and directed by the Engineer.

Should it be necessary to increase the gauge or thickness of the tunnel liner over that shown or specified, by order of the Engineer, additional compensation shall be limited to actual material cost differential and rehandling charges as verified by the supplier.

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SECTION 1013 — SEWER SYSTEM REHABILITATION

1013.01 DESCRIPTION. Sanitary sewer rehabilitation shall include but not necessarily be limited to sewer pipe cleaning, sewer flow control, television inspection, sewer pipe joint testing, sewer pipe joint sealing, sewer manhole sealing, sewer manhole rehabilitation, sewer manhole lining, pipe lining, pipe and fitting replacement, and sewer manhole replacement in accordance with the Contract Documents.

1013.02 MATERIALS.

1013.02.01 Chemical Sealing Materials.

Chemical sealing materials shall conform to Section 964.03 and 964.04 of these Specifications.

1013.02.02 Manhole Liners.

Manhole liners shall conform to Section 964.04.02 of these Specifications.

1013.02.03 Pipe Slip Liners.

Pipe slip liners shall conform to Section 964.01 and 964.02 of these Specifications.

1013.02.04 Video Media.

Video media shall be as required in the special provisions of the Contract Documents.

1013.02.05 Miscellaneous Materials.

Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as Flexible pipe gaskets, cast-in-place concrete, pre-cast concrete sections and grade rings, mortar, brick, manhole frames, covers, and steps, waterproofing and bentonite, manhole interior wall rehabilitation compounds, and curing compounds.

1013.03 GENERAL.

1013.03.01 Material Removal and Disposal.

All loose debris and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. When hydraulic cleaning equipment is used, a suitable dam or weir shall be placed in the downstream manhole to trap all such materials. Passing material from manhole section to

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manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment, shall not be permitted.

Under no circumstances shall any loose debris removed during these operations be dumped or spilled into streets, ditches, storm drains, or other sanitary sewers. All solids or semisolids resulting from the cleaning operations shall be removed from the site and disposed of by the Contractor in a legal and sanitary manner as approved by appropriate authorities at the Contractor's cost. All materials shall be removed from the site no less often than the end of each workday. Under no circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers and as acceptable to the County. The Contractor shall dispose of this material in a properly licensed sanitary landfill.

The Contractor shall insure that all Federal, State and Local permits related to his disposal operations have been obtained, and the Contractor shall comply with all requirements of those permits.

All waste materials, including but not limited to excavated materials, demolished pavement, arboreal (landscaping) waste and other debris, that are not suitable for project related purposes (e.g., backfill) or are surplus to the needs of the project, both as determined by the Engineer, shall become the property of the Contractor for disposal at no additional cost to the County.

1013.03.02 Protection of Existing System.

During all rehabilitation operations, all necessary precautions shall be taken to protect the sewer from damage. If in the course of normal cleaning operations, damage results from pre-existing and/or unforeseen conditions such as broken pipe, the Contractor will notify the Engineer of the location and nature of the damage. The Contractor will be required to make repairs at his cost only when the Engineer has determined the Contractor was negligent in performance of his cleaning operations.

During these operations, precautions shall also be taken to insure that no damage is caused to property adjacent to or served by the sewer or its branches, any damage caused to property as a result of rehabilitation operations shall be restored to pre-existing conditions by the Contractor at no additional costs to the County.

1013.03.03 Control of Flows.

When pumping and bypassing is required, the Contractor shall furnish temporary pumps, conduits, and other equipment to divert the flow of sewage around the manhole section in which work is to be performed. The bypass system shall be of sufficient capacity to transport existing flow plus additional flow that may occur during a rainstorm. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. Any time sewer bypass pumping occurs, the Contractor shall be physically present at the jobsite to respond to any pump or

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equipment failures. Pump engines shall be equipped with exhaust silencers to keep noise to a minimum. The system shall be so constructed as to prevent spills from leaving the immediate vicinity of the site. Any spillage that occurs shall be immediately cleaned up and the site returned to a clean sanitary condition. A standby pump of equal capacity and a qualified mechanic shall be provided on-site at all times during pump operations.

When flow in a sewer line is plugged, blocked, or bypassed; sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging or surcharging of existing service connections. Existing flows shall not be interrupted for periods longer than one hour.

The Contractor shall take necessary precautions to prevent sewage backup and shall be responsible for any resulting damages if backups occur. Sewage diverted during rehabilitation operations shall be returned to the sanitary system and not discharged into streams or the storm drain system.

1013.04 SEWER LINE LIGHT CLEANING

1013.04.01 Description.

The work covered by this section consists of providing all labor, equipment, material and supplies and performing all operations required to light clean sewer lines and manholes prior to the internal television inspection(s), repair and lining operations.

1013.04.02 Determination of Required Cleaning.

The intent of sewer pipe cleaning is to remove foreign materials from the sewer and restore the pipeline to a minimum of 95% of the original pipe diameter or cross-section as required for proper seating of internal pipe joint sealing packers or as required for installation of pipe liners. It is recognized there are some conditions such as broken pipe and major blockages that prevent cleaning from being accomplished or where additional damage would result if cleaning were attempted or continued. Should such conditions be encountered, the Contractor shall notify the Engineer of the location and nature of obstruction. The Engineer will evaluate the obstruction and will direct the Contractor as to the amount and method to be used to clean those specific pipe sections if cleaning is determined by the Engineer to be feasible.

If it is determined that through visual inspection only small loose deposits of debris exist within the pipeline (average depth of two inches or less of debris) and it can be removed by light cleaning methods such as the use of sewer jet apparatus, the Contractor shall clean such pipe of all debris through the use of sewer jet apparatus or similar method. If medium or heavy cleaning is required for televised inspection, repair or lining of sewer pipe it shall be in accordance with Section 1013.05 of this specification.

1013.04.03 Cleaning Equipment.

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The designated sewer sections shall be light cleaned using high-velocity jet equipment. The equipment shall be capable of removing small loose debris. If cleaning of an entire sewer section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that medium or heavy cleaning is required.

All high-velocity sewer light cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel.

1013.04.04 Acceptance of Light Cleaning Operation.

Acceptance of sewer line light cleaning shall be made upon the Contractor's completion of the television inspection and shall be to the satisfaction of the County. The Contractor shall be required to re-clean and re-inspect the sewer line until the cleaning is shown to be satisfactory to the County.

1013.05 SEWER LINE MEDIUM AND HEAVY CLEANING.

1013.05.01 Description.

The work covered by this section consists of providing all labor, equipment, material and supplies and performing all operations required to medium and heavy clean sewer lines prior to the internal television inspection(s), repair, and lining operations. All medium and heavy cleaning methods shall be as described herein.

Medium cleaning procedures shall clean and remove deposits of loose debris (an average depth of more than two inches and up to four inches) such as sludge, mud, sand, gravel, grease, and roots that exist within the pipe line that hinders televised inspection, repair or lining of the sanitary sewer pipe. Heavy cleaning procedures shall through use of heavy equipment clean and remove large roots, rocks, bricks, obstructions, concrete debris, pieces of broken pipe and objects that hinders televised inspection, repair or lining of the sanitary sewer pipe.

1013.05.02 Equipment.

The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes. If cleaning of an entire sewer section cannot be successfully performed from one manhole, the equipment shall be set

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up on the other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage exists and the cleaning effort shall be abandoned. All vacuum machines shall have sufficient power to perform the work in an efficient manner.

1013.05.03 Root Removal.

Roots shall be removed in the designated sections and manholes as needed for the lining process. Special attention should be used during the cleaning operation to assure almost complete removal of roots from the joints. Any roots, which could prevent the proper application of chemical sealants, or could prevent the proper seating and application of cured-in-place liners, shall be removed. Procedures may include the use of mechanical equipment such as rodding machines, bucket machines and winches using root cutters and porcupine, and equipment such as high-velocity jet cleaners. Chemical root treatment shall be used before or following the root removal operation, depending on the manufacturer's recommendation. Contractor shall capture and remove all roots from the line.

1013.05.04 Chemical Root Treatment.

To aid in the removal of roots, sewer sections that have root intrusion shall be treated with an acceptable herbicide. The application of the herbicide to the roots shall be done in accordance with the manufacturer's recommendations and specifications in such a manner to preclude damage to surrounding vegetation. Any damaged vegetation so designated by the County shall be replaced by the Contractor at no additional cost to the County. All safety precautions as recommended by the manufacturer shall be adhered to concerning handling and application of the herbicide.

1013.05.05 Acceptance of Medium and Heavy Cleaning Operation.

Acceptance of sewer line cleaning shall be made upon the completion of the TV inspection to the satisfaction of the County. The Contractor shall be required to re-clean and re-inspect the sewer line until the cleaning is shown to be satisfactory to the County.

1013.06 TELEVISION INSPECTION.

1013.06.01 Description.

The work covered by this section consists of providing all labor, equipment, material and supplies and performing all operations required to conduct the internal closed-circuit TV inspection of designated sewer lines. The County reserves the right to review and accept all video inspection media.

1013.06.02 Definitions.

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Pre-Installation TV Inspection. Pre-installation TV is a video inspection by the Contractor of sewer lines specified for rehabilitation to confirm cleaning, location of service connections, and constructability of line rehabilitation according to Drawings and Specifications.

Post-Installation TV Inspection. Post-installation TV is a video inspection to determine that rehabilitation and/or replacement of a sanitary sewer has been completed according to Drawings and Specifications.

TV Inspection Log. Information collected and recorded by each TV operator for any TV inspection effort that is submitted to the County.

1013.06.03 Equipment.

(a) Closed Circuit TV Equipment
Select and use closed-circuit television equipment that will produce color video media.

(b) Pipe Inspection Camera
Produce video media using a pan-and-tilt, radial viewing, and pipe inspection camera that pans ±275 degrees and rotates 360 degrees. The television camera used for the inspection shall be specifically designed and constructed for such inspection. The camera shall be operative in 100% humidity conditions. Use a camera with an accurate footage counter, which displays on the monitor the exact distance of the camera from the centerline of the starting manhole. Use a camera with camera height adjustment so that the camera lens is always centered at one-half the inside diameter, or higher, in the pipe being televised. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. A reflector in front of the camera may be required to enhance lighting in dark or large diameter pipe. The video camera shall be capable of showing on the video media the County name, Contractor name, date, line size and material, line identification (County's manhole numbers at both ends) and ongoing footage counter. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the County; and if unsatisfactory, equipment shall be removed and replaced with adequate equipment. No payment will be made for an unsatisfactory inspection.

1013.06.04 Pre-Installation Inspection.

(a) Procedure

(1) Perform pre-installation TV inspection immediately after line cleaning and before line rehabilitation work. Pre-installation TV is not required for sewer lines designated as remove and replace. Verify that the line is clean and ready to accept the line rehabilitation. Prepare Television Inspection Logs.

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Maintain copies of video media and reports for reference by the County for the duration of the project.

(2) Prior to any repair work, the entire sewer line (from manhole to manhole) shall be televised. The pre-installation inspection shall be used to determine whether the line has been cleaned sufficiently, to confirm the location and nature of defects, and to confirm that the proposed method of repair is proper for the defects observed. County shall review the pre-installation inspection video tape and approve the selected method.

(3) The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line.

If, during the inspection operation, the television camera will not pass through the entire sewer section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire pipe section, the inspection shall be considered complete and no additional inspection will be required at that time. Improper cleaning will not be an acceptable reason for incomplete televising of a line section.

(4) When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communication between members of the crew.

(5) The importance of accurate distance measurements is emphasized. Measurements for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by the use of a walking meter, roll-a-tape, or other suitable device. The meter device shall be accurate to one tenth of a foot.

(6) During the internal inspection, the television camera shall be temporarily stopped at each defect along the line. The nature and location of the defect shall be recorded by the Contractor. Where defects are also active infiltration sources, the rate of infiltration in gallons per minute shall be estimated by the Contractor and recorded. The camera shall also be stopped at active service connections where flow is discharging. If the flow continues, the property involved shall be checked by the Contractor to determine whether or not the

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flow is sewage. Flows from service connections, which are determined to be infiltration, shall also be recorded.

(7) Camera operator shall slowly pan beginning and ending manholes, each service connection, clamped joints, and when pipe material transitions from one material to another.

(8) TV inspection media shall be continuous for pipe segments between manholes. Do not leave gaps in the video media of a segment between manholes and do not show a single segment on more than one inspection media, unless specifically allowed by the Engineer.

(b) Flow Control

(1) Perform survey TV inspection on one manhole section at a time.

(2) Perform flow control and by-pass pumping as specified in these specifications.

If during survey TV inspection of a manhole section, the wastewater flow depth exceeds 20% of the inside pipe diameter, reduce the flow depth to an acceptable level by performing the survey TV inspection during minimum flow hours, by-pass pumping, plugging or by pulling the camera with swab, high-velocity jet nozzle or other acceptable dewatering device. Video inspection media made while floating the camera is not acceptable unless approved by the County.

(c) Documentation of Television Inspection

(3) Television Inspection Logs: Printed location records shall be kept by the Contractor and will clearly show the location in relation to an adjacent manhole of each infiltration point observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, presence of scale and corrosion, and other discernible features will be recorded and a copy of such records will be supplied to the County.

(1) Digital Photographs: Noted defects and lateral connections shall be documented as digital files and hard copy printouts.

(2) Video Media Recordings: The purpose of video media recording shall be to supply a visual and audio record of problem areas of the lines that may be replayed. Video media recordings shall include an audio track recorded by the inspection technician during the actual inspection work describing the parameters of the line being inspected (i.e. location, depth, diameter, pipe material), as well as describing connections, defects and unusual conditions

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observed during the inspection. Video media recording playback shall be at the same speed that it was recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor. Once televised, all media shall be labeled and become the property of the County. The Contractor shall have all video media and necessary playback equipment readily accessible for review by the County during the project.

1013.06.05 Post-Installation Inspection.

(a) Procedure

(1) Post-Installation TV inspection shall not be completed until all work, including lateral replacement and/or reactivation and manhole restoration is completed on a section of sewer. The post-installation TV inspection tapes shall be submitted to the County prior to substantial completion, or when requested.

(2) The post-installation TV inspection shall be completed to confirm completion of rehabilitation and replacement work, including removal and replacement of defective portions of the sewer. Verify that the rehabilitation work conforms to the requirements of the Contract Documents. Provide a color videotape showing the completed work, including the condition of restored service connections. Prepare and submit Television Inspection Logs providing location of service connections along with location of any discrepancies. All manhole work, including benches, inverts and pipe penetrations into manhole, should be complete prior to post-installation TV work.

(3) For post-installation TV inspection, exercise the full capabilities of the camera equipment to document the completion of the rehabilitation and replacement work and the conformance of the work to the Drawings and Specifications. Provide a full 360-degree view of pipe, joints, and service connections.

(4) Documentation of Television Inspection shall be conducted as specified in the Pre-Installation Inspection Procedure of this specification section.

1013.07 Cured In Place (CIP) or Sliplined Lining.

1013.07.01 General.

These specifications include requirements for all design, transportation, equipment and labor necessary to rehabilitate deteriorated sections of sewer listed in the Contract Documents by means of cured-in-place (CIP) or sliplined structural liner, herein referenced as a pipeline liner. All lining work may not commence until acceptance of

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cleaning operations specified above. All lining work and associated submittals must be provided in accordance with section 964 within these specifications.

(a) This section covers the materials and methods of application for the rehabilitation of existing pipelines through the use of a pipeline liner.

(b) The proposed locations for sewer rehabilitation are shown or described on the Contract Documents.

(c) The Contractor shall furnish all material, labor and special equipment required to accomplish the work in accordance with these specifications. The installation shall affect the complete interior relining of the existing sanitary sewer piping and shall result in a smooth, hard, strong and chemically inert interior finish, and closely following the contours of the existing piping. The Contractor shall provide a completed system with mainline sewer and all active lateral connections in operational condition.

(d) The Contractor shall perform all required permanent landscape restoration of disturbed areas on private property and within State or County rights-of-way upon completion of pipe rehabilitation, to the satisfaction of the County.

(e) Point Repairs: The Contractor shall repair all sections of pipe which are not in continuous alignment with the remainder of the sewer main, or sections which are obstructed (after mechanical or jet hose cleaning has been attempted) which prevent the insertion of the liner, as directed by the Engineer.

1013.07.02 Pre-construction Submittals.

Prior to beginning work, the Contractor shall submit the following items for the Engineer's approval.

(a) A comprehensive construction-sequencing plan. At minimum, the plan shall include:

(1) A proposed schedule.
(2) Identification of set-up locations for lining installation.
(3) Lining procedures.
(4) By-pass Pumping Plan
(5) MOT and Detour Plans
(6) Materials submittals, Calculations, Shop Drawings, etc. in accordance with section 964.

(b) Manufacturer's published literature and published data for the proposed pipeline liner system.

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(c) The pipeline liner's rehabilitation system supplier's letter of certification for each worker who will perform pipeline liner rehabilitation work.

(d) The manufacturer's certification that the proposed pipeline liner system for the project meets the requirements of these specifications and will meet or exceed the physical properties given in the manufacturer's published literature submitted as required by the pre-construction submittals.

(e) Shop drawings and product data for the rehabilitation method including a report outlining the process to be used in the rehabilitation of the sewer line. The report shall also include information specific to the job, such as coordination issues, access, timing, manufacturer's installation instructions, and by-pass pumping.

(f) All materials and equipment used in the lining and in the insertion process shall be of their best respective kinds and shall be as approved by the Engineer. Any materials not approved by the Engineer prior to insertion into the piping shall be rejected and shall be removed and replaced with approved materials at the Contractor's expense.

(g) One complete set of Pre-installation inspection video media as specified in Section 1013.06.04 of this Specification.

(h) All measurements made by the Contractor to verify length and diameter of pipe prior to ordering of material.

1013.07.03 Post-Construction Submittals.

After construction, the Contractor shall submit the following information for review and approval:

(a) Results of testing for materials provided for this job, as specified in the Testing Section 1013.07.10 of this Specification.

(b) One complete set of video media from the Post-Installation television inspections performed as specified in Section 1013.06.05 of this Specification.

1013.07.04 Accuracy of the Plans.

To the greatest practical extent, the plans accurately depict the details of the work, including the locations and numbers of all manholes, etc. However, the Contractor shall determine the locations of all structures and verify all dimensions, including lengths between manholes, by field measurement. The Contractor shall also be aware that minor variations in pipe diameter and circumference will occur, that it is not intended that such minor variations be indicated on the plans and that such variations will not be considered as grounds for additional claims for compensation**.**

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1013.07.05 CIP Lining Inspection and Installation.

(a) Prior to beginning insertion of the liner bag, the Contractor shall inspect the cleaned line by use of closed-circuit TV cameras, and shall confirm to his own satisfaction that the lines are adequately cleaned. Insertion of the bag by the Contractor shall serve as evidence of his acceptance of the condition of the piping and the suitability of the liner insertion within the host pipe. Failure of the liner system due to inadequately cleaned host pipes shall be repaired by the Contractor at no cost to the County.

(b) During the process of manufacture and impregnation, the County shall have the reasonable opportunity to examine all operations where the manufacture and impregnation (when applicable) of the liner is being carried out. The Contractor shall give appropriate prior notice in order that the County's inspector may be on hand to observe the various processes.

(c) No work shall be performed by the Contractor except in the presence of the County inspection personnel, unless otherwise approved. The Contractor shall coordinate his work schedule and give timely prior notice regarding his intentions to perform any and/or all parts of the work, in order that the County's inspector may be on hand. Any work performed in the absence of the County's inspector is subject to removal and replacement at the Contractor's expense.

(d) Upon substantial completion of the work the Contractor shall, in the presence of the County's inspector, inspect the line using closed-circuit television equipment. The video media thus produced shall be accompanied by a simultaneously produced, narrated sound tape. The sound narration shall draw attention to all recognizable defects, imperfections, etc., and the location along the length of the piping shall be accurately noted. In addition, the locations and all pertinent details regarding the entrance of service laterals into the main trunk sewer shall be accurately noted on the sound tape. All copies of the sound and video media shall become the property of the County. Televising shall be performed as specified in Section 1013.06.05.

1013.07.06 CIP Preparatory Procedures.

(a) The Contractor shall provide sewer service to affected property owners in the event of interruption, at no additional cost to the County.

(b) If excavation is required, the Contractor shall be responsible for the construction layout at the beginning of the project. The Contractor shall take all precautions to protect all stakes, hubs, control points, etc. If the stakes, hubs, control points, etc. are disturbed during construction, the Contractor shall re-stake at his expense. The Contractor is responsible for the accuracy of the re-staking.

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(c) If any open excavation is required all utilities must be marked by "Miss Utility" prior to construction layout.

(d) The actual sizes, lengths, and materials of the pipes to be relined shall be as indicated on the Contract Documents, but shall be verified by the Contractor prior to commencing with the work.

(e) Cleaning: Light cleaning of sewer lines shall be performed as specified in the Section 1013.04.

(f) TV Inspection: Inspection of sewer lines shall be performed as specified in the Section 1013.06.04.

By-pass Pumping: For acceptable completion of a liner insertion process, the Contractor shall provide for adequate flow control. The Contractor shall continuously monitor the weather forecasts before and during the TV inspection and sanitary sewer lining operations. Lining operation shall only proceed when the weather forecast is not anticipating wet weather events. By-pass pumping shall be in accordance with section 1013.03.03 of this Specification.

(g) Material Removal and Disposal shall be in accordance with section 1013.03.01 in this Specification.

1013.07.07 CIP Lining Procedures.

(a) Conduct operations in accordance with applicable OSHA standards, including those safety requirements involving work on an elevated platform and entry into a confined space. Make suitable precautions to eliminate hazards to personnel near construction activities when pressurized air is being used.

(b) In the event of insertion being delayed after impregnation by unexpected site conditions but prior to the start of the insertion process, the Contractor shall store, at his own cost, the liner, for a further period of at least 48 hours, below 39ºF for use when conditions allow.

(c) The liner shall be inverted into the pipeline from a suitable platform located above the manhole or other approved point of inversion. The Contractor shall be allowed to insert the liner using another process, which has been approved by the Engineer. The free open end of the liner bag shall be firmly secured to the platform and the folded liner passed down a suitably reinforced column to a chute or bend leading to the opening of the pipe to be lined. Clean water at ambient temperature shall be supplied to the platform at a rate sufficient to cause controlled installation of the liner into the pipeline.

(d) All lining procedures shall be in accordance with the manufacturer's recommendations

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(e) Maintain a curing log of CIP temperatures at the upstream and downstream manholes during the curing process to document that proper temperatures and cure times have been achieved.

(f) Invert through Manholes. The invert shall be continuous and smooth through all manholes. If a liner is installed through a manhole, the bottom portion of the liner shall remain and the bench of the manhole shall be grouted and shaped as necessary to support the liner. If the liner terminates on either side of a manhole, the invert shall be built up to remove any flow restrictions and to form a continuous invert through the manhole. The cost of this work shall be included in the unit price bid for the liner.

(g) The finished pipelining shall be continuous over the entire length of an insertion run between two manholes or structures and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, air bubbles, pinholes, dimples and delamination. The lining shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to the inside of the lined pipe.

(h) The inner surface shall be free of cracks and crazing with smooth finish and with an average of not over two pits per 12 inch square, providing the pits are less than 0.12 inch in diameter and not over 0.04 inch deep and are covered with sufficient resin to avoid exposure of the inner fabric. Some minor waviness and wrinkles, that in the County's opinion will not appreciably decrease the flow characteristics or be the cause of a possible blockage, shall be permissible.

1013.07.08 Sealing at Manholes.

Form a tight seal between the CIP and the host pipe at the pipe penetration. Do not leave any annular gaps or routes of infiltration. Seal the annular space with a ½-inch-diameter activated Oakum band soaked in chemical sealant or an approved equivalent. Seal any annular spaces greater than ½-inch with manhole wall repair material. Finish off the seal with a non-shrink grout or cementitious liner material placed around the pipe opening from inside the manhole in a band at least 4 inches wide. Complete the sealing procedure for each liner segment immediately after the liner is cured.

1013.07.09 Defective Work.

Any defects which, in the judgment of the County, will affect the integrity or strength of the lining, shall be repaired or the liner replaced at the Contractor's expense. Obtain approval of the Engineer for method of repair, which may require field or workshop demonstration.

1013.07.10 CIP Lining Testing.

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(i) The Contractor shall collect a coupon sample/specimen from each pipe diameter as described below. The Contractor shall stamp or mark the test pieces with the date of manufacture and batch number.

(j) Should the County desire to make additional tests, the Contractor shall, upon request of the County, furnish any reasonable number of test pieces of raw material samples as the County may require, stamped or marked with the date of manufacture and batch number if applicable.

(k) Tests shall be made on specimens of resin, catalyst and felt as supplied or pieces of cured liner cut from waste areas when possible. Otherwise, the specimens shall be cut from a piece of cured liner representative of the material inserted and prepared and cured in a similar technique to the process employed.

(l) The test specimen shall be conditioned in accordance with procedure 'A' of ASTM D618, Standard Methods for Conditioning Plastics and Electrical Materials for Testing.

(m) The test specimen shall be prepared and physical properties tested in accordance with ASTM F1216, Section 8.1. The properties shall meet or exceed the values identified in Table 1 of ASTM F1216.

(n) The Contractor shall in preparation for insertion of the liner bag, and in placing of stops within the terminal manholes of an insertion run, allow sufficient length to facilitate the cutting out of one (1) full size cured liner section for pipe 24-inch and smaller, for each thickness of liner installed, from the waste portion at the end of an insertion run. The lengths of the full size section thus provided shall be as practicable, in order to facilitate load testing if desired by the County. All testing shall be the responsibility of the Contractor. Results of the testing shall be submitted to the Engineer for review and approval.

1013.07.11 Final Acceptance of CIP.

Upon completion and before acceptance by the County, the Contractor shall reinspect the rehabilitated pipeline by the use of closed-circuit TV cameras and shall submit video media of the rehabilitated pipeline to the Engineer for approval/acceptance of the work in accordance with the Television Inspection of the Contract Documents.

1013.08 HEAVY CLEANING OF MANHOLES.

1013.08.01 Description.

The work covered by this section consists of providing all labor, equipment, material and supplies and performing all operations required to heavy clean sanitary manholes and structures prior to the internal television inspection(s), repair, and lining operations.

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1013.08.02 Equipment.

Heavy cleaning procedures shall be the use of equipment adequate to clean and remove large roots from the interior surface of the manhole or structure, boulders, obstructions, soil debris, concrete debris, pieces of broken pipe or material, and any other objects that hinders channel flow or is lying on the manhole bench.

1013.09 RE-ESTABLISH SEWER HOUSE CONNECTION LATERAL.

1013.09.01 Description.

This item consists of all the work necessary to re-establish sewer service to both existing house connection laterals and sewer main laterals.

1013.09.02 General.

Upon completion of each pipe segment rehabilitation, the Contractor shall open all house connection and sewer main laterals located and identified as such from the televised inspections.

(a) The work shall be accomplished from the interior of the pipe by means of a remote televised camera directed cutting device.

(b) Where holes are cut through the liner, they shall be neat and smooth in order to prevent blockage at the sewer or service connections. Cut-in sewer or service connections shall be opened to a minimum of 95 percent of the flow capacity of the sewer or service connection. All "coupons" or fragments of "coupons" resulting from cutting the liner shall be recovered at the downstream manhole and removed. All edges shall be brushed smooth.

(c) Acceptance of the re-established connections will be subject to the approval of the Engineer. Approval will be based upon review of the post-rehabilitation television inspection video media. The Engineer will be available on-site to view the Contractor's post-rehabilitation television inspection video media.

(d) The video media shall include a sound narration. The sound narration shall draw attention to all recognizable defects, imperfections, etc., and the location of the connections along the length of the piping shall be accurately noted. In addition, the locations and all pertinent details regarding the entrance of service laterals into the main trunk sewer shall be accurately noted on the video media. One copy of the video media shall become the property of the County. Televising shall be performed as specified in the TV Inspection section in section 1013.06 of this specification.

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1013.09.03 Sealing Laterals.

The Contractor shall seal all service and sewer lateral end connections to the newly lined sewer main to a water tight seal by chemical grout or other method approved by the Engineer.

1013.10 REPAIR AND COAT FOR MANHOLE INTERIOR.

1013.10.01 Description.

The repair and coating of manhole interior shall consist of all work necessary to provide minor repairs and interior coating to existing manholes.

1013.10.02 Preparatory Procedures.

(a) Prior to performance of the actual work, the Contractor shall carefully inspect the entire site and locate those manholes designated to be repaired and rehabilitated.

(b) Manhole Cleaning: All concrete and masonry surfaces must be clean prior to repair. Grease, laitance, loose bricks, mortar, unsound concrete, and other materials must be completely removed. Water blasting (minimum 1200 psi) utilizing proper nozzles shall be the primary method cleaning; however, other methods such as wet or dry sandblasting, acid wash, concrete cleaners, degreasers, or mechanical means may be required to properly clean the surface. Surfaces on which these other methods are used shall be thoroughly rinsed, scrubbed, and neutralized to remove cleaning agents and their reactant products. Heavy cleaning may be necessary to complete the lining process.

(c) By-pass Pumping: When required for acceptable completion of the rehabilitation process, the Contractor shall provide for adequate flow control as referenced in paragraph 1013.03.

1013.10.03 Repair and Coating Procedures for Manhole Interior.

(a) Place covers over invert to prevent extraneous material from entering the sewer.

(b) All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 3,500 psi). Loose and protruding brick, mortar, and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with quick-setting patching mix. The surface to be repaired must be clean and free of any loose materials with walls totally saturated with water.

(c) Minor leaks shall be stopped using the quick setting specially formulated infiltration control mix and shall be mixed and applied per manufacturer's

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recommendations. Some leaks may require weep holes to localize the infiltration during the application, after which the weep holes shall be plugged with the quick-setting infiltration control mix prior to the final liner application. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious or chemical grout. Manufacturer's recommendations shall be followed when pressure grouting is required.

(d) After all preparation work has been completed, remove all loose material and wash wall again.

(e) Any bench, invert, or service line repairs shall be made at this time using the quick-setting patching mix, and shall be used per manufacturer's recommendations.

(f) Invert Repair: Invert repair shall be performed on all inverts with visible damage or infiltration. After blocking flow through the manhole and thoroughly cleaning invert, the quick-setting patch mix shall be applied to the invert in an expeditious manner. The mix shall be troweled uniformly onto the damaged invert extending out onto the base of the manhole sufficiently to tie into the structural/structurally enhanced monolithic liner to be applied. The finished invert surfaces shall be smooth and free of ridges. The flow may be re-established in the manhole within 30 minutes after placement of the mix.

(g) The installation of the approved coating system shall be in strict accordance with the manufacturer's written instruction. This shall include re-grouting all steps, inlet and outlet lines and benches as needed, plus the preparation, installation, curing, and finish operation, for the completion of the rehabilitation process.

(h) Prior to coating application onto walls, manhole bench area shall be covered with plywood sections, which conform to the internal dimensions of the manhole, to prevent accumulation of coating/liner material on bench. No application shall be made to frozen surfaces or if freezing is expected to occur inside the manhole within 24 hours after application. If ambient temperatures are in excess of 95 °F, precautions shall be taken to keep the mix temperature at time of application below 90 °F. Mix water temperature shall not exceed 85 °F. Chill with ice if necessary.

(i) Spraying

(1) First Application: Materials shall be spray applied to a minimum uniform thickness to ensure that all cracks, crevices, and voids are filled and a relatively smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond.

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(2) Second Application: A second application is to be applied after the first application has begun to take an initial set to assure a minimum total finished thickness.

(3) Bench Application: The plywood covers shall be removed and the bench sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than ½ inch. The wall bench intersection shall be rounded to a uniform radius equal to the full circumference of the intersection.

(4) The Contractor shall take precautions to keep overspray or excess material from entering the newly installed liner pipe and any other pipes in the manhole.

(j) Replacement Manhole Steps

Replacement manhole steps shall be securely embedded in the manhole wall and they shall be spaced at a maximum space of 12 inches on center in vertical alignment. Replacement of manhole steps shall be done at the completion of all required repairs and interior lining.

(k) Repaired and coated manholes shall be tested as follows:
- **(1)** Visually verify the absence of leaks.
- **(2)** Perform an exfiltration test.
- **(3)** Manholes up to 6 feet deep: A water loss of 1 inch or less in 5 minutes is acceptable.
- **(4)** Manholes over 6 feet deep: A water loss of 1 inch or less plus 1/8 inch per additional foot of depth in 5 minutes is acceptable.

1013.11 NON-EXCAVATION POINT REPAIR FOR SANITARY SEWER.

1013.11.01 General.

The work shall be performed by a remote installation system between manholes utilizing a non-excavation point repair system.

(a) The non-excavation point repair shall be fabricated to the size conforming to the internal circumference and the required length of repair when installed.

(b) All applicable requirements of other portions of the Contract Documents apply to the Work of this Section.

(c) The Work of this item includes, but is not limited to, all Cured In Place (CIP) Point Repair Systems, segmented for sliplining of the sizes and sections shown on

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the Contract Documents and all appurtenances, which are required for the proper completion of the Work.

(d) All point repairs shall be approved by the Engineer.

(e) Cleaning shall be performed immediately before any repair or lining of the sewer section.

(f) Existing flows shall not be interrupted for periods longer than one hour. The Contractor shall take necessary precautions to prevent sewage backup and shall be responsible if damage results from sewage backup. Sewage diverted cleaning operations shall be returned to the sanitary system and not discharged into the streams or storm drain system.

1013.11.02 Submittals.

The Contractor shall submit the following information for review and approval:

(a) Shop drawings and product data for the rehabilitation method including submittals outlining the process to be used in the rehabilitation of the sewer line. The submittals shall also include information specific to the job, such as coordination issues, access, timing, manufacturer's installation instructions, and by-pass pumping.

(b) All measurements made by the Contractor to verify length and diameter of pipe prior to ordering of material.

(c) One complete set of video media from each of the television inspections performed (Pre and Post Installation TV Inspection), as specified in Section 1013.06 in this Specification.

1013.11.03 Installation, Inspection, and preparatory procedures.

All installation, inspection, and preparatory procedures shall be in accordance with section 1013.07.06 and 1013.07.07 of this specification

1013.11.04 Final Acceptance of Point Repair.

Acceptance of the point repair shall be based on a recorded video media inspection performed by the Contractor after installation to assure that the system is properly assembled, no damage exists, and that no infiltration is occurring. The Contractor shall, in the presence of the County's inspector, inspect the line using closed-circuit television equipment. The video media shall include sound narration. The sound narration shall draw attention to all recognizable defects, imperfections, etc., and the location along the length of the piping shall be accurately noted. In addition, the locations and all pertinent details regarding the entrance of service laterals into the main trunk sewer shall be

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accurately noted in the sound narration. All copies of the video media shall become the property of the County. Televising shall be performed as specified in Section 1013.06.05 in this Specification.

1013.12 METHOD OF MEASUREMENT. Work addressed under this Section of the Specifications but not addressed below will not be measured for payment, but shall be included in the various unit and/or lump sum prices bid for rehabilitation of the pipelines or appurtenances.

1013.12.01 Medium and Heavy Cleaning of Existing Sewer Pipe.

Measurement of these items will be made on a linear foot basis and the quantity to be paid for will be the number of linear feet of sewer pipe actually medium or heavy cleaned and accepted by the Engineer. Measurement shall be along the centerline of pipe.

1013.12.02 Heavy Cleaning of Manholes.

Measurement of these items will be made on per each basis and the quantity to be paid for will be the number of sanitary manholes or structure actually heavy cleaned and accepted by the Engineer.

1013.12.03 Repairing and Coating Interior Manholes.

Repairing and coating manhole interior will be measured per each.

1013.12.04 Reconnection of Sewer Laterals.

Measurement for this item will be made on a per each basis and the quantity to be paid for will be the actual number of service or sewer lateral connections cut and sealed, and accepted by the Engineer.

1013.12.05 Pipeline Lining of Existing Sewer Pipe.

Measurement of these items will be made on a linear foot basis and the quantity to be paid for will be the number of linear feet of liner actually installed and accepted by the Engineer. Measurement shall be along the centerline of pipe from end to end at the inside face of manhole wall.

1013.12.06 Point Repair of Existing Sewer Pipe.

Measurement shall be made per linear feet of point repairs actually installed of the designated inside diameter and wall thickness and accepted by the Engineer.

1013.12.07 Television Inspection with No Rehabilitation/Cleaning.

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Measurement shall be made per linear feet of sewer actually televised and accepted by the Engineer**.**

1013.13 BASIS OF PAYMENT METHOD. Work addressed under this Section of the Specifications but not addressed below will not be paid for as a separate bid item, but shall be included in the various unit and/or lump sum prices bid for construction of the pipelines or appurtenances.

1013.13.01 Medium and Heavy Cleaning of Existing Sewer Pipe.

If directed by the Engineer, payment for medium and heavy cleaning will be made at the unit price per linear foot which shall include all labor, tools, equipment, hauling; any sewer plugging or blocking of flow; bypass pumping, traffic control, television inspection, disposal and all incidentals necessary to complete this item of work complete for the medium or heavy cleaning of the sewer and disposing of material and cleanup.

1013.13.02 Heavy Cleaning of Manholes.

If directed by the Engineer, payment for heavy cleaning of sanitary manholes will be made at the unit price per each manhole heavy cleaned which shall include all labor, tools, bypass pumping, traffic control, equipment, hauling, disposal of materials and all incidentals necessary to complete this item of work.

1013.13.03 Repairing and Coating Interior Manholes.

Payment for repairing and coating manhole interiors will be made at the per each price in the proposal, which shall include all repairs and repair materials, manhole seals, tools, equipment, labor, cleaning, bypass pumping, traffic control, and all incidentals necessary to complete the work.

1013.13.04 Reconnection of Sewer Laterals.

Payment for this item will be made on the basis of the unit price bid in the proposal for each sewer or service connection lateral re-established; which price and payment will be full compensation for all labor, material, equipment, television inspection, sealing lateral end connections to the new lined sewer main, cleanup, and any incidentals required to satisfactorily complete the work as specified.

1013.13.05 Pipeline Lining of Existing Sewer Pipe.

Payment will be made at the unit price per linear foot which shall include all labor, tools, equipment, hauling and all incidentals necessary to complete this item of work complete in place, including light cleaning of the sewer and disposing of debris material; any sewer plugging or blocking of flow; design calculations; all television inspection (pre and post); bypass pumping, traffic control, and all materials, equipment, tools, and all incidentals

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necessary for the furnishing and installation complete in place of the pipeline liner and cleanup.

1013.13.06 Point Repair of Existing Sewer Pipe.

Payment for this item will be made at the unit price bid per linear feet at the proposed diameter and wall thickness; which prices shall include all materials, labor, tools, equipment, hauling, television inspection (pre and post), bypass pumping, traffic control, plugging of pipes, installation, shipping and hauling cost and all incidentals necessary for a complete in place point repair, and any required topsoiling, seeding, and other site restoration and cleanup.

1013.13.07 Television Inspection with No Rehabilitation/Cleaning.

Payment for this item will be made at the unit price bid per linear feet of sewer inspected. Payment for all television inspection shall include providing all labor, equipment, recording media, bypass pumping, traffic control, material and supplies and performing all operations required to conduct the internal closed-circuit television inspection of designated sewer lines. Payment will also include the production and distribution of video media to the County. Payment for television inspection as a separate pay item will only be made if the inspection is not performed as a requirement for other bid items.

SECTION 1014 — CORROSION CONTROL

1014.01 DESCRIPTION.

(a) The corrosion control system for ductile iron pipe (this includes all piping, joints, valves, fittings, etc.) includes, where necessary to meet the specific project requirements; electrical isolation (insulating corporation stops, insulating flanges, insulating couplings, casing spacers, linked rubber seals, and casing end seals), electrical continuity (joint bonding), sacrificial anode (magnesium) groundbeds, zinc ribbon anodes for AC ground mats, a field applied external pipe coating at poured concrete (thrust blocks, etc.), and corrosion control test facilities.

(b) The corrosion control system for steel pipe (this includes all piping, joints, valves, fittings, etc.) includes, where necessary to meet the specific project requirements; an external protective coating, electrical isolation (insulating corporation stops, insulating flanges, insulating couplings, casing spacers, linked rubber seals, and casing end seals), electrical continuity (joint bonding), sacrificial anode (magnesium) groundbeds, zinc ribbon anodes for AC ground mats, and corrosion control test facilities.

(c) The corrosion control system for prestressed concrete cylinder pipe (this includes all piping, joints, valves, fittings, etc.) includes, where necessary to meet the specific

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project requirements; an external protective coating, electrical isolation (insulating corporation stops, insulating flanges, insulating couplings, casing spacers, linked rubber seals, and casing end seals), electrical continuity (joint bonding, steel bonding plates, and shorting straps for embedded cylinder pipe), sacrificial anode (zinc) groundbeds, zinc ribbon anodes for AC ground mats, and corrosion control test facilities. The limits of the prestressed concrete pipe to be externally coated are shown on the Contract Documents. Prestressed concrete pipe must be fabricated with bonding plates (two per pipe joint) for connection of joint bond wires.

(d) The repair or replacement of any defective or improperly installed systems shall be the sole responsibility of the Contractor. Any and all repairs or replacement of defective or improperly installed corrosion control systems shall be performed by the Contractor at no additional cost prior to the final acceptance testing.

1014.02 REFERENCE STANDARDS. The following is a list of the publications referenced in this Section.

(a) NACE International (NACE)

(1) RP0274 High-Voltage Electrical Inspection of Pipeline Coatings Prior to Installation

(2) RP0188 Discontinuity (Holiday) Testing of Protective Coatings

(b) American Water Works Association (AWWA)

(1) AWWA C214 Tape Coating Systems for the Exterior of Steel Water Pipelines

1014.03 SUBMITTALS.

(a) Catalog cuts of all materials to be installed shall be required and shall be submitted for approval.

(b) Pipe coating, handling and testing procedures, and quality assurance procedures shall be required and shall be submitted for approval where necessary to meet the specific project requirements.

(c) Qualifications of independent corrosion control firm including test personnel (NACE International Certified Corrosion Technicians) and NACE International Certified Corrosion Specialist qualifications, shall be required and shall be submitted for approval. Copies of NACE International Certification Certificates must be submitted for personnel.

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(d) Standard test data format shall be required and shall be submitted for approval.

(e) Test procedures for verifying electrical isolation at insulating flanges and insulating corporation stops shall be required and submitted for approval.

(f) Test procedures and equipment list for post installation testing shall be required and submitted for approval.

1014.04 EXTERNAL COATING SYSTEM.

(a) General

(1) External pipe surfaces (this includes all piping, joints, valves, fittings, hydrants, etc.) are to be coated where necessary to meet the specific project requirements. Predominant method to be shop application. The piping shall receive an exterior coating in the pipe manufacturer's shop or at a separate applicator's facility.

(2) All components of the coating system shall be manufactured by a single supplier to assure compatibility of individual components.

(3) Field applied coatings to be limited to repairing damage to shop coating; coating exposed metal at joints, fittings, valves, bond and test wire connections; and other appurtenances that are not shop coated.

(4) The extent of piping to be shop coated and extent to be field coated to be clearly identified in Contractor's material and quality assurance submittals. Quality assurance submittals shall include pipe coating, handling and testing procedures.

(b) Application of Shop Applied Materials to Steel and Prestressed Concrete Pipe

The coating applicator, regardless of the location where the coating is applied, shall be certified as qualified by the coating manufacturer. The coating applicator must abide by and follow all manufacturer's application specifications for the coating system. All components of the coating system shall be manufactured by a single supplier to assure compatibility of individual components. The prestressed concrete piping shall be allowed to cure prior to coating in accordance with the coating manufacturer's requirements.

(c) Surface Preparation Prior to Coating

The exterior surface of the piping shall be cleaned in accordance with the coating manufacturer's recommendations.

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(d) Certification of External Coating

The pipe or fitting manufacturer or coating applicators, as appropriate, will test and certify the exterior coating prior to shipping to the project site. When the pipe or fitting arrives at the job site, the Contractor shall visually inspect the pipe or fitting and repair any and all damage as directed by the coating manufacturer and in accordance with these specifications.

(e) Inspection of External Coating

Immediately prior to installation of the pipe or fitting, the Contractor shall visually inspect all exterior coatings on pipe, fittings, specials and closures for holidays and other defects. All holidays and defects shall be repaired by the Contractor as directed by the coating manufacturer and in accordance with this specification, and to the satisfaction of the Engineer. The coating shall then be electrically tested for flaws in the coating with a holiday detector by the Engineer. The electrical test shall be in accordance with NACE RP0274 or RP0188 as appropriate. All holidays shall be immediately repaired by the Contractor. The repaired coating shall be rechecked by the Engineer with a holiday detector. Once the coating is verified to be free of holidays, the piping or fitting may be installed in the trench.

1014.05 PROTECTION OF COATING SYSTEMS DURING CONSTRUCTION.

(a) At all times during construction of the pipeline, the Contractor shall take every precaution to prevent damage to the protective coating. No metal tools or heavy objects shall be permitted to come into contact unnecessarily with the finished coating. Workmen shall not be permitted to walk on the coating, except when absolutely necessary and approved by the Engineer, in which case, they shall wear shoes with rubber or composition soles and heels or other suitable footwear which will not damage the coating.

(b) Pipe shall be hoisted from the trench side to the trench by means of a minimum of two 18-inch wide belt slings of sufficient strength to handle the weight of the piping safely or other means as determined necessary to meet the specific project requirements. Dragging and/or skidding of pipe on grade or in the trench shall not be permitted.

(c) Any and all coating damage shall be repaired with specified coating repair materials prior to installation.

1014.06 TRANSPORTATION, HANDLING AND STORAGE OF COATED PIPE.

Pipe shall be handled in accordance with AWWA C214 and in such a manner as to protect the pipe and the coating from damage.

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(a) At the pipe manufacturer's plant, if forklifts are used, all bearing surfaces of a forklift apparatus must be padded with suitable padding material. Web slings may also be used at the pipe manufacturer's plant.

(b) At the project site, the pipe shall only be handled with slings. Metal chains, cables, tongs, forklifts or other equipment likely to cause damage to the coating, will not be permitted. Web slings shall be a type that will not damage the coating. When pipe is handled with slings, there should be a minimum of two slings. Slings should be a minimum of 18 inches wide and of sufficient strength to handle the weight of the piping safely. Slings shall not pass through the pipe. Hooks on the end of the pipe will not be allowed. Handling equipment, materials, and procedures shall be submitted to the Engineer for approval. If possible, the pipe should be handled from cutback ends.

(c) Storing of the coated pipe shall be on padded 12-inch wide (minimum) skids or select loamy or sand dirt berms, or suspended from cutback ends, where possible. In urban areas, pipe should be suspended on padded skids or skids placed at cutback areas. Where skid chucks are used in contact with coated pipe, they should be padded with several layers of carpeting. Padded chucks should be placed such that coated pipe is nested on the skid rather than the chuck. Coated pipe shall not be laid on pavement without benefit of padding at contact points. In preparation for transporting pipe, the use of web slings is necessary for tie downs.

(d) If cables or chains are used during transportation, they must be properly padded with approved, suitable material as required to protect the coating from damage while in transit. Use of a padded horizontal separator strip between successive rows of pipe is necessary to prevent damage to the pipe coating, i.e.: strips of rug material over all contact areas where pipe will rest.

1014.07 THERMITE WELDING. Thermite welds shall be made in accordance with the manufacturer's recommendations using the proper combination of equipment for the pipe and wire size being welded.

All welding materials and equipment shall be the product of a single manufacturer. Thermite welds shall be tested by striking the weld with a hammer after the weld has cooled for approximately 1 minute. A 2 pound hammer with an 18 inch handle shall be used. The hammer shall be held vertically above the weld. The head of the hammer shall be held at an approximate 45 degree angle to the weld and the end of the hammer handle shall be held above the weld. The head of the hammer shall be allowed to swing freely into the weld. If the weld becomes loose, remove the weld and redo the thermite weld. If the weld remains firmly attached to the pipe, the weld shall be coated. Thermite welds to ductile iron and steel pipe shall be coated with a prefabricated plastic cap filled with elastomeric material in accordance with the recommendations of the manufacturer. Thermite welds to prestressed concrete pipe shall be coated with a minimum of 10 mils of a brush applied mastic and shall cover the entire area of the weld and the steel bonding plate. The mastic shall be allowed to

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completely dry before fully embedding within concrete mortar at the pipe joint. Follow all manufacturer's instructions for applying mastic coating.

1014.08 BONDED JOINTS.

(a) New pipeline joints, including those on pipe, fittings, valves and branch connections, except those specified to be insulated, shall be bonded as necessary to meet the specific project requirements. Bond cables shall be thermite welded to the pipe or fitting.

(b) Pipe joints are to be bonded with two insulated copper cables. Wire size shall be AWG No. 2 for piping larger than 36 inches in diameter, AWG No. 4 for 16 to 36 inch diameter piping, and AWG No. 6 for piping 12 inches and smaller in diameter.

(c) All thermite weld connections shall be coated. Thermite welds to ductile iron and steel pipe shall be coated with a prefabricated plastic cap filled with elastomeric material in accordance with the recommendations of the manufacturer. Thermite welds to prestressed concrete pipe shall be coated with a minimum of 10 mils of a brush applied mastic and shall cover the entire area of the weld and the steel bonding plate. The mastic shall be allowed to completely dry before fully embedding within concrete mortar at the pipe joint. Follow all manufacturer's instructions for applying mastic coating.

1014.09 PREPACKAGED ZINC AND MAGNESIUM ANODES. Prepackaged zinc and magnesium anodes shall be installed where necessary to meet the project requirements and shall never be in direct contact with the pipe. Prior to installation, remove all shipping covers from the anode. Install the anodes in existing soils (free from rocks, roots, organic material, trash or other debris) and backfill with existing soil (as described above). Do not install the anode in sand, rock or gravel backfill. Provide a minimum anode spacing of two feet from other pipelines. Pre-soak the anode in water after placement, but prior to backfilling.

1014.10 ZINC AND MAGNESIUM RIBBON ANODES. Zinc ribbon anodes and magnesium ribbon anodes shall be installed where necessary to meet the specific project requirements and shall never be in direct contact with the pipe. Maintain a minimum of 12 inches of separation between the pipe and the anode. Backfill around the anode ribbon shall be thoroughly compacted with a six inch minimum cover. The backfill material shall be native soil that is free of roots, organic material, trash and rocks. Do not backfill the anode with sand, rock or gravel.

1014.11 AC GROUND MATS. Zinc ribbon anode AC ground mats shall be installed where necessary to meet the specific project requirements in a spiral configuration at the

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locations required and shall never be in direct contact with the pipe. The zinc ribbon ground mat shall be designed to meet the specific project requirements.

1014.12 TEST STATIONS. Test stations shall be installed as necessary to meet the specific project requirements. Test stations are to be located directly over the pipeline except when in a roadway in which case the test station shall be located off the side of the road and the test station wiring shall be run inside non-metallic conduit. The test stations shall be set even with final grade in poured concrete, two feet on each side and six inches thick. The concrete pad shall be reinforced with 4 inches by 4 inches - W2.1 by W2.1 welded wire fabric.

1014.13 REFERENCE ELECTRODES. Install reference electrodes at the test stations where necessary to meet the specific project requirements.

1014.14 CORROSION RATE PROBES. Corrosion rate probes shall be installed as shown on the Drawings and where necessary to meet the specific project requirements.

1014.15 INSULATING FLANGES AND INSULATING COUPLINGS.

(a) Insulating flanges and/or insulating couplings shall be installed where necessary to meet the specific project requirements. Carefully align and install the insulating components according to the insulator manufacturer's instructions.

(b) Before backfilling, each insulator shall be tested for electrical insulation. If the flange is not properly insulated, the Contractor shall, at his expense, repair or replace all defective components. The repaired insulator shall be tested. This process will continue until the insulator is verified as being properly isolated.

(c) After the insulator is verified as being properly isolated, the insulator shall be coated. Test wires, a permanent reference electrode, and anodes shall be installed at the insulators when necessary to meet the specific project requirements.

(d) Should the insulator test effective during pre-backfill testing and then be determined non-effective during acceptance testing, the contractor shall repair the insulator at no additional cost.

1014.16 INSULATING CORPORATION STOP.

(a) Insulating corporation stops shall be installed where necessary to meet the specific project requirements to isolate service connections that are smaller than 4 inches in diameter to the water main. Service connections to the main that are 4 inches or

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greater in diameter shall be electrically isolated with insulating couplings or insulating flanges as necessary to meet the specific project requirements. Carefully align and install the insulating components according to the insulator manufacturer's instructions.

(b) Before backfilling, each insulator shall be tested for electrical insulation. If the corporation stop is not properly insulated, the Contractor shall, at his expense, repair or replace all defective components. The repaired insulator shall be tested. This process will continue until the corporation stop is verified as being properly isolated.

(c) After the corporation stop is verified as being properly isolated, the insulator shall be coated with a tape coating as described below.

(d) Should the insulator test effective during pre-backfill testing and then be determined non-effective during acceptance testing, the contractor shall repair the insulator at no additional cost.

1014.17 COATING OF INSULATING FLANGES, INSULATING COUPLINGS, AND INSULATING CORPORATION STOPS. The insulator, including all isolation components, shall be fully coated prior to backfill. The insulator shall be coated for a minimum of 12 inches on either side of the insulator. The insulator shall be coated after verification of proper electrical isolation.

1014.18 INSULATED CASING SPACERS AND LINKED RUBBER SEALS. Carrier pipe shall be electrically isolated from casings with insulated casing spacers and linked rubber end seals. The insulating spacers shall be of sufficient dimension to approximately center the carrier pipe within the casing and to serve as runners to slide the carrier through the casing. The insulating spacers shall be capable of supporting the weight of the carrier pipe filled with water.

1014.19 CONCRETE BUTTRESSES, SUPPORT BLOCKS, ANCHOR BLOCKS, AND OTHER CONCRETE STRUCTURES.

(a) Position reinforcing steel used in the construction of support blocks, anchor blocks, vaults, and any and all other concrete structures so that they are not in contact with the piping. Maintain a minimum of 2 inches of clearance between the piping and all reinforcement steel or other metallic components. Under no circumstances shall metallic pipe be in contact with reinforcing steel.

(b) When placing concrete in direct contact with ductile iron piping, apply a mastic coating to the external surface of the ductile iron piping prior to placing the concrete. Clean all dirt, moisture, oil, grease, and other contaminants from the piping surface.

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1014.20 PENETRATION OF CONCRETE STRUCTURES. When penetrating a concrete slab (wall or floor), install a linked rubber seal between the pipe and the concrete slab sleeve. Install the linked rubber seal in accordance with the manufacturer's recommendations. The linked rubber seal is to be installed to isolate the piping from direct contact to the concrete and to seal the area of the pipe penetration from water intrusion. Under no circumstances shall metallic pipe be in contact with reinforcing steel.

1014.21 CLEARANCE TO OTHER STRUCTURES. Maintain 12 inches of natural clearance to other structures, where possible. When 12 inches of clearance cannot be maintained, install a medium density flexible polyethylene mesh pattern webbing pad around coating and secure with non-metallic tape.

1014.22 POST INSTALLATION TESTING.

1014.22.01 Qualifications.

(a) General: The Contractor shall retain an independent corrosion control engineering company to perform post installation testing of all corrosion control components.

(b) Qualifications and Submittal Requirements: The independent corrosion control company shall have a minimum of five years of documented experience in the testing of corrosion control systems that are similar to those specified in the Contract Documents. The independent corrosion control company shall employ, on staff, a NACE International Certified Corrosion Specialist to oversee all work associated with the corrosion control aspects of the project. The independent corrosion control company shall employ, on staff, field personnel who are certified, at a minimum, as NACE International Certified Corrosion Technicians. The corrosion technicians shall perform all field work associated with the post installation testing.

(c) Submit for approval by the Engineer, the qualifications of the corrosion control company including a list of a minimum of 5 projects that involve testing of corrosion control systems for water mains that were performed by the same individuals that are proposed for use on this project. The list of water pipeline projects that are submitted shall be of similar type and equal complexity as the pipeline to be tested. The documentation provided for each project shall include:

(1) Project name;

(2) Project location (city and state);

(3) Pipe diameter and type of material installed;

(4) Length of pipeline;

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(5) Type of corrosion control provided to the pipeline;

(6) The name and phone number of a contact at the pipeline owner.

(7) The names of the responsible corrosion control company staff members that participated in the project.

(d) Submit the name of the NACE International Certified Corrosion Specialist. Documentation that shall be submitted shall include:

(1) Copy of the individual's NACE International Corrosion Specialist Certificate;

(2) A list of a minimum of five water pipeline corrosion control testing projects that the individual was in responsible charge of. The five water pipeline projects that are submitted shall be of similar type and equal complexity as the pipeline to be tested. The project documentation shall include the same information listed in 1014.09.01(c)(1) through (6) above.

(e) Submit the names of the NACE International Certified Corrosion Technicians who will be performing the field work associated with the project. Documentation that shall be submitted shall include:

(1) Copy of the individuals' NACE International Corrosion Technician Certificates;

(2) A list of a minimum of three water pipeline testing projects that the individuals were involved in. A list of projects shall be submitted for each Certified Corrosion Technician that will be involved with the new pipeline project. The list of water pipeline projects that are submitted shall be of similar type and equal complexity as the pipeline to be constructed. The project documentation shall include the same information listed in 1014.09.01(c)(1) through (6) above.

(f) The qualifications of the corrosion control engineering company and their personnel shall be submitted for review and approval by the Engineer prior to the start of construction. No corrosion control testing shall be performed until the corrosion control engineering company and their personnel are approved by the Engineer.

(g) No substitutions of NACE Certified personnel during the project, will be permitted without the approval of the Engineer.

1014.22.02 Post Installation Testing.

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Detailed testing requirements shall be specified as necessary to meet the specific project requirements. The detailed testing requirements shall include test procedures, test equipment, and acceptance criteria.

1014.22.03 Test Station As-Built Sketches.

As-built sketches shall be prepared for each test station. The as-built sketches shall include measurements to three permanent structures in the immediate area of each test station and GPS coordinates for each test station. The as-built sketches shall be submitted in hard copy and electronically in AutoCAD R14 format.

1014.22.04 Final Test Report.

A Final Test Report shall be prepared that includes all final test data (tabulated in computer generated format), copies of all field data test sheets, a description of all test procedures, legible sketches with GPS coordinates of test locations, test station as-built tie-down sketches in AutoCAD R14 format, and conclusions as to the condition and the operating status of, and the effectiveness of the cathodic protection system (in accordance with NACE International RP0169 criteria) and/or corrosion monitoring system. The close-interval potential survey (CIS) data shall be submitted with the final report in tabulated and plotted formats. The CIS data shall be plotted at a maximum of 500 feet per page. Certification that the cathodic protection system is functioning in accordance with NACE RP0169 shall be included. The Contractor's NACE Certified Corrosion Specialist shall sign the Final Acceptance Test Report and include their NACE certificate number with their signature.

1014.23 DEFECTIVE OR IMPROPERLY INSTALLED COMPONENTS. The repair or replacement of any defective or improperly installed systems shall be the sole responsibility of the Contractor. Any and all repairs or replacement of defective or improperly installed corrosion control systems shall be performed by the Contractor at no additional cost.

1014.24 METHOD OF MEASUREMENT. The work specified in this section shall not be measured separately.

1014.25 BASIS OF PAYMENT. Payment for work in this section will be included as part of the various other bid amounts.

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SECTION 1015 — ABANDONEMENT OF PIPELINE STRUCTURES AND APPURTENANCES

1015.01 DESCRIPTION. This work shall consist of the disposition of existing appurtenances noted on the contract drawings to be abandoned or removed and restoration of the site.

1015.02 MATERIALS.

1015.02.01 Miscellaneous Materials.
Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as concrete, masonry, reinforcement and castings.

1015.03 CONSTRUCTION. At the County's discretion, the Contractor shall remove fire hydrants, water valves ten inches and larger, and frames and covers which are to be abandoned and return them to the Howard County Department of Public Works.

For water valves 8" and smaller, the valves shall be abandoned in place, the top section of the valve box removed, and the excavation backfilled and paved. All appurtenances to be abandoned shall be at the Contractor's expense.

The Contractor shall remove water meters, which are to be abandoned and return them to Howard County Department of Public Works.

All water house connections to be abandoned as part of the contract shall be done at the main. For 3/4" through 2" water house connections, the corporation shall be removed from the main, and repaired with a County approved stainless steel full circle repair clamp. For services larger than 2 inch, the service valve located at the main shall be closed, the service line cut, capped, and buttressed. The valve box shall be removed and the closed valve abandoned in place. At the discretion of the Engineer, water house connections greater than 2 inch may be alternately abandoned by removing the valve and installing a blind flange. A note shall be placed on the as-built drawings referencing all abandoned connections.

The Contractor shall remove the top portions of valve vaults, meter vaults, manholes and roadway boxes to be abandoned and backfill the area with concrete or flowable fill. When indicated on the Contract Documents, all frames and covers for structures to be abandoned shall be returned to the Howard County Department of Public Works.

The Contractor shall restore the surface with materials appropriate to the site as directed by the Engineer.

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See Section 5.6 of the Howard County Design Manual Volume II for allowable methods of abandoning water and sewer mains.

1015.04 METHOD OF MEASUREMENT AND BASIS OF PAYMENT. This item is not measured. Costs of Abandonment of Appurtenances are included in the price bid for items of new construction.

SECTION 1016 — DIRECTIONAL DRILLING

1016.01 DESCRIPTION. This item shall consist of the furnishing of the trenchless directional drilling installation of pipe which will serve as the carrier for other utilities or as the conduits themselves. The directional drilling shall include all work necessary and required for the installation of the utility of the diameter shown on the Contract Documents, laid to a line and grade in accordance with this section and those of 1000, 1006 and 1007 as shown on the Contract Documents and as specified herein. The Contractor shall furnish all labor, equipment and items necessary to install the utility by the horizontally drilled, directionally controlled method of installing pipe. The directional drilling method shall be mechanical with fluid assistance.

1016.02 MATERIALS.

1016.02.01 Ductile Iron Pipe.

Ductile iron pipe, fittings and joints shall conform to Section 905.11 for the class of pipe as indicated on the Contract Documents.

1016.02.02 Steel Pipe.

Steel pipe, fittings and joints shall conform to Section 905.13 for the thickness of pipe as indicated on the Contract Documents.

1016.02.03 High Density Polyethylene (HDPE) Pipe.

High Density Polyethylene pipe and joints shall conform to section 905.02.02. HDPE pipe is only allowable under special circumstances when approved by the County.

1016.02.04 Miscellaneous Materials.

Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as concrete, masonry, reinforcement and castings:

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1016.03 CONSTRUCTION REQUIREMENTS

1016.03.01 General.

(a) Experience. All directionally drilled pipe shall be installed only by an experienced Contractor having installed at least five similar projects involving directionally drilled pipelines of the same material, equal size, and comparable length. The Contractor shall submit a comprehensive list of experience presenting similar experience on at least five (5) projects involving horizontally directional drilled utilities within the past three (3) years. Information to be submitted shall include but not be limited to: date and duration of work, location, pipe information (i.e., length, diameter, material, etc.); utility Owner information (i.e., name, address, telephone number, contact person); and pipeline use.

(b) Inspection. The Contractor shall at all times provide and maintain instrumentation which shall accurately locate the pilot hole and measure drilling fluid flow discharge rate and pressure. The Engineer shall have access to these instruments and readings at all times.

(c) Tools. Proper and suitable tools and appliances for the safe and convenient handling and laying of pipes and fittings shall be used. Great care shall be taken to prevent the pipe lining and coating from being damaged. Any lining or coating damaged in any way shall be repaired by the Contractor to the satisfaction of the Engineer.

(d) Protection of Pipe. The Contractor shall take precautions to protect the pipe while being handled. Chains, end hooks, or cable slings shall not be used to handle the pipe. Care shall be taken to protect the pipe from scarring, gouging, or excessive abrasion.

(e) Restoration. After installation of the pipeline is completed, the drilling area, receiving area, and other areas where the drilling fluid has surfaced, shall be completely restored to the condition that existed prior to construction.

1016.03.02 Equipment Requirements.

(a) Drilling Method.

(1) Drilling must be performed by a fluid cutting process (high pressure/low volume) utilizing a liquid clay (bentonite). The clay lining shall maintain borehole stability and shall provide lubrication to reduce frictional drag while the pipe is being installed in the bore hole. In additional, the clay fluid must be totally inert and contain no chemicals which could contaminate ground water. The Contractor shall have appropriate equipment on site to remove drilling spoils from the access pits. All drilling spoils must be removed from the site and disposed of at an approved location as excess and/or unsuitable

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excavation. Disposal of drilling spoils in the access pits, sanitary sewer, storm drain, or other water courses will not be permitted.

(2) After the initial bore has been completed, a reamer will be installed at the termination pit; and the pipe will be pulled back to the starting access point. The reamer must be capable of discharging liquid bentonite to facilitate the installation of the pipe into a stabilized and lubricated tunnel. Reaming diameter will not exceed 1.5 times the diameter of the product pipe being installed.

(3) The product pipe being pulled into the tunnel will be protected and supported so that it moves freely and is not damaged by stones and debris on the ground during installation.

(4) A swivel shall be used to connect the pull section to the reaming assembly to minimize torsional stress imposed on the section. The pull section shall be supported as it proceeds during pull back so that it moves freely.

(b) Length of Pull Section.

(1) The maximum length and pull back force for each pull shall not exceed the recommendations of the pipe manufacturer for this application. The Contractor shall verify that the pulling lengths and forces required will not damage the structural integrity of the pipe. All such verifications shall be submitted to the Engineer for approval prior to performing drilling operations.

(2) The Contractor shall allow sufficient lengths of product pipe to extend past the termination point to allow connections to adjacent pipe sections. Pulled pipe will be allowed twenty-four (24) hours of stabilization prior to making tie-ins. The length of extra product pipe will be sufficient to make all necessary connections and tests.

(c) Safety.

(1) These specifications are not intended to be a safety guide. The Contractor shall be responsible for the safety of his/her operations.

(2) All utilities are shown on the drawings for the Contractor's information only, and their exact location is not guaranteed.

(d) Electronic Monitoring - The drilling system shall include electronic monitoring of the drilling head horizontal and vertical location with an accuracy range within one inch of the actual position of the pipeline. Position readings shall be recorded at maximum intervals of five (5) feet. After installation of the pipeline is completed, the drilling area, receiving area, and other areas where the drilling

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fluid has surfaced, shall be completely restored to the condition that existed prior to construction.

1016.03.03 Drilling Fluid And Water.

(a) Drilling Fluid Composition. The composition of all drilling fluid used shall be submitted prior to utilization. The fluids shall be inert and of no risk to the environment. No fluid shall be used that does not comply with permit requirements and environmental regulations. The drilling fluid should remain in the bore hole to increase the stability of the surrounding soil and to reduce the drag on the pulled pipe.

(b) Drilling Water. Clean water required for drilling shall be provided by the Contractor. The Contractor is responsible for transporting and storing all water required, or obtaining a fire hydrant meter from the Howard County DPW.

(c) Disposal. Disposal of drilling fluid and all other spoils shall be the responsibility of the Contractor and shall be conducted in compliance with all relative environmental regulations, right-of-way and work space agreements and permit requirements. Excess drilling fluid shall be disposed of at an appropriate disposal site in accordance with all Federal, State and Local regulations. The Contractor is responsible for transporting all excess fluids and other spoils to the disposal site and paying all disposal costs. Drilling fluid returns at locations other than the entry and exit points shall be minimized. The Contractor shall immediately clean up any drilling fluid that inadvertently surfaces. Contractor shall have a vacuum truck available on a daily basis to clean up any areas where drilling fluid has surfaced. Drilling fluid shall not be discharged into sanitary or storm drain systems, ditches, canals, or waterways.

1016.03.04 Existing Utility Test Pits.

Utility Verifications and testing pitting of existing utilities is as required in Section 1000.03.01 of this specification.

1016.03.05 Alignment Adjustments And Restarts.

(a) Installation Tolerances. The pilot hole shall be drilled along the path shown on the drawings to the following tolerances:

(1) Elevations - Plus or minus 0.2 feet.
(2) Horizontal alignment - Plus or minus 0.5 feet.

(b) Installation Test Pits. The Contractor shall provide 1 test pit every 500' along the pipe installation to verify horizontal and vertical location. Cost for this test pitting shall be included in the bid. Additional test pits may be ordered at no

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additional compensation to the Contractor for each test pit that reveals the pipeline installation location is not in compliance with the Contract Documents. Test pits shall be backfilled in accordance with the typical trench detail as indicated on the Contract Documents.

(c) Adjustments Required. The Contractor shall follow the utility alignment as shown on the Contract Documents within the tolerances specified herein. The Contractor shall notify the Engineer for approval if any adjustments need be made to the proposed alignment prior to performing the adjustment. In the event difficulties are encountered at any time during the directional drilling requiring the complete withdrawal from the drilled hole, the Contractor shall be allowed to withdraw from and abandon the drilled hole, and begin a second installation attempt within the limits identified by the Engineer. All withdrawals, abandonments and restarts during performance of the directional drilling shall be at no additional cost to the County.

1016.03.06 Detection Wire.

(a) Redundant Installations. Two redundant detection wires shall be pulled along with the pipeline.

(b) The detection wire shall be PVC coated copper, 6 gage stranded copper wire.

(c) Termination of detection wire. The detection wires shall be electrically continuous, with splices designed for underground service. Locating vaults, of a County approved design, shall be spaced every 200 feet if possible, and be located next to existing fire hydrants, meter vaults, etc. to facilitate future locating.

(d) Testing of detection wire. Testing of the detection wire shall be the responsibility of the Contractor.

1016.03.07 Buttresses And Anchorages.

The Contractor shall provide concrete thrust blocks on all non-fused (or otherwise unrestrained) bends, tees, plugs and caps in accordance with the Contract Documents and Standard Details. The Contractor shall also provide concrete anchors immediately prior to transitions from HDPE to other pipe materials or structures, as well as all locations where HDPE segments of pipe terminate at non-flanged, non-threaded or non-fusion bonded valves, fittings or couplings to resist thermal expansion and contraction.

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1016.04 METHOD OF MEASUREMENT. Measurement for payment will be made horizontally on the basis of the linear foot along the centerline of the pipe through all fittings and valves, except between vertical bends where measurement will be made along the center of the pipe including all fittings.

1016.05 BASIS OF PAYMENT. Payment for furnishing and placing directional drilled water mains and sewer force mains, complete, will be made at the contract unit price bid for construction of mains for each size and type of pipe actually installed. No payment will be made under this item for utility lines for which payment is provided under other items in the Proposal. Price and payment shall constitute full compensation for furnishing and placing of all pipe, fittings, together with all appurtenances, jointing materials, concrete anchors and buttresses, removal of existing concrete, buttresses; all plugging or capping existing pipe, all excavation and refill operations, providing an approved spoil site and disposing of all spoil or excess material, crusher run stone trench backfill as per Standard Details, temporary paving with cold patch materials in all pavement areas, including removing and disposing of cold patch material together with surplus stone material, sawcut paving and apply permanent paving over disturbed pavement areas; maintenance and repair of trench backfill during warranty period after acceptance; all environmental, sediment and erosion control work including off site requirements; restoration of all disturbed areas, replace curb, gutter and sidewalk damaged ,during construction, seeding and/or sodding operations, supplying all necessary equipment and material for directional drill installation, removal and maintenance of drill spoils, and all other work necessary for making connections to existing water mains; the sterilization and testing of water lines; and for all other labor, equipment, tools, and incidentals to satisfactorily complete the work.

SECTION 1017 — LOW PRESSURE SEWER SYSTEM

1017.01 DESCRIPTION. This item shall consist of, but not necessarily be limited to, furnishing and installing pressure pipes, valves, fittings, and appurtenances for a low pressure sewer system at the locations specified on the Contract Documents or as directed by the Engineer in accordance with the Specifications. All associated equipment with grinder pumps, electrical service connections and pump controls are not owned, operated, or maintained by the County and are not included in this specification.

1017.02 MATERIALS.

1017.02.01 Material Options.

(a) For low pressure lines, open trench construction, Contractor shall furnish SDR-21 polyvinyl chloride (PVC) pipe, or HDPE DR11 unless otherwise indicated in the Contract Documents.

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(b) For low pressure lines, directional drilling, Contractor shall furnish high density polyethylene (HDPE) pipe, unless otherwise indicated in the Contract Documents.

1017.02.02 Polyvinyl Chloride (PVC) Pipe.

Polyvinyl Chloride pipe and joints shall conform to section 905.01.05.

1017.02.03 High Density Polyethylene (HDPE) Pipe.

High Density Polyethylene pipe and joints shall conform to section 905.02.02. HDPE pipe for sanitary force mains is only allowable under special circumstances when approved by the County.

1017.02.04 Ball Valve Curb Stops.

Ball valve curb stops shall conform to section. 961.11.02 of this specification.

1017.02.05 Sewage Air and Vacuum Valves.

Sewage air and vacuum valves shall conform to section 961.03 of this specification.

1017.02.06 Valve Boxes.

Valve boxes shall conform to section 961.06 of this specification.

1017.02.07 Flushing Connections.

See the Standard Details.

1017.02.08 In-line Cleanouts.

See the Standard Details

1017.02.09 Detection Wire and Locating Tape.

Detection wire and locating tape must conform to section 905.01.05 of this specification.

1017.02.10 Miscellaneous Materials.

Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as concrete, masonry, reinforcement and castings.

1017.03 CONSTRUCTION REQUIREMENTS.

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(a) For low pressure lines, open trench construction, see Category 1011 for construction requirements.

(b) For low pressure lines, directional drilling, see Category 1016 for construction requirements.

(c) For installation of detection wire and locating tape, see Category 1002 for construction requirements.

1017.03.01 Pressure Sewer House Connections.

(a) Provide sewer house connections from the main line sewer to property lines at the elevations indicated on the Contract Documents, Standard Details or as directed by the Engineer. Install tees, corporation stops, check valves, ball valves, saddles, and sleeves where indicated.

(b) All pressure sewer house connections shall terminate with a bronze ball valve at the property line in a valve box labeled "sewer". A 2 foot tailpiece shall be included on all pressure sewer house connections.

(c) Corporation stops, where required, shall not be tapped directly into the main line pressure sewer but shall be connected using service saddles and clamps or service sleeves. When installing service saddles and clamps, service sleeves, corporation stops, and when drilling, the pipe shall be supported and such care shall be taken that the pipe does not support the tapping machine and the pipe and fittings are not damaged.

(d) Mark the end of the sewer house connection at the property line with a piece of 2" x 4" lumber, painted green its entire length, placed vertically from bottom of the trench and extending two feet above finished grade. Place lumber so it does not interfere with blocking.

(e) Sewer house connections to new mainline pressure sewers shall be made by installing tees simultaneous with the main line installation. Sewer house connections to existing main line pressure sewers shall be made by installing a new saddle or new tee in the existing sewer, or by wet tap, in accordance with the Standard Details or as indicated on the Contract Documents. Wet taps shall be made by drilling and using service saddles with clamps, service sleeves and corporation or other stops. Work shall be done so that outlets are horizontal or up to 45° from horizontal

(f) Taps in main line pressure sewer pipe shall be done with drilling and tapping equipment specifically manufactured for use with the material to be drilled and in accordance with the manufacturer's recommendations. Drilling and installation of saddles with clamps and sleeves shall be performed only by qualified personnel. If shell cutter drills are used, they shall be of the type that retains the pipe coupon so that it is not left in the pipe.

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(g) Clean pipe surfaces before placing sleeves and saddles.

1017.03.02 New Main Line Connections to Existing Main Line PVC Pressure Sewer.

(a) Connect to existing main line pressure sewer where indicated on the Contract Documents. Connections shall be made by installing a new tee in the existing main line pressure sewer or as indicated on the Contract Documents.

(b) Contractor shall notify the Engineer at least three working days prior to making proposed connection. The connection shall be scheduled and performed as directed by the Engineer and in accordance with the Standard Details and the Contract Documents.

(c) The Contractor shall notify all affected customers who will be without service, 48 hours in advance of the scheduled shutdown and Howard County will operate valves necessary to shut-off the main line pressure sewer. Every reasonable will be made to provide a tight shut-off. Howard County does not warrant that the main will be dry. Sewage remaining in the main line pressure sewer after shut-off that must be removed to make a proper connection shall be pumped out and disposed of by the Contractor at the nearest gravity sewer manhole or as directed by the Engineer. Sewage shall not be allowed on the ground surface. The Contractor shall clean up sewage spills as directed by the Engineer. Connections shall be made by the Contractor in as short a time period as practical with verification of existing conditions and material made in advance and with all required material, labor and equipment to complete the connection on site before shut-off will be made.

(d) Connections shall be made by cutting and removing a length of existing main to accommodate the new tee assembly. Double bell or other couplings approved by the Engineer shall be used to sleeve the new tee into the existing main. The branch end of the new tee shall contain a ball valve. Joints from the tee to the valve shall be solvent cemented and cured prior to installation in the existing main.

(e) Extensions shall be made by cutting the existing pipe and removing the existing cap. A compatible pipe socket, sleeve or coupling shall be installed to extend the main line pressure sewer.

1017.04 TESTING REQUIREMENTS. All work under this section shall be tested in accordance with Section 1006, with the following exceptions:

(a) Chlorinated water is not required for low pressure sewer hydrostatic test.

(b) The test pressure for the low pressure sewer shall be 100 psi at the lowest point in the line, unless otherwise indicated in the Contract Documents.

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1017.05 METHOD OF MEASUREMENT. Work addressed under this Section of the Specifications but not addressed below will not be paid for as a separate bid item, but shall be included in the various unit and/or lump sum prices bid for construction of the pipelines or appurtenances.

1017.05.01 Pressure Sewer.

Measurement for payment for pressure sewer will be on a linear foot basis. Measurement will be made horizontally along the centerline of the pipe for the length and size actually installed.

1017.05.02 Terminal Flushing Connections.

Measurement and payment for the terminal flushing connection will be made on a unit basis per each terminal flushing connection.

1017.05.03 Combination Air Release/Vacuum Valves.

Measurement for the combination air release valve/vacuum valve will be made on a unit basis per each combination air release valve/vacuum valve connection.

1017.05.04 In-Line Cleanouts.

Measurement and payment for the in-line cleanout will be made on a unit basis per each in-line cleanout.

1017.06 BASIS OF PAYMENT.

1017.06.01 Pressure Sewer.

Payment will be made at the unit price per linear foot for the sizes listed in the Proposal for Pressure Sewer complete in place. The price shall include the furnishing and installing of all materials, labor, tools, equipment; excavation of all materials; sheeting, shoring and bracing, control of water; borrow; backfilling and compacting; excavations and disposal of excess or unsuitable materials, pipe, fittings, service valves, assembly, valve boxes, bedding materials, buttresses; detection wire, metallic detection tape; complete restoration such as but not limited to road, driveways, sidewalks, curbs and lawn areas; and all other incidental items and appurtenances necessary to complete this item of work.

1017.06.02 Terminal Flushing Connections.

Payment will be made at the unit price each listed in the proposal for Terminal Flushing Connection. The price shall include the furnishing and installing of all materials, labor, tools and equipment; furnishing and installing manhole and frame and cover; excavation necessary for this bid item; sheeting, shoring and bracing; control of water; borrow,

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backfilling, compaction, disposal of excess and unsuitable material; complete restoration such as but not limited to road, driveways, sidewalks, curbs and lawn areas; and all other incidental items and appurtenances necessary to complete this item of work.

1017.06.03 Combination Air Release Valve/Vacuum Valves.

Payment will be made at the unit price each listed in the proposal for Combination Air Release Valve/Vacuum Valve. The price shall include the furnishing and installing of all materials, labor, tools and equipment; furnishing and installing manhole and frame and cover, and valves; excavation necessary for this bid item; sheeting, shoring and bracing; control of water; borrow, backfilling, compaction, disposal of excess and unsuitable material; complete restoration such as but not limited to road, driveways, sidewalks, curbs and lawn areas; and all other incidental items and appurtenances necessary to complete this item of work.

1017.06.04 In-Line Cleanout.

Payment will be made at the unit price each listed in the proposal for the In-Line Cleanout. The price shall include the furnishing and installing of all materials, labor, tools and equipment; furnishing and installing manhole and frame and cover; excavation necessary for this bid item; sheeting, shoring and bracing; control of water; borrow, backfilling, compaction, disposal of excess and unsuitable material; complete restoration such as but not limited to road, driveways, sidewalks, curbs and lawn areas; and all other incidental items and appurtenances necessary to complete this item of work.

SECTION 1018 — SHARED SEPTIC SYSTEM

1018.01 DESCRIPTION. This item shall consist of, but not necessarily be limited to, furnishing and installing pipes, valves, fittings, manholes, septic tanks, and appurtenances for a shared septic system specified on the Contract Documents or as directed by the Engineer.

1018.02 MATERIALS.

1018.02.01 Polyvinyl Chloride (PVC).

Polyvinyl Chloride Pipe for distribution system shall be schedule 80 PVC and shall conform to section 905.01.05.

1018.02.02 Gate Valves. Resilient Seat Gate.

Valves shall be in accordance with section 961.01.01 of this Specification.

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1018.02.03 Manholes.

Manholes shall be in accordance with section 962 of this specification.

1018.02.04 Valve Boxes.

Valve boxes shall conform to section 961.06 of this specification.

1018.02.05 Septic Tanks/Concrete Distribution Boxes.

Septic Tanks shall be in accordance with section 966 of this specification.

1018.02.06 Pumps and Control Panels.

Pumps and control panels for any pressure dosing or lift stations shall be submersible grinder pumps in accordance with section 966 of this Specification.

1018.02.07 Miscellaneous Materials.

Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as concrete, masonry, reinforcement and castings·:

1018.03 METHOD OF MEASUREMENT. Measurement for payment will be made on a lump sum basis.

1018.04 BASIS OF PAYMENT. Payment for furnishing and placing the shared septic system will be made at the lump sum price bid. Price and payment will constitute full compensation for all valves, vaults, drain fields, pump stations and controls, septic tanks, valves and piping; materials including the valve vault, valve box, castings, concrete where required; and for all other labor, equipment, tools, and incidentals necessary to satisfactorily complete the work as indicated on the Contract Documents or by the Standard Details.

SECTION 1019 — RECLAIMED WATER SYSTEMS

1019.01 DESCRIPTION. This item shall consist of, but not necessarily be limited to, furnishing and installing pipes, valves, fittings, and appurtenances for a reclaimed water system specified on the Contract Documents or as directed by the Engineer.

1019.02 DEFINITIONS.

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- Reclaimed Water: Water discharged from a domestic wastewater treatment plant that has received at least secondary treatment and basic disinfection meeting the Maryland Department of the Environment criteria (Annotated Code 9-301).

- Reclaimed Water Distribution System: A network of pipes, pumping facilities, storage facilities and appurtenances designed to convey and distribute reclaimed water from one or more domestic wastewater treatment facilities to one or more users of reclaimed water. This distribution system terminates at the users' property line.

- Reclaimed Water Connection (RWC): Service lines within public roads or rights-of-way connecting the reclaimed water distribution mains to individual building or facilities.

1019.03 MATERIALS.

1019.03.01 Gate Valves. Resilient Seat.

Gate Valves shall be in accordance with section 961.01.01 of this Specification.

1019.03.02 Meter Boxes.

Meter boxes shall conform to section 961.08.11 of this Specification. All reclaimed water meter boxes shall be labeled as indicated in the Standard Details.

1019.03.03 Valve Boxes.

Valve boxes shall conform to section 961.06 of this Specification. All reclaimed water valve boxes shall be labeled as indicated in the Standard Details.

1019.03.04 Water Mains.

All reclaimed water piping shall be as referenced in section 1002.

1019.03.05 Service Lines.

All reclaimed water service lines shall be as referenced in section 1004 of this specification.

1019.03.03 Flush Type Hydrants.

Flush Type Hydrants shall conform to section 1005 of this specification.

1019.03.06 Miscellaneous Materials.

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Reference is also made to Category 900 of the Specifications for the several items incorporated in the work such as concrete, masonry, reinforcement and castings·:

1019.04 JOINTS.

All reclaimed water pipe joints shall be as referenced in Section 1002.05 of this specification.

1019.05 VALVES.

All reclaimed water pipe valves shall be installed as referenced in Section 1003 of this specification.

1019.06 TESTING REQUIREMENTS.

All reclaimed water pipe joints shall be tested in accordance with sections 1006 and 1007 of this specification. All water obtained for testing of reclaimed water systems cannot be obtained from a direct connection to a potable water system for testing.

1019.07 BLOWOFF HYDRANTS.

Blowoff Hydrants shall be installed in accordance section 1005.03 of this specification with the exception of the following:

Hydrants shall be painted the color specified in the County products list and marked "Caution: Reclaimed Water – Do Not Drink". A stem shall require a special wrench for opening, which is not interchangeable with the potable water hydrants.

1019.08 METHOD OF MEASUREMENT AND BASIS OF PAYMENT. All method of measurements and basis for payment for individual components for the reclaimed water system shall made in accordance with the individual bid items referenced in each individual section for the above referenced components

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CATEGORY 1100 - SUBDIVISIONS

1100.01 DESCRIPTION. All construction of public improvements in approved subdivisions undertaken in Howard County and subject to inspection and acceptance by the Department of Public Works of Howard County is required by law to conform with Volume IV Specifications and Details for Construction.

1100.02 CONSTRUCTION REQUIREMENTS.

1100.02.01 Environmental Requirements.

Compliance with Sections 308 and 316 of these Specifications shall be a condition of acceptance of the developer construction into the County owned system of public improvements.

1100.02.02 Removal or Relocation of County Highway Sign.

Prior to the required removal or relocation of County installed traffic control or highway signs or markers, the Contractor shall notify the Traffic Engineering Division a minimum of 24 hours in advance in order that the County can assign crews to relocate or simply identify the new location the signing as necessary.

1100.02.03 Preservation and Restoration of Monuments.

The Contractor shall carefully protect from disturbances or damages all land monuments and property markers until the Engineer has referenced their locations, and shall replace them as directed by the Engineer. All Howard County geodetic control monuments disturbed by the developer's contractor will be restored by the Howard County Survey Division at the developer's expense.

1100.02.04 Landscaping Guide for Stormwater Management Areas.

Refer to the latest version of the Maryland Department of the Environment Stormwater Management Design Manual for landscaping requirements around Stormwater Management Areas.

1100.03 ACCEPTANCE OF SUBDIVISION ROADS, WATER, SEWER, STORM WATER MANAGEMENT AND STORM DRAIN INTO COUNTY OWNERSHIP.

In order to convey the roads in an approved subdivision to Howard County, the following is required.

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(a) The work must be completed in accordance with the Construction drawings approved by Howard County and executed Developer Agreements.

(b) The materials and construction requirements must pass field inspection and tests as required by these Specifications or otherwise included in the Developer Agreement.

(c) The developer shall have his engineer provide an "as-built" survey marked in red on copies of the approved construction drawing. The survey will check the "as-built" final grade of the road, sewer system, storm water management and storm drain system.

(d) The developer shall have his engineer certify that all lines and grades have been constructed in accordance with the approved plans if the work is inspected by the developer's engineer. All work inspected by Howard County personnel, will not require certification.

1100.03.01 As-Built Requirements.

Upon final completion of all required Public Improvements, the Developer's Engineer shall submit to CID for review red-line as-built prints, on a complete set of the latest approved drawings, associated with the Roads and Storm Water Public Improvements together with the Engineer's Certification, as defined below. If the as-built information is incomplete, the prints shall be returned without further action until such time as the required information is provided. A semi-final inspection of the Public Improvements does not begin until CID receives the required as-built information, in acceptable form. The submission of the as-built prints must comply with the following criteria.

(1) Engineer's Certification. A certification letter, see sample following this section.
(2) The as-built print shall indicate the date of survey.
(3) The as-built print, signed and sealed by a Registered Professional Engineer, shall indicate all deviations in red pencil or ink, as follows:
   a. Centerline elevations shall be required at 50-foot intervals and all PVC's and PVT's or any other breaks in grades with exact elevations plotted on the profile.
   b. Storm drainage structures shall have all invert elevations noted on the profile, plan, and structure schedule. Indicate any and all changes of location or change in structure type.
   c. Indicate paving width and length of roads and/or streets.
   d. Indicate center locations of all sewer manhole covers within the right-of-way.
   e. Deviations from the approved plan should be corrected in the filed or resubmitted as design revisions to the agencies that approved the original design. The as-built should not be processed until deficiencies are corrected in the field or receive design approval.
   f. Indicate horizontal and vertical control references.

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Required:

1. Horizontal datum for this as-built survey is based on the Maryland State Reference System NAD '83/<<insert date of adjustment used>>. As projected by Howard County Geodetic Control Stations <<insert station numbers>>. Vertical datum for this as-built survey is North American Vertical Datum (NAVD) 1988 as projected by the above mentioned Howard County Geodetic Control Stations or Howard County Vertical Control Bench Marks <<insert benchmark numbers>>.

2. This as-built was performed by <<insert company name>>.

Preferred:

3. The instruments were used in performing this as-built survey: <<insert instrument type (i.e., 5 second Total Station & prism; 1 second Robotic Total Station & prism; Reflector less Total Station; RTK GPS, Scanner, Digital Level). [This information will afford Howard County an understanding of the quality of the measurements.]

g. Indicate locations and elevations of concrete monuments at all intersections and metal pipes at all PVC's and PVT's. This shall be done in accordance with the provisions of the Howard County Design Manual, Volume IV, Standards and Specifications and Details; and the Howard County Subdivision and Land Development Regulations, Section 16.
h. Show a recovery sketch for each concrete monument only.
i. Submit a copy of all engineering inspection and test reports. Test reports and certifications will be required at specific stages of the Project's construction. The culmination of test results or individual reports here may include previously supplied information or a summary of the same.

1100.03.02 As-built Processing.

After CID review and approve the red-line as-built prints, The Developer's Engineer shall revise the original drawings on file in the Department of Planning and Zoning in accordance with the approved redlined As-Built prints. The revision involves placing the approved redlined As-Built information, along with the appropriate Engineer's Certification, Seal, Signature, and date (originals only – no sticky backs permitted) onto every sheet of the set. The Developer's Engineer shall then return the original set to the Department of Planning and Zoning and provide five copies of the revised original As-Built to CID. Note that certain storm water management (SWM) ponds As-Builts are reviewed by Howard County Soil Conservation District (HSCD). HSCD's approval should be obtained prior to processing the redlined As-Built prints through CID.

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HOWARD COUNTY
ROAD AND DRAIN
SAMPLE - OFFICIAL LETTER OF CERTIFICATION

MUST BE SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF MARYLAND.

MUST BE ON A PROFESSIONAL ENGINEER'S LETTERHEAD

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Date

John Seefried, Chief
Construction Inspection Division
Bureau of Engineering
Howard County Public Works Department
9250 Bendix Road
Columbia, MD 21045

Subject: P & Z File No. _____
Name of Subdivision, Section, Area, Lots

Dear Mr. Seefried:

In accordance with Section 1100.03 of Volume IV, Howard County Design Manual, this letter is to certify that the roads and storm drainage facilities within (Name of Subdivision, Section, Area, Lots):

1. Are constructed in the lines and grades shown in red and marked as built on the attached ____ copies of the approved road and storm drainage construction drawings.

2. Are constructed is in accord with the approved plans, and are completely within the shown right-of-way and/or easements.

3. The location of the elevation of all concrete monuments and metal pipes have been done in accordance with the Howard County Subdivision and Land Development Regulations, Section 16.139.

Sincerely,

Professional Engineer's Name

ENGINEER CERTIFICATION OF AS-BUILT DRAWINGS

MUST BE DATED, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF MARYLAND.

EVERY SHEET OF THE ENTIRE PLAN SET MUST BE SEALED AND CONTAIN THE TEXT "AS-BUILT" IN PROXIMITY OF THE SHEET NAME.

IN THE EVENT THAT A PARTICULAR SHEET DOES NOT REQUIRE DRAFTING OF AS-BUILT ELEMENTS, THE ENGINEER, AT HIS/HER DISCRETION, MAY NOTE THAT NO AS-BUILT INFORMATION IS REQUIRED ON A GIVEN SHEET. HOWEVER, EACH SHEET MUST BE DATED, SEALED, SIGNED AND CONTAIN THE TEXT "AS-BUILT" IN PROXIMITY OF THE SHEET NAME.

CARE MUST BE TAKEN AS IT IS THE APPLICANT'S RESPONSIBILITY TO FILE DRAWINGS AS-BUILT THAT ARE

ALL SHEETS WITH AS-BUILT INFORMATION MUST HAVE THE FOLLOWING CERTIFICATION TEXT.

AS-BUILT CERTIFICATION
I hereby certify, by my seal, that the facilities shown on this plan were constructed as shown on this "AS-BUILT" plan meet the Approved Plans and Specifications.
<Print or type the MD PE's NAME. PE #, and DATE of AS-BUILT>

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G-2.12	Pipe Trench Plastic & Copper	7/17/2015
G-2.13	Pipe Trench Cradle & Encasement	7/17/2015
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~~G-9.03~~	~~BRICK MANHOLE 42" to 72" Pipe Private~~	~~5/7/2007~~
~~G-9.04~~	~~BRICK MANHOLE Offset Cover 24" Pipe and Smaller Private~~	~~5/7/2007~~
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D-4.27	Type 'S' Inlet Vane Grate	7/17/2015
D-4.31	Double WR Inlet Precast	7/17/2015
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D-4.33	WR Inlet Frame, Grate & Anchorage	7/17/2015
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D-9.03	**Private Micro-Bio Retention Private for Reference**	**7/17/2015**
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R-6.02	RESIDENTIAL DRIVEWAY ENTRANCE 7" Combination Curb and Gutter Sidewalk Abutting Curb	7/17/2015
R-6.03	RESIDENTIAL DRIVEWAY ENTRANCE Modified Combination Curb and Gutter Sidewalk Setback from Curb	7/17/2015
R-6.04	RESIDENTIAL DRIVEWAY ENTRANCE Hot Mix Asphalt Curb Sidewalk Setback from Curb	7/17/2015
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R-8.04	SOLID WASTE Single Container Enclosure	7/17/2015
R-8.05	SOLID WASTE Double Container Enclosure 2 Gate System	7/17/2015
R-8.06	SOLID WASTE Double Container Enclosure 4 Gate System	7/17/2015
R-8.07	SOLID WASTE Recycling Toter Storage Area Layouts	7/17/2015
R-9.01	CURB AND GUTTER 6" Combination Curb and Gutter Private	7/17/2015
R-9.02	TEE TURN-AROUND Offset Private	7/17/2015
R-9.03	Monolithic Curb and Sidewalk Private Parking Area	7/17/2015

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R-9.05	Noise Wall Private	7/17/2015
R-9.06	Noise Wall Notes Private	7/17/2015

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Italics notes SHA Detail approved for use in Howard County

Howard County Design Manual, Volume IV
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T-1.03b	*MD-810.03 LOOP DETECTOR LEED IN INSTALATION*	see SHA
T-1.07a	*MD 810.01 SPLICE KIT FOR LOOP DETECTOR WIRE AND LOOP DETECTOR LEED IN*	see SHA
T-1.21a	*MD SHA Category 1 - Preliminary*	see SHA
T-2.01	Loop Detector Installation	7/17/2015
T-3.01	Precast Concrete Hand box	7/17/2015
T-3.02	Typical Hand box Frame And Cover	7/17/2015
T-4.01	Ground Mount Controller Cabinet	7/17/2015
T-5.01	Traffic Signal Pole Foundation Detail	7/17/2015
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Italics notes SHA Detail approved for use in Howard County

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L-6.01a	*MD-710.03-10* *PLANTING VINES ADJACENT TO WALLS, FLAT AREAS AND SLOPES FLATTER THAN 4:1*	see SHA
L-6.02a	*MD-710.03-11* *PLANT BED MULCHING AND PLANT LAYOUT ON FLAT AREAS AND SLOPES FLATTER THAN 4:1*	see SHA
L-6.03a	*MD-710.03-12* *PLANT BED MULCHING AND PLANT LAYOUT ON SLOPES 4:1 AND STEEPER*	see SHA
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L-7.02a	*MD-710.03-15* *ROOT COLLAR HEIGHTS FOR VARYING SOIL CONDITIONS*	see SHA

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Italics notes SHA Detail approved for use in Howard County

Detail #	Detail Title	Date Approved or Revised
	CORROSION CONTROL DETAILS	
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C-1.02	TEST STATION Flush to Grade Test Box and Pad	7/17/2015
C-1.03	Splice Prepackaged Anode to Header Cable	7/17/2015
C-1.04	Splice Ribbon Anode to Header Cable	7/17/2015
C-2.01	TEST STATION Monitoring	7/17/2015
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C-2.03	TEST STATION Insulating Joint	7/17/2015
C-2.04	TEST STATION Insulating Joint DIP Connection to Main	7/17/2015
C-2.05	TEST STATION Insulating Joint and Anodes	7/17/2015
C-2.06	TEST STATION Casing	7/17/2015
C-2.07	TEST STATION Casing and Anodes	7/17/2015
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C-2.09	TEST STATION Type-A Anode (Both ends of Each Section of Anode Ribbon)	7/17/2015
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Italics notes SHA Detail approved for use in Howard County

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Detail #	Detail Title	Date Approved or Revised
	CORROSION CONTROL DETAILS (continued)	
C-2.11	TEST STATION IR Drop	7/17/2015
C-2.12	TEST STATION IR Drop and Anodes	7/17/2015
C-2.13	TEST STATION AC Ground Mat	7/17/2015
C-2.14	TEST STATION AC Ground Mat Installation	7/17/2015
C-3.01	BONDING Joints	7/17/2015
C-3.02	BONDING Fire Hydrant Piping	7/17/2015
C-3.03	BONDING PCCP Joint	7/17/2015
C-3.04	BONDING Horizontal Thermite Weld	7/17/2015
C-3.05	BONDING Vertical Thermite Weld	7/17/2015
C-4.01	INSULATOR Flange	7/17/2015
C-4.02	INSULATOR Coating Insulated Flange	7/17/2015
C-4.03	INSULATOR Coupling	7/17/2015
C-4.04	INSULATOR Coating Insulating Coupling	7/17/2015
C-4.05	INSULATOR Corporation Stop	7/17/2015

Italics notes SHA Detail approved for use in Howard County

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Detail #	Detail Title	Date Approved or Revised
	CORROSION CONTROL DETAILS (continued)	
C-4.06	INSULATOR Separator Mesh	7/17/2015
C-4.07	INSULATOR Casing Spacers and End Seal	7/17/2015
C-5.01	PVC MAIN 4-inch, 6-inch or 8-inch Ductile Iron Valve	7/17/2015
C-5.02	PVC MAIN 10-inch or 12-inch Ductile Iron Valve	7/17/2015
C-5.03	PVC MAIN Tapping Sleeve and Spacer	7/17/2015
C-5.04	PVC MAIN Ductile Iron Elbow	7/17/2015
C-5.05	PVC MAIN Ductile Iron Tee	7/17/2015
C-5.06	PVC MAIN Ductile Iron Cross	7/17/2015
C-5.07	PVC MAIN Ductile Iron Cap	7/17/2015
C-5.08	PVC MAIN Ductile Iron Coupling	7/17/2015
C-5.09	PVC MAIN Fire Hydrant wit PVC Lateral	7/17/2015
C-5.10	PVC MAIN Restraining Harness	7/17/2015
C-5.11	PVC MAIN Service Saddle	7/17/2015
C-5.12	PVC MAIN In Line Thrust Block	7/17/2015

Italics notes SHA Detail approved for use in Howard County

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Detail #	Detail Title	Date Approved or Revised
CORROSION CONTROL DETAILS (continued)		
C-5.13	PVC MAIN Connector Plate	7/17/2015
C-5.14	PVC MAIN Single Anode Placement	7/17/2015
C-5.15	PVC MAIN Multiple Anode Placement	7/17/2015

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UTILITIES
EXISTING WORK

- SANITARY SEWER MAIN
- SANITARY SEWER FORCE MAIN
- SANITARY SEWER MANHOLE
- SANITARY SEWER TERMINAL MANHOLE
- SANITARY SEWER VALVE
- STORM DRAINS & CULVERTS
- STORM DRAIN MANHOLE
- STORM DRAIN JUNCTION CHAMBER
- INLET, CURB TYPE
- INLET, GRATING TYPE
- INLET, CURB & GRATING TYPE
- WATER MAIN
- WATER MAIN VALVE VAULT
- WATER METER BOX
- WATER VALVE, TEE, & CROSS
- WATER REDUCER, Y-BRANCH, & BEND
- WATER BLOW-OFF & AIR RELEASE
- WATER FIRE HYDRANT
- WATER STAND PIPE
- ELEVATED WATER TANK
- ELECTRIC (UNDERGROUND)
- TELEPHONE (UNDERGROUND)
- CABLE (UNDERGROUND)
- GAS MAINS
- GAS METER
- GAS DRIP, STOP OR PLUG

PROPOSED WORK

- WATER MAIN
- SANITARY SEWER OR STORM DRAIN
- SANITARY SEWER OR STORM DRAIN MANHOLE
- SANITARY SEWER TERMINAL MANHOLE
- SANITARY SEWER HOUSE CONNECTION
- STORM DRAIN JUNCTION CHAMBER
- WATER HOUSE SERVICE & METER BOX
- WATER VALVE, TEE, & CROSS
- WATER REDUCER, Y-BRANCH, & BEND
- WATER BLOW-OFF, AIR RELEASE, & FIRE HYDRANT
- STORM DRAIN INLET & CATCH BASIN
- STORM DRAIN END SECTION

7/17/2015
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MISCELLANEOUS

- ABANDONED UTILITY
- FENCE
- FENCE, HEDGE
- STONE, BRICK, CONCRETE WALLS
- POLES IDENTIFY – B.G.&E. NO. OR VERIZON NO.
- STREET LIGHT
- RAILROAD TRACKS
- EXCAVATION OR CUT
- EMBANKMENT OR FILL
- POT HOLE, PIT, DEPRESSION, SINK HOLE
- CELLAR ELEVATION — C. E. 178.45
- CONTOUR LINES (INTERMEDIATE) (INDEX) — 400
- BORING
- TEST PIT

Revised	Howard County, Maryland Department of Public Works	Standard Symbols	Detail G-1.01
Revised 5/7/2007 Approved	Approved: Chief, Bureau of Engineering		

NATURAL FEATURES

WOODS,UNDERGROWTH AND BRUSH

MARSH

TREES– DECIDUOUS

EVERGREEN

STREAMS (NOTE DIRECTION OF FLOW)

DITCHES (NOTE DIRECTION OF FLOW)

GULLIES AND WET WEATHER WATER–COURSES

ROCK (DESCRIBE BY NOTE AND INDICATE OUTCROP OR LOOSE ROCK) — ROCK

ROADS AND STREETS

PLAN

EXISTING CURB

PROPOSED CURB

WALKS (NOTE WIDTH AND TYPE)

CONCRETE VALLEY GUTTER

EDGE MACADAM OR CONCRETE ROAD

EDGE DIRT OR GRAVEL ROAD

EXISTING RIGHT–OF–WAY LINE (R/W)

EXISTING PROPERTY LINE

CENTERLINE OF EXISTING R/W OR ROAD

CENTERLINE OF PROPOSED R/W OR ROAD — 1+00 2+00

TRANSIT OR TRAVERSE LINE — 1+00 2+00

(SHOW IN RED) (SHADE IN FOR HUB OR NAIL AND CAP)

P.I. TRANSIT LINE OR CENTER LINE — 3+39.11

P.I. FACE CURB LINE (NOTE CORNER) — +N.E.

HORIZONTAL CURVES–

–POINT OF CURVATURE	P.C.
–POINT OF TANGENT	P.T.
–POINT OF INTERSECTION	P.I.
–POINT OF REVERSE CURVATURE	P.R.C.
–POINT OF COMPOUND CURVATURE	P.C.C.

ARCHITECTURAL & STRUCTURAL SYMBOLS

CONCRETE

METAL

WOOD

GRAVEL

SAND

RIPRAP

EARTH

ROADS AND STREETS

PROFILE

ESTABLISHED TOP GRADE CURB (CIRCLES DESIGNATE VERTICAL CURVE POINTS, P.I.'S OF CURB LINES AND P.I.'S OF INTERSECTING STREETS AND ALLEYS.)

CENTERLINE OF EXISTING ROAD

PROPERTY LINES (LABEL EACH SIDE) — N E S W

VERTICAL CURVES–

–POINT OF VERTICAL CURVATURE	P.V.C.
–POINT OF VERTICAL TANGENT	P.V.T.
–POINT OF VERTICAL INTERSECTION	P.V.I.
–POINT ON CURVE	P.O.C.
–POINT OF VERTICAL REVERSE CURVE	P.V.R.C.
–POINT OF VERTICAL COMPOUND CURVE	P.V.C.C.

SURVEYORS SYMBOLS

BENCH MARK — B.M. NO.

TRAVERSE STATION

STAKE (HUB) WITH TACK CENTER

STAKE WITHOUT TACK

IRON PROPERTY PIPE

NAIL OR SPIKE

PROPERTY & BOUNDARY STONES

CITY BOUNDARY

DISTRICT BOUNDARY

AREA BOUNDARY

LAND ACQUISITION

TEMPORARY CONSTRUCTION AREA

SLOPE EASEMENT

AREA TO BE RELEASED

EXISTING UTILITY R/W

PROPOSED DRAINAGE & UTILITY R/W

STREAM RELOCATION AND BRIDGE–EASEMENT

EXISTING ROADS & STREETS R/W

PROPOSED ROADS & STREETS R/W

EXISTING R/W'S (AGENCIES OTHER THAN–HOWARD COUNTY) — NAME

7/17/2015 DRAFT

Revised

Revised 5/7/2007 Approved

Howard County, Maryland
Department of Public Works

Approved: _____
Chief, Bureau of Engineering

Standard Symbols

Detail
G–1.02

DESCRIPTION	ABBREVIATION
AMERICAN CONCRETE INSTITUTE	ACI
ALTERNATE	ALT
ALUMINUM ALLOY	AA
ALUMINIZED CORRUGATED METAL PIPE	ACMP
AREA OF STEEL	A_S
AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS	AASHTO
AMERICAN SOCIETY OF TESTING AND MATERIALS	ASTM
AMERICAN WIRE GAUGE	AWG
AMERICAN WATER WORKS ASSOCIATION	AWWA
BITUMINOUS COATED CORRUGATED METAL PIPE	BCCMP
CAST IRON	CI
CENTER TO CENTER	C/C
CURB AND GUTTER	C&G
CENTERLINE	℄
CLEAR	CLR
CLEARANCE	CL
CONCRETE	CONC
COUNTERSINK	CSK
CUBIC	CU
CUBIC YARD	CY
DRY FILM THICKNESS	DFT
DEGREE	°
DIAMETER	DIA
DIAMETER	Ø
DIAGONAL	DIAG
DUCTILE IRON	DI
DUCTILE IRON PIPE	DIP
DEPARTMENT OF PUBLIC WORKS	DPW
EACH WAY	EW
EXISTING	EX
EXPANSION	EXP
FEET	FT
FEET	'
GRADED AGGREGATE BASE	GAB
GALVANIZED	GALV
GAUGE	GA
HIGH DENSITY POLYTHYLENE	HDPE
HOT MIX ASPHALT	HMA
INSIDE DIAMETER	ID
INCH	IN.
INCH	"
JOINT	JT
RATIO OF ACTIVE LATERAL UNIT PRESSURE TO VERTICAL UNIT PRESSURE	K
POUNDS	LBS
LINEAR FOOT	LF
MANHOLE	MH
MAXIMUM	MAX
MECHANICAL	MECH
MECHANICAL JOINT	MJ
MILLIMETERS	MIL
MINIMUM	MIN
NUMBER	NO.
NUMBER	#

DESCRIPTION	ABBREVIATION
NATIONAL PIPE THREAD	NPT
NON-REINFORCED CIRCULAR CONCRETE PIPE	NRCP
NOT TO SCALE	NTS
ON CENTER	O/C
OUTSIDE DIAMETER	OD
OVERALL	OA
PRESTRESSED CONCRETE CYLINDER PIPE	PCCP
POLYTHYLENE PRE-COATED CORRUGATED STEEL PIPE	PESCP
PRESSURE REDUCING VALVE	PRV
POUNDS PER SQUARE INCH	PSI
POLYVINYL CHLORIDE	PVC
RADIUS	R.
REINFORCED CONCRETE	R.C.
REINFORCED CONCRETE ARCH PIPE	RCAP
REINFORCED CIRCULAR CONCRETE PIPE	RCCP
REINFORCED CONCRETE ELLIPTICAL PIPE	RCEP
REINFORCED CONCRETE PIPE	RCP
REINFORCEMENT	REINF
RIGHT OF WAY	R/W
STABILIZED CONSTRUCTION ENTRANCE	SCE
SCHEDULE	SCH
MARYLAND STATE HIGHWAY ADMINISTRATION	SHA
SEWER HOUSE CONNECTION	SHC
STEEL PIPE	SP
STRUCTURAL PLATE PIPE	SPP
SQUARE	SQ
STAINLESS STEEL	SS
STORM WATER MANAGEMENT	SWM
TERMINAL	TERM
TYPICAL	TYP
VOLTS	V
COEFFICIENT OF FRICTION BETWEEN FILL MATERIAL AND SIDES OF TRENCH	μ'
SQUARE MEMBER	□
C SHAPED MEMBER	⊏

7/17/2015
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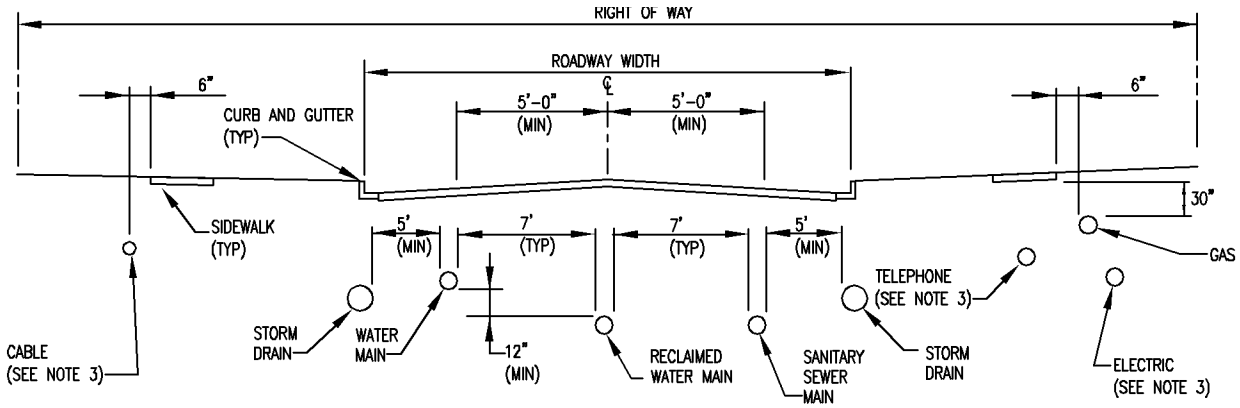
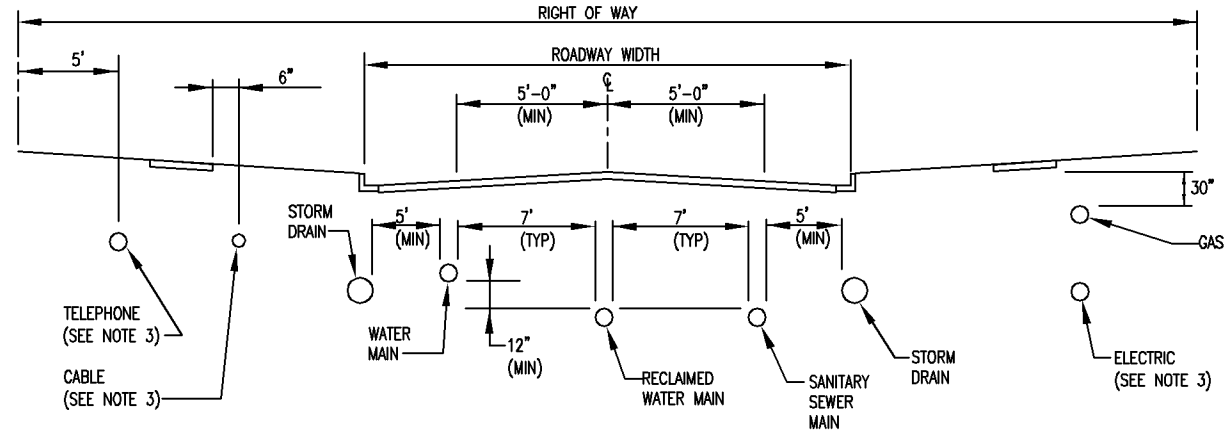
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Abbreviations & Acronyms	Detail G-1.03



PUBLIC UTILITY LAYOUT IN CLOSED SECTION
PUBLIC R/W



PUBLIC UTILITY LAYOUT IN CLOSED SECTION
PUBLIC R/W
(ALTERNATE)

NOTES:

1. DPW SHALL BE CONSULTED CONCERNING THE UTILITY LOCATION ARRANGEMENTS FOR A GIVEN ROADWAY PROJECT.
2. GAS, ELECTRIC AND TELEPHONE LINES MAY BE PLACED IN THE SAME TRENCH AT THE OPTION OF THE UTILITY OWNERS AND AS SHOWN ON THE CONTRACT DRAWINGS.
3. ⚠1 ELECTRIC REQUIRES 36" MINIMUM COVER. GAS REQUIRES 30" MINIMUM COVER. COMMUNICATIONS (TELEPHONE, CABLE, INTERNET, ETC.) REQUIRES 24" MINIMUM COVER IN PAVED ROADWAY AND 18" MINIMUM COVER IN ALL OTHER RIGHT-OF-WAY. COVER IS THE DEPTH OF MATERIAL FROM THE TOP OF UTILITY TO THE FINISHED GRADE.
4. TELEPHONE. CABLE, GAS AND ELECTRIC SHALL HAVE A MINIMUM OF 5' HORIZONTAL SEPARATION FROM WATER AND SEWER UTILITIES.
5. SEE W-3.11 FOR WATER METER VAULT LOCATION.

7/17/2015
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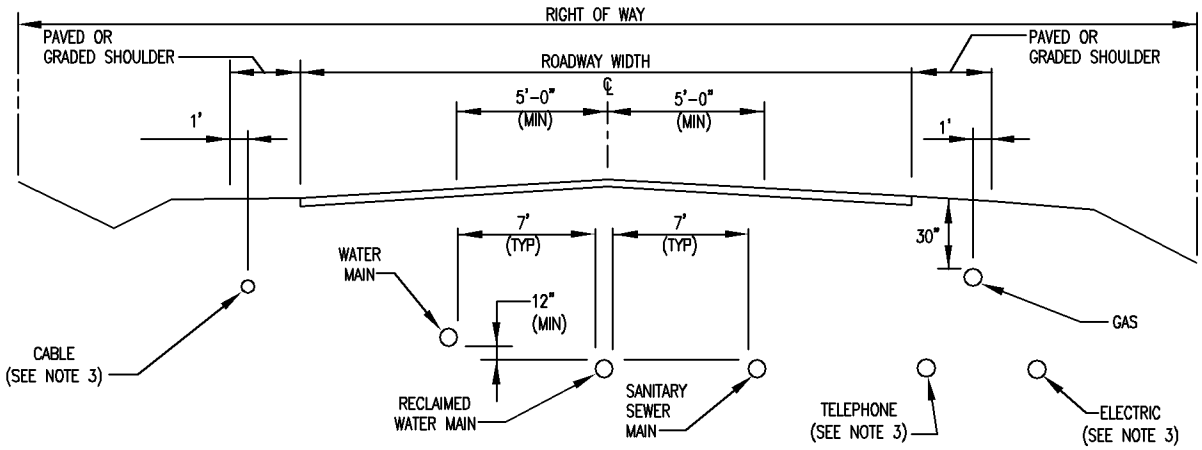
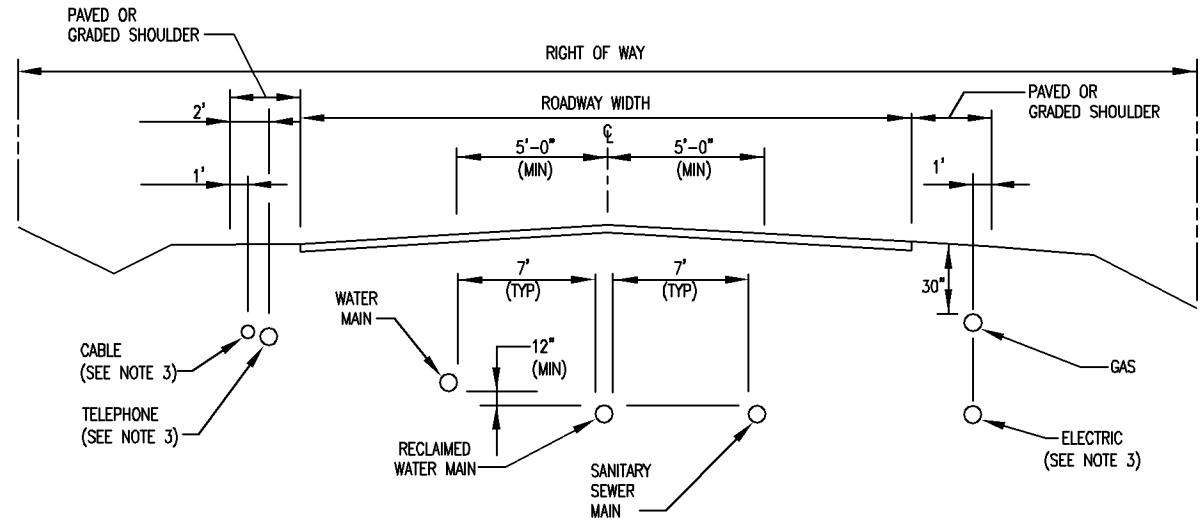
Revised	Howard County, Maryland	Public Utilities	Detail
⚠1 5/1/2014 Revised	Department of Public Works	Closed Section Roadway	G-2.01
5/7/2007 Approved	Approved: Thomas E. Butler, Chief, Bureau of Engineering		



PUBLIC UTILITY LAYOUT IN OPEN SECTION
PUBLIC R/W



PUBLIC UTILITY LAYOUT IN OPEN SECTION
PUBLIC R/W
(ALTERNATE)

NOTES:

1. DPW SHALL BE CONSULTED CONCERNING THE UTILITY LOCATION ARRANGEMENTS FOR A GIVEN ROADWAY PROJECT.
2. GAS, ELECTRIC AND TELEPHONE LINES MAY BE PLACED IN THE SAME TRENCH AT THE OPTION OF THE UTILITY OWNERS AND AS SHOWN ON THE CONTRACT DRAWINGS.
3. ⚠1 ELECTRIC REQUIRES 36" MINIMUM COVER. GAS REQUIRES 30" MINIMUM COVER. COMMUNICATIONS (TELEPHONE, CABLE, INTERNET, ETC.) REQUIRES 24" MINIMUM COVER IN PAVED ROADWAY AND 18" MINIMUM COVER IN ALL OTHER RIGHT-OF-WAY. COVER IS THE DEPTH OF MATERIAL FROM THE TOP OF UTILITY TO THE FINISHED GRADE.
4. TELEPHONE. CABLE, GAS AND ELECTRIC SHALL HAVE A MINIMUM OF 5' HORIZONTAL SEPARATION FROM WATER AND SEWER UTILITIES.
5. SEE W-3.11 FOR WATER METER VAULT LOCATION.

7/17/2015
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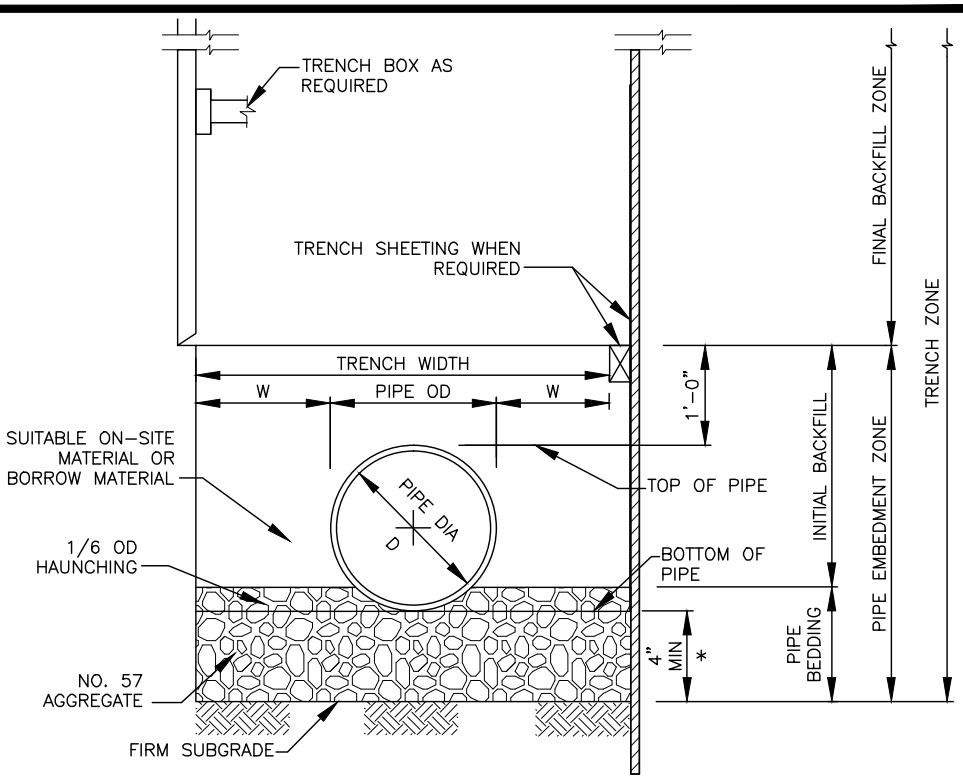
Revised ⚠1 5/1/2014 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Thomas E. Butler Chief, Bureau of Engineering	Public Utilities Open Section Roadway	Detail G-2.02

DIP		
PIPE DIA "D"	"W"	TRENCH PAYMENT WIDTH
4	12	28
6	11	28
8	10	28
10	9	28
12	8	28
14	8	30
16	8	32
18	8	34
20	8	36
24	12	48

RCP		
PIPE DIA "D"	"W"	TRENCH PAYMENT WIDTH
4	12	28
6	11	28
12	8	28
15	8	31
18	8	34
21	8	37
24	12	48
27	12	51
30	12	54
33	15	63
36	15	66
42	15	72
48	18	84
54	18	90
60	18	96
66	18	102
72	18	108
78	18	114
84	18	120
90	18	126
96	18	132
102	18	138
108	18	144

ALL DIMENSIONS IN INCHES



* FOR TRENCHES IN ROCK, MINIMUM BEDDING DEPTH IS 6 INCHES. FOR RCP 96 INCHES AND GREATER, MINIMUM BEDDING DEPTH IS 12 INCHES.

NOTES:

1. THE "W" DIMENSION SHALL BE USED TO CALCULATE MAXIMUM TRENCH PAY WIDTH.
2. FOR TRENCHES WHERE TRENCH BOX OR TRENCH SHEETING IS NOT REQUIRED, MEASUREMENT FOR CONTINGENT BORROW MATERIALS WILL BE BASED ON THE TRENCH WIDTH SHOWN.
3. FOR TRENCHES WHERE TRENCH BOX OR TRENCH SHEETING IS REQUIRED, MEASUREMENT FOR CONTINGENT BORROW MATERIALS WILL BE BASED ON THE TRENCH WIDTH SHOWN PLUS 24 INCHES.
4. THE MAXIMUM WIDTH OF THE TRENCH EXCAVATED ON-SITE FOR RCP, SHALL NOT EXCEED THE TRENCH PAYMENT WIDTH PLUS 12 INCHES.
5. MINIMUM SPACING BETWEEN PARALLEL CULVERT PIPES SHALL BE TWICE THE "W" DIMENSION.
6. SPECIAL DESIGN IS REQUIRED AND SHALL BE SPECIFIED OR DETAILED IN THE CONTRACT DOCUMENTS FOR THE FOLLOWING PIPES:

   RCP STORM DRAINS LARGER THAN 108 INCHES
   RCP GRAVITY SANITARY SEWERS LARGER THAN 48 INCHES
   DIP LARGER THAN 24 INCHES
   STREAM CROSSINGS SEE S-3.11 AND S-3.12

⚠7. WATERMAIN SHALL BE SPECIAL THICKNESS CLASS 54 DIP MINIMUM.

7/17/2015
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Revised
⚠ 6/30/2011
Revised
5/7/2007
Approved

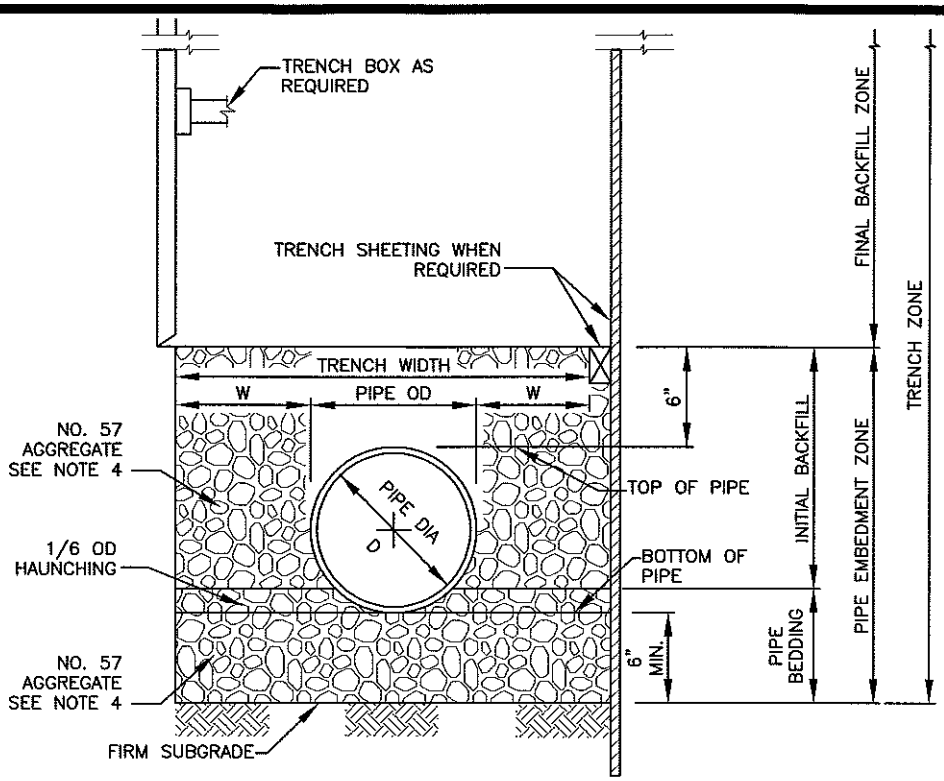
Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

Pipe Trench
DIP & RCP

Detail
G-2.11

PLASTIC		
PIPE DIA "D"	"W"	TRENCH WIDTH
4	12	28
6	11	28
8	10	28
10	9	28
12	8	28

ALL DIMENSIONS IN INCHES



NOTES:

1. THE "W" DIMENSION SHALL BE USED TO CALCULATE MAXIMUM TRENCH PAY WIDTH.
2. FOR TRENCHES WHERE TRENCH BOX OR TRENCH SHEETING IS NOT REQUIRED, MEASUREMENT FOR CONTINGENT BORROW MATERIALS WILL BE BASED ON THE TRENCH WIDTH SHOWN.
3. FOR TRENCHES WHERE TRENCH BOX OR TRENCH SHEETING IS REQUIRED, MEASUREMENT FOR CONTINGENT BORROW MATERIALS WILL BE BASED ON THE TRENCH WIDTH SHOWN PLUS 24 INCHES.
4. FOR COPPER, PVC AND HDPE PIPE, 3 INCHES OR SMALLER:
   PIPE EMBEDMENT ZONE MATERIAL IS FINE AGGREGATE (SAND)
   "W" DIMENSION IS 6 INCHES MINIMUM AND BEDDING THICKNESS UNDER PIPE IS 4" MINIMUM.
   FOR TRENCHES IN ROCK, MINIMUM BEDDING THICKNESS IS 6 INCHES.
5. SPECIAL DESIGN IS REQUIRED AND SHALL BE SPECIFIED OR DETAILED IN THE CONTRACT DOCUMENTS FOR THE FOLLOWING PIPES:

   PVC AWWA C-905 LARGER THAN 12 INCHES
   PVC GRAVITY SANITARY SEWERS LARGER THAN 12 INCHES
   HDPE CORREGATED DRAIN PIPE
   STREAM CROSSINGS SEE DETAILS S-3.11 AND S-3.12

7/17/2015
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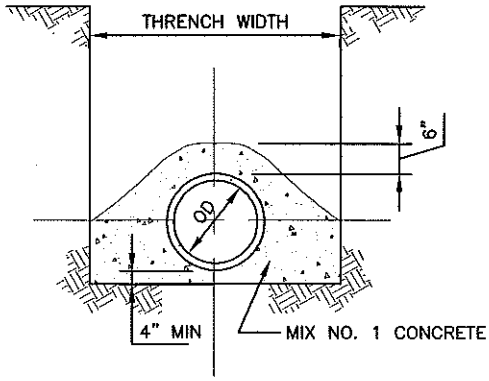
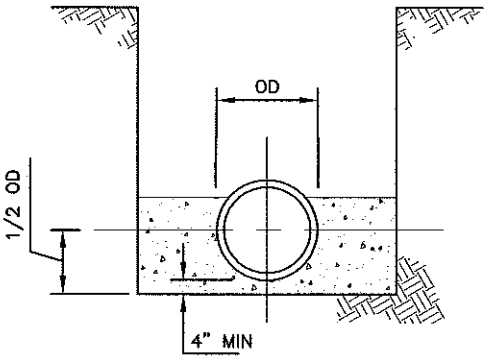
Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Pipe Trench Plastic & Copper	Detail G-2.12

NORMAL PIPE DIAMETER	MAXIMUM PAYMENT CUBIC FT PER LINEAR FT	
	CRADLE	CONCRETE ENCASEMENT
6"	1.28	1.53
8"	1.58	2.55
10"	1.86	2.95
12"	2.33	3.63
15"	2.82	4.20
18"	4.02	5.71
21"	4.52	6.35
24"	5.95	8.22
27"	6.58	8.94
30"	7.42	9.83
33"	9.42	12.16
36"	10.53	13.09
42"	12.30	15.22
48"	16.25	19.83
54"	18.46	22.97
60"	20.80	24.95
66"	23.08	27.71



CONCRETE ENCASEMENT DETAIL



CONCRETE CRADLE DETAIL

NOTES:

1. POUR CONCRETE TO UNDISTURBED EARTH.
2. CONCRETE CRADLES AND ENCASEMENT SHALL BE MIX NO. 1 CONCRETE.
3. ALL PAYMENT FOR CONCRETE ENCASEMENT OR CRADLES SHALL BE IN ACCORDANCE WITH THE TABLE ON THIS DETAIL. PAYMENT WILL NOT BE PER ACTUAL TRENCH WIDTH.
4. CONCRETE ENCASEMENTS AND CRADLES FOR WATER AND SEWER LINES ARE NOT PERMITTED WITHOUT WRITTEN AUTHORIZATION FROM THE DEPARTMENT OF PUBLIC WORKS.
5. SEE DETAIL S-3.11 AND S-3.12 FOR STREAM CROSSING DETAILS.

7/17/2015
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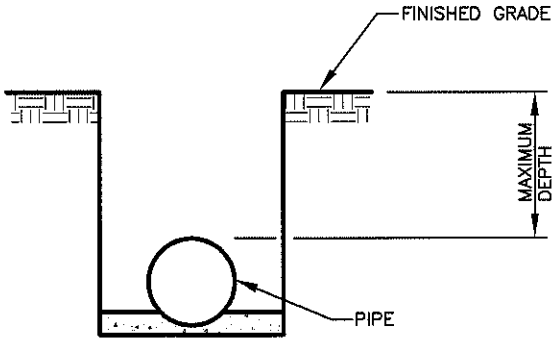
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Pipe Trench Cradle & Encasement	Detail G-2.13

MAXIMUM PERMISSIBLE DEPTH

PIPE DIA (IN)	DUCTILE IRON SPECIAL THICKNESS CLASS (SEWER)			DR-18 C-900 PVC (WATER/FORCE MAIN)	SDR-35 PVC (GRAVITY)
	50	52	54		
	MAXIMUM DEPTH (FEET)	MAXIMUM DEPTH (FEET)	MAXIMUM DEPTH (FEET)	MAXIMUM DEPTH (FEET)	MAXIMUM DEPTH (FEET)
4"	NA	20	20	20	16
6"	20	20	20	20	16
8"	20	20	25	20	16
12"	20	20	25	20	16

1. MINIMUM DEPTH INSTALLATIONS IS 3.5' FOR WATER MAINS AND 4' FOR SEWER MAINS.
2. MAXIMUM DEPTHS INDICATED ARE FROM PIPE CROWN TO FINISHED GRADE. DEPTHS ARE BASED ON A TYPE III BEDDING IN ACCORDANCE WITH AWWA C-150, WITH A MAXIMUM COVER OF 20'. THE COUNTY REQUIRES A MINIMUM OF TYPE IV BEDDING FOR ALL DIP INSTALLATIONS AND TYPE V BEDDING FOR PVC. SEE DETAILS G-2.11 AND G-2.12 FOR BEDDING DETAILS.
3. C-900 PVC FOR WATER MAINS OR FORCE MAINS IS ONLY ALLOWABLE UNDER SPECIAL CIRCUMSTANCES WHEN APPROVED BY THE COUNTY.
4. WATER MAIN SHALL BE CLASS 54 ONLY.



7/17/2015
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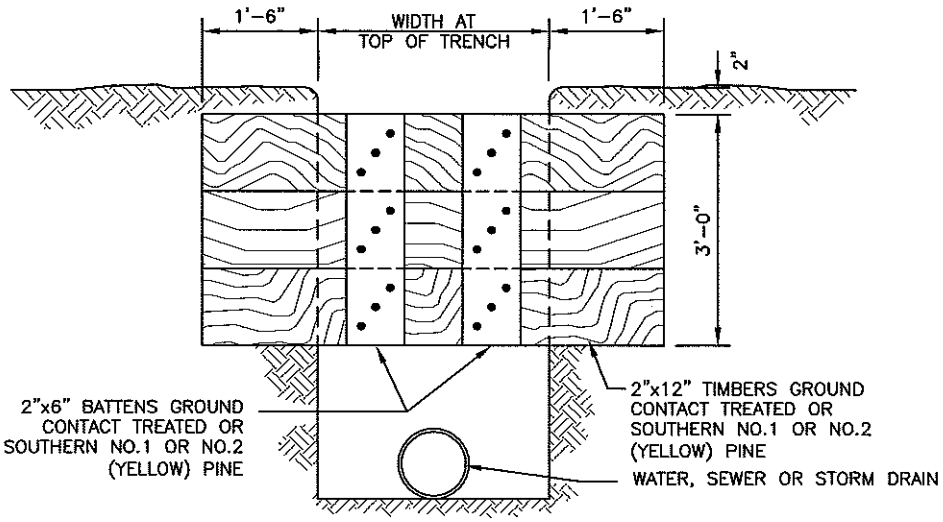
Revised	Howard County, Maryland Department of Public Works	Water and Sewer PVC & DIP Pipe Permissible Depth Table	Detail G-2.14
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		

NOTES

1. NAIL BATTENS TO TIMBERS.
2. PLACE TRENCH EROSION CHECK ACCORDING TO SPACING AS SHOWN ON PLANS.

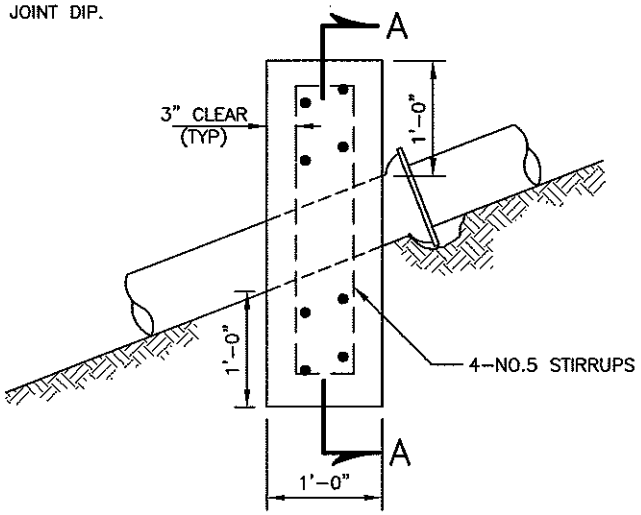


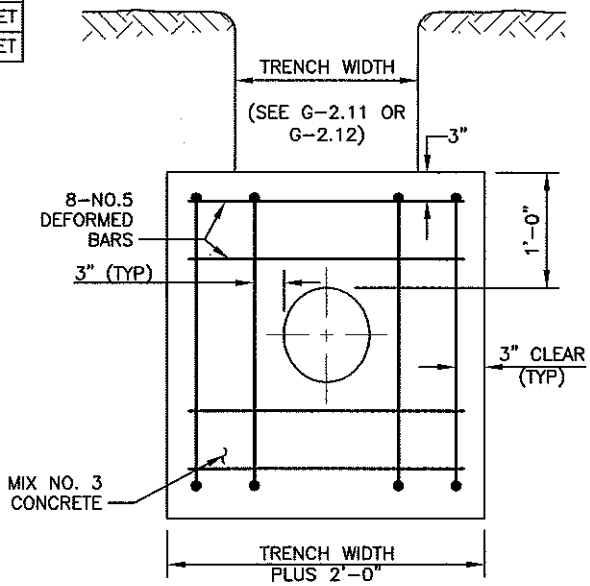
FRONT VIEW
TRENCH EROSION CHECK
(FOR USE IN GRANULAR SOILS)

NOTES

1. WHEN PIPE SLOPE > 20% USE DIP ONLY.
2. PLACE CONCRETE ANCHOR AGAINST DOWNGRADE SIDE OF BELL.
3. CARRY ALL BEARING SURFACES TO UNDISTURBED EARTH.
4. ALL ANCHORED PIPELINES SHALL BE RESTRAINED JOINT DIP.

SLOPE	SPACING
>20%-35%	36 FEET
36%-50%	24 FEET
>50%	16 FEET



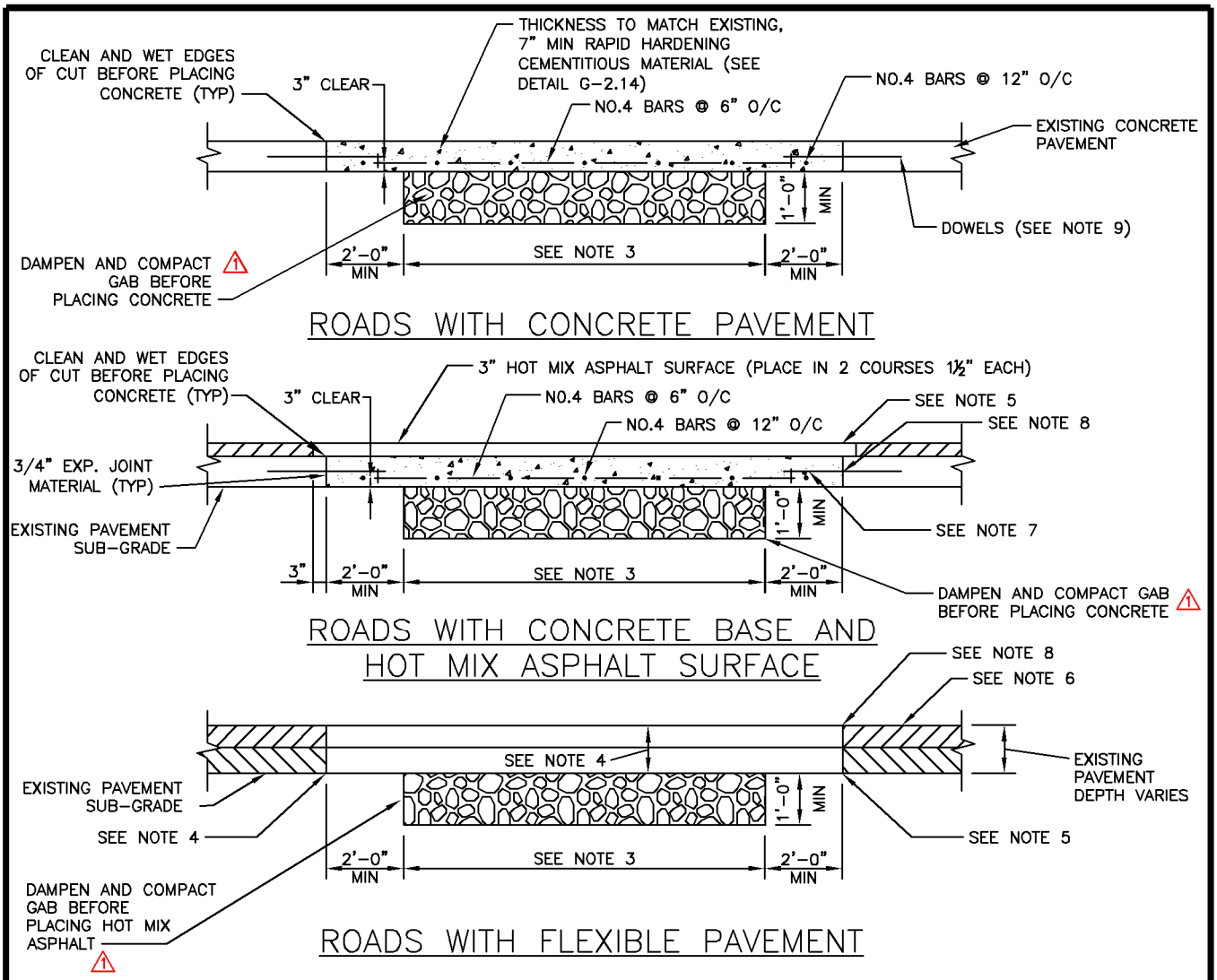


SECTION A-A

ELEVATION
CONCRETE ANCHOR
(FOR USE WHEN PIPE SLOPES EXCEED 20%)

7/17/2015
DRAFT

Revised	Howard County, Maryland Department of Public Works	Pipe Trench Erosion Check and Concrete Slope Anchor	Detail G-3.01
Revised 5/7/2007 Approved	Approved: Chief, Bureau of Engineering		



NOTES:

1. WHEREVER A TRENCH CROSSES A CONCRETE ROADWAY THAT HAS JOINT INSTALLATIONS THE ENTIRE SLAB BETWEEN THE EDGE OF THE TRENCH AND THE NEAREST JOINT SHALL BE REMOVED IF THE DISTANCE IS LESS THAN 10 FEET.
2. CLEAN AND WET EDGES OF CUT AND SUBGRADE BEFORE PLACING CONCRETE.
3. AGGREGATE SUB-BASE WIDTH SHALL BE 6 FT MINIMUM OR ACTUAL TRENCH WIDTH, WHICH EVER IS GREATER.
4. HOT MIX ASPHALT PAVEMENT PATCH THICKNESS SHALL BE EQUAL TO THE EXISTING PAVING SECTION OR AS APPROVED BY DPW. THE MINIMUM PAVING PATCH SHALL CONSIST OF 2" HMA SURFACE COURSE OVER 4" HMA BASE COURSE. GRADED AGGREGATE BASE (GAB) SHALL BE PLACED AND COMPACTED IN 6" MAXIMUM COMPACTED THICKNESS LAYERS.
5. CLEAN EXPOSED VERTICAL SURFACE OF ADJACENT PAVEMENT AND PLACE TACK COAT ON ALL VERTICAL SURFACES PRIOR TO PLACING HMA.
6. IF THE REMAINING EXISTING PAVEMENT IS LESS THAN 4' WIDE , THE RESIDUAL PAVEMENT SHALL BE REMOVED IN ITS ENTIRITY AND REPLACED.
7. CONCRETE REPLACEMENT SHALL BE 10" MINIMUM MIX NO. 6.
8. SAW CUT FULL DEPTH ALL JOINTS OF EXISTING CONCRETE, BITUMINOUS, AND BASE PAVEMENTS.
9. REINFORCEMENT OF CONCRETE PAVING SHALL BE ACCOMPLISHED BY DOWELING. DOWELS SHALL BE CENTERED IN PAVEMENT THICKNESS. NEW REINFORCING SHALL BE TIED TO DOWELS.
10. TOTAL REPAIR WIDTH SHALL BE EQUAL TO THE LANE WIDTH IN ACCORDANCE WITH THE SPECIFICATIONS.

7/17/2015
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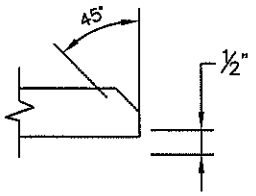
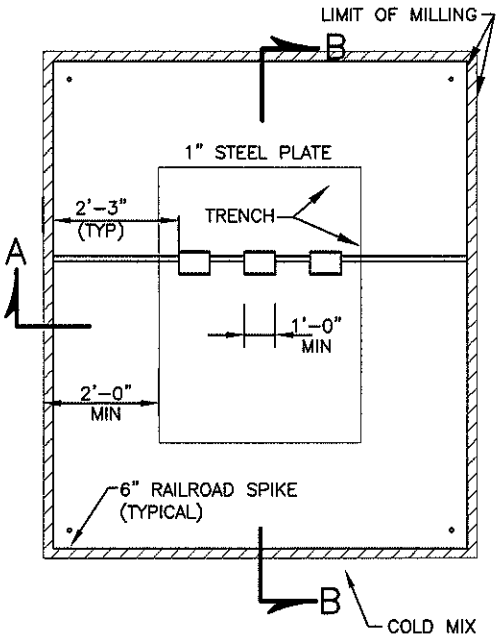
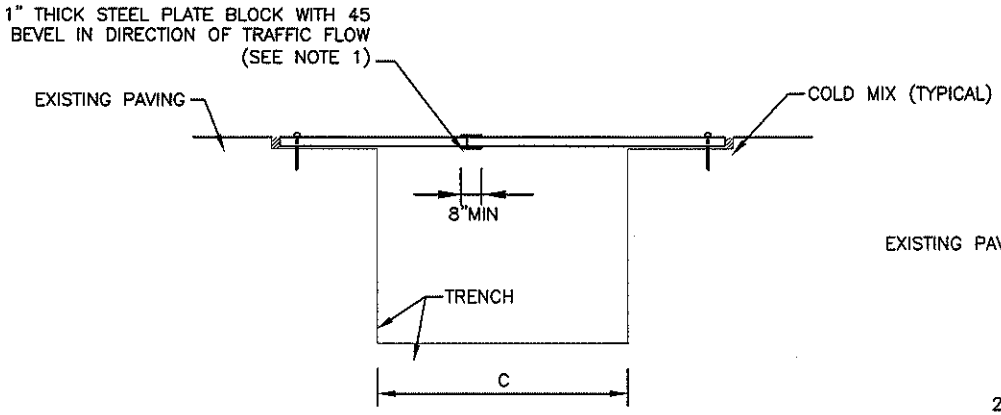
Revised	Howard County, Maryland		Detail
1 5/1/2014 Revised	Department of Public Works	Utility Trench	G-4.01
5/7/2007 Approved	Approved: Thomas E. Butler, Chief, Bureau of Engineering	Roadway Repaving	



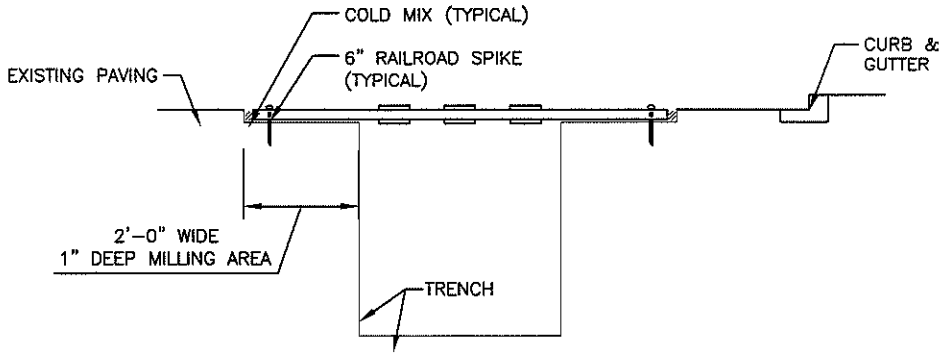
BEVEL DETAIL



PLAN



SECTION B–B



SECTION A–A

NOTE:

1. STEEL PLATE BLOCKS ARE ONLY WELDED TO ONE OF THE TWO STEEL PLATES
2. PROVIDE STRUCTURAL SUPPORT AS NEDDED TO SUSTAIN TRAFFIC LOADING.

7/17/2015
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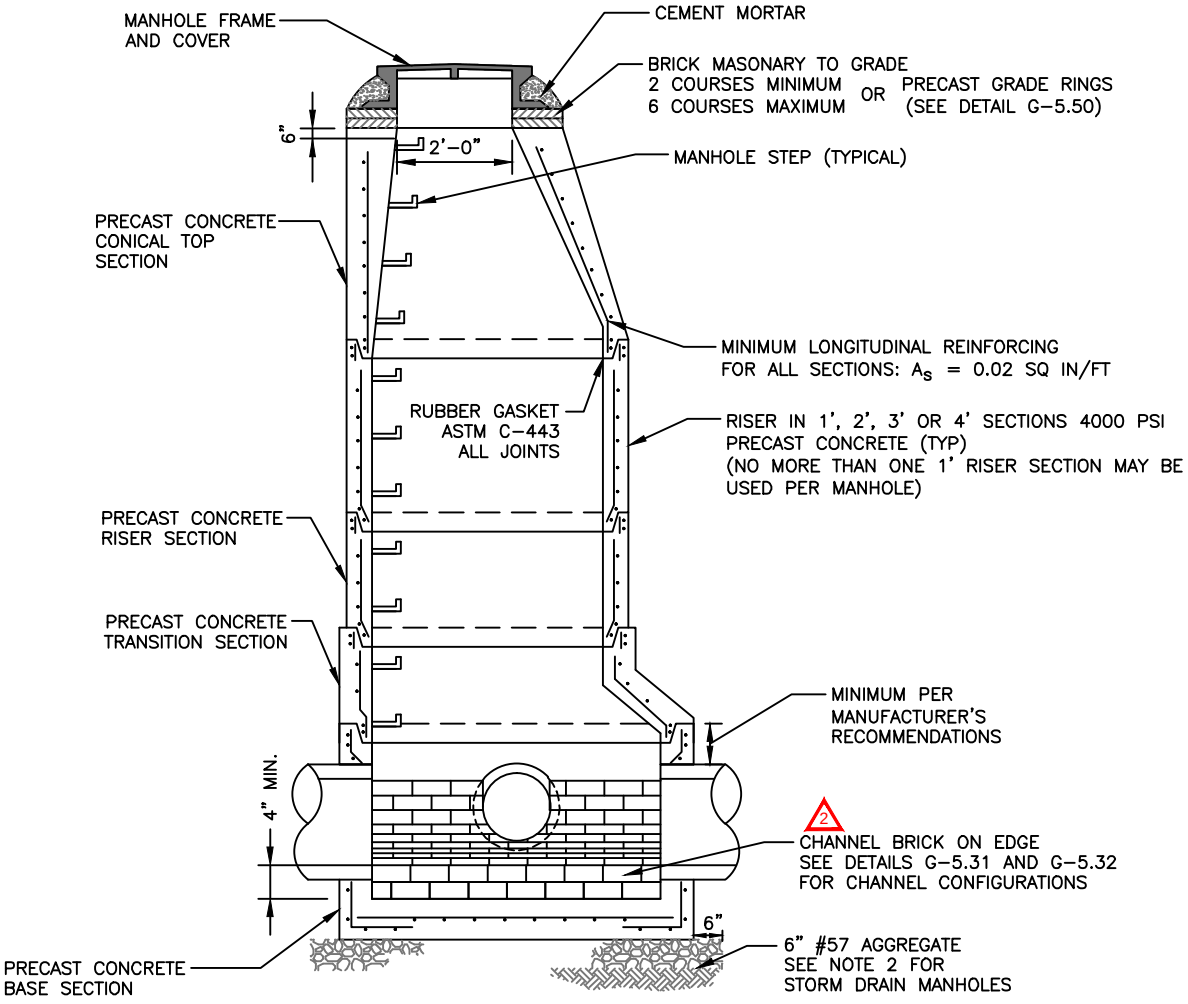
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Utility Trench Roadway Repaving Steel Plates	Detail G-4.02



2 SECTION

GENERAL NOTES APPLICABLE TO ALL PRECAST MANHOLES

1. MANHOLE BASE SECTION SHALL BE BEDDED ON 6-INCH #57 AGGREGATE ON FIRM SUBGRADE.
2. #57 AGGREGATE MATERIAL SHALL BE EXTENDED FROM 6-INCHES UNDERNEATH BOTTOM OF STRUCTURE TO SUBGRADE (STORM ONLY).
3. CONNECTION BETWEEN MANHOLE WALL AND PIPE BE NON-SHRINK GROUT (STORM) OR COMPRESSION TYPE RUBBER GASKET (SANITARY SEWER).
4. MANHOLE STEPS SHALL BE AS INDICATED ON DETAIL G-5.21.
5. MANHOLE COVER SHALL BE AS SPECIFIED ON DETAIL G-5.51, G-5.52, & G-5.53.
6. PROVIDE TWO APPLICATIONS OF BITUMINOUS MATERIAL (MINIMUM 16 MILS DFT) COATING ON EXTERIOR SURFACE OF MANHOLES (SANITARY SEWER ONLY).
2 7. MANHOLE CHANNELS SHALL BE FORMED TO PROVIDE A SMOOTH HYDRAULIC TRANSITION BETWEEN PIPES. BENCH SHALL BE TO TOP OF PIPE OR AS SHOWN ON CONTRACT DOCUMENTS. SANITARY SEWER MANHOLE CHANNEL AND BENCH SHALL BE PRECAST OR FORMED FROM SEWER BRICK SET ON EDGE. STORM DRAIN MANHOLE CHANNELS SHALL BE SEWER BRICK SET ON EDGE.
8. MANHOLE SHALL BE IN ACCORDANCE WITH ASTM C-478 EXCEPT AS INDICATED.
2 9. MAXIMUM SANITARY SEWER INVERT DIFFERENTIAL IS 6 INCHES WITHOUT A DROP CONNECTION. SEE DETAIL S-1.32 FOR DROP CONNECTION DETAILS.
10. THE MINIMUM DISTANCE BETWEEN PIPE OPENINGS IN THE WALL OF THE MANHOLE SHALL BE 12 INCHES.
11. A MINIMUM OF 4" SHALL BE PROVIDED BETWEEN MANHOLE FLOOR AND LOWEST PIPE INVERT.
12. PRECAST RINGS MAY BE SUPPLIED IN PLACE OF BRICK MASONRY COURSES. SEE DETAIL G-5.50.
13. MANHOLE INTERMEDIATE LANDINGS SHALL BE AS INDICATED ON DETAIL G-5.16.
2 14. SEE DETAIL D-4.01 FOR GRANITE BOTTOM WHEN INVERT DIFFERENTIAL IS EQUAL OR GREATER THAN 6' FOR STORM DRAIN MANHOLES.

7/17/2015
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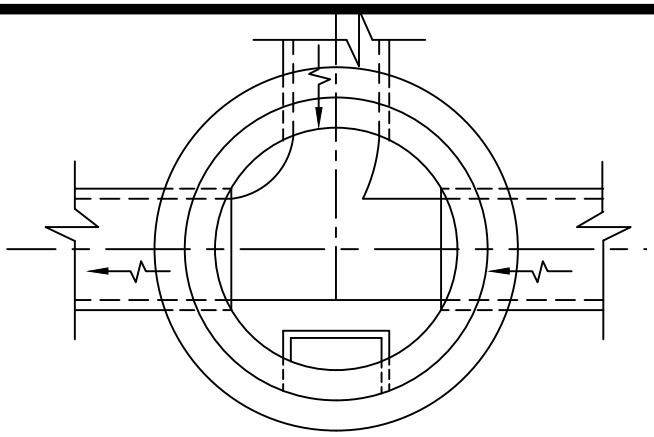
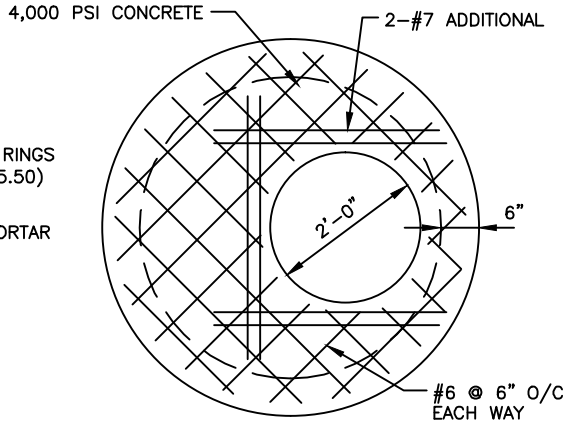
2 X/XX/2015 Revised 5/1/2014 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	PRECAST MANHOLE Notes	Detail G-5.11



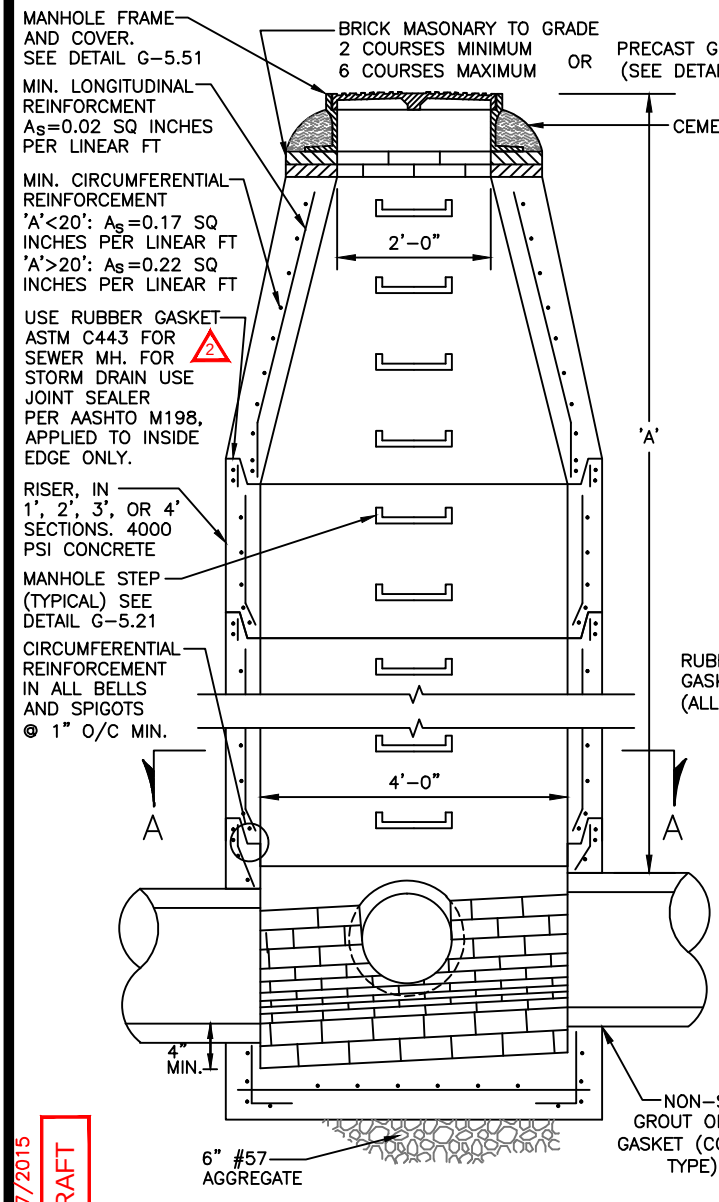
SECTION A–A

NOTES:

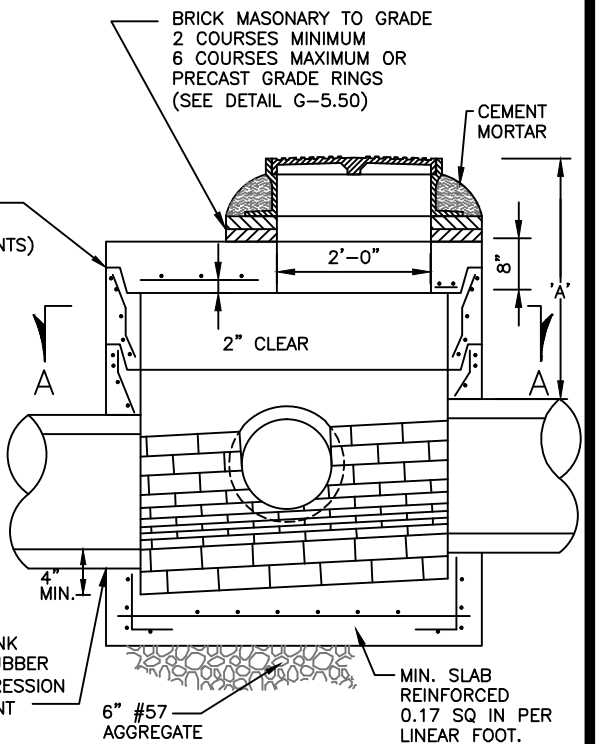
1. SEE GENERAL NOTES APPLICABLE TO ALL PRECAST MANHOLES ON DETAIL G–5.11.
2. FOR PIPE SIZES 27" TO 36" USE DETAIL G–5.13
3. WHERE 'A' (COVER) IS MORE THAN 4.5 FEET USE STANDARD PRECAST MANHOLE.
4. MAXIMUM INVERT DIFFERENTIAL FOR SANITARY SEWER IS 6" WITHOUT DROP CONNECTION. (SEE DETAIL S–1.32 FOR DROP CONNECTION)
5. SEE DETAIL D–4.01 REQUIREMENT FOR GRANITE BOTTOM.



SLAB REINFORCING SHALLOW PRECAST MANHOLE



STANDARD PRECAST MANHOLE



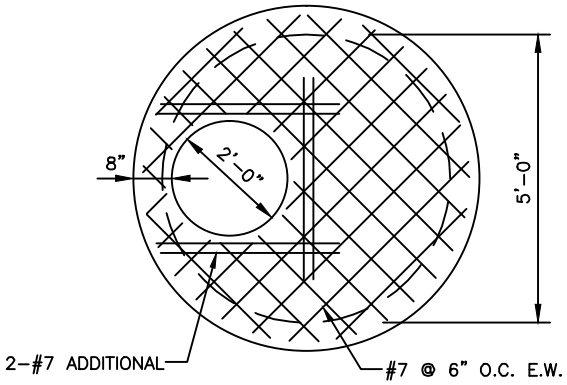
2 SHALLOW PRECAST MANHOLE

7/17/2015 DRAFT

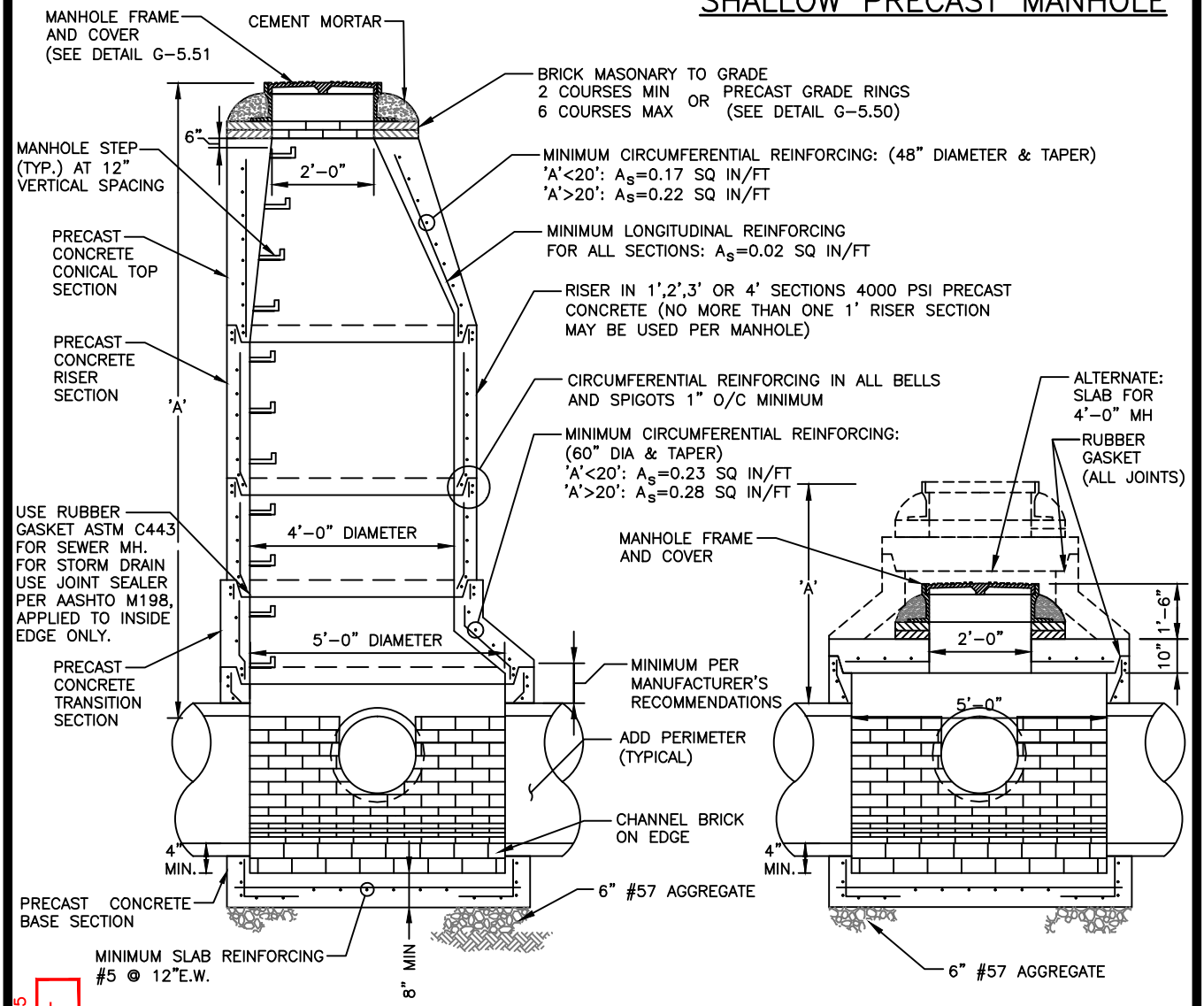
2 X/X/2015 Revised 5/1/2014 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: \\N\13767\Final Volume 4\signatures.bmp Chief, Bureau of Engineering	PRECAST MANHOLE Standard and Shallow 4'–0" for 24" Pipe and smaller	Detail G–5.12

NOTES: 1

1. SEE GENERAL NOTES APPLICABLE TO ALL PRECAST MANHOLES ON DETAIL G-5.11.
2. FOR PIPE SIZES 24" AND SMALLER USE DETAIL G-5.12
3. WHERE 'A' IS LESS THAN 4.5 FEET USE SHALLOW MANHOLE.
4. MAXIMUM INVERT DIFFERENTIAL FOR SANITARY SEWER IS 6" WITHOUT DROP CONNECTION. (SEE DETAIL S-1.32 FOR DROP CONNECTION)
5. SEE DETAIL G-5.21 FOR STEPS.
6. FOR PIPES LARGER THAN 36" DIAMETER, THE MANHOLE SHALL BE DESIGNED AND DETAILED IN CONSTRUCTION DOCUMENTS.



SLAB REINFORCING SHALLOW PRECAST MANHOLE

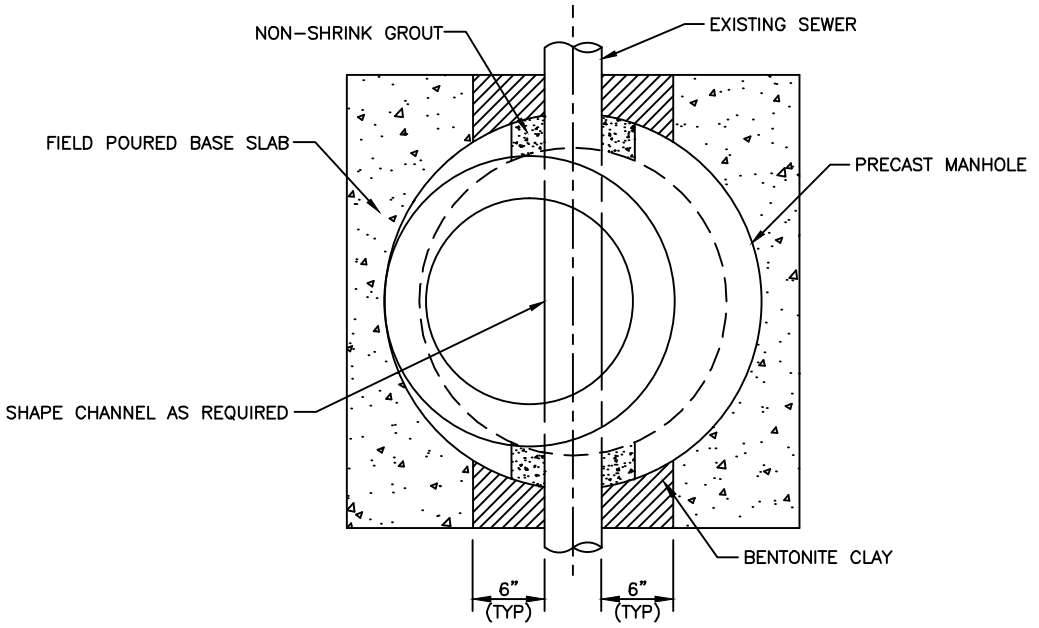


7/17/2015 DRAFT

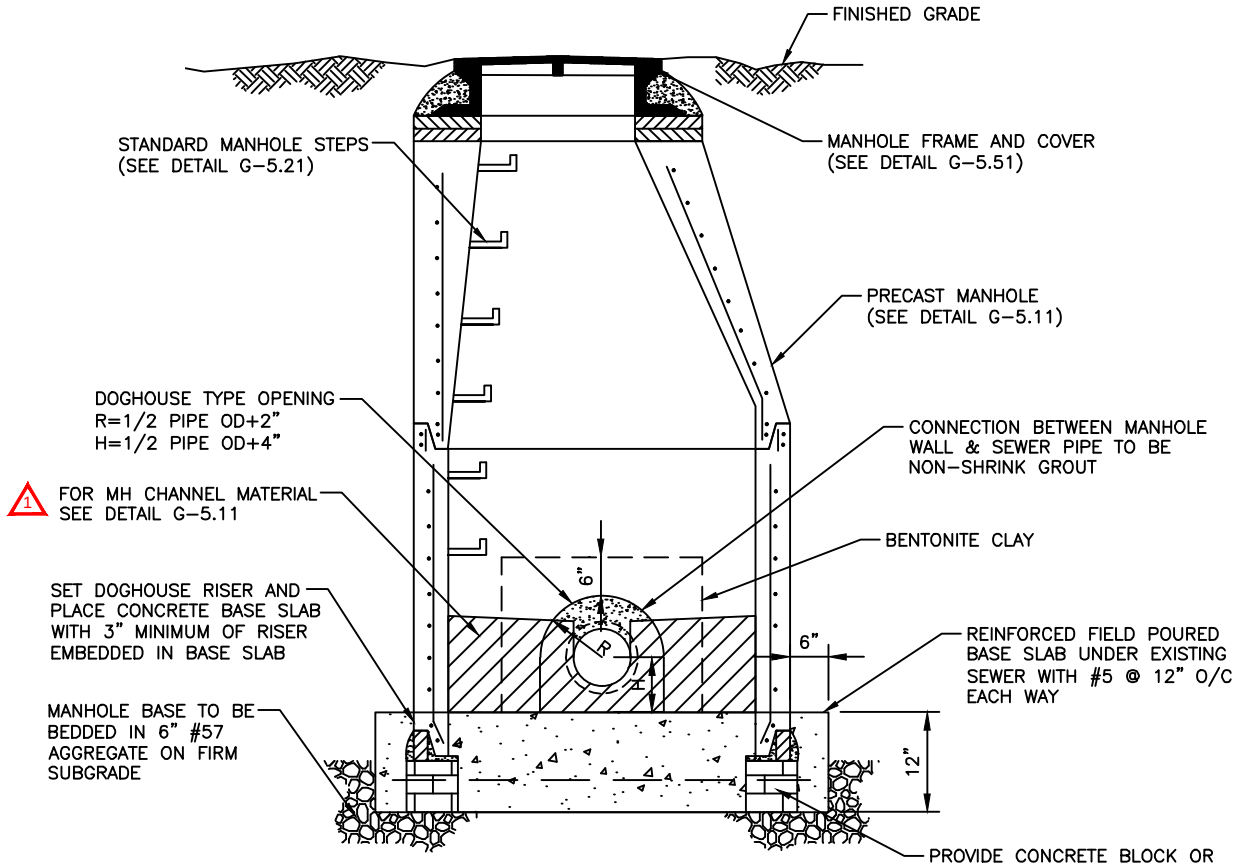
1 STANDARD PRECAST MANHOLE

1 SHALLOW PRECAST MANHOLE

1 Revised 7/17/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: h:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	PRECAST MANHOLE Standard and Shallow 5'-0" for 27" to 36" Pipe	Detail G-5.13



1 PLAN



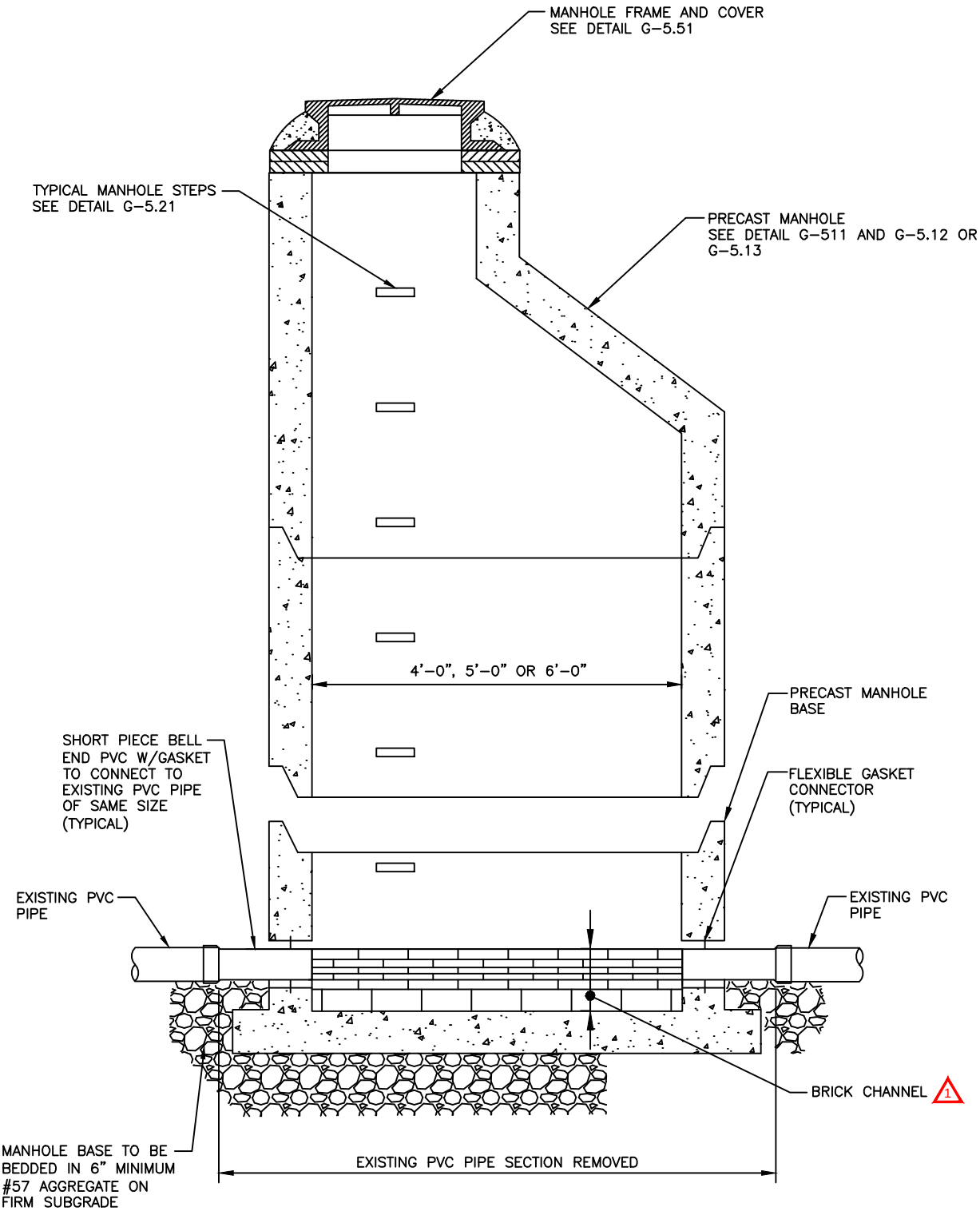
ELEVATION

NOTES

1. SEE DETAIL G-5.11 FOR GENERAL NOTES APPLICABLE TO ALL PRECAST MANHOLES.
2. SEE DETAIL G-5.13 FOR MANHOLE DETAILS FOR PIPES 27 INCHES TO 36 INCHES.

7/17/2015
DRAFT

Revised	Howard County, Maryland	PRECAST MANHOLE	Detail
1 X/XX/2015	Department of Public Works	Doghouse Over Existing Sewer	G-5.14
Approved 5/7/2007	Approved: N:\13767\Final Volume 4\signature.bmp	24" Pipe and Smaller	
Approved	Chief, Bureau of Engineering		



7/17/2015

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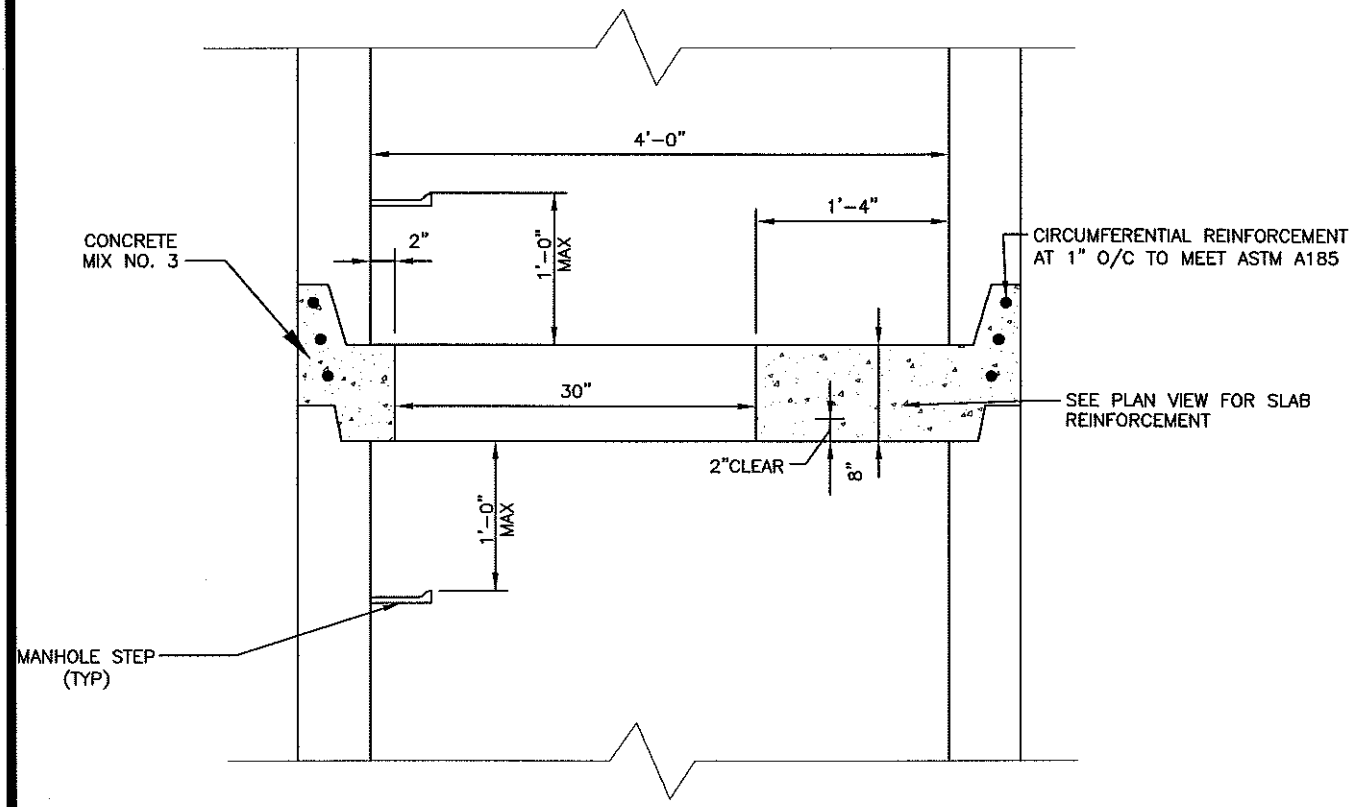
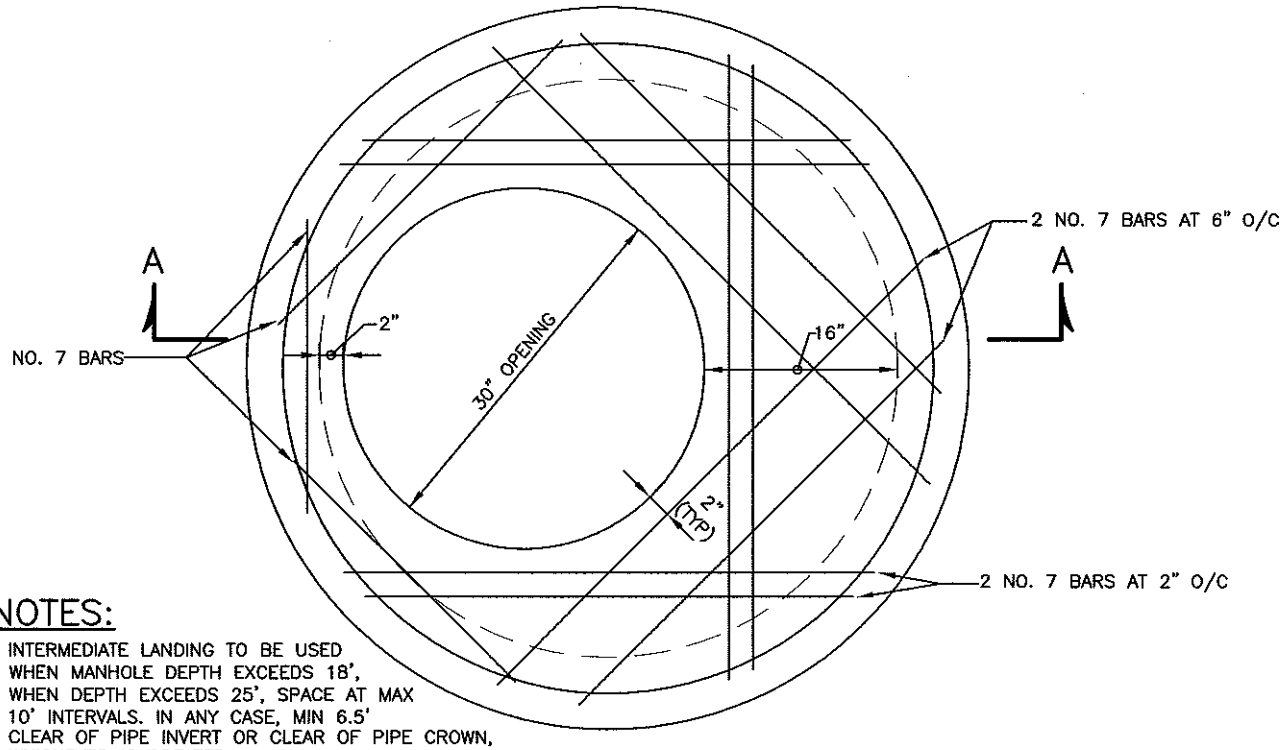
Revised	Howard County, Maryland	PRECAST MANHOLE	Detail
1 X/XX/2015	Department of Public Works	Over Existing Plastic Sewer	G-5.15
Approved 5/7/2007	Approved: N:\13767\Final Volume 4\signature.bmp		
Approved	Chief, Bureau of Engineering		



SECTION A-A



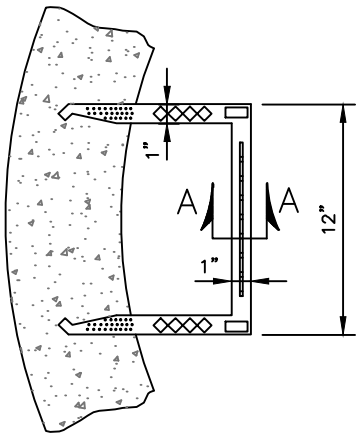
PLAN

NOTES:

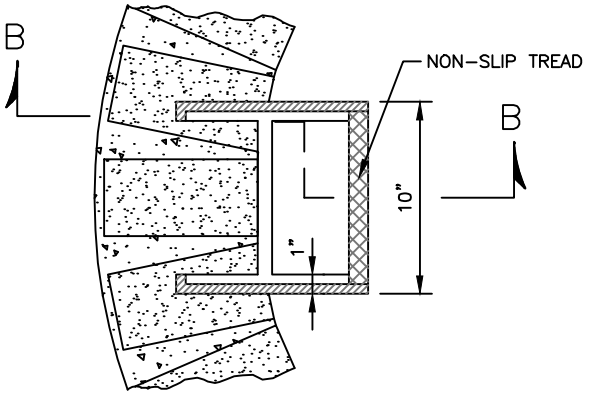
1. INTERMEDIATE LANDING TO BE USED WHEN MANHOLE DEPTH EXCEEDS 18', WHEN DEPTH EXCEEDS 25', SPACE AT MAX 10' INTERVALS. IN ANY CASE, MIN 6.5' CLEAR OF PIPE INVERT OR CLEAR OF PIPE CROWN, WHICHEVER IS GREATER.
2. SEE GENERAL NOTES APPLICABLE TO ALL PRECAST MANHOLES ON DETAIL G-5.11.

7/17/2015 DRAFT

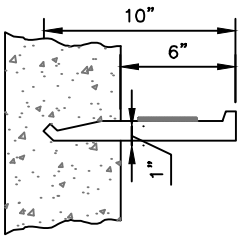
Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	PRECAST MANHOLE Intermediate Landing	Detail G-5.16



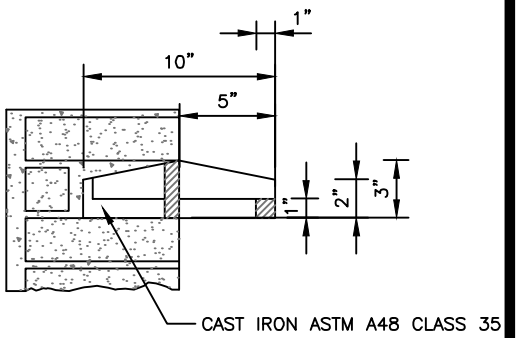
PLAN



PLAN

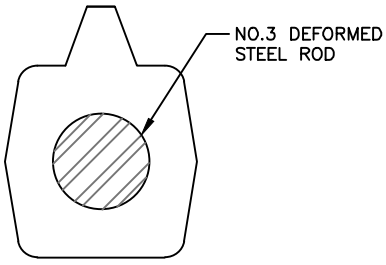


ELEVATION



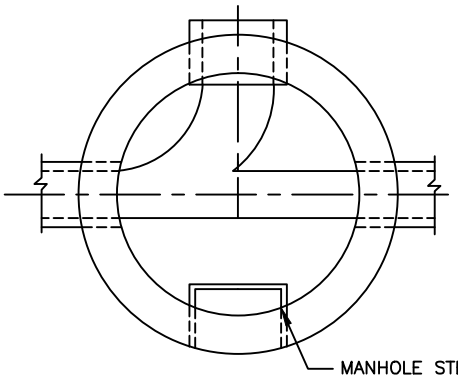
SECTION B–B

TYPE 2 CAST IRON STEP FOR BRICK MANHOLE



SECTION A–A

TYPE 1 POLYPROPYLENE PLASTIC CAOTED STEEL STEP & INLET FOR PRECAST MANHOLE



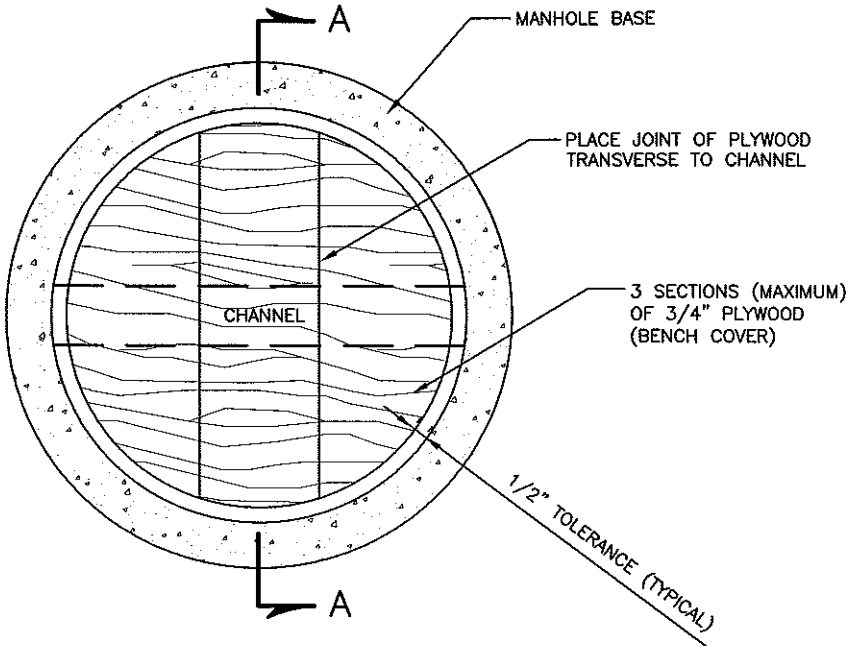
NOTES: 1

1. STEPS SHALL BE DESIGNED SO THAT FEET CANNOT SLIP OFF THE END.
2. STEPS SHALL BE ALIGNED TO FORM A CONTINUOUS LADDER WITH STEPS EQUALLY SPACED VERTICALLY AT A DISTANCE OF 12" APART.
3. BOTTOM STEP SHALL BE A MAXIMUM 12" ABOVE THE TOP OF BENCH.
4. THE TOP STEP SHALL BE 2'–0" BELOW THE TOP OF MANHOLE FRAME AND COVER FOR BRICK MANHOLES AND 6" BELOW TOP OF THE PRECAST SECTION OF THE MANHOLE.
5. LINE UP FRAME AND COVER WITH STEPS.
6. STEPS ARE REQUIRED IF THE VERTICAL DISTANCE FROM OPENING TO THE LOWEST PIPE INVERT IS GREATER OR EQUAL TO 3.5'.

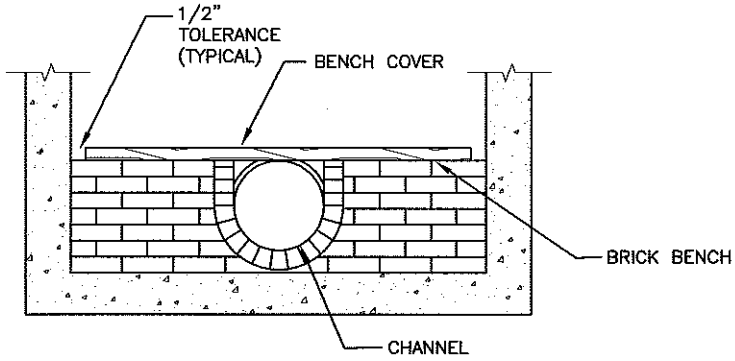
7/17/2015

DRAFT

Revised 1 7/17/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signatures.bmp Chief, Bureau of Engineering	MANHOLE & INLET Steps	Detail G-5.21



PLAN



SECTION A–A

NOTES:

1. PIPE LINES AND APPURTENANCES SHALL BE KEPT CLEAN DURING CONSTRUCTION AND UNTIL FINAL ACCEPTANCE.

2. THE TEMPORARY PROTECTIVE CHANNEL COVER SHALL BE PLACED AT TIME OF IN–SERVICE, REMOVED AND/OR REPLACED, AS REQUIRED FOR TELEVISION INSPECTION, AND REMOVED AT THE TIME OF FINAL INSPECTION.

7/17/2015
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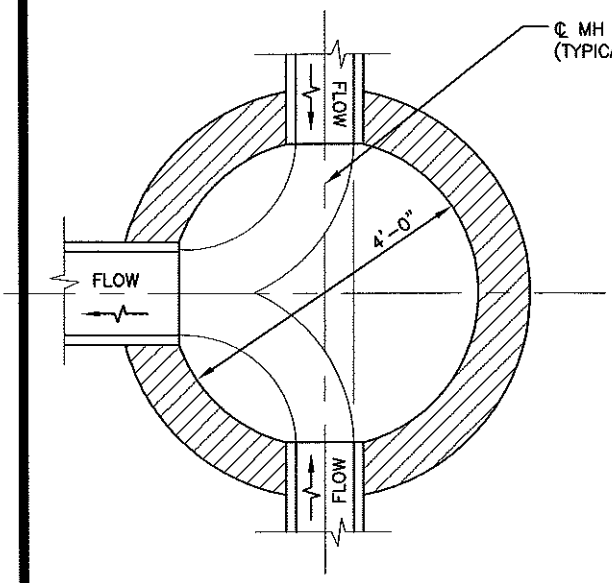
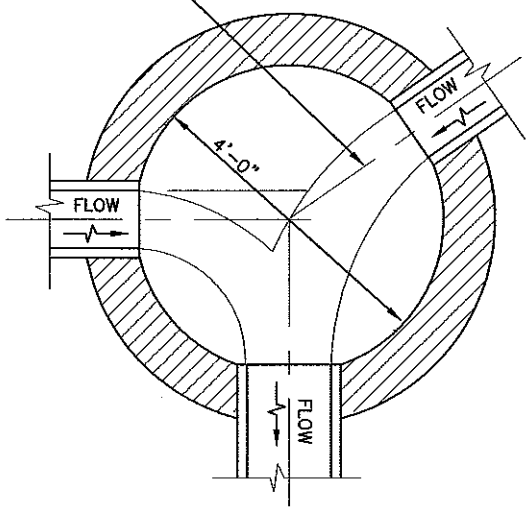
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Temporary Protective Bench Cover	Detail G–5.22



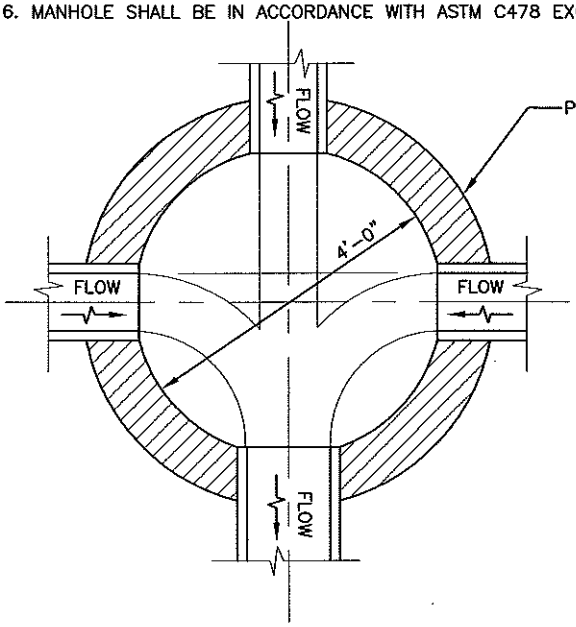
TYPE "A"



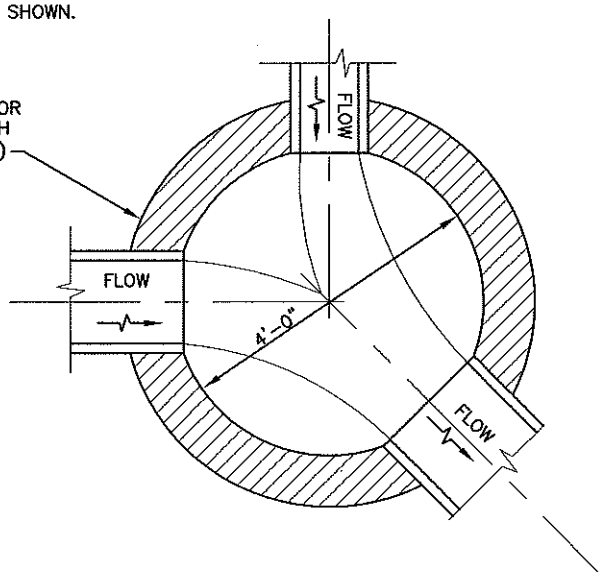
TYPE "B"

CHANNEL LINING NOTES

1. CHANNEL LININGS SHALL BE FORMED USING SEWER BRICK (ASTM C32, GRADE SM, SIZE NO.1) OR PRECAST CONCRETE BY MANHOLE MANUFACTURER. USE NON-REINFORCED 3500 PSI CONCRETE FOR PRECAST CHANNEL.
2. CHANNEL SHALL PROVIDE SMOOTH HYDRAULIC TRANSITION BETWEEN PIPES, INCLUDING MATCHING INSIDE DIAMETER OF PIPES.
3. MINIMUM CENTERLINE CHANNEL RADIUS SHALL BE 2.5 TIMES OUTLET PIPE DIAMETER.
4. MAXIMUM ALLOWABLE NUMBER OF CHANNELS IS FOUR (4) – SEE TYPE "C".
5. THE CENTERLINE OF ALL PIPES ENTERING A MANHOLE SHALL INTERSECT WITHIN 11" OF THE LOGITUDINAL AXIS OF THE MANHOLE BARREL (CENTER) AND SHALL BE AS DETAILED ON THE CONTRACT DRAWINGS.
6. MANHOLE SHALL BE IN ACCORDANCE WITH ASTM C478 EXCEPT AS SHOWN.



TYPE "C"



TYPE "D"

7/17/2015
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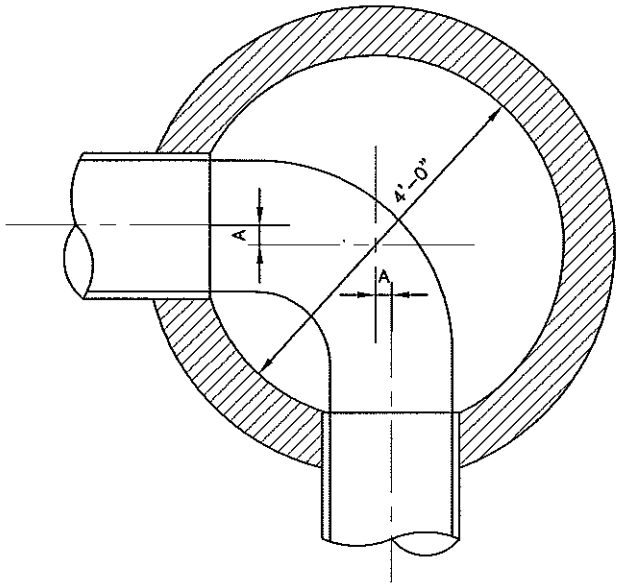
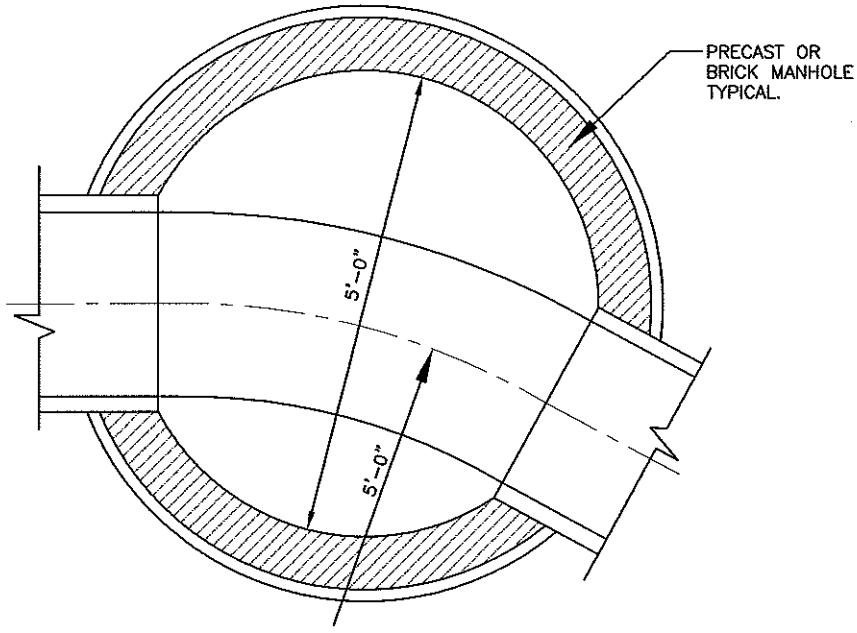
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Manhole Channel Configuration Types A, B, C & D	Detail G-5.31



TYPE E



TYPE G

NOTES:

1. ALL NOTES ON DETAIL G-5.31 APPLY HERE.
2. THE "A" DIMENSIONS SHALL BE AS SHOWN ON THE CONTRACT DRAWINGS.
3. TYPE "G" CHANNELS ARE APPLICABLE TO 18, 21, AND 24-INCH DIAMETER SEWERS.
4. ℄ CHANNEL RADIUS SHALL BE MIN 2.5 TIMES OUTLET PIPE DIAMETER

7/17/2015

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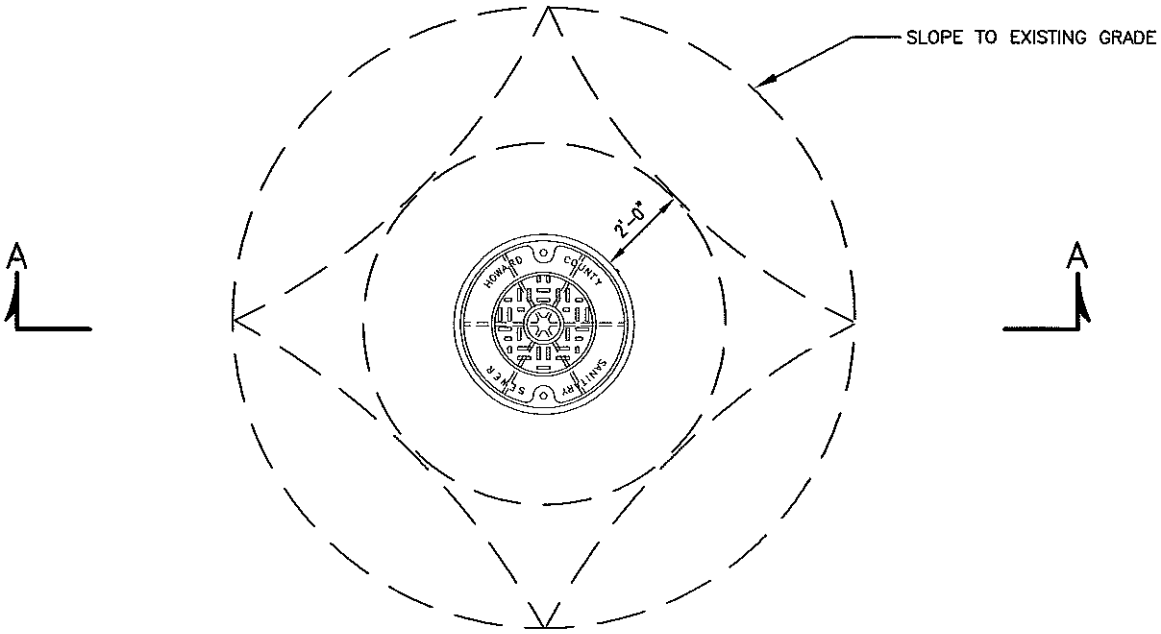
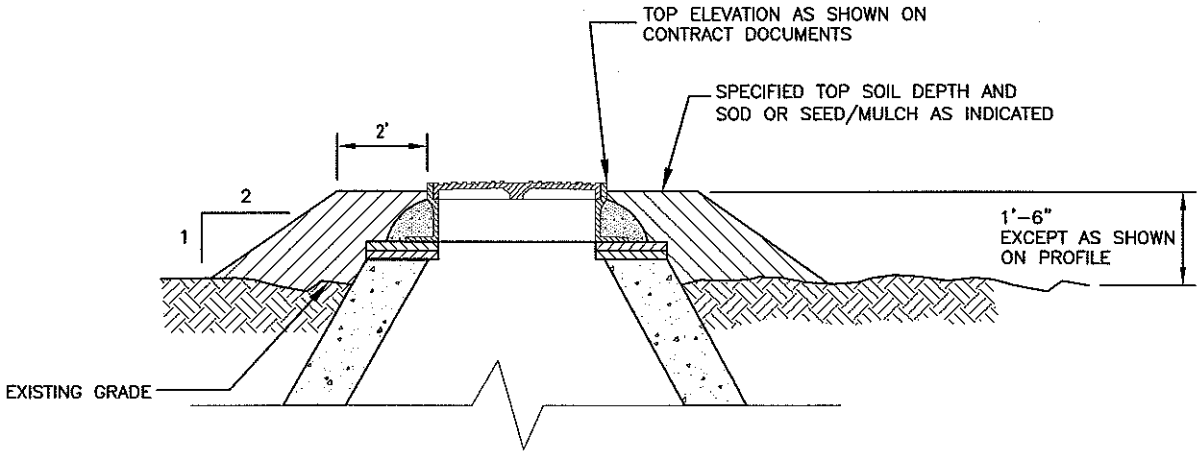
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Manhole Channel Configuration Types E & G	Detail G-5.32



PLAN



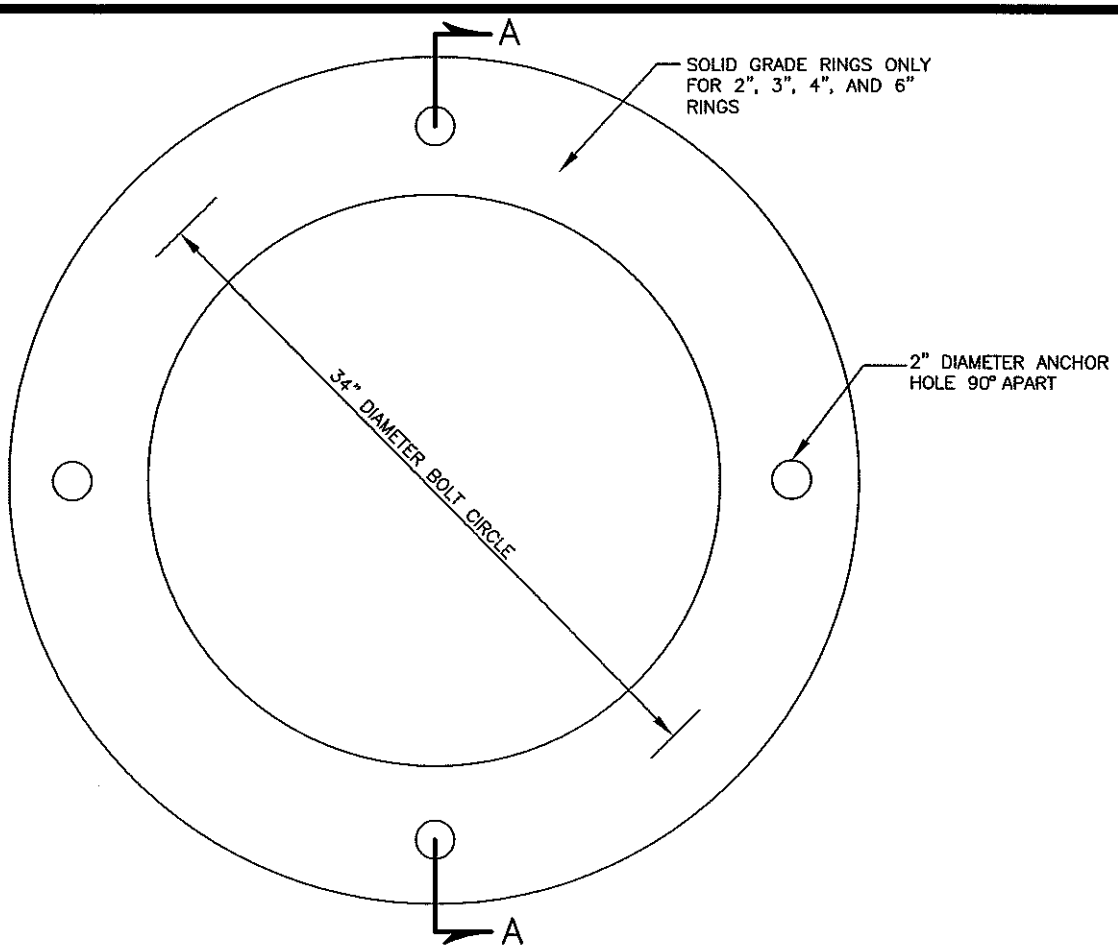
SECTION A–A

NOTES:

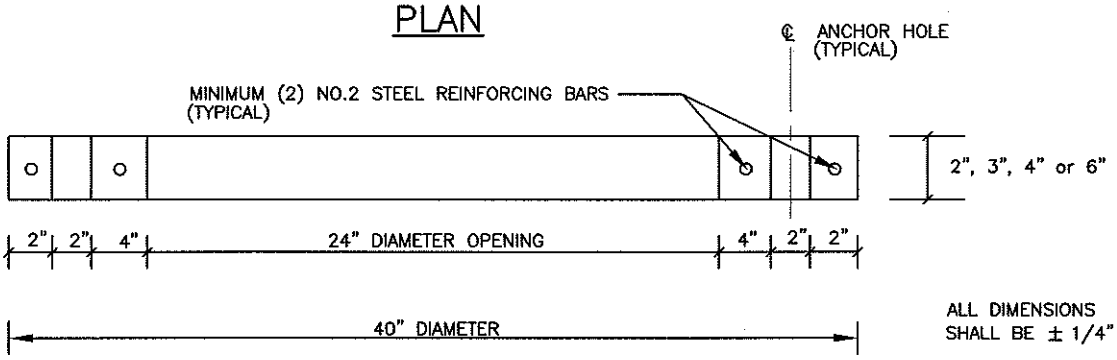
1. MANHOLE FRAME AND COVER SHALL BE FLUSH WITH GRADE EXCEPT WHEN SHOWN ON PROFILE TO BE SET HIGHER THAN GRADE.
2. WHERE MANHOLE FRAME AND COVER TO BE SET HIGHER THAN GRADE WITHOUT INDICATING HEIGHT SHALL BE SET 1'–6" ABOVE GRADE IN ACCORDANCE WITH THIS DETAIL.
3. MANHOLE FRAME AND COVER TO BE SET HIGHER THAN 1'–6" ABOVE GRADE SHALL BE SET AS NOTED ON THE PROFILE AND GRADED IN ACCORDANCE WITH THIS DETAIL.

7/17/2015 DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Manhole Special Backfill	Detail G–5.41



PLAN



SECTION A–A

NOTES:

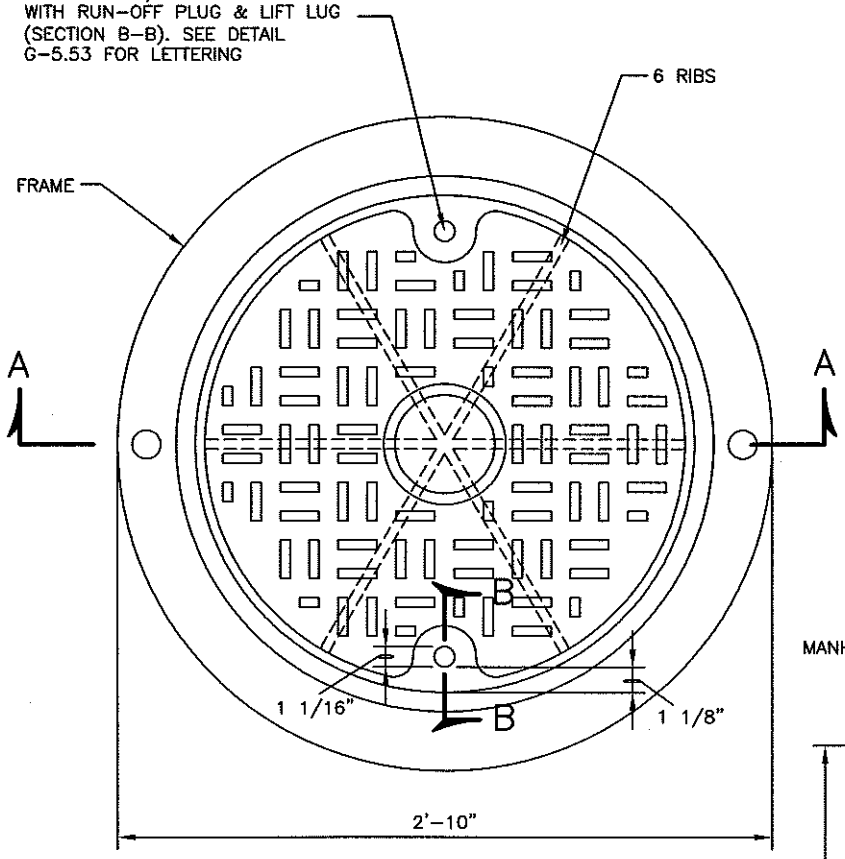
1. PRECAST CONCRETE, f'c= 5,000 PSI AT 28 DAYS.
2. REINFORCEMENT SHALL CONFORM TO ASTM C478.
3. CAST LIFT LUGS REQUIRED FOR 4" AND 6" RINGS.
4. GRADE RINGS SHALL BE FLAT AND TRUE WITHIN 1/4".
5. USE BEVELED GRADE RINGS TO ACCOMODATE ROAD SLOPE.
6. NUMBER OF GRADE RINGS SHALL NOT EXCEED FOUR, REGARDLESS OF SIZE. A MINIMUM OF ONE GRADE RING SHALL BE USED IN THE ABSENCE OF THE MINIMUM 2 BRICK COURSES.
7. TWO FLEXIBLE GASKETS OF BUTYL ROPE, TYPE B, 3/4 INCH MINIMUM DIAMETER, CONFORMING TO AASHTO M198 SHALL BE USED BETWEEN RINGS, FRAME, AND MANHOLE TOP. GASKETS SHALL BE PLACED BOTH INSIDE AND OUTSIDE THE BOLT CIRCLE, AND MINIMUM OF 2" OVERLAP SHALL BE USED AT THE JOINTS.
8. THE DISTANCE BETWEEN THE MANHOLE FRAME AND MANHOLE PRECAST TOP SHALL NOT EXCEED 18 INCHES.

7/17/2015
DRAFT

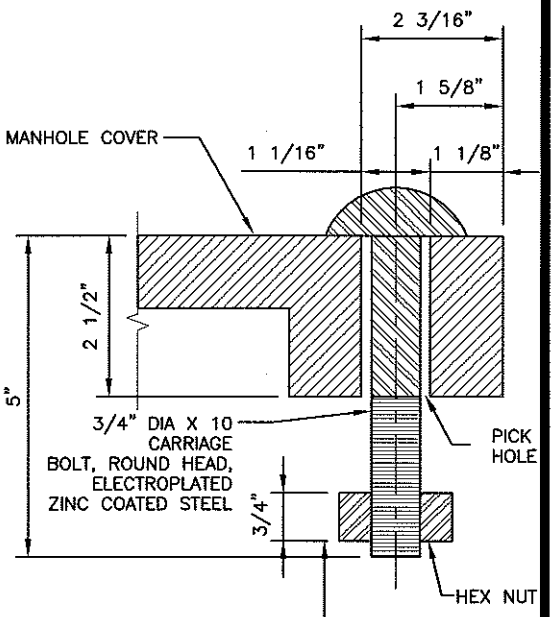
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Manhole Precast Adjustable Grade Rings	Detail G-5.50

NOTES:

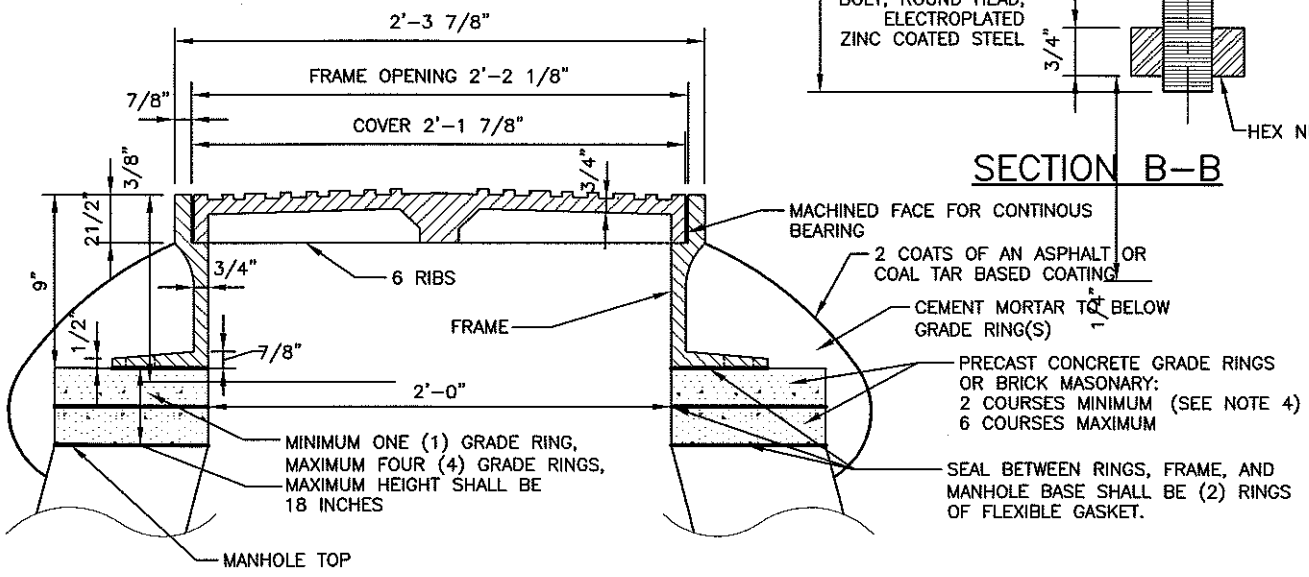
1. WEIGHT OF FRAME SHALL NOT BE LESS THAN 250 POUNDS.
2. WEIGHT OF COVER SHALL NOT BE LESS THAN 170 POUNDS.
3. MANHOLE FRAME AND COVER SHALL BE HEAVY DUTY AND BE CAST IRON MEETING ASTMA-48 CLASS 35B
4. PRECAST CONCRETE RINGS MAY BE USED IN PLACE OF BRICK MASONRY COURSES. A MINIMUM OF ONE GRADE RING AND MAXIMUM OF FOUR GRADE RINGS SHALL BE PROVIDED, WITH A MAX. TOTAL HIEGHT OF 18 INCHES FROM THE TOP OF THE MANHOLE TO BOTTOM OF FRAME, SEE DETAIL G-5.50. GRADE RINGS SHALL BE BEVELED WHEN NECESSARY TO ACCOMODATE ROAD SLOPE.
5. SEE DETAILS G-5.11 FOR GENERAL NOTES.



PLAN



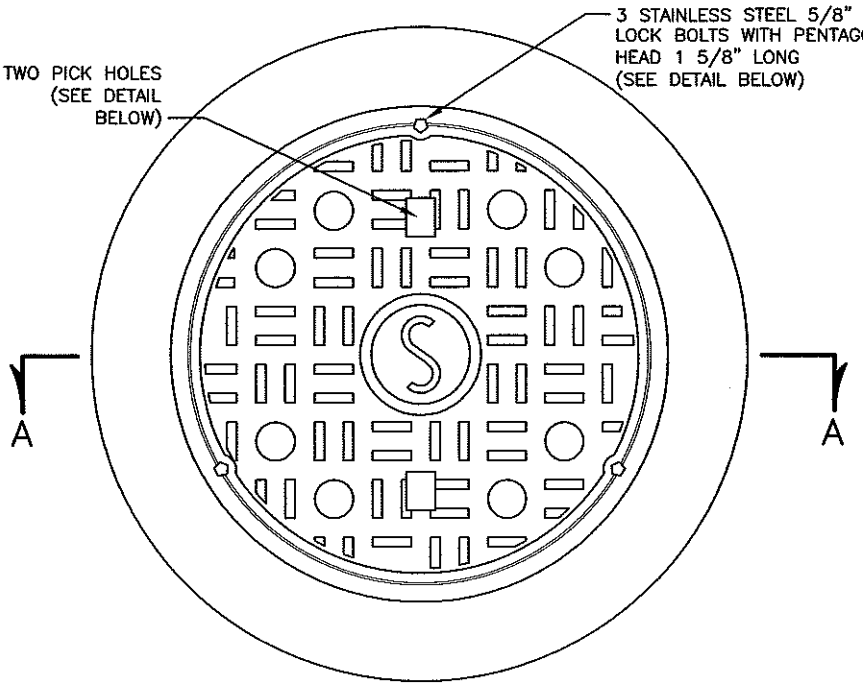
SECTION B-B



SECTION A-A

7/17/2015
DRAFT

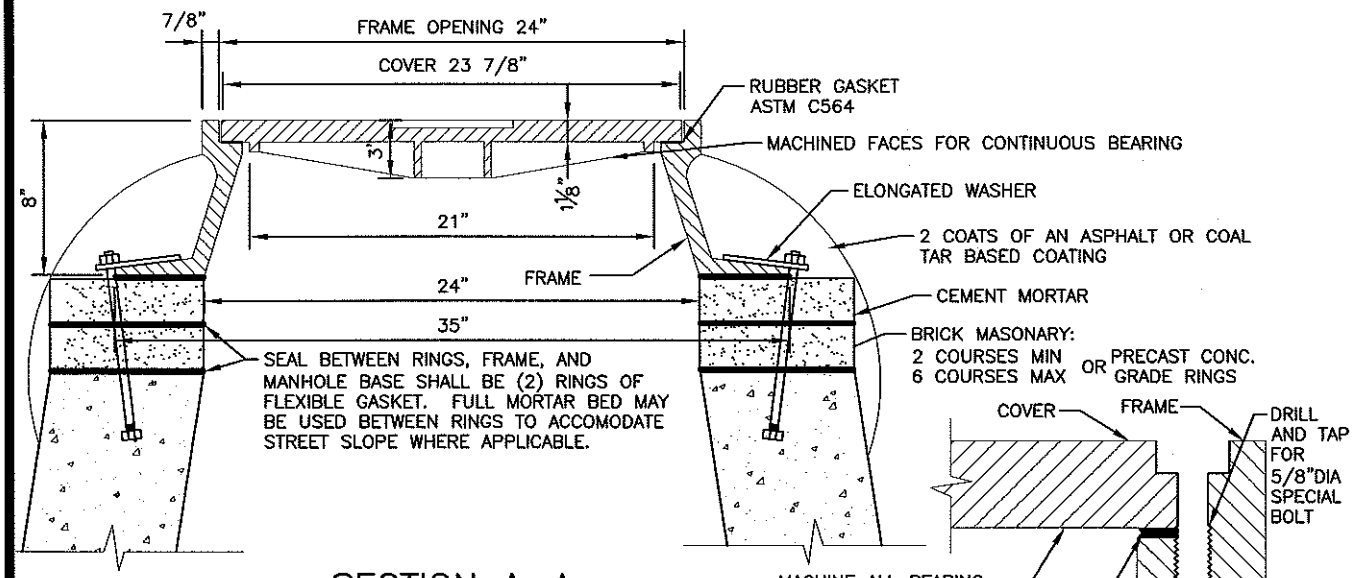
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Manhole Heavy Traffic Frame and Cover	Detail G-5.51



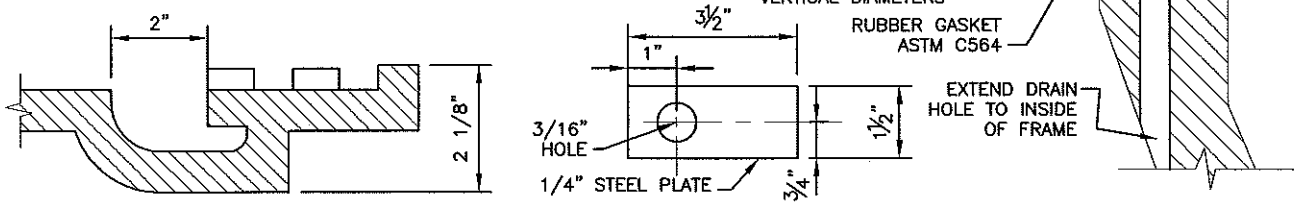
PLAN

NOTES:

1. WIEGHT OF FRAME SHALL NOT BE LESS THAN 215 POUNDS.
2. WEIGHT OF COVER SHALL NOT BE LESS THAN 170 POUNDS.
3. TOTAL WEIGHT SHALL NOT BE LESS THAN 385 POUNDS.
4. MANHOLE FRAME AND COVER TO BE CAST IRON, ASTM CLASS 35B.
5. FASTEN ANCHOR BOLTS TO MANHOLE WITH NON-SHRINK GROUT. FOR PRECAST MANHOLES PROVIDE RECESS FOR ANCHOR BOLTS AS SHOWN.
6. MINIMUM ONE (1), MAXIMUM FOUR (4) GRADE RINGS, MAXIMUM HEIGHT SHALL BE 18 INCHES.
7. SEE DETAIL G-5.11 FOR GENERAL NOTES.



SECTION A–A



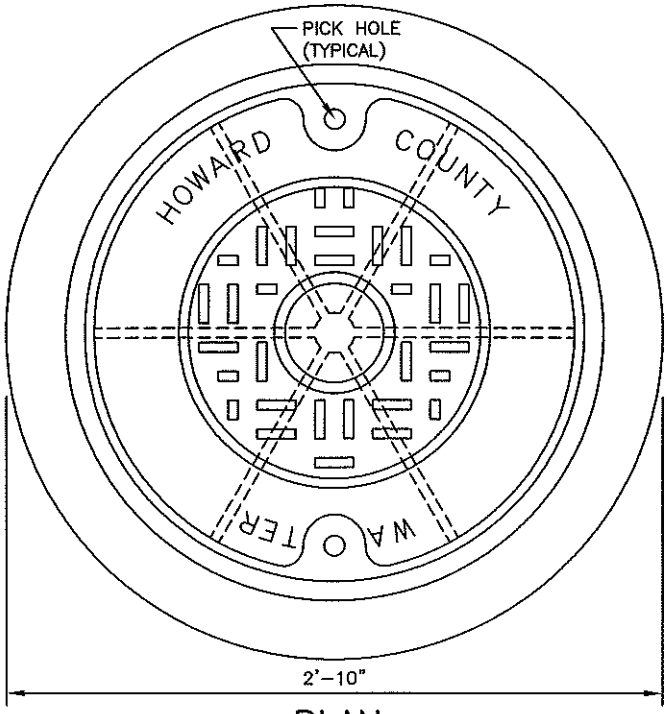
WATERTIGHT PICKHOLE

ELONGATED WASHER

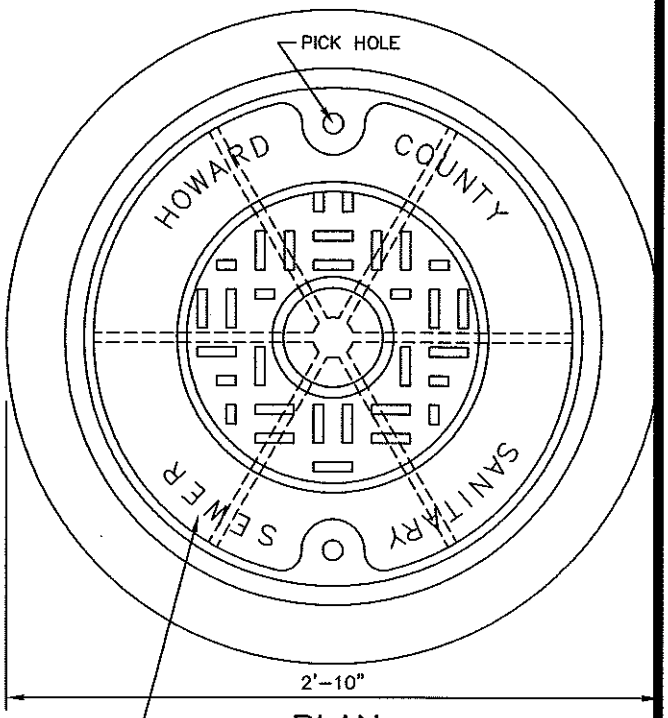
TAP AND GASKET

7/17/2015
DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Manhole Watertight Frame & Cover	Detail G-5.52



PLAN



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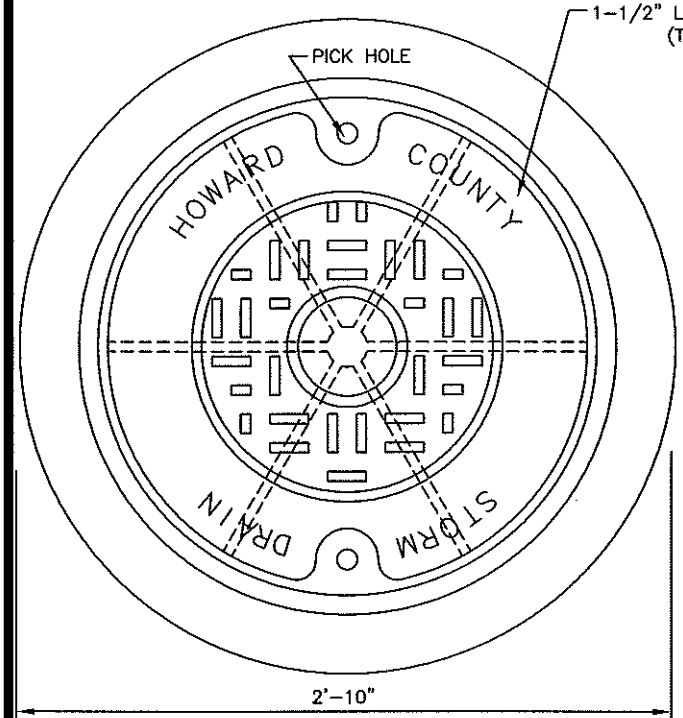

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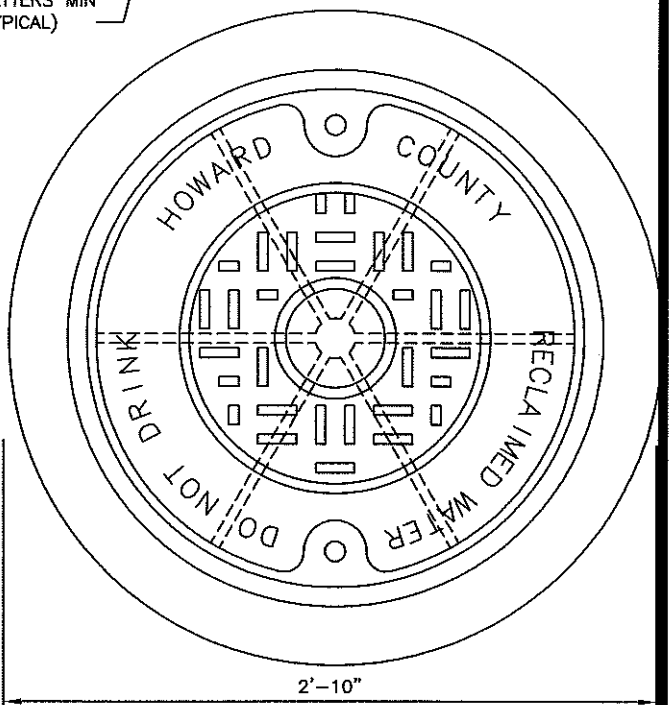

PLAN

NOTES:

1. FOR FRAME AND COVER ASSEMBLY, AND NOTES SEE DETAIL G-5.51.

7/17/2015
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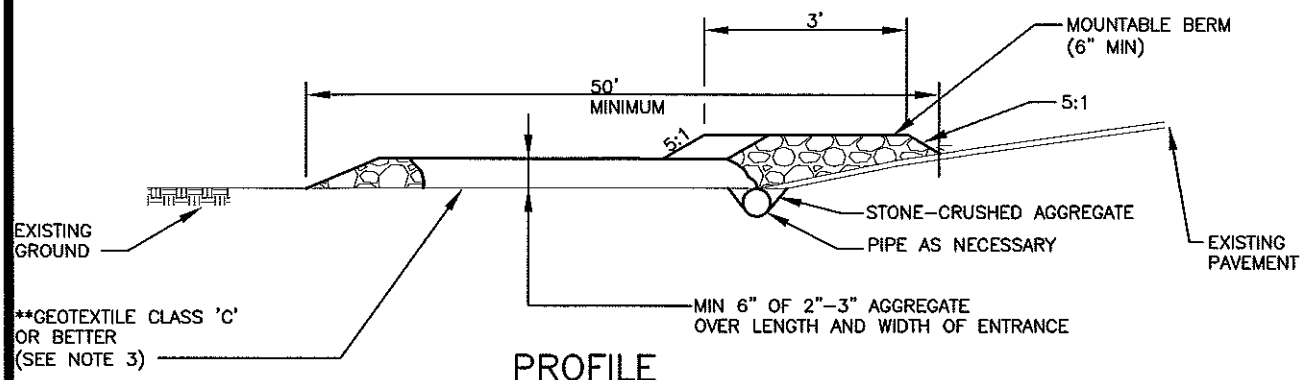
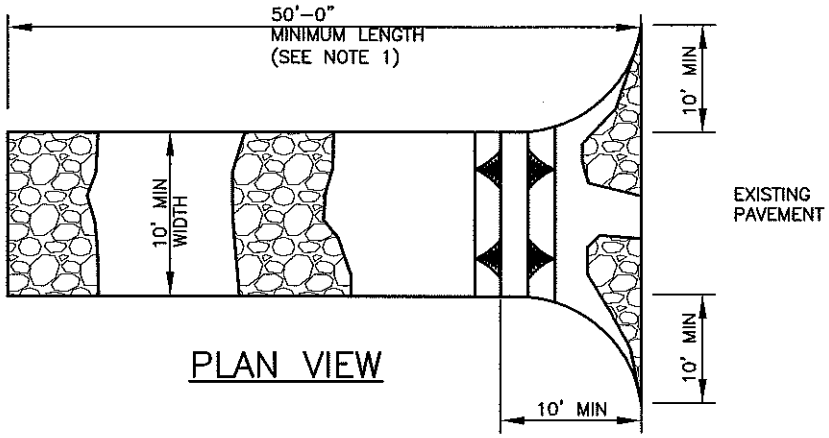
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Manhole Cover Lettering	Detail G-5.53



PROFILE



PLAN VIEW

NOTES:

1. LENGTH – MINIMUM OF 50' (30' FOR SINGLE RESIDENCE LOT).
2. WIDTH – 10' MINIMUM SHOULD BE FLARED AT THE EXISTING ROAD TO PROVIDE A TURNING RADIUS.
3. GEOTEXTILE FABRIC (FILTER CLOTH) SHALL BE PLACED OVER THE EXISTING GROUND PRIOR TO PLACING STONE. ** THE PLAN APPROVAL AUTHORITY MAY NOT REQUIRE SINGLE FAMILY RESIDENCES TO USE GEOTEXTILE.
4. STONE-CRUSHED AGGREGATE (2" TO 3") OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT SHALL BE PLACED AT LEAST 6" DEEP OVER THE LENGTH AND WIDTH OF THE ENTRANCE.
5. SURFACE WATER-ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED THROUGH THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE. PIPE INSTALLED THROUGH THE STABILIZED CONSTRUCTION ENTRANCE SHALL BE PROTECTED WITH A MOUNTABLE BERM WITH 5:1 SLOPES AND A MINIMUM OF 6" OF STONE OVER THE PIPE. PIPE HAS TO BE SIZED ACCORDING TO THE DRAINAGE. WHEN THE SCE IS LOCATED AT A HIGH SPOT AND HAS NO DRAINAGE TO CONVEY A PIPE WILL NOT BE NECESSARY. PIPE SHOULD BE SIZED ACCORDING TO THE AMOUNT OF RUNOFF TO BE CONVEYED. A 8" MINIMUM DIAMETER IS REQUIRED.
6. LOCATION- A STABILIZED CONSTRUCTION ENTRANCE SHALL BE LOCATED AT EVERY POINT WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES A CONSTRUCTION SITE. VEHICLES LEAVING THE SITE MUST TRAVEL OVER THE ENTIRE LENGTH OF STABILIZED CONSTRUCTION ENTRANCE.
7. STABILIZED CONSTRUCTION ENTRANCE SHALL BE PLACED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. ADDITIONAL ENTRANCES ARE PROHIBITED.

7/17/2015
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Revised Revised 1/2/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Stabilized Construction Entrance	Detail G-6.01

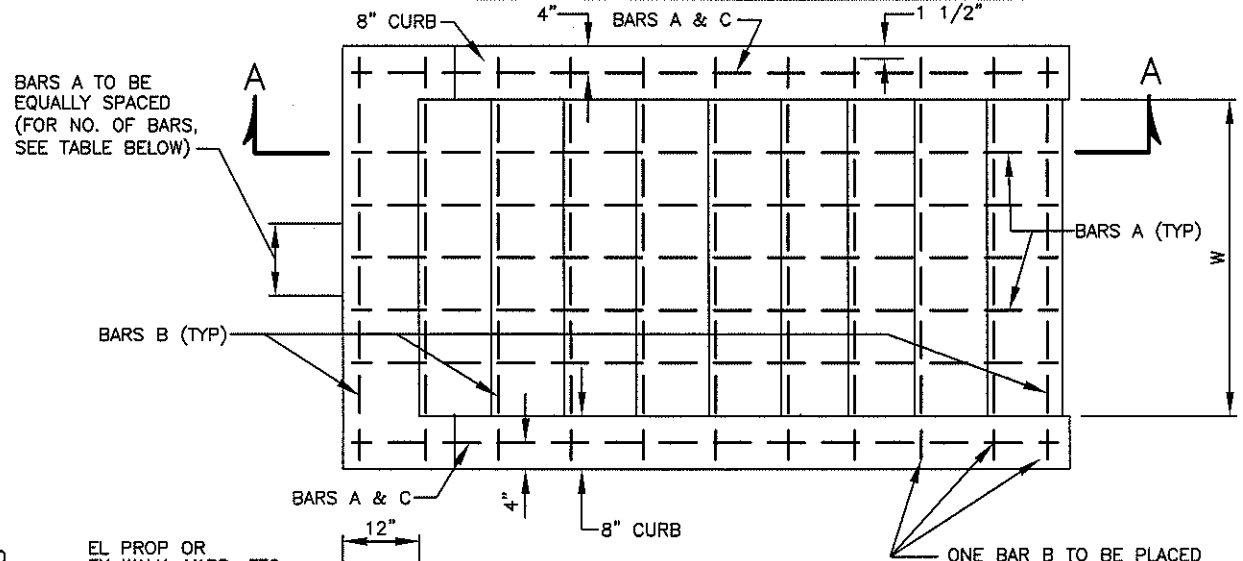
NOTES:

1. CONCRETE: MIX NO.2
2. CHAMFERS: 3/4"x3/4"
3. EXPOSED SURFACES: CLASS 1 SURFACE FINISH.
4. REINFORCING STEEL: A-15 WITH A-305 DEFORMATIONS.
5. ALL REINFORCING BARS SHALL BE NO.4 BARS EXCEPT NOSING BARS.
6. A, B, AND C BARS SHALL BE USED IN THE INSTALLATIONS OF SIX OR MORE STEPS.
7. NOSING BARS SHALL BE NO.2 BARS AND PLACED IN ALL STEPS REGARDLESS OF STAIR LENGTH. MINIMUM COVER 2 INCHES.
8. UNLESS OTHERWISE NOTED, ALL TREADS SHALL BE FINISHED WITH A LIGHTLY BROOMED SURFACE. PROVIDE MAXIMUM 2% WASH AT EXTERIOR LOCATIONS.
9. FOR RAILING DETAILS, SEE G-7.02 AND G-7.03.
10. THE STAIRS SHALL BE PAID FOR ON THE UNIT PRICE BID PER CUBIC YARD FOR "MIX NO.2 CONCRETE FOR MISCELLANEOUS STRUCTURES", COMPLETE IN PLACE OR ON A LUMP SUM BID FOR EACH "CONCRETE STAIRS", COMPLETE IN PLACE.

NUMBER OF BARS A									
	N=1-5	N=6	N=7	N=8	N=9	N=10	N=11	N=12	N=13-25
W=3'		4	5	5	6	6	7	7	8
W=4'		5	6	7	7	8	8	9	10
W=5'		6	7	8	9	9	10	11	12

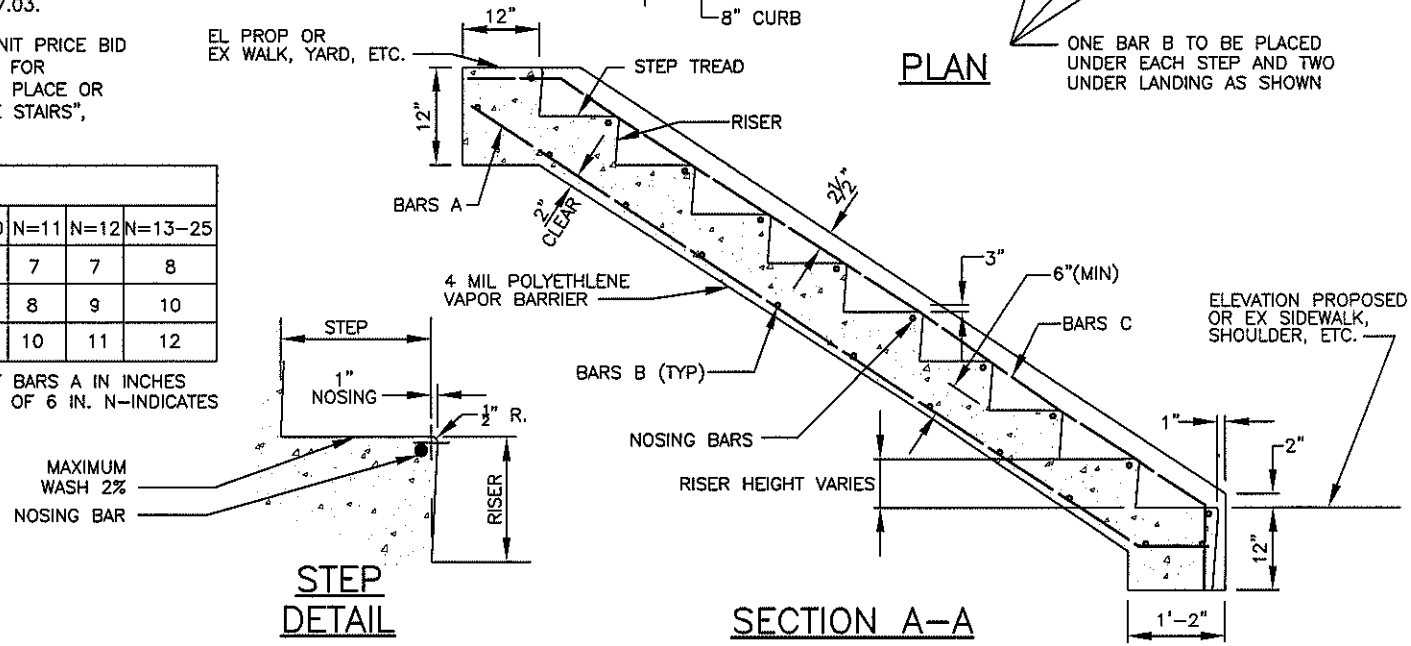
FOR OTHER WIDTHS, THE APPROX. SPACING OF BARS A IN INCHES WILL BE EQUAL TO 80/N WITH A MIN SPACING OF 6 IN. N-INDICATES NUMBER OF STEPS EXCLUSIVE OF LANDING.

STAIRWAYS		
SLOPE	RISER	STEP
1:1.57	7" MAX	11"
2:1	6"	12"
4:1	4" MIN	16"



PLAN

ONE BAR B TO BE PLACED UNDER EACH STEP AND TWO UNDER LANDING AS SHOWN



SECTION A-A

STEP DETAIL

7/17/2015 DRAFT

Revised

Revised 5/7/2007 Approved

Howard County, Maryland
Department of Public Works

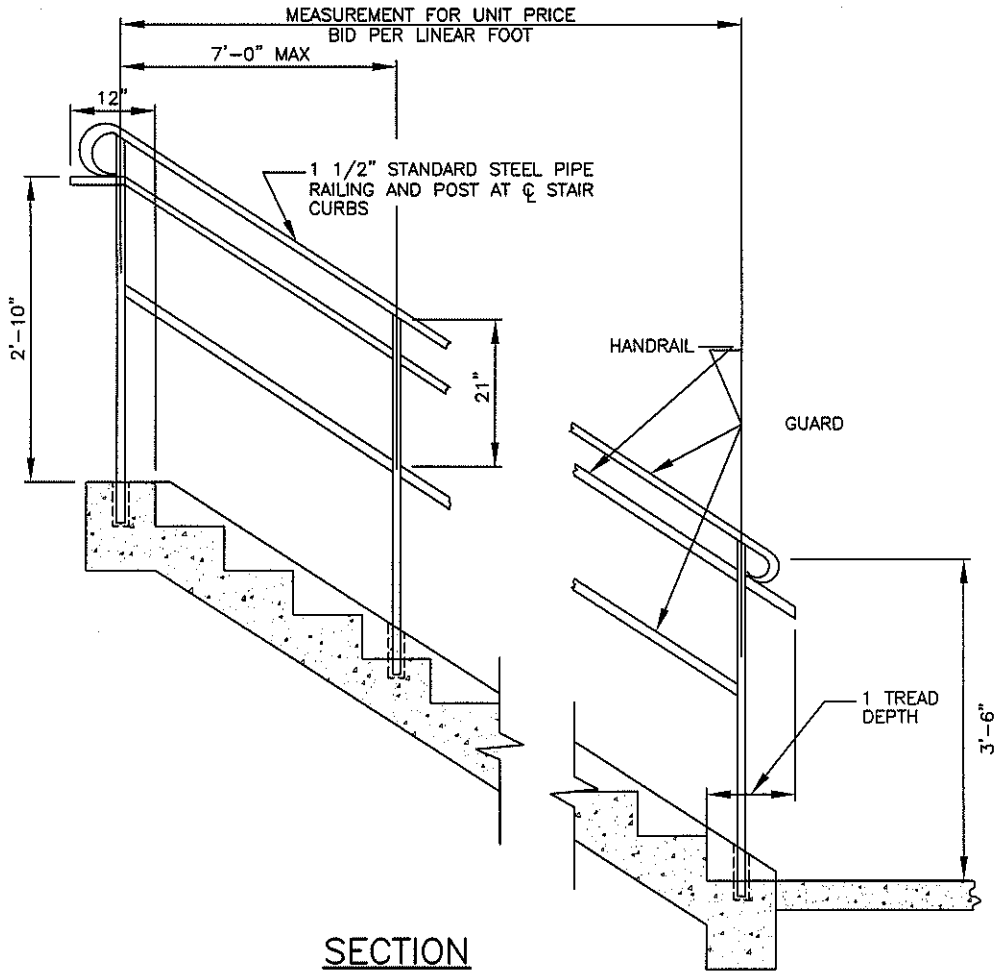
Approved: _____
Chief, Bureau of Engineering

Concrete Stairs

Detail
G-7.01

NOTES:

1. UNLESS OTHERWISE NOTED, PAINTED RAILINGS SHALL BE FURNISHED.
2. RAILING AND POSTS TO BE PAINTED SHALL CONFORM TO ASTM A120 STANDARD WEIGHT.
3. RAILING AND POSTS TO BE GALVANIZED SHALL CONFORM TO ASTM A441 SEE SPECIFICATIONS.
4. UNLESS OTHERWISE NOTED, RAILINGS SHALL BE FURNISHED FOR BOTH SIDES OF STAIRS AND ON ALL STAIRS HAVING 4 RISERS AND OVER.
5. RAILING SHALL BE ALL WELDED WITH ITS JOINTS GROUND SMOOTH AND FREE OF BURRS.
6. RAILING POSTS SHALL BE SET IN METAL SLEEVES, 6" DEEP AND FILLED WITH HOT POURED LEAD OR HOT POURED SULFUR OR AN EQUIVALENT EPOXY COMPOUND.
7. GALVANIZED RAILINGS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION.
8. PAINTED RAILINGS SHALL BE PAINTED IN ACCORDANCE WITH SECTION 912 OF THE SPECIFICATIONS.
9. THIS HANDRAIL IS TO BE USED ONLY AS A PROTECTION FOR PEDESTRIANS AND SHOULD NOT BE PLACED IN ANY LOCATION WHERE IT MIGHT BE SUBJECT TO VEHICULAR IMPACT. FOR VEHICULAR PROTECTION, STANDARD GUARD RAIL SHOULD BE USED.
10. THE RAILING SHALL BE PAID FOR AT THE UNIT PRICE BID PER LINEAR FOOT, MEASURED HORIZONTALLY, FOR "CONCRETE STAIRS PIPE RAILING" COMPLETE IN PLACE; OR ITS COST SHALL BE INCLUDED IN THE LUMP SUM PRICE BID FOR "CONCRETE STAIRS", COMPLETE IN PLACE.
11. THIS DETAIL IS APPLCABLE ONLY IN INDUSTRIAL SETTINGS WITH NO PUBLIC ACCESS. (EXAMPLE: PUMP STATIONS)



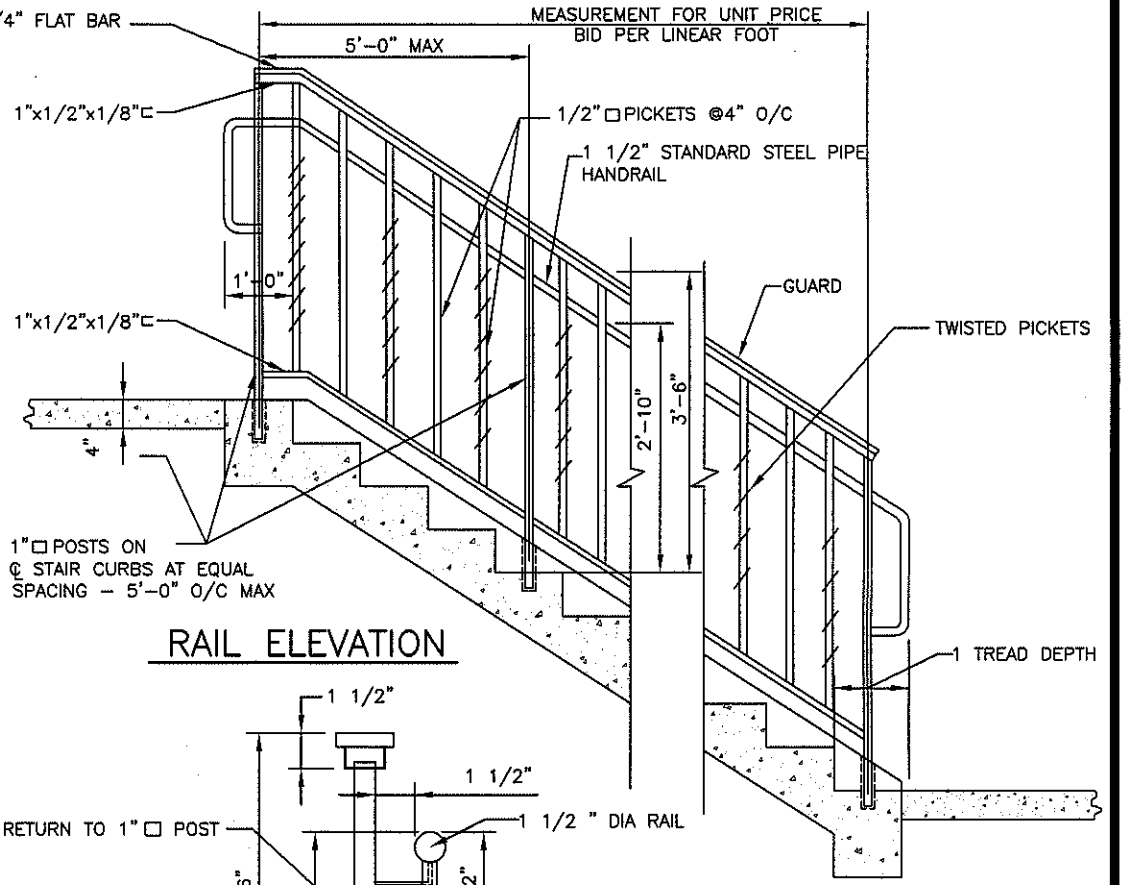
SECTION

7/17/2015
DRAFT

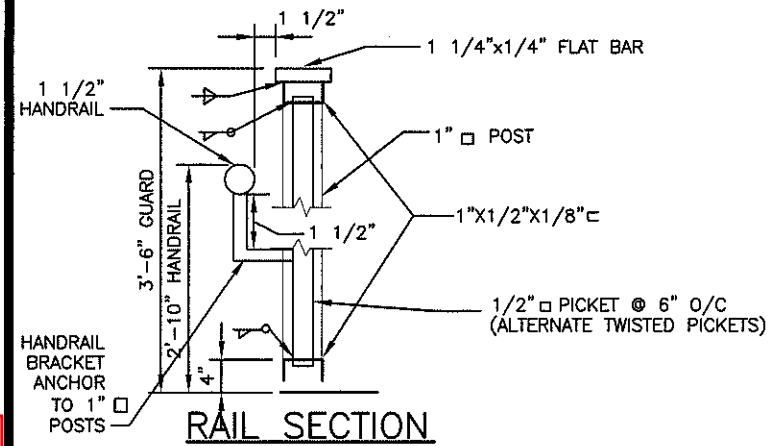
Revised	Howard County, Maryland Department of Public Works	Concrete Stairs Pipe Railing	Detail G-7.02
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		

NOTES:

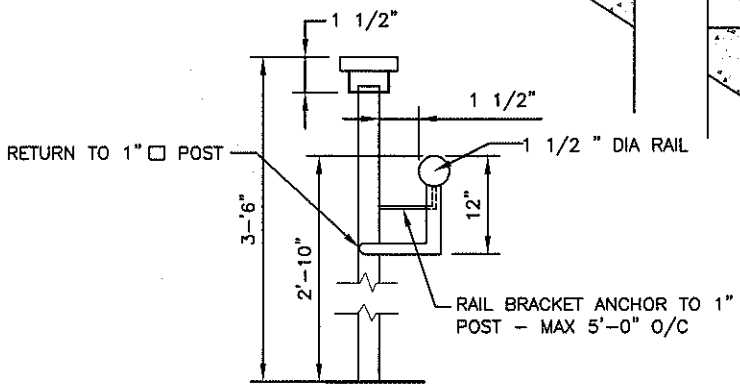
1. UNLESS OTHERWISE NOTED, PAINTED RAILING SHALL BE FURNISHED.
2. RAILING AND POSTS TO BE PAINTED OR GALVANIZED SHALL CONFORM TO ASTM A36.
3. UNLESS OTHERWISE NOTED, RAILING SHALL BE FURNISHED FOR BOTH SIDES OF STAIRS AND ALL STAIRS HAVING 4 RISERS AND OVER. PROVIDE INTERMEDIATE RAILS AS REQUIRED BY CODE.
4. RAILING SHALL BE ALL WELDED WITH ITS JOINTS GROUND SMOOTH AND FREE OF BURRS.
5. GUARD POSTS SHALL BE SET IN METAL SLEEVES, 6" DEEP AND FILLED WITH HOT POURED LEAD OR HOT POURED SULFUR OR AN EQUIVALENT EPOXY COMPOUND.
6. GALVANIZED RAILINGS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION.
7. PAINTED RAILINGS SHALL BE PAINTED IN ACCORDANCE TO SECTION 912 OF THE SPECIFICATIONS. EXCEPT THAT THE FINAL COAT SHALL BE BLACK.
8. THIS HANDRAIL IS TO BE USED ONLY AS A PROTECTION FOR PEDESTRIANS AND SHOULD NOT BE PLACED IN ANY LOCATION WHERE IT MIGHT BE SUBJECT TO VEHICULAR IMPACT. FOR VEHICULAR PROTECTION, STANDARD GUARD RAIL SHOULD BE USED.
9. THE RAILING SHALL BE PAID FOR AT THE UNIT PRICE BID PER LINEAR FOOT, MEASURED HORIZONTALLY, FOR "CONCRETE STAIRS PIPE RAILING" COMPLETE IN PLACE; OR ITS COST SHALL BE INCLUDED IN THE LUMP SUM PRICE BID FOR "CONCRETE STAIRS", COMPLETE IN PLACE.
10. GUARD REQUIRED ALONG OPEN SIDE OF STAIRS WITH VERTICAL DROP OVER 30" ABOVE GRADE OR FLOOR



RAIL ELEVATION



RAIL SECTION



END ELEVATION

7/17/2015 DRAFT

Revised

Revised 5/7/2007 Approved

Howard County, Maryland
Department of Public Works

Approved: _____
Chief, Bureau of Engineering

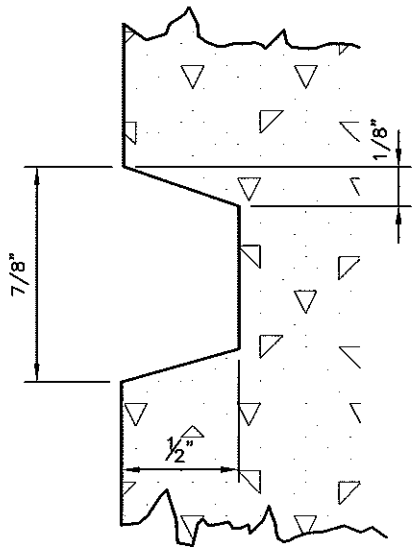
Concrete Stairs
Ornamental Railing

Detail
G-7.03

1 2 3 4

5 6 7 8

9 0

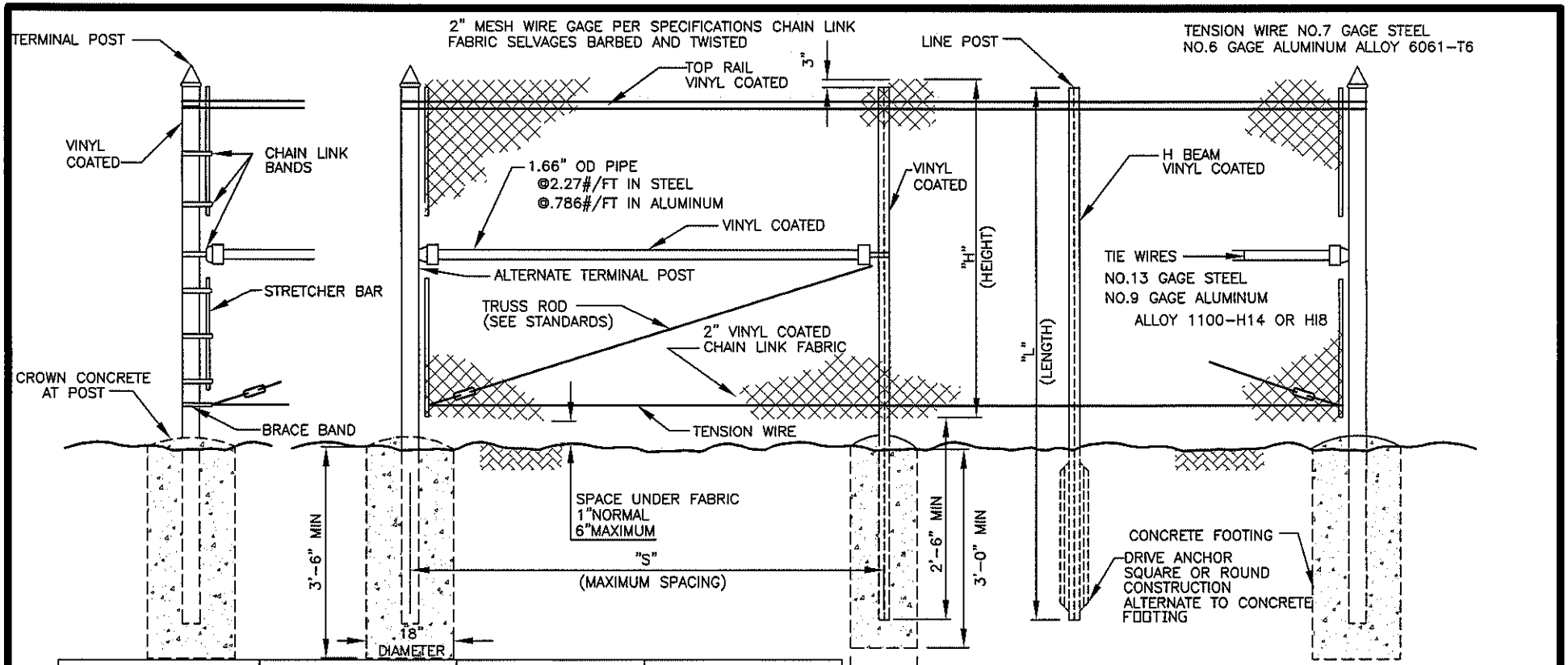


NOTES:

1. ALL NUMBERS TO BE 5" HIGH.
2. ALL NUMBERS TO BE 3" WIDE OVERALL EXCEPT THE NUMERAL ONE(1) WHICH WILL BE 7/8" WIDE.

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Year Built Numbers	Detail G-7.11



"H" HEIGHT OF FENCE	5'-0" RURAL	6'-0"	8'-0"
"S" POST SPACING MAX	12'-0"	10'-0"	10'-0"
"L" LENGTH OF H BEAM	7'-8" MIN	8'-8" MIN	10'-8" MIN
H BEAM - STEEL	1.875"x1.65"@2.70"/FT	2.25"x1.95"@4.10"/FT	2.25"x1.95"@4.10"/FT
H BEAM - ALUMINUM	1.875"x1.625"@0.91"/FT	2.25"x1.95"@1.25"/FT	2.25"x1.95"@1.25"/FT
TERM POST STEEL	2.375"OD@3.65"/FT	2.875"OD@5.79"/FT	2.875"OD@5.79"/FT
TERM POST ALUMINUM	2.375"OD@1.26"/FT	2.875"OD@2.00"/FT	2.875"OD@2.00"/FT
ALT TERM POST STEEL	2.00"SQ @3.85"/FT	2.50"SQ @5.70"/FT	2.50"SQ @5.70"/FT
ALT TERM POST ALUMINUM	2.50"SQ @1.26"/FT	3.00"SQ @2.00"/FT	3.00"SQ @2.00"/FT

NOTES:

1. ALL POSTS (TERMINAL AND LINE) TO BE SAME LENGTH (L).
2. TENSION WIRE CLIP AT 18"± O/C 12 1/2 GA. GALVANIZED STEEL WIRE .110 DIAMETER ALUMINUM WIRE ALLOY 5058-H38.
3. MATERIALS TO MEET REQUIREMENTS OF AASHTO M181.
4. VINYL CLAD STEEL IF SPECIFIED BY ENGINEER SHALL BE COLORED BLACK UNLESS OTHERWISE SPECIFIED.

	5'-0" RURAL & 6'-0"
HOG RING - STEEL	18" ± O/C 12.5 GA GALVANIZED STEEL WIRE
HOG RING - ALUMINUM	18" ± O/C 110 0 ALUMINUM WIRE ALLOY 5058 - H38

7/17/2015 DRAFT

Revised

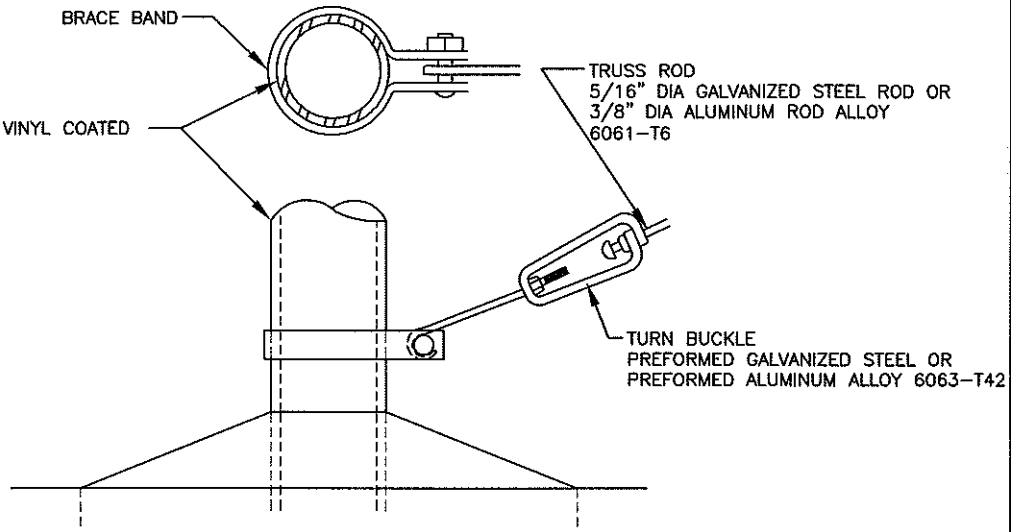
Revised 5/7/2007 Approved

Howard County, Maryland
Department of Public Works

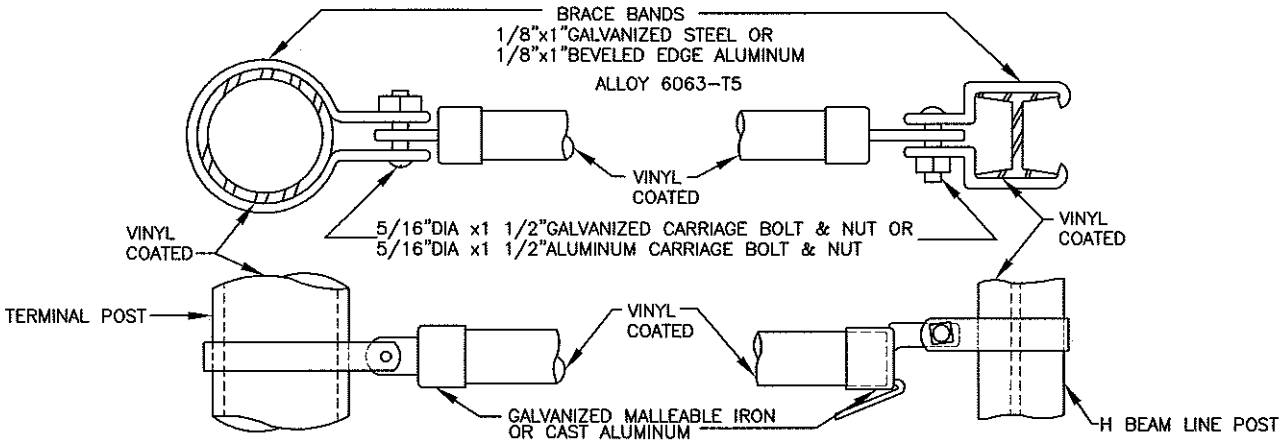
Approved: _____
Chief, Bureau of Engineering

CHAIN LINK FENCE

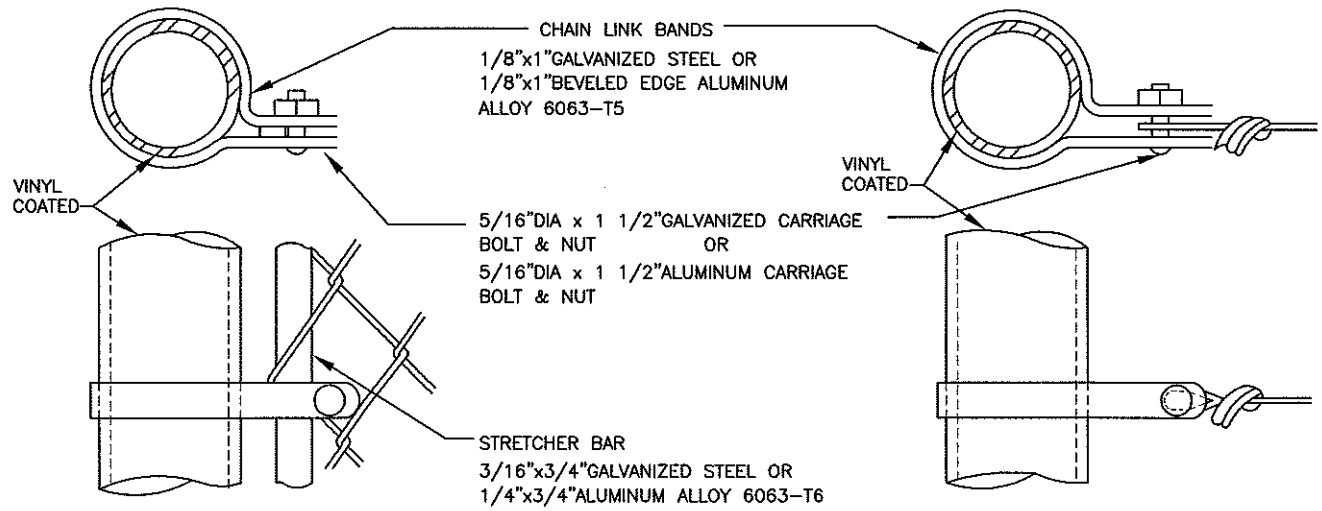
Detail
G-7.21



TRUSS BRACE ATTACHMENT FOR ROUND CONSTRUCTION



BRACE RAIL ATTACHMENT FOR ROUND CONSTRUCTION

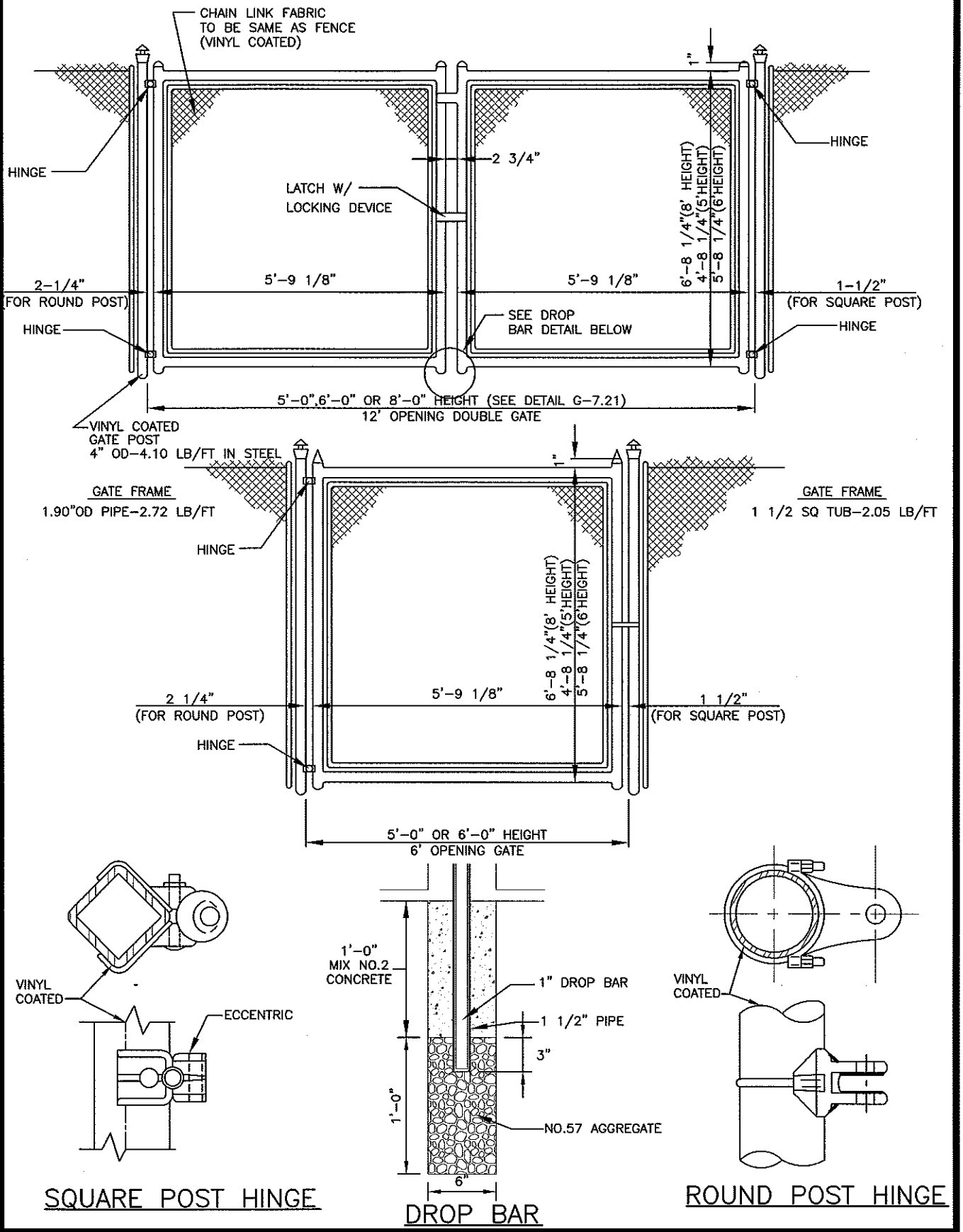


STRETCHER ROD ATTACHMENT

ATTACHMENT FOR BARB WIRE OR TENSION WIRE

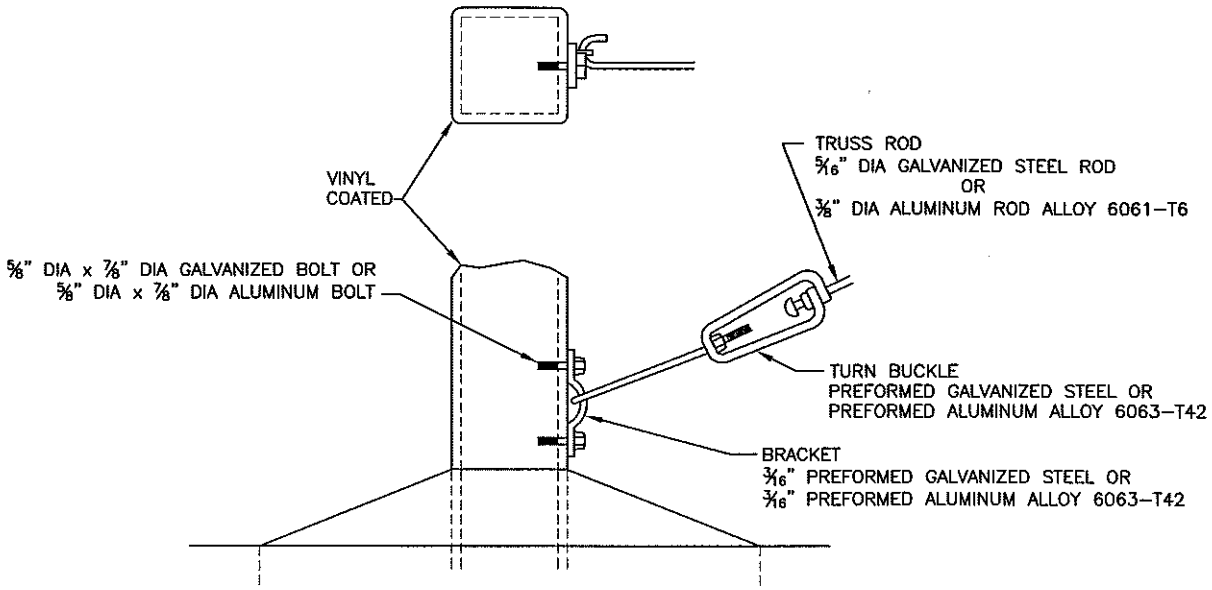
7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	CHAIN LINK FENCE Brace & Rod Attachments Round Post	Detail G-7.22

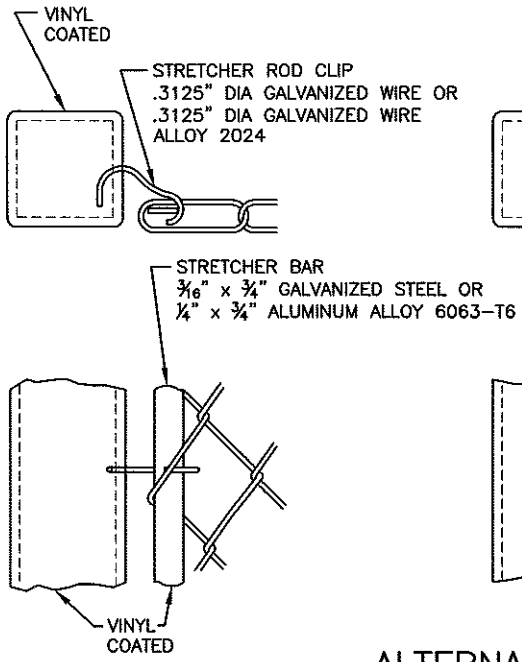


7/17/2015 DRAFT

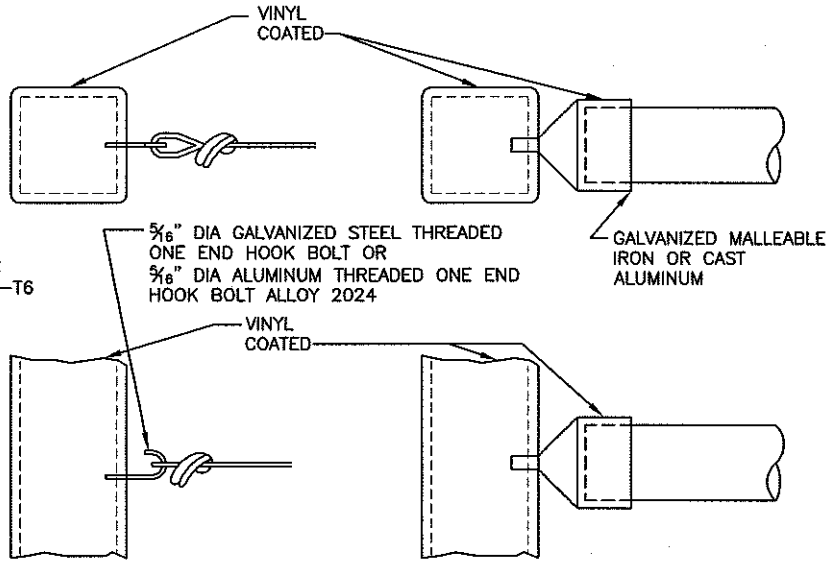
Revised	Howard County, Maryland Department of Public Works	CHAIN LINK FENCE Gate	Detail G-7.23
Revised 5/7/2007 Approved	Approved: Chief, Bureau of Engineering		



ALTERNATE TRUSS BRACE ATTACHMENT FOR SQUARE CONSTRUCTION



ALTERNATE STRETCHER ROD ATTACHEMENT



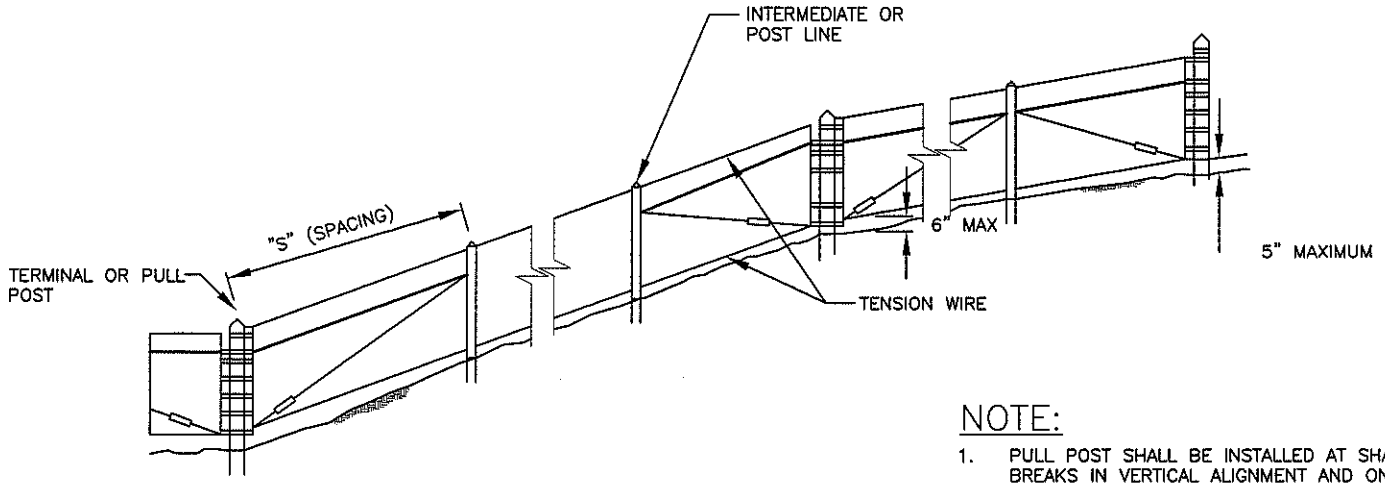
ALTERNATE ATTACHEMENT FOR BARB WIRE OR TENSION WIRE

ALTERNATE BRACE RAIL ATTACHMENT FOR SQUARE CONSTRUCTION

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	CHAIN LINK FENCE Brace & Rod Attachment Square Posts	Detail G-7.24

FENCE HEIGHT	5'–0" RURAL	6'–0"	8'–0"
(S) MAXIMUM	12'–0"	10'–0"	10'–0"
(S) MINIMUM	10'–0"	8'–0"	8'–0"



NOTE:

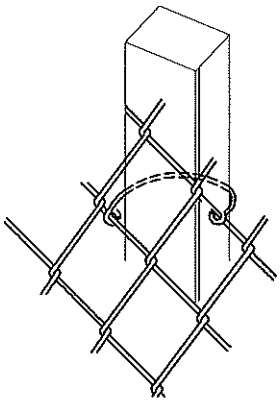
1. PULL POST SHALL BE INSTALLED AT SHARP BREAKS IN VERTICAL ALIGNMENT AND ON APPROXIMATE 500' CENTERS IN STRAIGHT RUNS OF ALL TERM POSTS, PULL POST & CORNER POST SHALL BE BRACED AS SHOWN

FENCING AT GRADE CHANGES

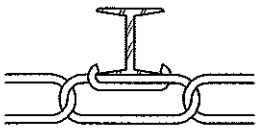
7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	CHAIN LINK FENCE Grade Changes	Detail G–7.25

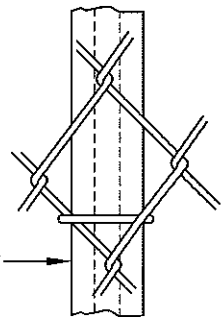
"H" POST OR "ROUND" POST



"H" POST



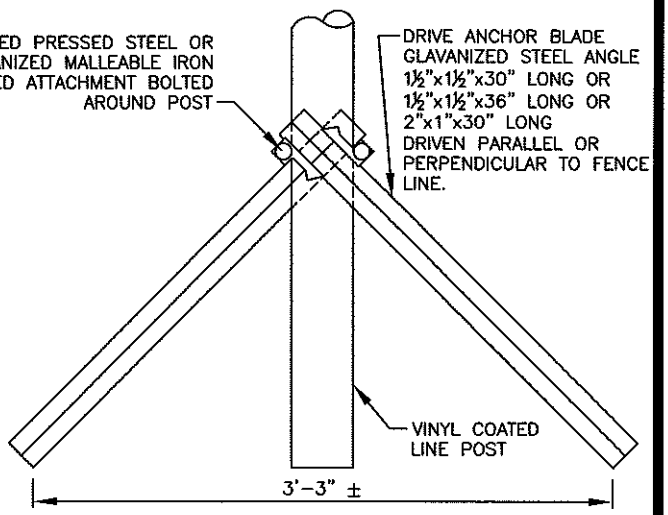
LINE POST TIES ON 12" O/C
GALVANIZED STEEL CLIP



LINE POST

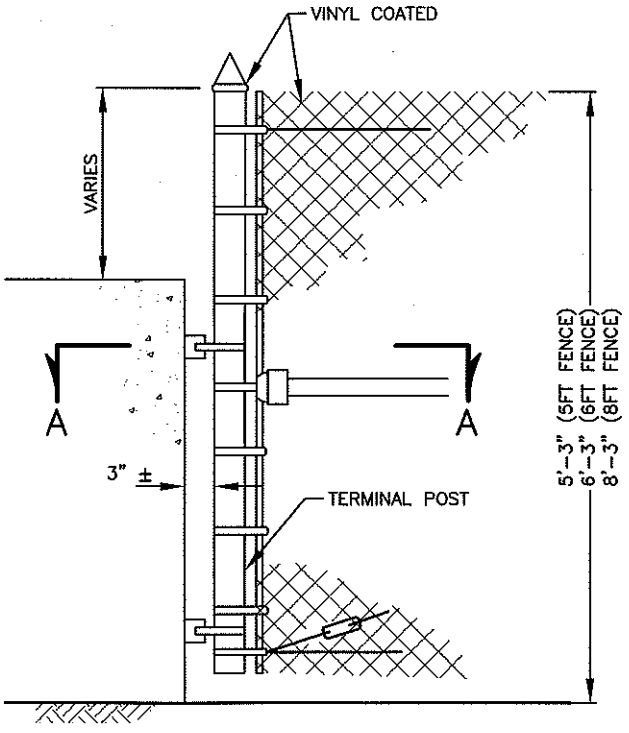
GALVANIZED PRESSED STEEL OR GALVANIZED MALLEABLE IRON SLOTTED ATTACHMENT BOLTED AROUND POST

DRIVE ANCHOR BLADE GLAVANIZED STEEL ANGLE 1½"x1½"x30" LONG OR 1½"x1½"x36" LONG OR 2"x1"x30" LONG DRIVEN PARALLEL OR PERPENDICULAR TO FENCE LINE.

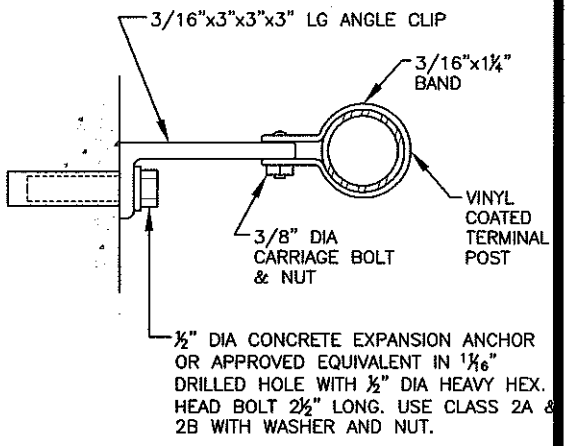


DRIVE ANCHOR FOR LINE POST ALTERNATE TO CONCRETE FOOTING

TIE WIRE ATTACHMENT FOR LINE POST



OUTSIDE



INSIDE

SECTION A–A

ALTERNATE POST ATTACHMENT AT BRIDGE END

7/17/2015
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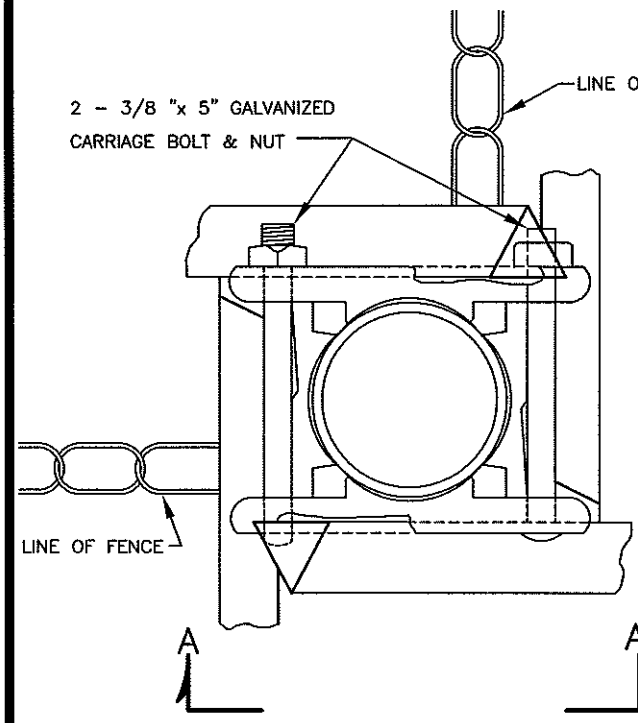
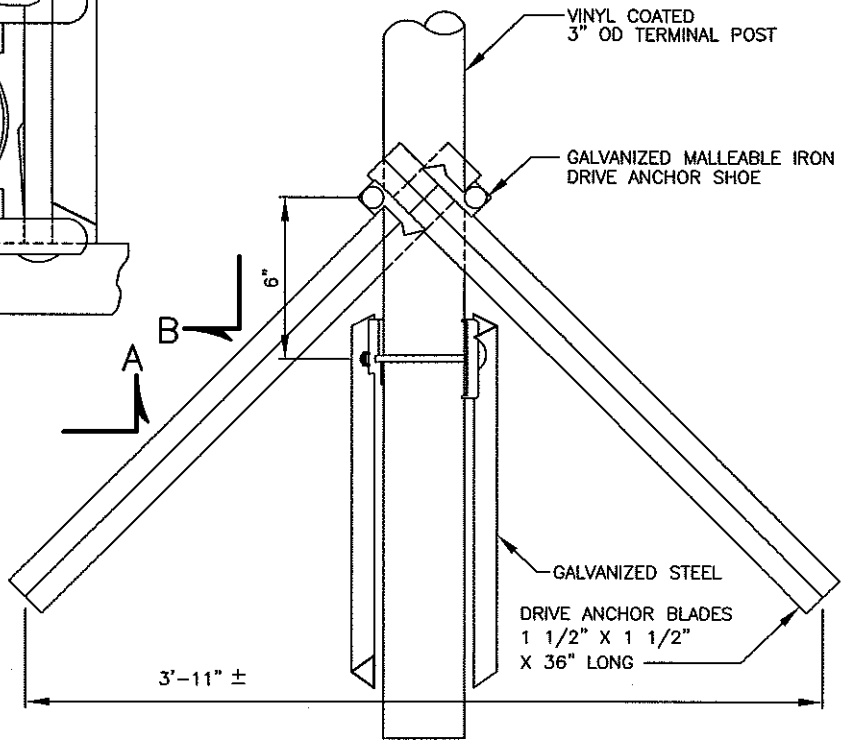
Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	CHAIN LINK FENCE Drive Anchor & Post at Bridge	Detail G-7.26



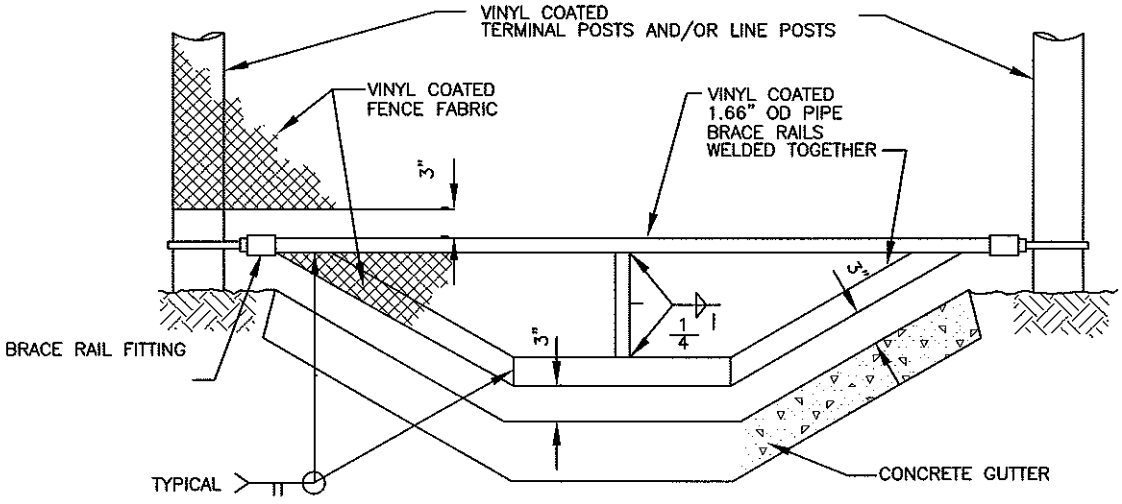
PLAN



SECTION A-A & SECTION B-B SIMILAR
ELEVATION

NOTES:

DOUBLE DRIVE ANCHOR TO BE USED AT ALL TERMINAL POSTS.



7/17/2015
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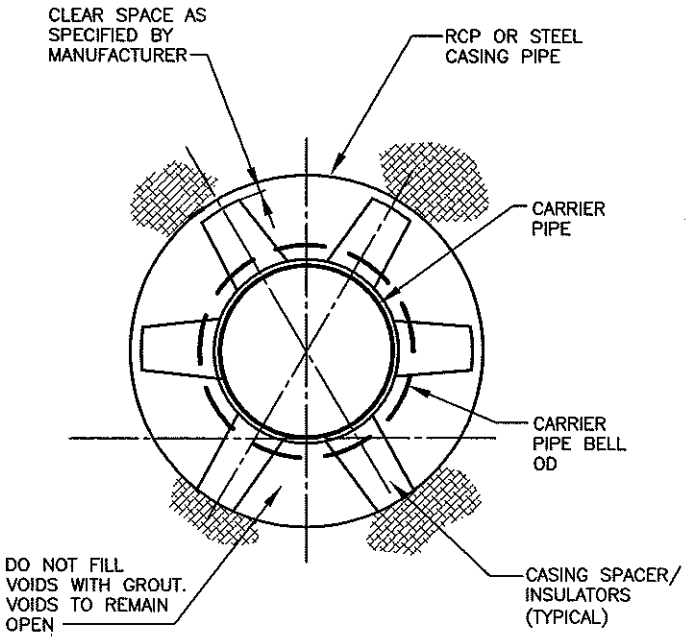
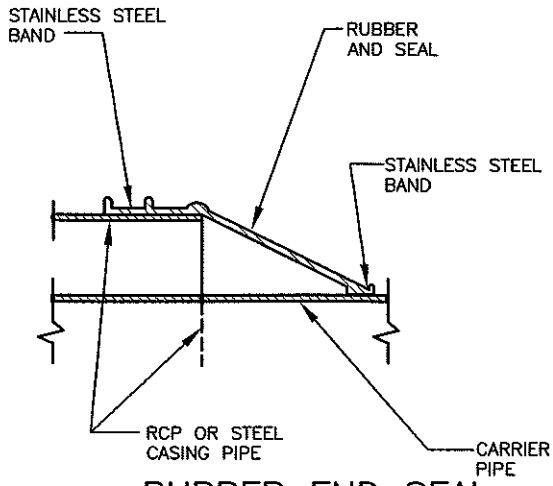
FENCE TREATMENT AT CONCRETE DITCH

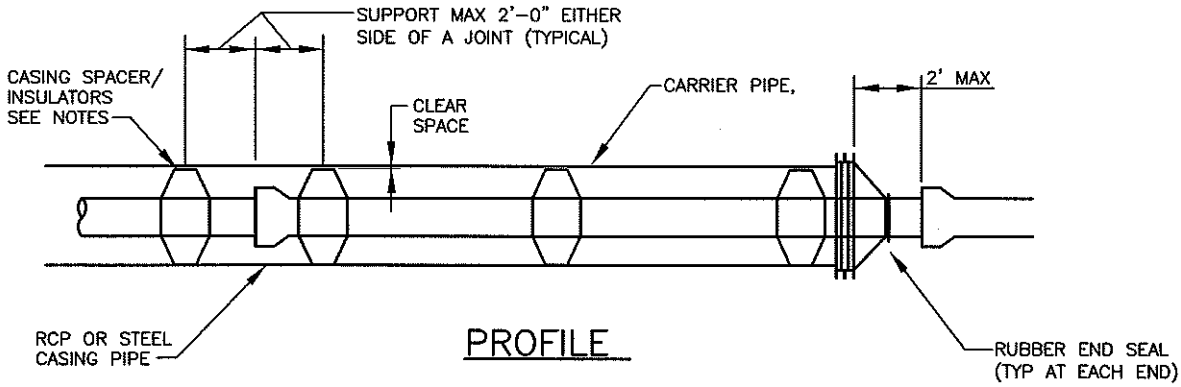
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	CHAIN LINK FENCE Double Drive Anchor & Ditch Treatment	Detail G-7.27



TYPICAL SECTION



RUBBER END SEAL



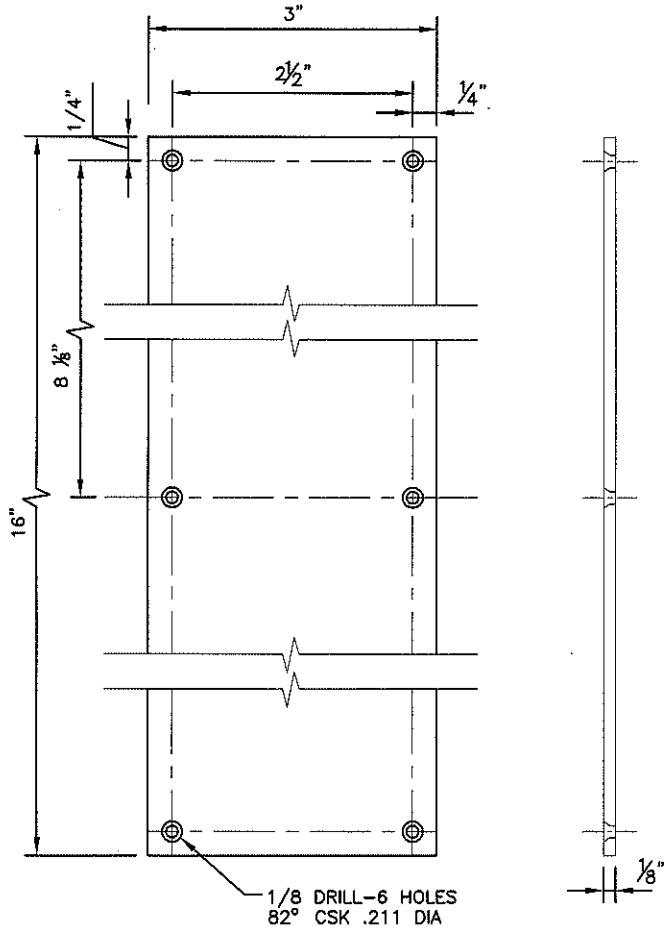
PROFILE

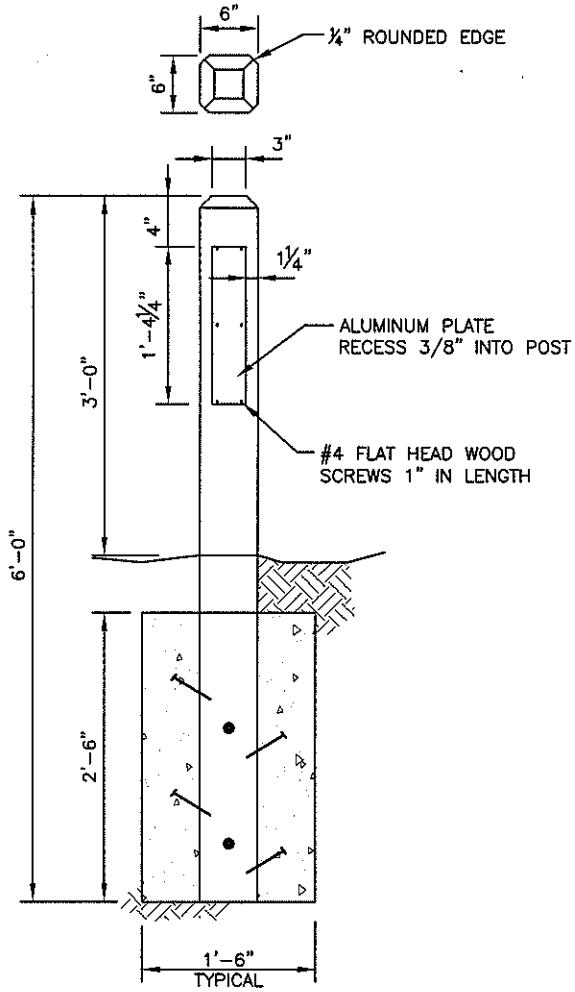
NOTES:

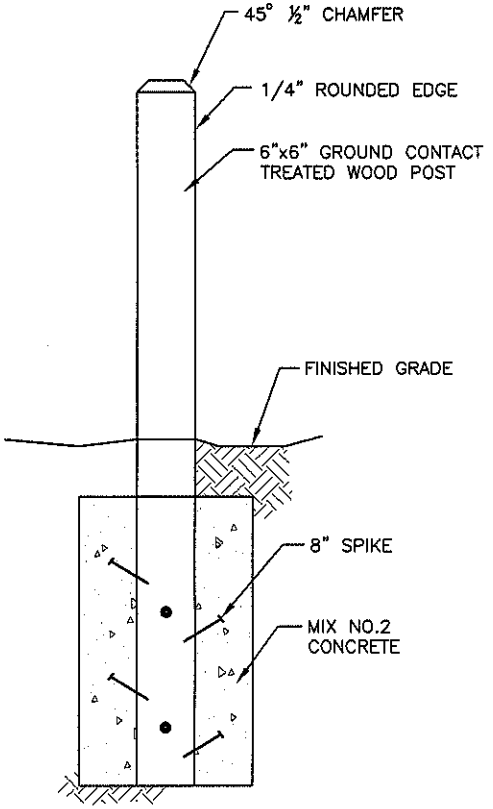
1. MATERIAL AND INSTALLATION REQUIREMENTS SHALL BE IN ACCORDANCE W/SPECIFICATION SECTION 963 AND 1012.
2. FOR WATER AND SEWER MAIN, THE MINIMUM STEEL CASING DIAMETER SHALL BE 36" WITH A MINIMUM WALL THICKNESS OF 1/2". JOINTS SHALL BE WELDED FULL CIRCUMFERENCE.
3. REINFORCED CONCRETE CASING SHALL BE MINIMUM STRENGTH CLASS V MINIMUM THICKNESS WALL B, WITH RUBBER JOINTS.
4. CASING SPACER/INSULATORS SHALL BE AS SPECIFIED, OR AS APPROVED BY THE COUNTY FOR INSERTING, SUPPORTING, SPACING AND INSULATING THE CARRIER PIPE.
5. A MINIMUM OF 3 SPACER/INSULATORS PER PIPE LENGTH SHALL BE SPACED PER MANUFACTURER'S RECOMMENDATIONS FOR THE PARTICULAR CASING AND CARRIER PIPES SPECIFIED.
6. A JOINT IN THE CARRIER PIPE SHALL BE PROVIDED WITHIN 2 FEET OF EACH OUTSIDE END OF CASING.

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Jack and Bore Casing with Casing Spacers	Detail G-7.31





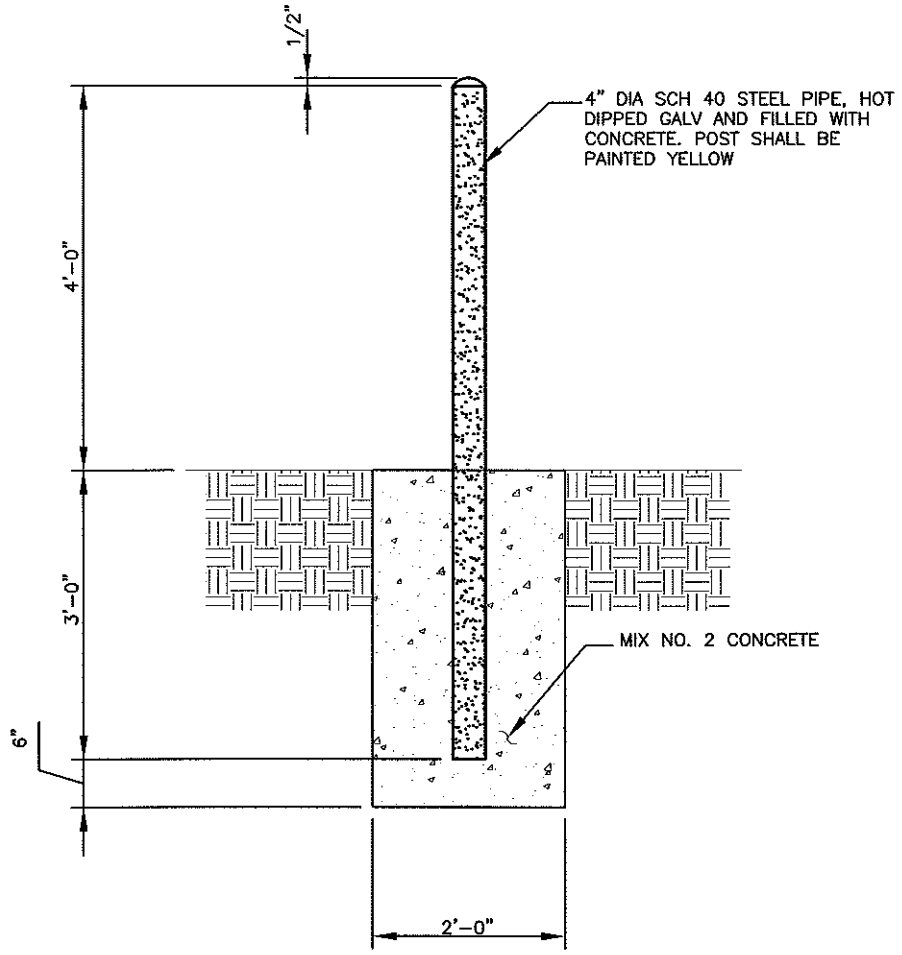


NOTES: ALUMINUM PLATE

1. PLATE TO BE SCREWED & GLUED IN PLACE. SCREWS ARE TO BE COUNTERSUNK.
2. BOLLARDS WILL BE PLACED AT THE FOUR CORNERS OF THE OPEN SPACE ACCESS STRIP.
3. THE ALUMINUM PLATE WILL ONLY BE REQUIRED ON THE FRONT RIGHT BOLLARD DIRECTLY FACING THE ROAD.

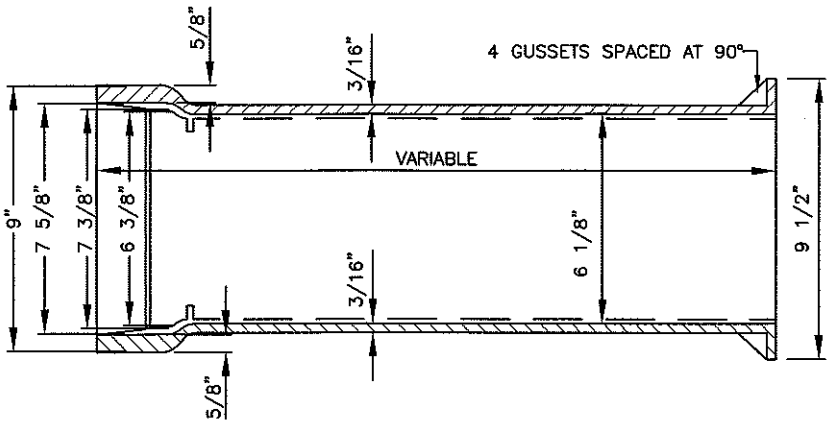
7/17/2015 DRAFT

Revised	Howard County, Maryland Department of Public Works	Open Space Bollard	Detail G-7.41
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		

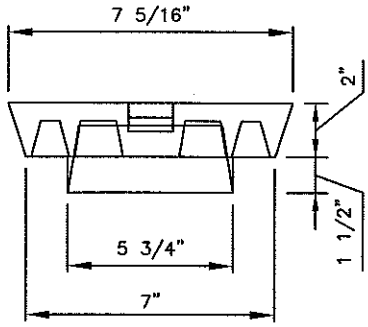


7/17/2015
DRAFT

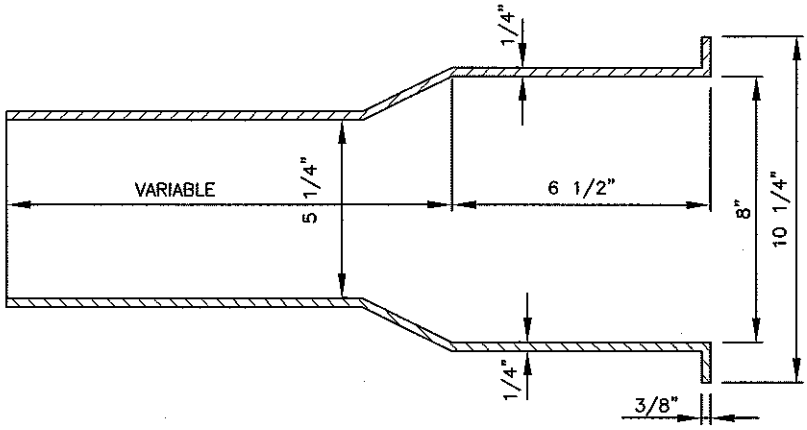
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Metal Bollard	Detail G-7.42



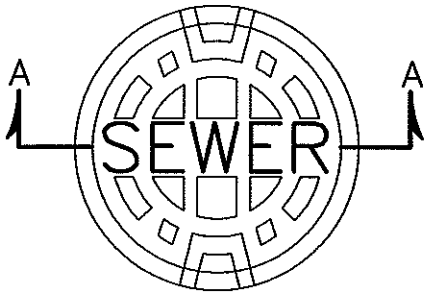
SECTION THROUGH
TOP HALF OF VALVE BOX



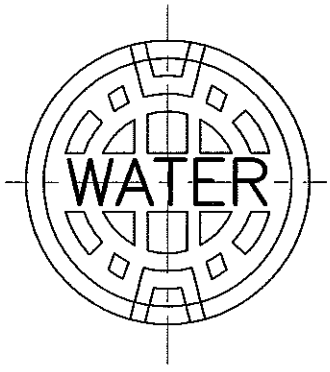
SECTION A–A



SECTION THROUGH
BOTTOM HALF OF VALVE BOX



PLAN VIEW



7" FRAME AND COVER
CAST IRON

NOTES:

1. ALL VALVES BOXES SHALL BE THE SLIDING TYPE IN PAVED AREAS. USE SCREW TYPE VALVE BOXES IN LAWN AREAS.
2. ALL WATER VALVES SHALL BE MARKED "WATER" AND ALL SEWER VALVES SHALL BE MARKED "SEWER".
3. ENTIRE VALVE BOX AND ASSEMBLY SHALL BE CAST FROM CLASS 35 GREY IRON. ALL PARTS SHALL BE SUPPLIED BY THE SAME MANUFACTURER.
4. INSTALLATION SHALL BE PLUMB.
5. FOR BOXES ADJUSTABLE 23" TO 34"
   TOP SECTION–16"
   BOTTOM SECTION–18"
6. FOR BOXES ADJUSTABLE 34" TO 46"
   TOP SECTION–16"
   BOTTOM SECTION–30"
7. MINIMUM WEIGHT PER BOX– 100 LBS
8. BOTTOM SECTION SHALL REST ON VALVE BONNET.

7/17/2015
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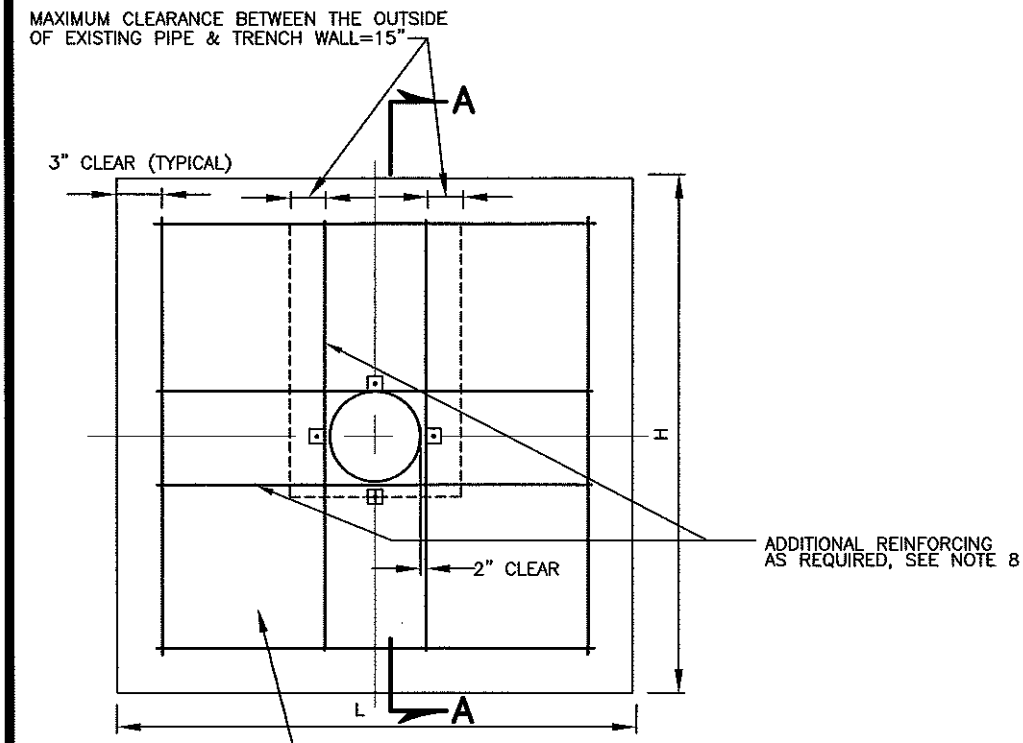
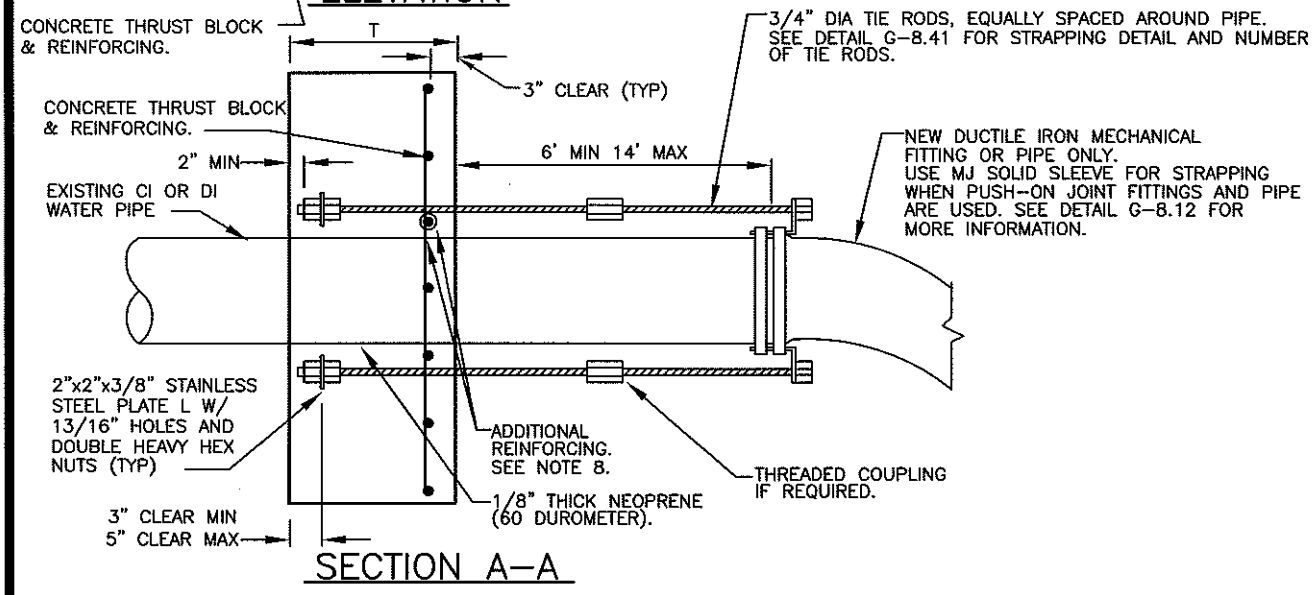
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Valve Box Adjustable Round Head	Detail G-8.01



ELEVATION



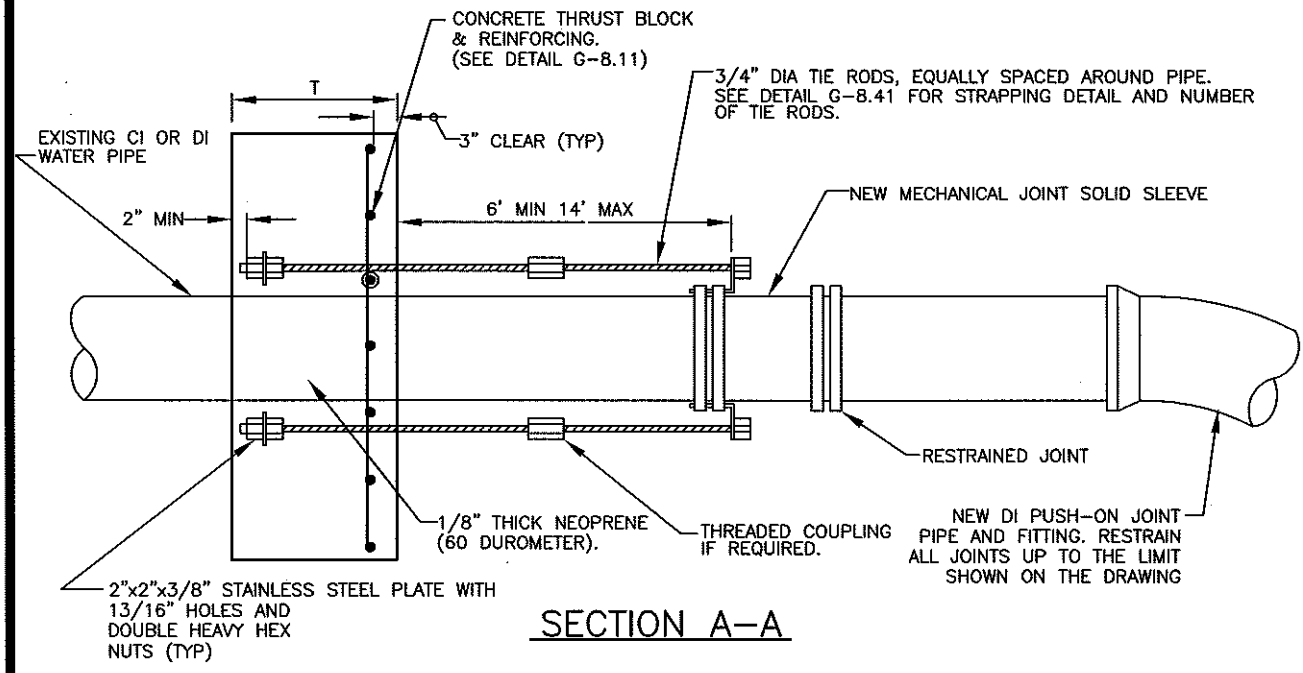
SECTION A-A

NOTES

1. ALL CONCRETE SHALL BE 4000 PSI. PIPELINE SHALL NOT BE PRESSURIZED UNTIL CONCRETE STRENGTH REACHES 4000 PSI.
2. ALL REBARS SHALL BE ASTM A615 GRADE 60.
3. STEEL PLATES SHALL BE ASTM A36.
4. MAINTAIN 2" CLEAR BETWEEN ALL REBARS AND PIPE.
5. WHERE GALVANIZED COATING IS DAMAGED, COVER WITH BITUMINIOUS MATERIAL.
6. BOLT CIRCLE FOR 3/4" TIE RODS AT THRUST COLLAR SHALL EQUAL BOLT CIRCLE AT TIE BOLTS.
7. ALL TIE RODS SHALL BE PARALLEL TO AXIS OF PIPE.
8. ALL THRUST BLOCKS SHALL BE DESIGNED BASED ON ACTUAL SOIL, GROUNDWATER, AND PIPE DEPTH CONDITIONS.
9. THIS TYPE OF RESTRAINING SYSTEMS SHALL ONLY BE DESIGNED OR INSTALLED IN PLACE OF A RESTRAINED JOINT SYSTEM WITH THE WRITTEN AUTHORIZATION OF THE HOWARD COUNTY DPW.
10. 4 TIE RODS SHOWN ON ELEVATION VIEW FOR CLARITY ONLY. (DESIGN IS REQUIRED)

7/17/2015
DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	DIP Mechanical Fitting Connection to Thrust Block (Alternate to restraint glands)	Detail G-8.11



SECTION A-A

NOTES

1. FOR CONCRETE THRUST BLOCK INFORMATION AND NOTES SEE DETAIL G-8.11.
2. ALL HARDWARE SHALL BE HOT DIPPED GALVANIZED.

7/17/2015
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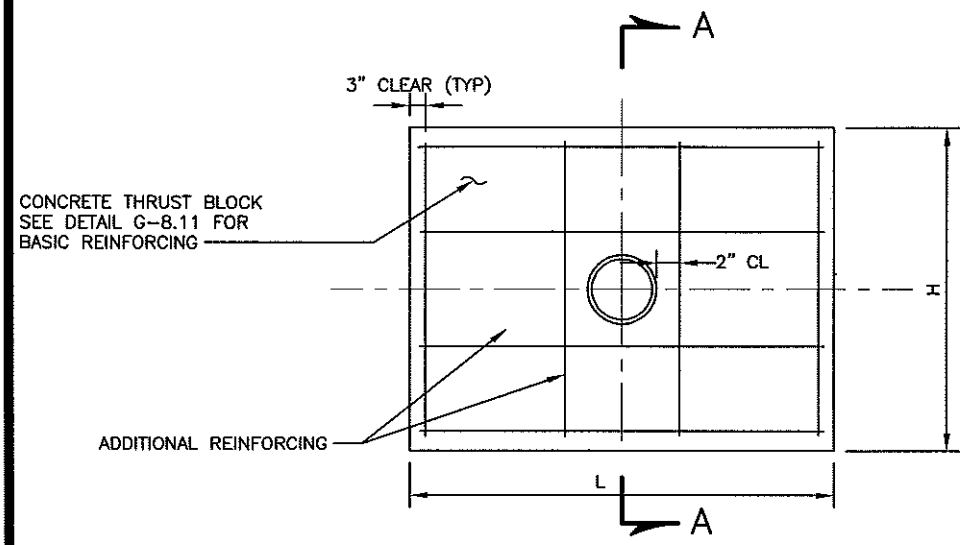
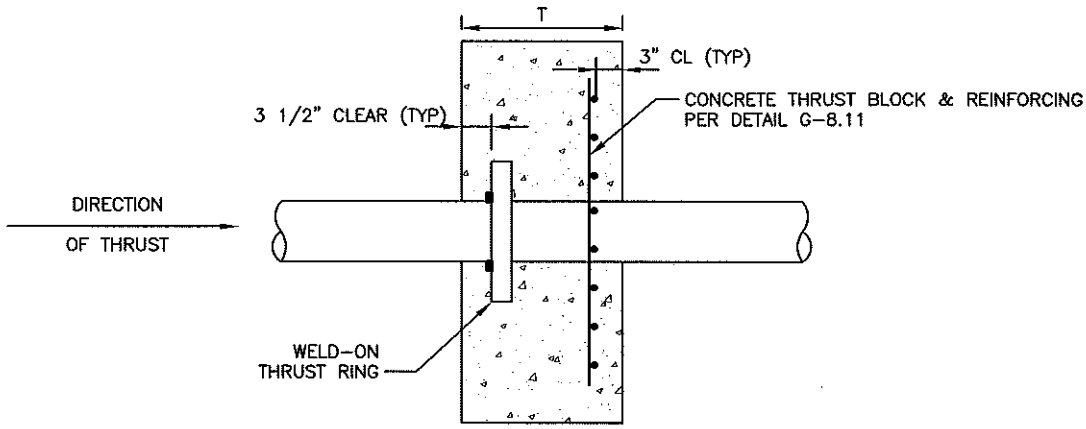
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	DIP Push-on Fitting Connection to Thrust Block (Alternate to restraint glands)	Detail G-8.12



ELEVATION



SECTION A-A

NOTES:

1. SEE DETAIL G-8.11 FOR THRUST BLOCK DETAIL.
2. ALL CONCRETE SHALL BE 4000 PSI. PIPE LINE SHALL NOT BE PRESSURIZED UNTIL CONCRETE STRENGTH REACHES 4000 PSI.
3. ALL REBARS SHALL BE ASTM A615 GRADE 60.
4. MAINTAIN 2" CLEAR BETWEEN ALL REBAR AND PIPE.
5. WELD-ON THRUST RINGS AND PIPE TO WHICH THEY ARE ATTACHED SHALL BE DESIGNED AND SUPPLIED BY THE PIPE MANUFACTURER FOR THE THRUST EQUIVALENT AS SPECIFIED ON THE CONTRACT DOCUMENTS. THE AREA OF THE RING SHALL BE PROPORTIONED SUCH THAT THE BEARING STRESS ON THE CONCRETE DOES NOT EXCEED 1000 PSI.
6. IN THE CASE WHERE THE THRUST FORCE CAN ACT IN EITHER DIRECTION, THE THRUST RING SHALL BE DESIGNED TO ACCOMODATE A BI-DIRECTIONAL FORCE. IN SUCH CASE, REINFORCING SHALL BE PROVIDED ON BOTH FACES OF THE BLOCK.
7. REPLACE ALL DISTURBED SOIL ON THE TRUST SIDE OF THE BLOCK WITH CRUSHED STONE COMPACTED AS STRUCTURAL BACKFILL.
8. THIS TYPE OF RESTRAINING SYSTEM SHALL ONLY BE DESIGNED OR INSTALLED IN PLACE OF A RESTRAINED JOINT SYSTEM WITH THE WRITTEN AUTHORIZATION OF THE HOWARD COUNTY DPW.

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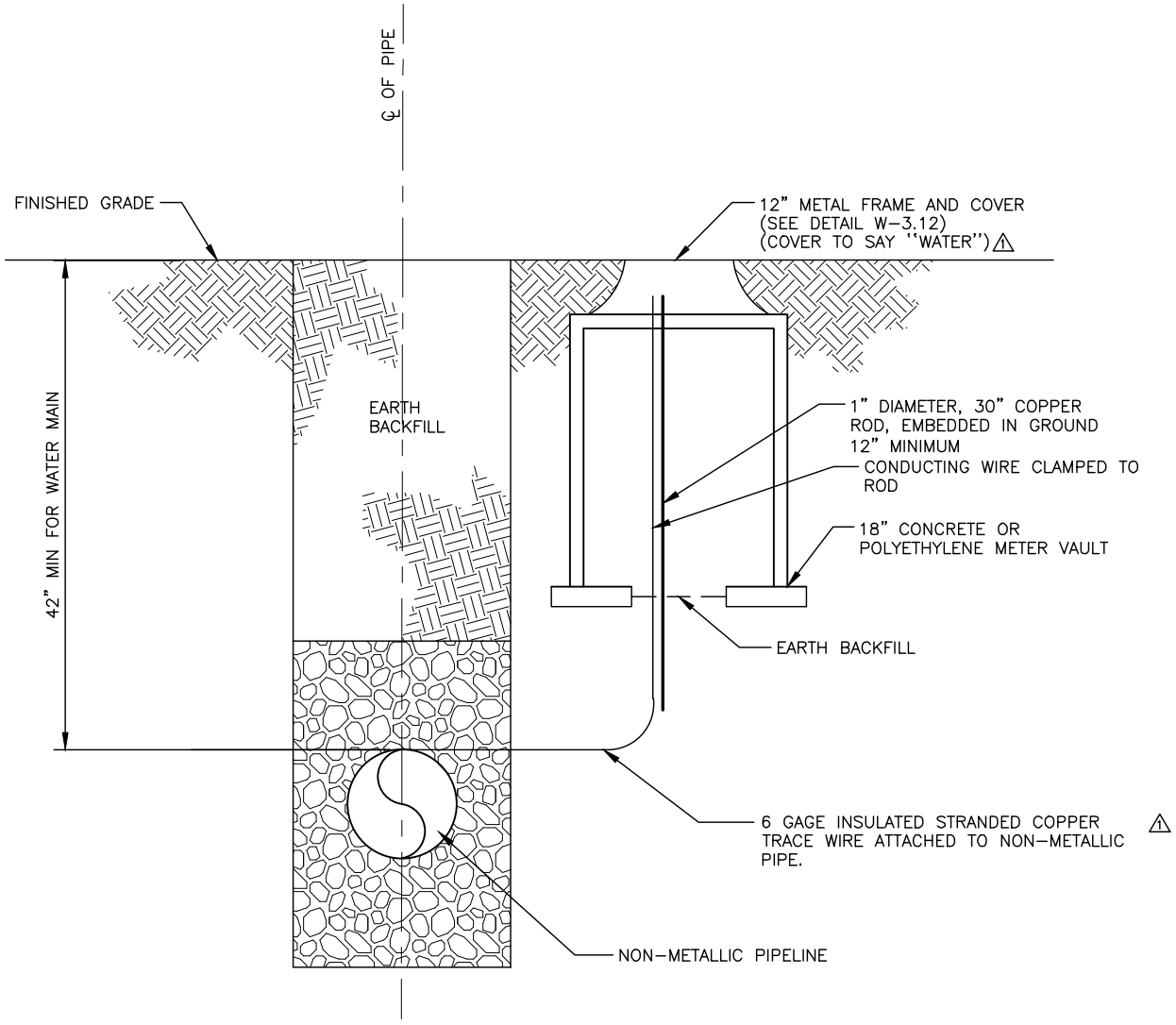
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	DIP Weld-on Thrust Ring Concrete Thrust Block (Alternate to restraint glands)	Detail G-8.13



NOTES:

⚠1 1. TEST STATIONS SHALL BE USED FOR ALL NON-METALLIC PIPE EXCEPT GRAVITY SEWER MAINS UNLESS REQUIRED BY THE DPW.

⚠1 2. FOR SPLICING BETWEEN TEST STATIONS, SEE NOTE 4 ON DETAIL W-1.15.

⚠1 3. TEST STATION SPACING SHALL BE A MAXIMUM OF 400 FEET, OR IMMEDIATELY ADJACENT TO FIRE HYDRANTS, WHICHEVER IS LESS. FOR RECLAIMED WATER OR PRESSURE SEWER, TEST STATION SPACING SHALL BE A MAXIMUM OF 400 FEET, AND PLACED ADJACENT TO EXISTING AT-GRADE STRUCTURES SUCH AS VALVES OR MANHOLES WHERE POSSIBLE.

4. TEST STATION SHALL BE INSTALLED IN NON-TRAFFIC BEARING AREAS. DO NOT INSTALL IN ROADWAY.

5. SEE DETAIL G-2.11 & G-2.12 FOR TRENCH BEDDING INFORMATION.

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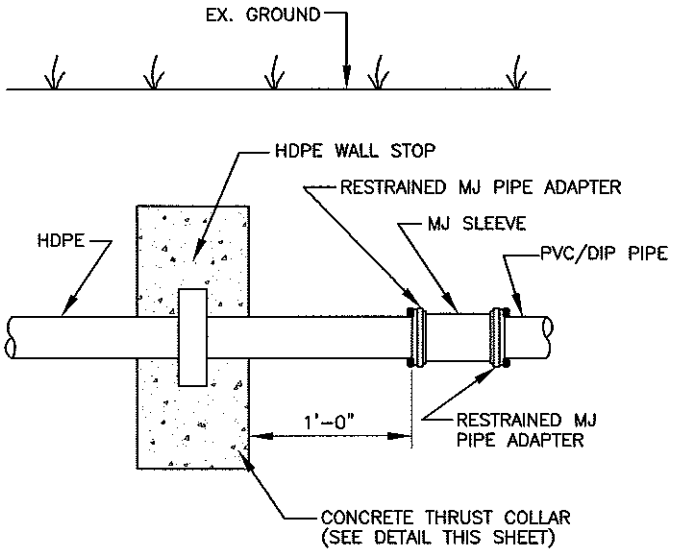
⚠1 6. REFER TO APPLICABLE SPECIFICATION SECTIONS 905,1002,1011,1017, AND 1018 FOR ADDITIONAL REQUIREMENTS.

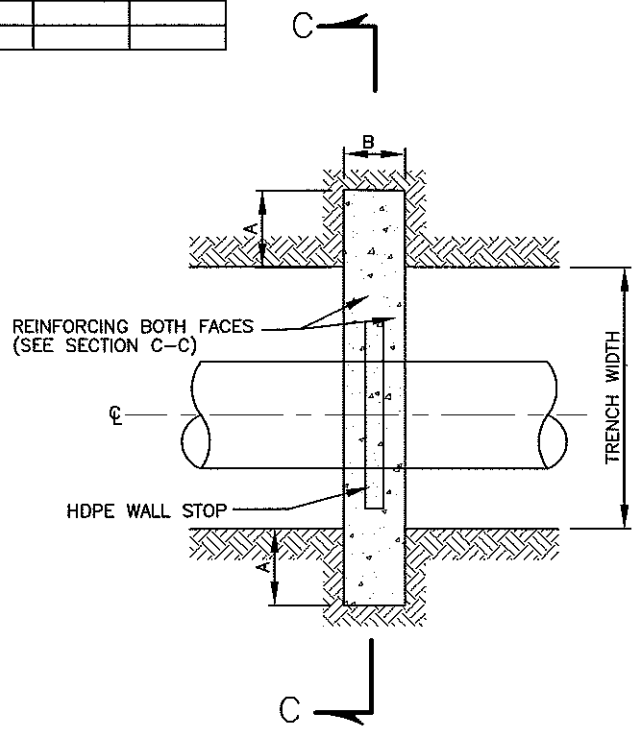
Revised ⚠1 6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Continuity Test Station	Detail G-8.21

THIS BLANK TABLE IS TO BE COMPLETED BY A PROFESSIONAL ENGINEER FOR INCLUSION IN THE CONTRACT DOCUMENTS.

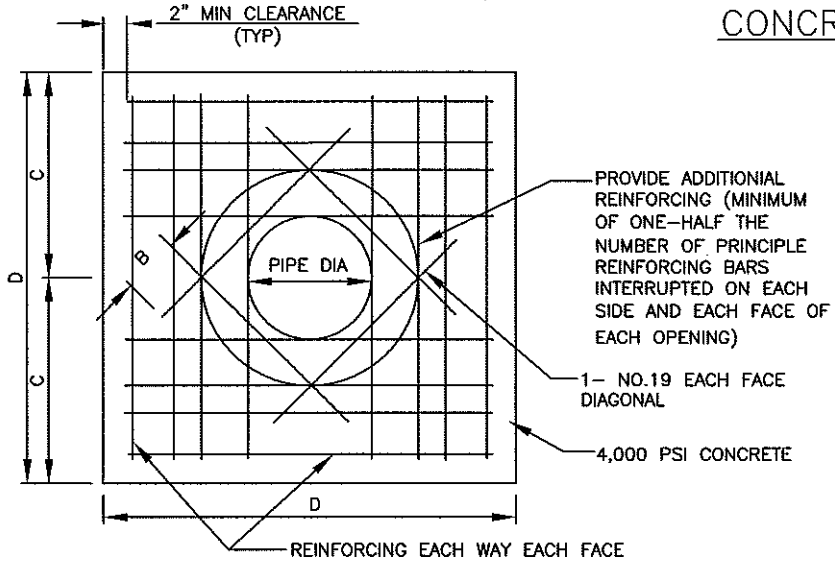
BUTTRESS DIMENSIONS (SEE NOTE 3)					
	DIAMETER				
DIMENSION	4	6	8	12	16
A					
B					
C					
D					



CONNECTION



CONCRETE THRUST COLLAR PLAN



SECTION C-C

NOTES:

1. PROVIDE 2" MINIMUM CONCRETE COVER OVER ALL REINFORCING.
2. ADEQUATE CURING TIME OR USE OF HIGH EARLY CONCRETE TO OBTAIN THE REQUIRED 4,000 PSI STRENGTH SHALL BE PROVIDED FOR ALL THRUST COLLARS PRIOR TO TESTING FORCE MAIN.
3. ALL CONCRETE THRUST COLLARS MUST BE DESIGNED FOR SITE SPECIFIC SOIL, GROUNDWATER AND SYSTEMS PRESSURE CONDITIONS.
4. ALL FITTINGS TO USE STAINLESS STEEL BOLTS.
5. FOR DIRECTIONAL DRILLING, A MINIMUM OF 48 HOURS TIME SHALL BE PROVIDED AFTER DRILL IS COMPLETE PRIOR TO CONSTRUCTING AND INSTALLING THE THRUST COLLARS.

CONCRETE THRUST COLLAR

7/17/2016
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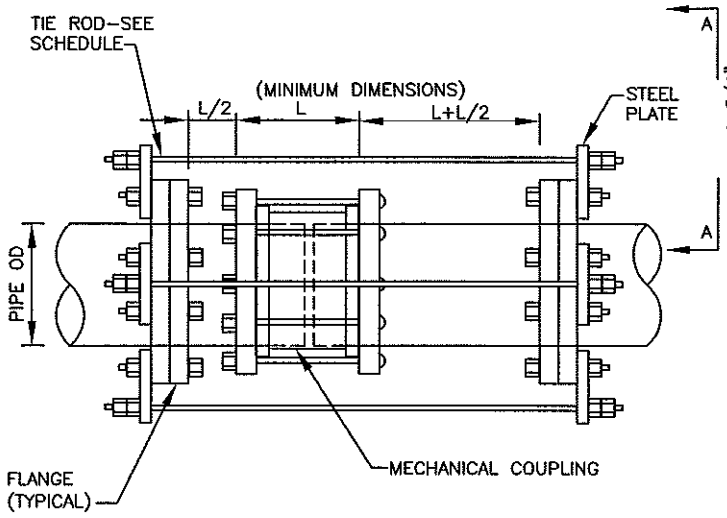
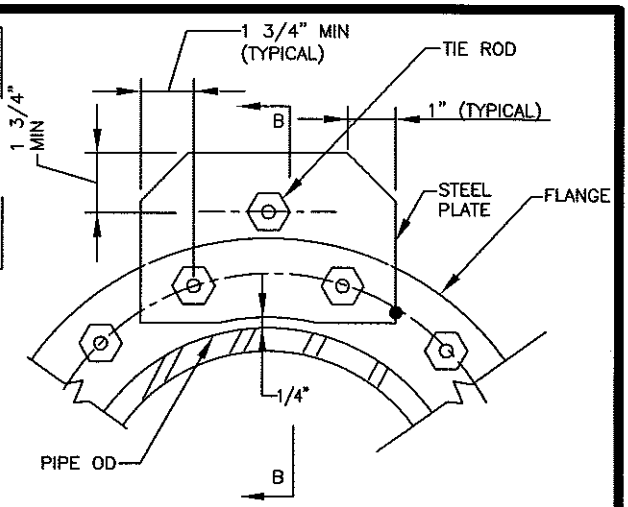
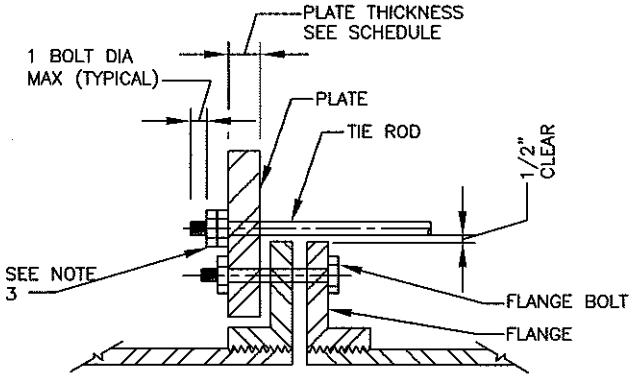
Revised	Howard County, Maryland Department of Public Works	DIP/PVC to HDPE Transition Connection	Detail G-8.31
Revised 5/7/2007	Approved: _____ Chief, Bureau of Engineering		
Approved			



PLAN



SECTION A–A



SECTION B–B

NOTES:

1. TIE RODS SHALL CONFORM TO ASTM A588 SPECIFICATION AND SHALL BE HOT DIPPED GALVANIZED
2. STEEL PLATE SHALL CONFORM TO ASTM A36 SPECIFICATION.
3. INSIDE NUT TO BE HAND TIGHT, AND TWO NUTS SHALL BE TIGHTENED AGAINST EACH OTHER.
4. STRAPPING DESIGN INCLUDES SURGE PRESSURE ADDED TO OPERATING PRESSURE IN PSI.
5. WHEN THE STRAPPING ASSEMBLY IS LOCATED NEAR THE FLANGED VALVE, PROVIDE A FLANGED SPOOL PIECE (1' MIN LENGTH) BETWEEN THE VALVE AND ASSEMBLY IN ORDER TO AVOID STRAPPING DIRECTLY TO THE VALVE.
6. ALL HARDWARE SHALL BE HOT–DIPPED GALVANIZED.

TIE–ROD SCHEDULE

PIPE DIA	MAXIMUM OPERATING PRESSURE (PSI)	NO. OF RODS	DIA OF RODS IN	PLATE THICKNESS
4"	125	2	3/4"	3/4"
	250	2	3/4"	3/4"
6"	125	2	3/4"	3/4"
	250	2	3/4"	3/4"
8"	125	2	7/8"	1"
	250	2	7/8"	1 1/8"
12"	125	3	7/8"	1 1/8"
	250	4	7/8"	1 1/8"
16"	125	4	1"	1 1/4"
	250	4	1 1/8"	1 1/2"
18"	125	4	1"	1 1/2"
	250	6	1"	1 1/2"
20"	125	4	1"	1 1/2"
	250	6	1 1/8"	1 1/2"
24"	125	6	1"	1 1/2"
	250	6	1 1/8"	1 3/4"
30"	125	7	1 1/8"	1 3/4"
	250	7	1 1/2"	2"

7/17/2015
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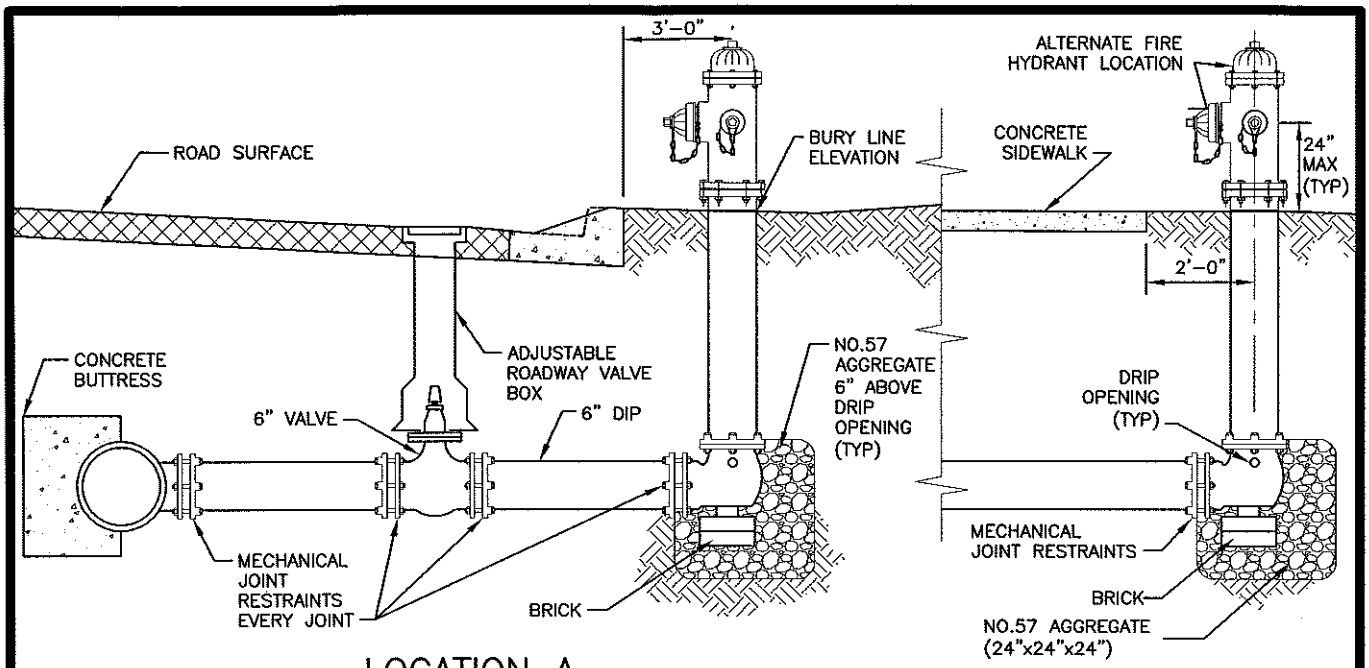
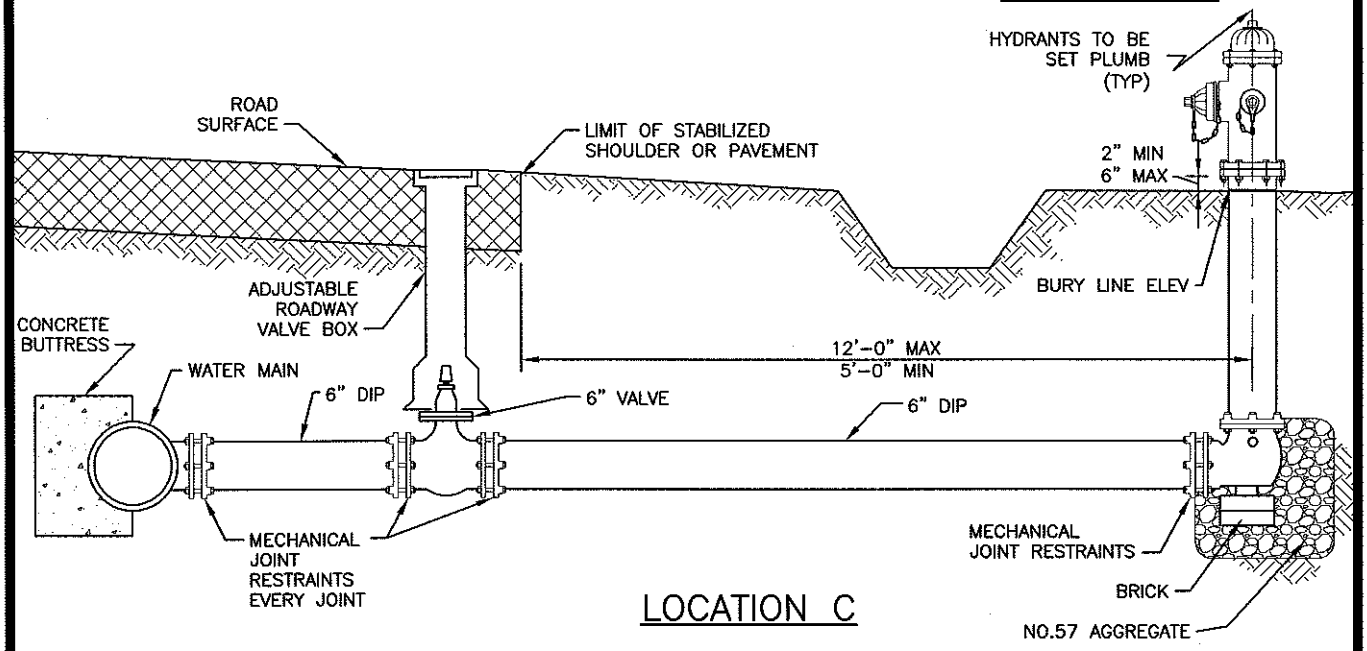
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Strapping Mechanical Couplings in Vaults & Facilities	Detail G–8.41



LOCATION A

LOCATION B



LOCATION C

NOTES:

1. PLACE MINIMUM OF 1/3 CY OF NO.57 AGGREGATE FULL WIDTH OF TRENCH FOR DRAIN SUMP.
2. WHEN LOCATION 'B' IS USED, PROVIDE 10'x10' R/W FOR FIRE HYDRANTS, (SEE DETAIL W-1.13).
3. ALL FIRE HYDRANTS SHALL BE RESTRAINED (SEE DETAIL W-2.11).
4. USE PLAIN CONCRETE 3000 PSI FOR ALL CONCRETE BUTTRESSES.
5. SEE DETAIL W-1.12 FOR GRADING AROUND FIRE HYDRANT.
6. HYDRANTS AND VALVE BOXES ARE TO BE INSTALLED PLUMB.
7. KEEP DRIP OPENING CLEAR AND FREE TO DRAIN.

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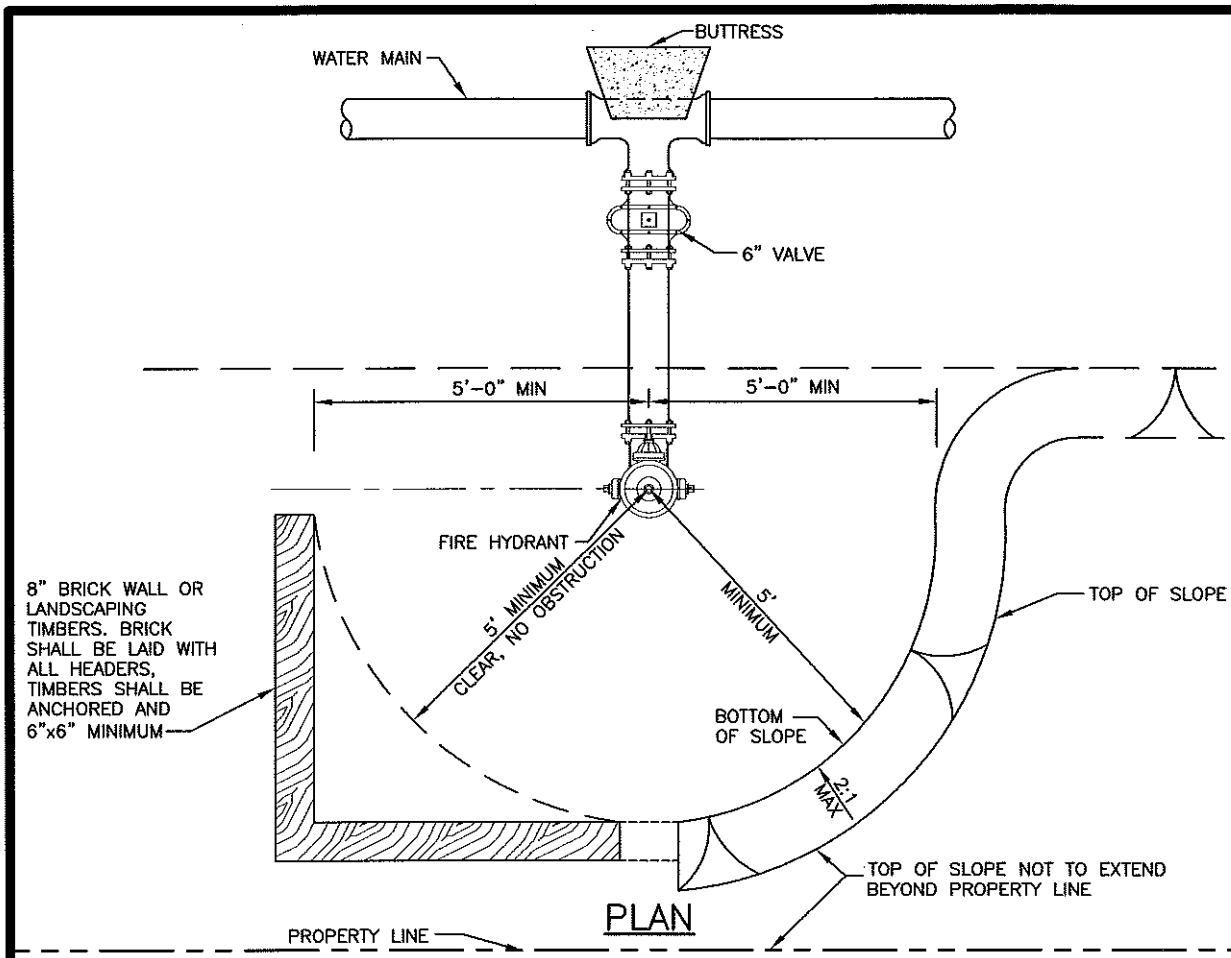
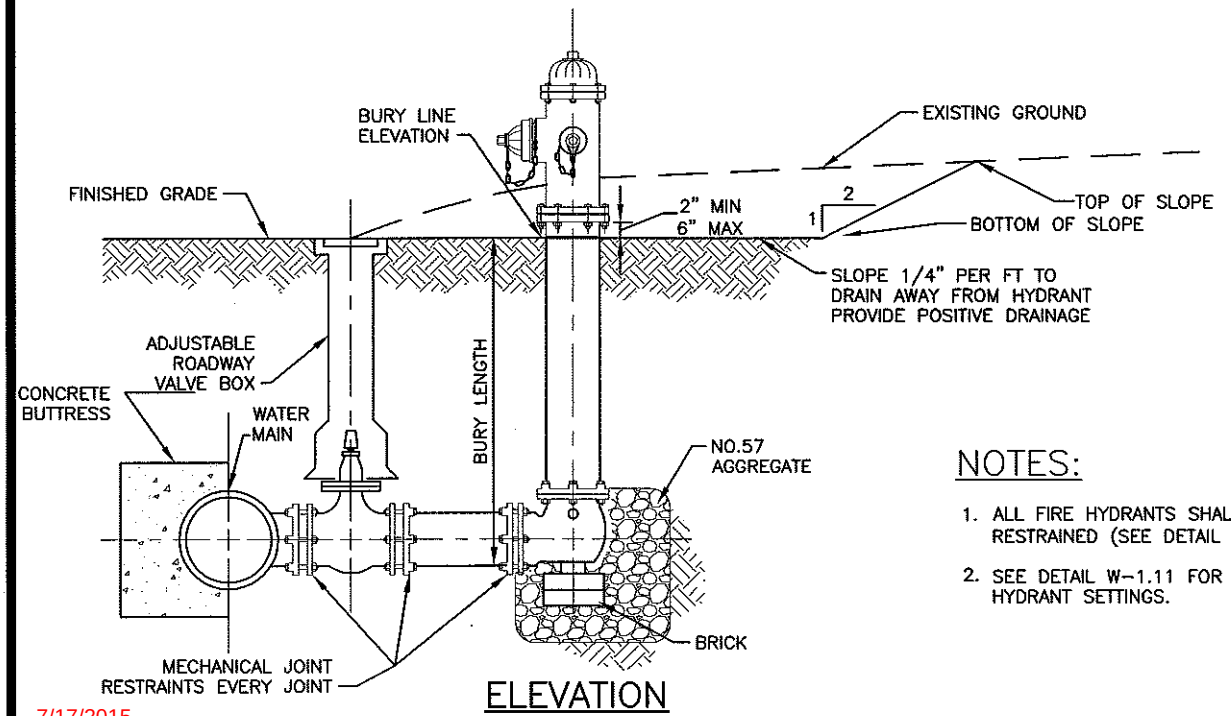
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	FIRE HYDRANT Settings	Detail W-1.11



PLAN



ELEVATION

NOTES:

1. ALL FIRE HYDRANTS SHALL BE RESTRAINED (SEE DETAIL W-2.11).
2. SEE DETAIL W-1.11 FOR FIRE HYDRANT SETTINGS.

7/17/2015
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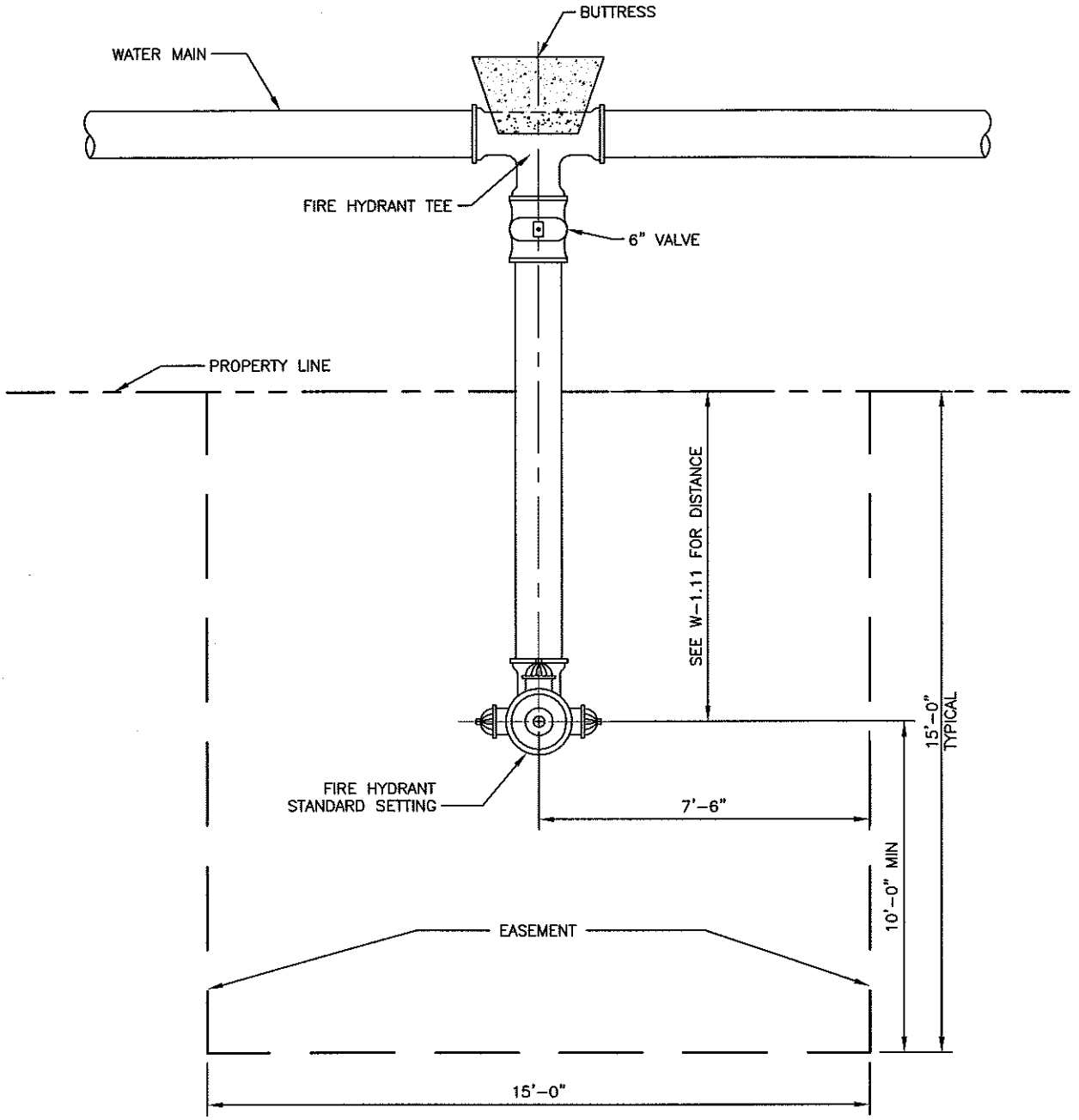
Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	FIRE HYDRANT Grading	Detail W-1.12



PLAN

NOTES:

1. SEE DETAIL W-1.12 FOR GRADING WITHIN RIGHT-OF-WAY.
2. ALL FIRE HYDRANTS SHALL BE RESTRAINED (SEE DETAIL W-2.11).
3. SEE DETAIL W-1.11 FOR FIRE HYDRANT SETTINGS.

7/17/2015
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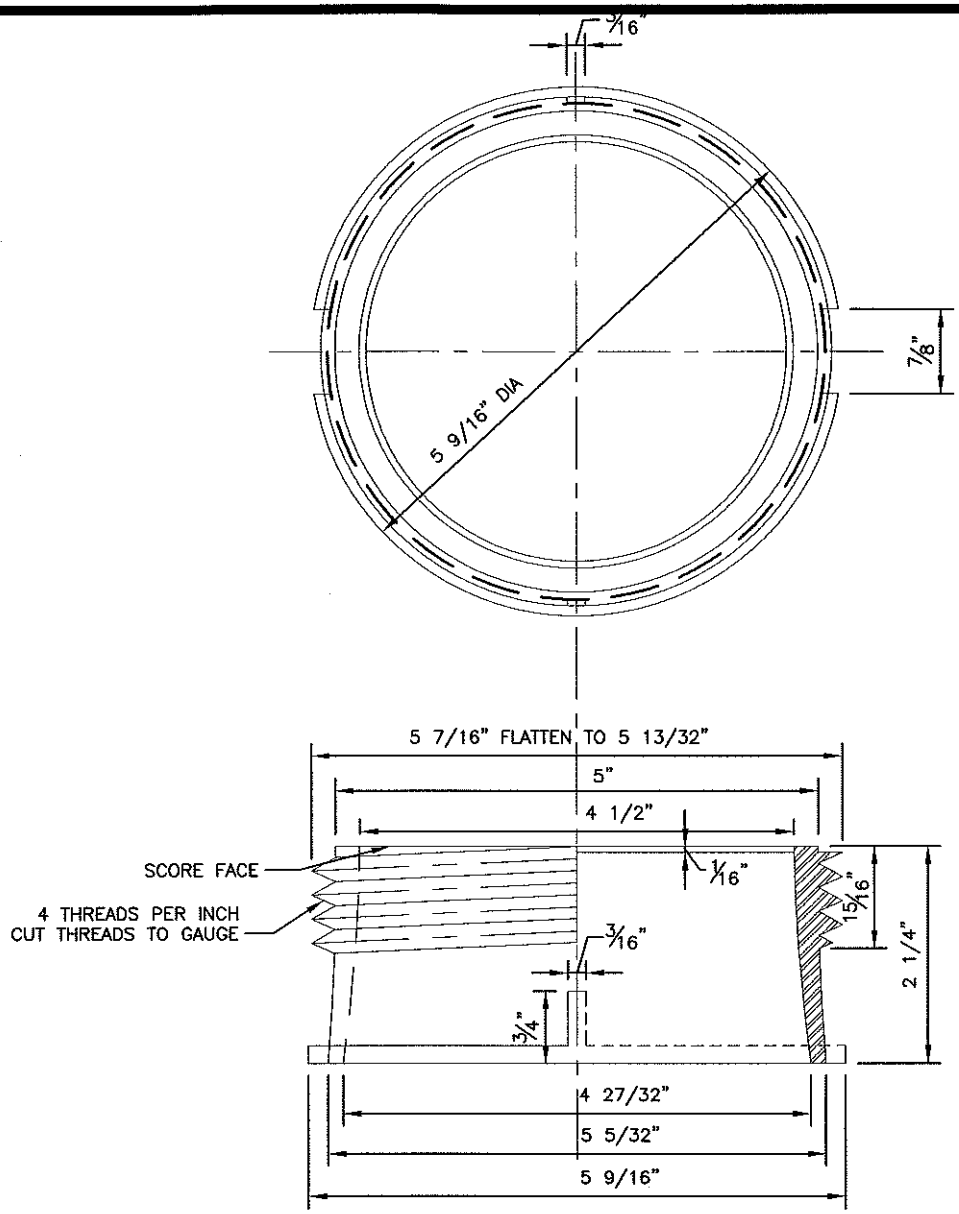
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	FIRE HYDRANT Minimum Easement Requirements	Detail W-1.13



4 1/2 INCH NOZZLE

NOTES:

1. NOZZLE TO BE BRONZE, ASTM B62, GRADE I.
2. NOZZLE TO BE MADE IN ACCORDANCE WITH BALTIMORE FIRE THREAD SPECIFICATIONS.
3. TOLERANCES: FINISH DIMENSIONS SHOWN IN FRACTIONS TO BE ± 0.010 INCH UNLESS OTHERWISE NOTED.
4. 2 1/2" DIAMETER NOZZLES SHALL BE NATIONAL STANDARD FIRE HOSE COUPLING SCREW THREAD.

7/17/2015
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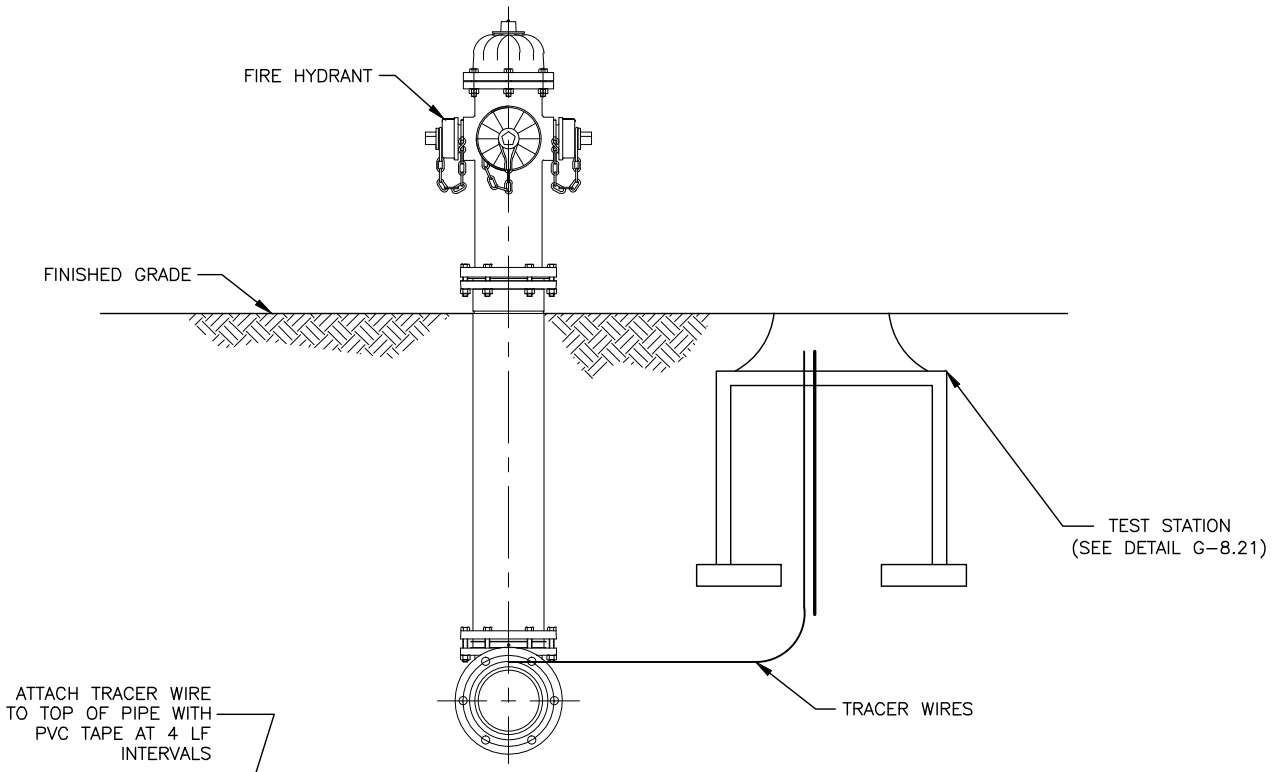
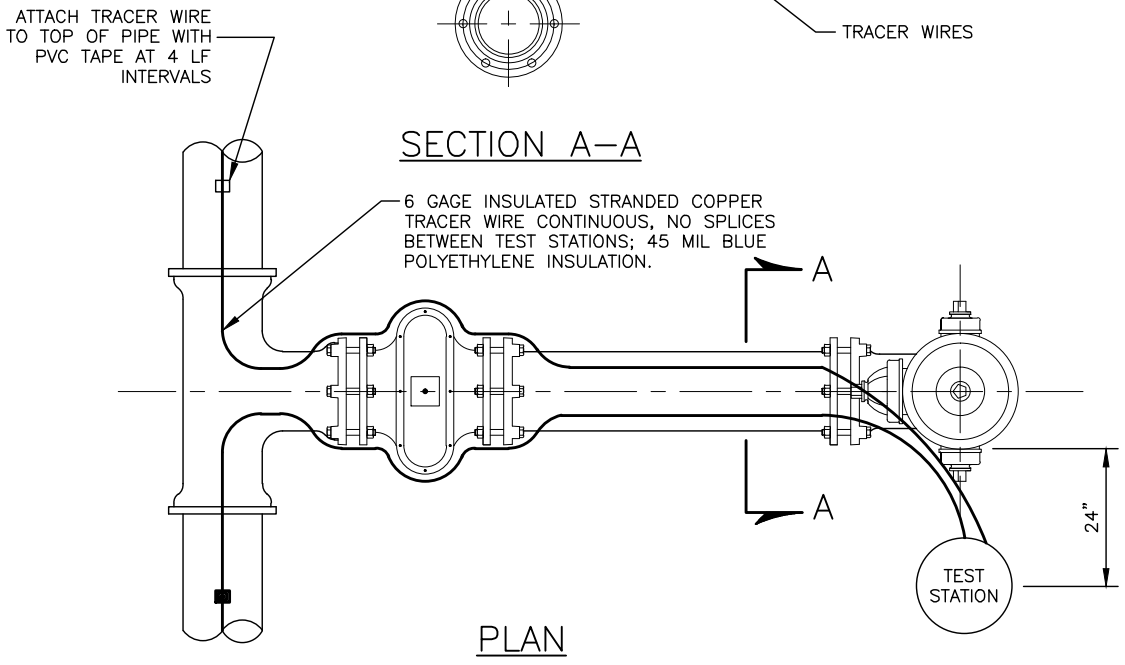
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	FIRE HYDRANT Nozzle	Detail W-1.14





SECTION A–A

PLAN

NOTES:

1. TEST STATION MUST BE PLACED TO THE RIGHT OR LEFT SIDE OF THE FIRE HYDRANT.
2. VALVE VAULT FRAME AND COVER TO BE SET FLUSH WITH FINAL GRADE.
3. BUTTRESSES AND STRAPPING NOT SHOWN FOR CLARITY.
4. NO SPLICES BETWEEN TEST STATIONS, UNLESS APPROVED BY HOWARD COUNTY. LATERAL SPLICES APPROVED BY THE COUNTY SHALL CONSIST OF A BRASS COMPRESSION NUT, WATERPROOF BINDER, AND UNDERGROUND ELECTRICAL TAPE. EXTENSION SPLICES SHALL BE MADE USING A CRIMP CONNECTOR AND SHRINK TUBING.

7/17/2015
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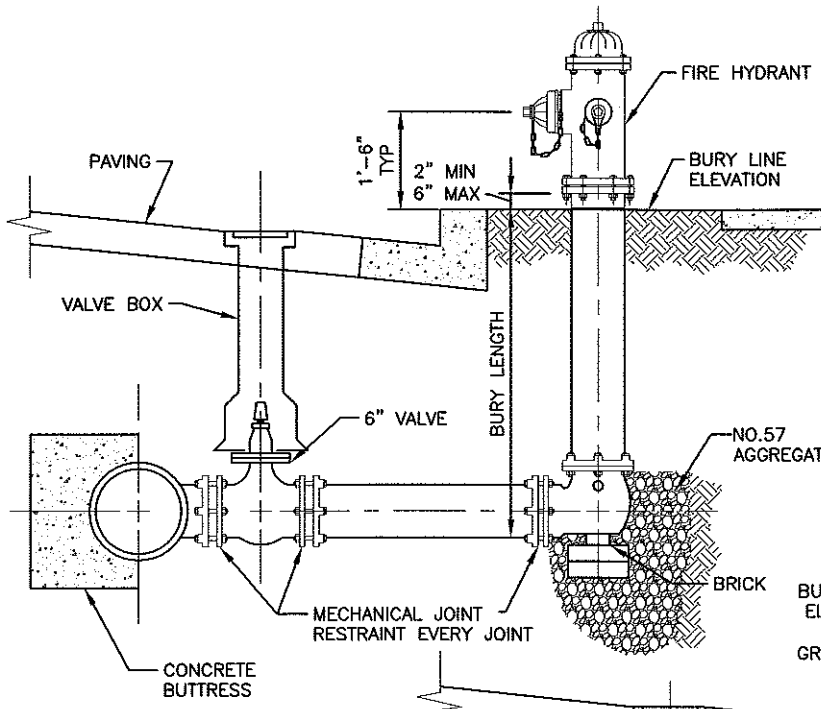
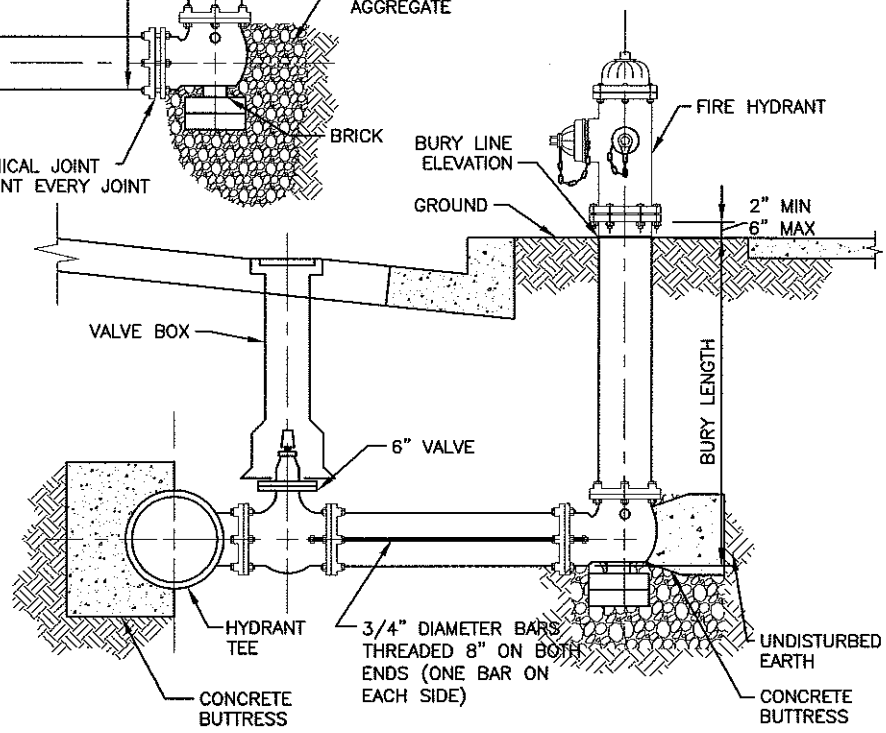
Revised	Howard County, Maryland	FIRE HYDRANT	Detail
⚠1 6/30/2011 Revised	Department of Public Works	Continuity Test Station	W-1.15
5/7/2007 Approved	Approved: Chief, Bureau of Engineering		

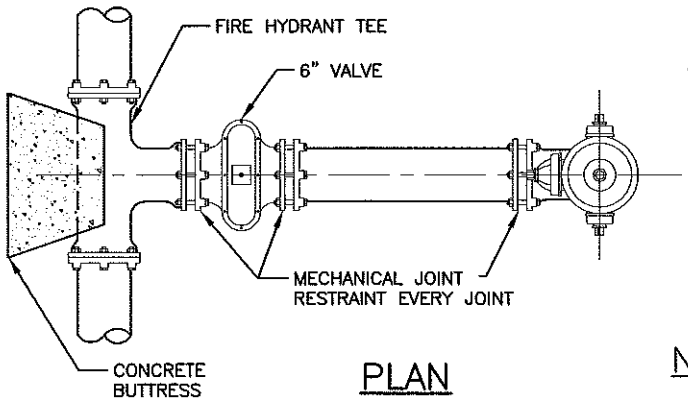


ELEVATION



ALTERNATE HYDRANT VALVE ANCHORING TEE

ELEVATION



PLAN

NOTES:

1. APPLY BITUMINOUS MATERIAL PROTECTIVE COATING TO ALL EXPOSED STEEL PER AWWA C203.
2. BURY LENGTH = BURY LINE ELEV (–) FIRE HYDRANT INVERT.
3. SEE DETAIL W-1.11 FOR HYDRANT SETTINGS.

7/17/2015
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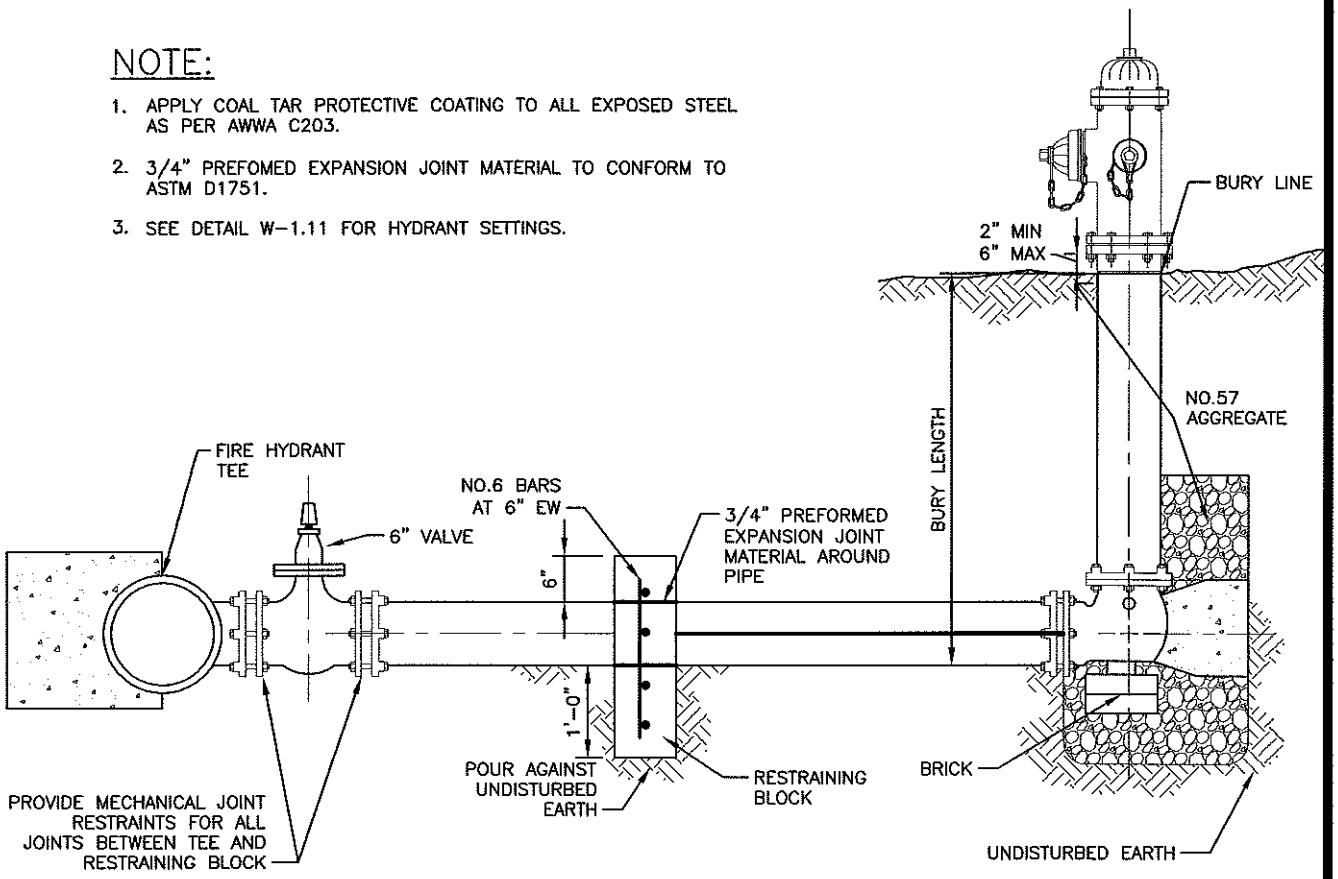
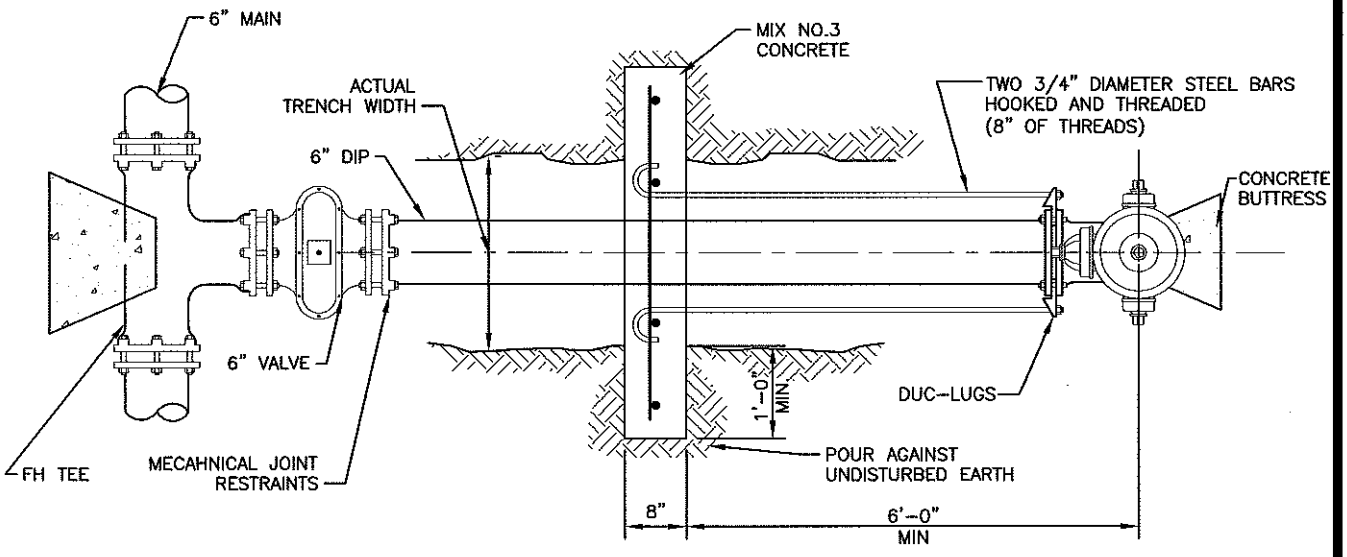
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	FIRE HYDRANT Restraining Hydrant to Main	Detail W-2.11

NOTE:

1. APPLY COAL TAR PROTECTIVE COATING TO ALL EXPOSED STEEL AS PER AWWA C203.
2. 3/4" PREFOMED EXPANSION JOINT MATERIAL TO CONFORM TO ASTM D1751.
3. SEE DETAIL W-1.11 FOR HYDRANT SETTINGS.



ELEVATION



PLAN

7/17/2015
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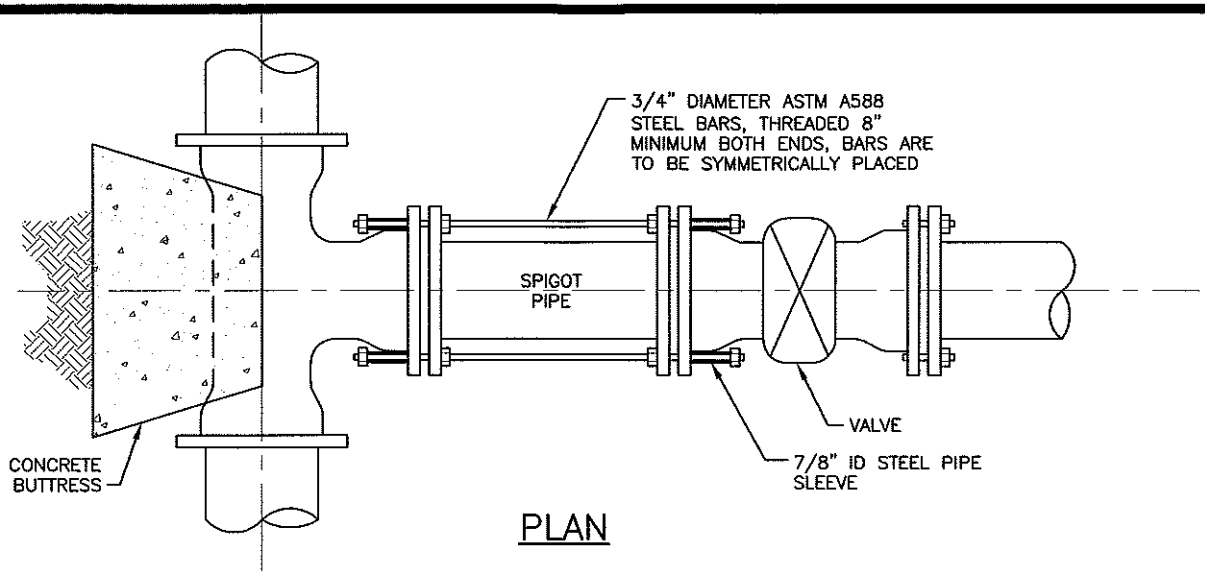
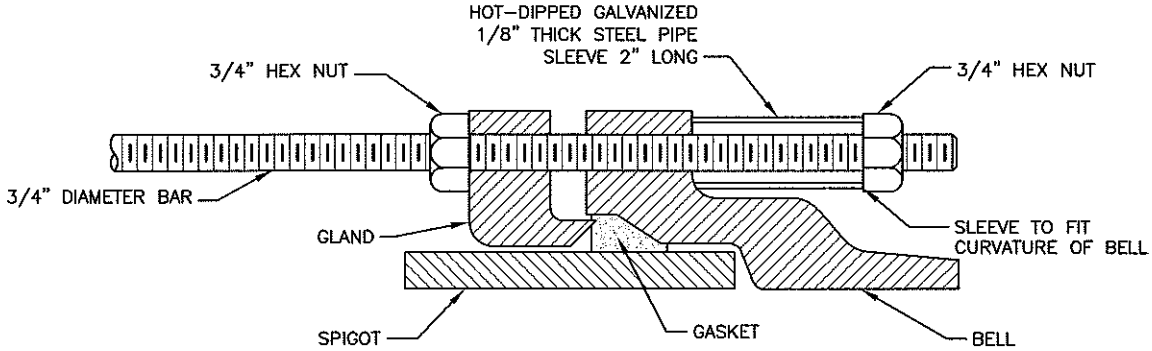
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	FIRE HYDRANT Restraining Hydrant to Main Alternate	Detail W-2.12



PLAN



CROSS-SECTION

SLEEVE AND BAR ASSEMBLY

VALVE SIZE	NUMBER OF ¾" DIA BARS REQUIRED	MAX LENGTH OF SPIGOT PIPE
6"	2	27"
8"	2	27"
12"	6	27"
16"	8	36"
18"	10	36"
20"	12	36"
24"	16	36"

NOTES:

1. APPLY BITUMINOUS MATERIAL PROTECTIVE COATING TO ALL EXPOSED STEEL PER AWWA C203.

7/17/2015
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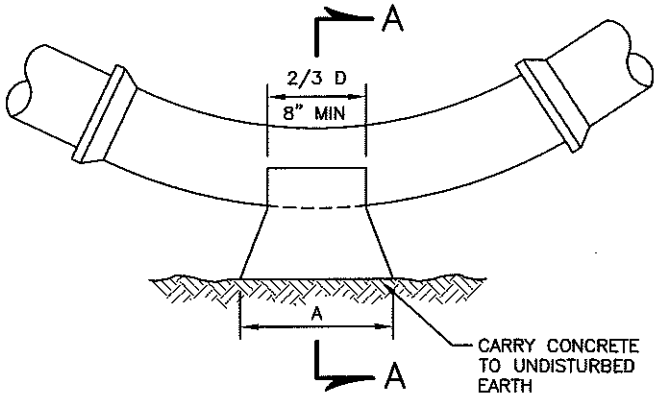
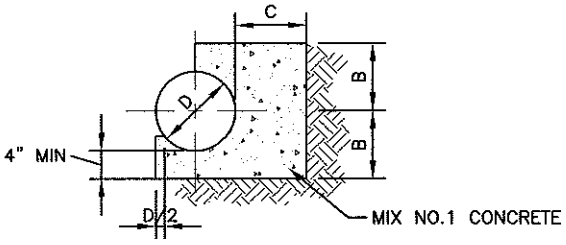
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	WATER MAIN Restraining Valve To Main	Detail W-2.13



PLAN

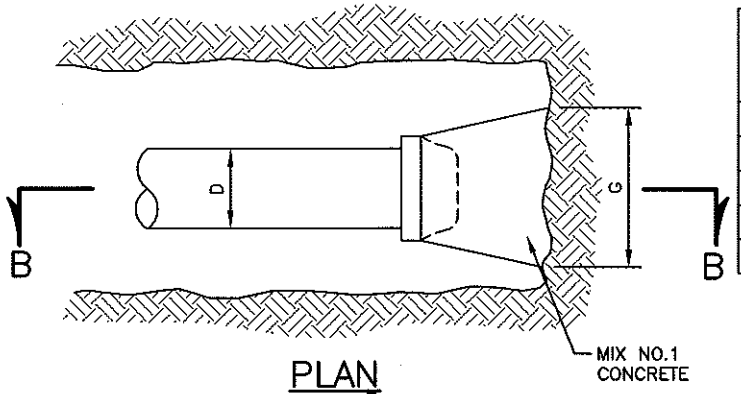


SECTION A–A

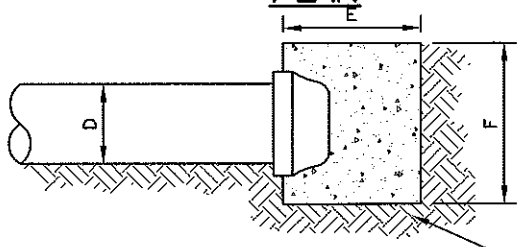
MINIMUM DIMENSIONS OF BUTTRESS FOR HORIZONTAL BENDS *							
DIAMETER: (D)		6"	8"	12"	16"	20"	24"
BEND							
1/64 (5 5/8°)	A	–	–	–	–	1'–8"	2'–0"
	B	–	–	–	–	1'–2"	1'–4"
	C	–	–	–	–	10"	1'–0"
1/32 (11 1/4°)	A	6"	8"	1'–2"	1'–7"	2'–0"	2'–5"
	B	7"	8"	10"	1'–0"	1'–2"	1'–4"
	C	8"	8"	8"	10"	10"	1'–0"
1/16 (22 1/2°)	A	11"	1'–2"	1'–10"	2'–5"	3'–0"	3'–7"
	B	7"	8"	10"	1'–1"	1'–2"	1'–5"
	C	8"	9"	11"	1–2"	1'–4"	1'–6"
1/8 (45°)	A	1'–5"	1'–10"	2'–10"	3'–9"	4'–8"	5'–7"
	B	7"	8"	11"	1'–3"	1'–7"	1'–11"
	C	8"	9"	11"	1'–2"	1'–4"	1'–9"

AREA OF BEARING = Ax2B

BUTTRESS FOR HORIZONTAL BENDS



PLAN



SECTION B–B

MINIMUM DIMENSIONS OF BUTTRESS FOR CAPS AND PLUGS *			
	SIZE		
D	6"	8"	10"
E	7"	9"	11"
F	1'–1"	1'–5"	1'–9"
G	1'–7"	2'–2"	2'–8"

AREA OF BEARING = FxG

NOTES:

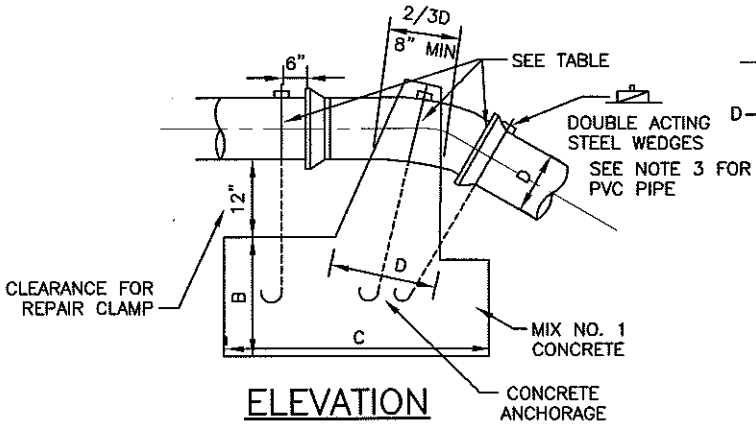
1. PLUGS FOR 12" DIAMETER AND GREATER PIPE ARE ON DETAIL W–2.23.
2. BUTTRESSES FOR 90° HORIZONTAL BENDS ARE ON DETAIL W–2.23.

BUTTRESS FOR CAPS AND PLUGS

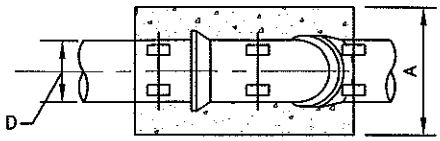
* ALL BUTTRESS DIMENSIONS ARE BASED ON A STATIC WATER PRESSURE OF 150 PSI AND A MINIMUM SOIL BEARING PRESSURE OF 3000 PSF. WHERE ACTUAL FIELD CONDITIONS ARE DIFFERENT, THE AREA OF BEARING SHALL BE INCREASED AS DETERMINED BY THE ENGINEER.

7/17/2015
DRAFT

Revised	Howard County, Maryland Department of Public Works	WATER MAIN Buttress Cap & Horizontal Bend	Detail W–2.21
Revised 5/7/2007	Approved: _____		
Approved	Chief, Bureau of Engineering		



ELEVATION

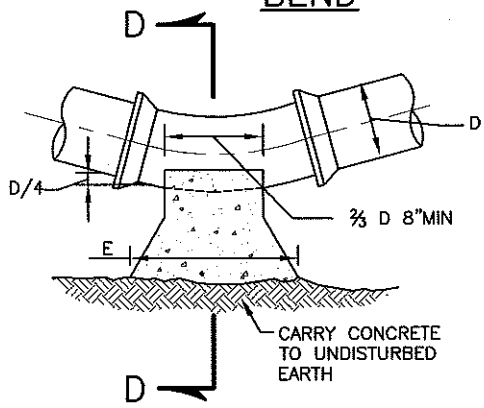


PLAN

TABLE 'A'

SIZE (D)	BENDS		
	1/32	1/16	1/8
	REINFORCING BARS		
6"	3-#4	3-#4	3-#4
8"	3-#4	3-#4	3-#4
12"	3-#4	3-#4	3-#5
16"	3-#6	3-#6	3-#6
20"	3-#6	3-#6	4-#6
24"	3-#6	3-#6	5-#6

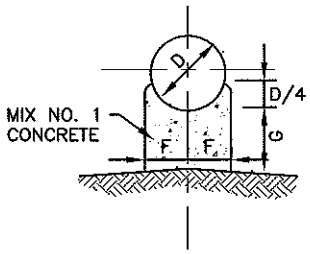
ANCHORAGE FOR UPPER VERTICAL BEND



ELEVATION

TABLE 'B'

ANCHORAGES FOR VERTICAL BENDS								
BEND		SIZE (D)						
		6"	8"	10"	12"	16"	20"	24"
1/32 (11-1/4°)	A	1'-6"	1'-6"	1'-5"	3'-0"	3'-6"	4'-0"	4'-3"
	B	1'-3"	1'-9"	1'-3"	2'-0"	2'-0"	2'-6"	2'-6"
	C	2'-0"	2'-6"	2'-9"	3'-0"	4'-0"	5'-0"	5'-9"
1/16 (22-1/2°)	A	2'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"	5'-0"
	B	1'-9"	2'-3"	2'-6"	2'-6"	2'-6"	2'-8"	3'-8"
	C	2'-6"	2'-8"	3'-10"	4'-0"	5'-6"	7'-6"	8'-6"
1/8 (45°)	A	2'-6"	3'-0"	4'-0"	4'-6"	5'-2"	5'-6"	6'-0"
	B	2'-6"	2'-9"	3'-0"	3'-6"	4'-0"	4'-6"	5'-6"
	C	3'-0"	4'-0"	4'-6"	4'-9"	6'-6"	8'-0"	9'-6"



SECTION D-D

BUTTRESS FOR LOWER VERTICAL BEND

BUTTRESSES FOR VERTICAL BENDS							
BEND		SIZE (D)					
		6"	8"	12"	16"	20"	24"
1/32 (11-1/4°)	E	5"	6"	1'-2"	1'-7"	2'-0"	2'-5"
	F	5"	6"	7"	9"	11"	1'-2"
	G	5"	6"	7"	9"	11"	1'-2"
1/16 (22-1/2°)	E	11"	1'-2"	1'-10"	2'-5"	3'-0"	3'-7"
	F	5"	6"	8"	11"	1'-2"	1'-5"
	G	5"	6"	8"	11"	1'-2"	1'-5"
1/8 (45°)	E	1'-5"	1'-10"	2'-10"	3'-9"	4'-8"	5'-7"
	F	7"	8"	11"	1'-3"	1'-7"	1'-11"
	G	7"	8"	11"	1'-3"	1'-7"	1'-11"

NOTE:

1. ANCHORAGE & BUTTRESS DIMENSIONS ARE BASED ON A STATIC WATER PRESSURE OF 150 PSI AND A MINIMUM SOIL BEARING PRESSURE OF 3000 PSF WHEN ACTUAL FIELD CONDITIONS ARE DIFFERENT THE AREA OF BEARING SHALL BE INCREASED AS DETERMINED BY THE ENGINEER.
2. PAINT EXPOSED BARS/STRAPS WITH 2 COATS OF BITUMINOUS MATERIAL PROTECTIVE COATING PER AWWA C203.
3. WHEN ANCHORING PVC PIPE, THE STRAPPING IN CONTACT WITH THE PIPE SURFACE SHALL BE 1" WIDE X ¼" THICK STEEL (NOT SHOWN). THE REMAINING PORTION OF THE STRAP SHALL BE A REINFORCING BAR SIZED IN ACCORDANCE WITH TABLE A.

7/17/2015 DRAFT

Revised

Revised 5/7/2007 Approved

Howard County, Maryland
Department of Public Works

Approved: _____
Chief, Bureau of Engineering

WATER MAIN
Buttress & Anchorage
Vertical Bend

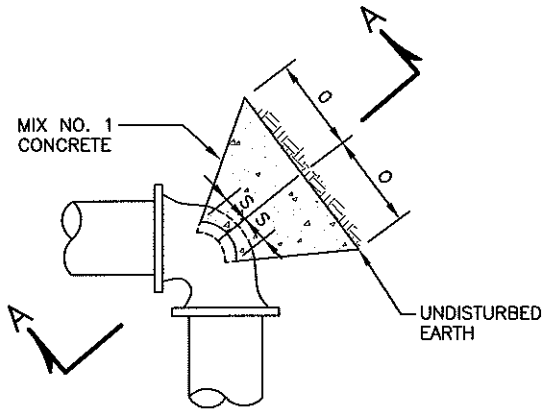
Detail
W-2.22

DIAMETER	O	P	R	S
6"	1' – 2"	1' – 2"	1' – 8"	5"
8"	1' – 7"	1' – 6"	1' – 8"	6"
12"	2' – 0"	2' – 6"	1' – 11"	7"
16"	2' – 10"	3' – 0"	2' – 2"	10"
18"	3' – 1"	3' – 6"	2' – 6"	1' – 0"
20"	3' – 6"	3' – 10"	2' – 10"	1' – 0"
24"	4' – 8"	4' – 0"	3' – 0"	1' – 0"

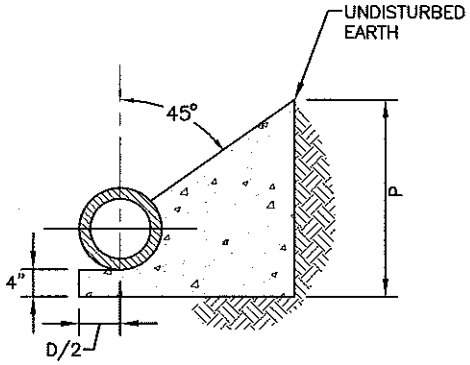
MINIMUM DIMENSIONS OF BUTTRESS FOR TEES						
LABEL	SIZE OF BRANCH					
D	6"	8"	12"	16"	20"	24"
H	8"	9"	1'-0"	1'-4"	1'-8"	2'-2"
I	10"	1'-1"	1'-7"	2'-2"	2'-8"	3'-2"
J	6"	8"	1'-1"	1'-5"	1'-9"	2'-1"
K	6"	7"	9"	10"	1'-2"	1'-4"

BUTTRESS FOR TEES

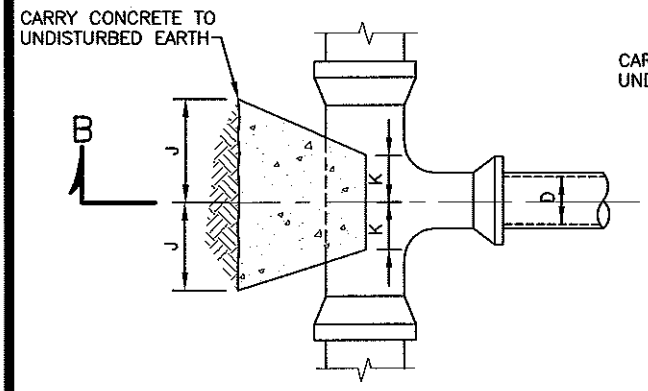
AREA OF BEARING = 2 X O X P



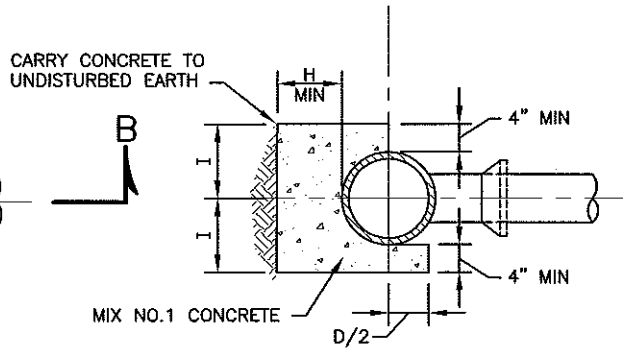
PLAN A



SECTION A–A



PLAN B



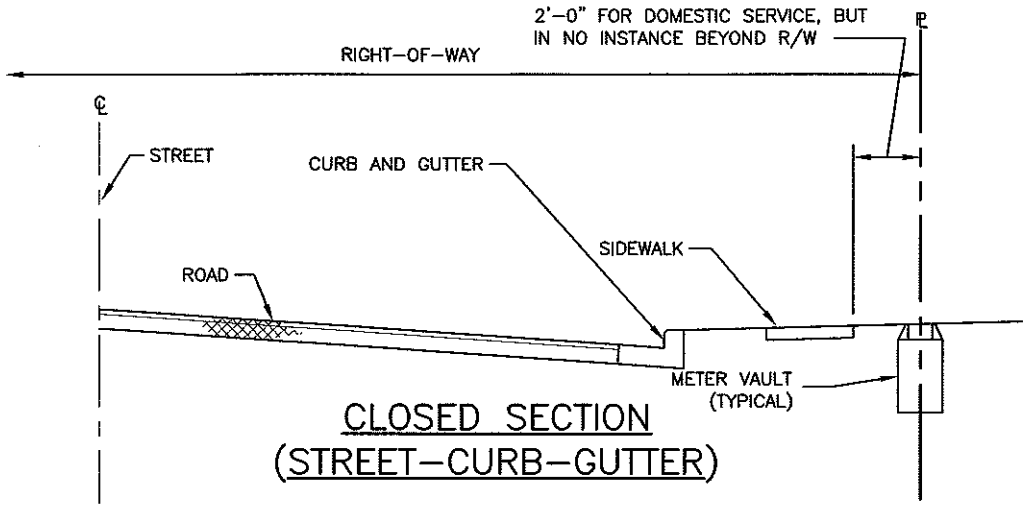
SECTION B–B

NOTES:

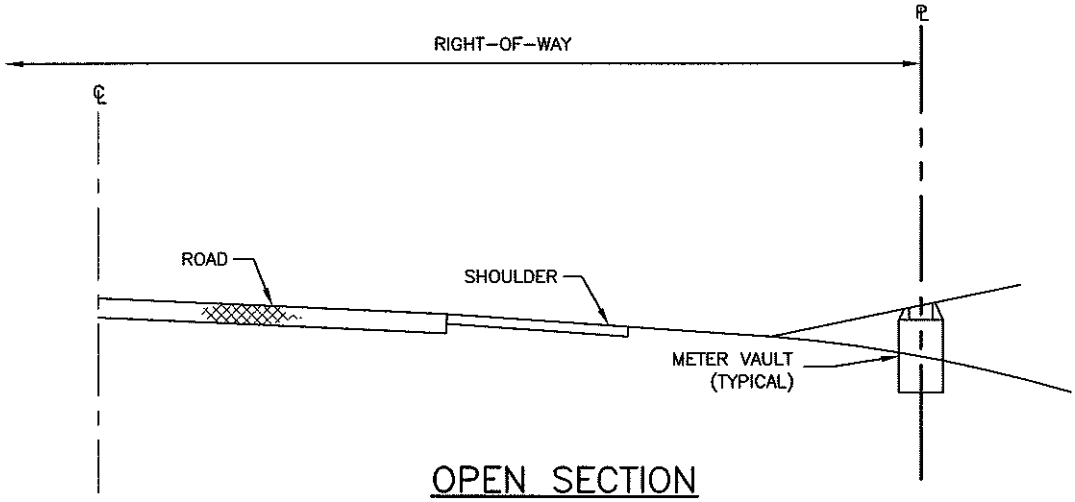
1. BUTTRESS DIMENSIONS ARE BASED ON A WATER PRESSURE OF 150 PSI. AND A MINIMUM SOIL BEARING PRESSURE OF 3000 PSF. WHEN ACTUAL FIELD CONDITIONS ARE DIFFERENT THE AREA OF BEARING SHALL BE INCREASED AS DETERMINED BY THE ENGINEER AND SHOWN ON THE CONTRACT DOCUMENTS.
2. AREA OF BEARING = 2J x 2I

7/17/2015 DRAFT

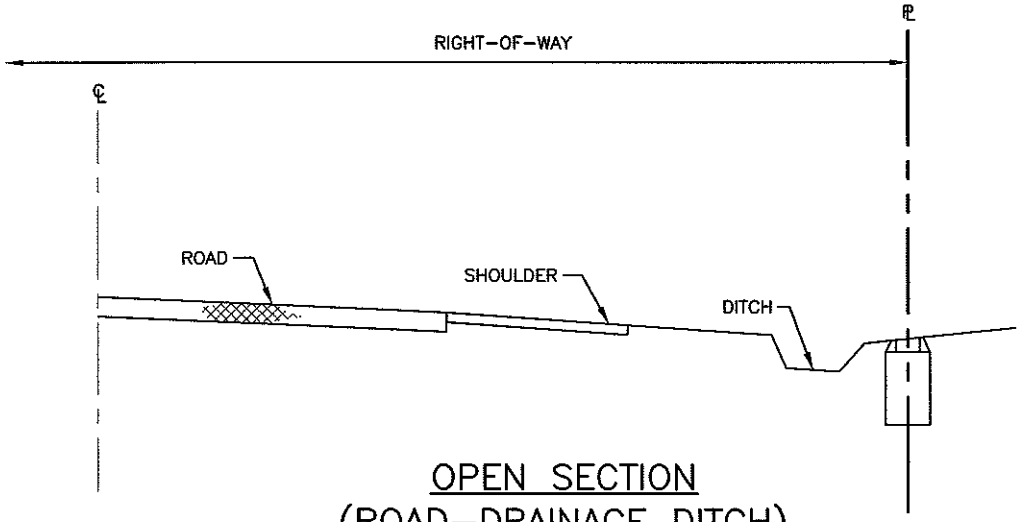
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	WATER MAIN Buttress Tee & 1/4 Bend	Detail W-2.23



CLOSED SECTION
(STREET-CURB-GUTTER)



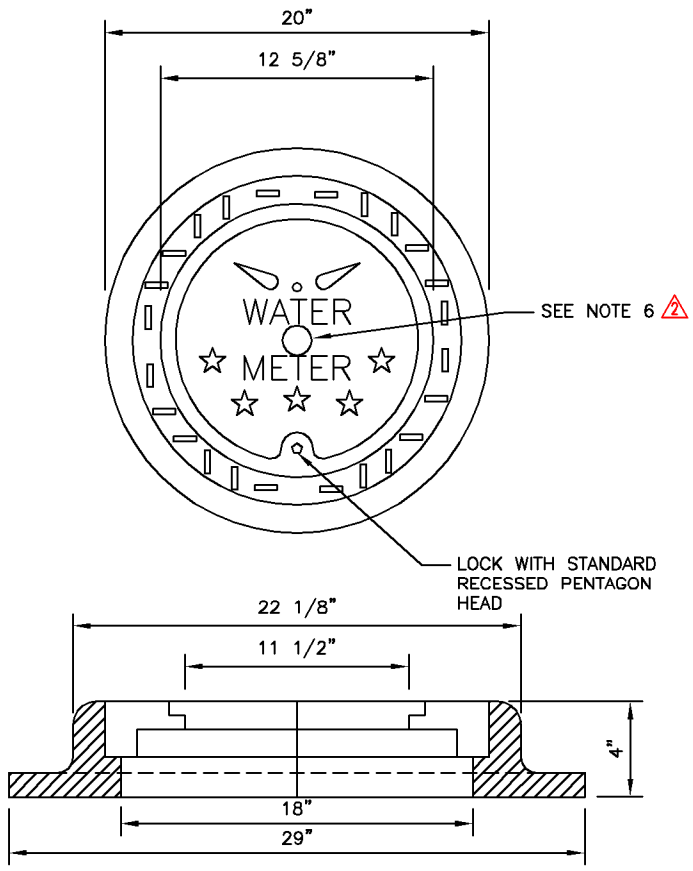
OPEN SECTION
(ROAD-NO DRAINAGE DITCH)



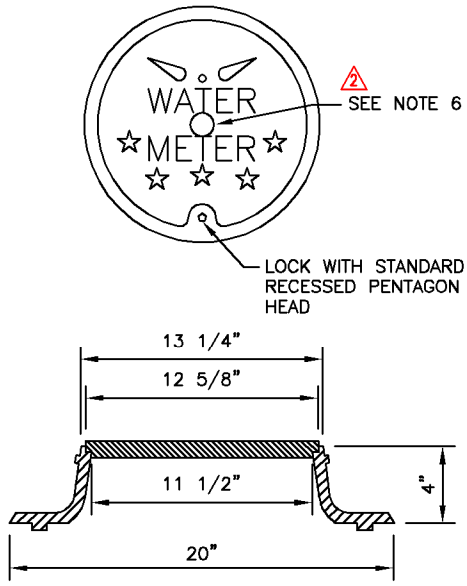
OPEN SECTION
(ROAD-DRAINAGE DITCH)

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	WATER METER Vault Location Outside	Detail W-3.11



18"x12" METER FRAME AND COVER
CAST IRON



12" METER FRAME AND COVER
CAST IRON

NOTES:

2 1. 12" METER FRAME AND COVER FOR USE WITH EXISTING WATER SERVICES FOR PURPOSE OF RELOCATION, TYPE "A" FRAME AND COVER (RECESSED).

2. 18"x12" METER FRAME AND COVER FOR USE WITH SECTIONAL CONCRETE VALVE VAULTS.

3. ALL STANDARD FRAME & COVER MATERIAL SHALL BE CAST IRON AND SHALL CONFORM TO ASTM A48, CLASS 30.

4. THE USE OF ADJUSTABLE FRAME AND COVER IS ALSO ACCEPTABLE. SEE THE HOWARD COUNTY APPROVED MATERIALS LIST SECTION 961.08.11.

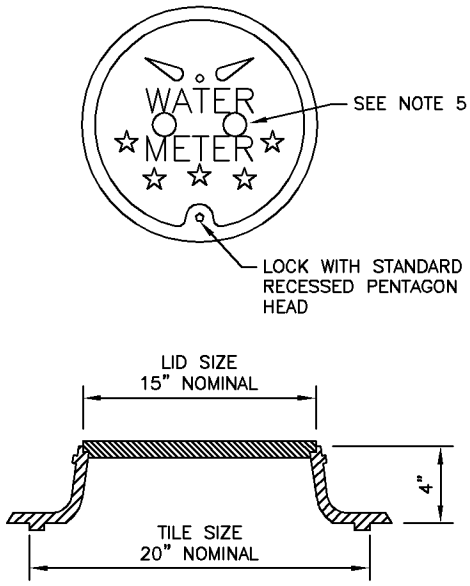
2 5. EXTENSION RINGS FOR ADAPTING THE 12" METER FRAME TO THE VAULT SHALL BE USED.

2 6. SINGLE 2" DIAMETER HOLE FOR RADIO READ METERS WITH PLUG.

7/17/2015 DRAFT

* PRIOR REVISION LABELS REMOVED FOR PRESENTATION CLARITY.

2 5/1/2014 * Revised 1 6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Thomas E. Butler Chief, Bureau of Engineering	WATER METER Frame and Cover	Detail W-3.12



15" METER FRAME AND COVER
CAST IRON

NOTES:

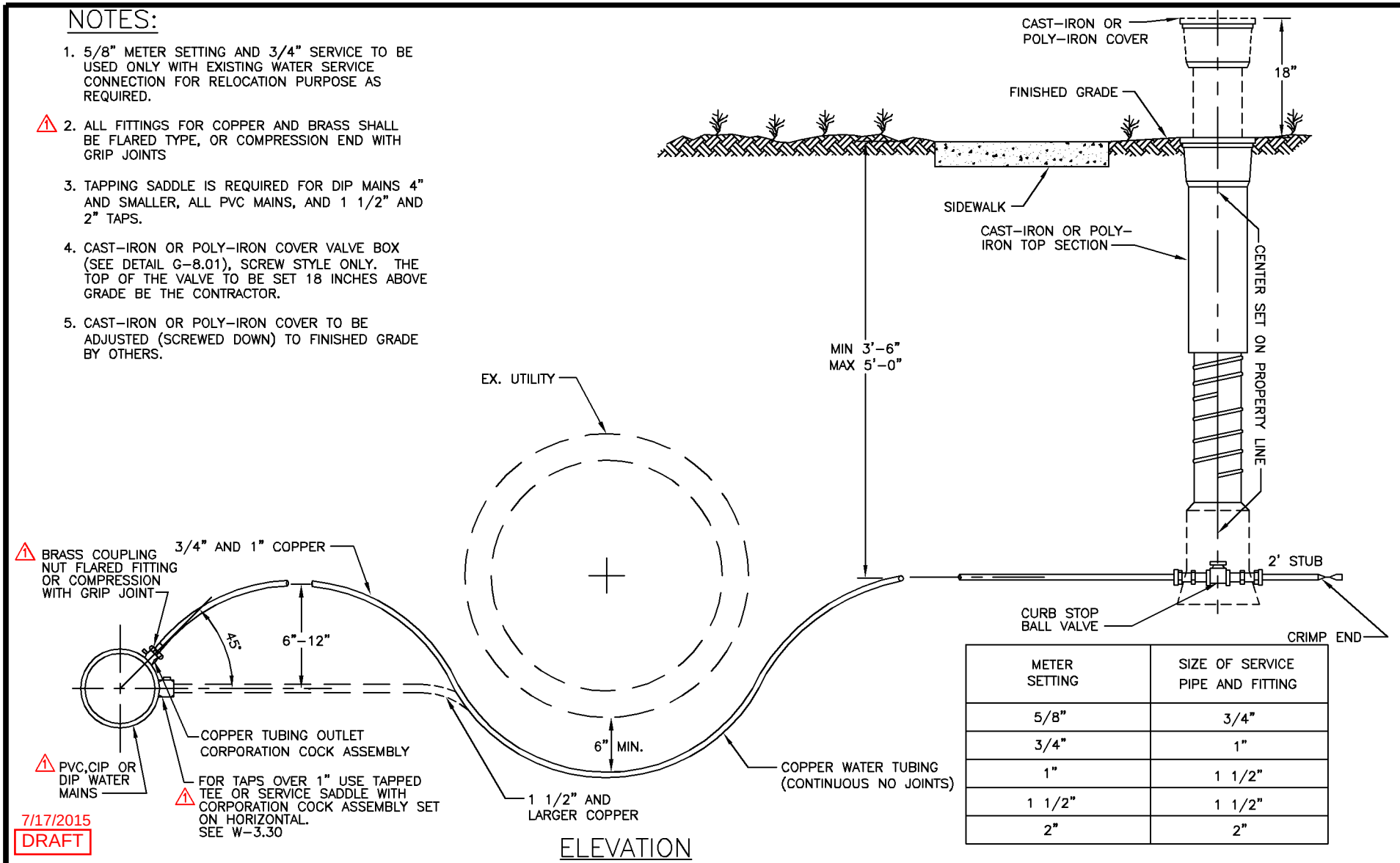
1. 15" METER FRAME AND COVER FOR USE WITH 24 AND 30–INCH DIAMETER METER BOX, TYPE "A" (RECESSED).
2. ALL STANDARD FRAME & COVER MATERIAL SHALL BE CAST IRON AND SHALL CONFORM TO ASTM A48, CLASS 30.
3. THE USE OF ADJUSTABLE FRAME AND COVER IS ALSO ACCEPTABLE. SEE THE HOWARD COUNTY APPROVED MATERIALS LIST SECTION 961.08.11.
4. EXTENSION RINGS FOR ADAPTING THE 15" METER FRAMES TO THE VAULT SHALL BE USED.
5. DUAL 2" DIAMETER HOLES FOR RADIO READ METERS WITH PLUGS.

7/17/2015
DRAFT

Revised Revised 5/1/2014 Approved	Howard County, Maryland Department of Public Works Approved: Thomas E. Butler Chief, Bureau of Engineering	WATER METER 15" Frame and Cover	Detail W-3.13

NOTES:

1. 5/8" METER SETTING AND 3/4" SERVICE TO BE USED ONLY WITH EXISTING WATER SERVICE CONNECTION FOR RELOCATION PURPOSE AS REQUIRED.
2. ⚠1 ALL FITTINGS FOR COPPER AND BRASS SHALL BE FLARED TYPE, OR COMPRESSION END WITH GRIP JOINTS
3. TAPPING SADDLE IS REQUIRED FOR DIP MAINS 4" AND SMALLER, ALL PVC MAINS, AND 1 1/2" AND 2" TAPS.
4. CAST–IRON OR POLY–IRON COVER VALVE BOX (SEE DETAIL G–8.01), SCREW STYLE ONLY. THE TOP OF THE VALVE TO BE SET 18 INCHES ABOVE GRADE BE THE CONTRACTOR.
5. CAST–IRON OR POLY–IRON COVER TO BE ADJUSTED (SCREWED DOWN) TO FINISHED GRADE BY OTHERS.



ELEVATION

METER SETTING	SIZE OF SERVICE PIPE AND FITTING
5/8"	3/4"
3/4"	1"
1"	1 1/2"
1 1/2"	1 1/2"
2"	2"

7/17/2015
DRAFT

⚠1 5/1/2014 Revised
5/7/2007 Approved

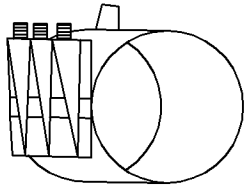
Howard County, Maryland
Department of Public Works
Approved: Thomas E. Butler
Chief, Bureau of Engineering

WATER SERVICE CONNECTION
5/8", 3/4", 1", 1 1/2", & 2"
Inside Meter Settings

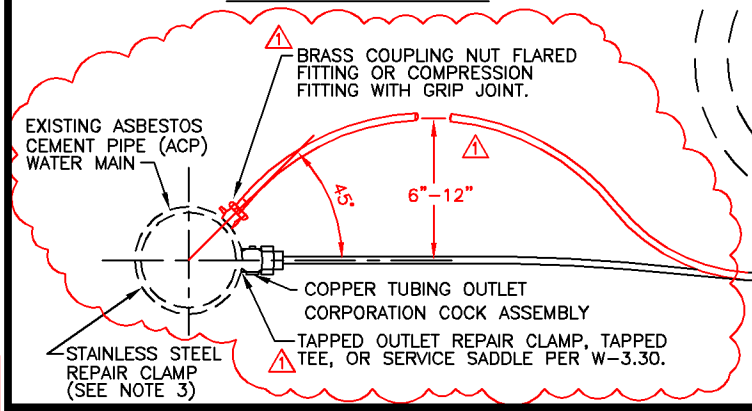
Detail
W–3.21

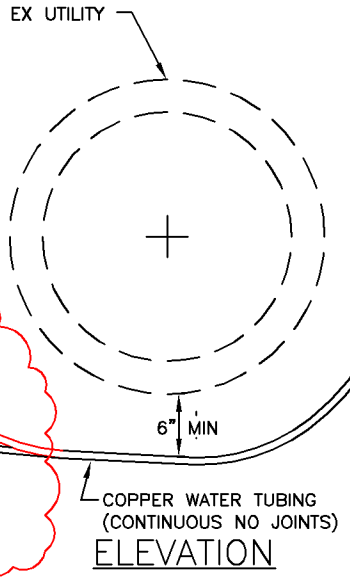
NOTES:

1. 5/8" METER SETTING AND 3/4" SERVICE TO BE USED ONLY WITH EXISTING WATER SERVICE CONNECTION FOR RELOCATION PURPOSE AS REQUIRED.
2. ALL FITTINGS FOR COPPER AND BRASS SHALL BE FLARED TYPE, OR COMPRESSION END WITH GRIP JOINTS.
3. REPAIR CLAMP LENGTH TO BE NO LESS THAN 12". PIPE OD WILL DETERMINE THE SIZE OF THE CLAMP. PVC SERVICE SADDLES PER W-3.30 ARE ALSO ACCEPTABLE.
4. CAST-IRON OR POLY-IRON COVER VALVE BOX (SEE DETAIL G-8.01), SCREW STYLE ONLY. THE TOP OF THE VALVE TO BE SET 18 INCHES ABOVE GRADE BE THE CONTRACTOR.
5. CAST-IRON OR POLY-IRON COVER TO BE ADJUSTED (SCREWED DOWN) TO FINISHED GRADE BY OTHERS.

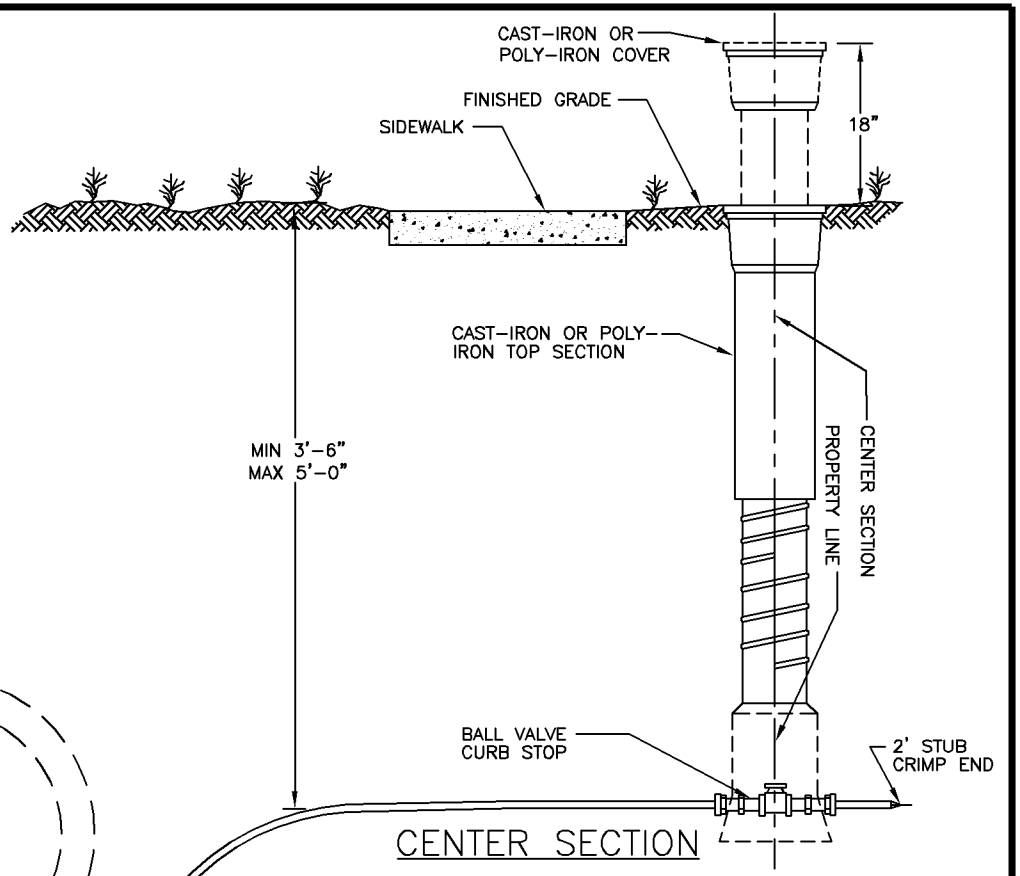


REPAIR CLAMP





ELEVATION



CENTER SECTION

METER SETTING	SIZE OF SERVICE PIPE AND FITTING
5/8"	3/4"
3/4"	1"
1"	1 1/2"
1 1/2"	1 1/2"
2"	2"

7/17/2015 DRAFT

Revised
1 5/1/2014
Revised
5/7/2007
Approved

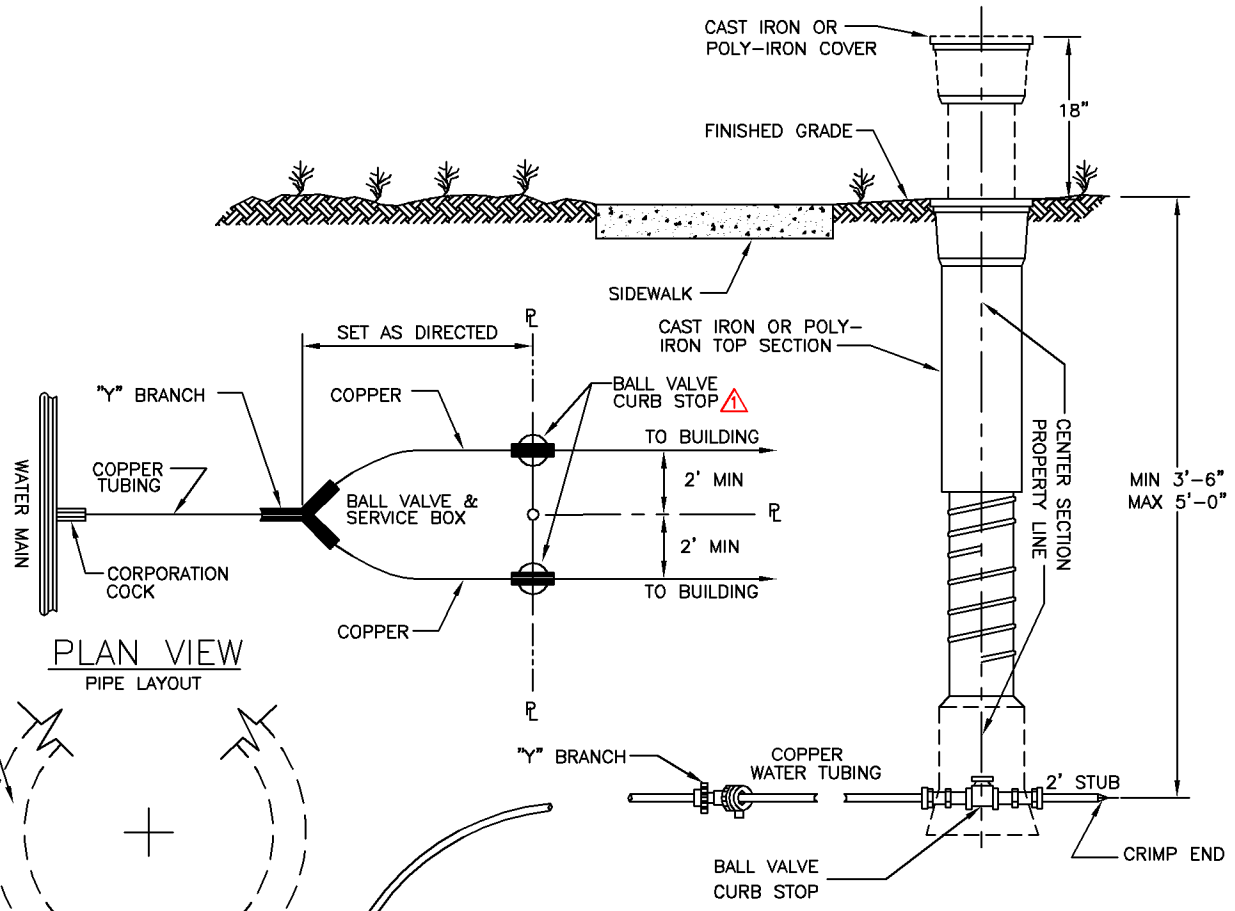
Howard County, Maryland
Department of Public Works
Approved: Thomas E. Butler
Chief, Bureau of Engineering

WATER SERVICE CONNECTION
5/8", 3/4", 1", 11/2", & 2"
Existing A.C.P. Main

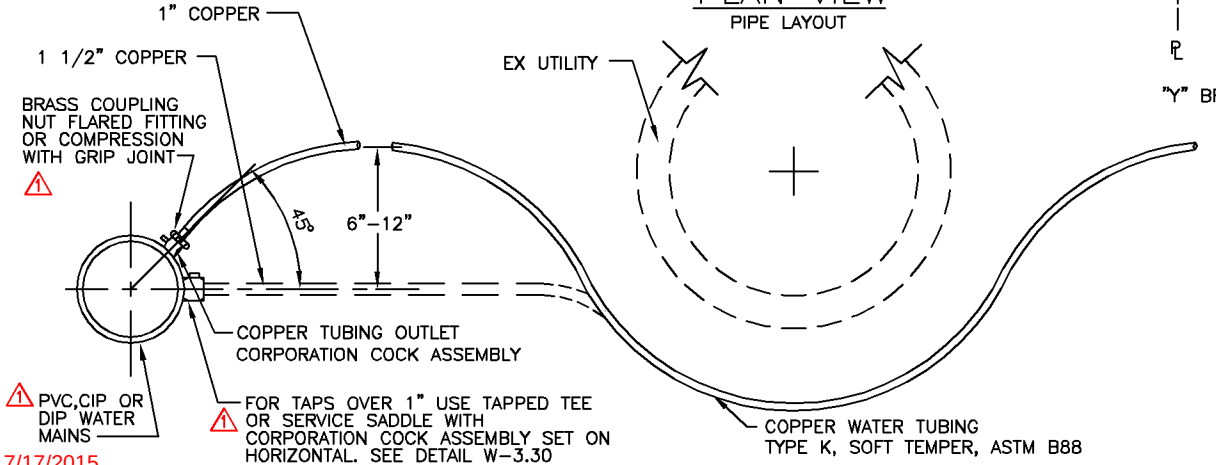
Detail
W-3.22

NOTES:

1. 5/8" METER SETTINGS MAY ONLY BE USED FOR RELOCATION PURPOSES.
2. ALL FITTINGS FOR COPPER AND BRASS SHALL BE FLARED TYPE, OR COMPRESSION END WITH GRIP JOINTS.
3. TAPPING SADDLE IS REQUIRED FOR 4" DIAMETER AND SMALLER DIP MAINS, ALL PVC MAINS, AND ALL 1 1/2" AND 2" TAPS.
4. CAST-IRON OR POLY-IRON COVER VALVE BOX (SEE DETAIL G-8.01), SCREW STYLE ONLY. THE TOP OF THE VALVE TO BE SET 18 INCHES ABOVE GRADE BE THE CONTRACTOR.
5. CAST-IRON OR POLY-IRON COVER TO BE ADJUSTED (SCREWED DOWN) TO FINISHED GRADE BY OTHERS.



PLAN VIEW
PIPE LAYOUT



ELEVATION

METER SETTING	SIZE OF SERVICE PIPE & FITTING	
	INLET	OUTLET
5/8"	1"	3/4"
3/4"	1 1/2"	1"
1"	1 1/2"	1 1/2"

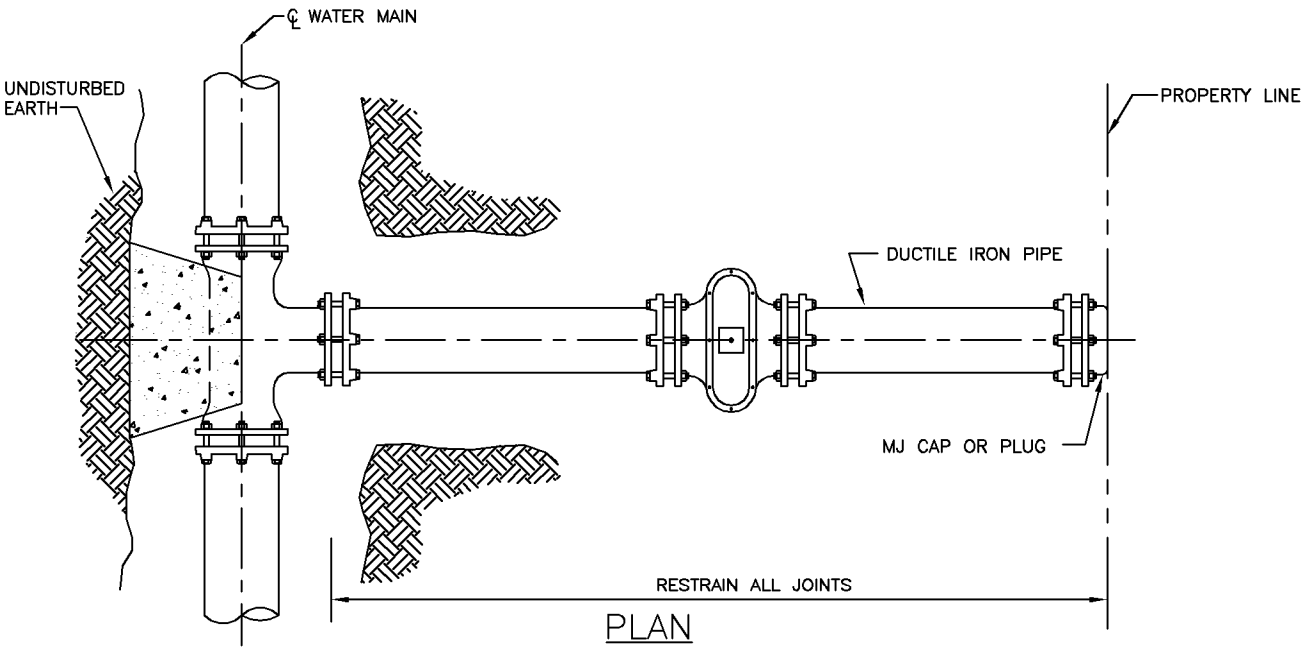
7/17/2015
DRAFT

Revised
1 5/1/2014
Revised
5/7/2007
Approved

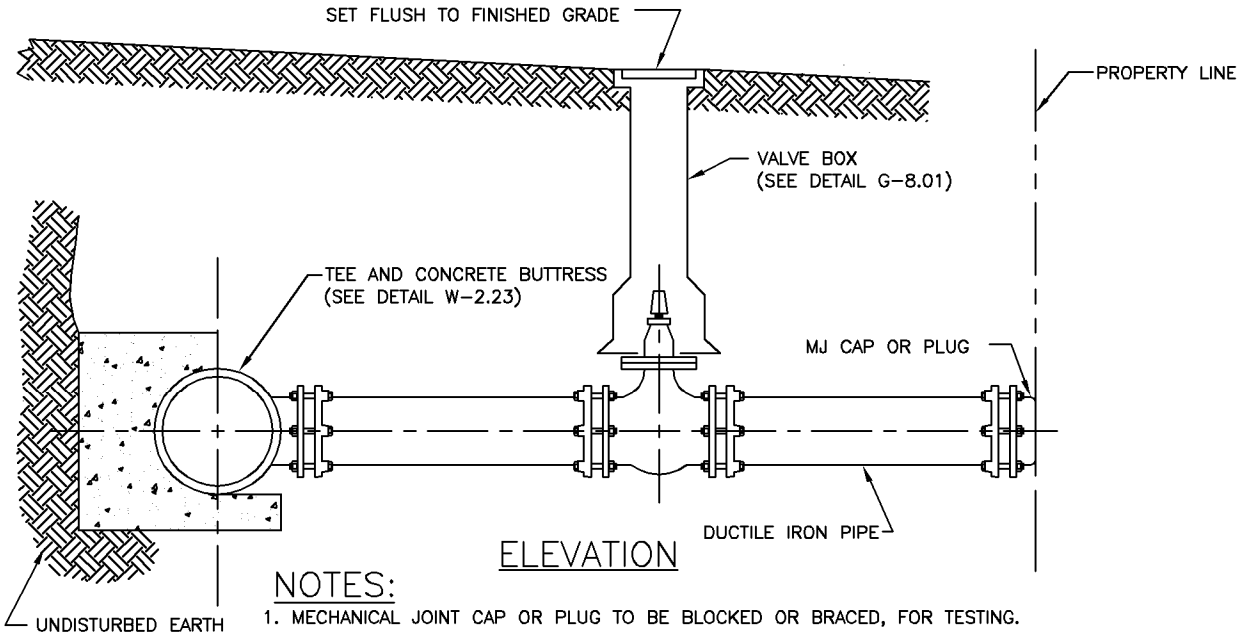
Howard County, Maryland
Department of Public Works
Approved: Thomas E. Butler
Chief, Bureau of Engineering

WATER SERVICE CONNECTION
5/8", 3/4", & 1" Dual Building Inside Meter Settings

Detail
W-3.23



PLAN



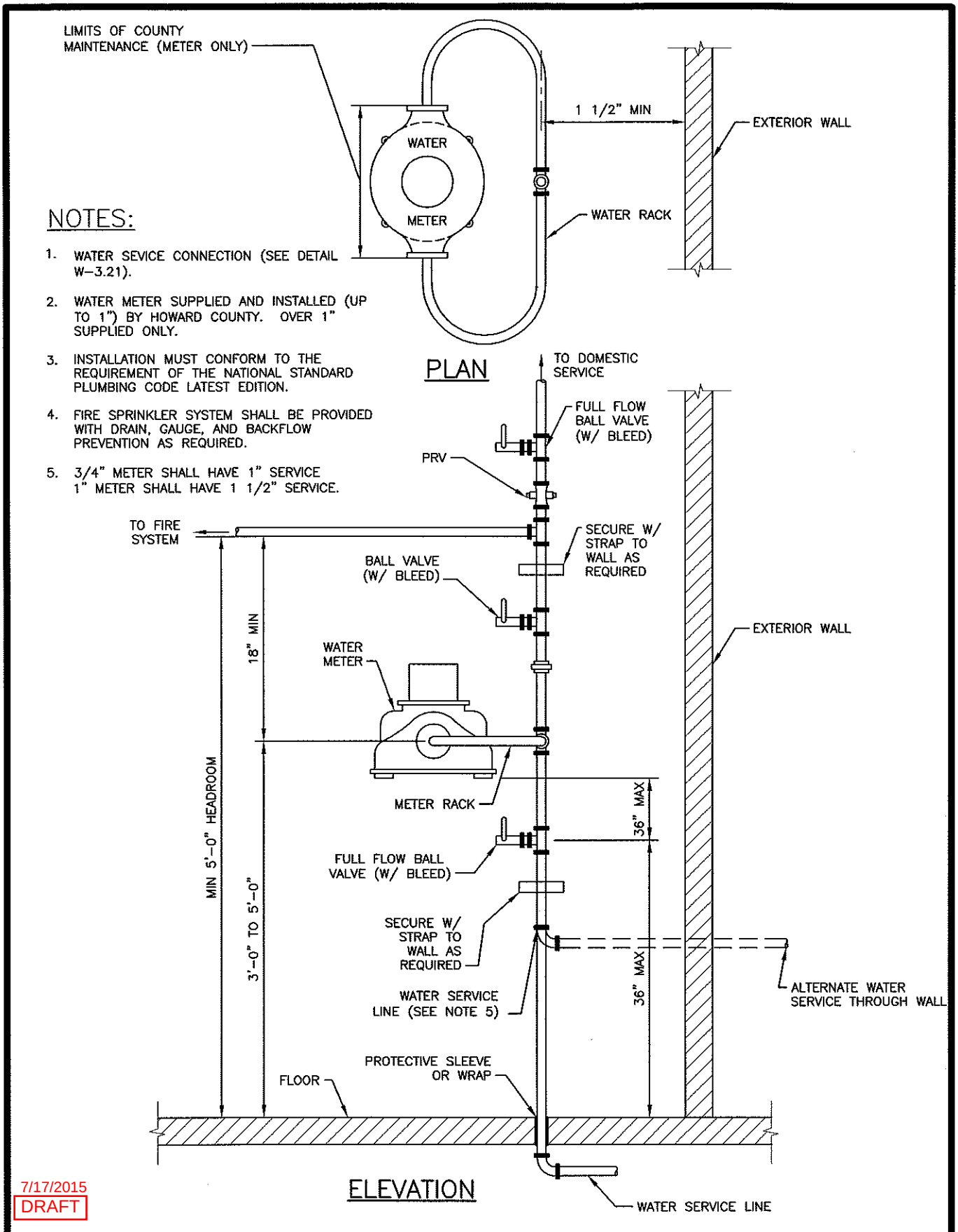
ELEVATION

NOTES:

1. MECHANICAL JOINT CAP OR PLUG TO BE BLOCKED OR BRACED, FOR TESTING.
2. LAY SERVICE HORIZONTAL UNLESS NOTED OTHERWISE.
3. FOR 3" SERVICES, USE A 4" OUTLET ON TEE, 4" VALVE INSTALL A 4" x 3" REDUCER AT THE PROPERTY LINE OR EASEMENT LINE.

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	WATER SERVICE CONNECTION 3", 4", 6", 8", 10", & 12" Inside Meter Settings	Detail W-3.24



NOTES:

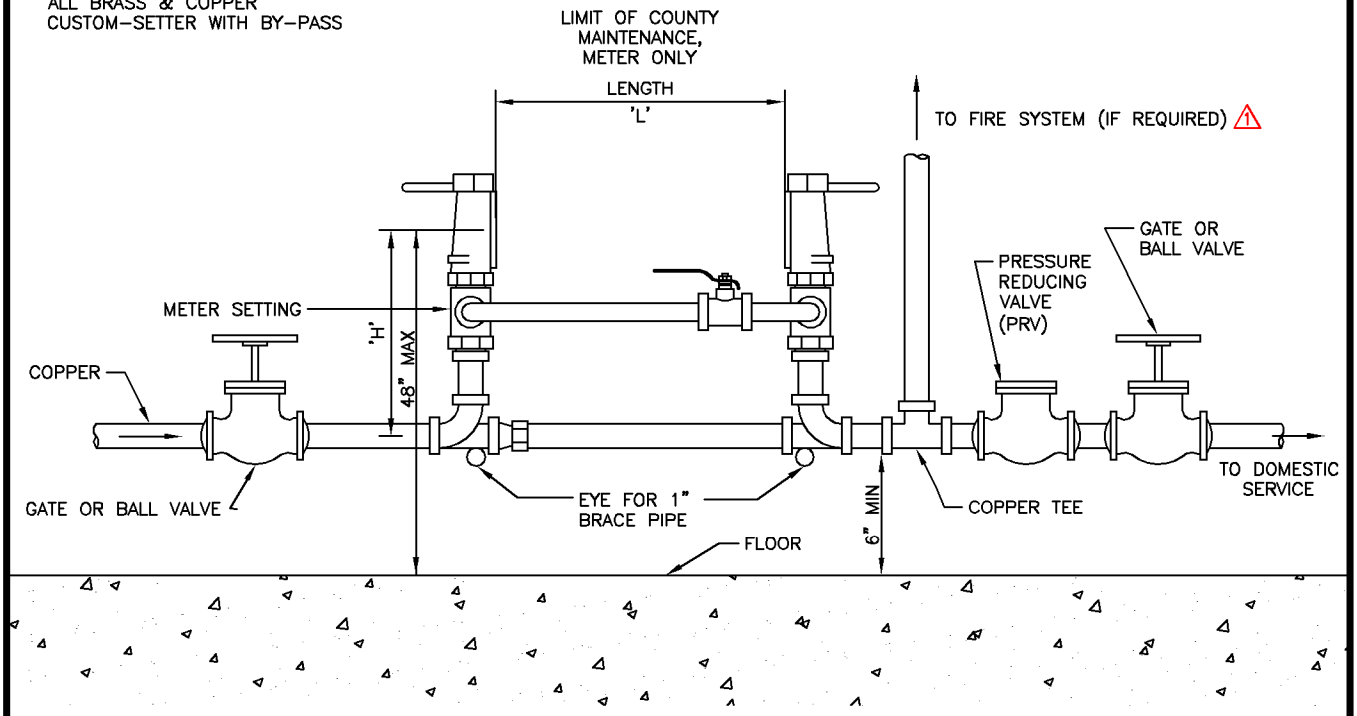
1. WATER SEVICE CONNECTION (SEE DETAIL W–3.21).
2. WATER METER SUPPLIED AND INSTALLED (UP TO 1") BY HOWARD COUNTY. OVER 1" SUPPLIED ONLY.
3. INSTALLATION MUST CONFORM TO THE REQUIREMENT OF THE NATIONAL STANDARD PLUMBING CODE LATEST EDITION.
4. FIRE SPRINKLER SYSTEM SHALL BE PROVIDED WITH DRAIN, GAUGE, AND BACKFLOW PREVENTION AS REQUIRED.
5. 3/4" METER SHALL HAVE 1" SERVICE
   1" METER SHALL HAVE 1 1/2" SERVICE.

7/17/2015
DRAFT

Revised	Howard County, Maryland Department of Public Works	WATER METER 3/4" & 1" Inside Settings	Detail W–3.25
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		

METER SIZE	LENGTH 'L'	HEIGHT 'H'
1 1/2"	13 1/4"	15"
2"	17 1/4"	15"

ALL BRASS & COPPER
CUSTOM-SETTER WITH BY-PASS



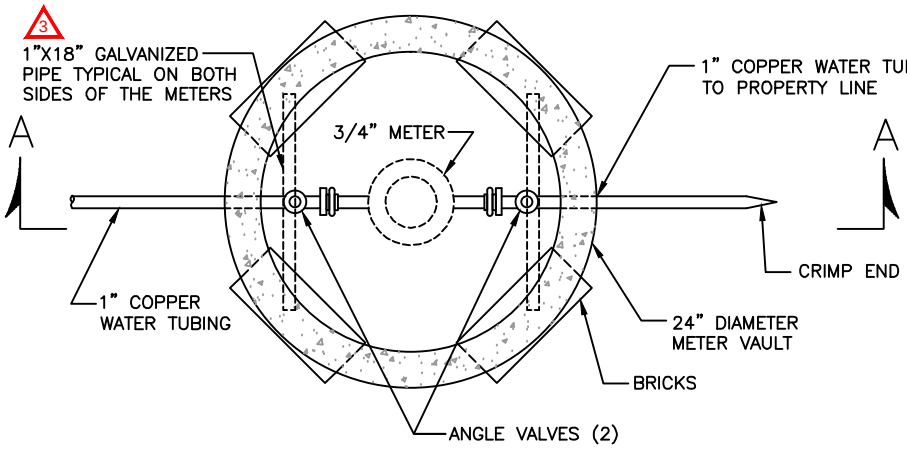
ELEVATION

NOTES:

1. 1. MINIMUM OF 6" CLEAR BETWEEN METER AND WALL.
2. WATER METER SUPPLIED BY HOWARD COUNTY BUREAU OF UTILITIES AND INSTALLED BY CONTRACTOR.
3. PROVIDE RIGID WALL AND/OR FLOOR BRACING TO ACCOMMODATE WEIGHT OF METER, UTILIZING EYES FOR BRACE PIPE.
4. 1. FOR PARTIAL FIRE SPRINKLER SYSTEM PROVIDE DRAIN, GAUGE, AND BACKFLOW PREVENTER AS REQUIRED.

7/17/2015
DRAFT

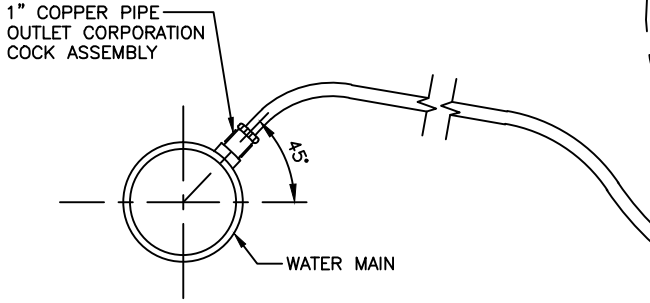
Revised	Howard County, Maryland	WATER METER	Detail
1 5/1/2014 Revised	Department of Public Works	1 1/2" & 2"	W-3.26
5/7/2007 Approved	Approved: Thomas E. Butler	1 Inside Meter Settings	
	Chief, Bureau of Engineering		

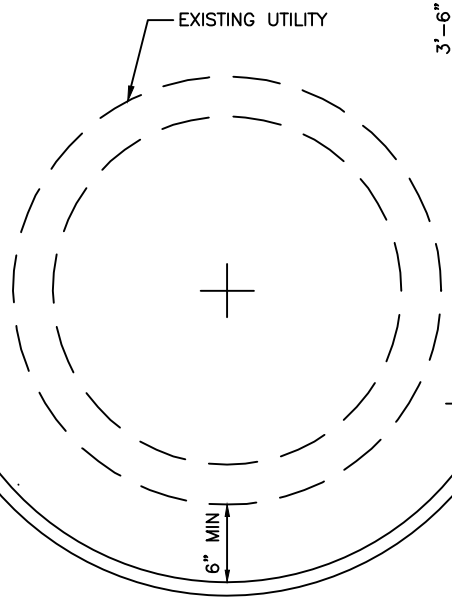


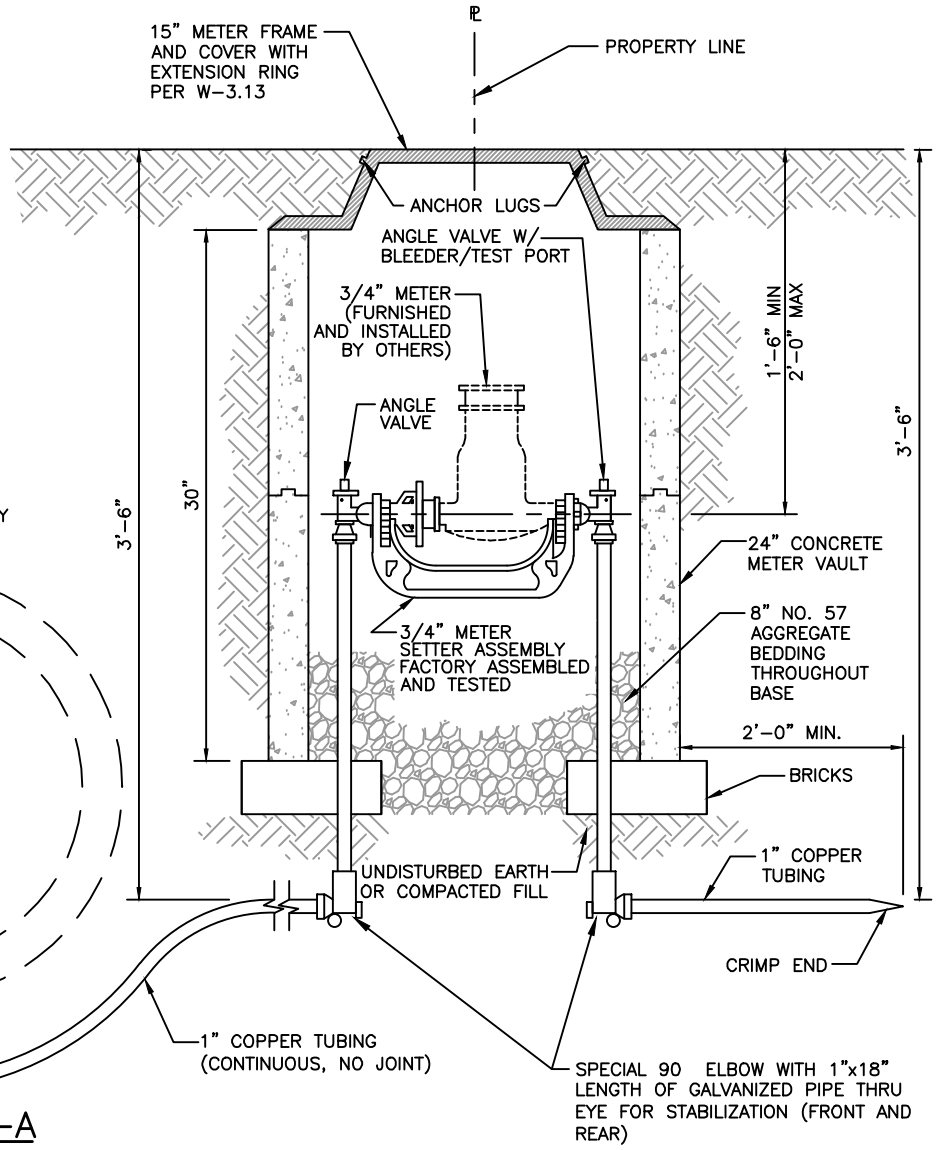
3 PLAN

NOTES:

1. SEE DETAILS W-3.21 AND W-3.22 FOR TAPPING SADDLE REQUIREMENTS.







SECTION A-A

7/17/2015

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3 X/XX/2015 Revised

5/1/2014 Revised

6/30/2011 Revised

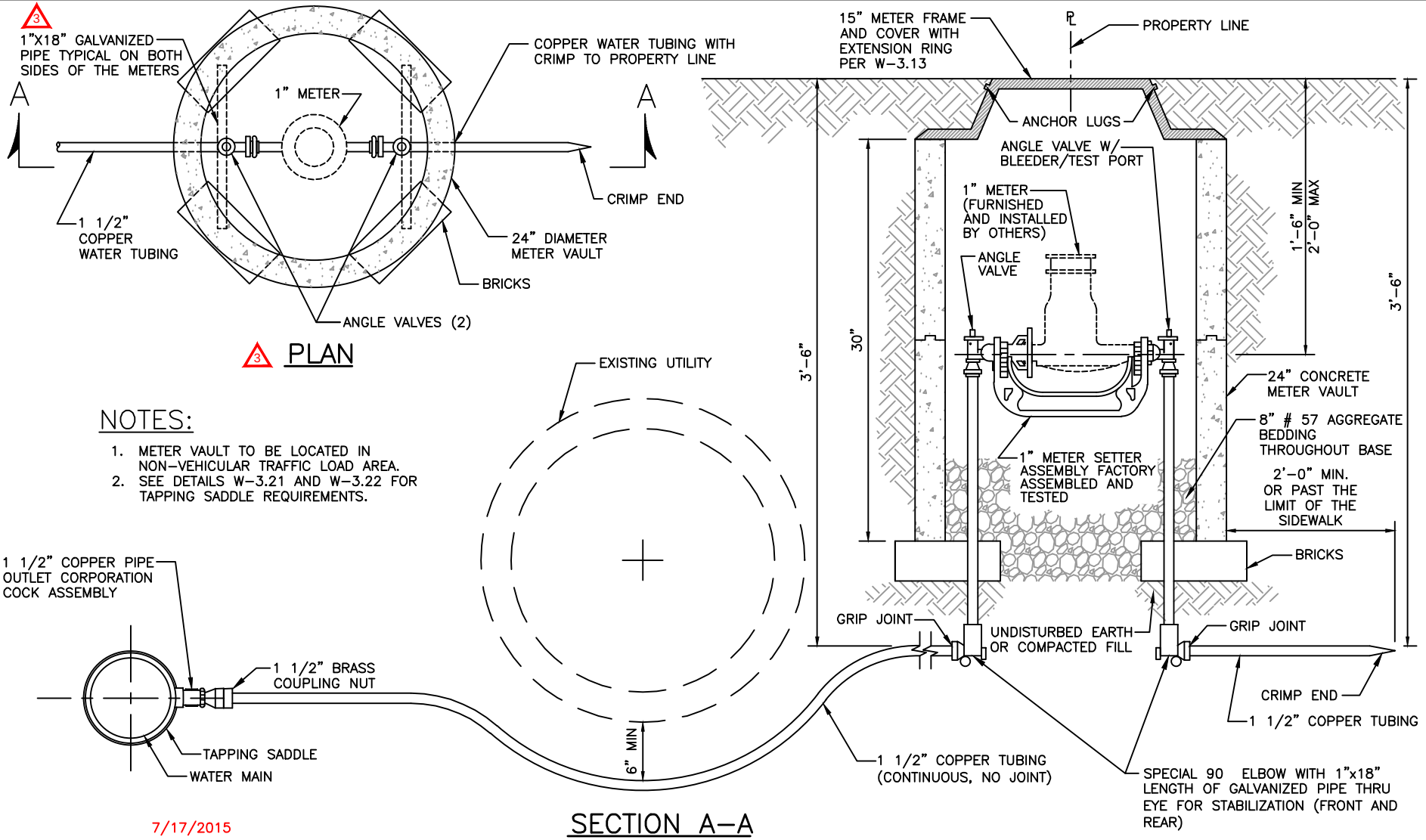
5/7/2007 Approved

Howard County, Maryland
Department of Public Works

Approved: .\Data In\Tom Butler's Signature.tiff
Chief, Bureau of Engineering

WATER METER
3/4"
Outside Meter Setting

Detail
W-3.27



7/17/2015

DRAFT

3 X/XX/2015
Revised

5/1/2014
Revised

6/30/2011
Revised

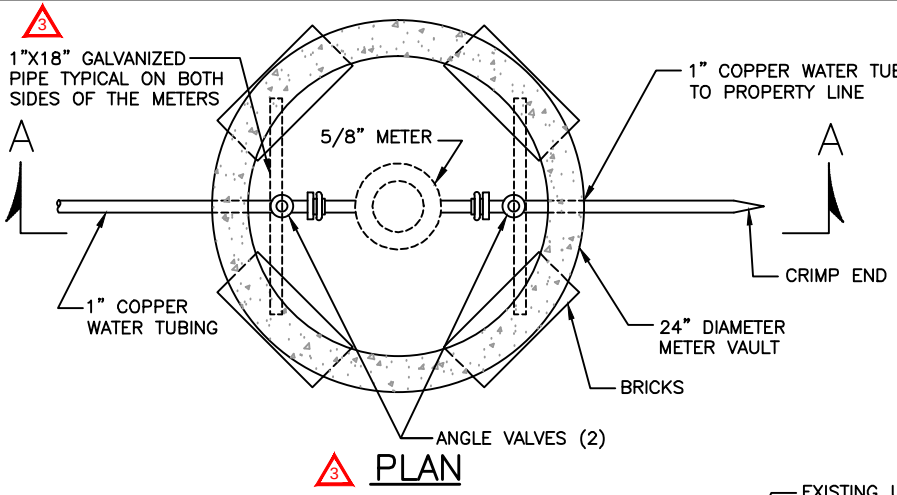
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

Approved: .\Data In\Tom Butler's Signature.tiff
Chief, Bureau of Engineering

WATER METER
1"
Outside Meter Setting

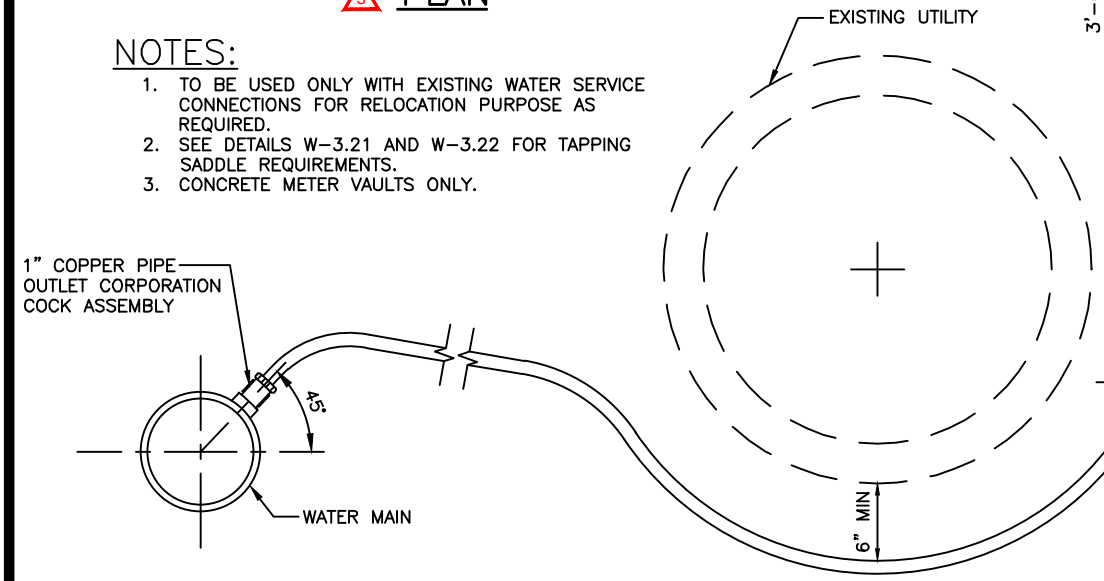
Detail
W-3.28



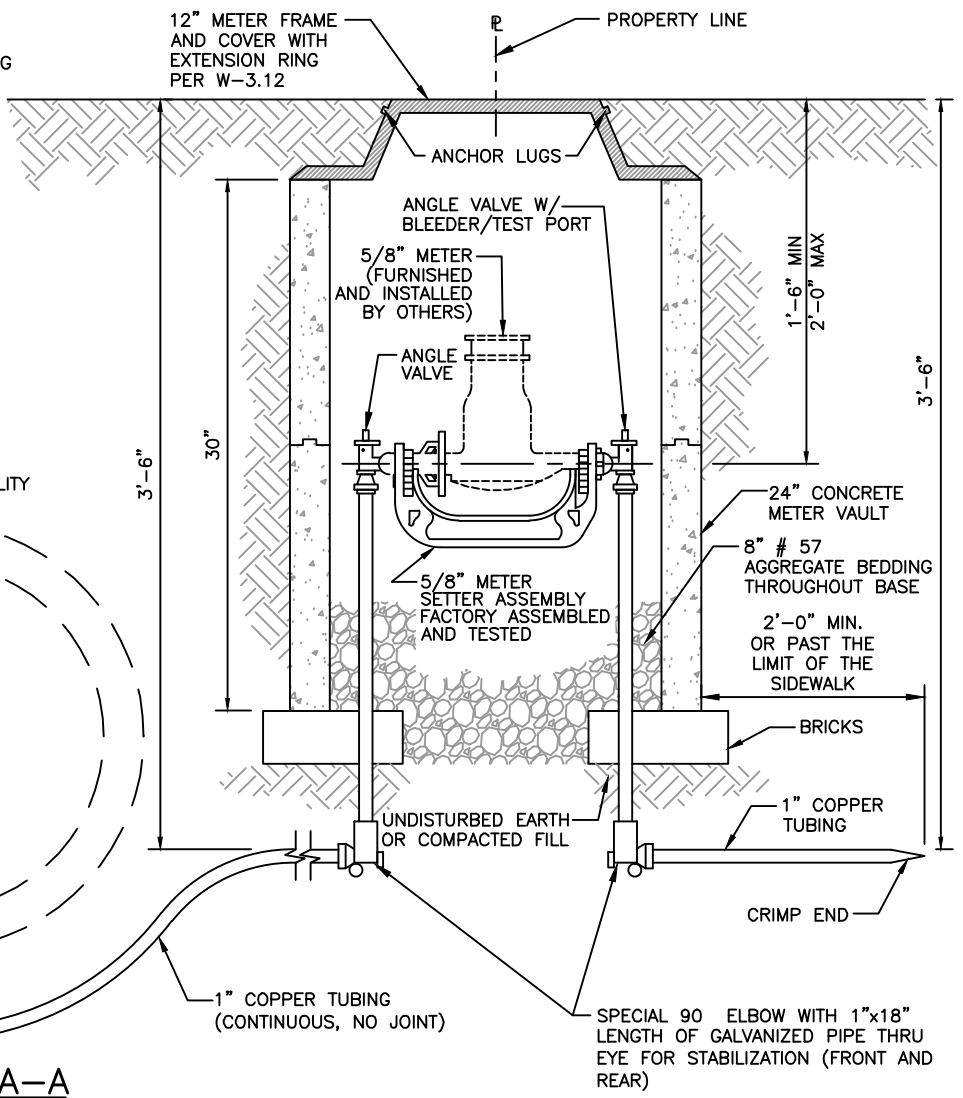
3 PLAN

NOTES:

1. TO BE USED ONLY WITH EXISTING WATER SERVICE CONNECTIONS FOR RELOCATION PURPOSE AS REQUIRED.
2. SEE DETAILS W-3.21 AND W-3.22 FOR TAPPING SADDLE REQUIREMENTS.
3. CONCRETE METER VAULTS ONLY.



SECTION A-A



7/17/2015

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3 X/XX/2015 Revised

5/1/2014 Revised

6/30/2011 Revised

5/7/2007 Approved

Howard County, Maryland
Department of Public Works

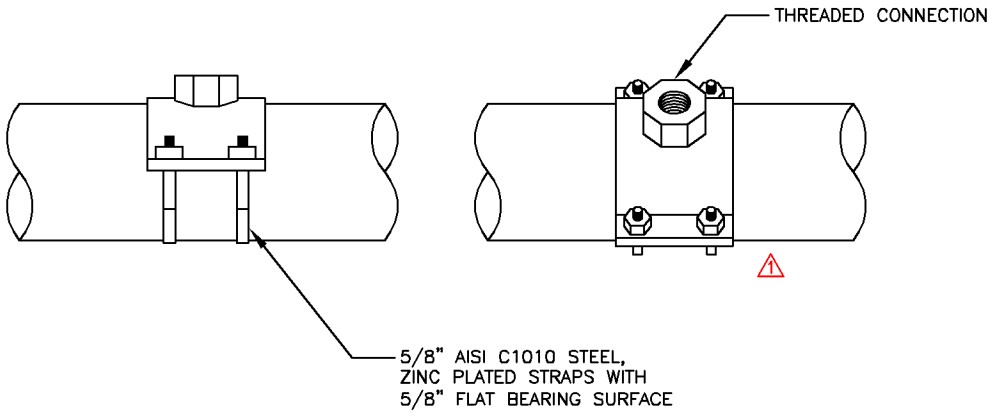
Approved: .\Data In\Tom Butler's Signature.tiff

Chief, Bureau of Engineering

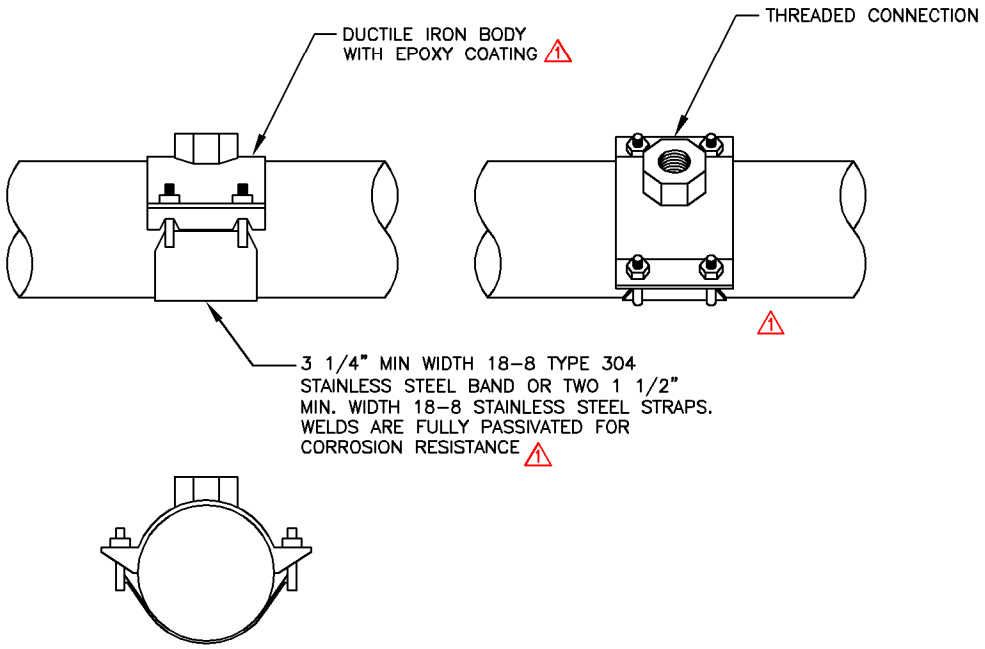
WATER METER 5/8" Outside Meter Setting

Detail

W-3.29



METAL PIPE



PLASTIC PIPE

NOTES:

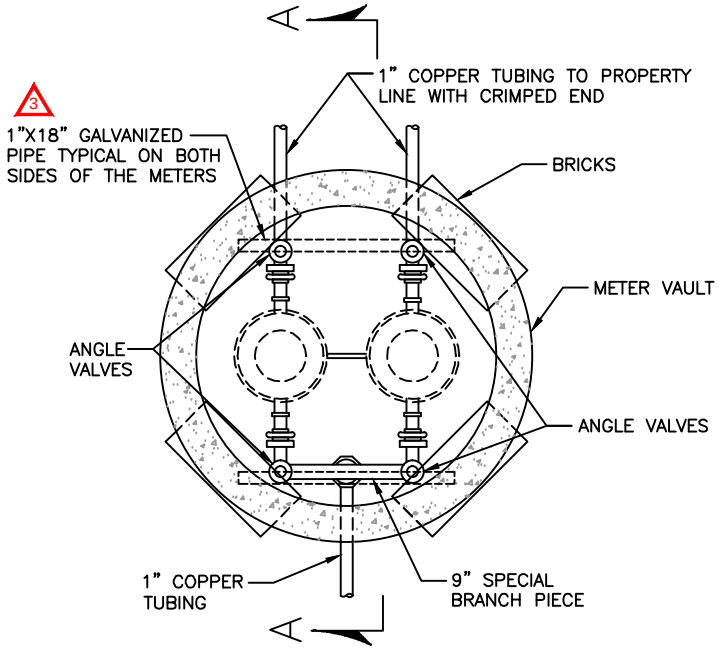
1. SADDLE SHALL CONFORM TO ANSI/NSF STANDARD 61.
1. 2. PLASTIC PIPE SADDLE SHALL CONFORM TO THE RECOMMENDATION OF UNI-BELL HANDBOOK OF PVC PIPE AND AWWA MANUAL M23.
3. TIGHTEN SADDLE PER MANUFACTURER'S REQUIREMENTS.
1. 4. NUTS SHALL BE 1/2" TO 5/8" HEAVY HEX NUTS AND WASHERS AND SHALL BE COATED TO PREVENT GALLING.
1. 5. GASKETS SHALL BE RUBBER PER ASTM D2000.

7/17/2015 DRAFT

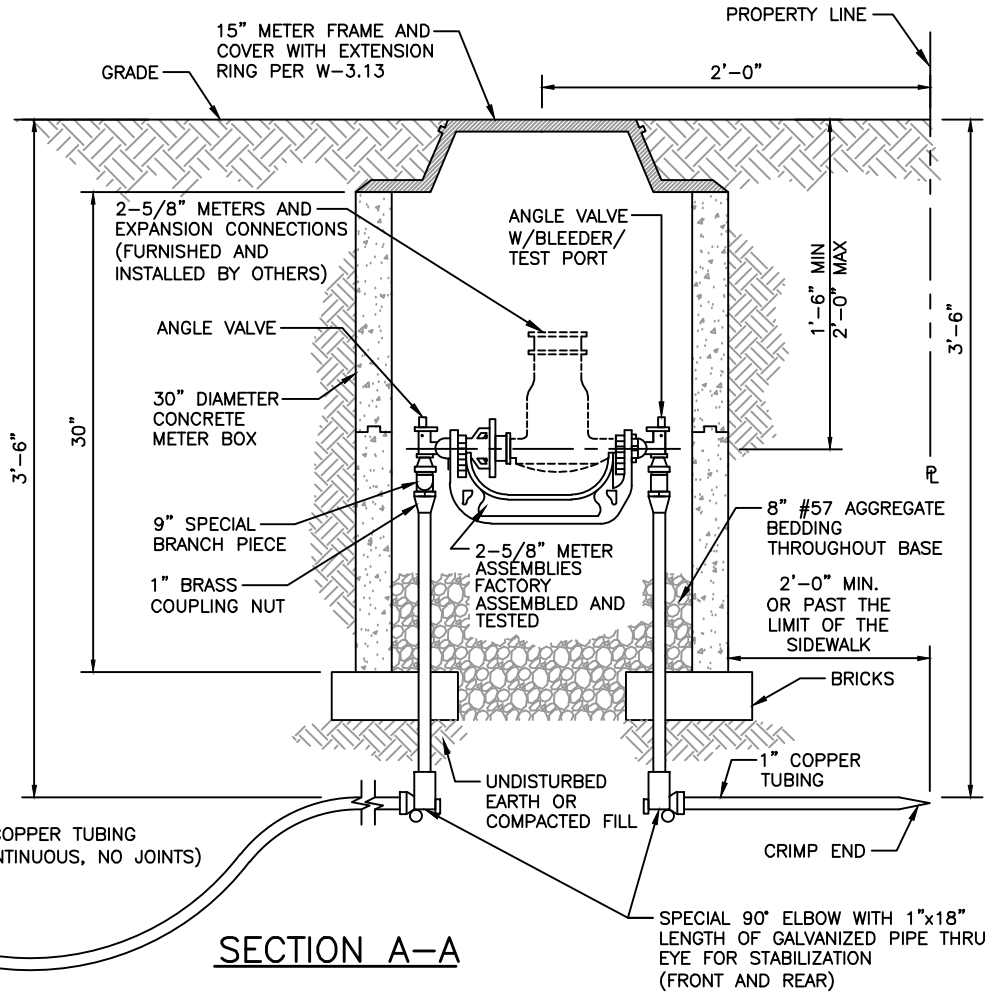
Revised	Howard County, Maryland	WATER METER	Detail
1 5/1/2014 Revised	Department of Public Works	Water Service Saddle	W-3.30
5/7/2007 Approved	Approved: Thomas E. Butler	3/4" Thru 2"	
	Chief, Bureau of Engineering		

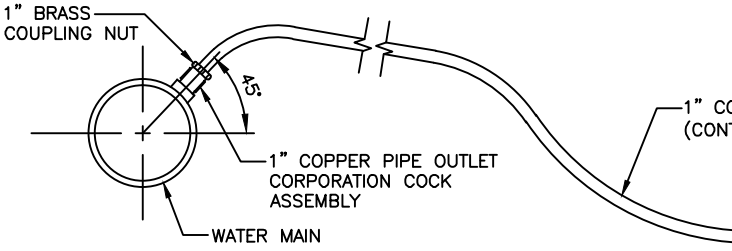
NOTES:

1. TO BE USED ONLY WITH EXISTING WATER SERVICE CONNECTIONS FOR RELOCATION PURPOSE AS REQUIRED.
2. SEE DETAILS W-3.21 AND W-3.22 FOR TAPPING SADDLE REQUIREMENTS.



3 PLAN





SECTION A-A

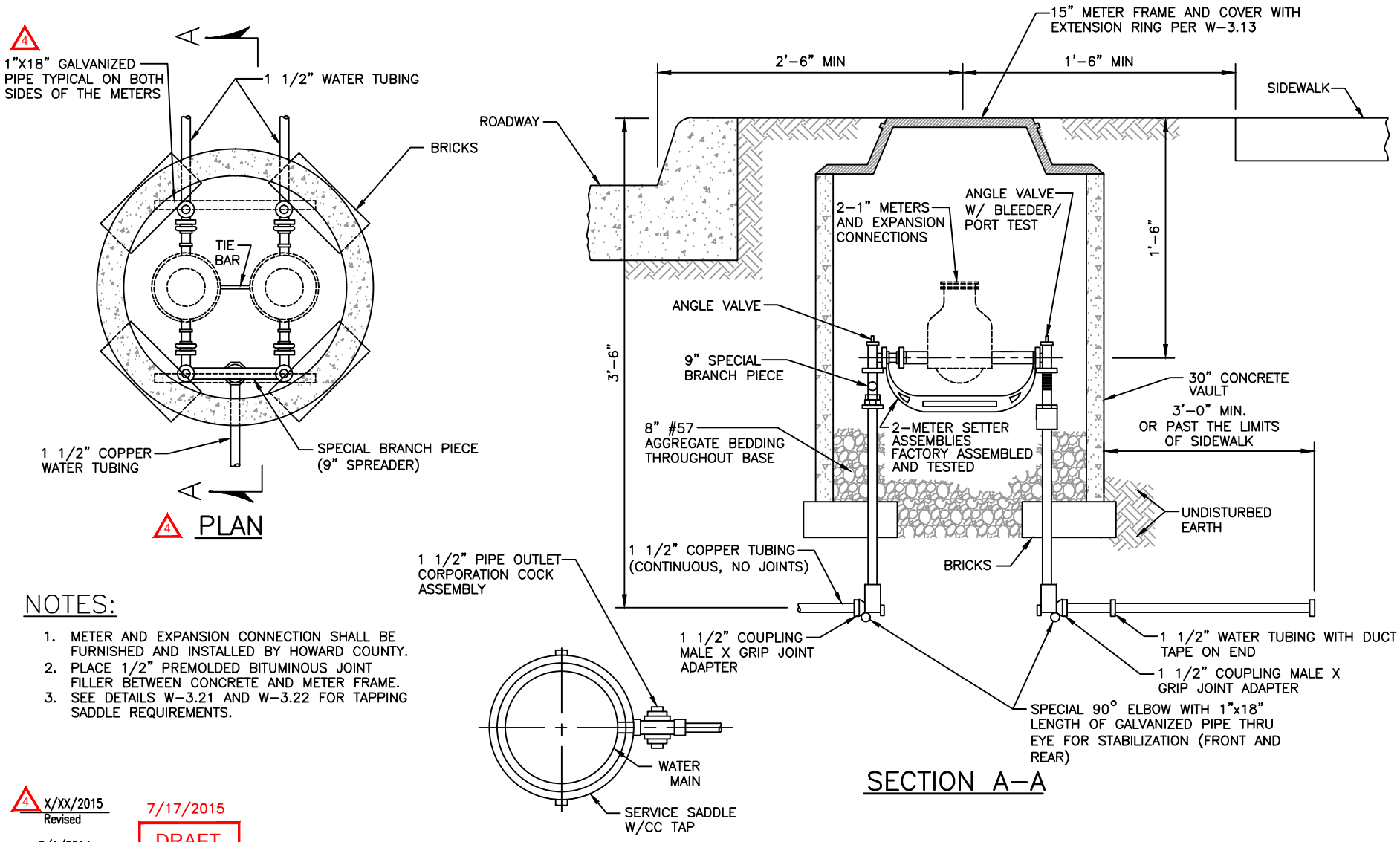
7/17/2015
DRAFT
3 X/XX/2015
Revised

5/1/2014 Revised
6/30/2011 Revised
5/7/2007 Approved

Howard County, Maryland
Department of Public Works
Approved: .\Data In\Tom Butler's Signature.tiff
Chief, Bureau of Engineering

WATER METER
Twin 5/8"
Outside Meter Settings

Detail
W-3.31



NOTES:

1. METER AND EXPANSION CONNECTION SHALL BE FURNISHED AND INSTALLED BY HOWARD COUNTY.
2. PLACE 1/2" PREMOLDED BITUMINOUS JOINT FILLER BETWEEN CONCRETE AND METER FRAME.
3. SEE DETAILS W-3.21 AND W-3.22 FOR TAPPING SADDLE REQUIREMENTS.

4 X/XX/2015 Revised

5/1/2014 Revised

7/17/2015

DRAFT

7/29/2011 Revised

6/30/2011 Revised

5/7/2007 Approved

Howard County, Maryland
Department of Public Works

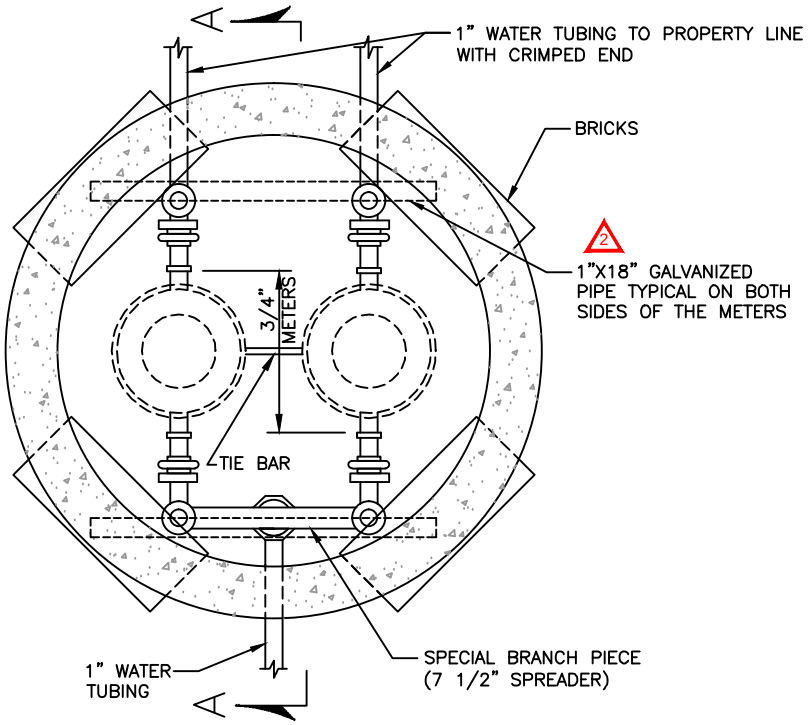
Approved: .\Data In\Tom Butler's Signature.tiff

Chief, Bureau of Engineering

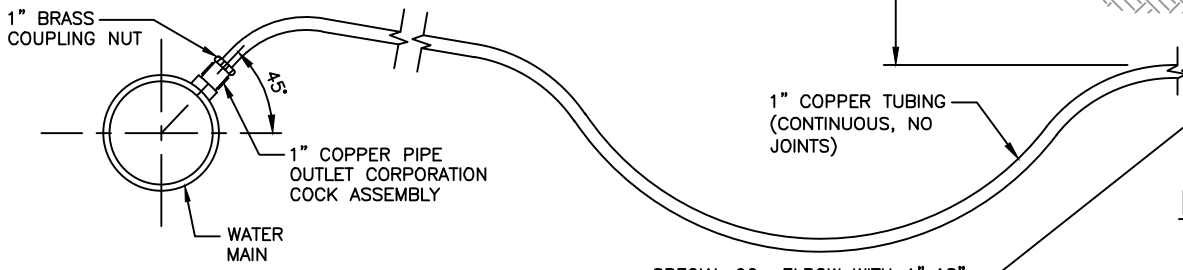
WATER METER
Twin 1"
Outside Meter Settings

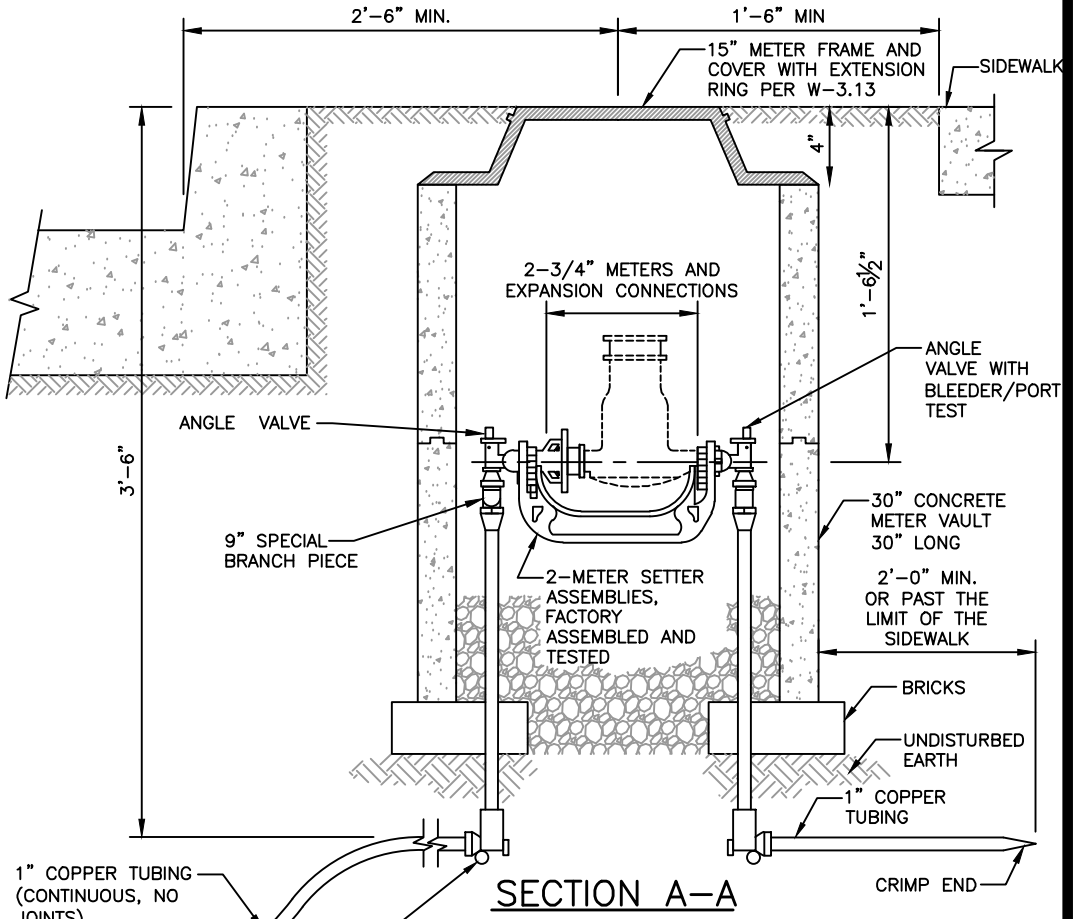
Detail

W-3.32



2 PLAN





SECTION A-A

SPECIAL 90 ELBOW WITH 1"x18" LENGTH OF GALVANIZED PIPE THRU EYE FOR STABILIZATION (FRONT AND REAR)

NOTES:

1. METER AND EXPANSION CONNECTION SHALL BE FURNISHED AND INSTALLED BY HOWARD COUNTY.
2. SEE DETAIL W-3.21 AND W-3.22 FOR TAPPING SADDLE REQUIREMENTS.
3. PLACE 1/2" PREMOLDED BITUMINOUS JOINT FILLER BETWEEN CONCRETE AND METER FRAME.

7/17/2015

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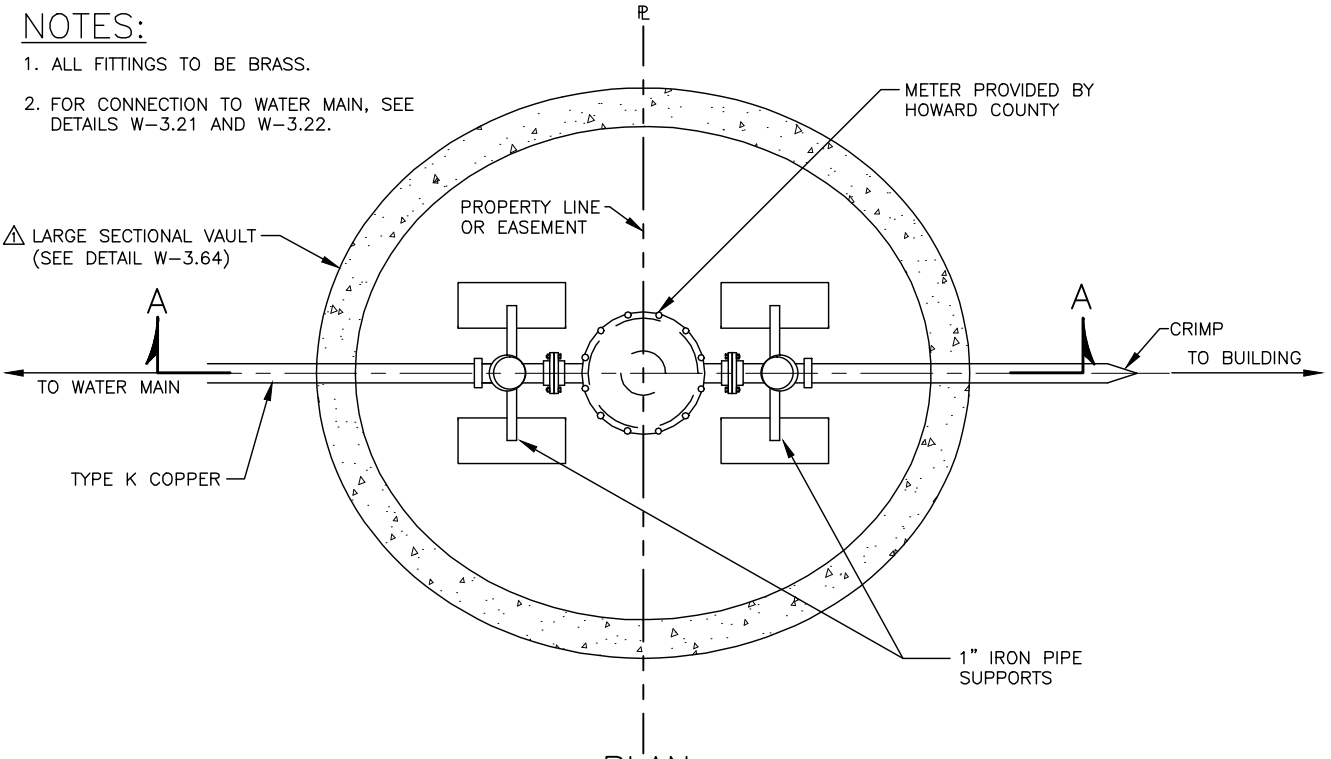
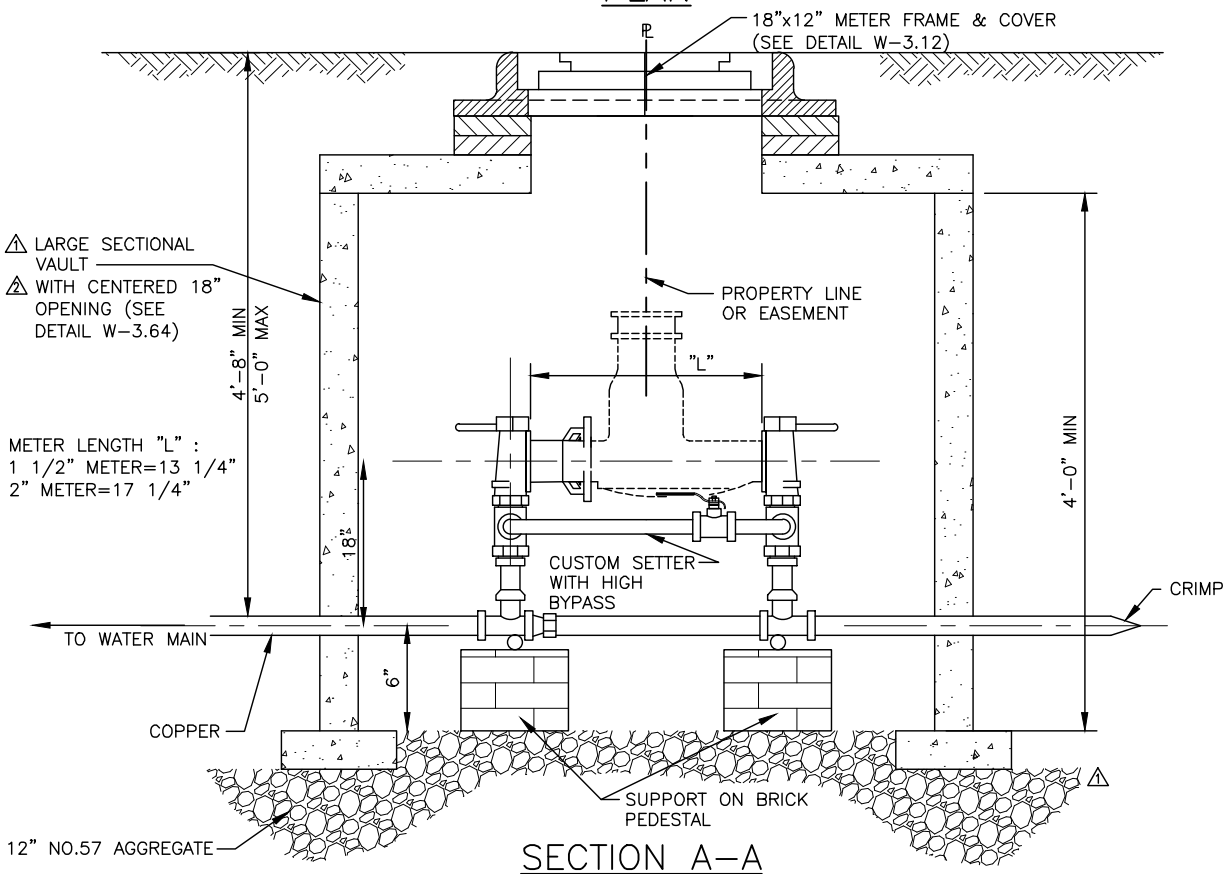
2 X/XX/2015 Revised 5/1/2014 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: .\Data In\Tom Butler's Signature.tiff Chief, Bureau of Engineering	WATER METER Twin 3/4" Outside Meter Settings	Detail W-3.33

NOTES:

1. ALL FITTINGS TO BE BRASS.
2. FOR CONNECTION TO WATER MAIN, SEE DETAILS W-3.21 AND W-3.22.



PLAN



SECTION A-A

7/17/2015
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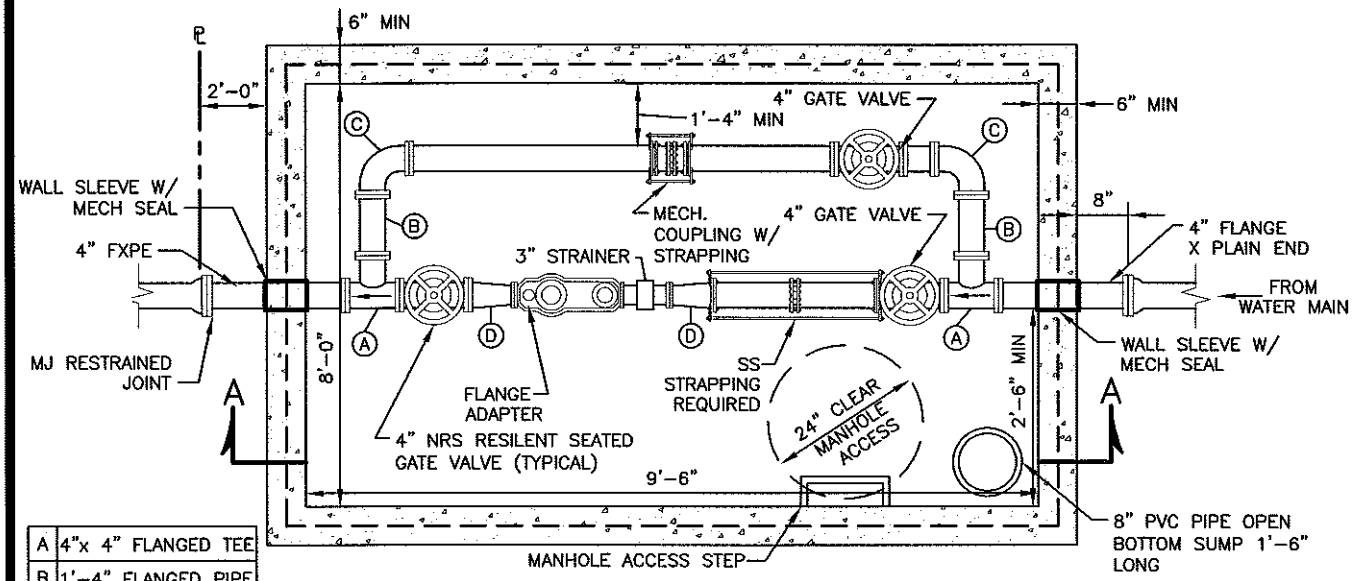
⚠2 7/29/2011 Revised ⚠1 6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	WATER METER 1 1/2" & 2" Outside Meter Settings	Detail W-3.34

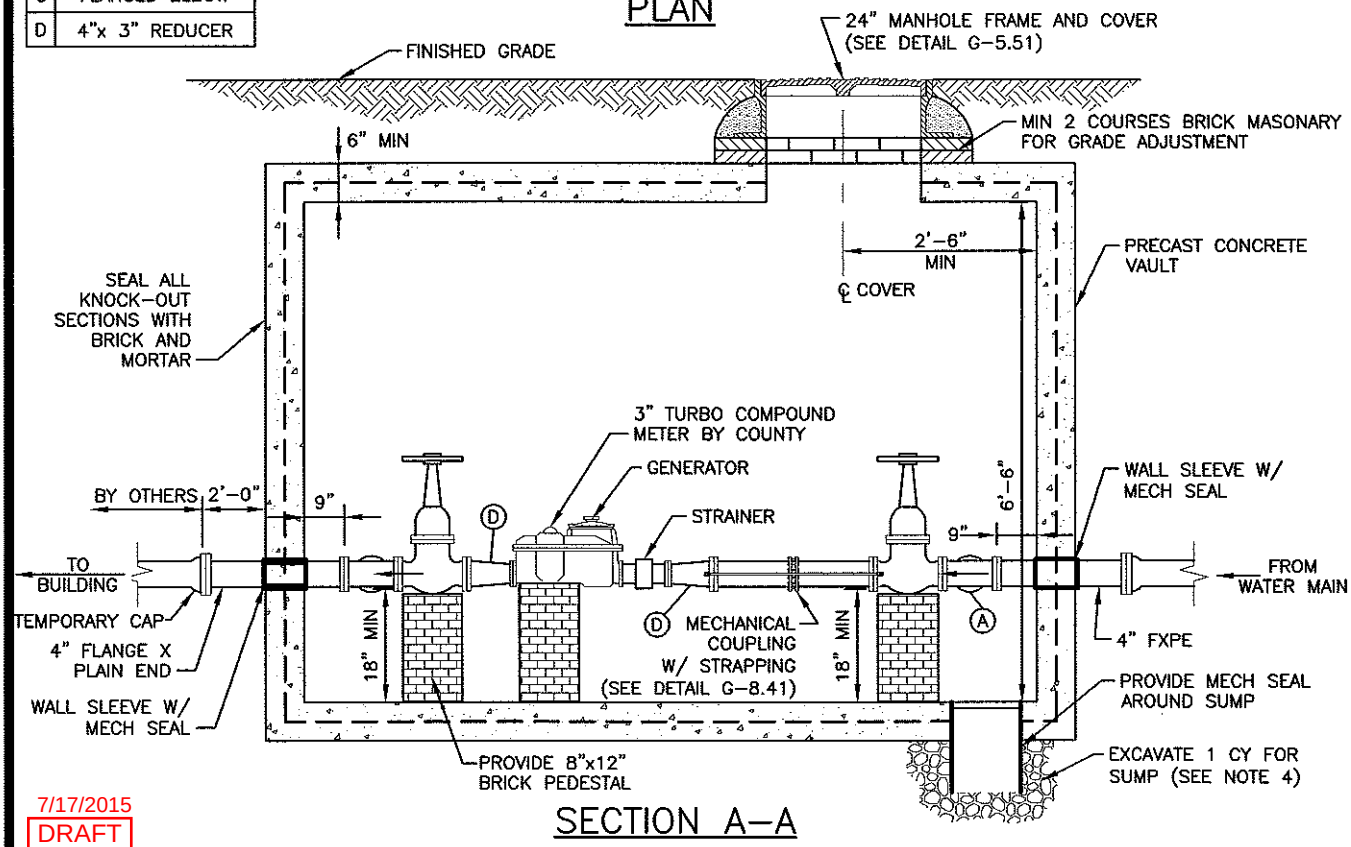
NOTES:

1. MINIMUM 5" PIPE DIAMETERS UPSTREAM OF METER.
2. IF 9'-6"x8'-0" INSIDE DIMENSIONS OF VAULT ARE EXCEEDED INCREASE 4" MECHANICAL COUPLINGS ACCORDINGLY.
3. APPLY TWO (2) COATS OF BITUMINOUS PAINT TO ALL STRAPPING COMPONENTS.
4. WHEN WATER TABLE IS ABOVE FLOOR SLAB, DO NOT PROVIDE OPEN BOTTOM SUMP; CLOSED BOTTOM SUMP AND SUMP PUMP SHALL BE USED.
5. ALL PIPING IN VAULT SHALL BE FLANGED.



A	4"x 4" FLANGED TEE
B	1'-4" FLANGED PIPE
C	FLANGED ELBOW
D	4"x 3" REDUCER

PLAN



SECTION A-A

7/17/2015
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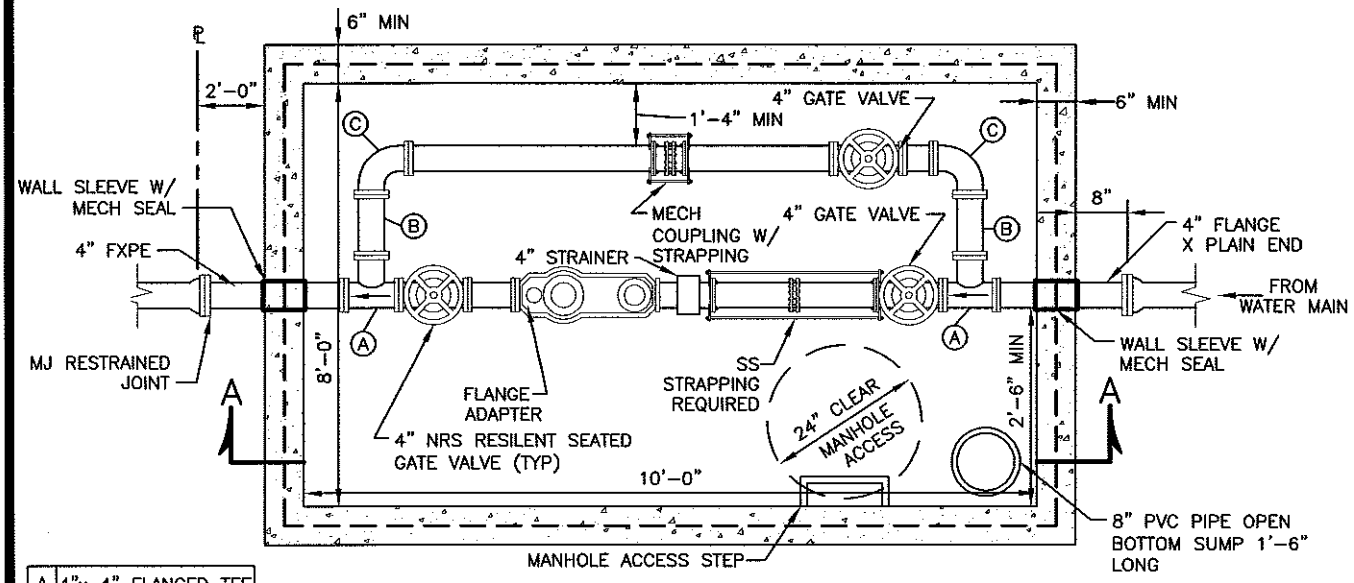
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	WATER METER 3" Meter Vault	Detail W-3.35

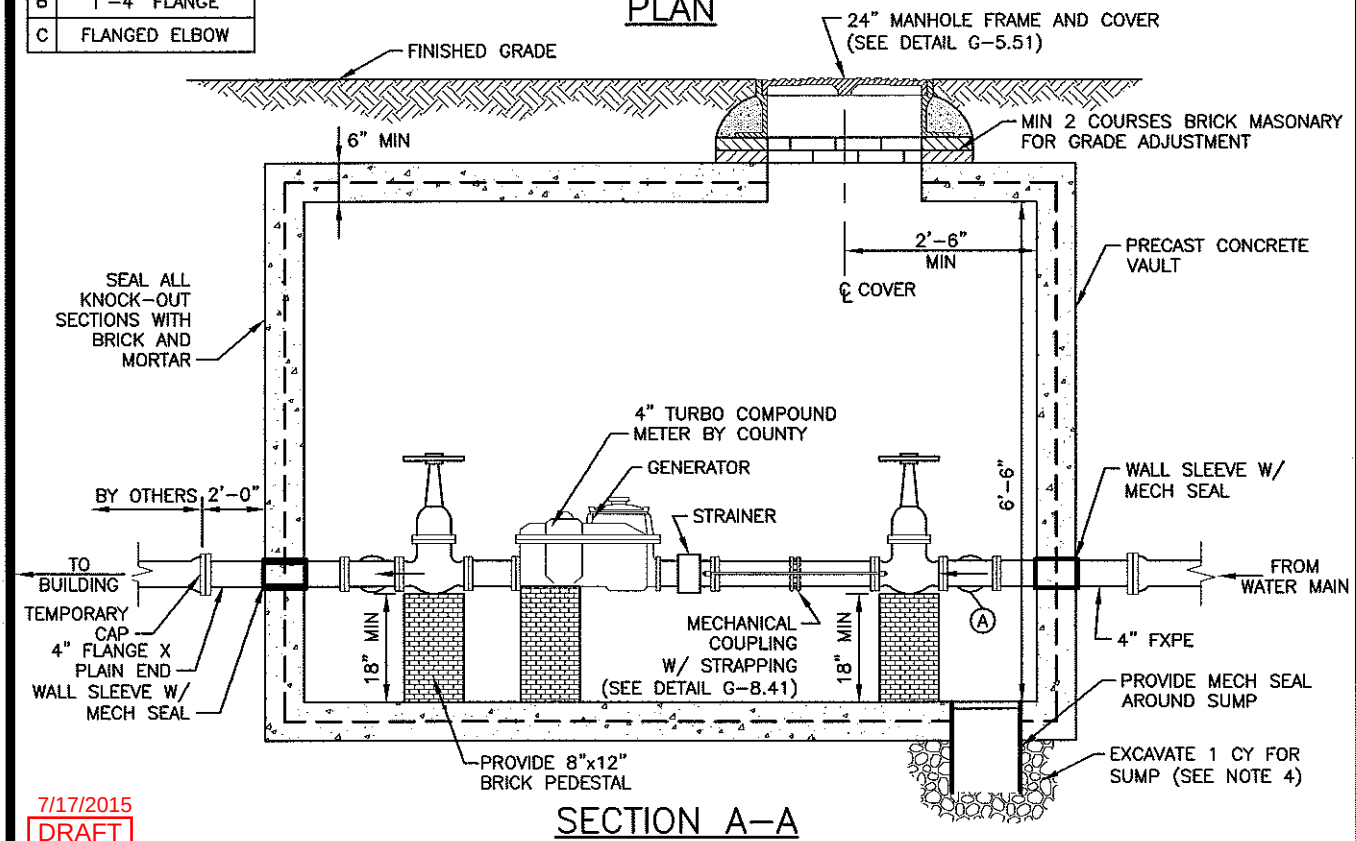
NOTES:

1. MINIMUM 5" PIPE DIAMETERS UPSTREAM OF METER.
2. IF 10'–0"x 8'–0" INSIDE DIMENSIONS OF VAULT ARE EXCEEDED INCREASE 4" MECHANICAL COUPLINGS ACCORDINGLY.
3. APPLY TWO (2) COATS OF BITUMINOUS PAINT TO ALL STRAPPING COMPONENTS.
4. WHEN WATER TABLE IS ABOVE FLOOR SLAB, DO NOT PROVIDE OPEN BOTTOM SUMP; CLOSED BOTTOM SUMP AND SUMP PUMP SHALL BE USED.
5. ALL PIPING IN VAULT SHALL BE FLANGED.



A	4"x 4" FLANGED TEE
B	1'–4" FLANGE
C	FLANGED ELBOW

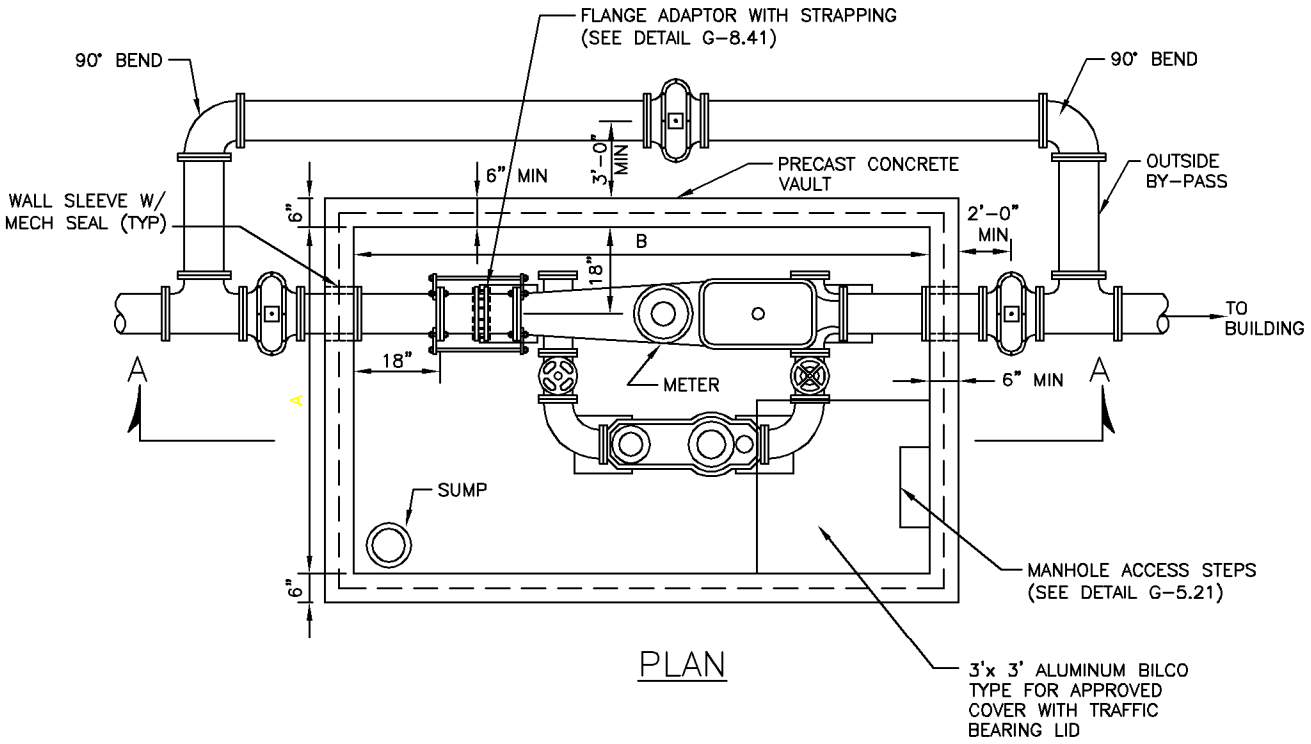
PLAN



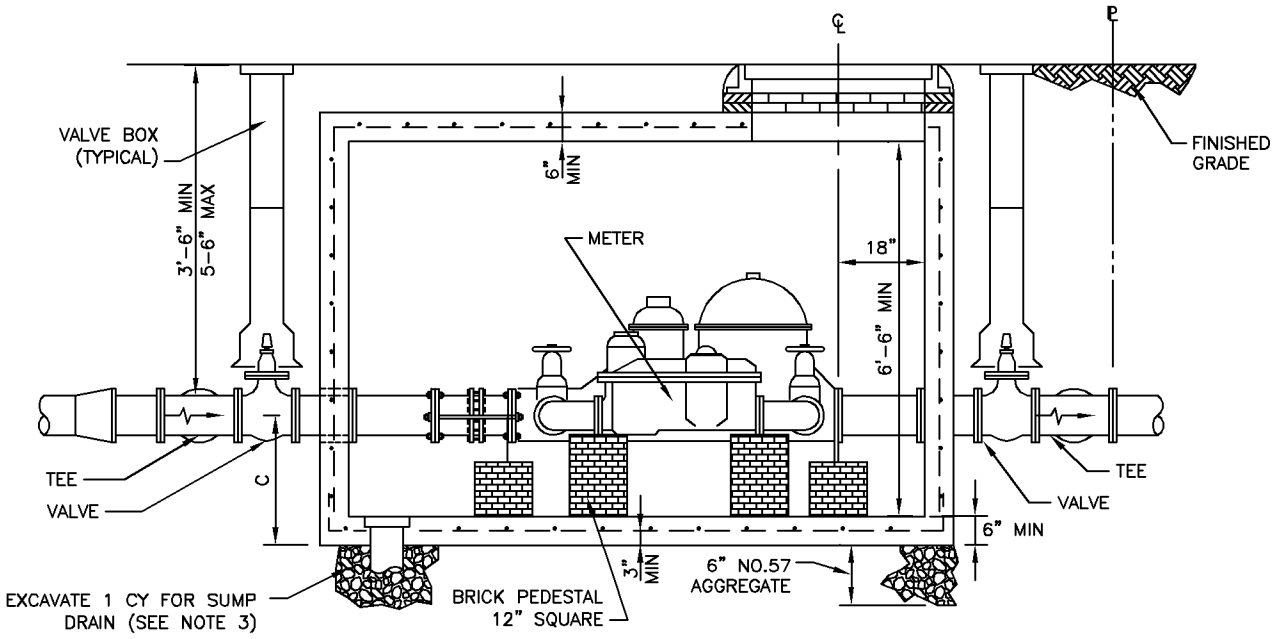
SECTION A–A

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	WATER METER 4" Meter Vault	Detail W–3.36



PLAN



SECTION A-A

NOTES:

1. ALL FITTINGS AND PIPING IN VAULT SHALL BE FLANGED JOINT.
2. ALL VALVES TO HAVE VALVE BOX AND EXTENSION.
3. WHEN WATER TABLE IS ABOVE FLOOR SLAB, DO NOT PROVIDE OPEN BOTTOM SUMP, CLOSED BOTTOM SUMP AND SUMP PUMP SHALL BE USED.
4. ALL TEES & VALVES SHALL BE STRAPPED & BUTTRESSED.
5. METER SUPPLIED BY HOWARD COUNTY INSTALLED BY OTHERS.

SIZE	A	B	C	BY PASS SIZE
6"	6'-0"	10'-0"	2'-3"	4"
8"	7'-0"	10'-0"	2'-5"	6"
10"	8'-0"	10'-0"	2'-8"	6"

7/17/2015 DRAFT

Revised

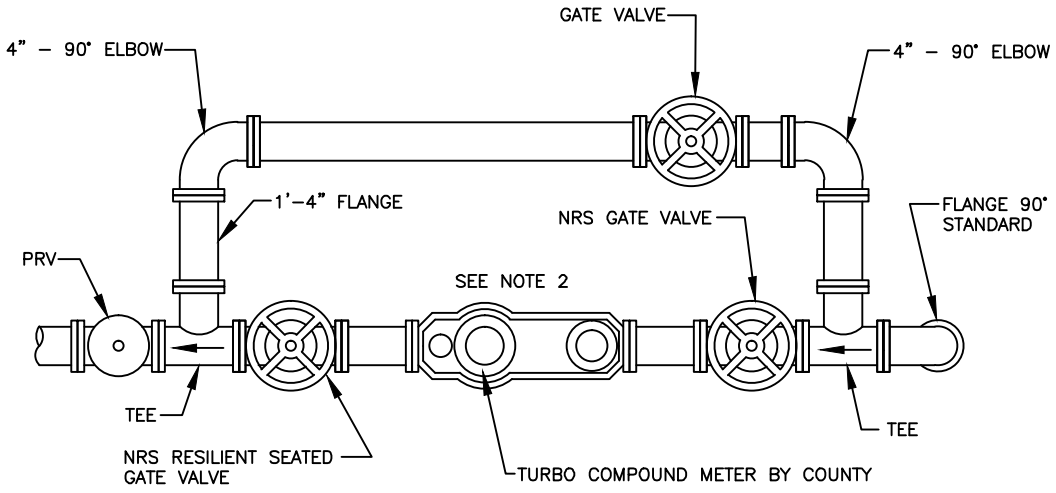
Revised 5/7/2007 Approved

Howard County, Maryland
Department of Public Works

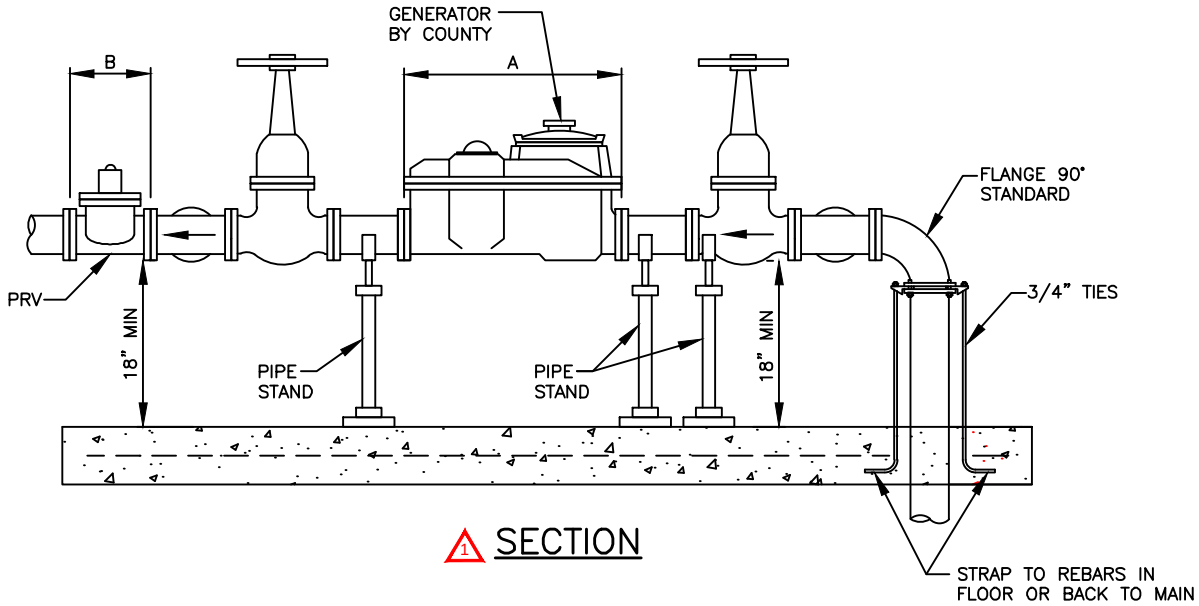
Approved: _____
Chief, Bureau of Engineering

WATER METER
6", 8" & 10"
Outside Combined Fire/Domestic

Detail
W-3.37



1 PLAN



1 SECTION

1 NOTES:

1. OUTSIDE THE WATER SERVICE CONNECTION IS CONTROLLED AS PER W–3.24.
2. A MINIMUM OF 2.5 PIPE DIAMETERS OF STRAIGHT RUN OF PIPE OR EQUIVALENT FULL OPEN PIPE COMPONENTS IS REQUIRED UPSTREAM AND DOWNSTREAM OF THE METER. FULL OPEN FLOW COMPONENTS MAY CONSIST OF: STRAIGHT PIPE, FULL OPEN GATE VALVES AND BYPASS TEES.
3. INSTALL NON–CONCENTRIC REDUCERS, CHECK VALVES, BACK FLOW PREVENTERS, PRV, THROTTING DEVICES NO CLOSER THAN 4 PIPE DIAMETERS DOWNSTREAM OF THE METER. ALWAYS AVOID PLACING ANY OF THESE DEVICES UPSTREAM OF THE METER.
4. PRV (PRESSURE REDUCING VALVE) SIZED ACCORDING TO METER.
5. A MINIMUM OF 6" CLEARANCE REQUIRED BETWEEN METER, PIPING AND APPURTENANCE AND WALL OF BUILDING.
6. EXCEPTIONS TO STANDARD LAYOUT DUE TO MATERIAL AVAILABILITY OR ARCHITECTURAL RESTRICTIONS ARE TO BE APPROVED BY DEPARTMENT OF INSPECTIONS, LICENSES AND PERMITS AND DPW, BUREAU OF UTILITIES 410–313–1980.
7. ALL PIPING, TEES, VALVES, PRV, STRAINER AND METER SHALL BE FLANGE TO FLANGE CONNECTIONS.

DIMENSIONS OF COMPOUND WATER METER, STAINER AND PRV

1

METER SIZE	A	B PRV	TEE
3"	24"	12 1/2"	3" x 3"
4"	29"	27 1/2"	4" x 3"
6"	36"	33 7/16"	6" x 3"

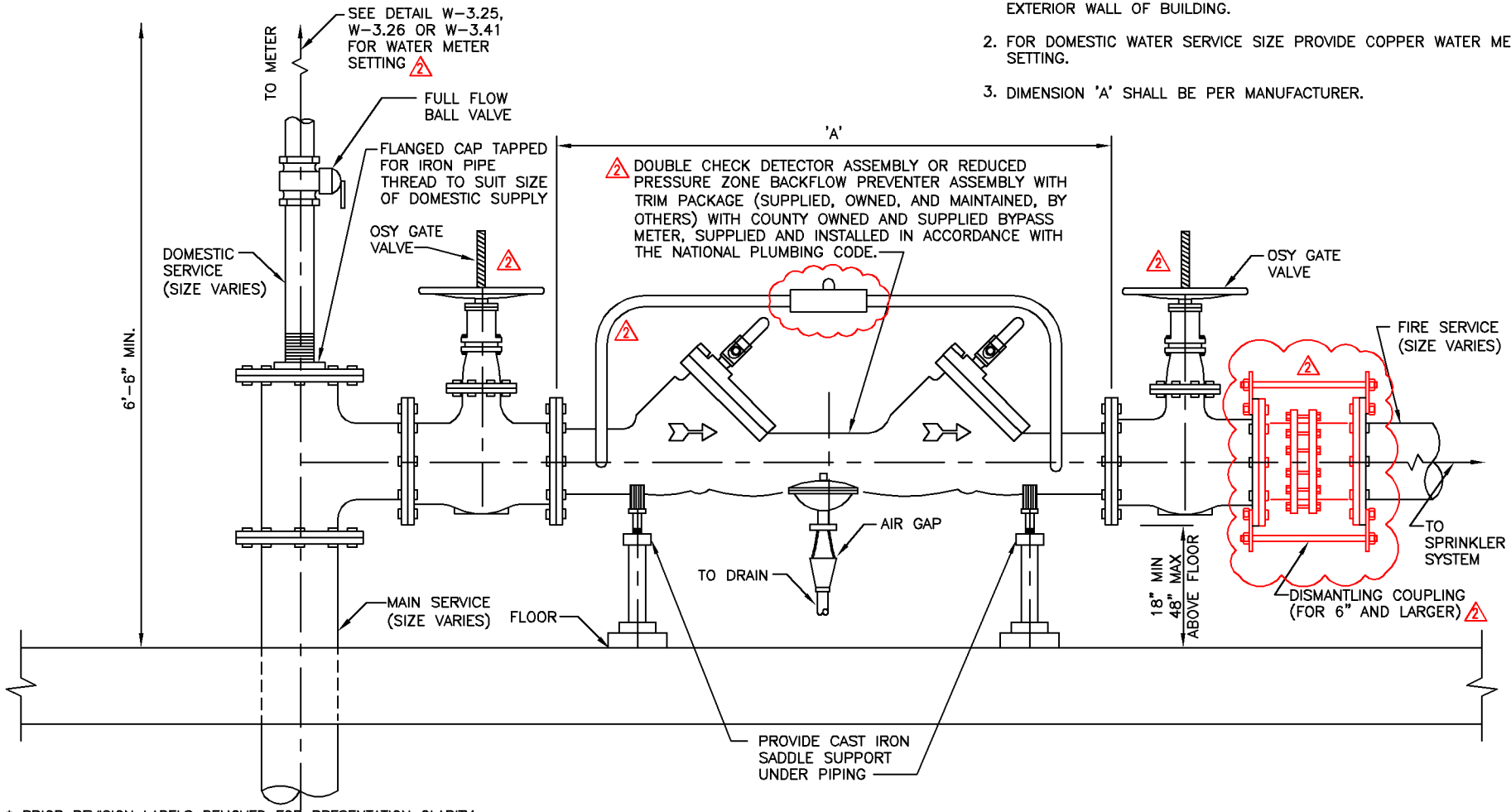
7/17/2015

DRAFT

1 7/17/2015 Revised 5/1/2014 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	WATER METER 3", 4" & 6" Connection Commercial Inside Meter Settings	Detail W–3.41

NOTES:

1. MAINTAIN 6" MINIMUM CLEARANCE BETWEEN BACKFLOW DEVICE AND EXTERIOR WALL OF BUILDING.
2. FOR DOMESTIC WATER SERVICE SIZE PROVIDE COPPER WATER METER SETTING.
3. DIMENSION 'A' SHALL BE PER MANUFACTURER.



* PRIOR REVISION LABELS REMOVED FOR PRESENTATION CLARITY.

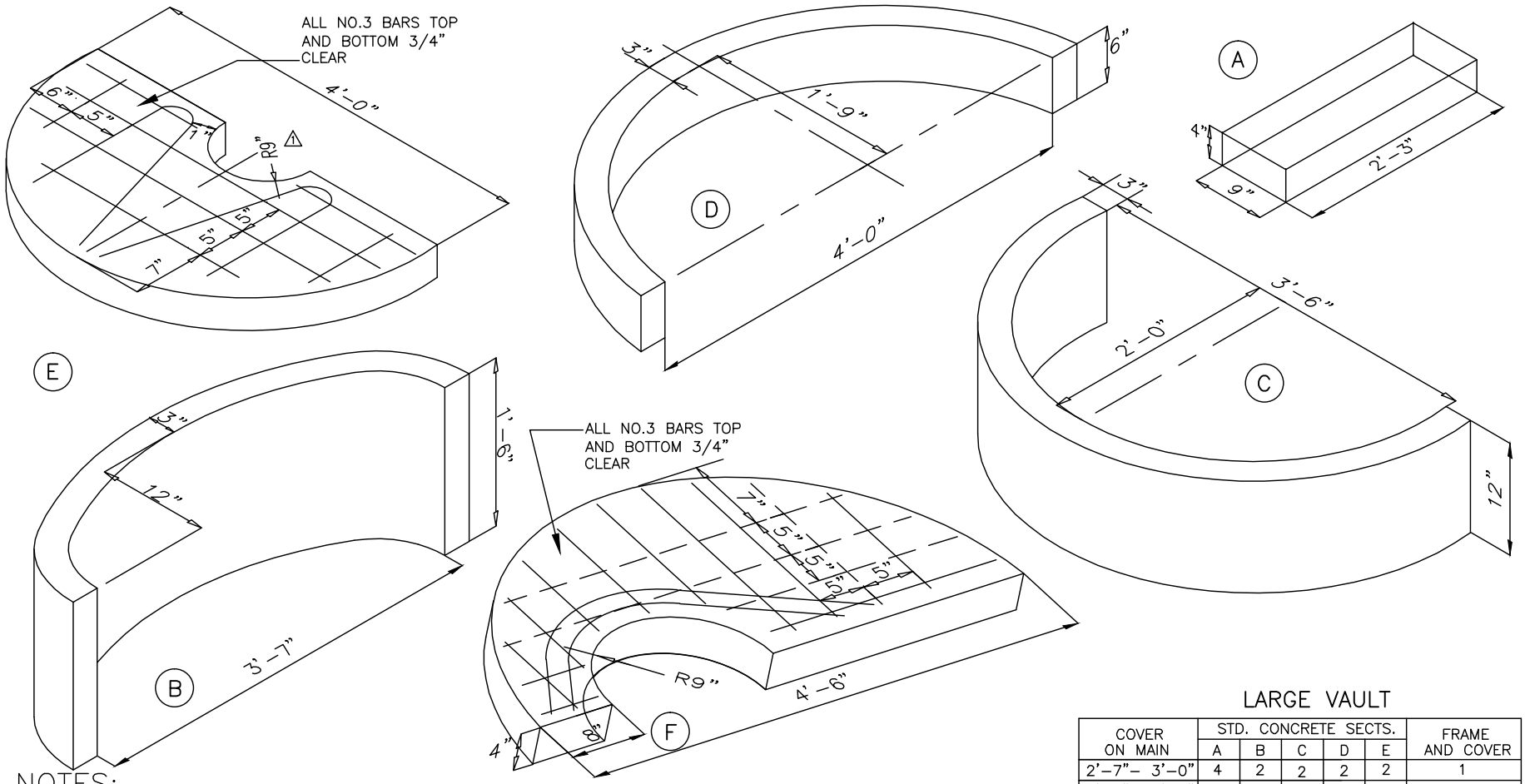
7/17/2015 DRAFT

2 5/1/2014 * Revised
1 6/30/2011 Revised
5/7/2007 Approved

Howard County, Maryland
Department of Public Works
Approved: Thomas E. Butler
Chief, Bureau of Engineering

WATER METER
3",4",6",8" & 10"
Inside Combined Fire/Domestic

Detail
W-3.44



NOTES:

1. ALL SECTIONS TO HAVE 6x6 W2.9xW2.9 WIRE MESH EXCEPT AS INDICATED ON SECTIONS E AND F.
2. ALL CONCRETE SHALL BE MIX NO. 3.
3. PRECAST VAULTS SHALL NOT BE USED IN STREETS AND AREAS SUBJECTED TO HEAVY TRUCK TRAFFIC. ANY VAULT TO BE USED WITH THIS APPLICATION SHALL BE DESIGNED FOR LIVE LOAD=AASHTO H-20 LOADING.
4. REINFORCING STEEL BARS SHALL HAVE 60,000 PSI TENSILE STRENGTH.
5. ALL BARENDS TO HAVE 1"R HOOK FOR ANCHORING.

LARGE VAULT

COVER ON MAIN	STD. CONCRETE SECTS.					FRAME AND COVER
	A	B	C	D	E	
2'-7"- 3'-0"	4	2	2	2	2	1
3'-1"- 3'-6"	4	2	2	4	2	1
3'-7"- 4'-0"	4	2	2	6	2	1
4'-1"- 4'-6"	4	2	4	4	2	1
4'-7"- 5'-0"	4	2	4	6	2	1
5'-1"- 5'-6"	4	2	4	8	2	1
5'-7"- 6'-0"	4	2	6	6	2	1

7/17/2015 DRAFT

Revised

⚠ 7/29/2011 Revised

5/7/2007 Approved

Howard County, Maryland
Department of Public Works

Approved: _____
Chief, Bureau of Engineering

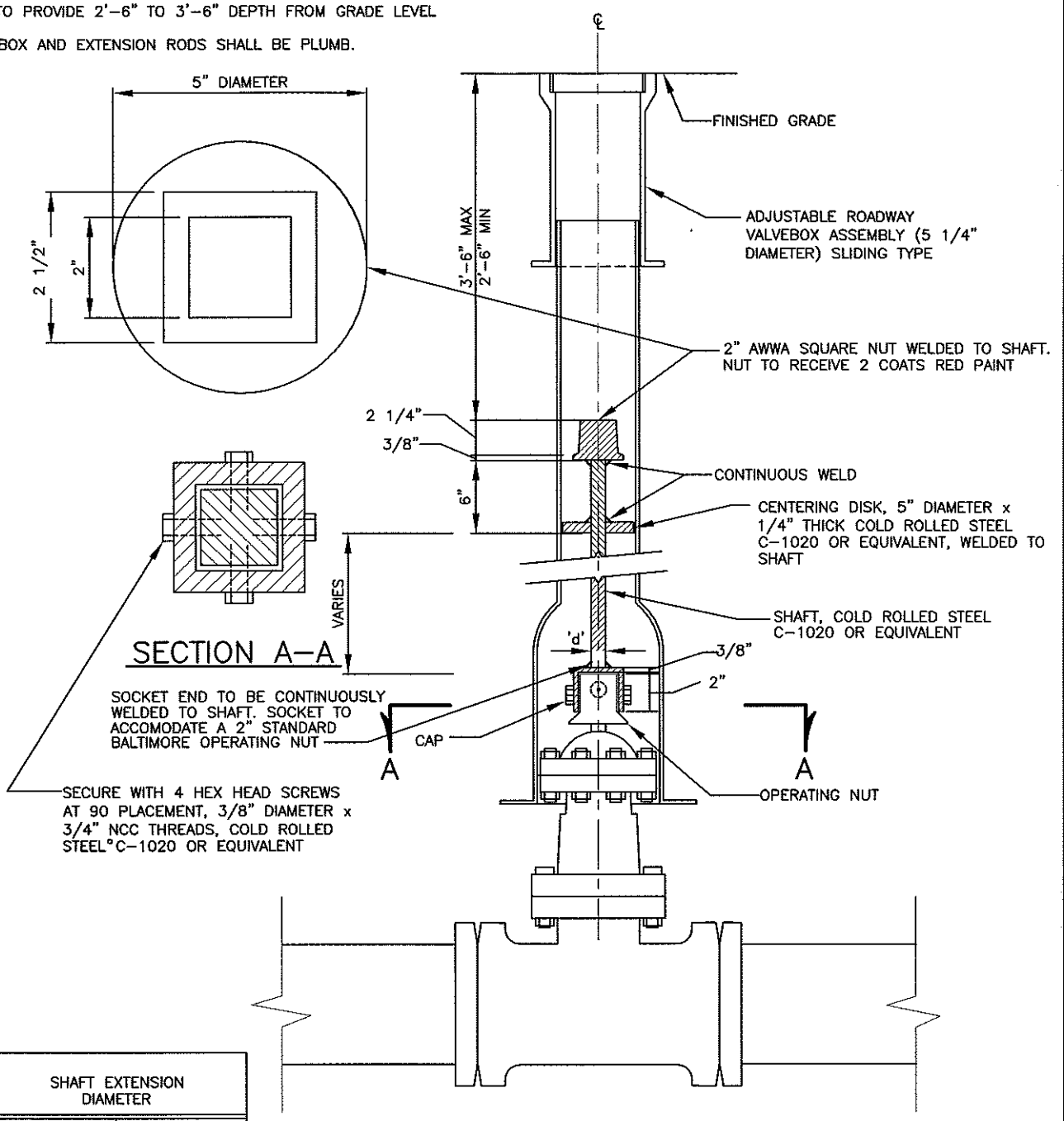
WATER MAIN
Large Concrete Vaults Sections

Detail

W-3.64

NOTES:

1. PROVIDE VALVE KEY EXTENSION WHEN DEPTH OF MAIN LINE VALVE OPERATING NUT EXCEEDS 6'–0".
2. ALL EXPOSED METAL TO RECEIVE 2 COATS BITUMINOUS PAINT. SHAFT AND CENTERING DISK TO RECEIVE 2 COATS BITUMINOUS PAINT.
3. OVERALL LENTGH OF VALVE KEY EXTENSION TO BE DETERMINED BY FIELD MEASUREMENT TO PROVIDE 2'–6" TO 3'–6" DEPTH FROM GRADE LEVEL.
4. BOX AND EXTENSION RODS SHALL BE PLUMB.



ELEVATION

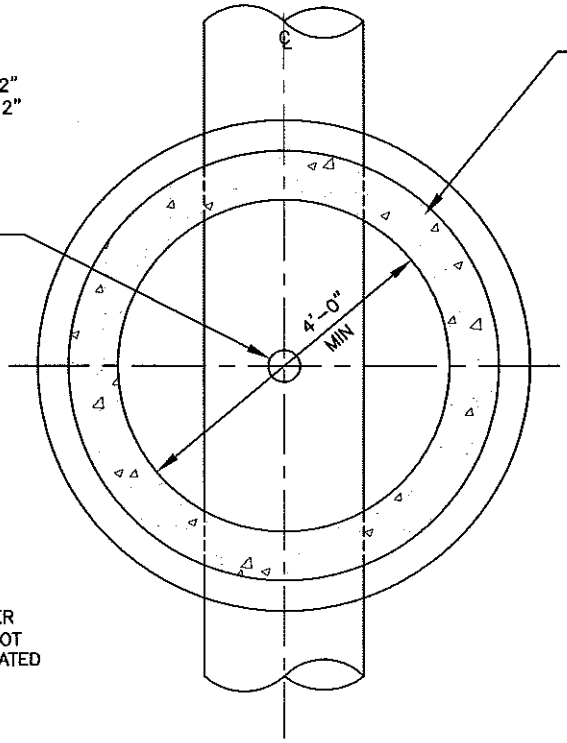
SHAFT EXTENSION DIAMETER	
VALVE SIZE	'd' INCHES
8" OR LESS	1"
10" TO 12"	1 1/4"
16" & UP	1 1/2"

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	WATER MAIN Valve Key Extension	Detail W–3.65

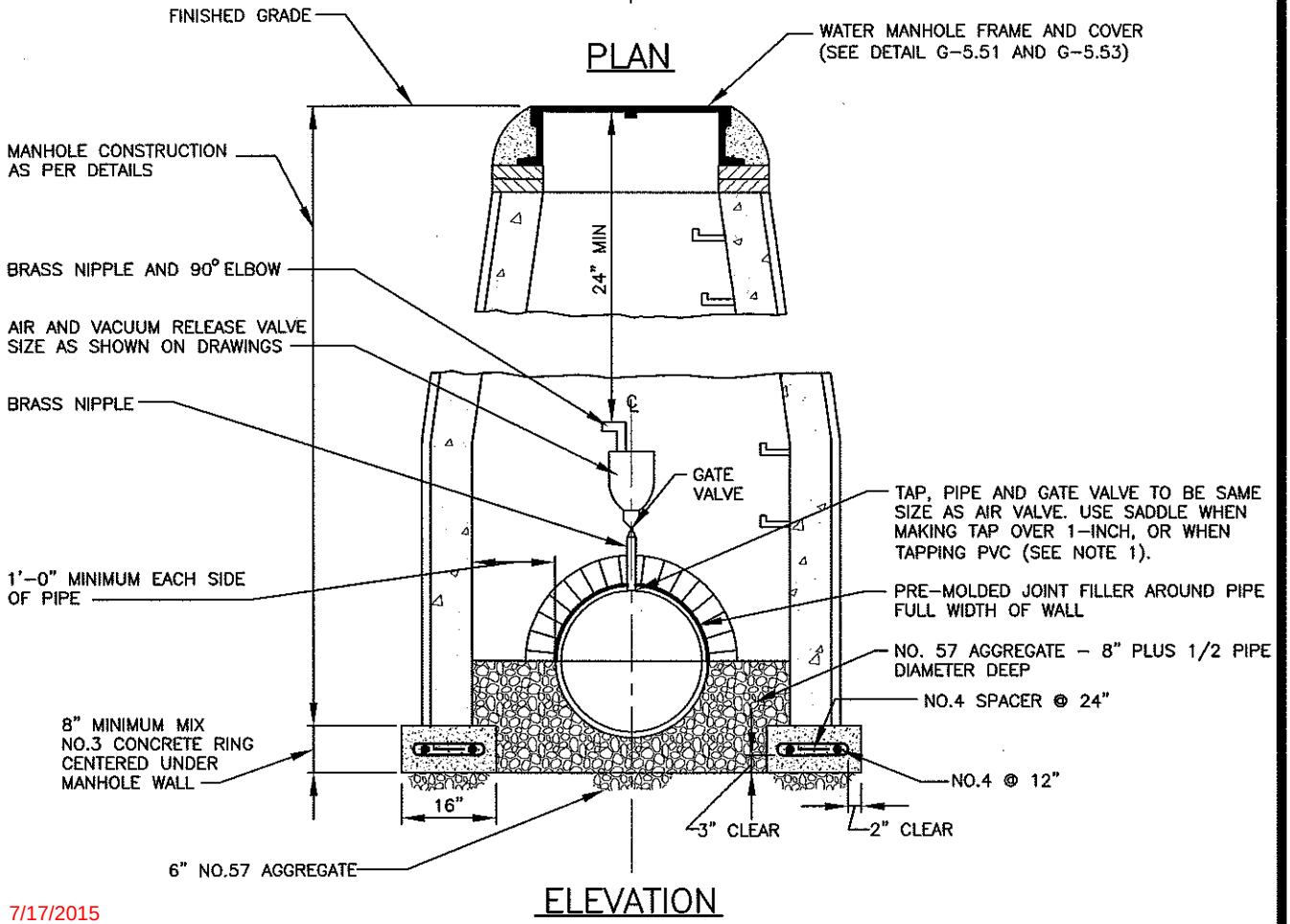
NOTES:

1. SADDLE NOT REQUIRED FOR DIP 12" DIAMETER AND LARGER WITH TAPS 2" DIAMETER OR SMALLER.



PROVIDE 2-3/4" HOLES IN COVER (PICK HOLES MAY BE USED IF NOT OBSTRUCTED WHEN COVER IS SEATED IN FRAME)

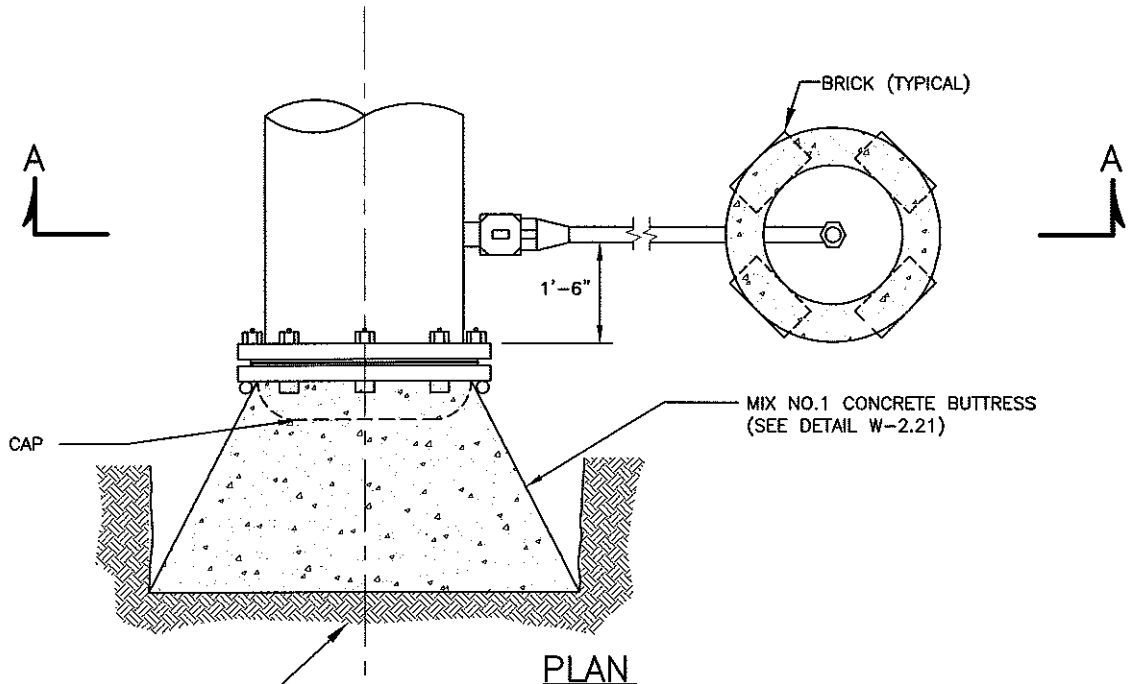
PLAN



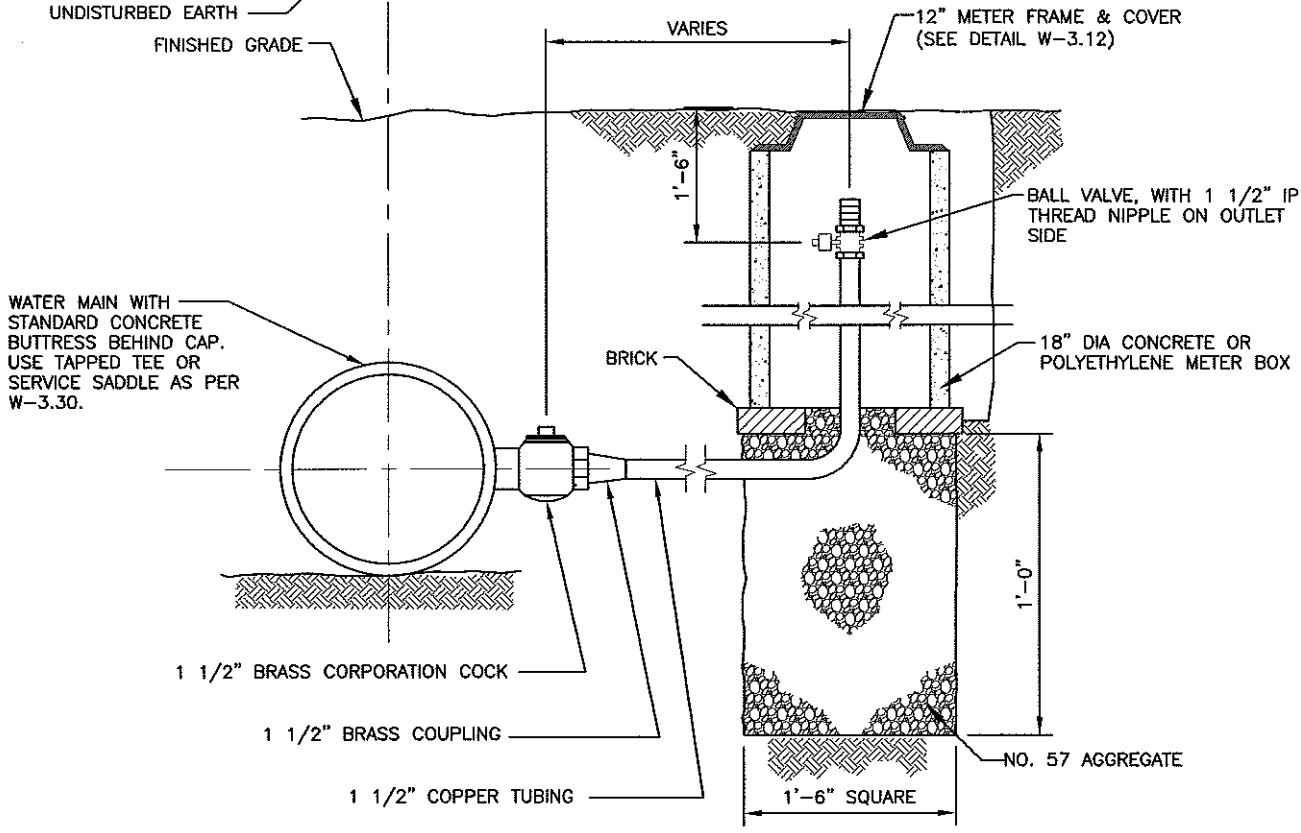
ELEVATION

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	WATER MAIN Air Release Valve Manhole	Detail W-4.11



PLAN



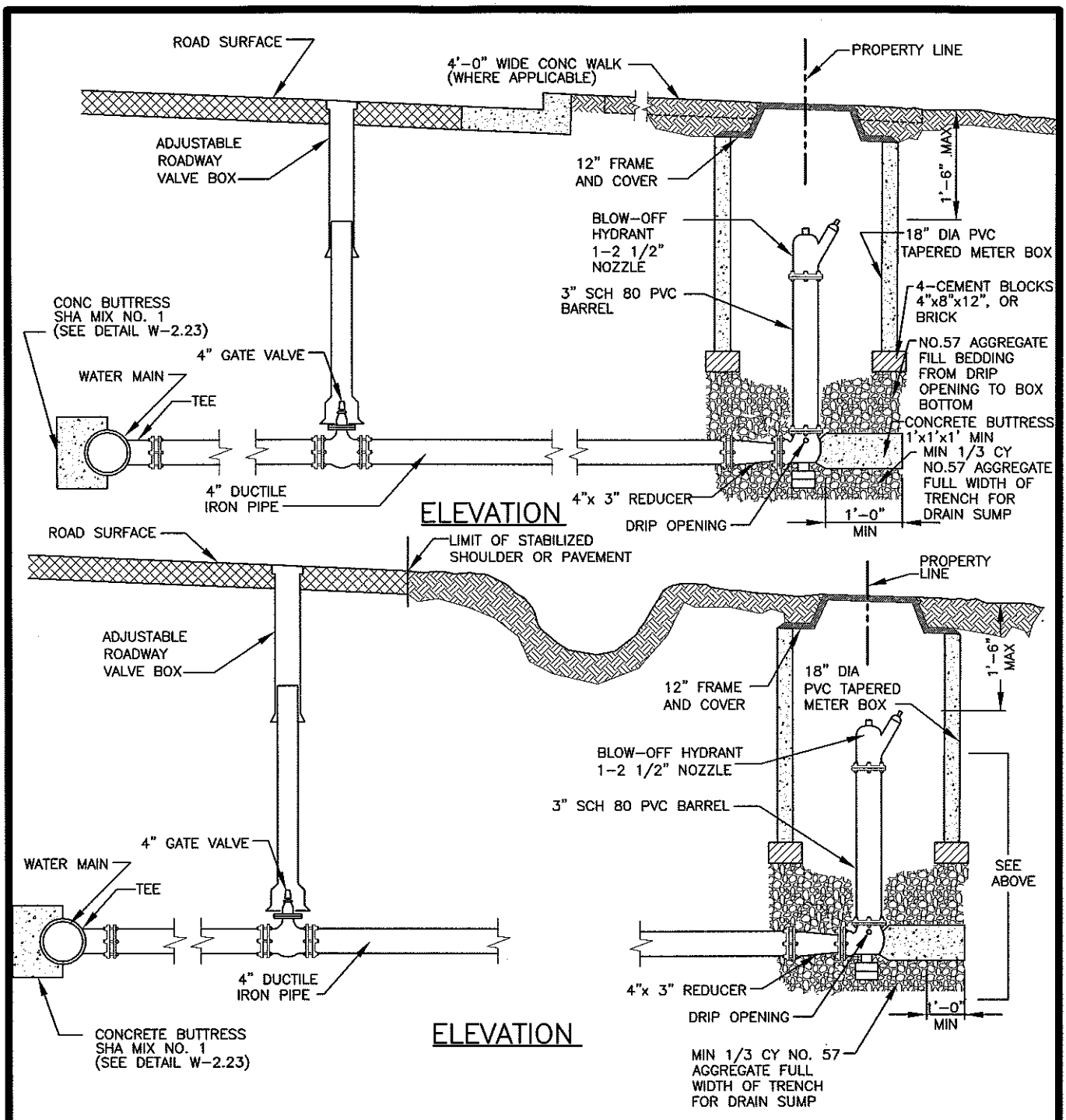
SECTION A-A

NOTES:

1. LOCATE DRAIN VAULT BEHIND CURB OUTSIDE OF TRAVELED WAY, I.E. DRIVEWAY, SIDEWALK, ETC. AND BEYOND LIMITS OF FUTURE ROADWAYS.

7/17/2015 DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	WATER MAIN Drain	Detail W-4.12

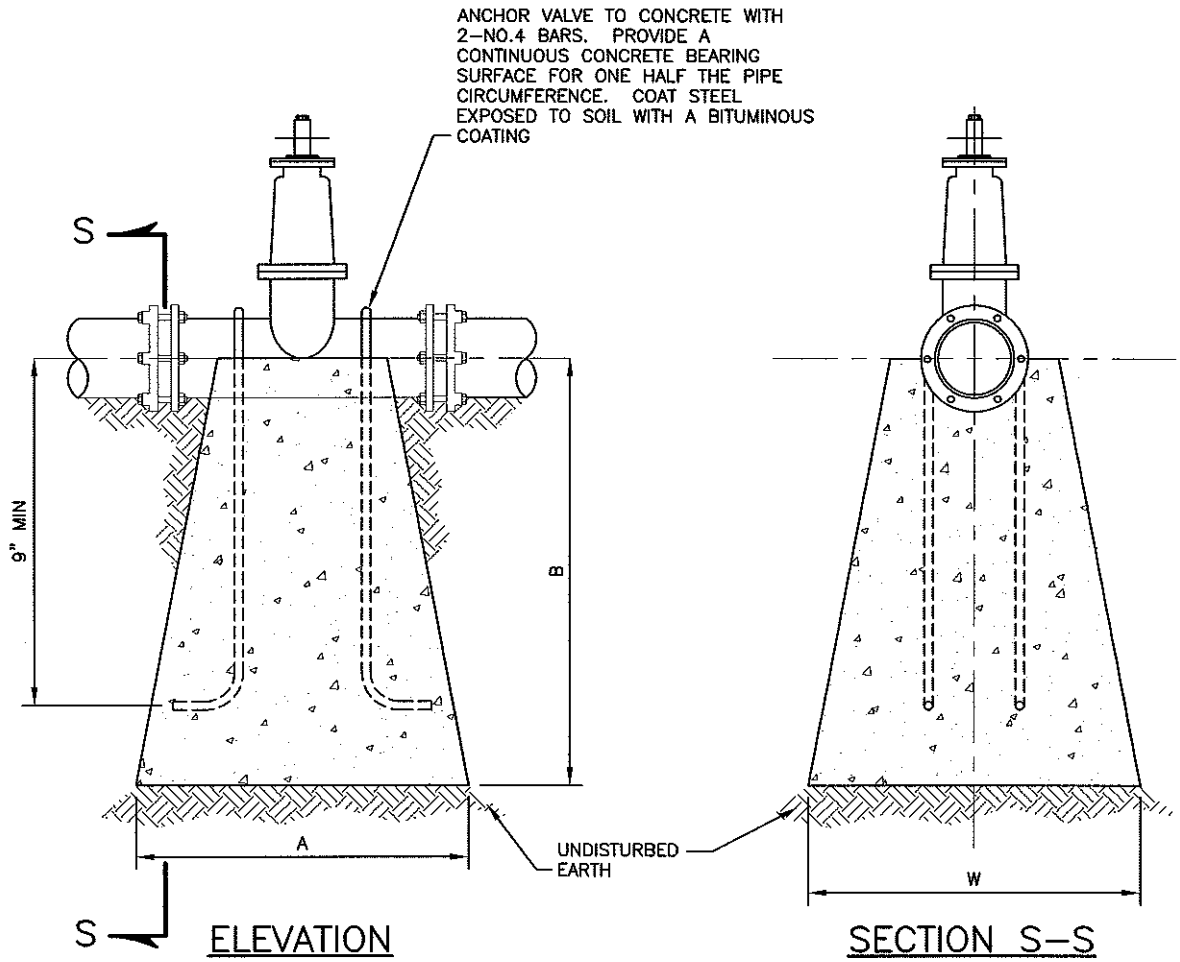


NOTES:

1. METER BOX AND COVER SHALL BE A ROUGH FIELD SETTING UNTIL FINISHED GRADE IS ESTABLISHED. CONTRACTOR TO MAKE FINAL GRADE ADJUSTMENTS WITH METER BOX AND COVER. BLOW-OFF HYDRANT SHALL BE CENTERED AND POSITIONED BELOW FRAME & COVER AND ABOVE CEMENT BLOCKS.
2. RESTRAIN ALL JOINTS FROM TEE TO BLOW OFF.

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	WATER MAIN 6"-12" Blow-off	Detail W-4.13



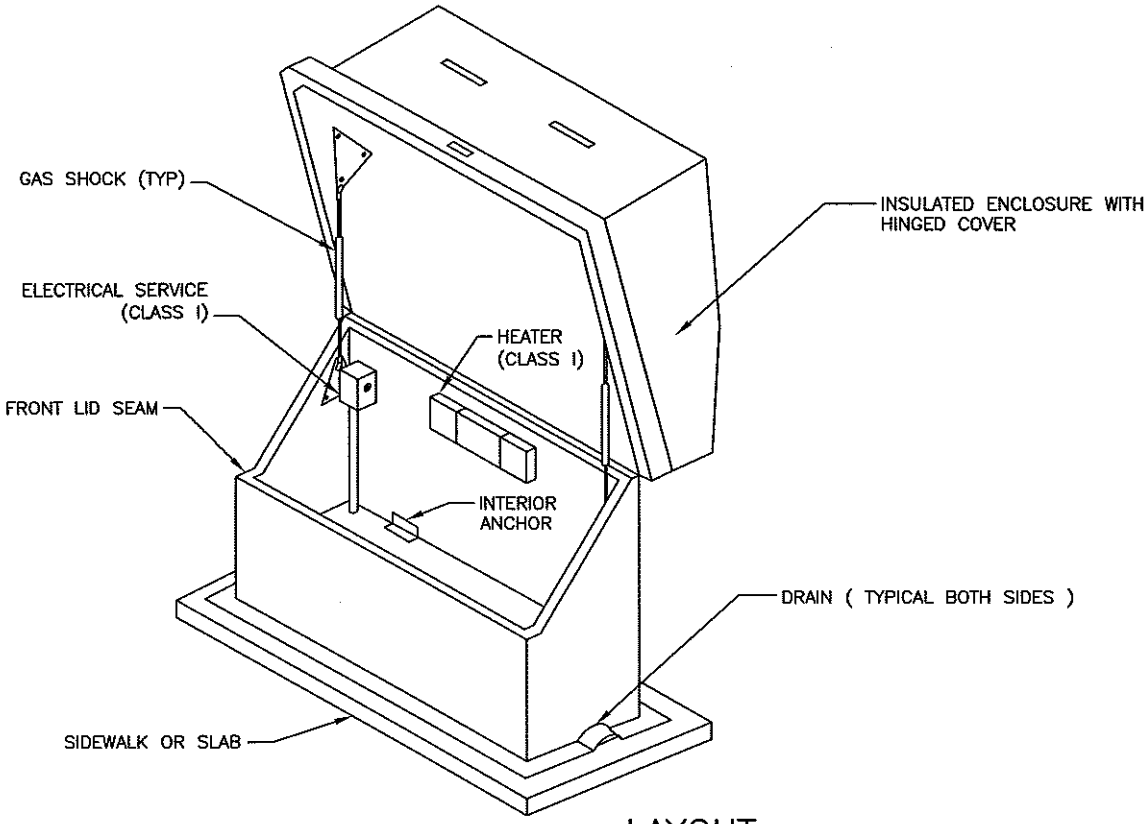
NOTES:

1. ALL CONCRETE TO BE MIX NO. 2

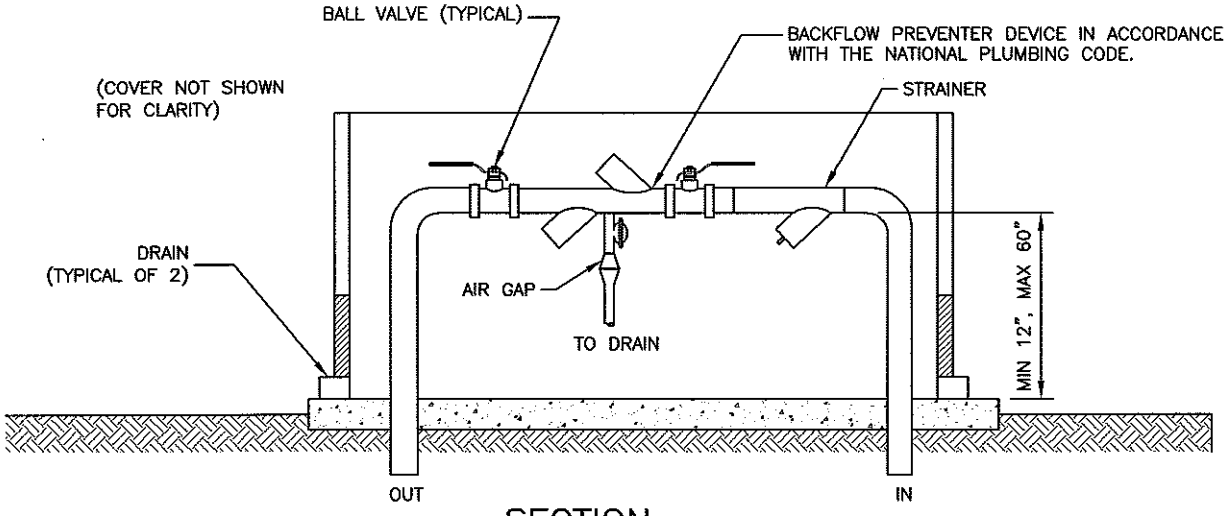
PIPE SIZE	A	B	W
4"	10"	1'–0"	1'–6"
6"	1'–0"	1'–6"	1'–6"
8"	1'–6"	2'–0"	2'–0"
12"	2'–0"	2'–0"	3'–0"

7/17/2015
DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	PVC WATER MAIN Valve Anchorage	Detail W-5.01



LAYOUT



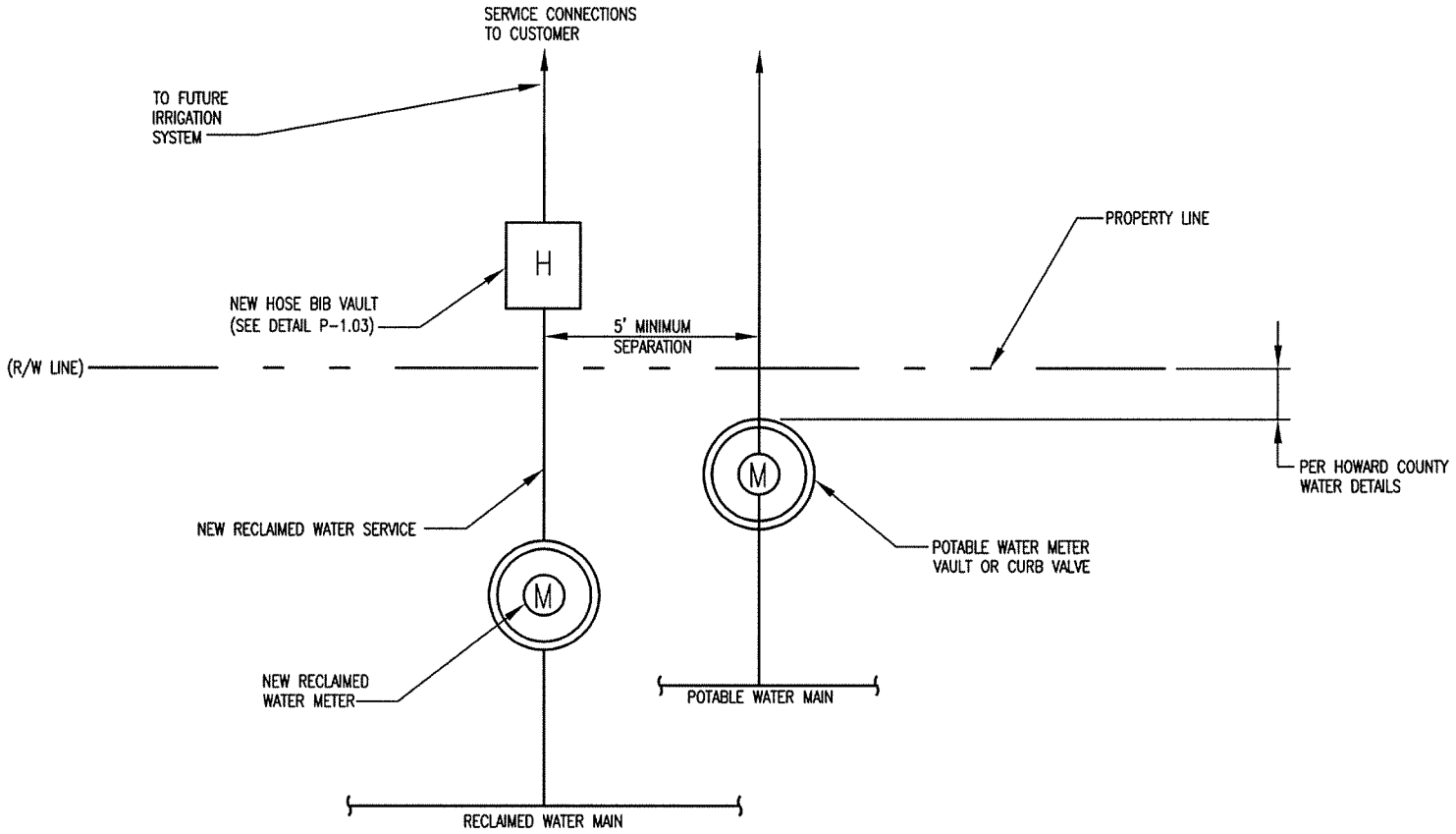
SECTION

NOTES

1. CLASS I ENCLOSURES SHALL HAVE ELECTRIC HEATER AND INSULATION.
2. CLASS II ENCLOSURES SHALL HAVE INSULATION.
3. THIS DETAIL IS FOR USE WITH 2" DIAMETER AND SMALLER SERVICES.
4. FOR SERVICES LARGER THAN 2" SEE DETAIL W-3.44

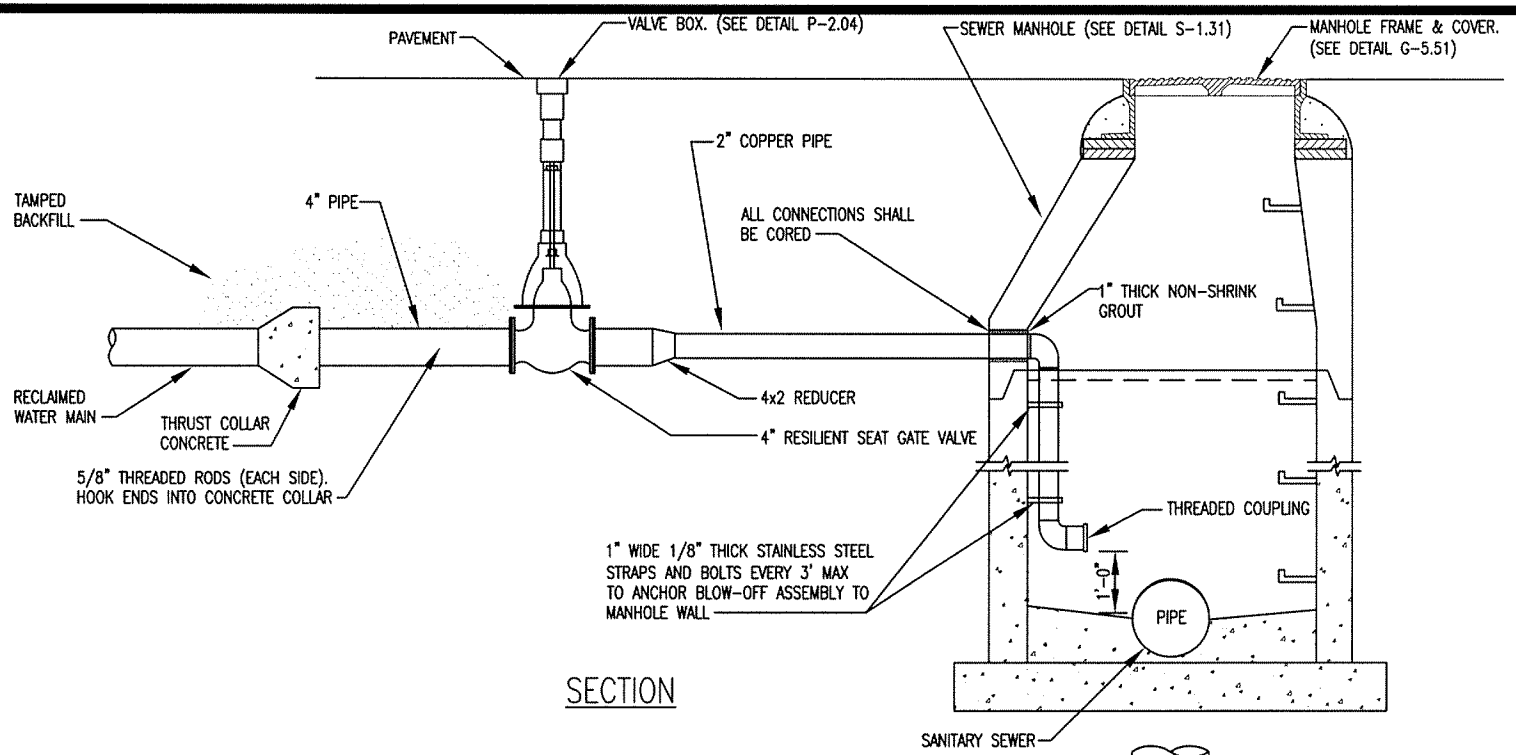
7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Backflow Prevention Between Meter and Building Private	Detail W-9.01



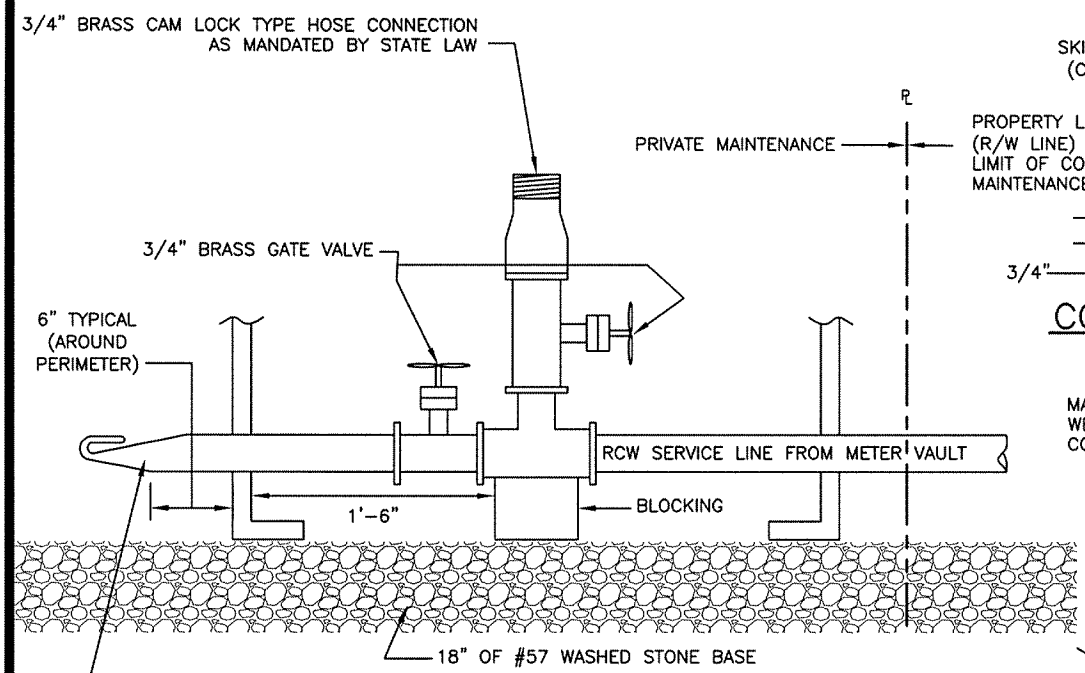
7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	RECLAIMED WATER Service Connections	Detail P-1.01

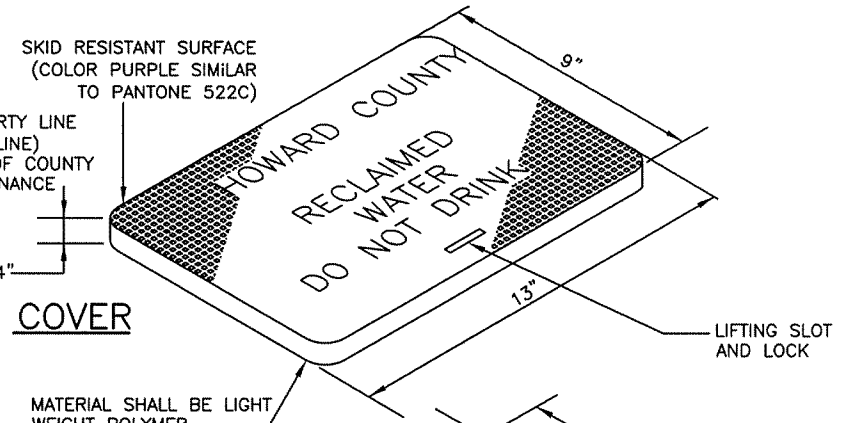


7/17/2015
DRAFT

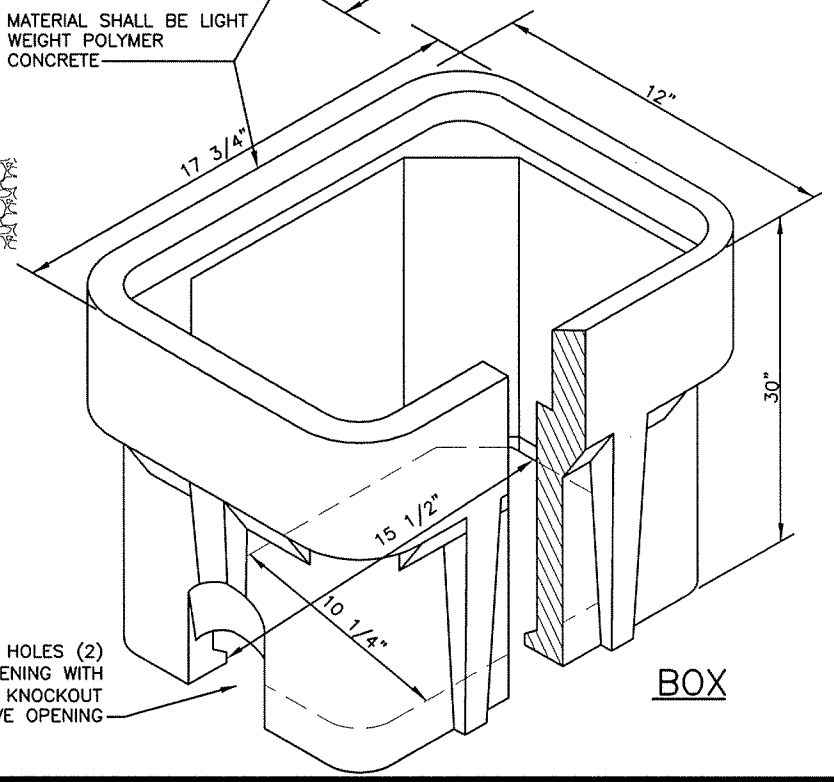
Revised	Howard County, Maryland Department of Public Works	RECLAIMED WATER 2" Blow-off Assembly	Detail P-1.02
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		



ELEVATION



COVER



BOX

NOTES:

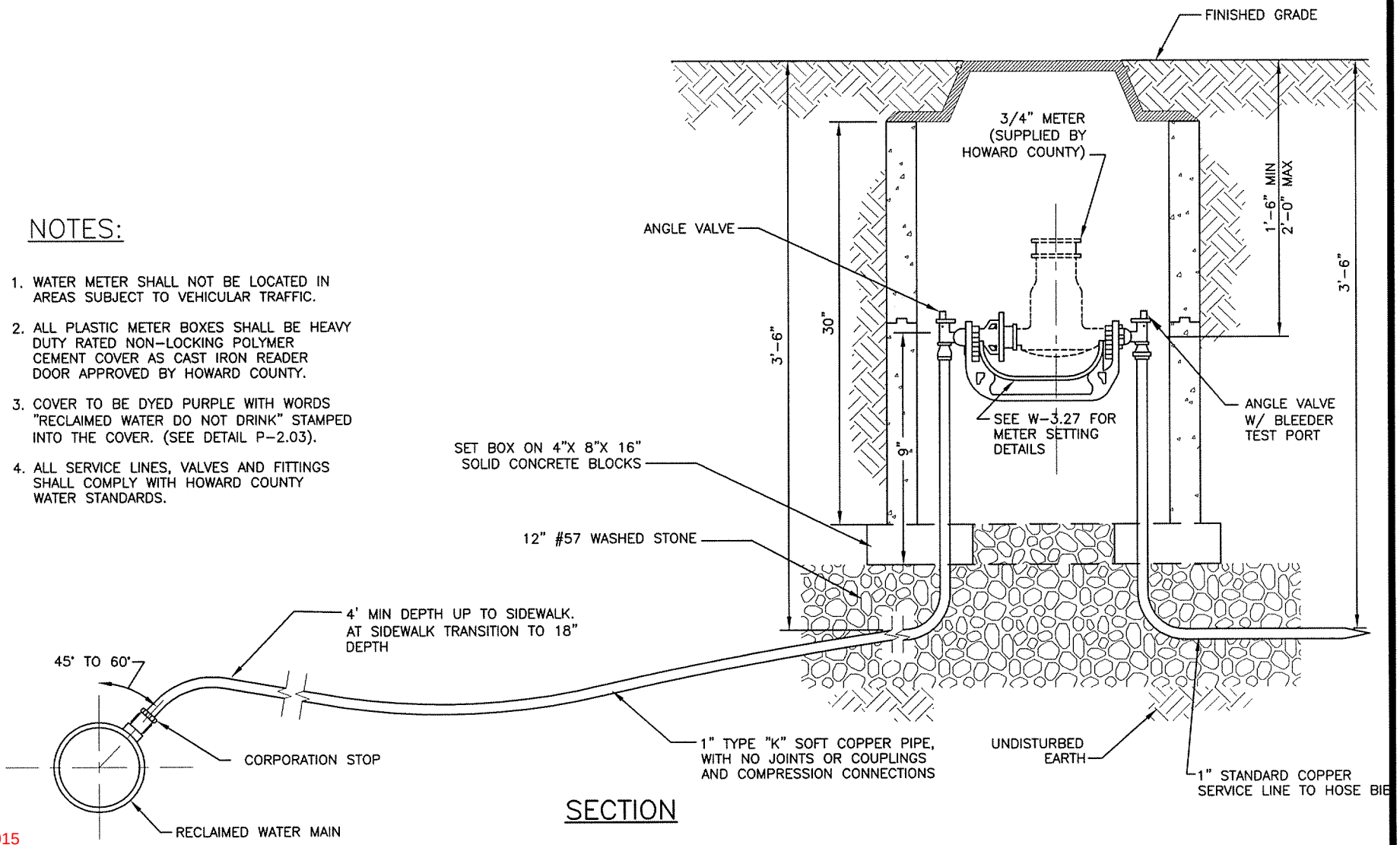
1. TO ENSURE POSITIVE DRAINAGE, THE VAULT SHALL HAVE AN OPEN BOTTOM TO ALLOW DRAINAGE THROUGH STONE.
2. COUNTY MAINTENANCE ENDS AT PROPERTY LINE
3. PRECAST CONCRETE BOX WITH ALUMINUM ACCESS HATCH WILL BE AN ACCEPTABLE ALTERNATIVE WITH APPROVAL OF THE ENGINEER

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	RECLAIMED WATER Hose Bib and Box	Detail P-1.03

NOTES:

1. WATER METER SHALL NOT BE LOCATED IN AREAS SUBJECT TO VEHICULAR TRAFFIC.
2. ALL PLASTIC METER BOXES SHALL BE HEAVY DUTY RATED NON-LOCKING POLYMER CEMENT COVER AS CAST IRON READER DOOR APPROVED BY HOWARD COUNTY.
3. COVER TO BE DYED PURPLE WITH WORDS "RECLAIMED WATER DO NOT DRINK" STAMPED INTO THE COVER. (SEE DETAIL P-2.03).
4. ALL SERVICE LINES, VALVES AND FITTINGS SHALL COMPLY WITH HOWARD COUNTY WATER STANDARDS.



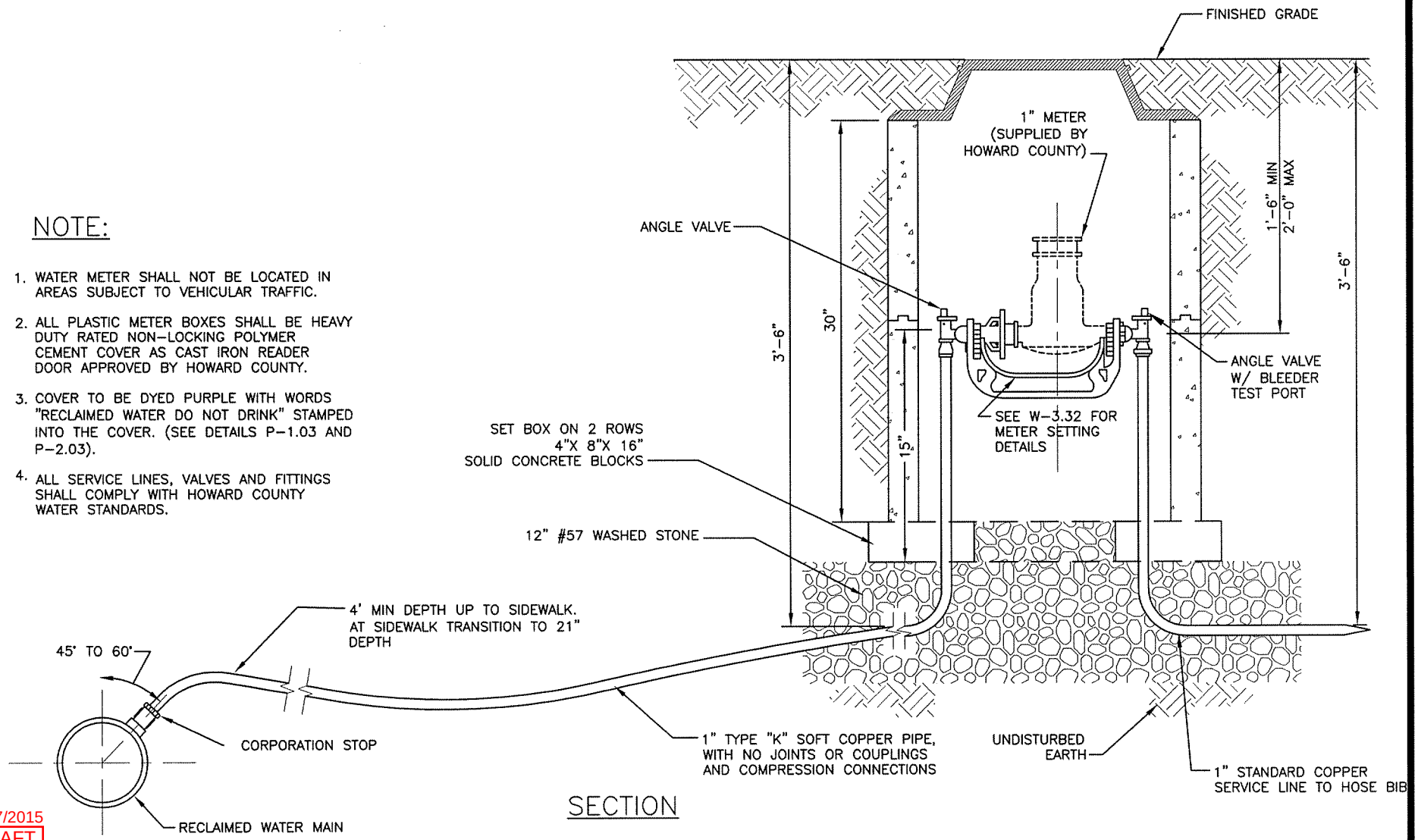
SECTION

7/17/2015
DRAFT

Revised	Howard County, Maryland Department of Public Works	RECLAIMED WATER 3/4" Water Service	Detail P-2.01
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		

NOTE:

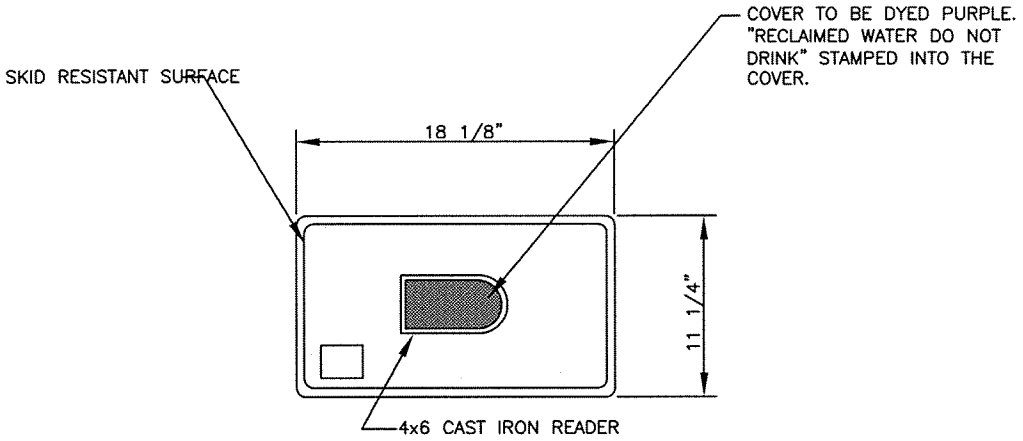
1. WATER METER SHALL NOT BE LOCATED IN AREAS SUBJECT TO VEHICULAR TRAFFIC.
2. ALL PLASTIC METER BOXES SHALL BE HEAVY DUTY RATED NON-LOCKING POLYMER CEMENT COVER AS CAST IRON READER DOOR APPROVED BY HOWARD COUNTY.
3. COVER TO BE DYED PURPLE WITH WORDS "RECLAIMED WATER DO NOT DRINK" STAMPED INTO THE COVER. (SEE DETAILS P-1.03 AND P-2.03).
4. ALL SERVICE LINES, VALVES AND FITTINGS SHALL COMPLY WITH HOWARD COUNTY WATER STANDARDS.



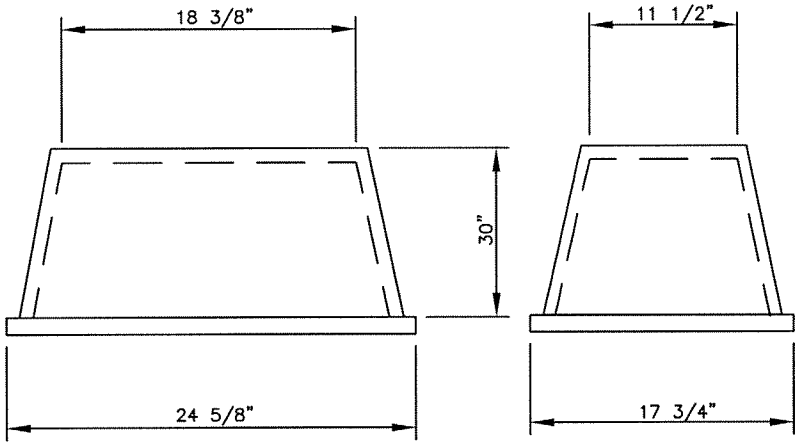
SECTION

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	RECLAIMED WATER 1" Water Service	Detail P-2.02



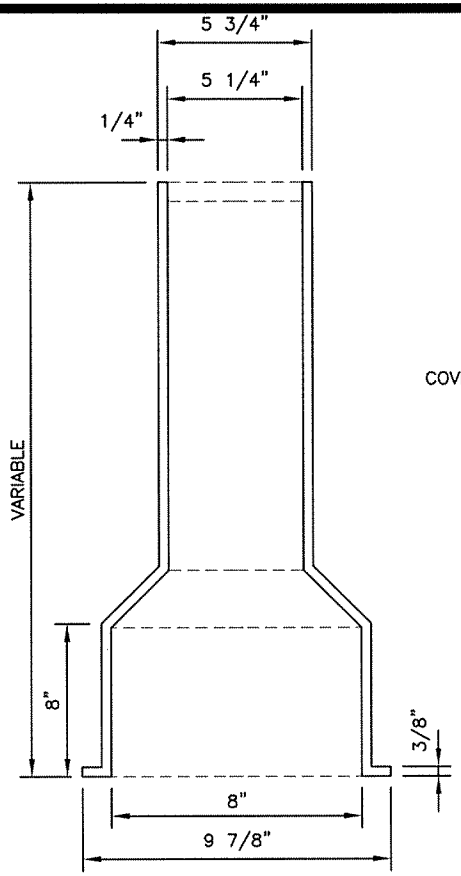
METER BOX COVER TOP VIEW



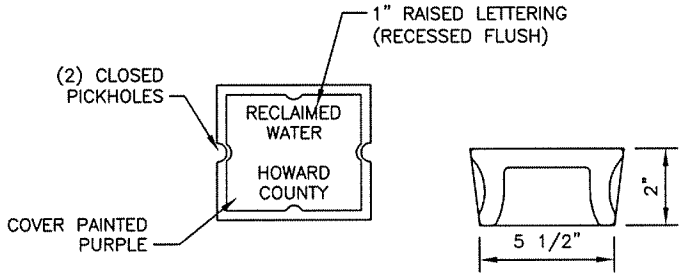
STANDARD HEAVY DUTY POLYMER CONCRETE METER BOX

7/17/2015
DRAFT

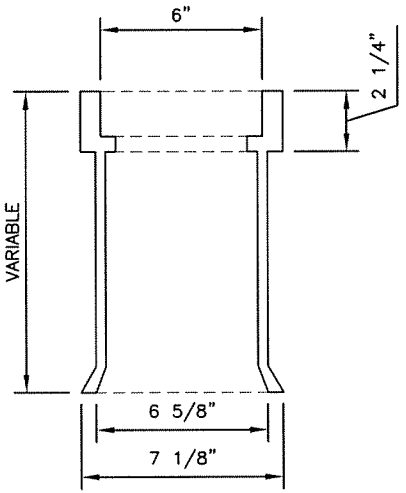
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	RECLAIMED WATER Heavy Duty Polymer Meter Box	Detail P-2.03



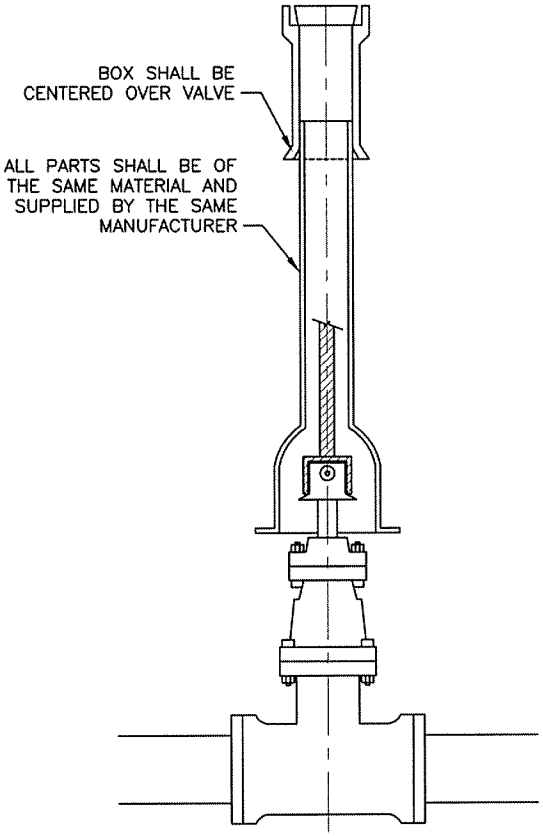
BOTTOM SECTION



LID



SQUARE UPPER SECTION



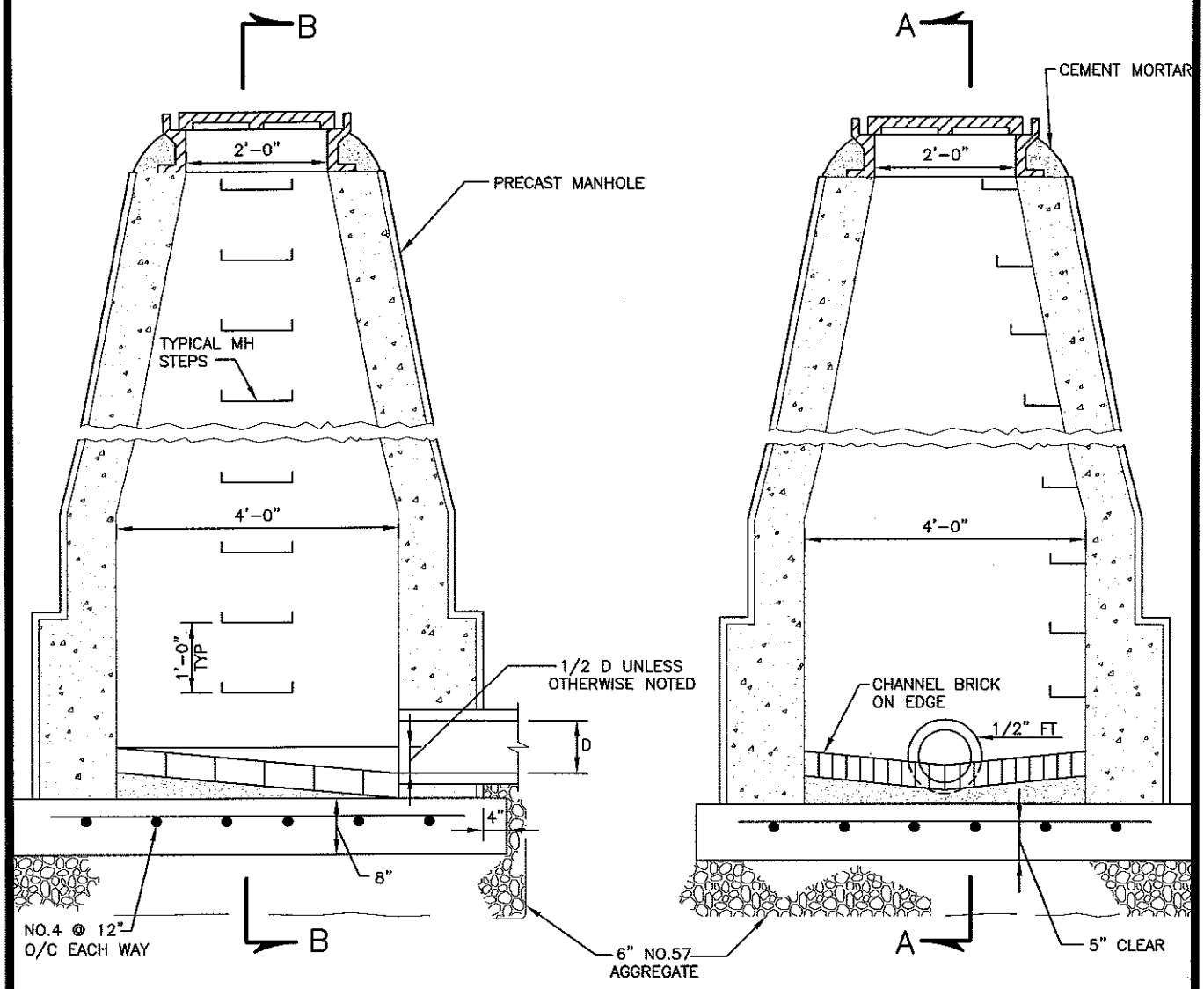
COMPLETE BOX

NOTES:

1. VALVE BOX COVER SHALL WEIGH A MINIMUM OF 13 LBS.
2. ENTIRE VALVE BOX ASSEMBLY & COVER SHALL BE CAST FROM CLASS 35 GRAY IRON.
3. ASSEMBLY OTHER THAN COVER SHALL BE PAINTED BLACK.
4. INSTALLATION SHALL BE IN ACCORDANCE WITH HOWARD COUNTY WATER DETAILS.

7/17/2015 DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	RECLAIMED WATER Valve Box	Detail P-2.04



SECTION A–A

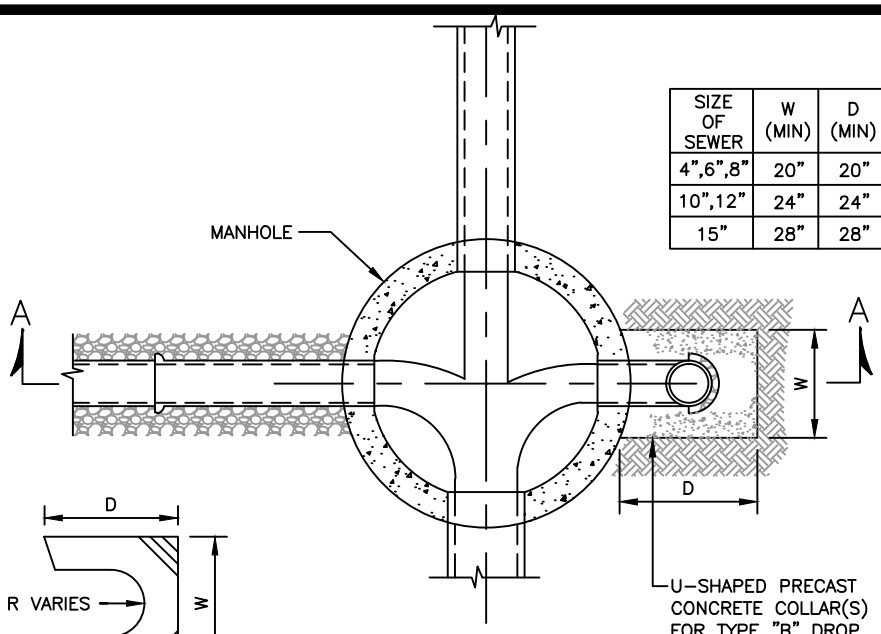
SECTION B–B

NOTES:

1. SEE GENERAL NOTES APPLICABLE TO ALL PRECAST MANHOLES ON DETAIL G–5.11.
2. USE SHALLOW MANHOLE WHERE APPLICABLE. (SEE DETAIL G–5.12 AND G–5.13.)

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	MANHOLE Terminal Manhole	Detail S-1.31



PLAN 1

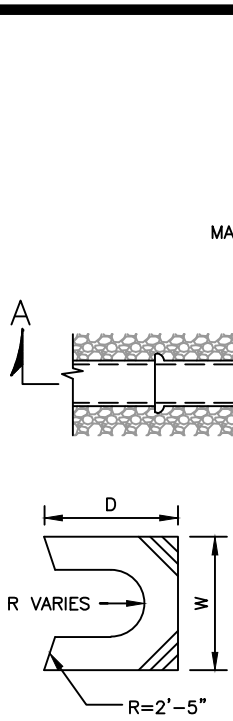
SIZE OF SEWER	W (MIN)	D (MIN)
4",6",8"	20"	20"
10",12"	24"	24"
15"	28"	28"

NOTES:

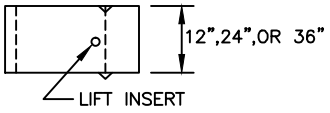
1. HEIGHT CRITERIA FOR DROP CONNECTIONS SHALL BE AS FOLLOWS.

SIZE OF SEWER	TYPE A MAX DROP	TYPE A MIN DROP	TYPE B MIN DROP
4",6",8"	3'-9"	2'-2"	3'-9"
10"	4'-0"	2'-2"	4'-0"
12"	6'-0"	2'-6"	6'-0"
15"	6'-0"	2'-6"	6'-0"

2. SEE GENERAL NOTES APPLICABLE TO ALL PRECAST MANHOLES ON DETAIL G-5.12.
3. U-SHAPED PRECAST CONCRETE COLLARS SHALL BE 1''-0", 2'-0", OR 3'-0" IN HEIGHT. PLACE #57 AGGREGATE BETWEEN COLLAR AND UNDISTURBED EARTH AND/OR SAND BETWEEN COLLAR AND PIPE.
4. TYPE "B" DROP CONNECTION MAY BE PRECAST BY MANHOLE MANUFACTURER.

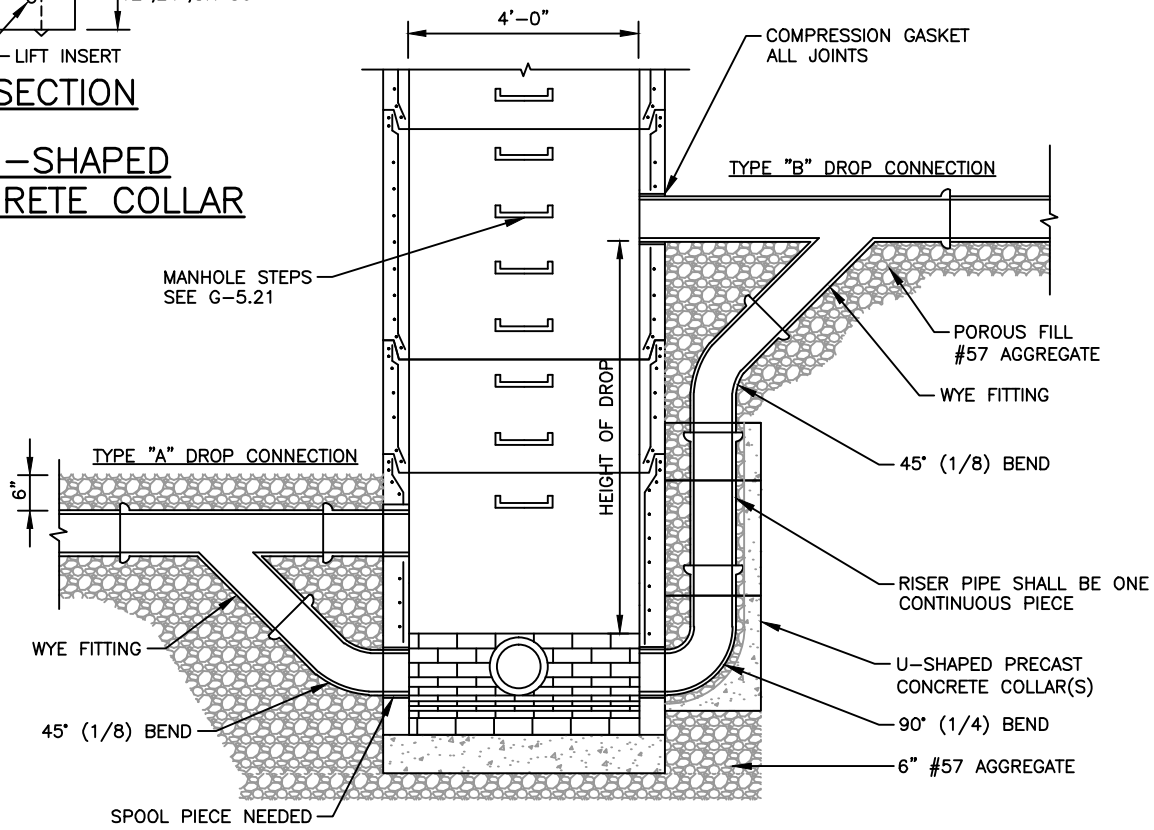


PLAN



SECTION

U-SHAPED CONCRETE COLLAR

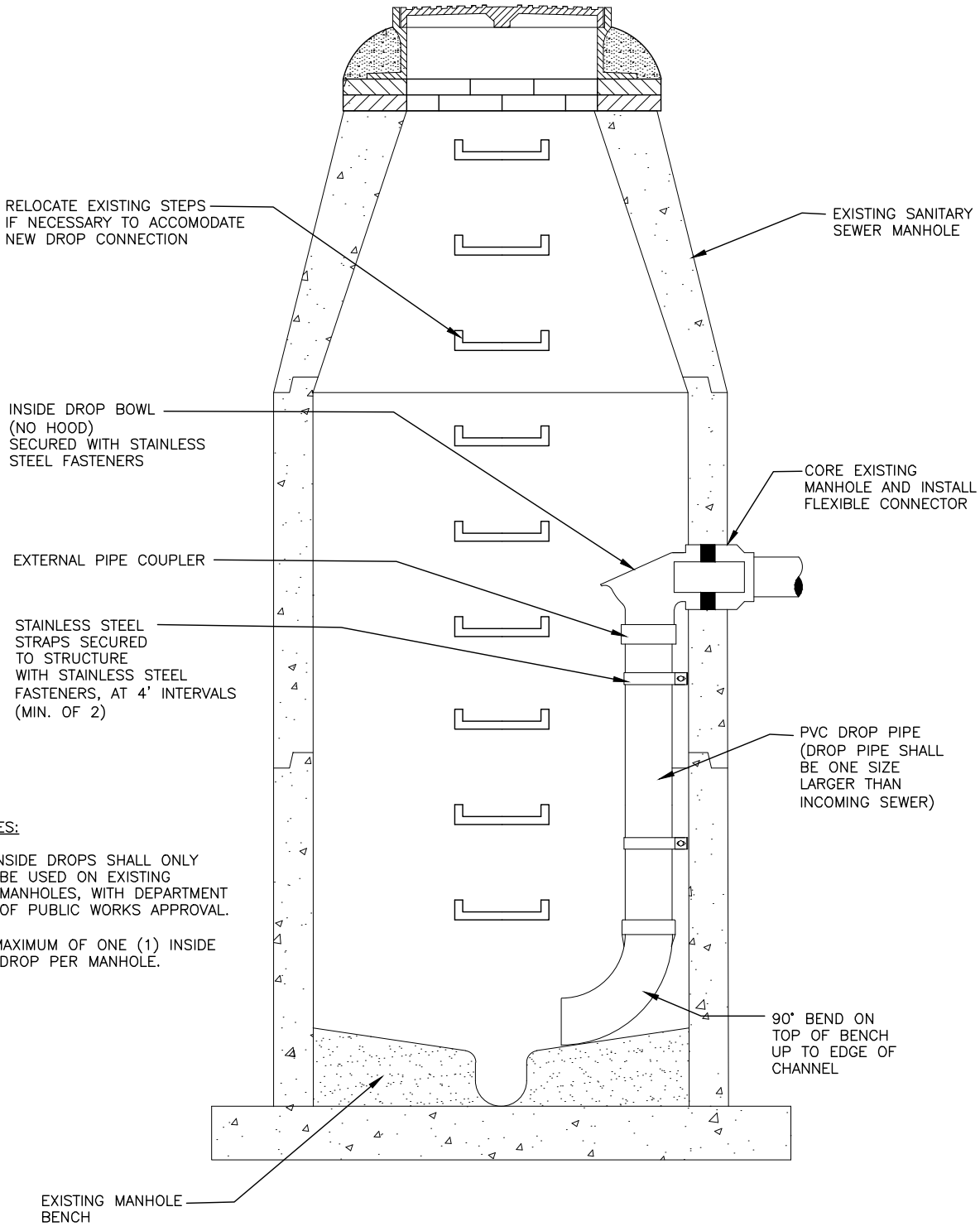


SECTION A-A 1

7/17/2015

DRAFT

Revised 1 X/X/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signatures.bmp Chief, Bureau of Engineering	MANHOLE Drop Connection Types "A" and "B"	Detail S-1.32

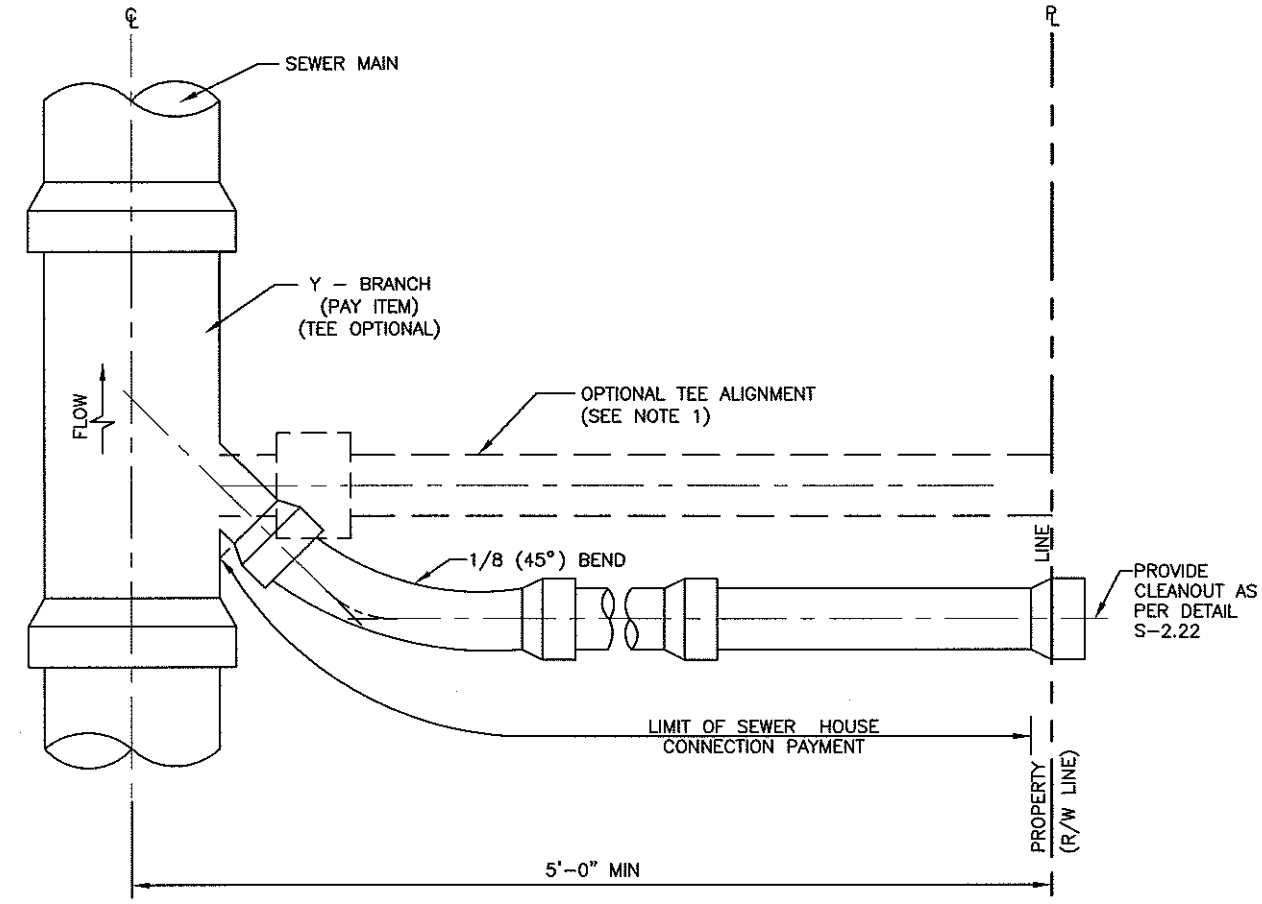


NOTES:

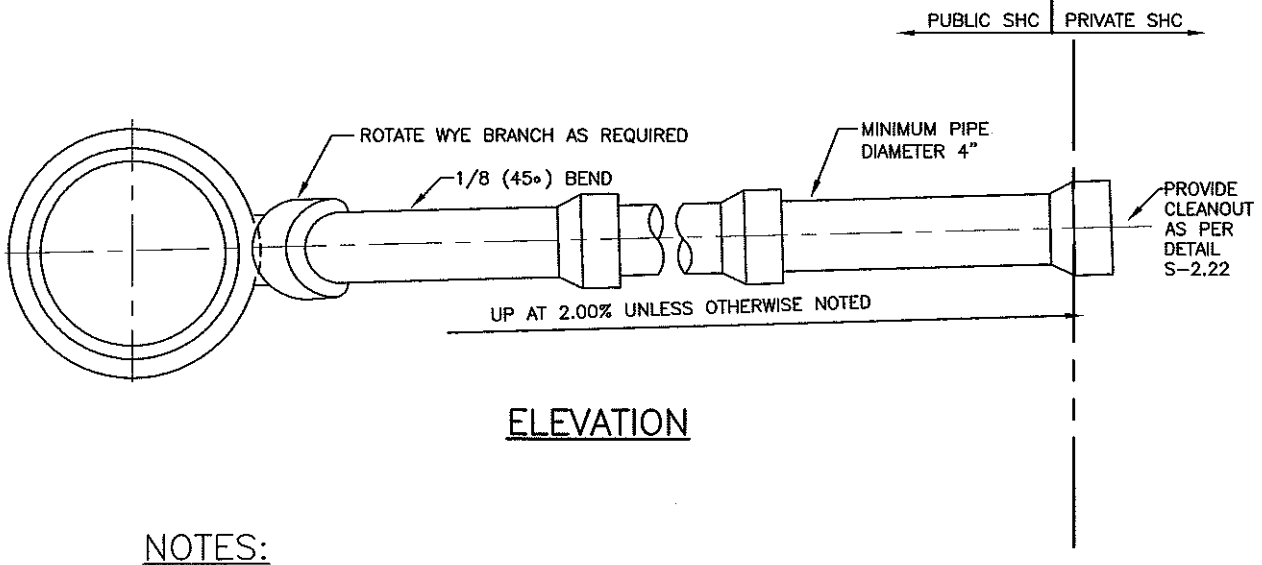
1. INSIDE DROPS SHALL ONLY BE USED ON EXISTING MANHOLES, WITH DEPARTMENT OF PUBLIC WORKS APPROVAL.
2. MAXIMUM OF ONE (1) INSIDE DROP PER MANHOLE.

7/17/2015
DRAFT

Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	INSIDE DROP– EXISTING MANHOLE	Detail S-1.33



PLAN



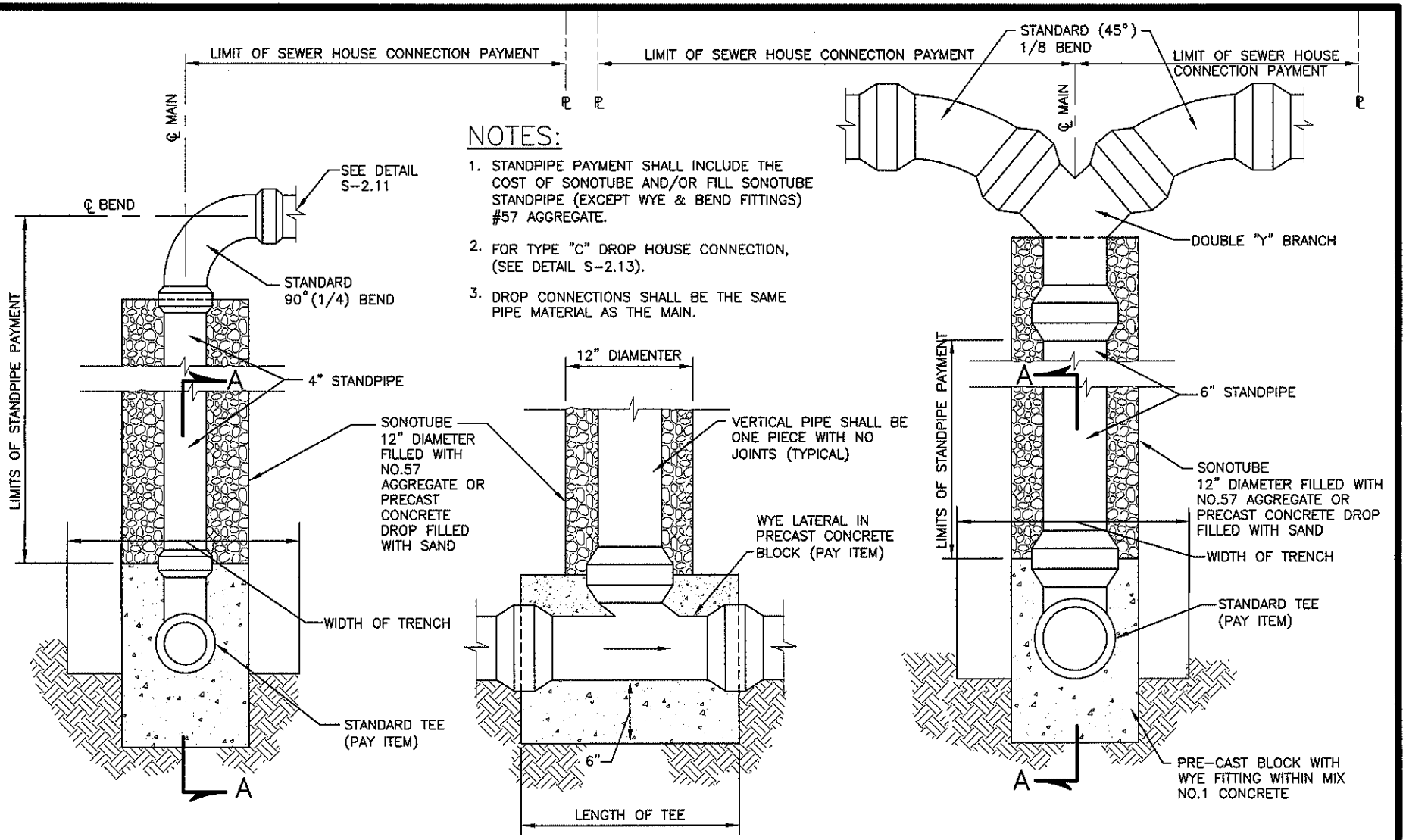
ELEVATION

NOTES:

1. FOR USE WITH TAPPING SADDLES ON EXISTING MAINS ONLY. (SEE DETAIL S–2.21)

7/17/2015
DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	SEWER HOUSE CONNECTION SHC	Detail S–2.11



7/17/2015
DRAFT

TYPE "A" – ELEVATION

SECTION A–A

TYPE "B" – ELEVATION

Revised

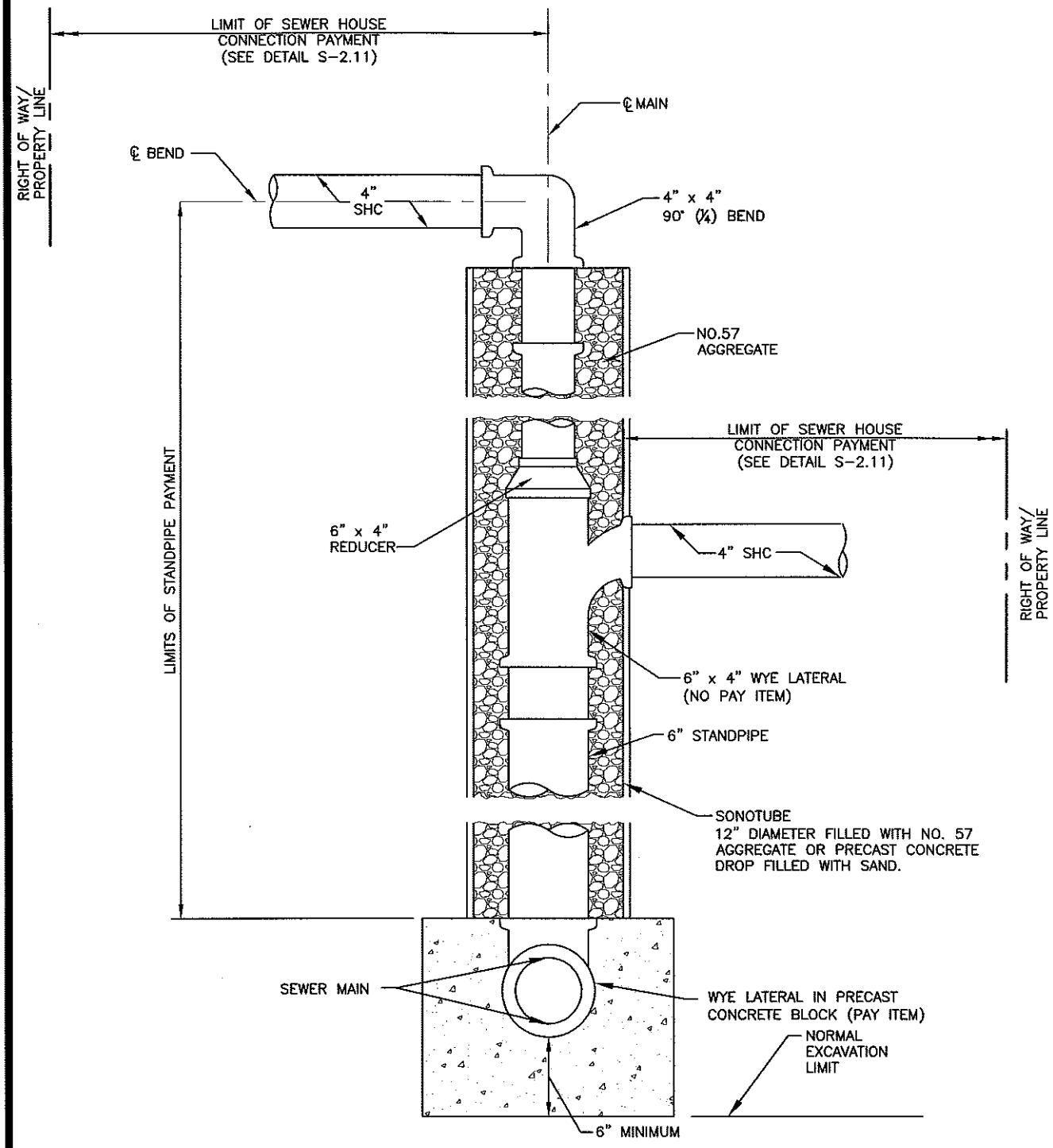
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

Approved: _____
Chief, Bureau of Engineering

SEWER HOUSE CONNECTION
Drop
Types "A" and "B"

Detail
S-2.12



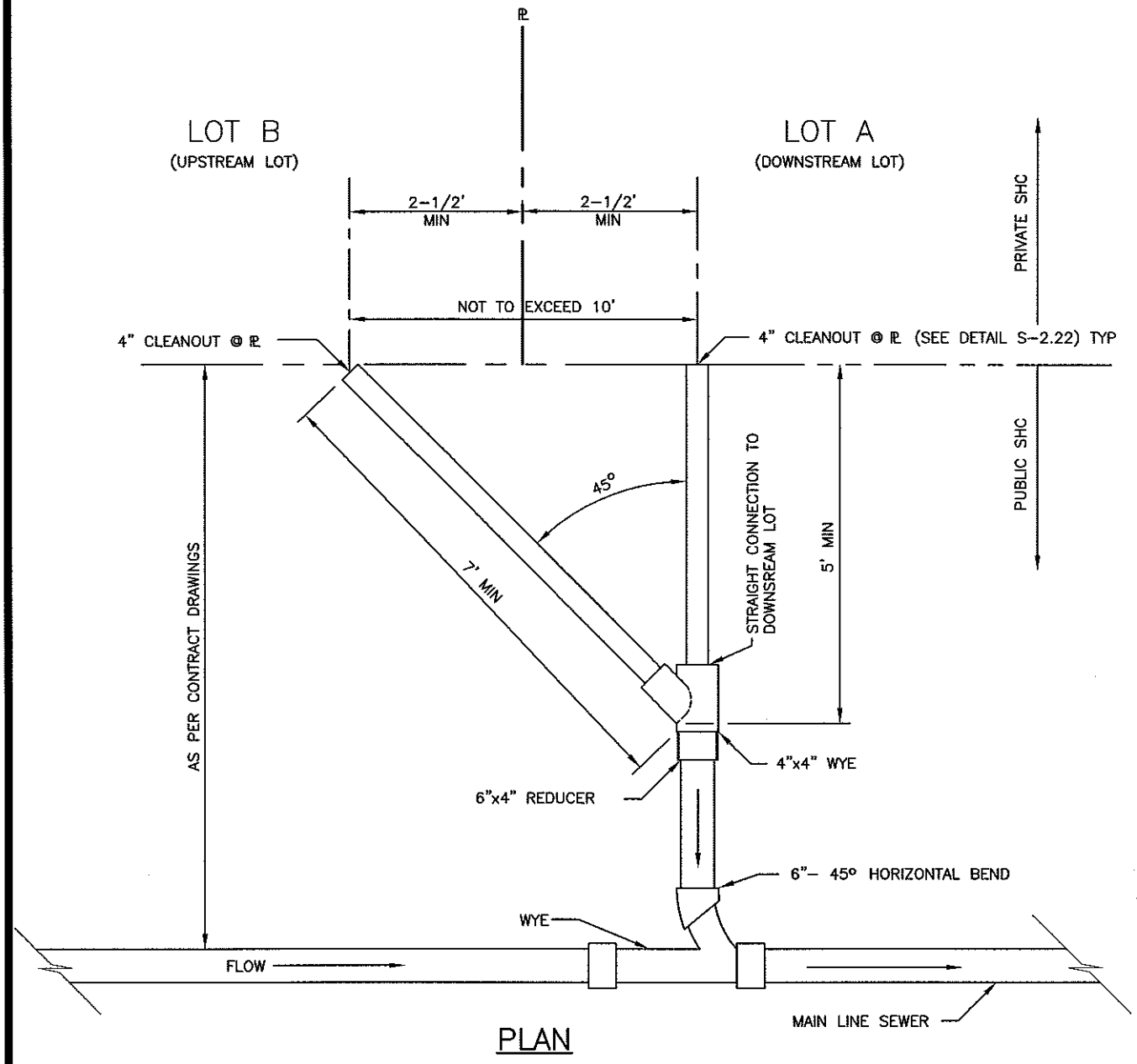
ELEVATION

NOTES:

1. THIS IS AN ALTERNATE TO DETAIL S-2.12, TYPE 'B'.

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	SEWER HOUSE CONNECTION Double Drop Alternate Type 'C'	Detail S-2.13



PLAN

NOTES:

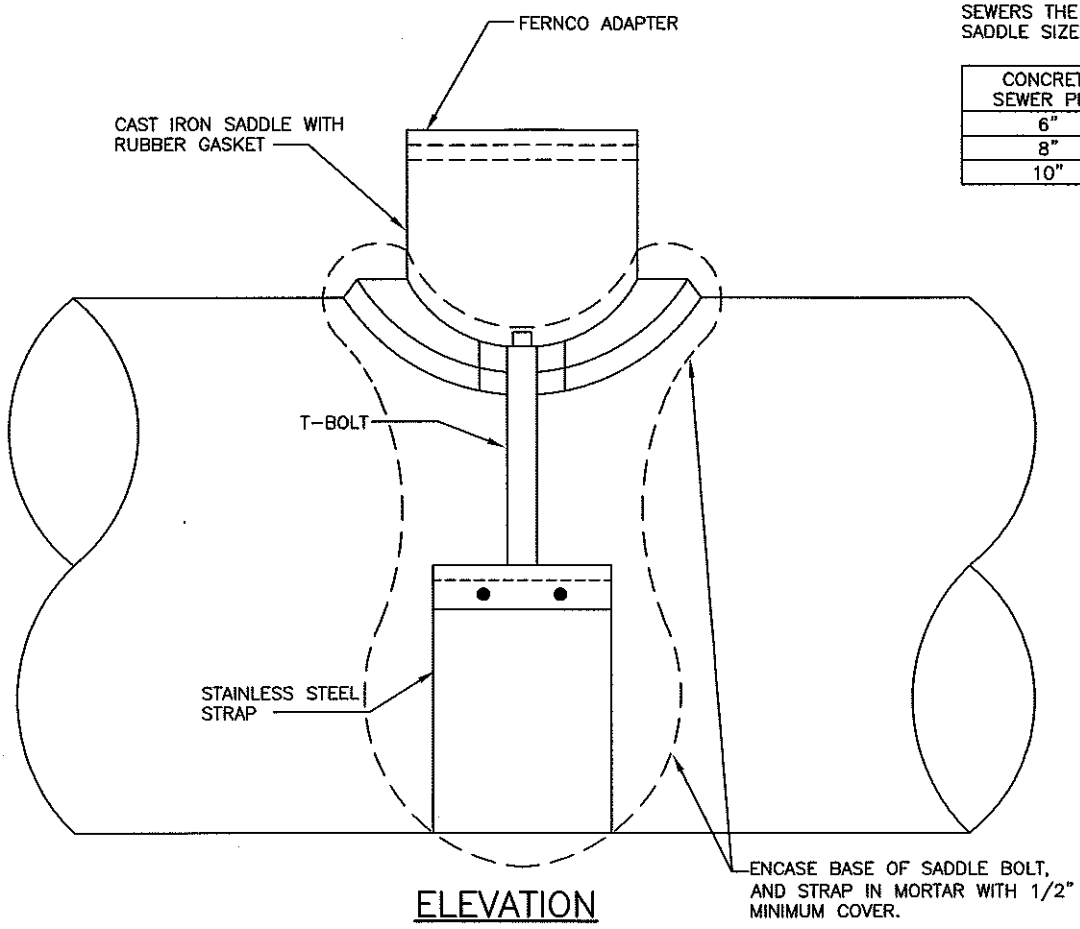
1. SEE DETAIL S-2.11 FOR STANDARD SEWER HOUSE CONNECTION.

7/17/2015
DRAFT

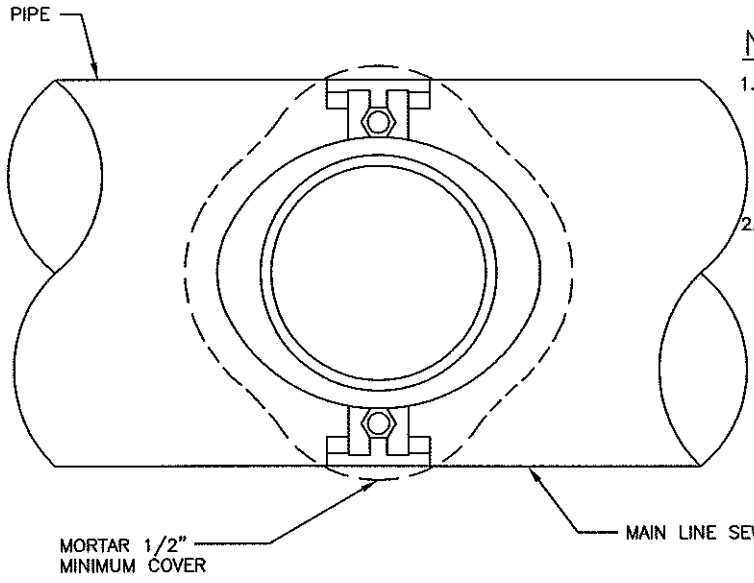
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	SEWER HOUSE CONNECTION Twin	Detail S-2.14

WHEN CONNECTIONS TO CONCRETE SEWERS THE FOLLOWING LISTED SADDLE SIZES SHALL BE USED:

CONCRETE SEWER PIPE	SADDLE SIZE
6"	4" x 8"
8"	6" OR 4" x 10"
10"	6" OR 4" x 12"



ELEVATION



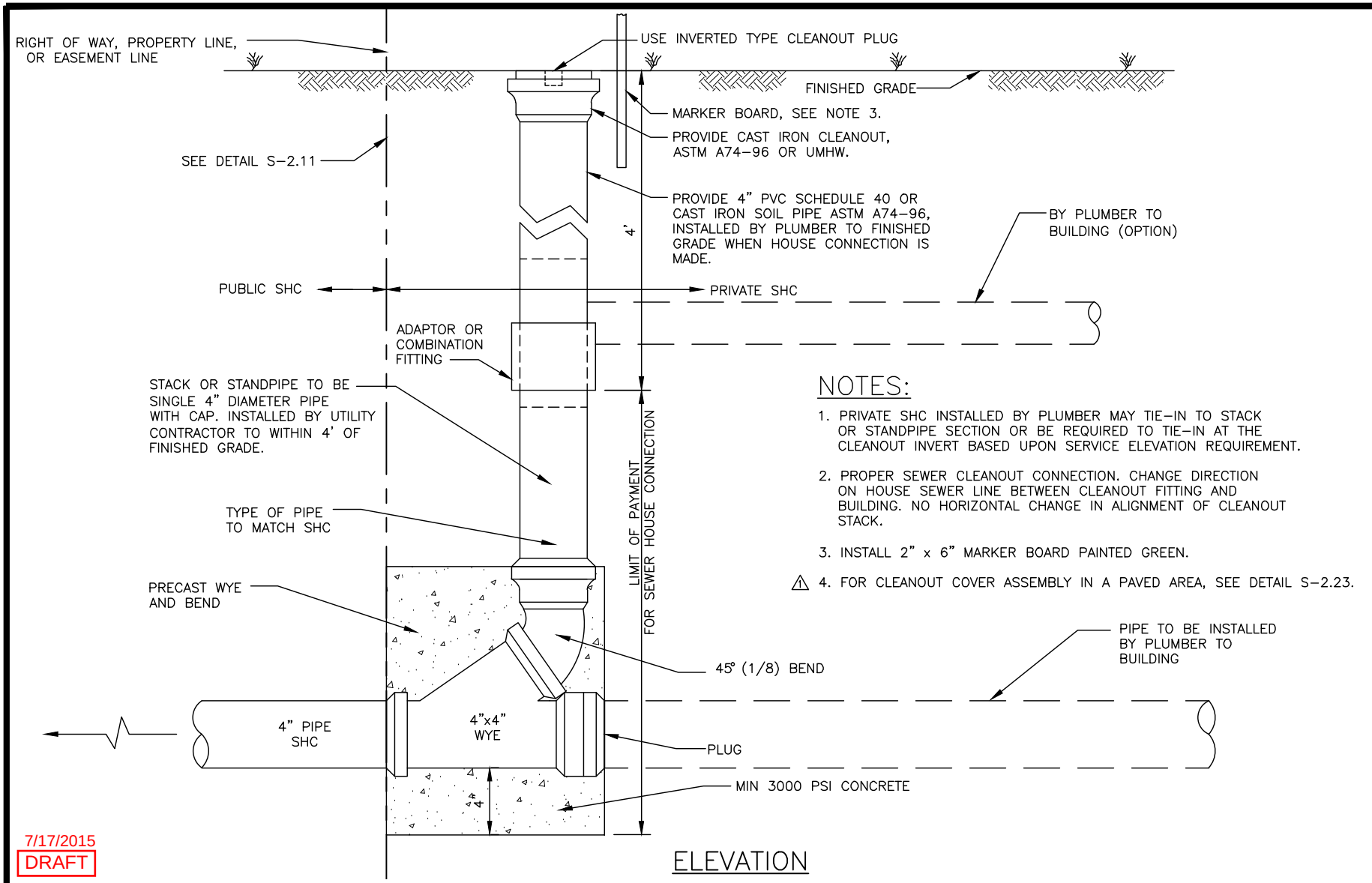
PLAN

NOTES:

1. JOINT BETWEEN SADDLE AND HOUSE CONNECTION PIPE TO BE FERNCO COMPRESSION GASKET. OPENING IN SEWER PIPE WALL TO BE MECHANICALLY CORED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATION.
2. CUT IN EXISTING SEWER MUST BE FULL LATERAL DIAMETER.

7/17/2015
DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	SEWER HOUSE CONNECTION 4" SHC Saddle to Main	Detail S-2.21



NOTES:

1. PRIVATE SHC INSTALLED BY PLUMBER MAY TIE-IN TO STACK OR STANDPIPE SECTION OR BE REQUIRED TO TIE-IN AT THE CLEANOUT INVERT BASED UPON SERVICE ELEVATION REQUIREMENT.
2. PROPER SEWER CLEANOUT CONNECTION. CHANGE DIRECTION ON HOUSE SEWER LINE BETWEEN CLEANOUT FITTING AND BUILDING. NO HORIZONTAL CHANGE IN ALIGNMENT OF CLEANOUT STACK.
3. INSTALL 2" x 6" MARKER BOARD PAINTED GREEN.
4. ⚠ FOR CLEANOUT COVER ASSEMBLY IN A PAVED AREA, SEE DETAIL S-2.23.

7/17/2015
DRAFT

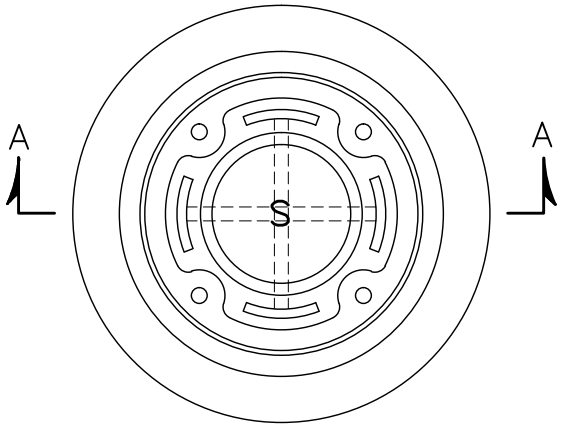
ELEVATION

Revised
⚠ 6/30/2011
Revised
5/7/2007
Approved

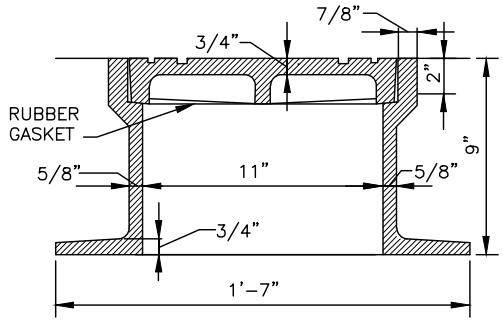
Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

SEWER HOUSE CONNECTION
Cleanout

Detail
S-2.22



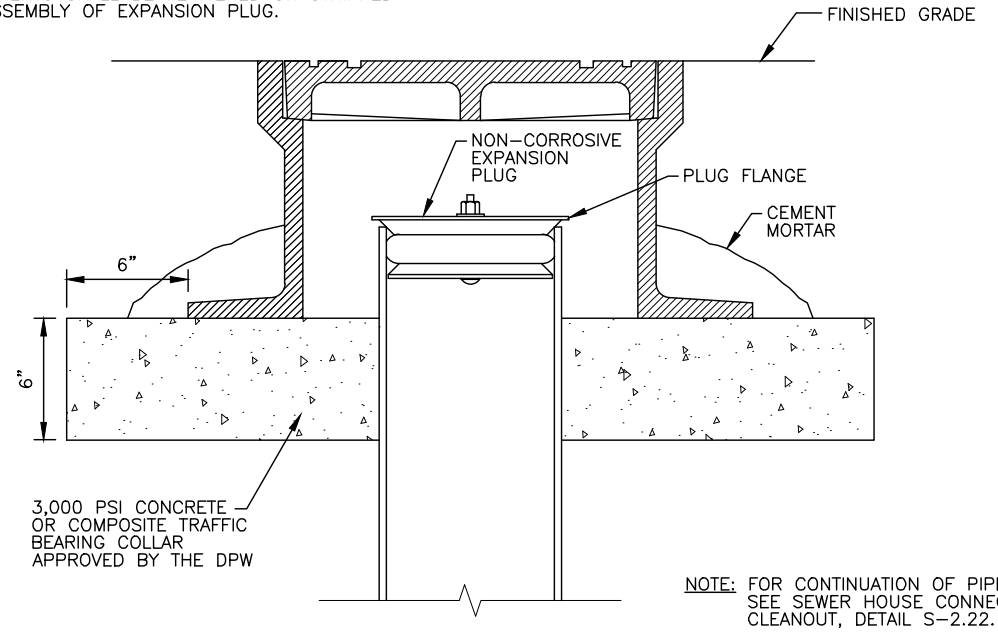
PLAN



SECTION A–A
CAST IRON FRAME & COVER

EXPANSION PLUG NOTES:

1. EXPANSION PLUG SHALL NOT INTERFERE WITH LID.
2. PLUG FLANGE SHALL BE LARGER THAN PIPE ID.
3. THREADED COMPONENTS SHALL BE FLATTENED OR STRIPPED TO PREVENT DISASSEMBLY OF EXPANSION PLUG.

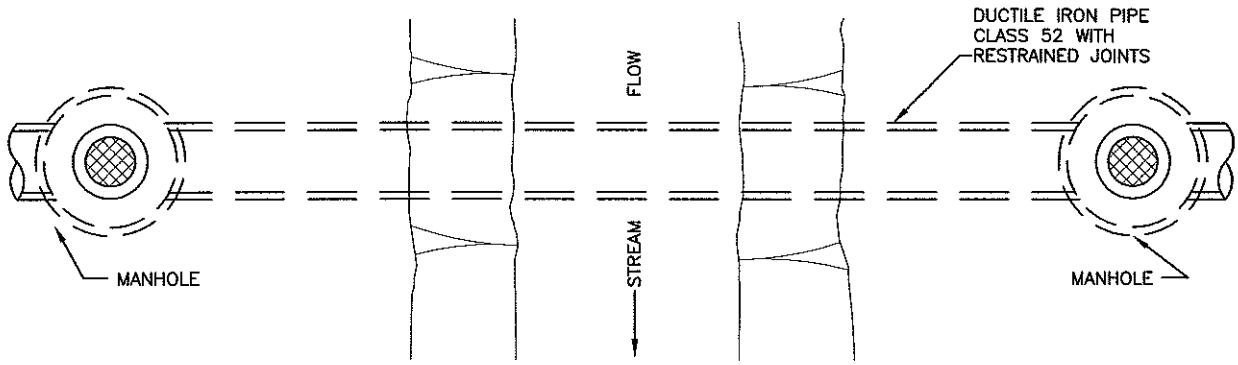


NOTE: FOR CONTINUATION OF PIPE, SEE SEWER HOUSE CONNECTION CLEANOUT, DETAIL S-2.22.

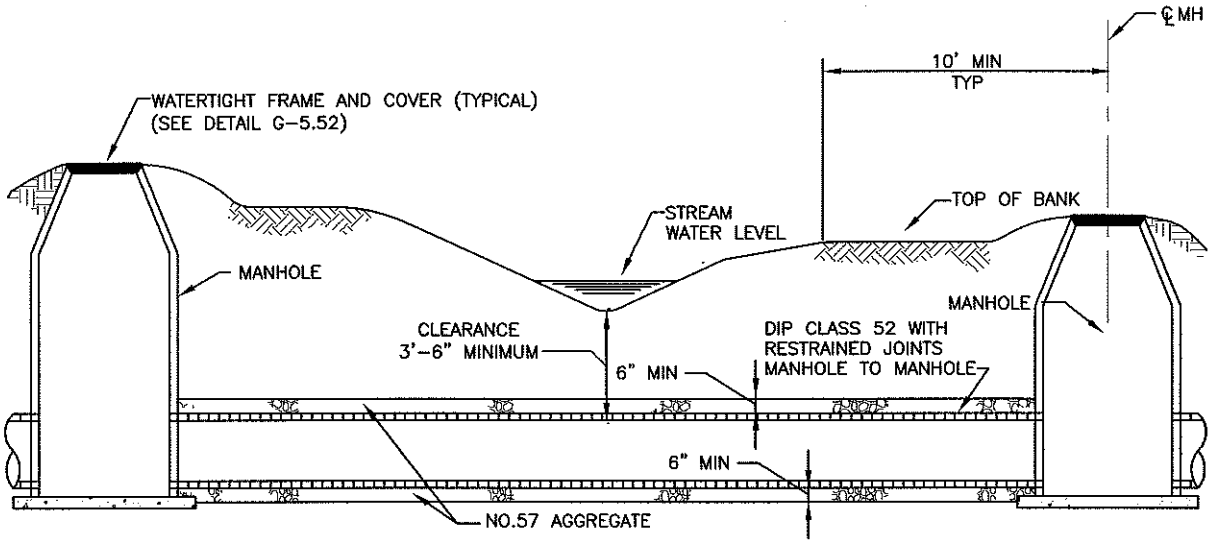
ELEVATION

7/17/2015
DRAFT

Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Cleanout Cover Assembly For All Paved Areas	Detail S-2.23



PLAN



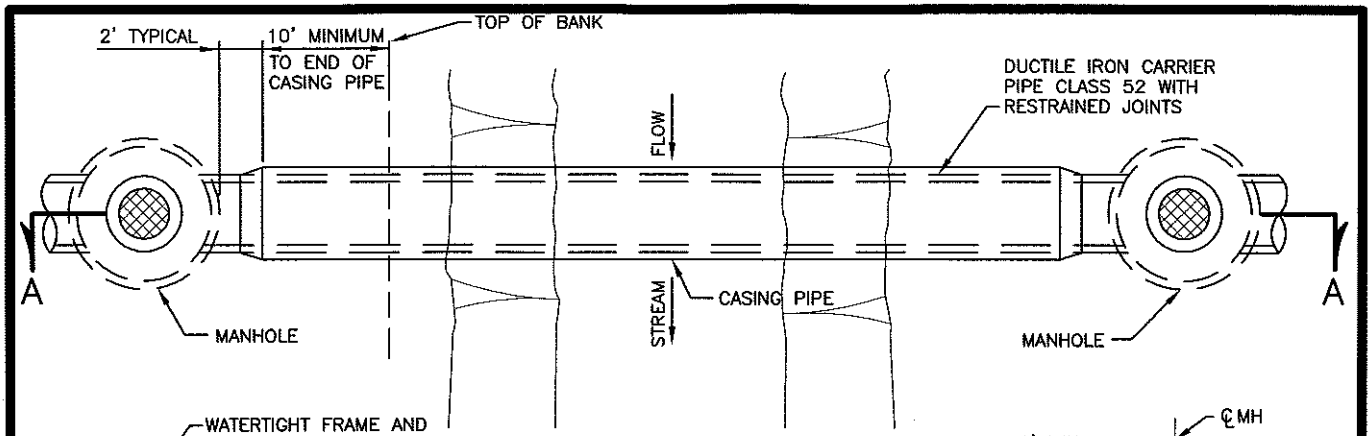
ELEVATION

NOTES:

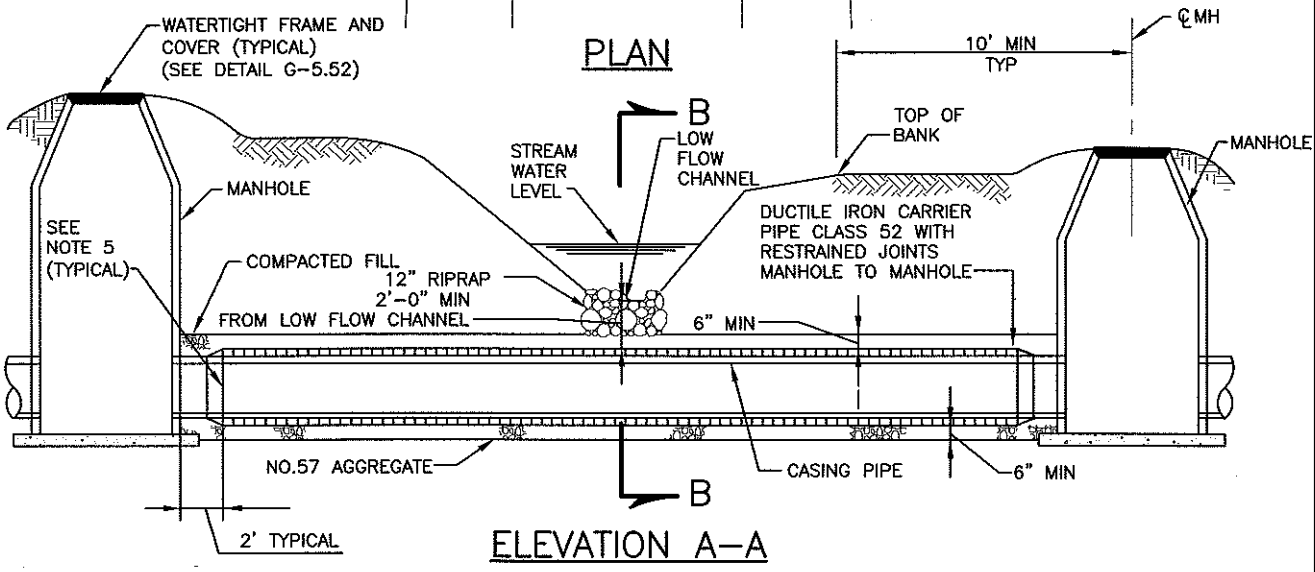
1. SEE DETAIL FOR RIP-RAP PROTECTION OF STREAM BANK.
2. PIPE SHOULD BE LOCATED AS CLOSE TO 90° TO STREAM FLOW AS FEASIBLE.
3. CONSTRUCT SEDIMENT CONTROL DEVICES AS PER CONTRACT DOCUMENTS OR AS DIRECTED.
4. FOR CLEARANCE GREATER THAN 42", USE NUMBER 57 AGGREGATE, SEE S-3.12 FOR CLEARANCE 24" TO 36". CLEARANCE LESS THAN 24" IS UNACCEPTABLE.

7/17/2015 DRAFT

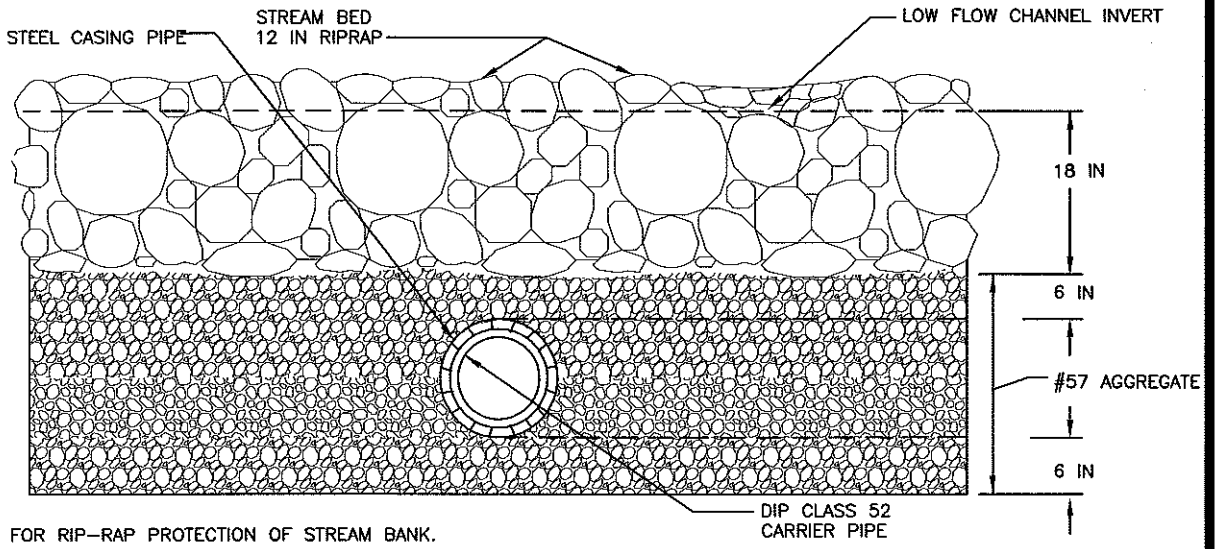
Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Stream Crossing 3'-6" Clearance	Detail S-3.11



PLAN



ELEVATION A–A



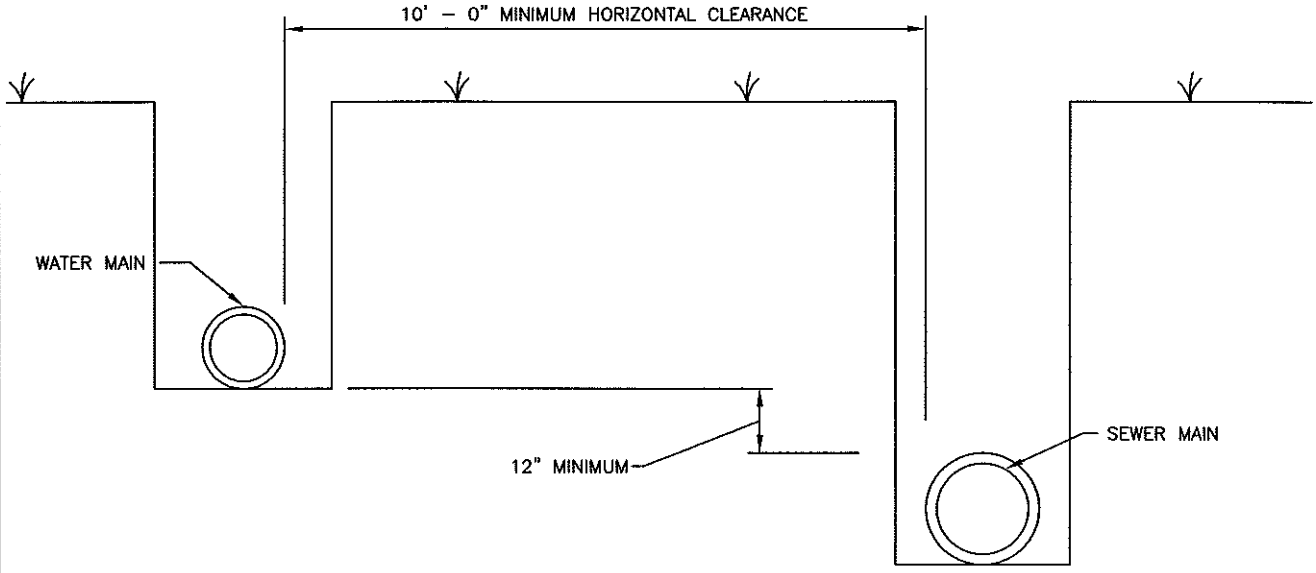
ENLARGED STREAM VIEW: B–B

NOTES:

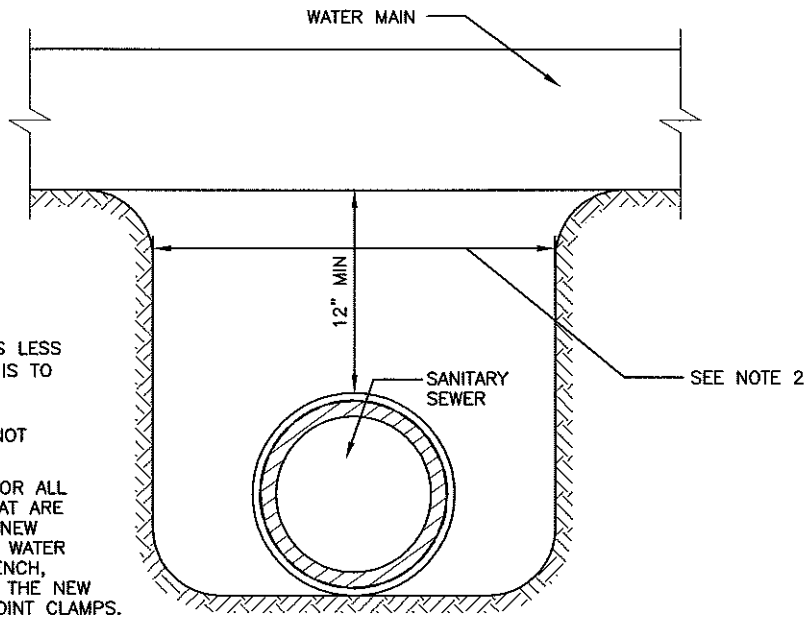
1. SEE DETAIL FOR RIP–RAP PROTECTION OF STREAM BANK.
2. PIPE SHOULD BE LOCATED AS CLOSE TO 90° TO STREAM FLOW AS FEASIBLE.
3. CONSTRUCT SEDIMENT CONTROL DEVICES AS PER CONTRACT DRAWINGS OR AS DIRECTED.
4. CLEARANCE FROM STREAM TO CASING PIPE SHALL NOT BE LESS THAN 2'.
5. PROVIDE END SEAL TRANSITION BETWEEN CARRIER AND CASING PIPES OUTSIDE OF MANHOLE. SEE DETAIL G–7.31 FOR RUBBER END SEAL DETAIL.

7/17/2015 DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Stream Crossing 2'-0" Clearance	Detail S-3.12



MINIMUM HORIZONTAL AND VERTICAL SEPARATION FOR SEWER PARALLEL TO WATER



NOTES:

1. WHEN HORIZONTAL CLEARANCE IS LESS THAN 10' VERTICAL SEPARATION IS TO BE 6' MINIMUM, WITH MINIMUM HORIZONTAL CLEARANCE OF 5'. MAXIMUM SEWER DEPTH SHALL NOT EXCEED 16'.
2. PROVIDED BELL JOINT CLAMPS FOR ALL EXISTING WATER MAIN JOINTS THAT ARE WITHIN THE PIPE TRENCH OF A NEW SEWER INSTALLATION. FOR NEW WATER MAIN JOINTS OVER A SEWER TRENCH, PROVIDE RESTRAINED JOINTS ON THE NEW WATER MAIN IN LIEU OF BELL JOINT CLAMPS.

WATER/SANITARY CROSSING CLEARANCE

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Clearance Requirements Water To Sewer	Detail S-3.13

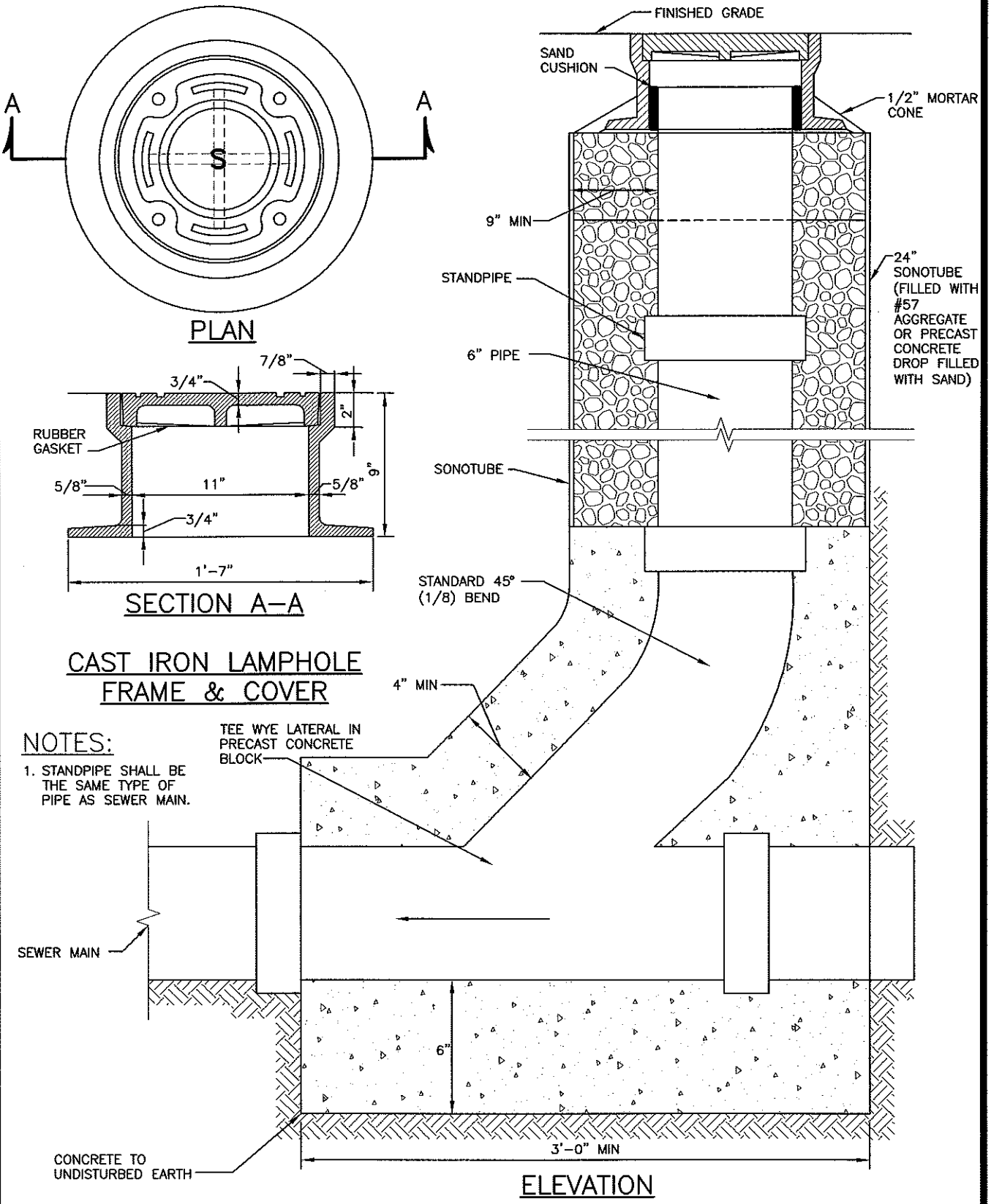
PLAN

SECTION A–A

CAST IRON LAMPHOLE FRAME & COVER

NOTES:

1. STANDPIPE SHALL BE THE SAME TYPE OF PIPE AS SEWER MAIN.



ELEVATION

7/17/2015
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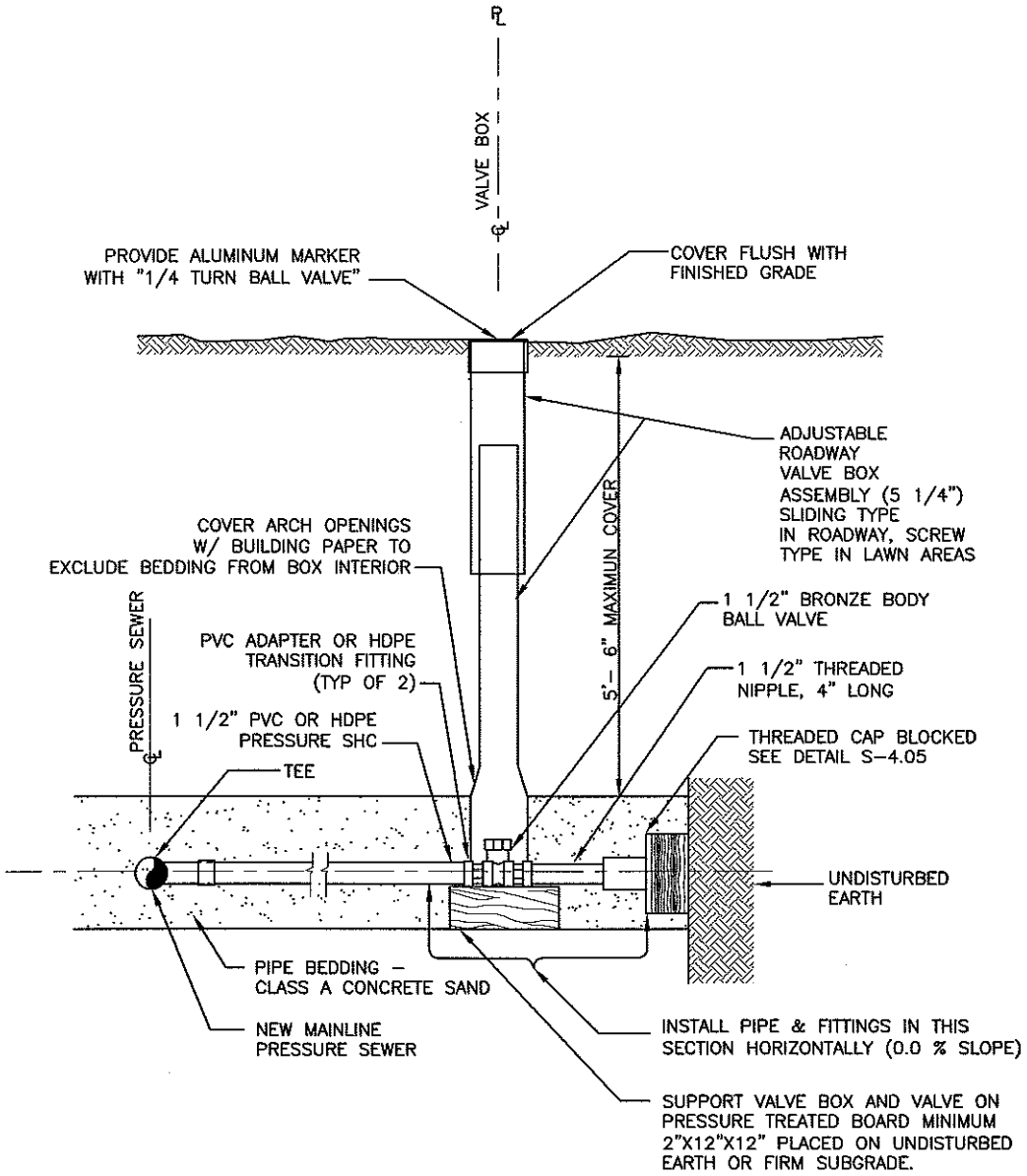
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Main Line Cleanout Lamphole	Detail S-3.21



NOTES:

1. SERVICE VALVE TO BE LEFT IN THE CLOSED POSITION.
2. UNLESS OTHERWISE NOTED ALL 1 1/4" DIAMETER PVC PIPE SHALL HAVE SOLVENT CEMENT JOINTS AND HDPE WILL HAVE BUTT FUSED JOINTS.
3. FITTINGS SHALL BE BLOCKED OR ANCHORED IN ACCORANCE WITH DETAILS S-4.04 AND S-4.06.

7/17/2015
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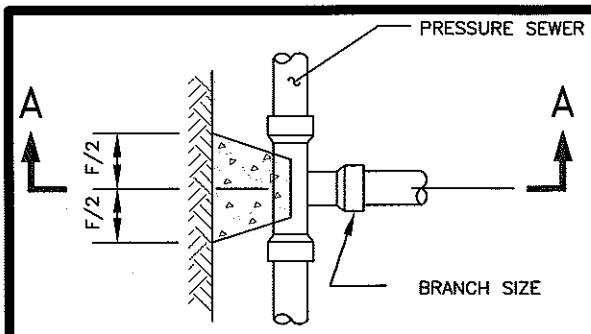
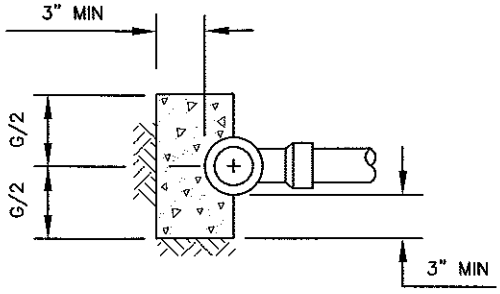
Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	PRESSURE SEWER House Connection Service Valve Assembly	Detail S-4.03

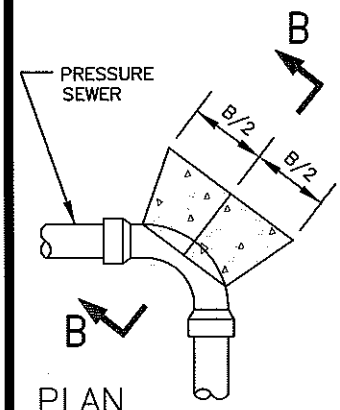


PLAN

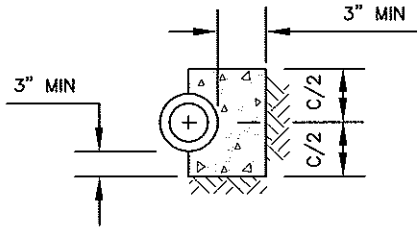


SECTION A–A

TEES, INCLUDING PRESSURE SHC'S

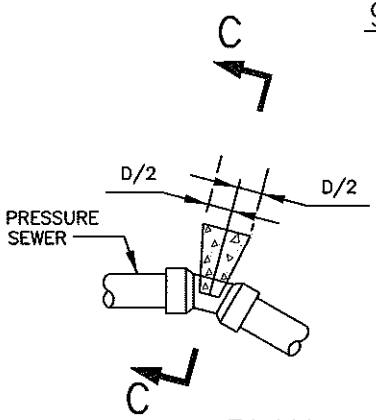


PLAN

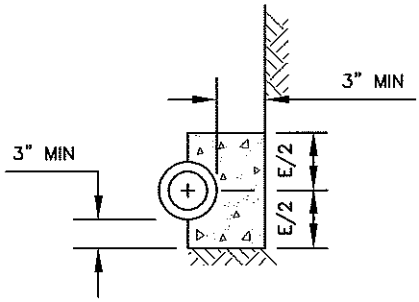


SECTION B–B

90° HORIZONTAL BENDS



PLAN



SECTION C–C

11–1/4°, 22–1/2°, 45° HORIZONTAL & LOWER VERTICAL BENDS

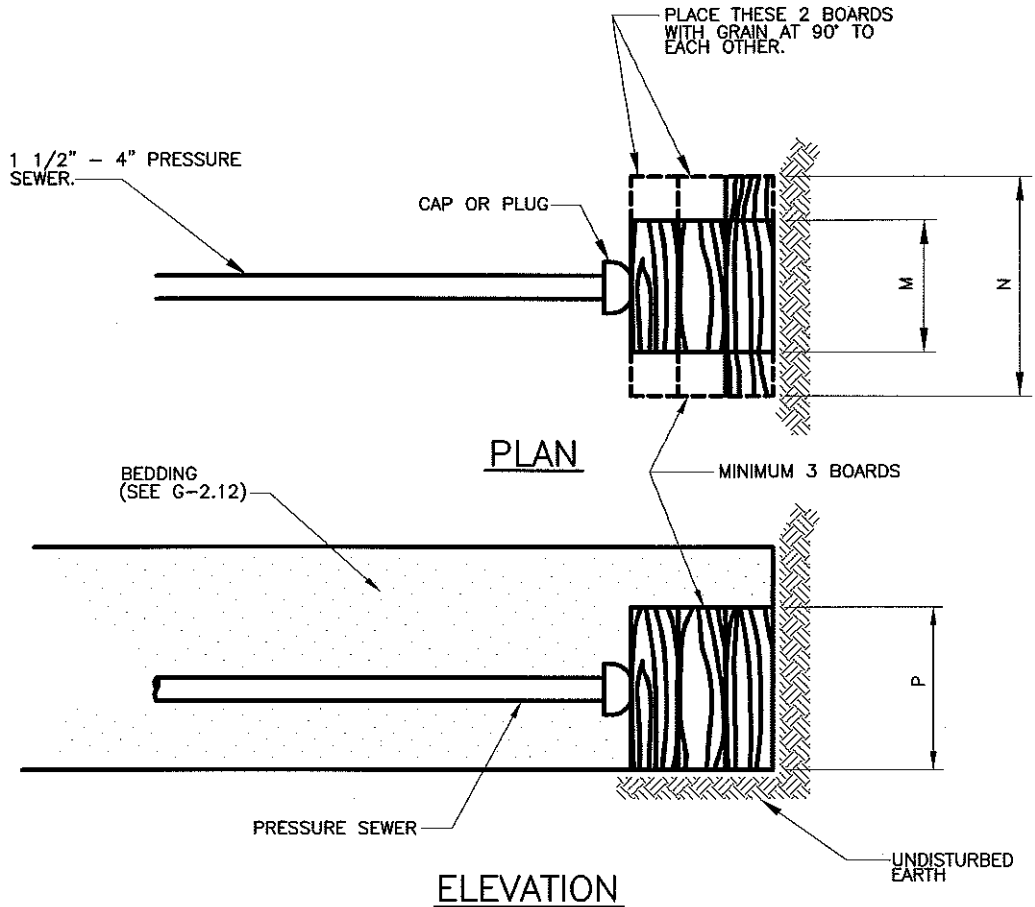
PIPE SIZE	B	C	D	E	F	G
1–1/4" & 1–1/2"	8"	8"	5"	5"	6"	6"
2"	10"	10"	7"	7"	10"	10"
2–1/2"	10"	10"	7"	7"	10"	10"
3"	12"	12"	9"	9"	12"	12"
4"	16"	12"	12"	12"	16"	12"

NOTES:

1. USE MIX NO. 1 CONCRETE.
2. CARRY ALL BEARING SURFACES TO UNDISTURBED GROUND OR FIRM SUBGRADE.
3. BUTTRESS SIZED FOR 160 PSI
4. SEE DETAIL S–4.06 FOR UPPER VERTICAL BENDS.
5. DO NOT ENCASE JOINTS.

7/17/2015 DRAFT

Revised Revised Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PRESSURE SEWER Blocking	Detail S–4.04



NOTES:

1. CARRY ALL BEARING SURFACES TO UNDISTURBED EARTH OR FIRM SUBGRADE.
2. BUTTRESS SIZED FOR 150 PSI
3. NOMINAL THICKNESS OF EACH BOARD IS 2".
4. ALL BOARDS TO BE GROUND CONTACT TREATED.

PIPE SIZE	M	N	P
1 1/4"	6"	6"	8"
1 1/2"	6"	6"	8"
2"	6"	8"	8"
2 1/2"	8"	8"	10"
3"	12"	18"	12"
4"	12"	18"	12"

7/17/2015
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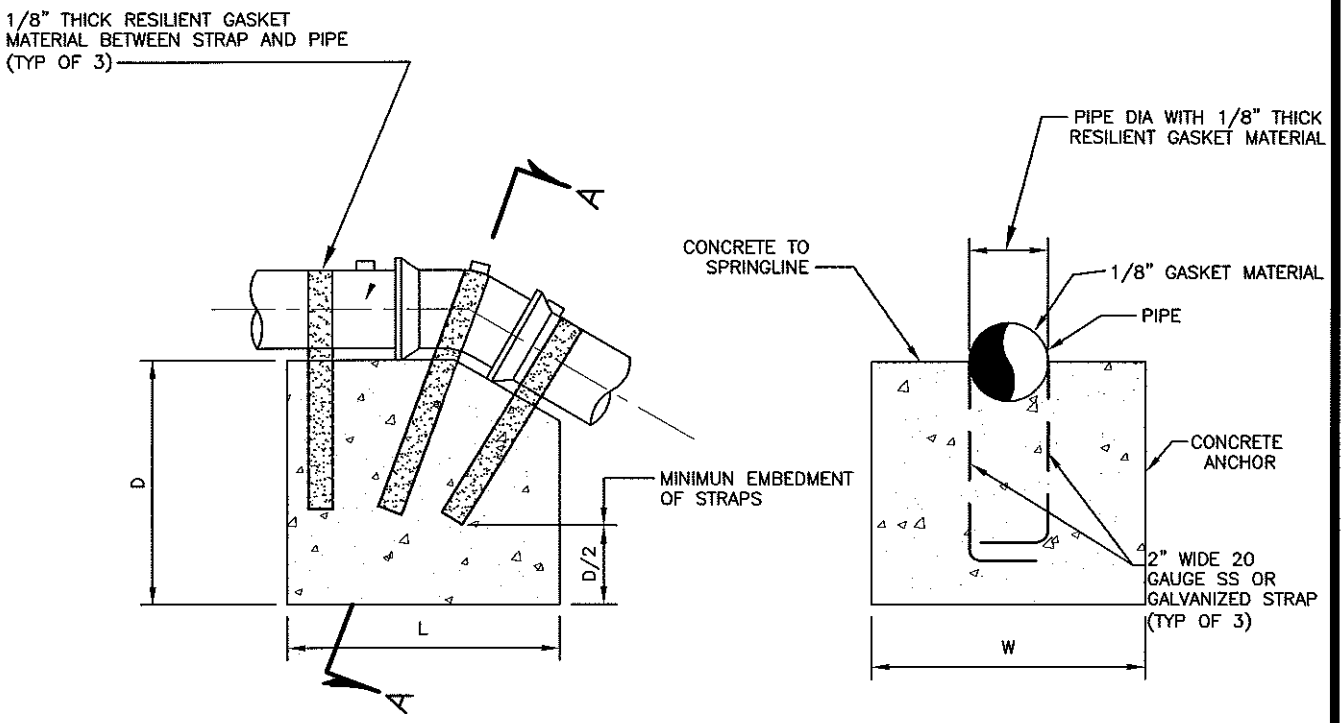
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PRESSURE SEWER House Connection Cap & Plug Blocking	Detail S-4.05



PROFILE

SECTION A–A

BEND		SIZE IN INCHES			
		1–1/4, 1–1/2	2, 2–1/2	3	4
11 1/4° (1/32)	L	12	15	18	18
	W	10	12	15	18
	D	10	15	15	18
22 1/2° (1/16)	L	15	20	20	24
	W	15	20	20	24
	D	12	12	18	20
45° (1/8)	L	20	24	24	30
	W	20	20	24	30
	D	12	20	24	26

NOTES:

1. COAT EXPOSED GALVANIZED STRAPS WITH FIELD APPLIED TWO COATS OF BITUMINOUS PAINT.
2. USE MIX NO. 1 CONCRETE
3. CARRY ALL BEARING SURFACES TO UNDISTURBED EARTH OR FIRM SUBGRADE.
4. CONCRETE ANCHORAGE DIMENSIONS ARE BASED ON TOTAL PRESSURE OF 150 PSI.

7/17/2015
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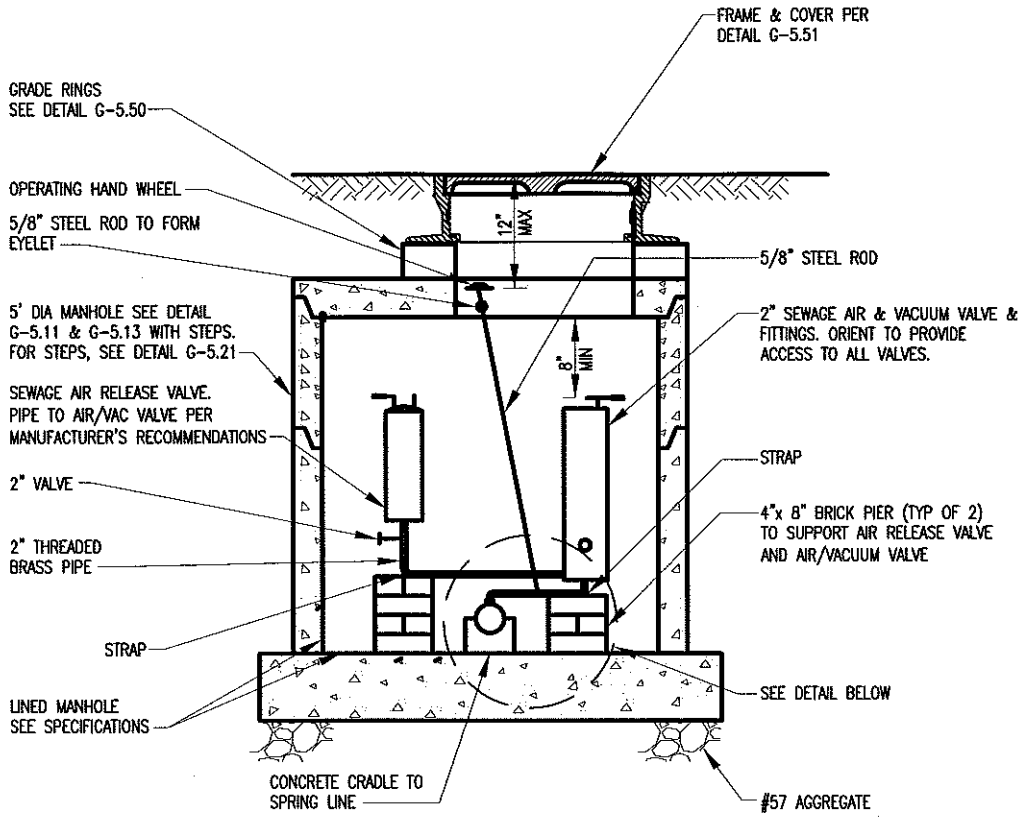
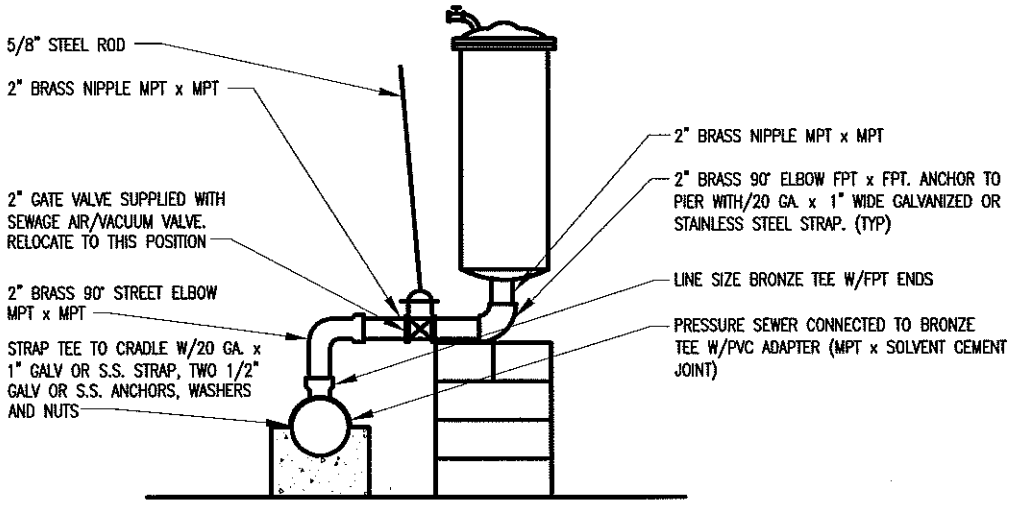
Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	PRESSURE SEWER Anchoring (Upper Vertical Bends)	Detail S-4.06

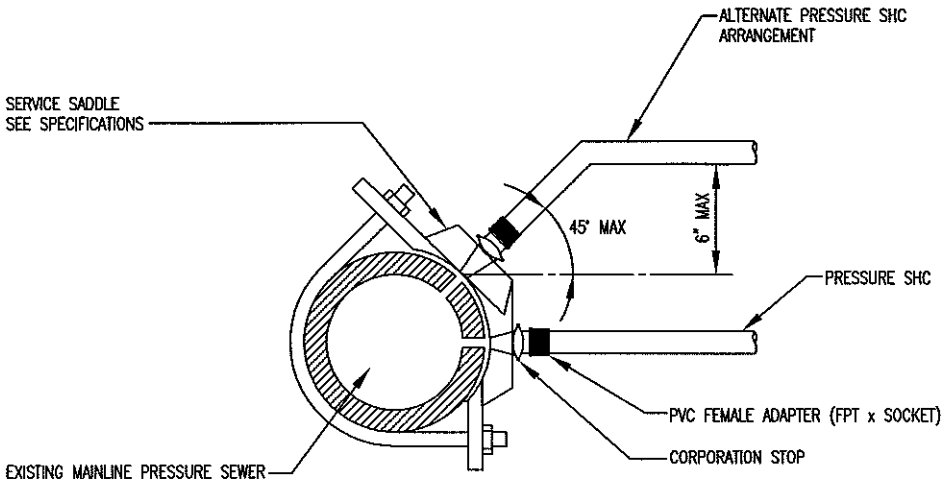




CONNECTION AIR/VACUUM VALVE TO MAINLINE PRESSURE SEWER

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	PRESSURE SEWER Sewage/Air Vacuum & Release Valve	Detail S-4.07



SECTION

NOTES:

1. CONNECTION OF NEW PRESSURE SEWER HOUSE CONNECTION TO NEW MAINLINE PRESSURE SEWER SHALL BE DONE IN ACCORDANCE WITH DETAIL S-4.03.
2. ALL FITTINGS TO BE BLOCKED OR ANCHORED IN ACCORDANCE WITH DETAILS S-4.04, S-4.05 AND S-4.06.
3. SOLVENT CEMENT JOINT PIPE SHALL BE PLACED IN TRENCH IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS OR AS DIRECTED BY THE ENGINEER.
4. REFER TO DRAWINGS FOR SIZES AND LOCATION OF MAINLINE PRESSURE SEWER AND PRESSURE SEWER HOUSE CONNECTIONS.
5. CONNECTION OF NEW PRESSURE SEWER HOUSE CONNECTION TO GRAVITY SEWER SHALL BE DONE IN ACCORDANCE WITH DETAIL S-4.15.
6. BEDDING, HAUNCHING AND BACKFILL SHALL BE IN ACCORDANCE WITH DETAIL G-2.12.
7. SET SADDLE/SLEEVE, CORPORATION STOP, OUTLET IN HORIZONTAL POSITION OR ANY ANGLE UP TO 45° FROM HORIZONTAL. SELF-TAPPING SADDLES SHALL BE POSITIONED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
8. SUPPORT PIPE, SADDLE, CORPORATION STOP AND TAPPING MACHINE AS REQUIRED TO PREVENT DAMAGE TO PIPE.

7/17/2015
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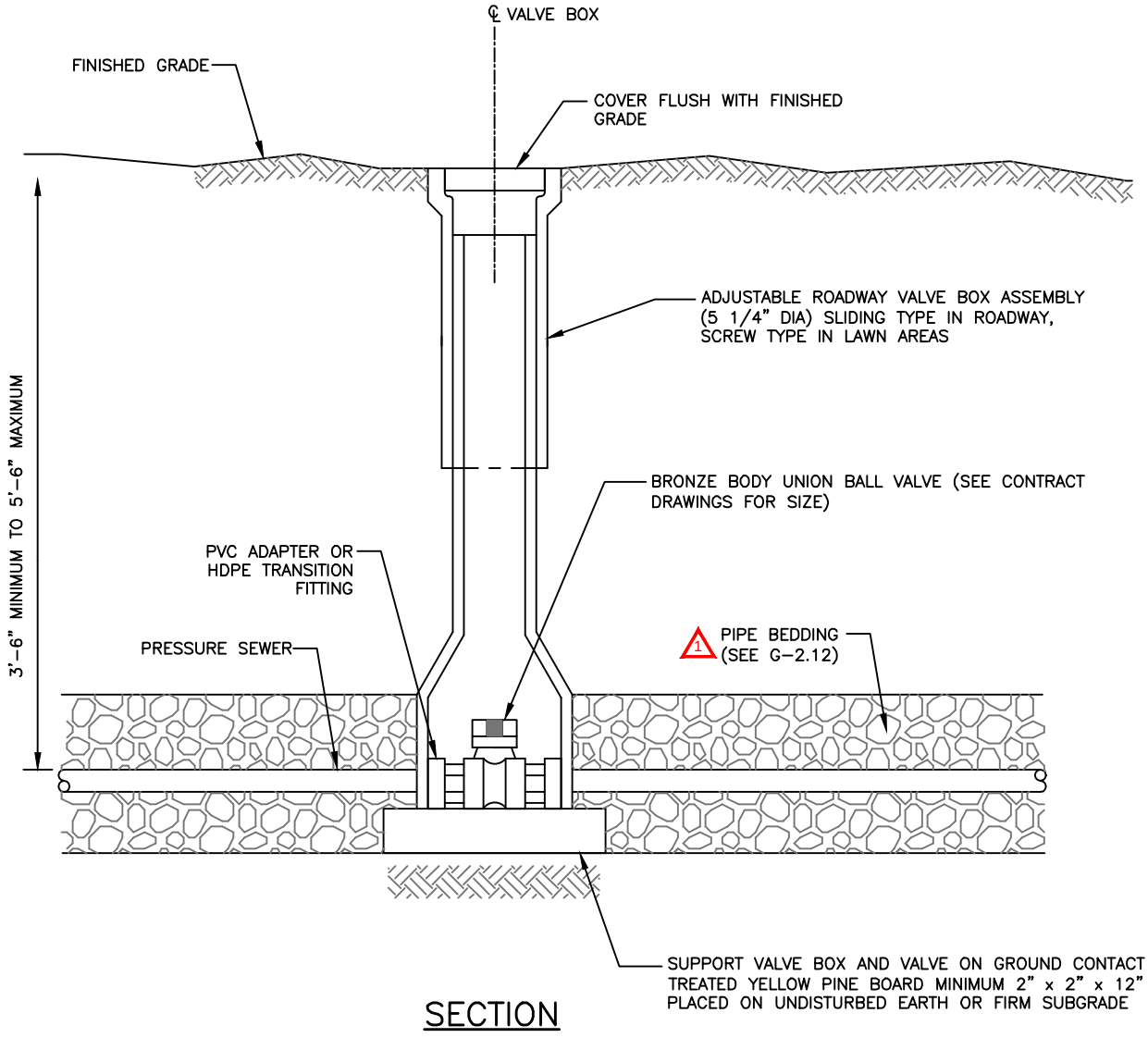
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	PRESSURE SEWER SHC to Existing Mainline Wet Tap	Detail S-4.08

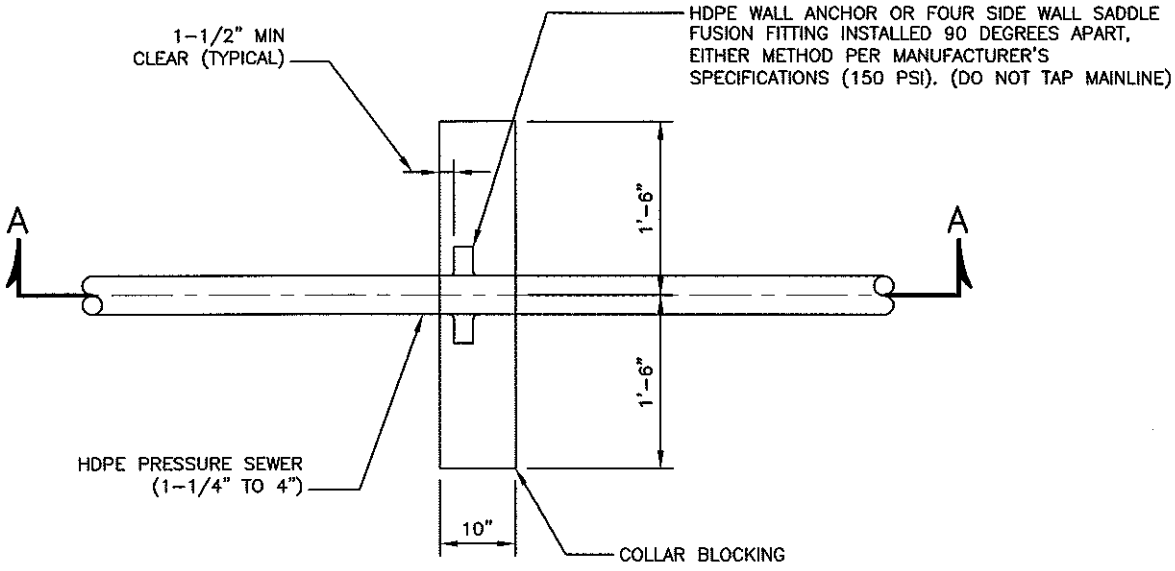


SECTION

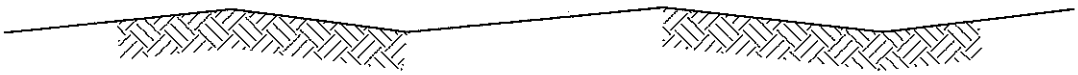
7/17/2015

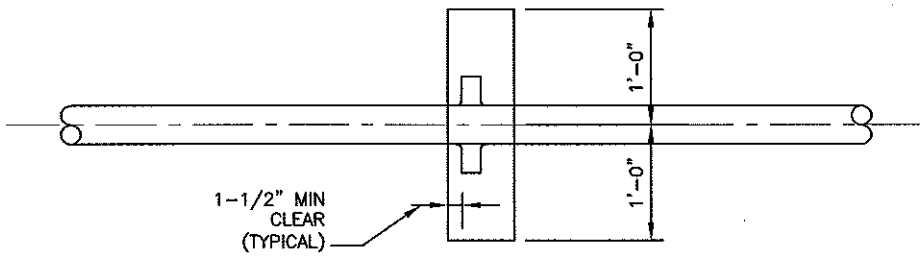
DRAFT

Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	PRESSURE SEWER In-Line Valve Installation	Detail S-4.11



PLAN





SECTION A--A

NOTES:

1. USE MIX NO. 1 CONCRETE FOR BLOCKING.
2. CARRY ALL BEARING SURFACES TO UNDISTURBED GROUND OR FIRM SUBGRADE
3. WHEN CONNECTING TO PVC PRESSURE SEWER: AT THE PIPE'S INTERFACE INSTALL SEAL-ONLY NON-RESTRAINING MECHANICAL COUPLING. CENTERLINES OF COUPLING AND HDPE PIPE SHALL BE 3'-0" APART.

7/17/2015
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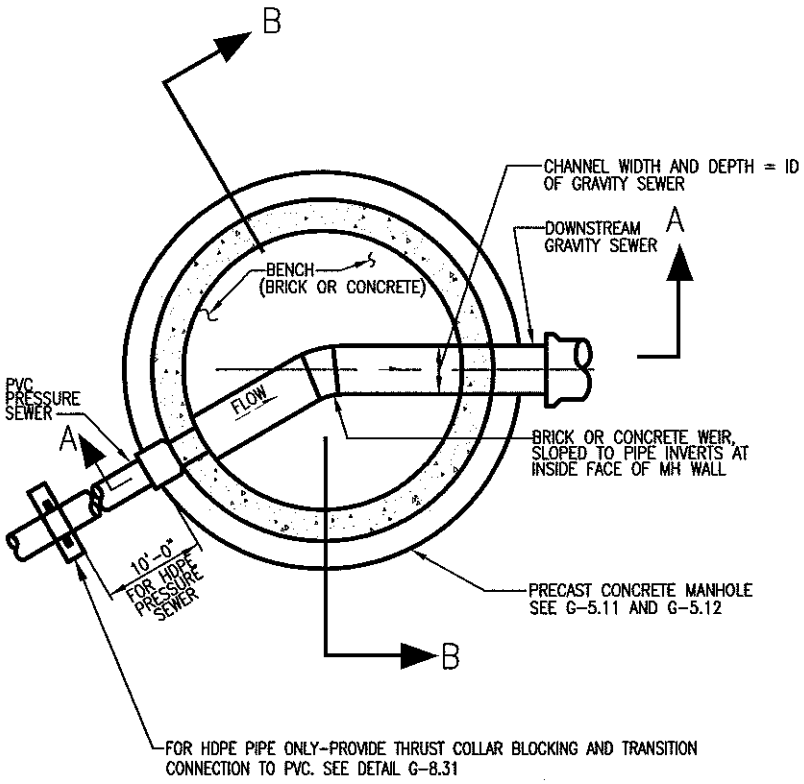
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PRESSURE SEWER Blocking Collar HDPE Pipe	Detail S-4.12



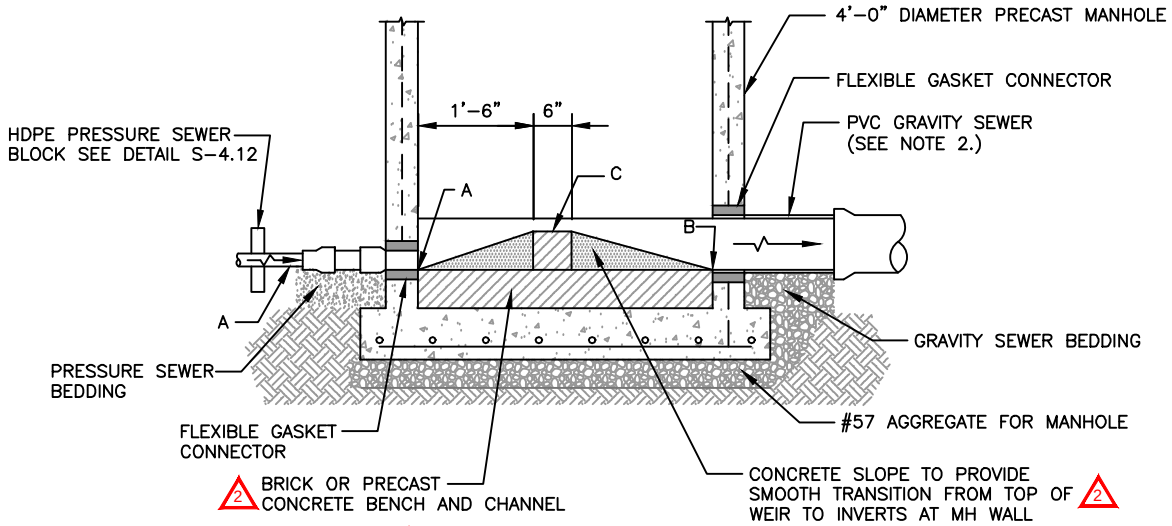
PLAN

NOTES:

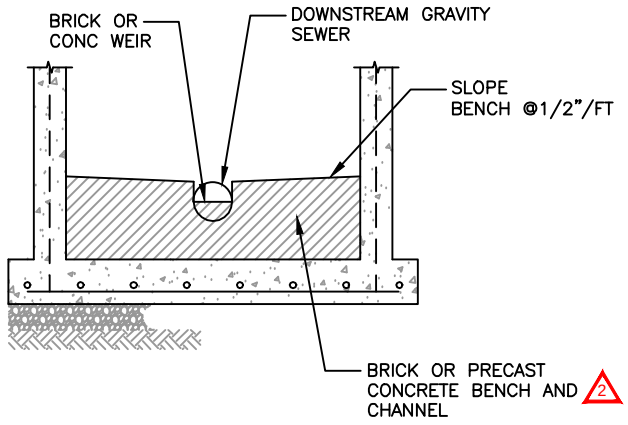
1. FOR SECTION A-A, SEE DETAIL S-4.15
2. FOR SECTION B-B, SEE DETAIL S-4.15

7/17/2015 DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PRESSURE SEWER Gravity Transition Manhole	Detail S-4.14



2 SECTION A–A



SECTION B–B

NOTES:

1. SEE DETAIL S–4.14 FOR PLAN VIEW.
2. FOR DIP SEWER, SEE SPECIFICATIONS FOR SPECIAL INTERIOR LININGS.
3. PROVIDE WATERTIGHT FRAME AND COVER (DETAIL G–5.52) ON TRANSITION MANHOLE.
4. PROVIDE TWO COATING APPLICATIONS OF BITUMINOUS MATERIAL (12MILS D.F.T. MINIMUM) ON BOTH THE INTERIOR AND EXTERIOR SURFACES OF TRANSITION MANHOLE.

ELEVATION AND FITTING SCHEDULE	
A	PRESSURE SEWER INFLUENT INVERT ELEVATION
B	GRAVITY SEWER OUTLET INVERT ELEVATION
C	WEIR TOP ELEVATION 1" HIGHER THAN CROWN OF PRESSURE SEWER

7/17/2015

DRAFT

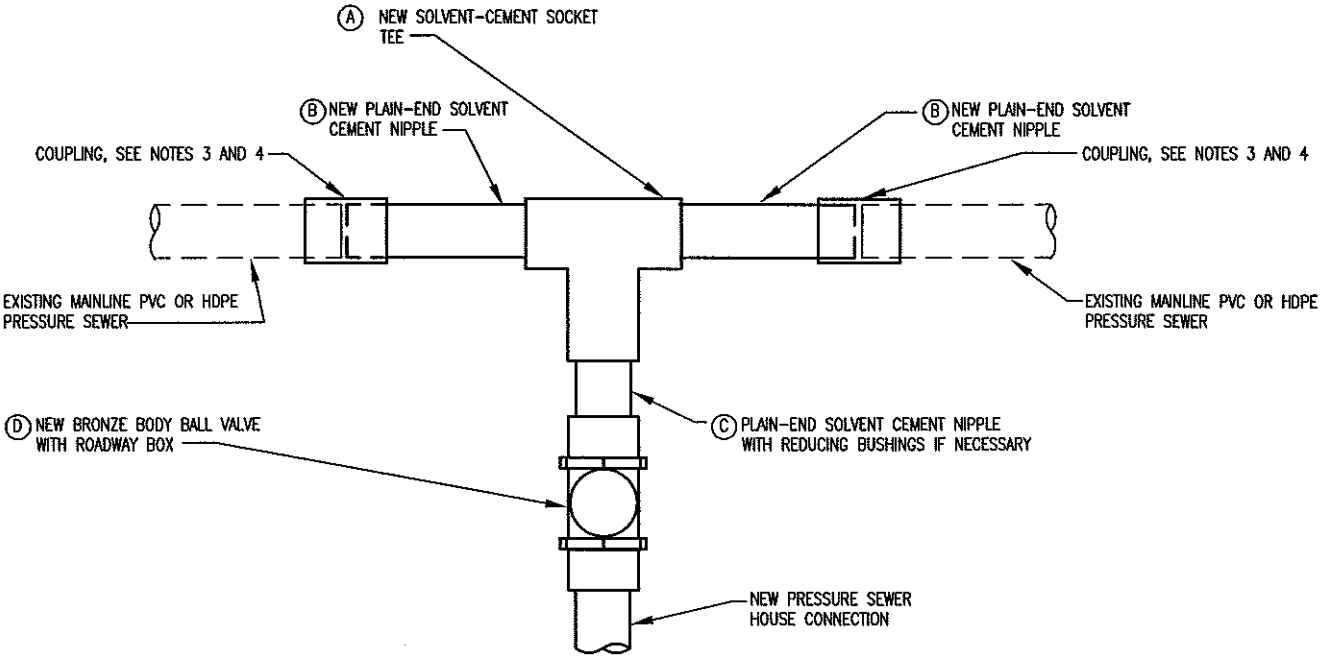
2 7/17/2015 Revised
6/30/2011 Revised
5/7/2007 Approved

Howard County, Maryland
Department of Public Works

Approved: \\hc\13767\Final Volume 4\signature.bmp
Chief, Bureau of Engineering

PRESSURE SEWER
Gravity Transition Manhole
Sections

Detail
S–4.15



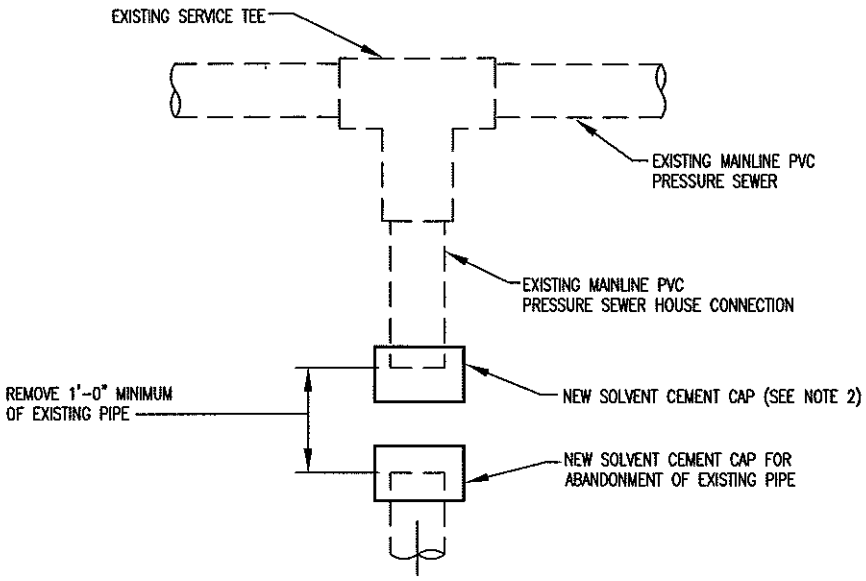
PLAN

NOTES:

1. FOR PIPE SIZES, SEE CONTRACT DOCUMENTS.
2. SOLVENT CEMENT PARTS A, B, C AND D TOGETHER PRIOR TO CUTTING EXISTING MAINLINE PRESSURE SEWER.
3. CONNECTION TO EXISTING PVC. O-RING GASKET DOUBLE BELL PVC COUPLING.
4. CONNECTION TO EXISTING HDPE, SEAL AND RESTRAINT TYPE MECHANICAL COUPLING, SEE SPECIFICATION.

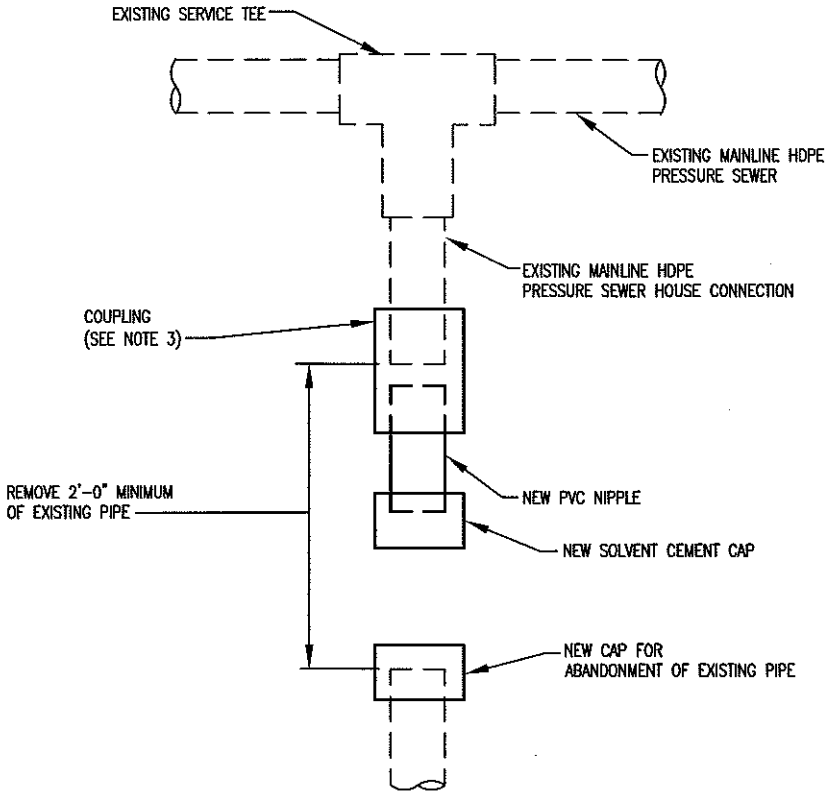
7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PRESSURE SEWER Connection to Main	Detail S-4.16



PLAN

PVC PRESSURE SEWER HOUSE CONNECTION ABANDONMENT



PLAN

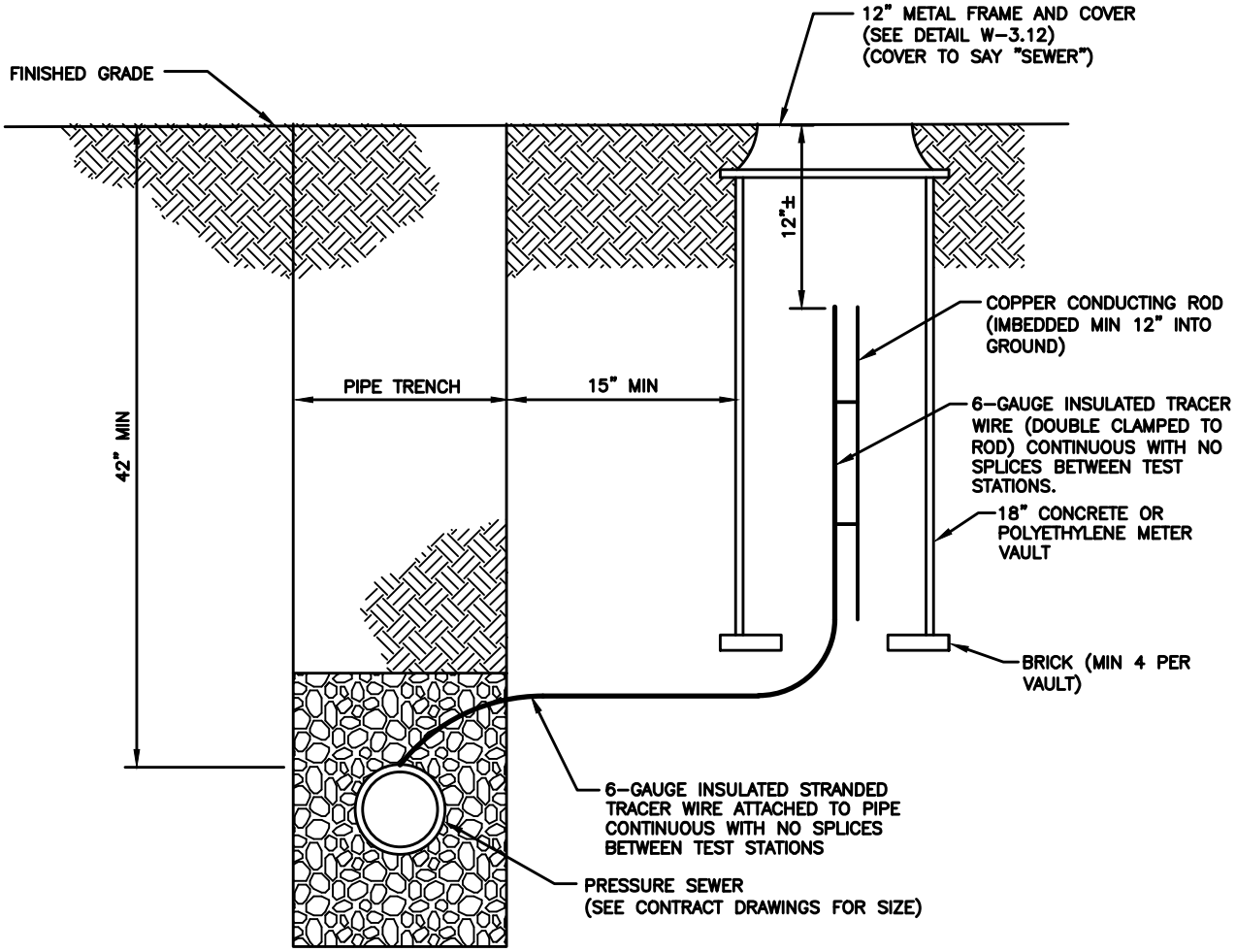
HDPE PRESSURE SEWER HOUSE CONNECTION ABANDONMENT

NOTES:

1. FOR PIPE SIZES, SEE DRAWINGS
2. IF EXISTING SERVICE TEE HAS GASKET TYPE JOINTS, PROVIDE BLOCKING FOR CAP, SEE DETAIL S-4.05
3. COUPLING FOR EXISTING HDPE, SEAL AND RESTRAINT TYPE MECHANICAL COUPLING, SEE SPECIFICATIONS.

7/17/2015 DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	PRESSURE SEWER Abandonment Sewer House Connection	Detail S-4.17



NOTES:

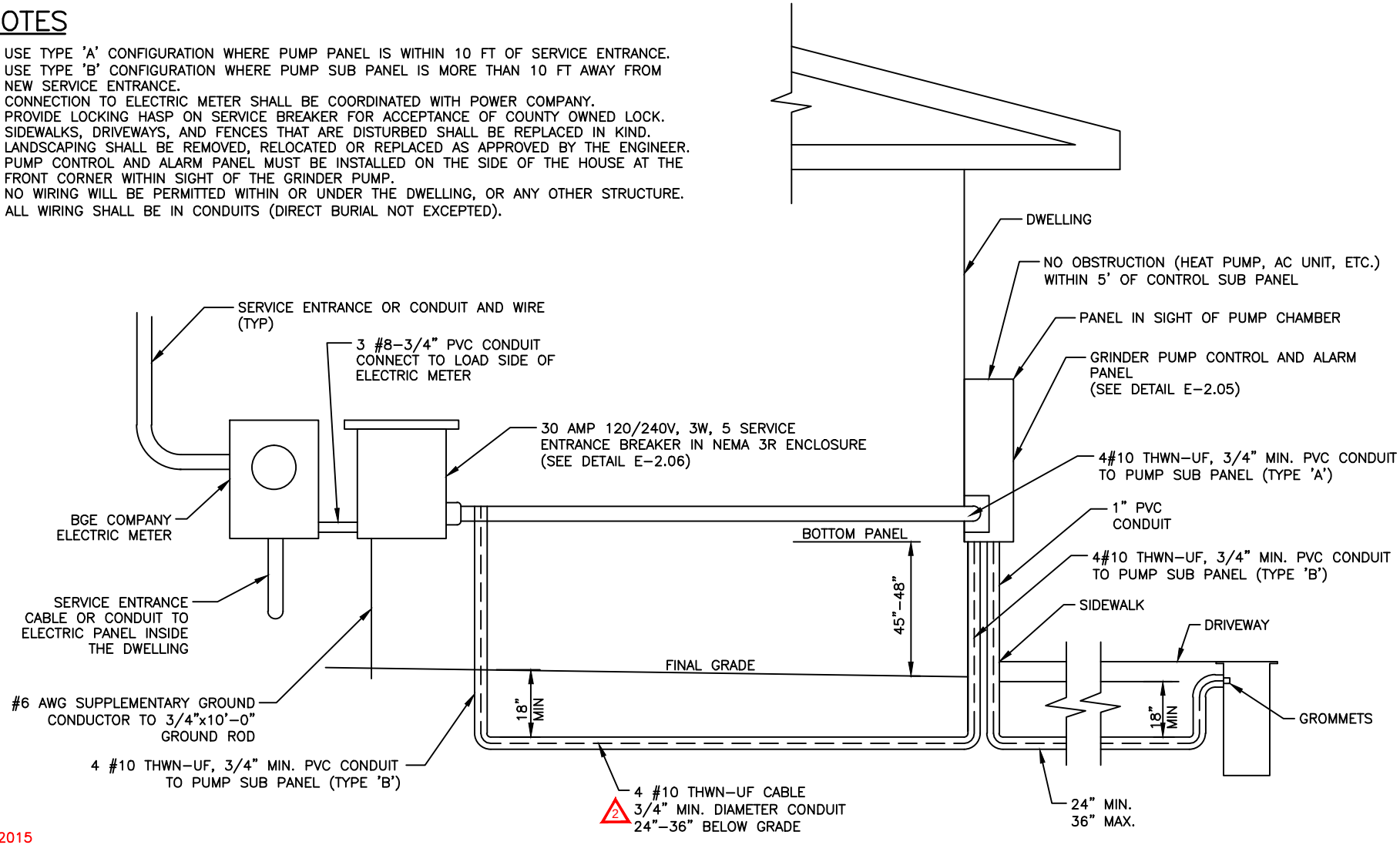
1. FOR LOCATIONS ALONG PRESSURE SEWER ALIGNMENT, SEE G-8.21.
2. ⚠1 SEE G-8.21 FOR OTHER CONTINUITY TEST STATION INFORMATION.
3. ⚠1 NO SPLICES BETWEEN TEST STATIONS, UNLESS APPROVED BY HOWARD COUNTY. LATERAL SPLICES APPROVED BY THE COUNTY SHALL CONSIST OF A BRASS COMPRESSION NUT, WATERPROOF BINDER, AND UNDERGROUND ELECTRICAL TAPE. EXTENSION SPLICES SHALL BE MADE USING A CRIMP CONNECTOR AND SHRINK TUBING.

7/17/2015
DRAFT

Revised	Howard County, Maryland	PRESSURE SEWER	Detail
⚠1 6/30/2011 Revised	Department of Public Works	Tracer Wire, Conducting Rod & Vault	S-4.18
5/7/2007 Approved	Approved: Chief, Bureau of Engineering		

NOTES

1. USE TYPE 'A' CONFIGURATION WHERE PUMP PANEL IS WITHIN 10 FT OF SERVICE ENTRANCE.
2. USE TYPE 'B' CONFIGURATION WHERE PUMP SUB PANEL IS MORE THAN 10 FT AWAY FROM NEW SERVICE ENTRANCE.
3. CONNECTION TO ELECTRIC METER SHALL BE COORDINATED WITH POWER COMPANY.
4. PROVIDE LOCKING HASP ON SERVICE BREAKER FOR ACCEPTANCE OF COUNTY OWNED LOCK.
5. SIDEWALKS, DRIVEWAYS, AND FENCES THAT ARE DISTURBED SHALL BE REPLACED IN KIND. LANDSCAPING SHALL BE REMOVED, RELOCATED OR REPLACED AS APPROVED BY THE ENGINEER.
6. PUMP CONTROL AND ALARM PANEL MUST BE INSTALLED ON THE SIDE OF THE HOUSE AT THE FRONT CORNER WITHIN SIGHT OF THE GRINDER PUMP.
7. NO WIRING WILL BE PERMITTED WITHIN OR UNDER THE DWELLING, OR ANY OTHER STRUCTURE.
8. ALL WIRING SHALL BE IN CONDUITS (DIRECT BURIAL NOT EXCEPTED).



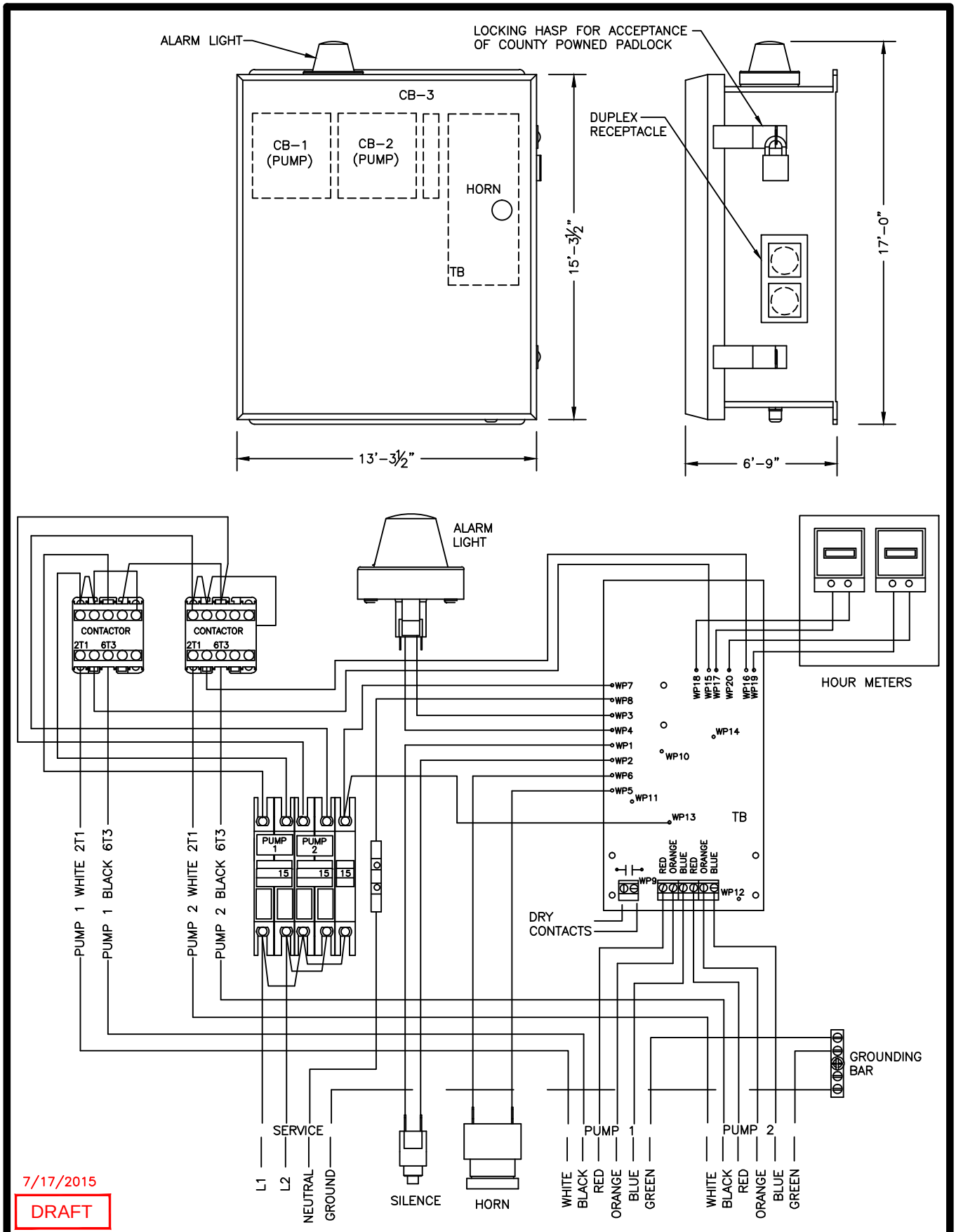
7/17/2015

DRAFT

2 X/XX/2015 Revised 6/30/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	2 ELECTRIC SERVICE Grinder Pump

Detail

E-1.01



7/17/2015

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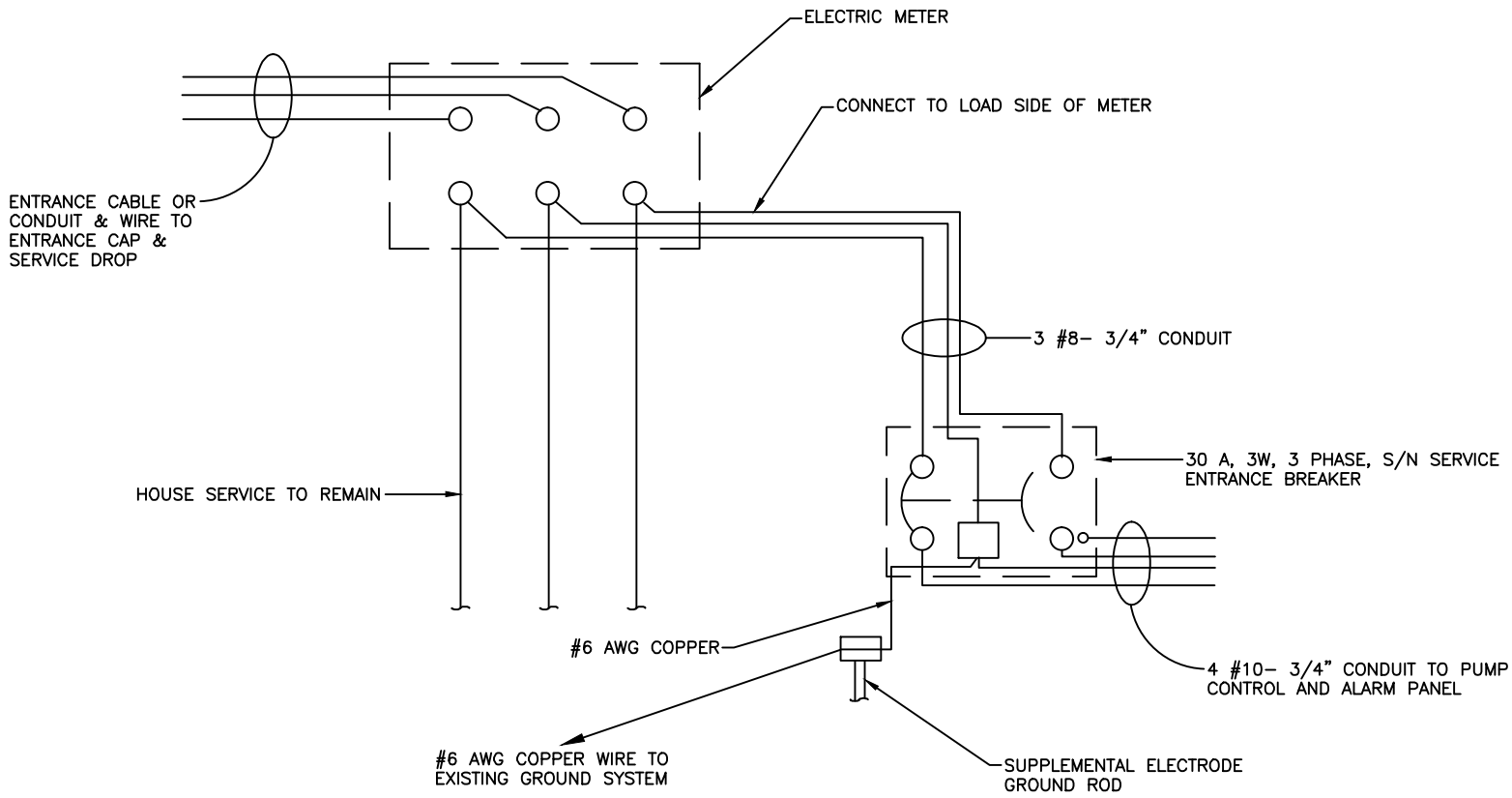
Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signatures.bmp Chief, Bureau of Engineering	GRINDER PUMP CONTROL AND ALARM Panel Wiring	Detail 1 E-1.02



NOTES

1. 30 AMP BREAKER TO BE EQUIPPED WITH A NON–CASE HARDENED PADLOCK THAT CAN BE CUT WITH BOLT CUTTERS.

7/17/2015

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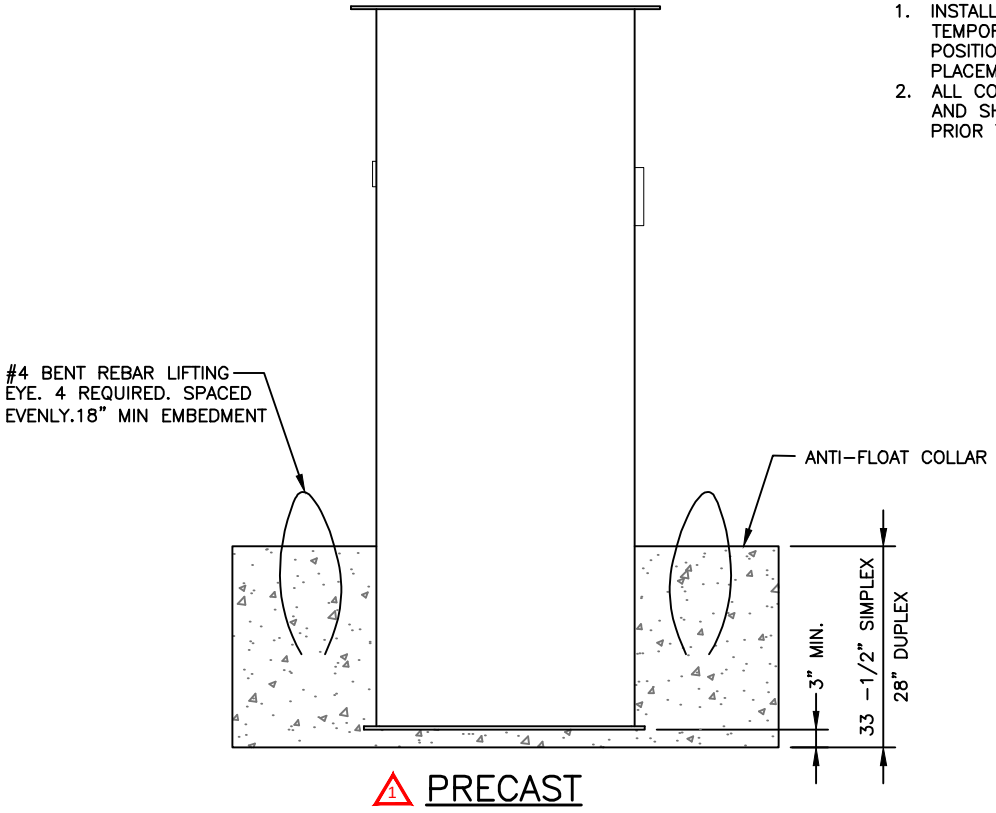
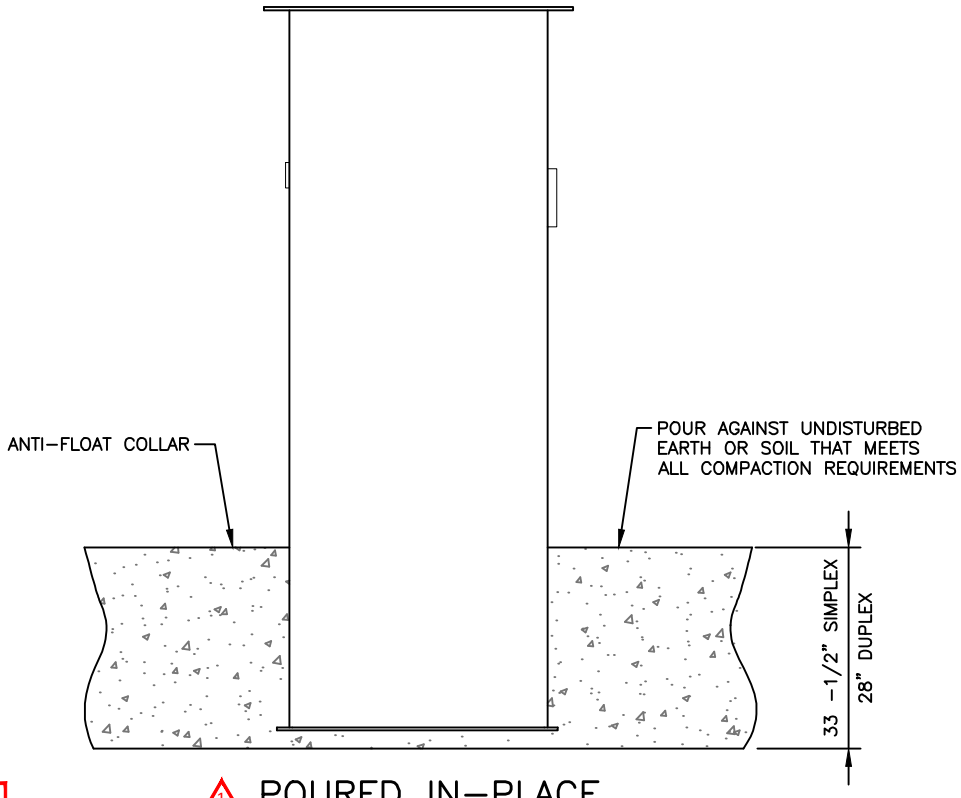
Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	ENTRANCE WIRING DIAGRAM Grinder Pump	Detail 1 E–1.03

NOTES

1. INSTALL PLUMB – PROVIDE TEMPORARY BRACING TO MAINTAIN POSITIONING DURING CONCRETE PLACEMENT.
2. ALL CONCRETE TO BE MIX NO. 1 AND SHALL CURE 24 HOURS PRIOR TO BACKFILL.



1 PRECAST

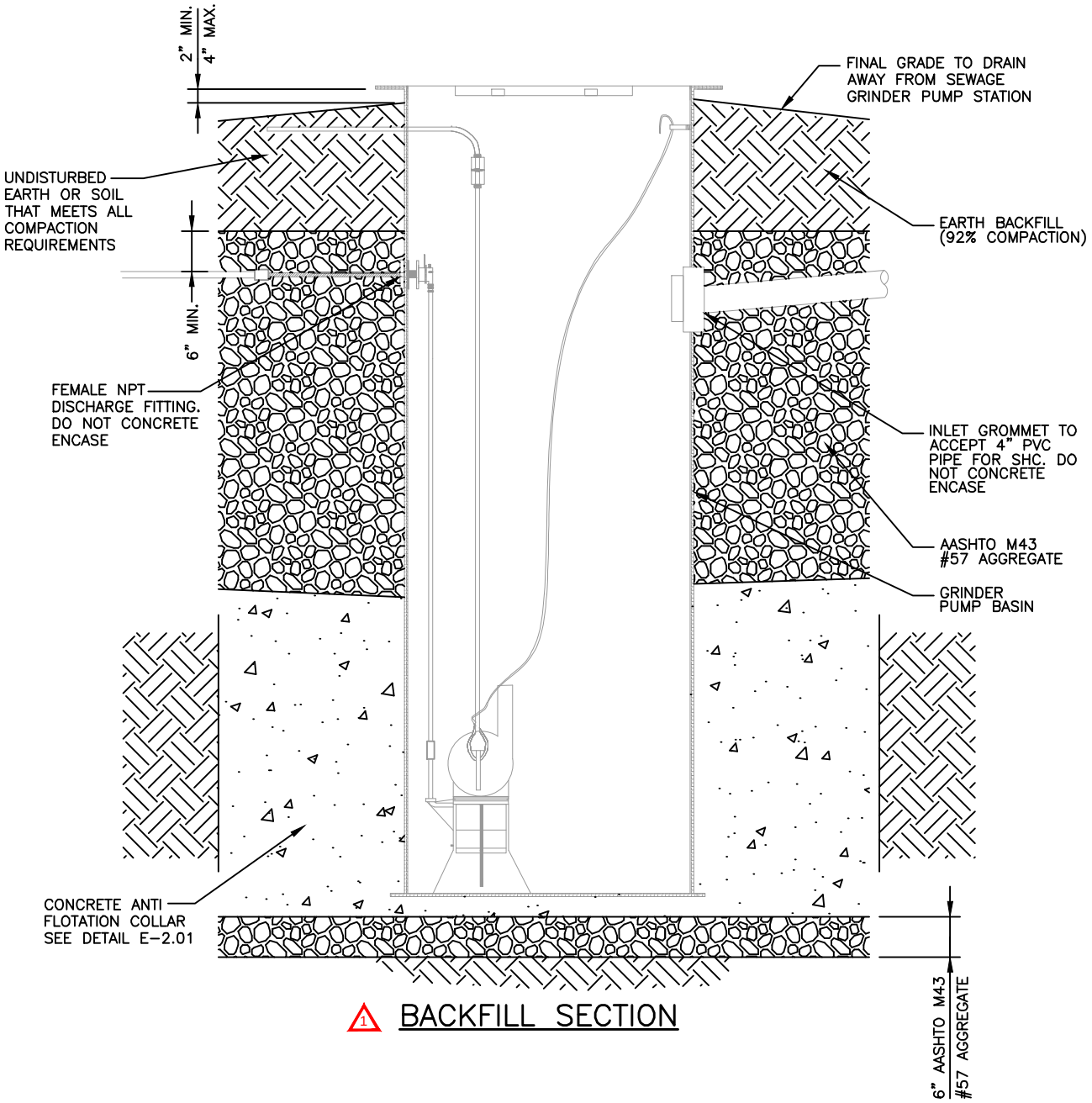


1 POURED IN–PLACE

7/17/2015

DRAFT

Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: M:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	1 GRINDER PUMP TANK Anti–Floatation Collar	Detail E–2.01



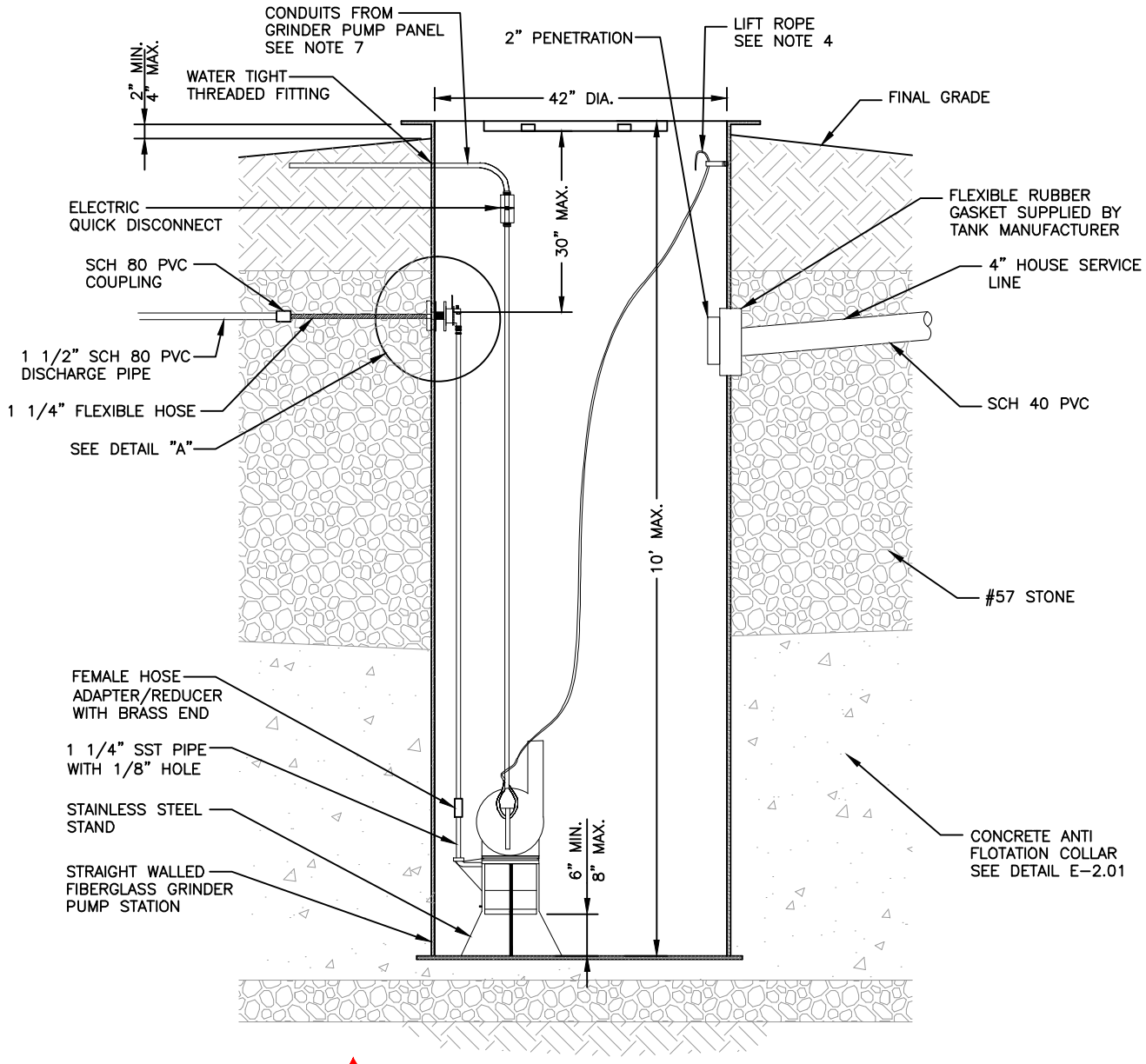
1 BACKFILL SECTION

NOTES:

1. SIMPLEX PUMP SHOWN. DUPLEX BACKFILL IS THE SAME.
2. INSTALL PLUMB. PROVIDE TEMPORARY BRACING TO MAINTAIN POSITIONING DURING BACKFILL.
3. CONCRETE SHALL CURE A MINIMUM OF 24 HOURS PRIOR TO BACKFILL.

DRAFT 7/17/2015

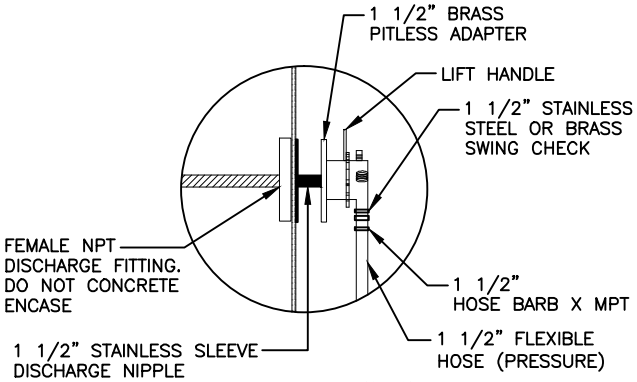
Revised	Howard County, Maryland	1 GRINDER PUMP BACKFILL	Detail
1 X/XX/2015	Department of Public Works		E-2.02
Revised 5/7/2007	Approved: _____		
Approved	Chief, Bureau of Engineering		



1 GRINDER PUMP SECTION

NOTES:

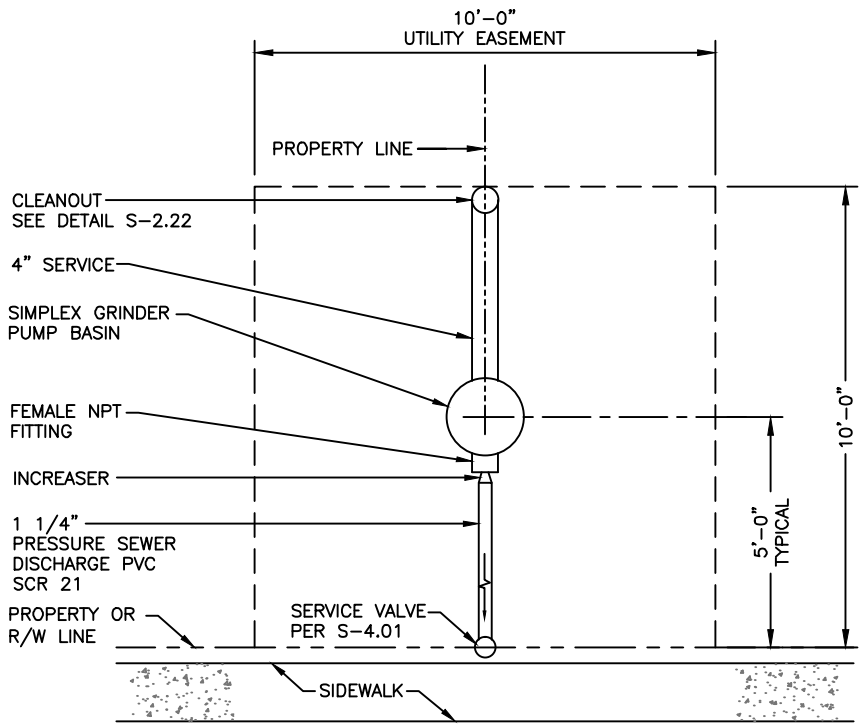
1. FLEXIBLE HOSE SHALL BE PRESSURE RATED "NYLOBRADE" HIGH PRESSURE HOSE OR EQUIVALENT.
2. LEVEL CONTROLS BY MANUFACTURER.
3. SS CARABINER FOR LIFTING EYE AT PUMP.
4. USE 1/4" MIN. NYLON ROPE ATTACHED TO SS EYE TO SIDE WALL WITH MINIMAL SLACK.
5. LIFT HANDLE TO BE SUPPLIED BY THE PUMP MANUFACTURER.
6. WATER TIGHT THREADED FITTING FOR ELECTRIC SERVICE LINE TO BE SUPPLIED BY THE TANK MANUFACTURER.
7. SEE DETAIL E-1.01 FOR ELECTRIC SERVICE OUTSIDE OF THE TANK TO THE GRINDER PUMP SUB PANEL.
8. PROVIDE POSITIVE DRAINAGE AWAY FROM GRINDER TANK LID.
9. ELECTRICAL QUICK DISCONNECT TO BE RECOMMENDED BY THE PUMP MANUFACTURER.
10. SEE DETAIL E-1.07 FOR LEVEL CONTROLS.
11. IF FLOAT TREE ASSEMBLY IS REQUIRED, IT MUST BE SUBMITTED FOR APPROVAL. FLOAT TREE ASSEMBLY MUST BE MINIMUM 6" OFF THE BOTTOM OF THE TANK AND ALL COMPONENTS SHALL BE CORROSION RESISTANT.



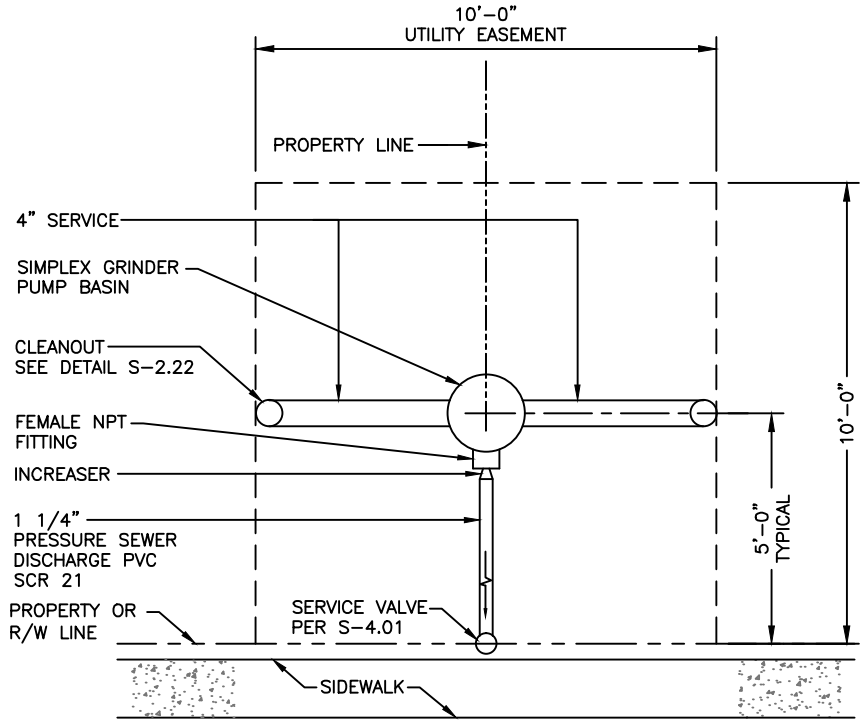
DETAIL "A"

DRAFT 7/17/2015

Revised	Howard County, Maryland Department of Public Works	1 GRINDER PUMP	Detail 1
1 X/XX/2015			E-2.03
Revised 5/7/2007	Approved: _____		
Approved	Chief, Bureau of Engineering		



SIMPLEX



DUPLEX

NOTES

1. ORIENTATION OF CLEANOUT, DISCHARGE, AND ELECTRICAL CONDUIT PER CONTRACT DRAWINGS OR SITE CONDITIONS.
2. PROVIDE REDUCER TO MATCH PRESSURE PIPE SIZE.
3. CENTER GRINDER PUMP AND APPURTENANCES IN EASEMENT UNLESS OTHERWISE DIMENSIONED.

7/17/2015

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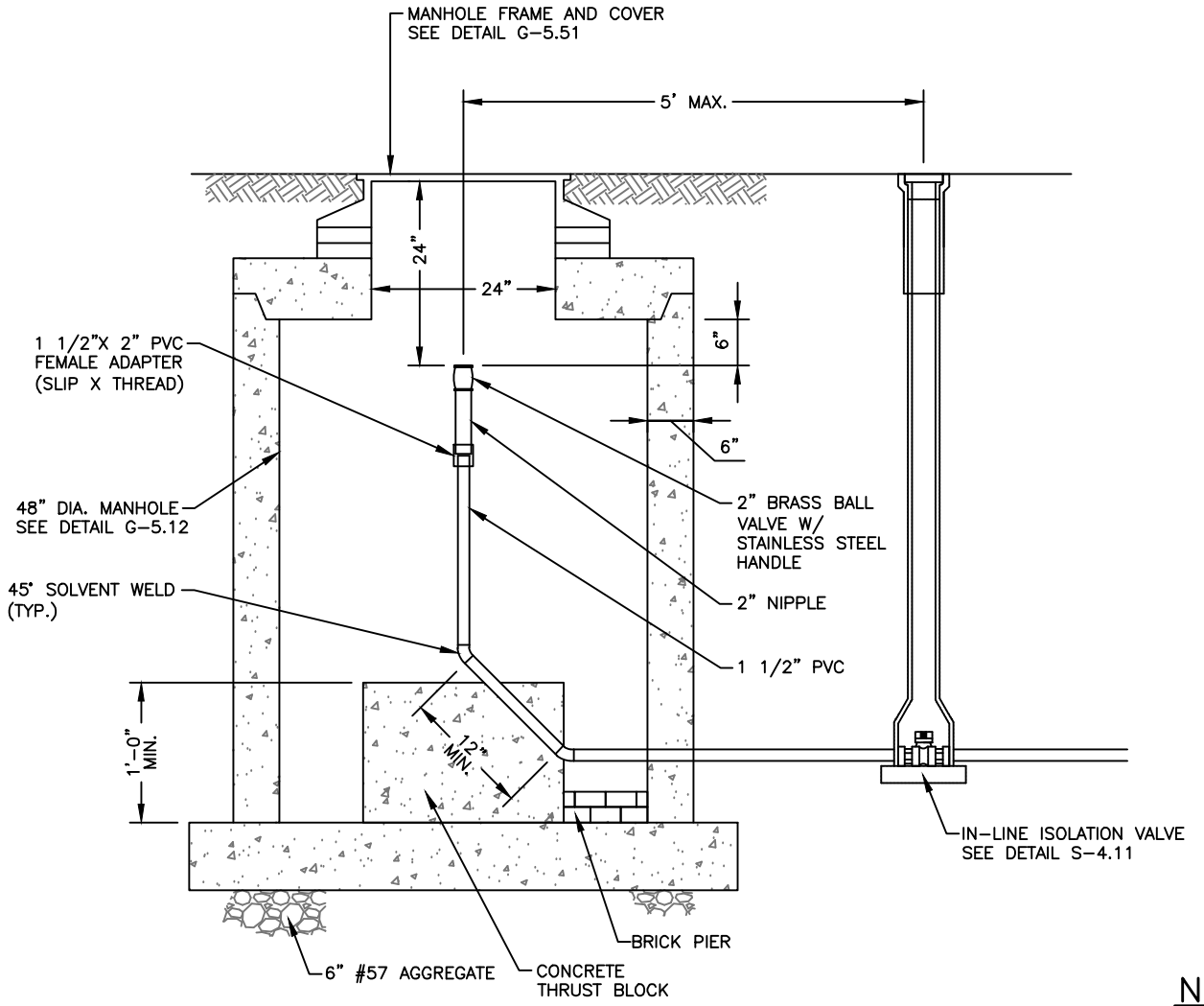
Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	GRINDER PUMP Layout	Detail 1 E-2.04



1 SECTION

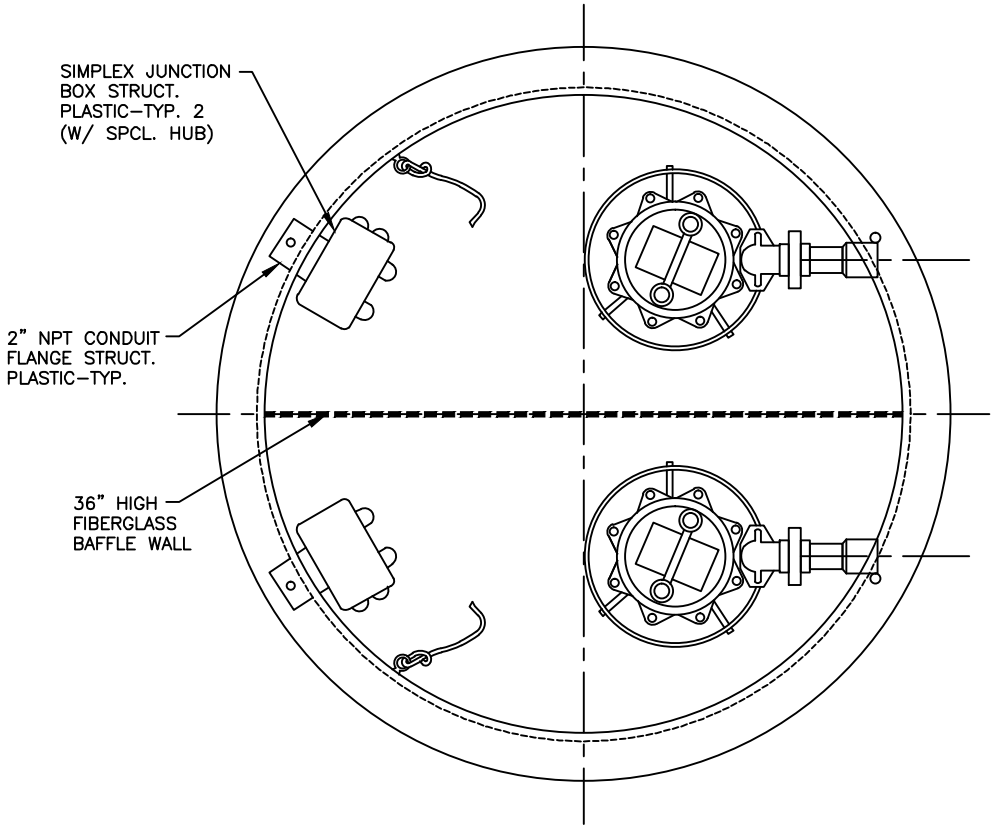
NOTES

1. F_c = 3000 PSI 28 DAYS
2. DO NOT ENCASE JOINTS.

7/17/2015

DRAFT

Revisions	Howard County, Maryland Department of Public Works	GRINDER PUMP 1 Terminal Flushing Connection	1 Detail E-2.05
1 Revised X/XX/2015 Revised 5/7/2007 Approved	Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering		



PLAN

7/17/2015

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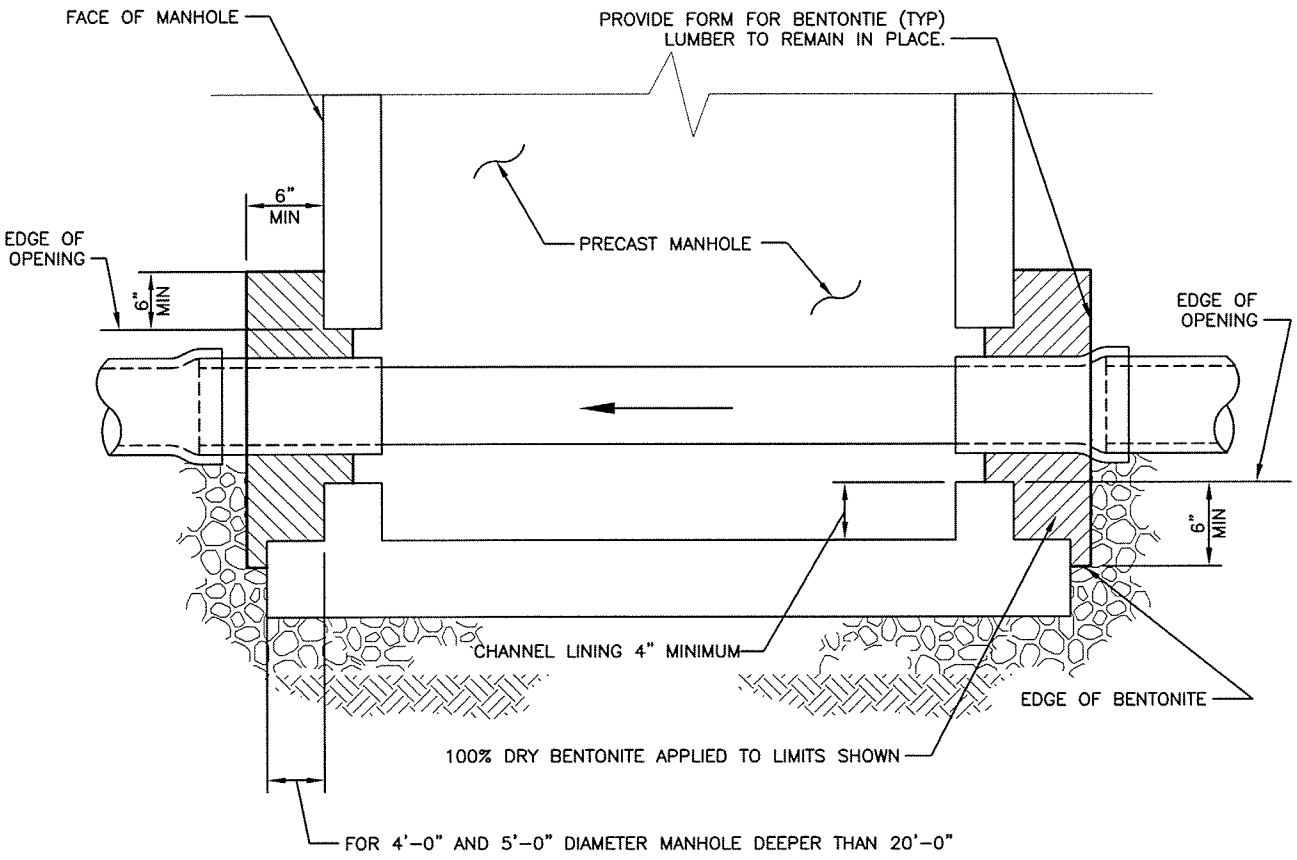
Revised Revised X/XX/2015 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	GRINDER PUMP Duplex	Detail E-2.06

NOTES:

1. USE THIS DETAIL FOR SEWER PIPE TO MANHOLE CONNECTION WHEN MANHOLE DEPTH IS DEEPER THAN 20'–0". MANHOLE DEPTH IS DEFINED AS TOP OF PRECAST CONE SECTION TO INVERT OF LOWEST PIPE ENTERING MANHOLE. WHEN MANHOLE DEPTH IS LESS THAN 20'–0" SEE OTHER DETAILS.



7/17/2015
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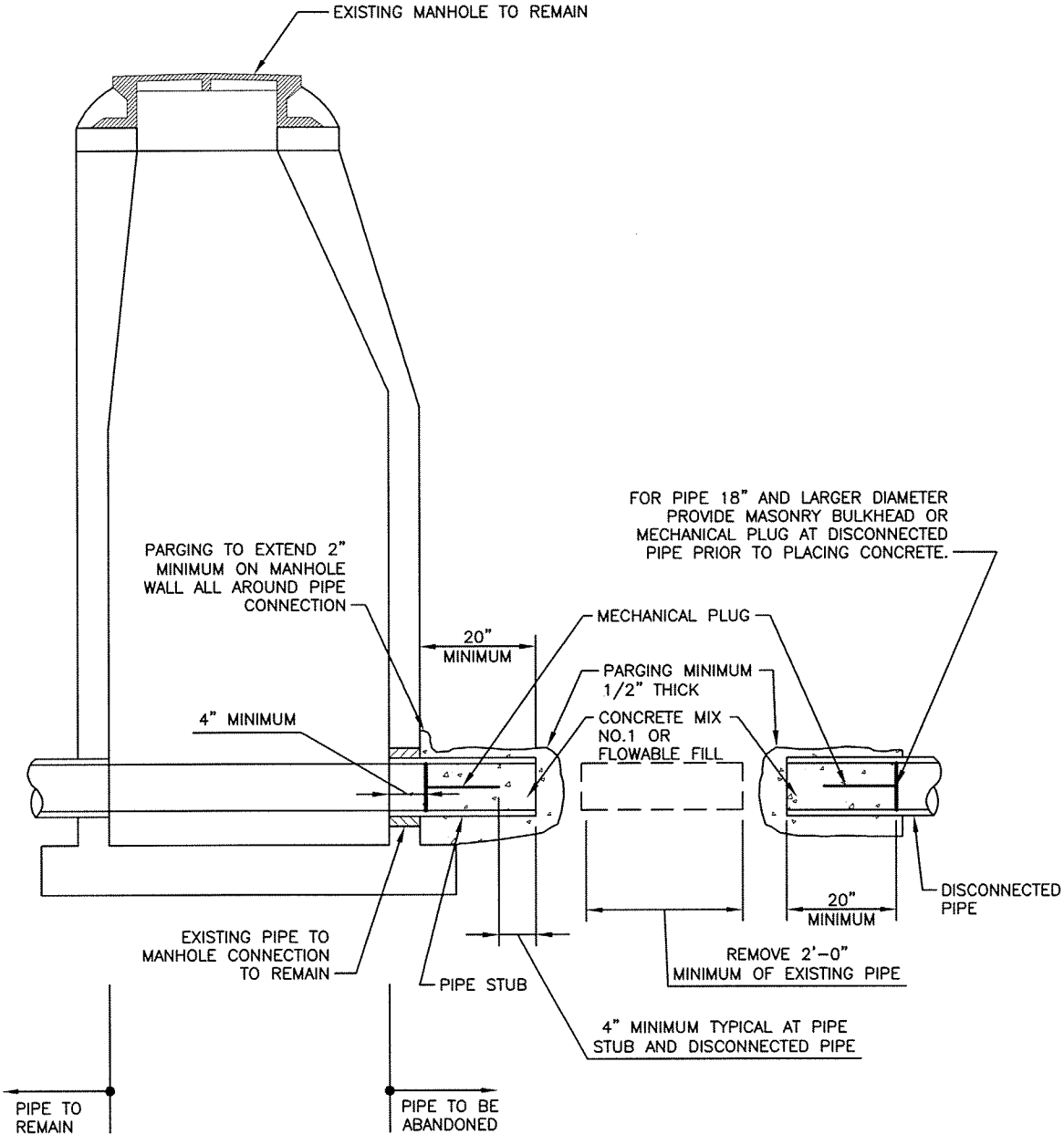
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Deep Manhole Pipe Connection	Detail E-3.01

NOTES:

1. FOR SEWERS 15" AND SMALLER DIAMETER, DISCONNECT SEWER AS SHOWN, INSERT MECHANICAL PLUGS, PLACE CONCRETE, PARGING AND COAT WITH TWO COATS OF ASPHALT–BASED COATING.
2. FOR SEWER 18" AND LARGER DIAMETER SAME AS 15" AND SMALLER EXCEPT MASONRY BULKHEAD MAY BE SUBSTITUTED FOR MACHANICAL PLUG.
3. RESHAPE AND FILL EXISTING CHANNEL AS NECESSARY TO PROVIDE SMOOTH CONTOUR BETWEEN INCOMING AND OUTGOING PIPES.



7/17/2015
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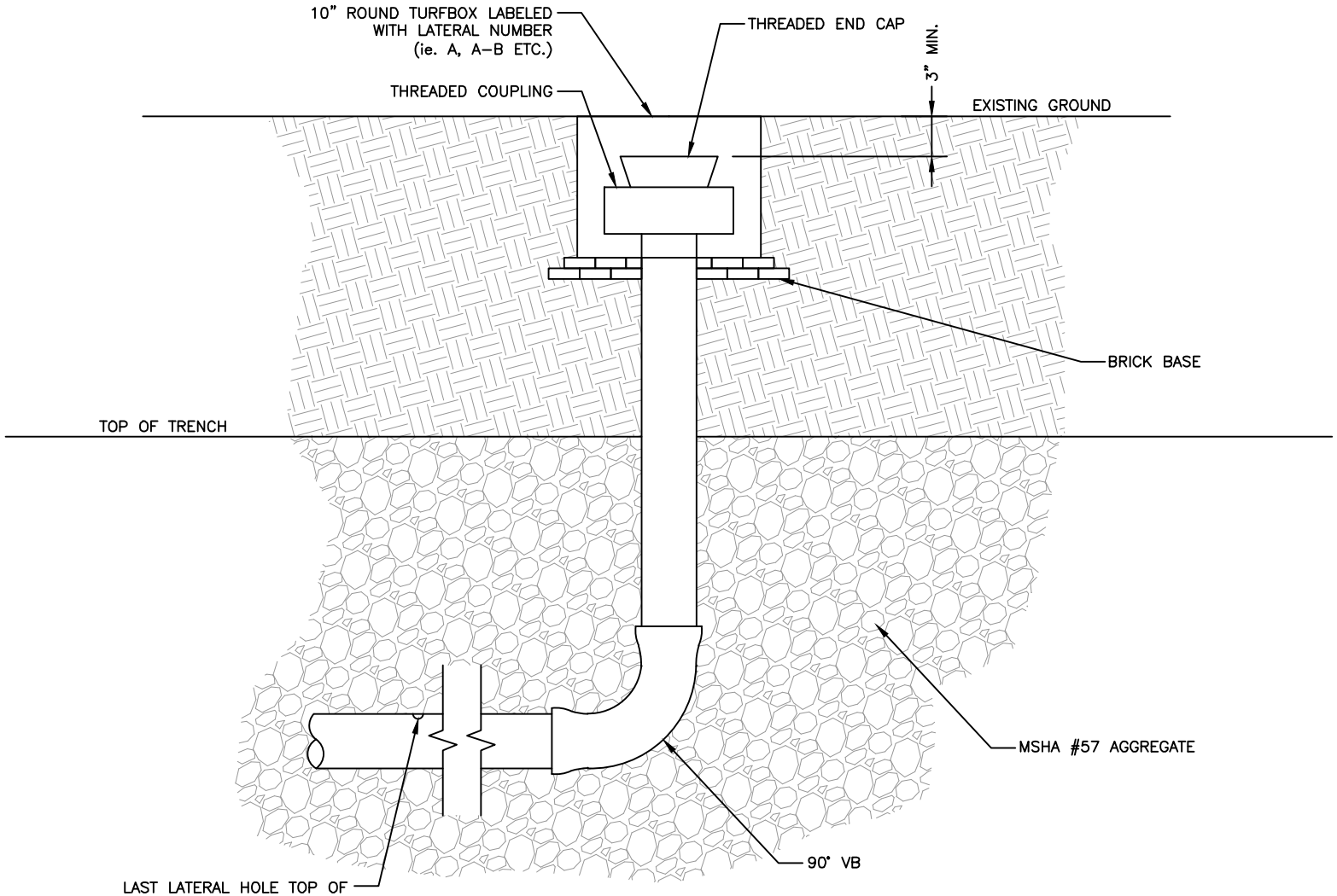
Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Abandonment Pipe at Manhole	Detail E-3.02



LATERAL CLEANOUT

7/17/2015

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Revised Revised X/XX/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	SEPTIC DRAINFIELD Lateral Cleanout	Detail E-4.01

FIGURES SHOWN IN TABLE ARE MEASURED FROM INVERT OF PIPE TO GRADE

PIPE DIA	REINFORCED CONCRETE PIPE ASTM-C76										HDPE PIPE ASTM F405, F667; AASHTO M252, M294, MP6-95		
	CLASS I		CLASS II		CLASS III		CLASS IV		CLASS V		PIPE DIAMETER	MIN DEPTH	MAX DEPTH
	MIN DEPTH	MAX DEPTH	MIN DEPTH	MAX DEPTH	MIN DEPTH	MAX DEPTH	MIN DEPTH	MAX DEPTH	MIN DEPTH				
12"					4	7	3	14	3		4"	3	15
14"											6"	3	15
15"					4	11	3	22	3		8"	3	13
16"											10"	3	12
18"					4	12	3	23	3	ALL PIPE CAN BE USED OVER 30 FEET DEPTH	12"	4	13
20"											15"	4	13
21"					4	12	3	24	3		18"	4	13
24"					5	13	4	25	4		24"	5	14
27"					5	13	4	20	4		30"	5	14
30"					5	13	4	21	4		36"	5	15
36"			6	9	5	14	5	22	5		42"	6	13
42"			6	9	5	14	5	21	5		48"	6	14
48"			6	10	6	15	6	22	6		60"	7	15
54"			6	11	6	16	6	23	6				
60"			7	12	7	17	7	23	7				
66"	8	10	7	13	7	17	7	24	7				
72"	8	11	8	13	8	17	8	25	8				

1. PIPE SHALL NOT BE USED WHERE THERE ARE BLANK SPACES IN THE TABLE.
2. SEE G-2.11 AND G-2.12 FOR BEDDING.

7/17/2015
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Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Storm Drain RCP & HDPE Pipe Permissible Depth Table	Detail D-3.01

BASIC TABLE
DEAD LOAD AT 110 LBS PER CU FT AND K μ= 0.130, ORDINARY MAXIMUM FOR CLAY
LIVE LOAD H = 20 LOADING WITHOUT IMPACT

SIZE PIPE	TRENCH WIDTH	DEPTH OF COVER											
		1 FT		2 FT		3 FT		4 FT		5 FT		6 FT	
		DEAD	LIVE	DEAD	LIVE	DEAD	LIVE	DEAD	LIVE	DEAD	LIVE	DEAD	LIVE
12"	3.0'			613	1460	881	788	1138	448	1287	320	1534	224
15"	3.0'	313	3760	613	1946	881	1088	1138	666	1287	448	1534	324
18"	3.42'	359	4058	693	2208	1014	1258	1309	778	1566	534	1823	374
21'	3.70'	393	4146	771	2384	1134	1376	1436	858	1754	582	2026	416
24"	4.0'	426	4380	827	2586	1214	1524	1566	960	1901	650	2218	464
27"	4.82'	518	4476	1035	2748	1477	1648	1919	1050	2323	720	2702	512
30"	5.08'	540	4576	1052	2896	1577	1770	2046	1136	2501	784	2984	560
36"	5.67'	607	4678	1176	3126	1748	1984	2331	1296	2825	906	3284	650
42"	6.75'	737	4784	1428	3296	2155	2170	2757	1450	3408	1014	4010	768
48"	7.33'	799	4828	1597	3440	2277	2320	3034	1578	3726	1136	4555	832
54"	7.92'	862	4988	1723	3520	2481	2442	3240	1690	4067	1232	4825	916
60"	8.5'	944	5088	1788	3584	2662	2538	3576	1792	4371	1306	5160	992
66"	9.08'	998	5196	1951	3632	2859	2608	3766	1878	4674	1392	5581	1050
72"	9.67'	1059	5302	2056	3670	3084	2666	4009	1930	4934	1462	6064	1104
		7 FT		10 FT		15 FT		20 FT		25 FT		30 FT	
12"	3.0'	1732	165	2208		2792		3152		3386		3564	
15"	3.0'	1732	240	2208		2792		3152		3386		3564	
18"	3.42'	2028	278	2631		3337		3761		4223		4467	
21'	3.70'	2268	314	2948		3780		4385		4805		5141	
24"	4.0'	2464	346	3256		4224		4928		5456		5808	
27"	4.82'	3080	384	4040		5429		6565		7322		7903	
30"	5.08'	3325	420	4272		5912		6821		7844		8526	
36"	5.67'	3708	544	5050		6816		8122		9182		10135	
42"	6.75'	4511	560	6165		8521		10375		11878		13281	
48"	7.33'	5087	628	6803		9465		11653		13427		15083	
54"	7.92'	5514	694	7444		10339		12890		15302		16543	
60"	8.5'	6000	752	8106		11127		14067		16292		18438	
66"	9.08'	6443	890	8712		12161		15246		17887		20147	
72"	9.67'	6835	864	11615		13157		16549		19221		21894	

LOAD UNITS = POUNDS PER LINEAR FOOT

7/17/2015
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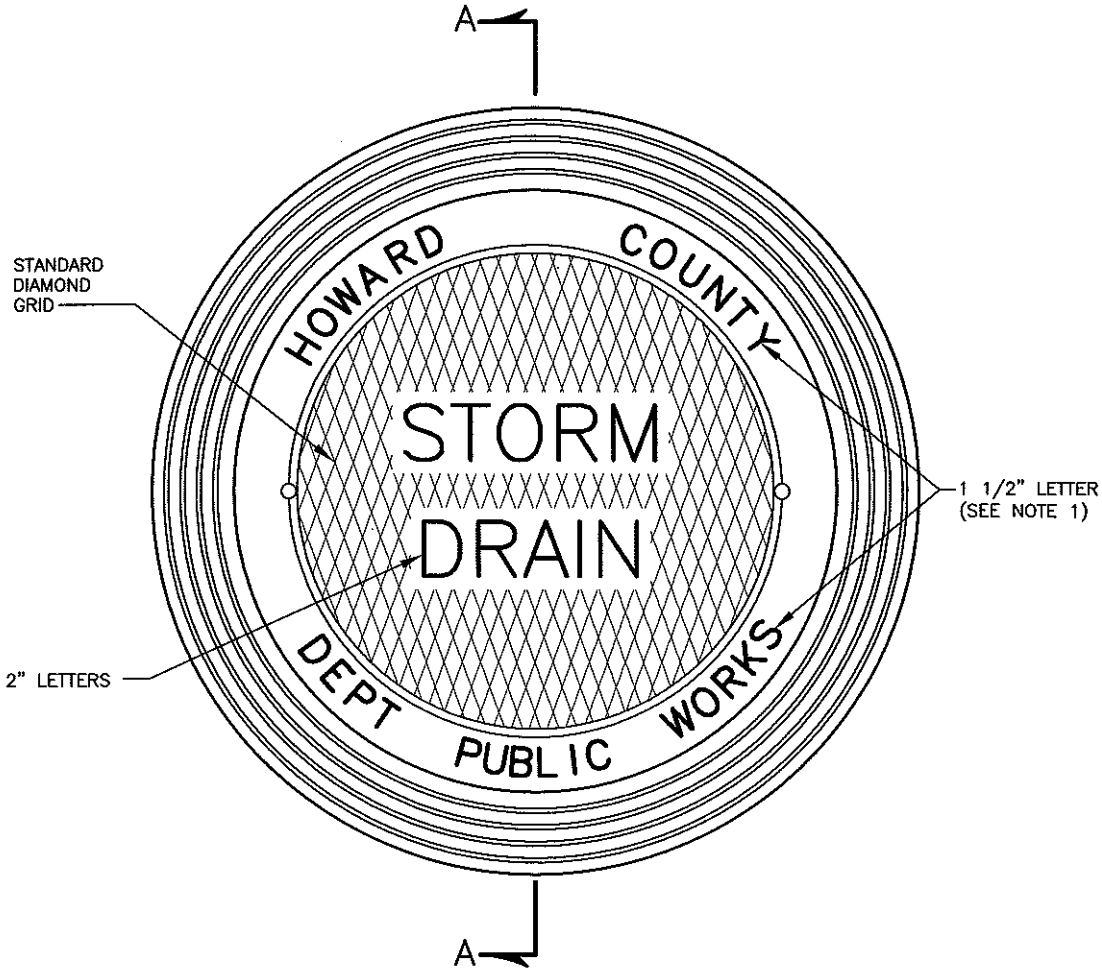
Revised

Revised
5/7/2007
Approved

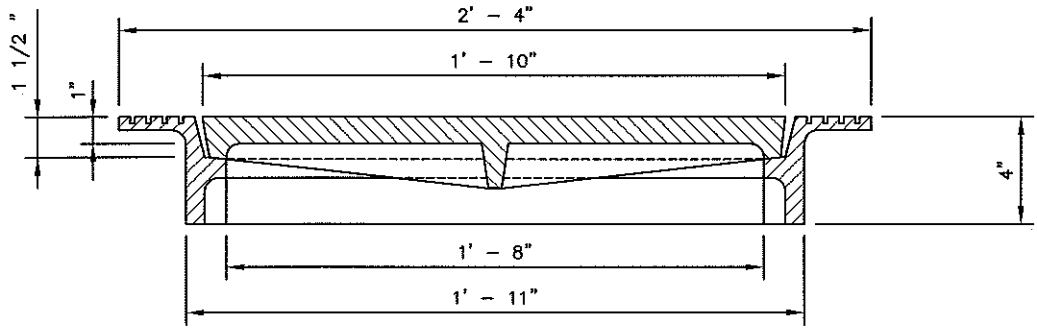
Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

Pipe
Computed Loads
on Conduits

Detail
D-3.02



PLAN



SECTION 'A'–'A'

NOTES:

1. THIS LETTERING NOT REQUIRED IN PRIVATE AREAS.
2. COVER TO BE PROVIDED WITH TWO 3/4" HOLES OPPOSITE EACH OTHER.
3. TOTAL WEIGHT OF FRAME AND COVER TO BE NO LESS THAN 185 LBS.

7/17/2015
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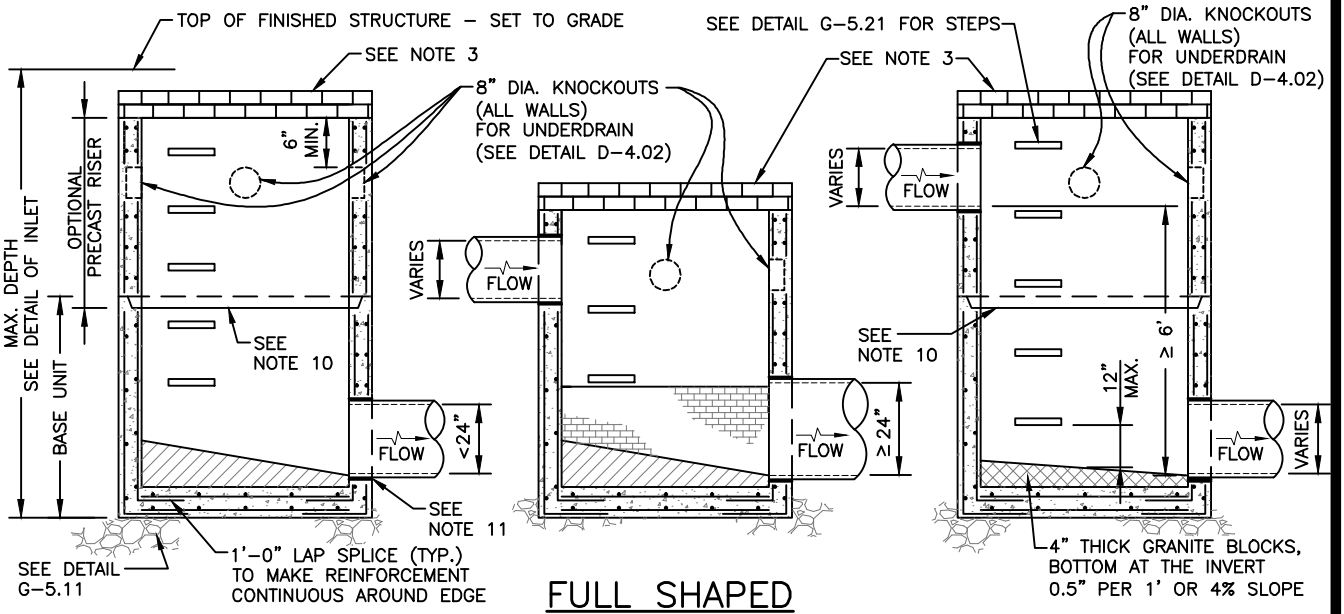
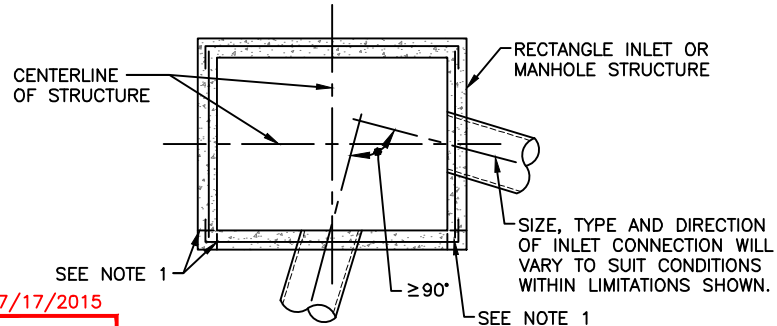
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Sidewalk Frame & Cover	Detail D-3.91



SLOPED BOTTOM | FULL SHAPED CHANNEL | GRANITE BOTTOM

NOTES:

1. PRECAST STRUCTURES SHALL BE DESIGNED AND CERTIFIED BY THE MANUFACTURER TO CONFORM TO LOADING SPECIFIED IN LATEST EDITIONS OF ASTM C857 AND ASTM C890.
2. PRECAST STRUCTURES SHALL CONFORM TO THE REQUIREMENTS OF LATEST EDITIONS OF ASTM C858.
3. A MAX. 2 COURSES OF BRICKS AND MORTAR SHALL BE USED TO ADJUST THE TOP OF INLET. DOWELS SHALL EXTEND ACCORDINGLY UP TO THE GUTTER PAN. THE INLET STRUCTURE SHALL NOT BE CUT WITHOUT PRIOR WRITTEN APPROVAL FROM THE COUNTY. BRICK SHALL BE ASTM C139 AND BUILT FLUSH WITH INTERIOR OR PRECAST WALL.
4. WHERE THE PIPE INVERT DIFFERENTIAL IS EQUAL TO OR GREATER THAN 6', THE BOTTOM OF THE INLET SHALL BE LINED WITH GRANITE BLOCKS AT LEAST 4" THICK SLOPED DOWN TOWARD THE OUTLET AT THE RATE OF 1/2" PER 1'. GRANITE BLOCKS SHALL COMPLY WITH ASTM C615.
5. WHERE PIPE DIAMETER IS 24" AND LARGER AND THE INVERT DIFFERENTIAL IS LESS THAN 6', A BRICK CHANNEL AND BENCH IS REQUIRED TO PROVIDE SMOOTH HYDRAULIC TRANSITION BETWEEN THE PIPES.
6. THE BRICK CHANNEL BENCH HEIGHT SHALL MATCH THE OUTLET PIPE DIAMETER OR THE HEIGHT AS DESIGNED AND APPROVED IN THE CONTRACT DOCUMENTS.
7. WHERE BRICK CHANNELS OR GRANITE BOTTOMS ARE NOT REQUIRED BY THE ABOVE CRITERIA THE BOTTOM MAY BE FORMED USING MIX #3 CONCRETE OR BRICK.
8. BRICK CHANNELS AND BENCHES SHALL CONFORM TO THE REQUIREMENTS OF THE LATEST EDITIONS OF ASTM C32 SEWER BRICK LAID ON EDGE. MORTAR SHALL BE NON-SHRINKING GROUT. JOINTS SHALL BE 1/4" TO 1/2" WIDE AND UNIFORMLY MAINTAINED THROUGH OUT THE BOTTOM.
9. ALL INLET BOTTOMS AND/OR CHANNELS MIN. SLOPE IS 1/2" PER FOOT, AND MAX. SLOPE OF 2" PER FOOT TOWARD THE OUTLET PIPE. THE INLET BOTTOM SLOPE MAY BE OTHERWISE DESIGNED AND APPROVED IN THE CONTRACT DOCUMENTS WITHOUT A DESIGN WAIVER.
10. PRECAST STRUCTURES JOINTS SHALL MEET THE STANDARDS FOR SOIL TIGHT CONNECTION. JOINT SEALER SHALL BE APPLIED TO INSIDE EDGE TO CONFORM WITH THE REQUIREMENTS OF LATEST EDITIONS OF THE AASHTO M198.
11. PROVIDE SOIL TIGHT CONNECTION BETWEEN PIPE AND INLET STRUCTURE.
12. UNDERDRAIN CONNECTIONS SHALL BE GROUTED IN PLACE THROUGH THE PROVIDED KNOCKOUT(S).
13. LIFTING POINTS PROVIDED FOR HANDLING PRECAST RISER(S), BASE AND TOP SLAB SHALL BE FILLED WITH MIX #3 AND MADE FLUSH WITH THE SURFACE UPON INSTALLATION. ENSURE THAT NO METAL IS EXPOSED OR RUSTING.
14. SEE DETAIL G-5.21 FOR STEPS.



7/17/2015
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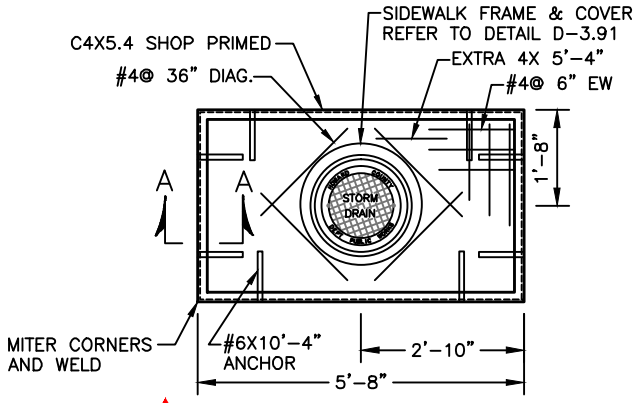
PLAN

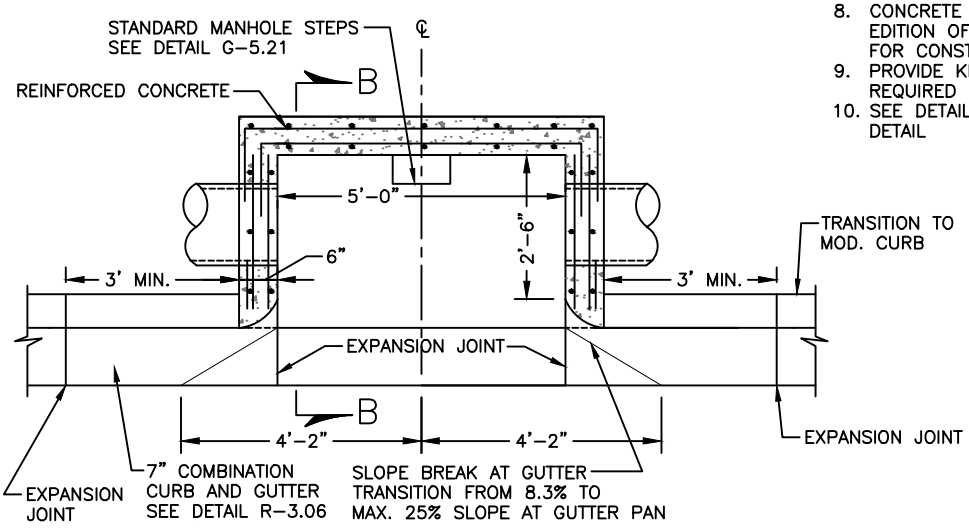
NOTES:

1. NO PART OF PIPE SHALL PASS THROUGH ANY CORNER OF STRUCTURE AS DEFINED BY PROJECTION OF INTERIOR WALLS.
2. BENCH SIMILAR TO TYPE A MANHOLE SHALL BE BUILT INTO INLET WHERE DRAINS 24" AND LARGER RUN THROUGH INLET. SEE DETAIL G-5.11

Revised / Revised X/XX/2015 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	STORM DRAIN INLET General Requirement	Detail D-4.01



1 PLAN 4" TOP SLAB

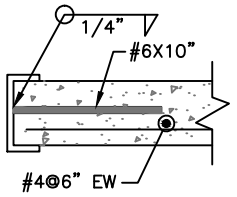


1 PLAN BELOW 4" SLAB

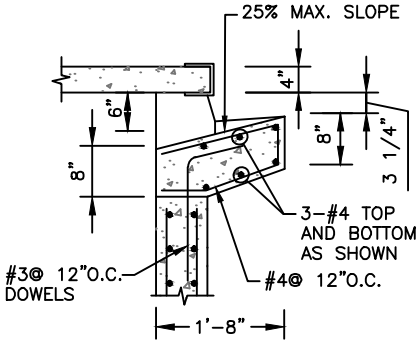
NOTE: FOR CURB AND GUTTER TRANSITION SEE DETAIL R-3.06

1 PRECAST NOTES

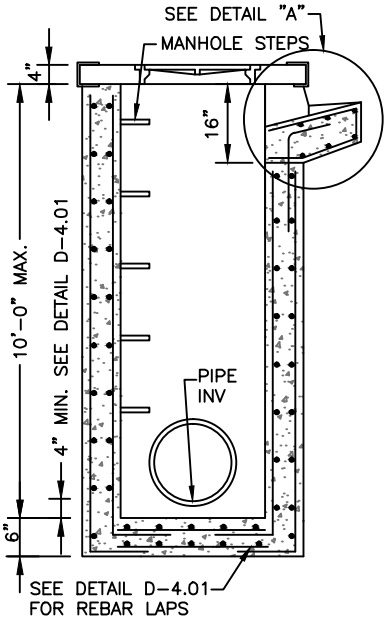
1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS.
2. CONCRETE TO BE MIX #6 (4500 PSI).
3. REINFORCING-2 LAYERS OF 4X4-W4.0XW4.0 WELDED WIRE FABRIC.
4. CONCRETE WORK SHALL CONFORM TO THE REQUIREMENTS OF LATEST EDITIONS OF ACI 301 AND ACI 318.
5. PRECAST STRUCTURES SHALL BE DESIGNED BY A PRECAST CONCRETE STRUCTURES MANUFACTURER IN ACCORDANCE TO LOADING SPECIFIED IN LATEST EDITIONS OF ASTM C857 ASTM C890.
6. PRECAST STRUCTURES SHALL CONFORM TO THE REQUIREMENT OF LATEST EDITIONS OF ASTM C858.
7. PROVIDE SOIL TIGHT CONNECTION BETWEEN PIPE AND INLET STRUCTURE.
8. CONCRETE SHALL CONFORM TO LATEST EDITION OF THE SHA STANDARD SPECIFICATION FOR CONSTRUCTION & MATERIALS.
9. PROVIDE KNOCKOUT FOR UNDERDRAIN AS REQUIRED BY DESIGN.
10. SEE DETAIL D-4.03 FOR PIPE PENETRATION DETAIL



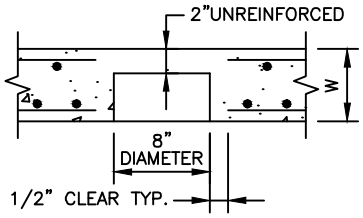
SECTION A-A



1 DETAIL "A"



1 SECTION B-B



UNDERDRAIN KNOCKOUT DETAIL

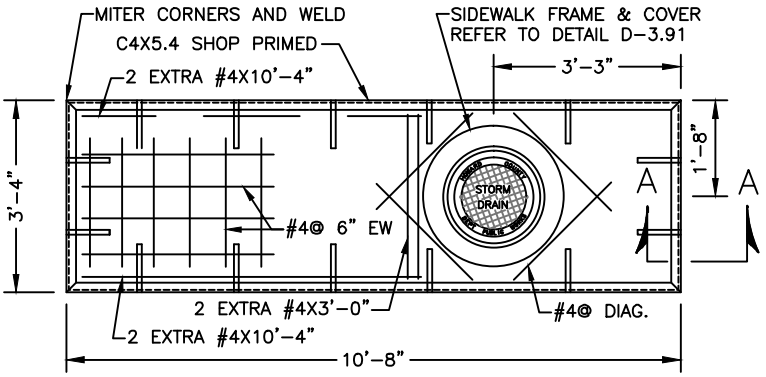
NOTES:

1. KNOCKOUTS MAY BE PLACED IN BASE UNIT ABOVE CENTER OF OUTLET PIPE.
2. MIN. DEPTH: 3' FROM TOP OF CURB TO TOP OF KNOCKOUT. MIN. 6" FROM EDGE OF KNOCKOUT TO EDGE OF PRECAST UNIT.
3. DESIGN HYDRAULIC GRADIENT IN STORM DRAIN SYSTEM MUST BE 6" BELOW KNOCKOUT INVERT.
4. SEE INLET DETAIL FOR "W".
5. KNOCKOUT LOCATIONS FOR EACH INLET TO BE PROVIDED IN THE DESIGN.

7/17/2015 DRAFT

Revised	Howard County, Maryland	TYPE A-5 INLET	Detail 1
1 X/XX/2015	Department of Public Works	≤10' Depth	D-4.02
Revised 5/7/2007	Approved: [redacted]		
Approved	Chief, Bureau of Engineering		

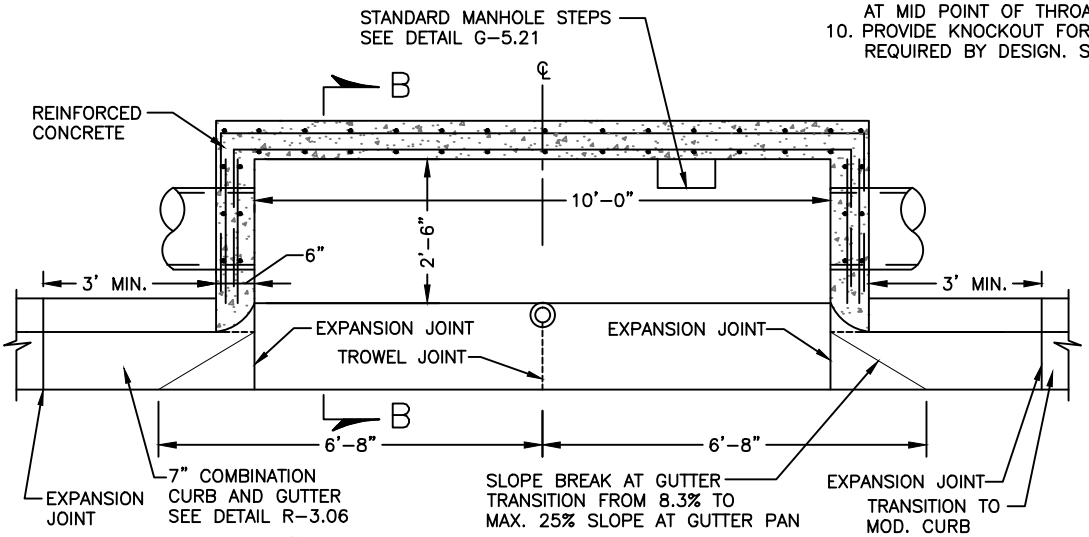
NOTE: FOR CURB AND GUTTER TRANSITION SEE DETAIL R-3.06



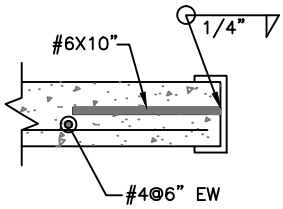
1 PLAN 4" TOP SLAB

1 PRECAST NOTES

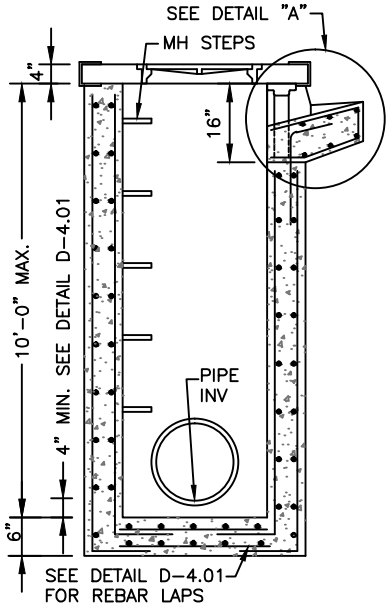
1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS.
2. CONCRETE TO BE MIX #6 (4500 PSI).
3. REINFORCING-2 LAYERS OF 4X4-W4.0XW4.0 WELDED WIRE FABRIC.
4. CONCRETE WORK SHALL CONFORM TO THE REQUIREMENTS OF LATEST EDITIONS OF ACI 301 AND ACI 318.
5. PRECAST STRUCTURES SHALL BE DESIGNED BY A PRECAST CONCRETE STRUCTURES MANUFACTURER IN ACCORDANCE TO LOADING SPECIFIED IN LATEST EDITIONS OF ASTM C857 ASTM C890.
6. PRECAST STRUCTURES SHALL CONFORM TO THE REQUIREMENT OF LATEST EDITIONS OF ASTM C858.
7. PROVIDE SOIL TIGHT CONNECTION BETWEEN PIPE AND INLET STRUCTURE.
8. CONCRETE SHALL CONFORM TO LATEST EDITION OF THE SHA STANDARD SPECIFICATION FOR CONSTRUCTION & MATERIALS.
9. PROVIDE 3" DIA RUST PROOF STEEL PIPE AND FLANGE FOR HEIGHT ADJUSTMENT, PAINTED GRAY AT MID POINT OF THROAT, FILL WITH CONCRETE.
10. PROVIDE KNOCKOUT FOR UNDERDRAIN AS REQUIRED BY DESIGN. SEE DETAIL D-4.02



1 PLAN BELOW 4" SLAB

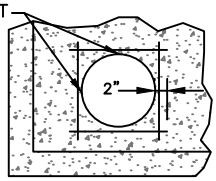


SECTION A-A

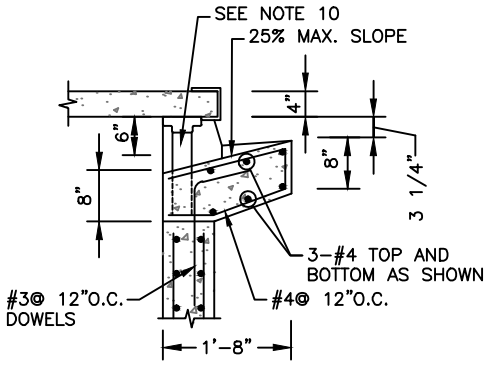


1 SECTION B-B

REPLACE REINFORCEMENT CUT OUT FOR PIPE PENETRATIONS. PROVIDE THE SAME AS ON EACH SIDE OF HOLE.



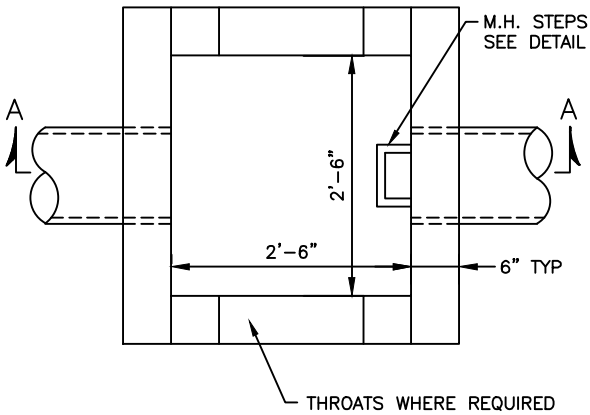
1 PIPE PENETRATION DETAIL



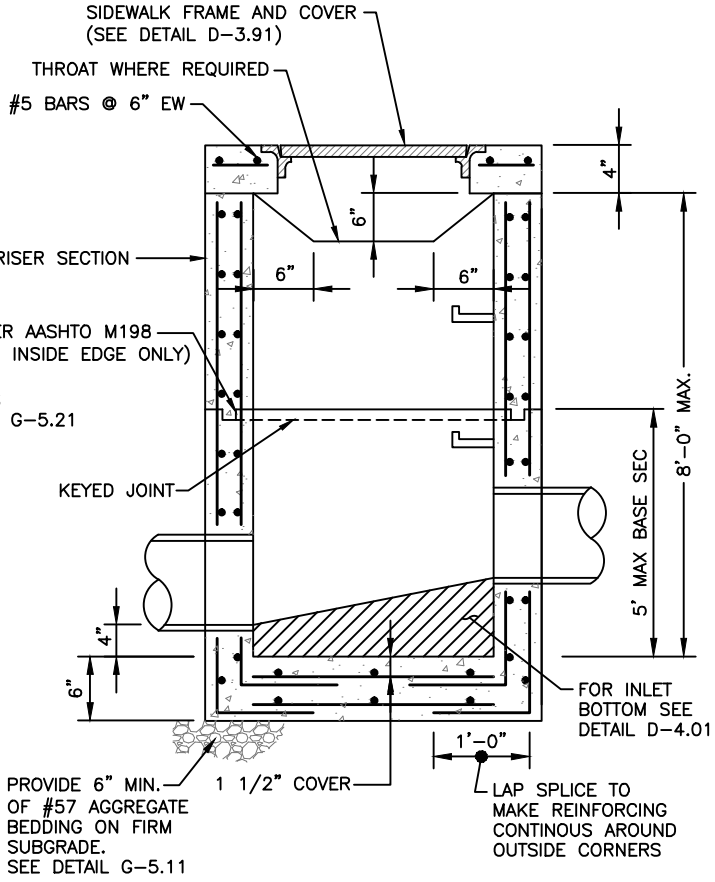
1 DETAIL "A"

7/17/2015 DRAFT

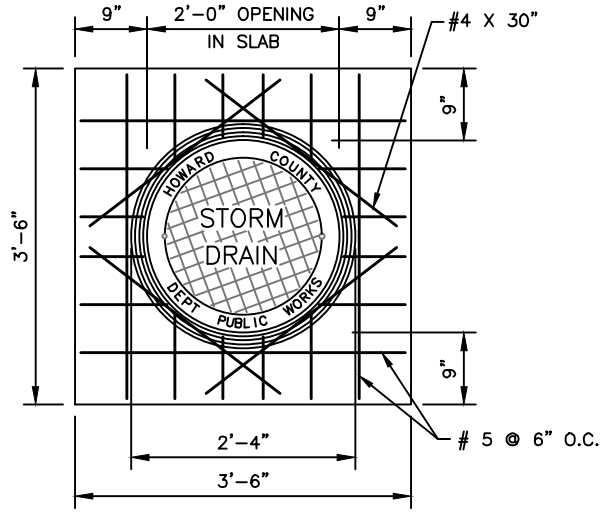
Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\12767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	TYPE A-10 INLET ≤10' Depth	Detail D-4.03



PLAN – BELOW SLAB



1 SECTION A–A



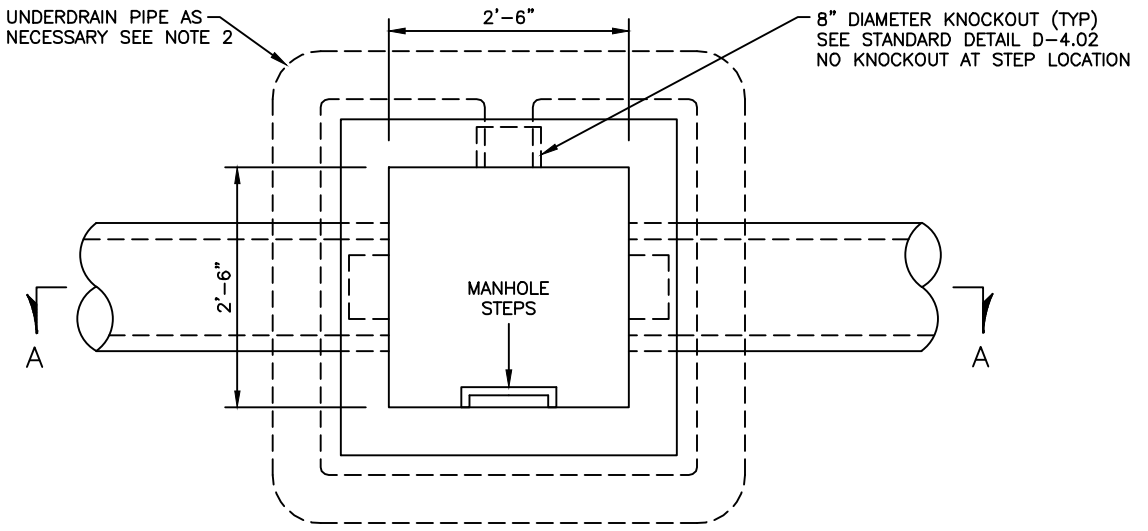
1 SLAB

NOTES 1

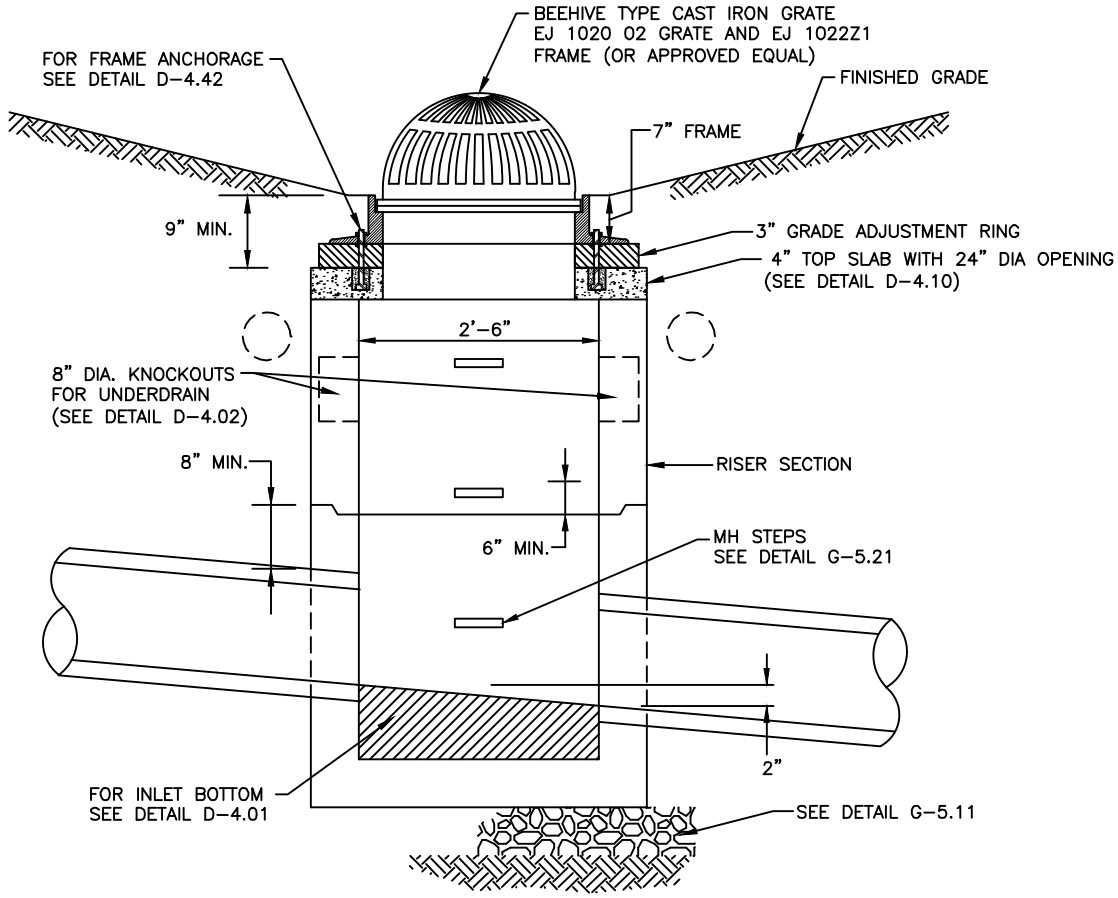
1. SEE DETAIL D–4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS.
2. CONCRETE TO BE MIX #6 (4500 PSI).
3. REINFORCING–2 LAYERS OF 4x4–W4.0xW4.0 WELDED WIRE FABRIC.
4. THIS INLET SHALL NOT BE USED ADJACENT TO PUBLIC ROADS OR ALLEYS NOR IN ANY LOCATION WHERE VEHICLES COULD ENCOUNTER IT.

7/17/2015 DRAFT

Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	TYPE 'D' INLET Precast	Detail D-4.10



PLAN



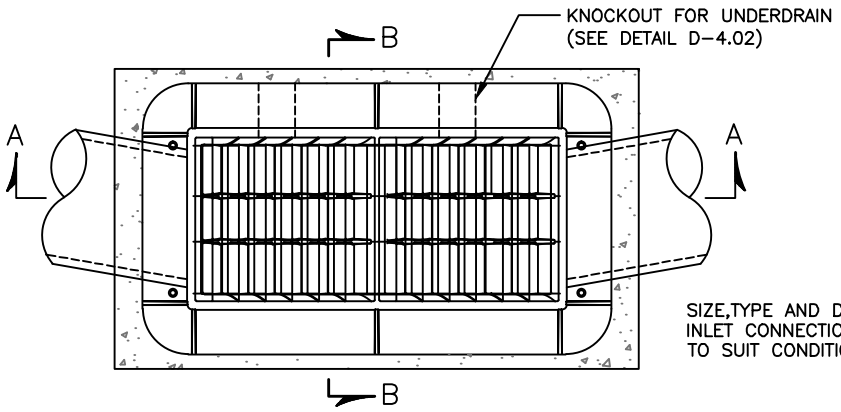
SECTION A-A

NOTES:

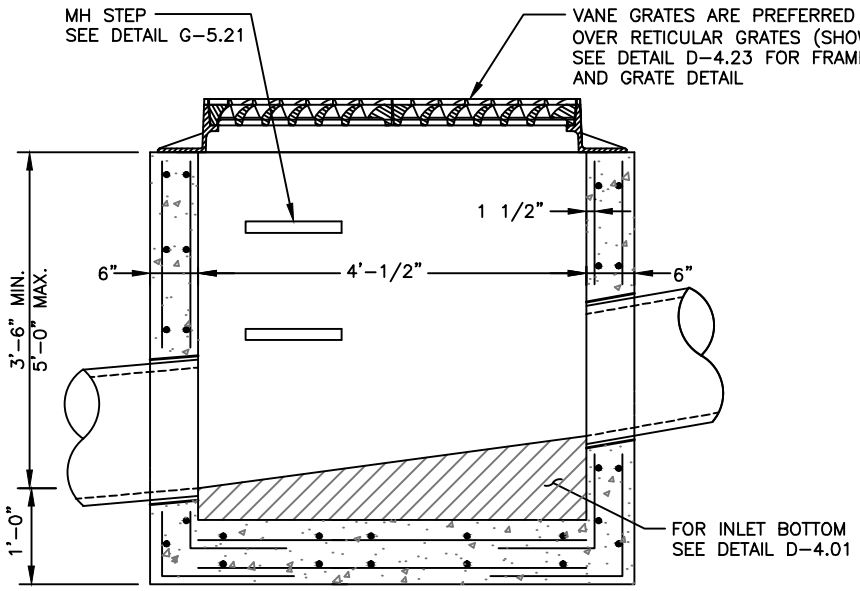
1. INLET TO BE USED IN SUMP (AS SHOWN) OR IN ENVIRONMENTAL SITE DESIGN APPLICATIONS. MAXIMUM DESIGN CAPACITY Q=3.0 CFS. TO BE USED WITH 24" RCCP MAXIMUM CONNECTION. NOT TO BE USED IN ROADWAY OR ADJACENT TO PARKING OR DRIVEWAY AREA. NOT FOR USE ADJACENT TO WOODED AREAS DUE TO POSSIBLE DEBRIS BLOCKAGE.
2. WHEN INLET IS USED IN SUMP AREA, UNDERDRAIN PIPE SHALL BE PROVIDED BELOW THE TOP SLAB ELEVATION TO ALLOW SURFACE WATER DRAIN TO THE INLET. SEE DETAIL R-1.09 FOR UNDERDRAIN DETAIL.
3. WHEN INLET IS USED AS OVERFLOW PROTECTION, UNDERDRAIN PIPE IS NOT NECESSARY.

Revised Revised X/XX/2015 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	TYPE D INLET With Beehive Grate	Detail D-4.11

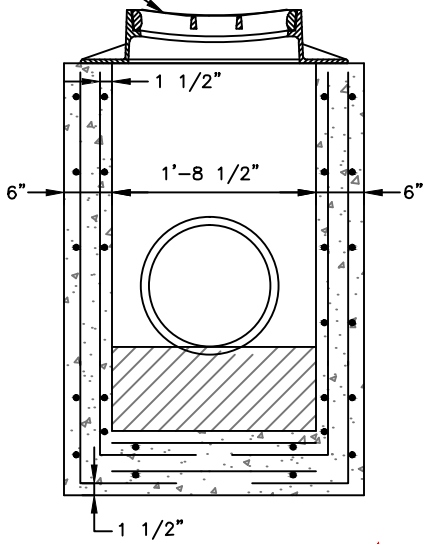
7/17/2015 DRAFT



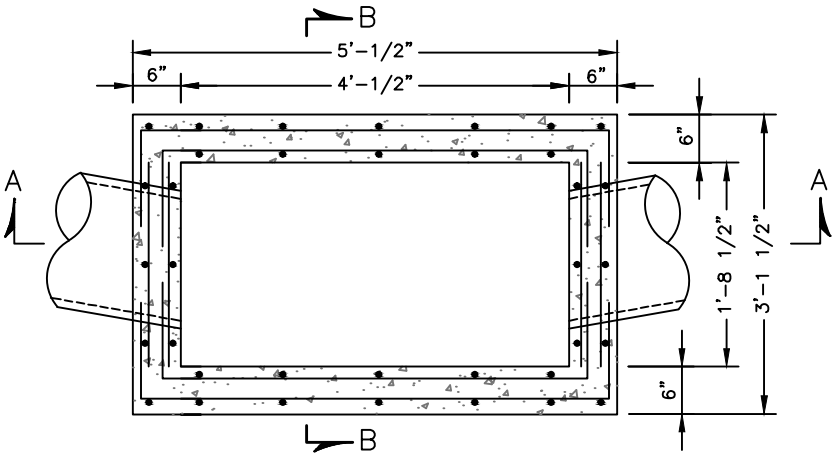
TOP PLAN 1



SECTION A-A 1



SECTION B-B 1



LOWER PLAN 1

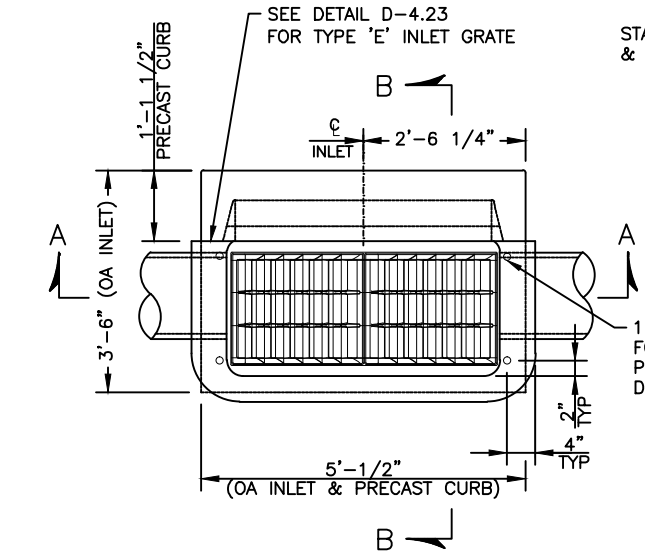
NOTES 1

1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS.
2. CONCRETE TO BE MIX #6 (4500 PSI).
3. REINFORCING-2 LAYERS OF 4X4-W4.0XW4.0 WELDED WIRE FABRIC.

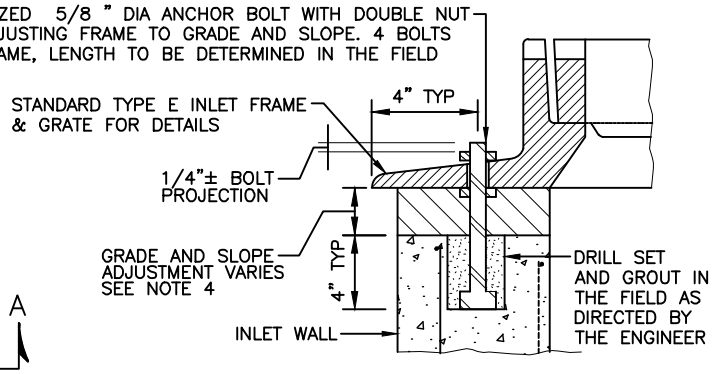
7/17/2015

DRAFT

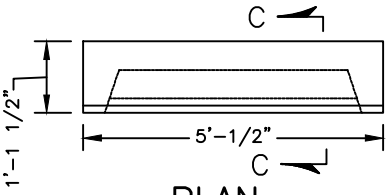
Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signatures.bmp Chief, Bureau of Engineering	TYPE 'E' INLET	Detail D-4.21



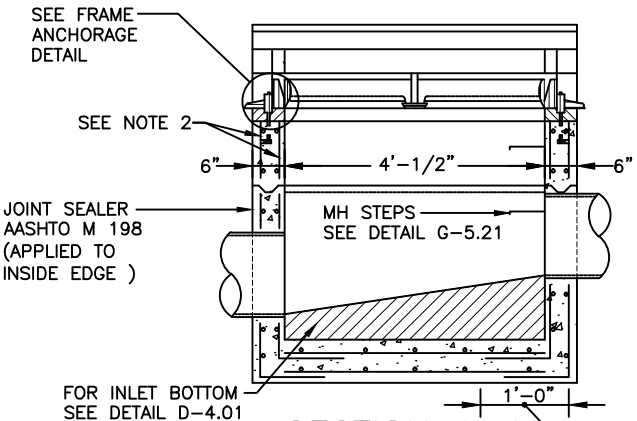
PLAN



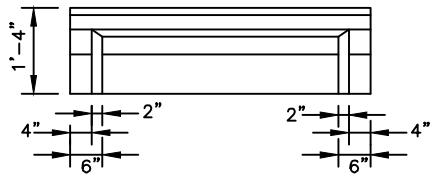
FRAME ANCHORAGE DETAIL



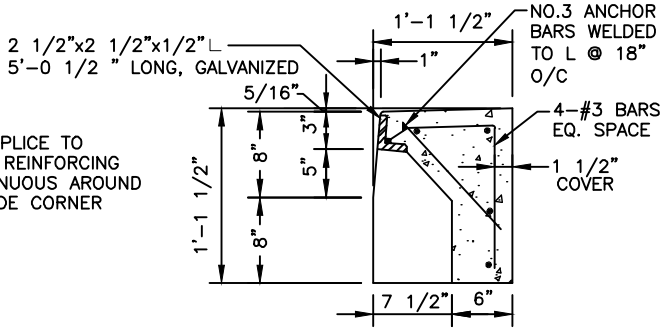
PLAN
PRECAST CURB



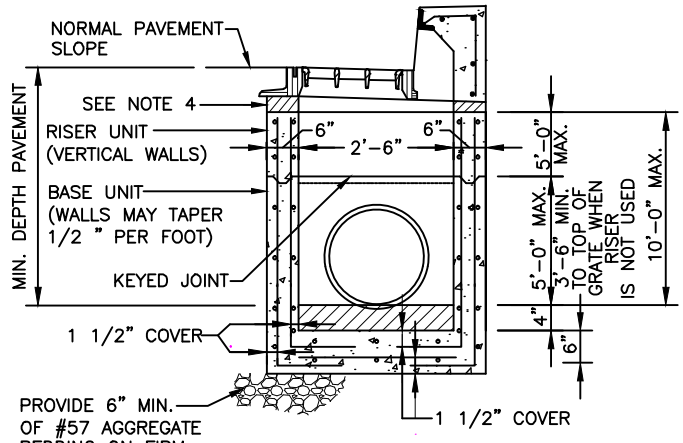
SECTION A-A



FRONT ELEVATION
PRECAST CURB



SECTION C-C
PRECAST CURB



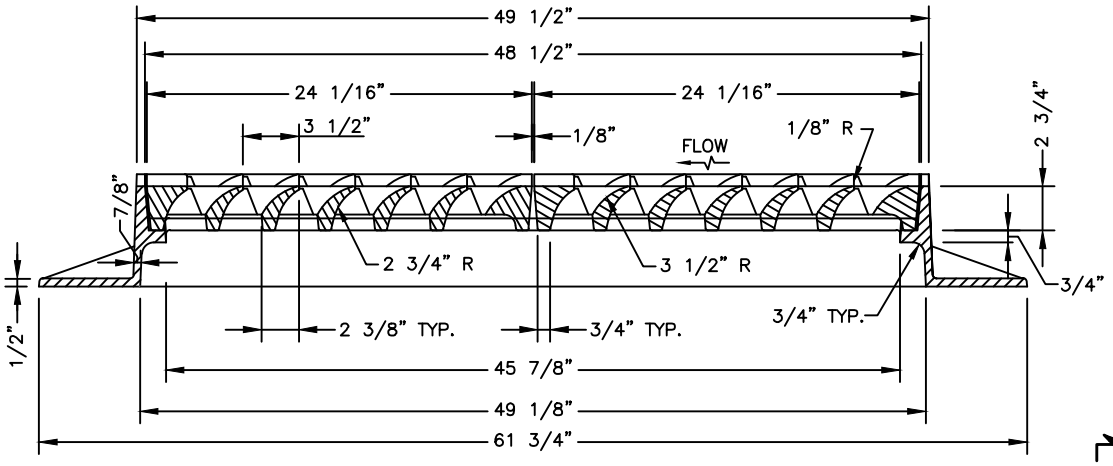
SECTION B-B

NOTES

1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS.
2. CONCRETE TO BE MIX #6 (4500 PSI).
3. REINFORCING-2 LAYERS OF 4x4-W4.0xW4.0 WELDED WIRE FABRIC.
4. THREADED PLASTIC INSERTS TO BE PROVIDED FOR HANDING.
5. GRADE AND SLOPE ADJUSTMENTS TO BE COMPLETED IN THE FIELD USING CONCRETE MIX #6.
6. PIPE OPENINGS TO BE PROVIDED AS REQUIRED. FOR SIZE, LOCATION, AND INVERT ELEVATIONS REFER TO THE PLANS.
7. PLACEMENT OF SUBGRADE DRAINAGE WILL BE AS DIRECTED BY THE ENGINEER OR AS NOTED ON THE CONSTRUCTION PLANS.

7/17/2015 DRAFT

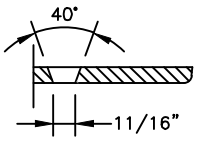
Revised 1 X/XX/2015 Approved 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	TYPE 'E' COMBINATION INLET	Detail 1 D-4.22



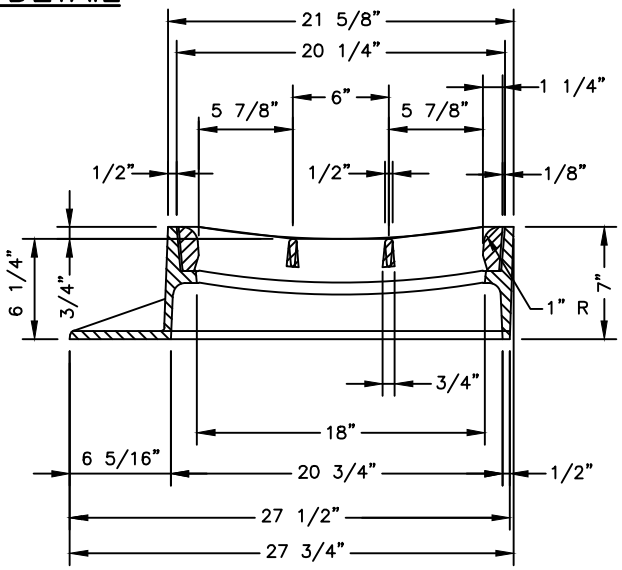
SECTION A–A

NOTES

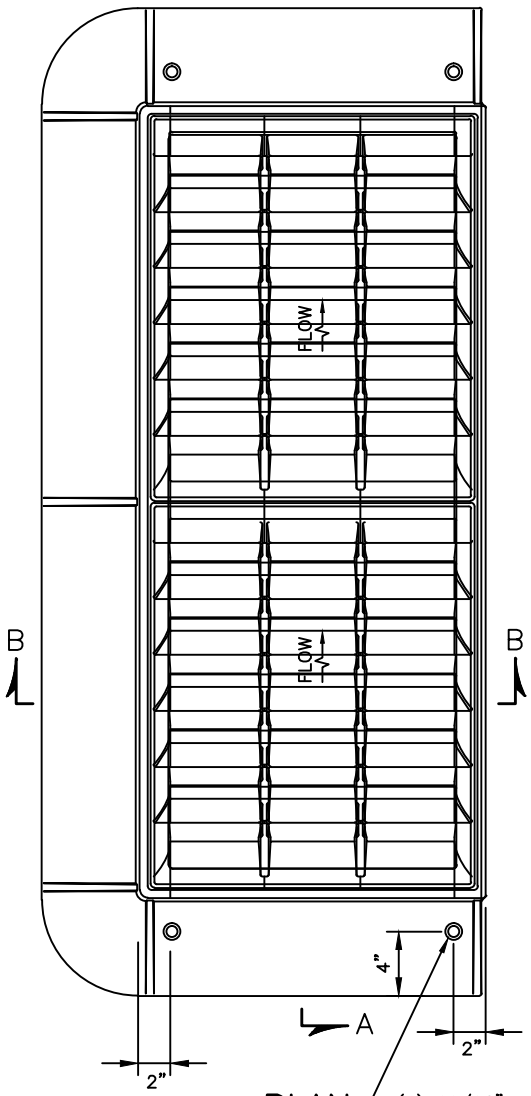
1. FRAME AND GRATE HAVE A RADIAL SEAT OF 52 7/8 " RADIUS
2. TOP OF FRAME ALSO HAS RADIUS OF 52 7/8" RADIUS
3. TOP OF GRATE HAS FLAT SURFACES WHICH CLOSELY MATCH THE RADIUS OF THE FRAME.
4. MATERIAL: CAST GRAY IRON ASTM A48, CLASS 35B
5. FINISH: NOT PAINTED
6. FRAMES TO BE CAST WITH FLANGE CUT, AS SHOWN, WHEN INLET TO BE PLACED ADJACENT TO CURB OPENING.



ANCHOR BOLT HOLE DETAIL



SECTION B–B



PLAN

(4) 11/16" ANCHOR BOLT HOLES (SEE DETAIL THIS SHEET)

7/17/2015

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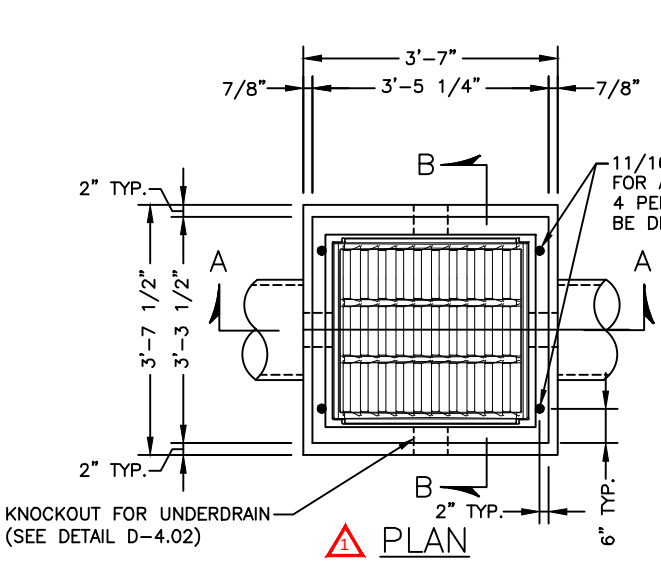
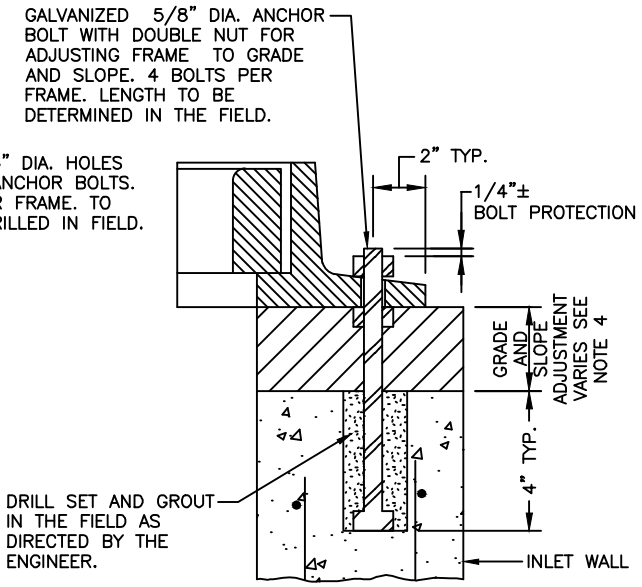
Revised 1 X/XX/2015 Approved 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	TYPE 'E' INLET Frame & Grate

Detail 1

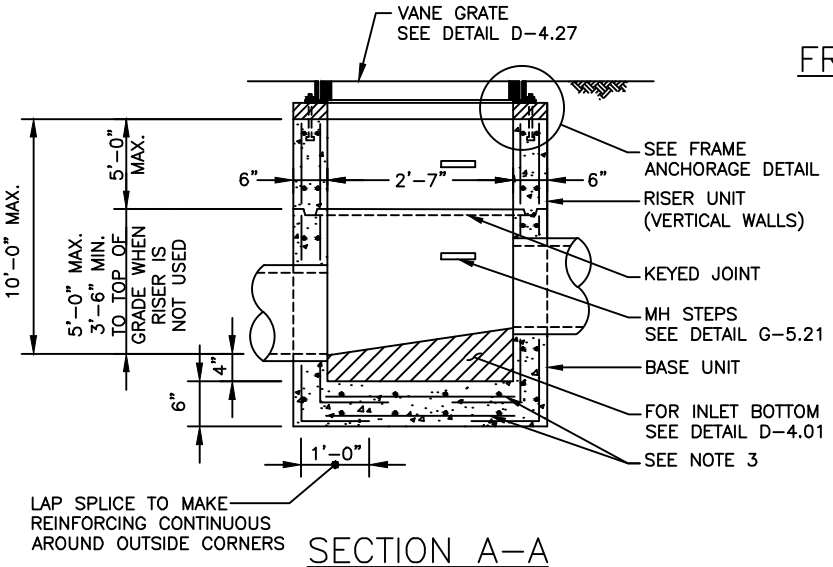
D-4.23



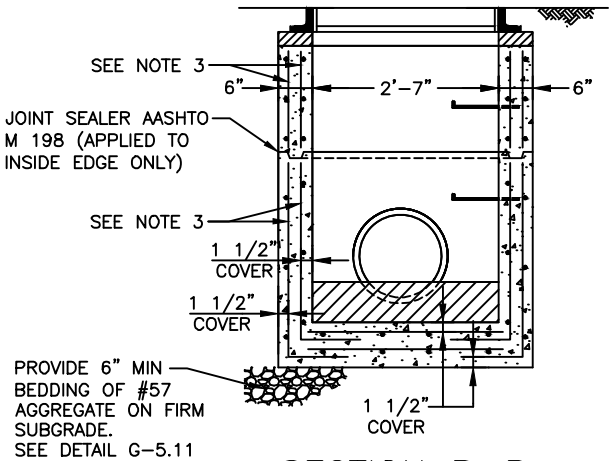
1 PLAN



FRAME ANCHORAGE DETAIL



SECTION A-A



SECTION B-B

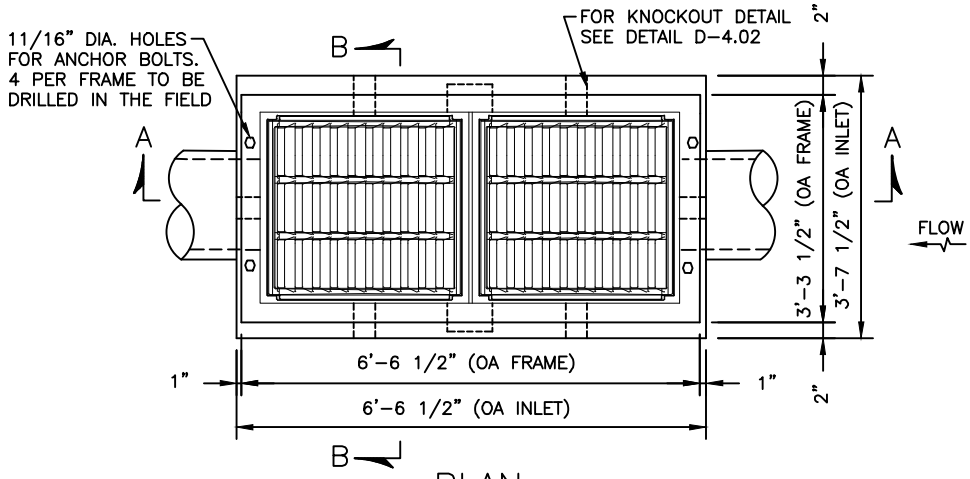
NOTES:

1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS.
2. CONCRETE TO BE MIX #6 (4500PSI).
3. REINFORCING-2 LAYERS OF 4x4 W4.0XW4.0 WELDED WIRE FABRIC.

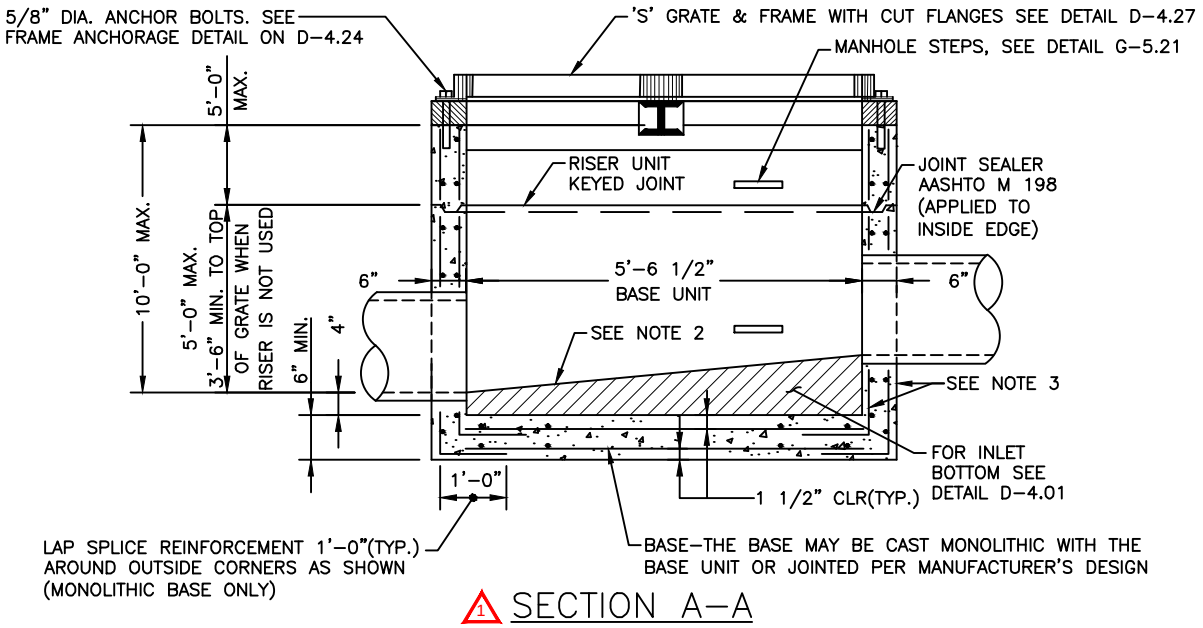
7/17/2015

DRAFT

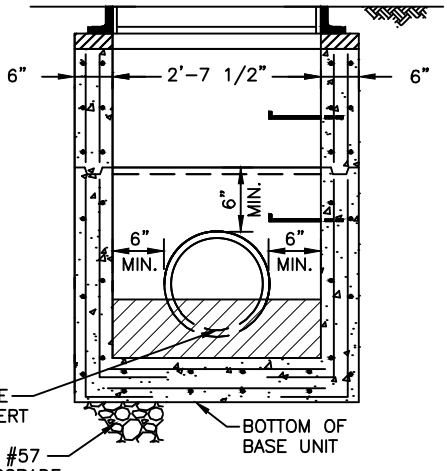
Revised 1 X/XX/2015 Approved 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	TYPE 'S' INLET	Detail 1 D-4.24



PLAN



1 SECTION A-A



SECTION B-B 1

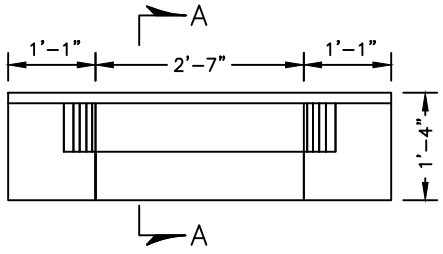
NOTES 1

1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS.
2. CONCRETE TO BE MIX #6 (4500 PSI).
3. REINFORCING-2 LAYERS OF 4x4-W4.0xW4.0 WELDED WIRE FABRIC.

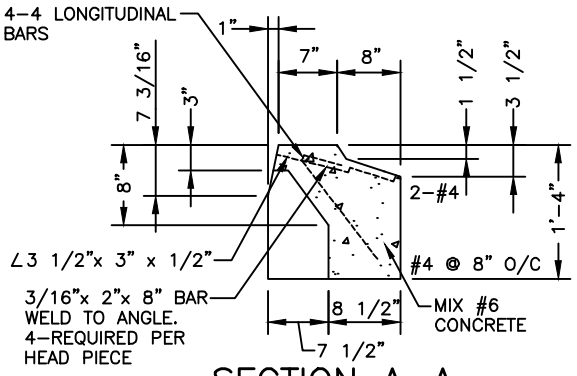
7/17/2015

DRAFT

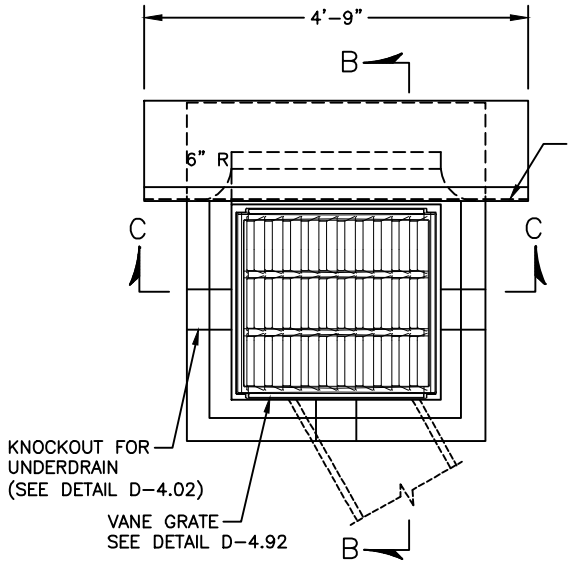
Revised 1 X/XX/2015 Approved 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	DOUBLE TYPE 'S' INLET	Detail 1 D-4.25



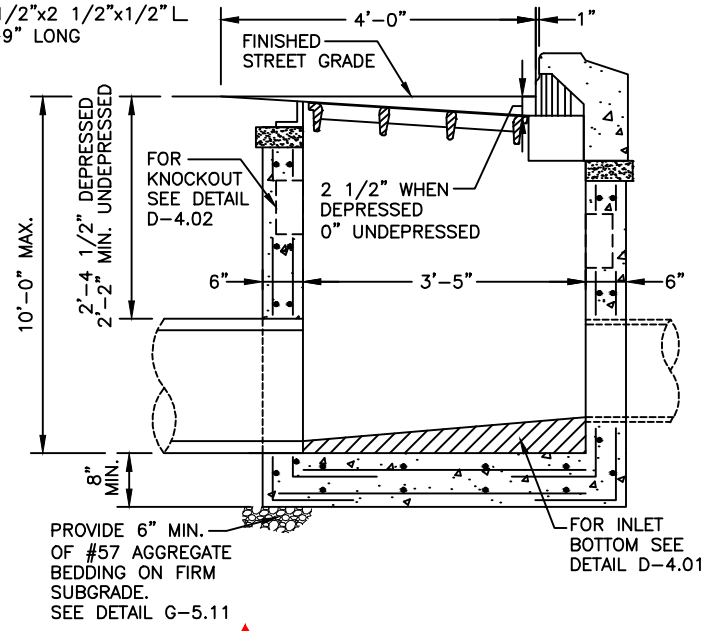
1 CONCRETE HEAD PIECE



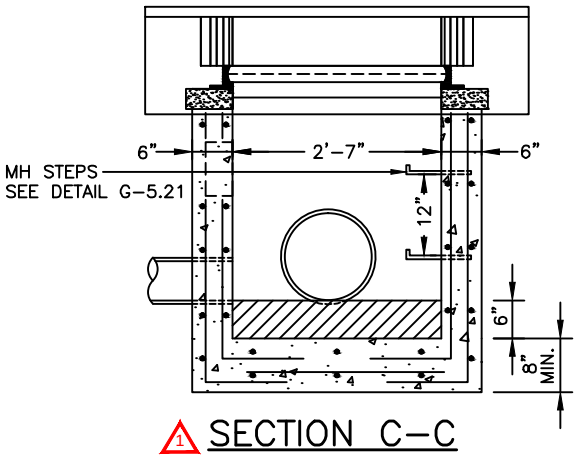
SECTION A-A



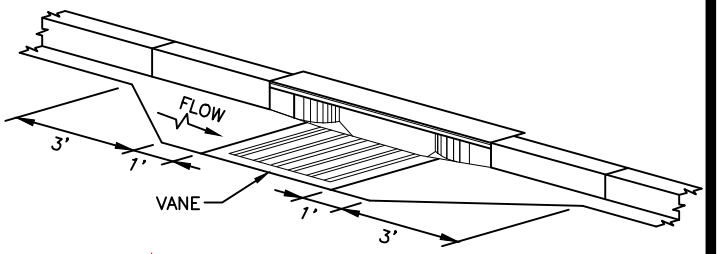
1 PLAN



1 SECTION B-B



1 SECTION C-C



1 PERSPECTIVE VIEW

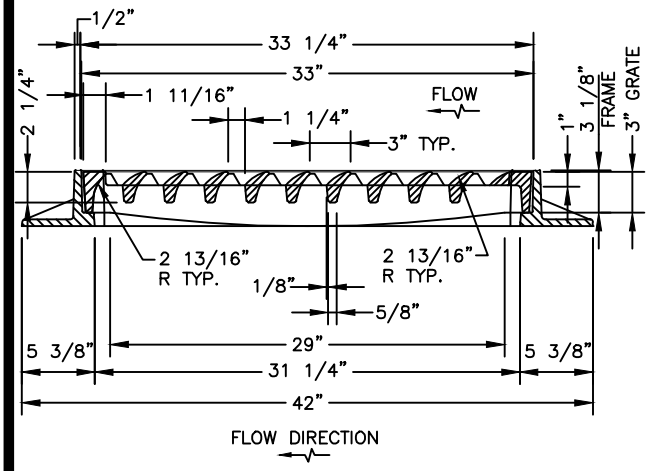
DEPRESSED INLET (SEE INLET DEPRESSION DETAIL)

NOTES 1

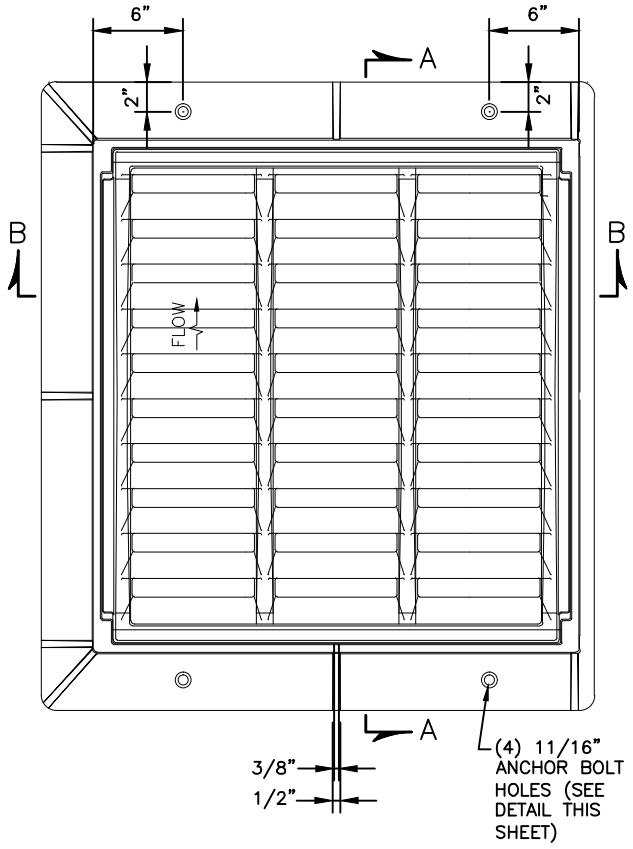
1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS.
2. CONCRETE TO BE MIX #6 (4500 PSI).
3. REINFORCING-2 LAYERS OF 4x4-W4.0xW4.0 WELDED WIRE FABRIC.

7/17/2015 DRAFT

Revised	Howard County, Maryland Department of Public Works	TYPE 'S' COMBINATION INLET	Detail 1
1 X/XX/2015			D-4.26
Revised 5/7/2007	Approved: N:\13767\Final Volume 4\signature.bmp		
Approved	Chief, Bureau of Engineering		



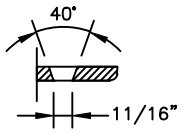
SECTION A–A



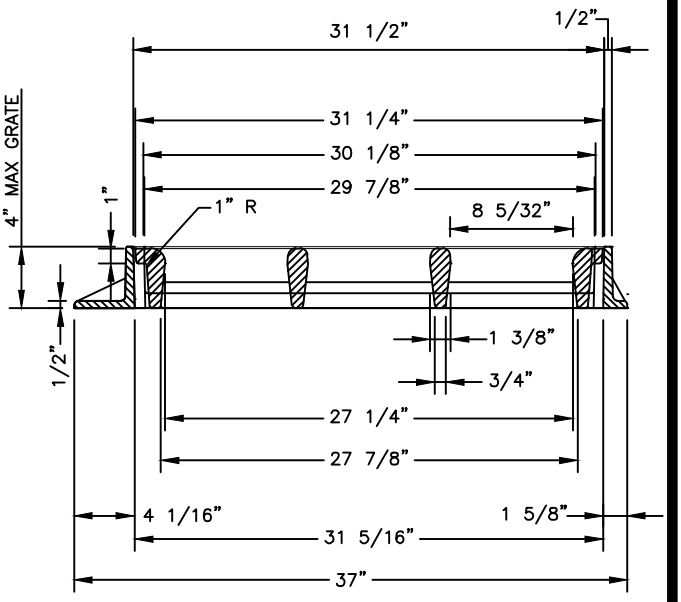
PLAN

NOTES

1. MATERIAL: CAST GRAY IRON ASTM A48, CLASS 35B
2. FINISH: NO PAINT
3. WEIGHT (MIN): FRAME 163#, GRATE 295#
4. FRAMES TO BE CAST WITH FLANGE CUT, AS SHOWN, WHEN INLET TO E PLACED ADJACENT TO CURB OPENING.
5. CONTRACTOR IS RESPONSIBLE FOR CORRECT ORIENTATION OF THE CV–GRATE TOWARD THE DIRECTION OF FLOW. MANUFACTURER TO VERIFY THAT FRAME IS DESIGNED FOR HS–25 LOADING.



ANCHOR BOLT HOLE DETAIL

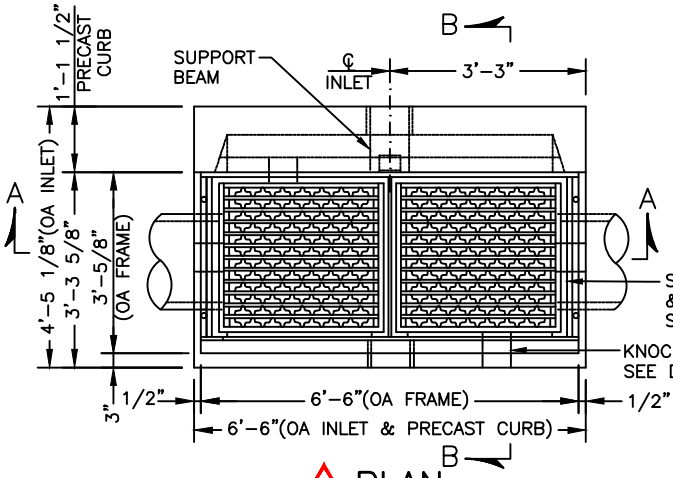


SECTION B–B

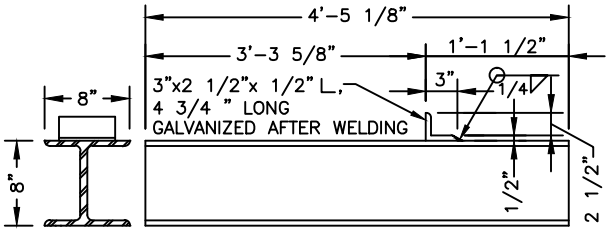
7/17/2015

DRAFT

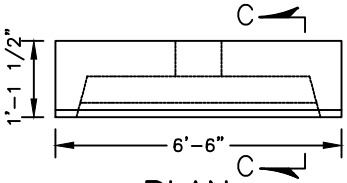
Revised 1 X/XX/2015 Approved 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	TYPE 'S' INLET Vane Grate	Detail 1 D-4.27



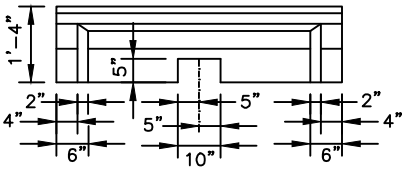
1 PLAN



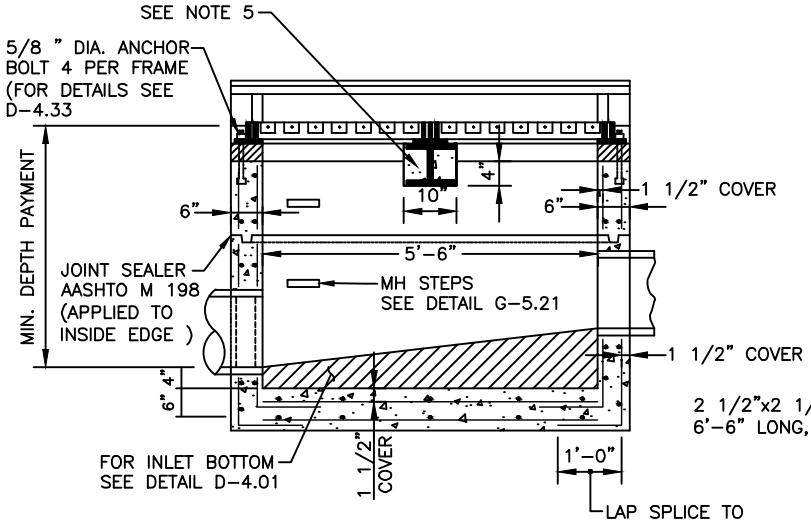
SUPPORT BEAM
W8x31 (GALVANIZED)



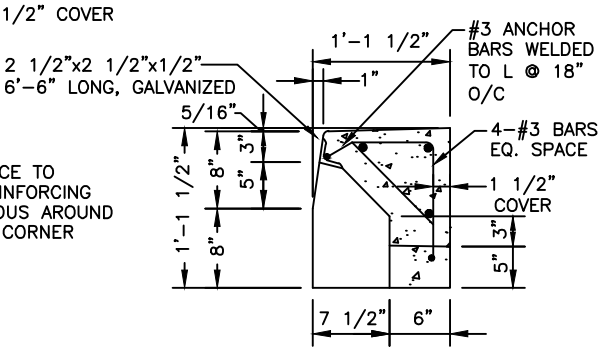
PLAN
PRECAST CURB



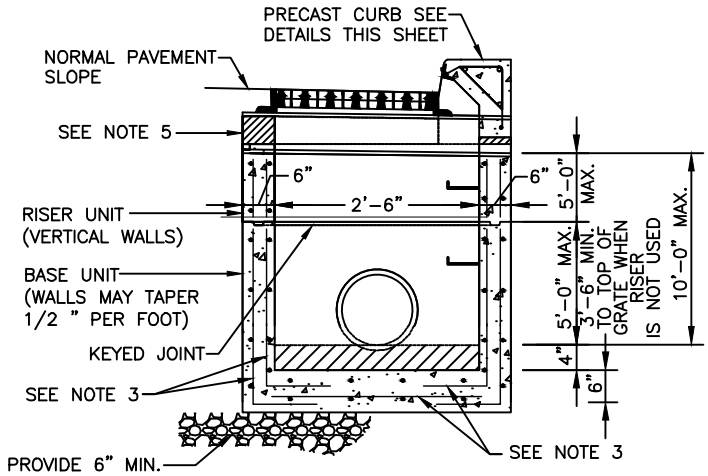
FRONT ELEVATION
PRECAST CURB



1 SECTION A-A



SECTION C-C



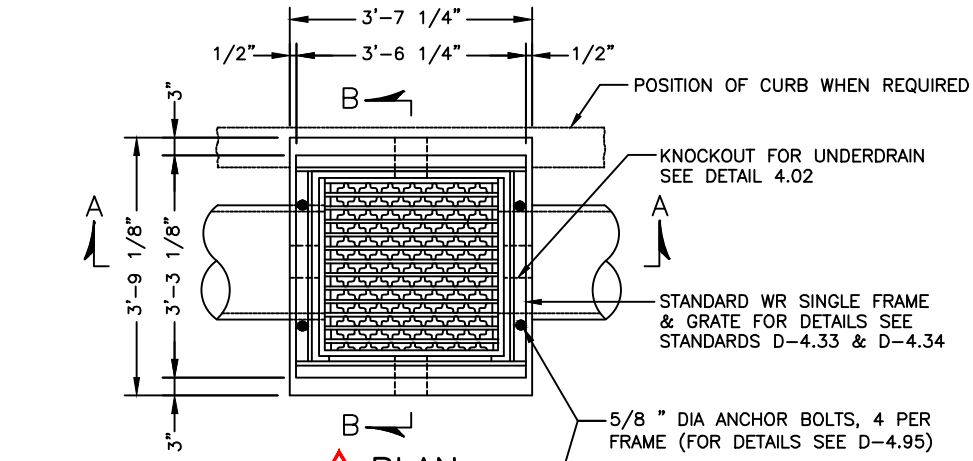
SECTION B-B 1

NOTES

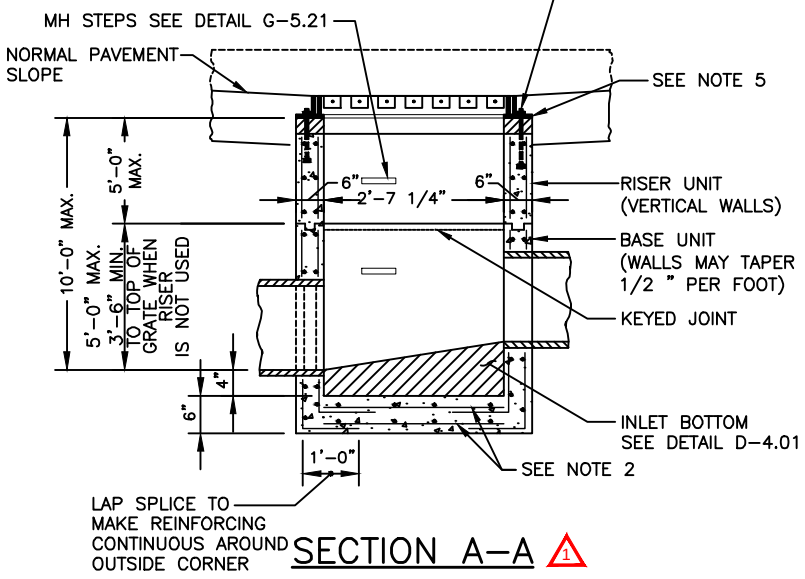
1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS
2. CONCRETE TO BE MIX NO.6 (4500PSI).
3. REINFORCING-2 LAYERS OF 4X4-W4.0 X 4.0 WELDED WIRE FABRIC.
4. THREADED PLASTIC INSERTS TO BE PROVIDED FOR HANDLING.
5. GRADE AND SLOPE ADJUSTMENTS COMPLETED IN THE FIELD USING CONCRETE MIX #6.
6. PIPE OPENINGS TO BE PROVIDED AS REQUIRED. FOR SIZE, LOCATION, AND INVERT ELEVATIONS REFER TO CONSTRUCTION PLANS. SEE DETAIL D-4.02 FOR THE KNOCKOUT DETAIL.
7. PLACEMENT OF SUBGRADE DRAINAGE WILL BE AS DIRECTED BY THE ENGINEER OR AS NOTED ON THE CONSTRUCTION PLAN.
8. MINIMUM DEPTH PAYMENT PER "EACH" INLET INCLUDES DEPTHS UP TO 3'-6". VERTICAL DEPTH PAYMENT PER LINEAR FOOT FOR DEPTHS IN EXCESS OF 3'-6".

7/17/2015 DRAFT

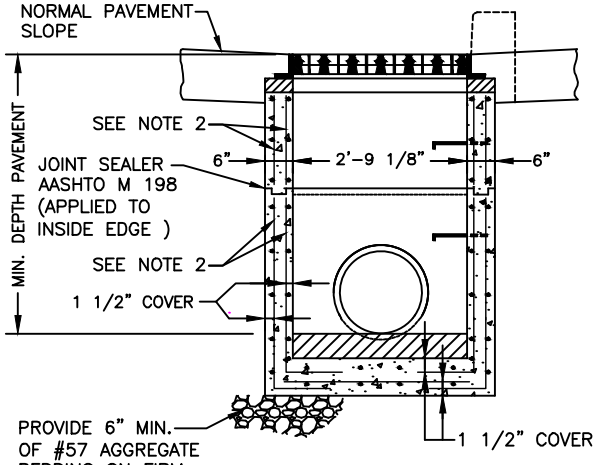
Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signaturebmp Chief, Bureau of Engineering	DOUBLE WR INLET Precast	Detail 1 D-4.31



1 PLAN



SECTION A-A 1



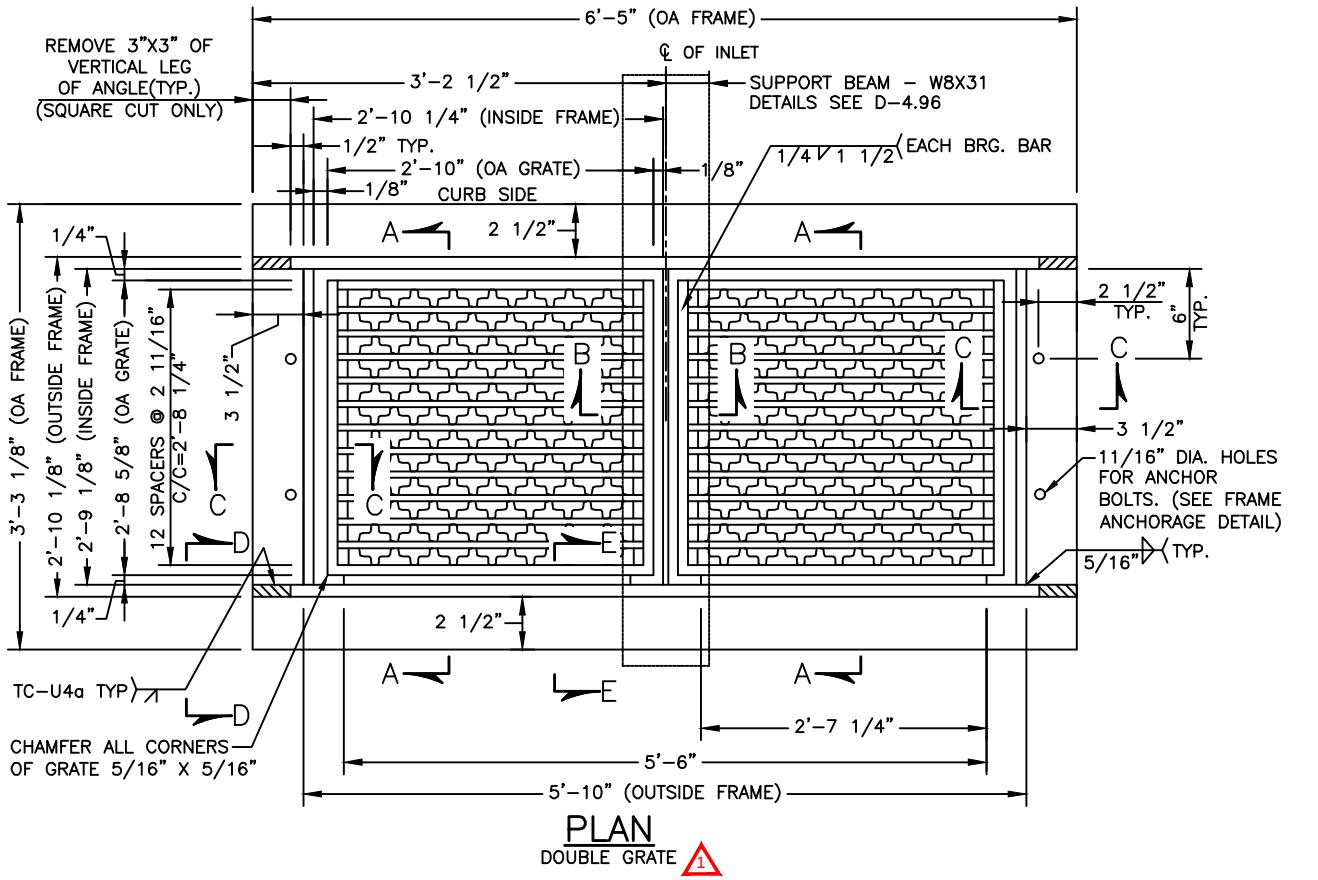
SECTION B-B 1

NOTES

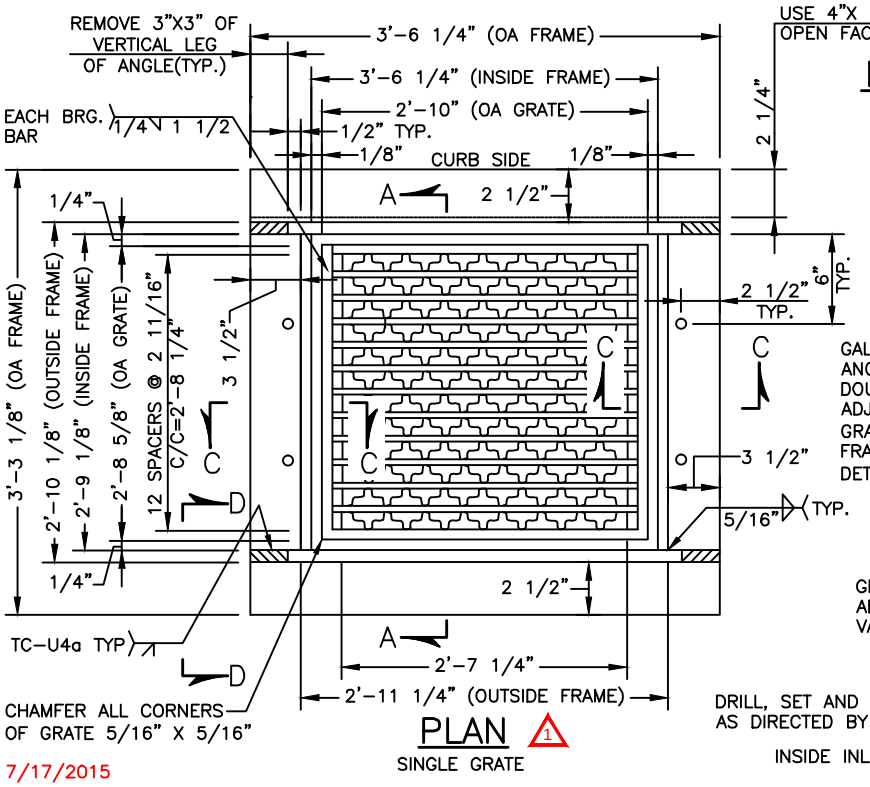
1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS
2. CONCRETE TO BE MIX NO.6 (4500PSI).
3. REINFORCING-2 LAYERS OF 4X4-W4.0 X 4.0 WELDED WIRE FABRIC.
4. THREADED PLASTIC INSERTS TO BE PROVIDED FOR HANDLING.
5. GRADE AND SLOPE ADJUSTMENTS COMPLETED IN THE FIELD USING CONCRETE MIX #6.
6. PIPE OPENINGS TO BE PROVIDED AS REQUIRED. FOR SIZE, LOCATION, AND INVERT ELEVATIONS REFER TO CONSTRUCTION PLANS. SEE DETAIL D-4.02 FOR THE KNOCKOUT DETAIL.
7. PLACEMENT OF SUBGRADE DRAINAGE WILL BE AS DIRECTED BY THE ENGINEER OR AS NOTED ON THE CONSTRUCTION PLAN.
8. MINIMUM DEPTH PAYMENT PER "EACH" INLET INCLUDES DEPTHS UP TO 3'-6". VERTICAL DEPTH PAYMENT PER LINEAR FOOT FOR DEPTHS IN EXCESS OF 3'-6".

7/17/2015 DRAFT

Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signaturebmp Chief, Bureau of Engineering	SINGLE WR INLET Precast	Detail 1 D-4.32



PLAN
DOUBLE GRATE 1

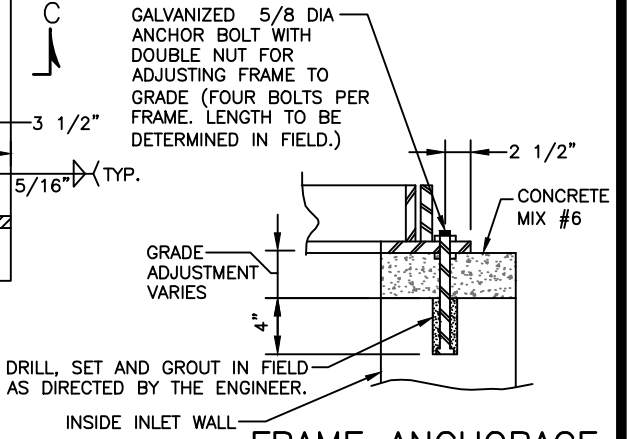


PLAN
SINGLE GRATE 1

USE 4"X 1/2" FLAT BAR WHEN OPEN FACED CURB IS USED

NOTES

1. FRAMES & GRATES TO BE SQUARE, FLAT AND TRUE.
2. STRUCTURAL STEEL SHALL BE ASTM A36.
3. FRAMES AND GRATES TO BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
4. GRADE AND SLOPE ADJUSTMENTS COMPLETED IN THE FIELD USING CONCRETE MIX #6.
5. FOR SECTIONS SEE DETAIL D-4.34.

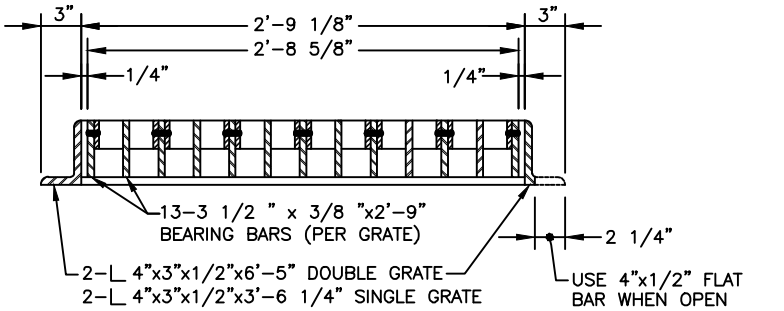


FRAME ANCHORAGE DETAIL

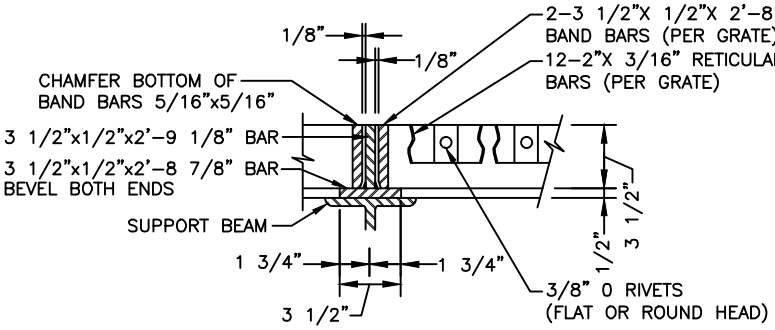
7/17/2015

DRAFT

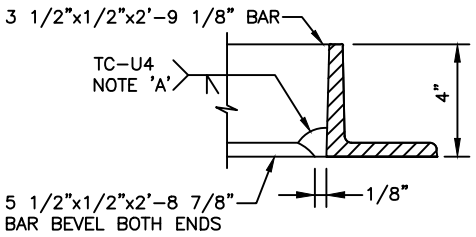
Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signatures.bmp Chief, Bureau of Engineering	WR INLET Frame, Grate & Anchorage	Detail 1 D-4.33



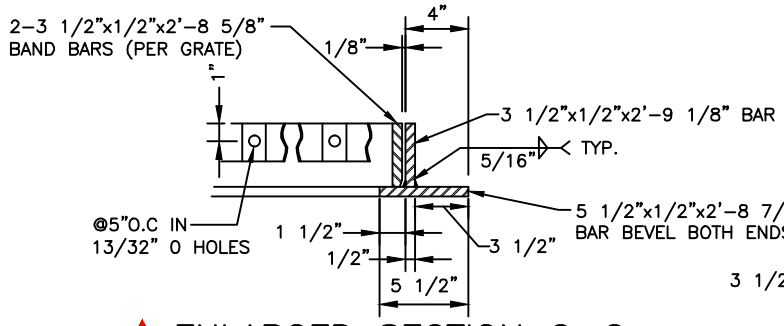
1 ENLARGED SECTION A-A



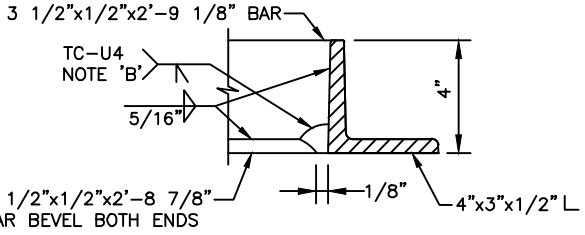
1 ENLARGED SECTION B-B



ENLARGED SECTION D-D

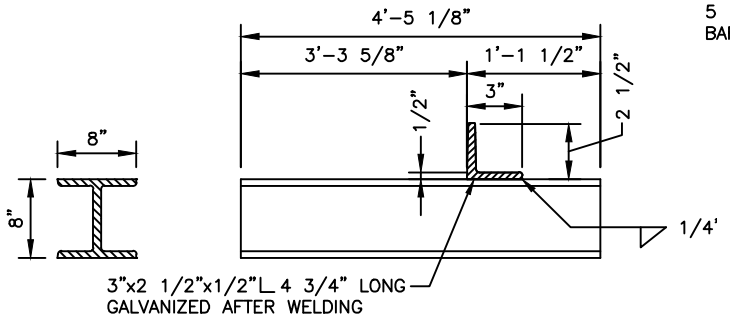


1 ENLARGED SECTION C-C



ENLARGED SECTION E-E

(SHOWN WITHOUT GRATE)



SUPPORT BEAM

W8x31 (GALVANIZED)

NOTE 'A': WELD 5 1/2"x1/2" BAR TO 4"x3"x1/2" BEFORE WELDING 3 1/2"x1/2" BAR

NOTE 'B': WELD 3 1/2"x1/2"x2'-8 7/8" BAR TO 4"x3"x1/2"L BEFORE WELDING 3 1/2"x1/2"x2'-9 1/8" BAR

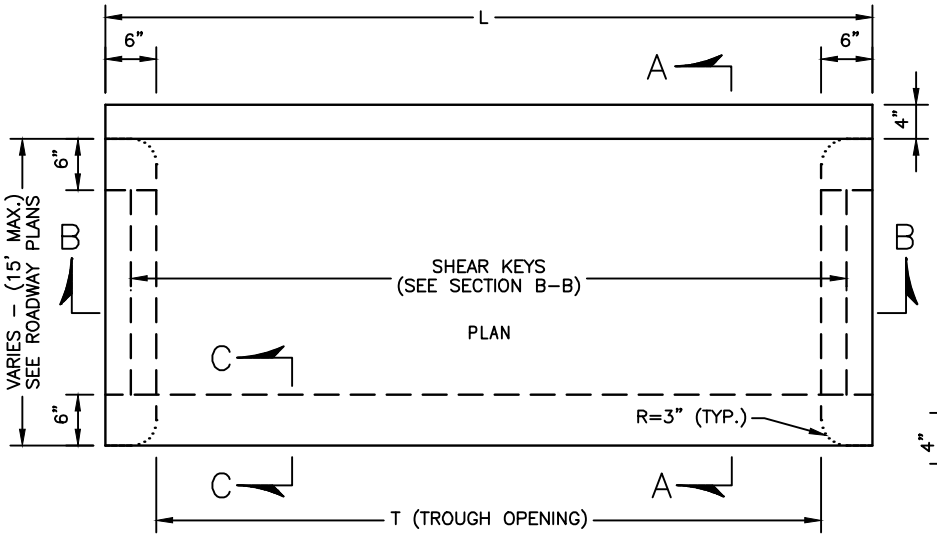
MATERIAL: STRUCTURAL STEEL ASTM A36, GALVANIZED AFTER FABRICATION

7/17/2015

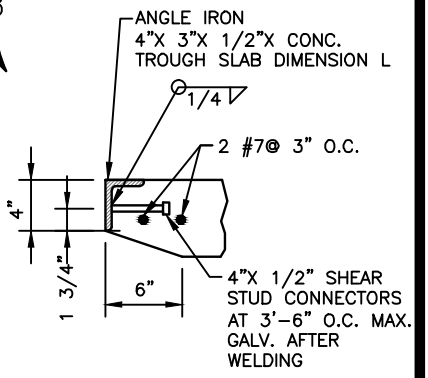
DRAFT

1 NOTE: FOR PLANS SEE DETAIL D-4.33

Revised	Howard County, Maryland	WR INLET	Detail 1
1 X/XX/2015	Department of Public Works	Frame, Grate & Support	D-4.34
Revised 5/7/2007 Approved	Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering		

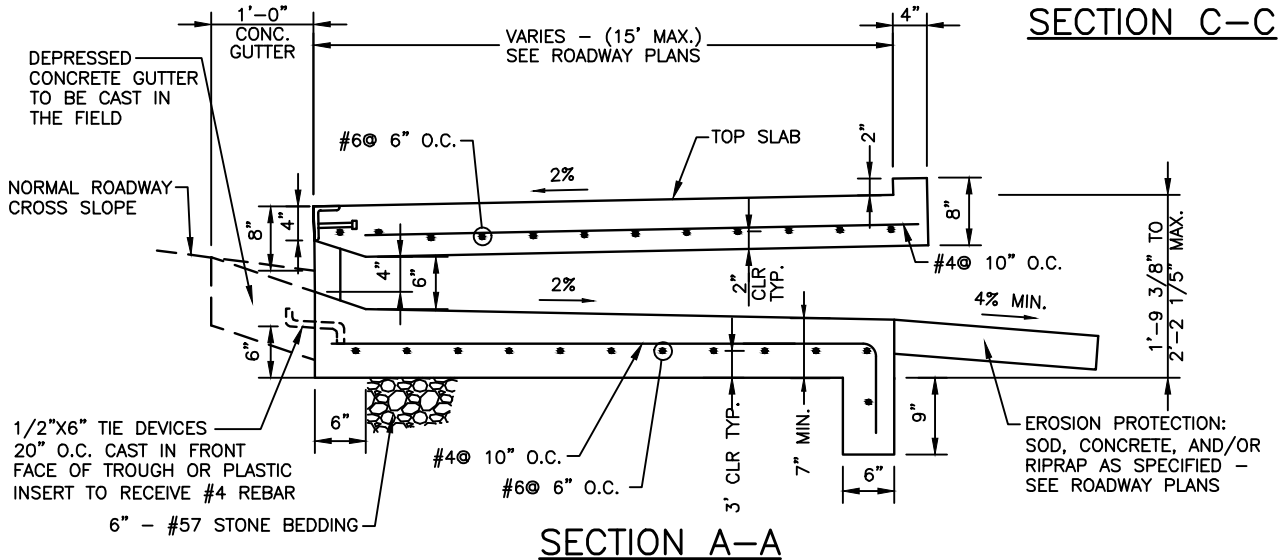


SLAB TYPE	L	T
I	6'–0"	5'–0"
II	11'–0"	10'–0"



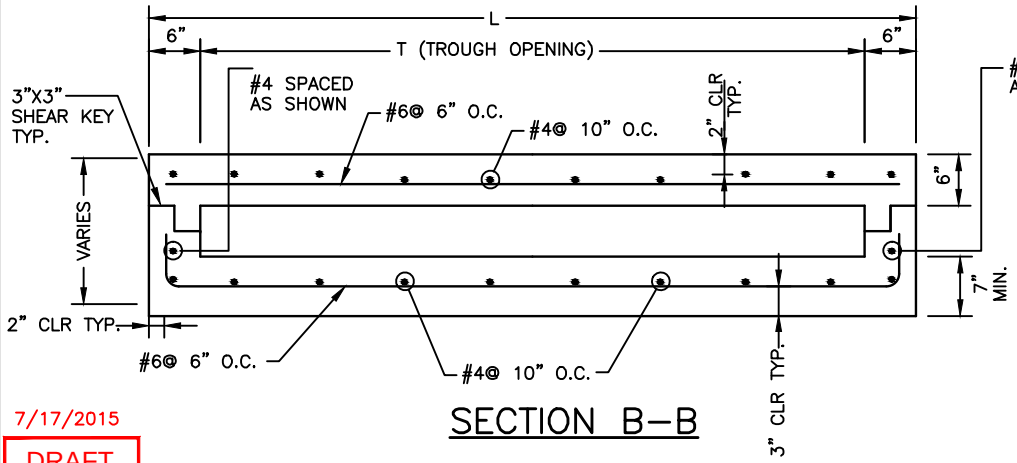
PRECAST CONCRETE TOP SLAB

NOTE: FOR 6" CURB SEE NOTE 4 BELOW.



SECTION C–C

SECTION A–A



SECTION B–B

NOTES

1. CONCRETE SHALL BE MIX #6 (4500 PSI).
2. REINFORCEMENT STEEL SHALL MEET THE REQUIREMENTS OF ASTM A615, GRADE 60.
3. ANGLE IRON AND SHEAR STUD CONNECTORS SHALL BE GALVANIZED AFTER WELDING IN ACCORDANCE WITH ASTM A 123.
4. EROSION PROTECTION TO BE PAID FOR SEPARATELY.

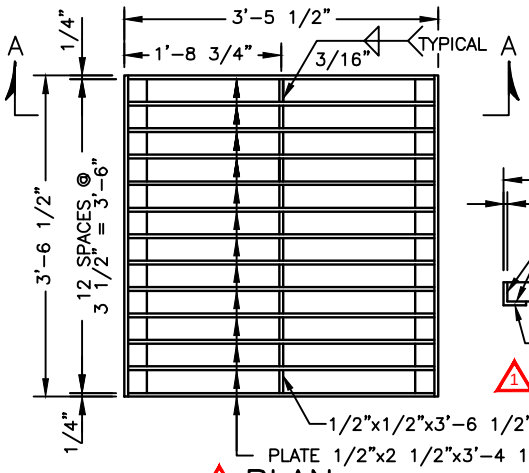
7/17/2015

DRAFT

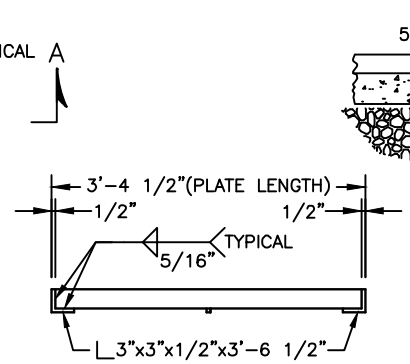
Revised / Revised X/XX/2015 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	INLET Flow Through	Detail D–4.35

NOTES 1

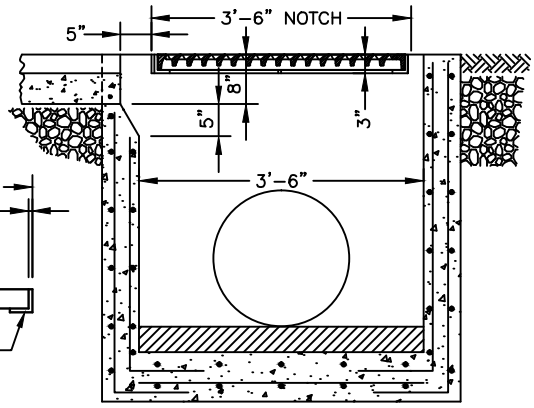
1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS.
2. CONCRETE TO BE MIX #6 (4500PSI).
3. REINFORCING:
   - WALL – 2 LAYERS OF 4X4-W4.0XW4.0 WELDED WIRE FABRIC.
   - BASE – 2 LAYERS OF 4X4-W5.0XW5.0 WELDED WIRE FABRIC.
4. THREADED PLASTIC INSERTS TO BE PROVIDED FOR HANDLING.
5. PIPE OPENINGS TO BE PROVIDED AS REQUIRED. FOR SIZE, LOCATION, AND INVERT ELEVATIONS, REFER TO CONSTRUCTION PLANS.
6. GRATE TO BE SHOWN AND GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
7. THIS INLET MAY BE USED IN MEDIAN DITCHES AND ANY DITCH BEYOND THE SHOULDER AREA. THIS INLET IS NOT TO BE USED IN ROADWAY OR SHOULDER PAVEMENT AREAS OR WHERE BICYCLE OR MOTORCYCLE TRAFFIC IS ANTICIPATED AND NOR USED IN RESIDENTIAL AREAS.



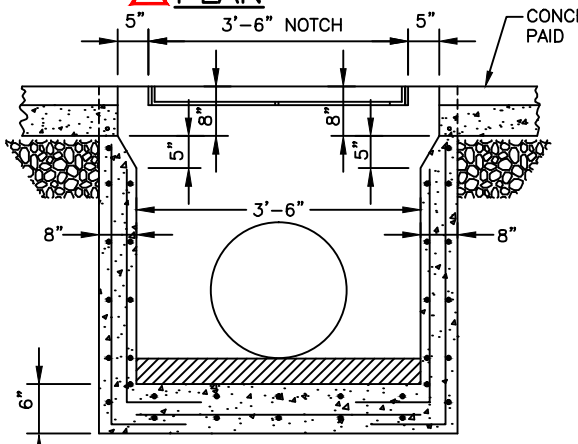
1 PLAN



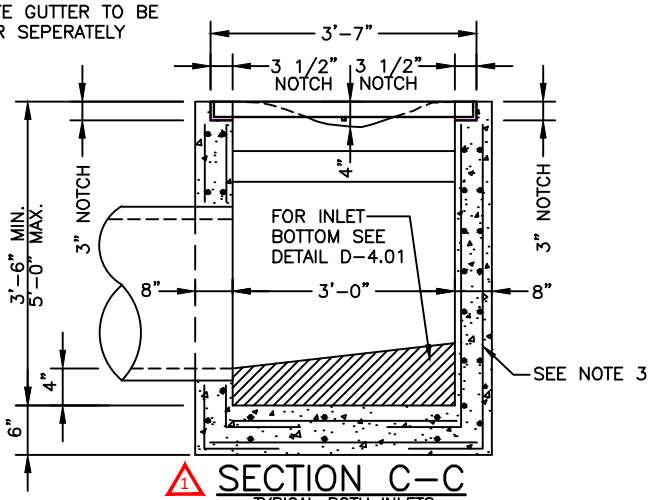
1 SECTION A-A



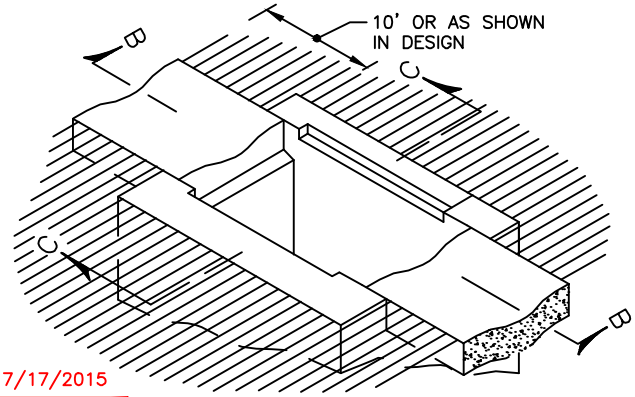
1 SECTION B-B
SINGLE OPENING



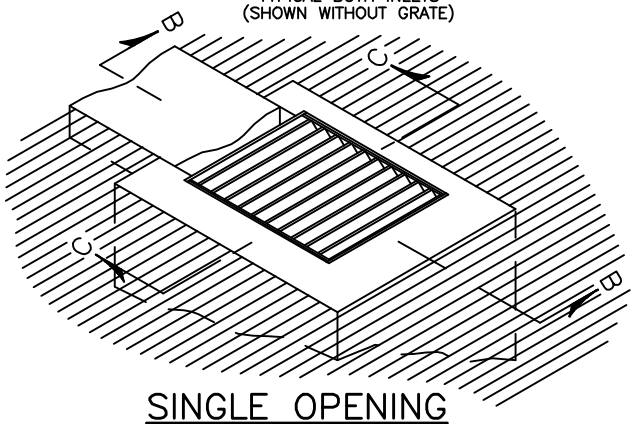
1 SECTION B-B DOUBLE OPENING



1 SECTION C-C
TYPICAL BOTH INLETS
(SHOWN WITHOUT GRATE)



DOUBLE OPENING
(SHOWN WITHOUT GRATE)

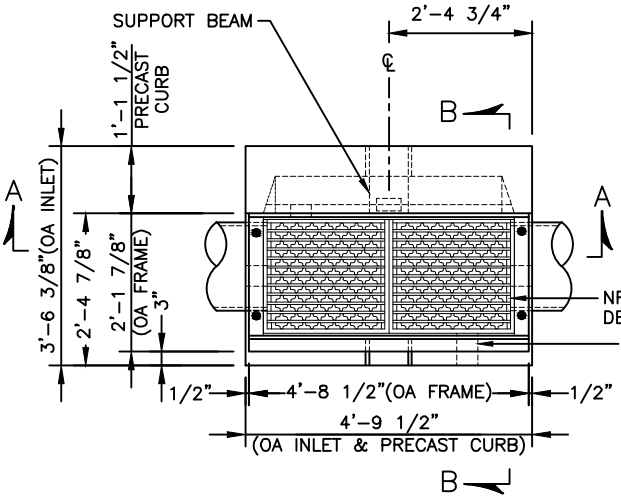


SINGLE OPENING

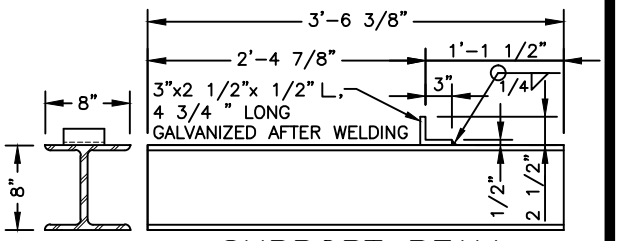
7/17/2015

DRAFT

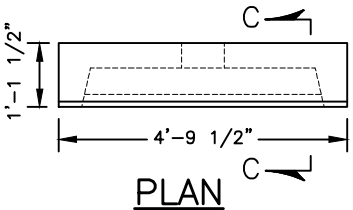
Revised 1 X/XX/2015 Approved 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signatures.bmp Chief, Bureau of Engineering	OPEN END GRATE Precast	Detail D-4.36



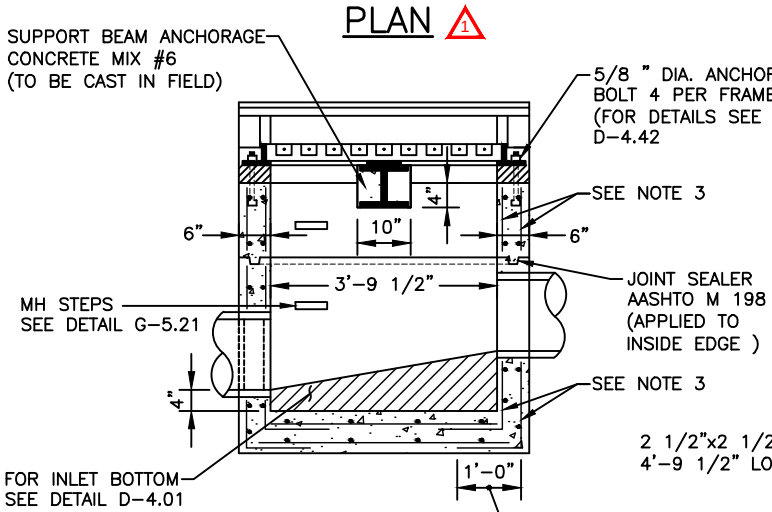
PLAN 1



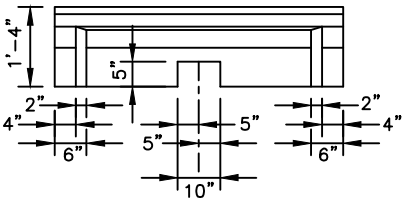
SUPPORT BEAM
W8x31 (GALVANIZED)



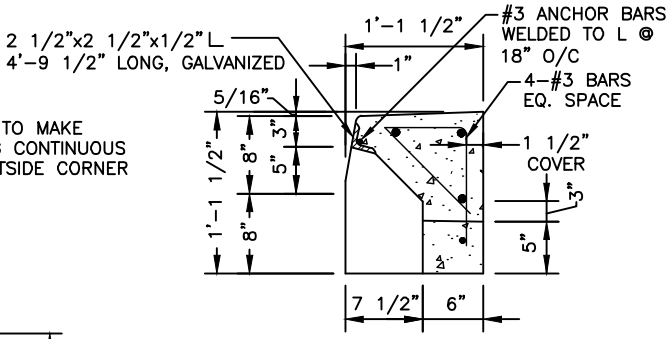
PLAN
PRECAST CURB



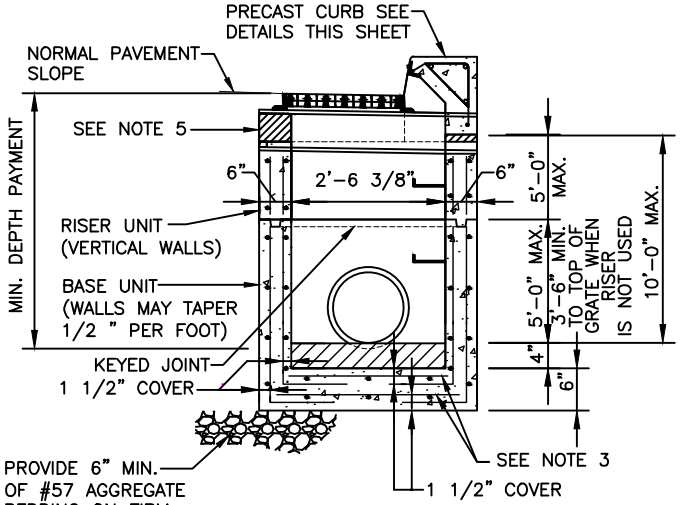
1 SECTION A-A



FRONT ELEVATION
(PRECAST CURB)



SECTION C-C



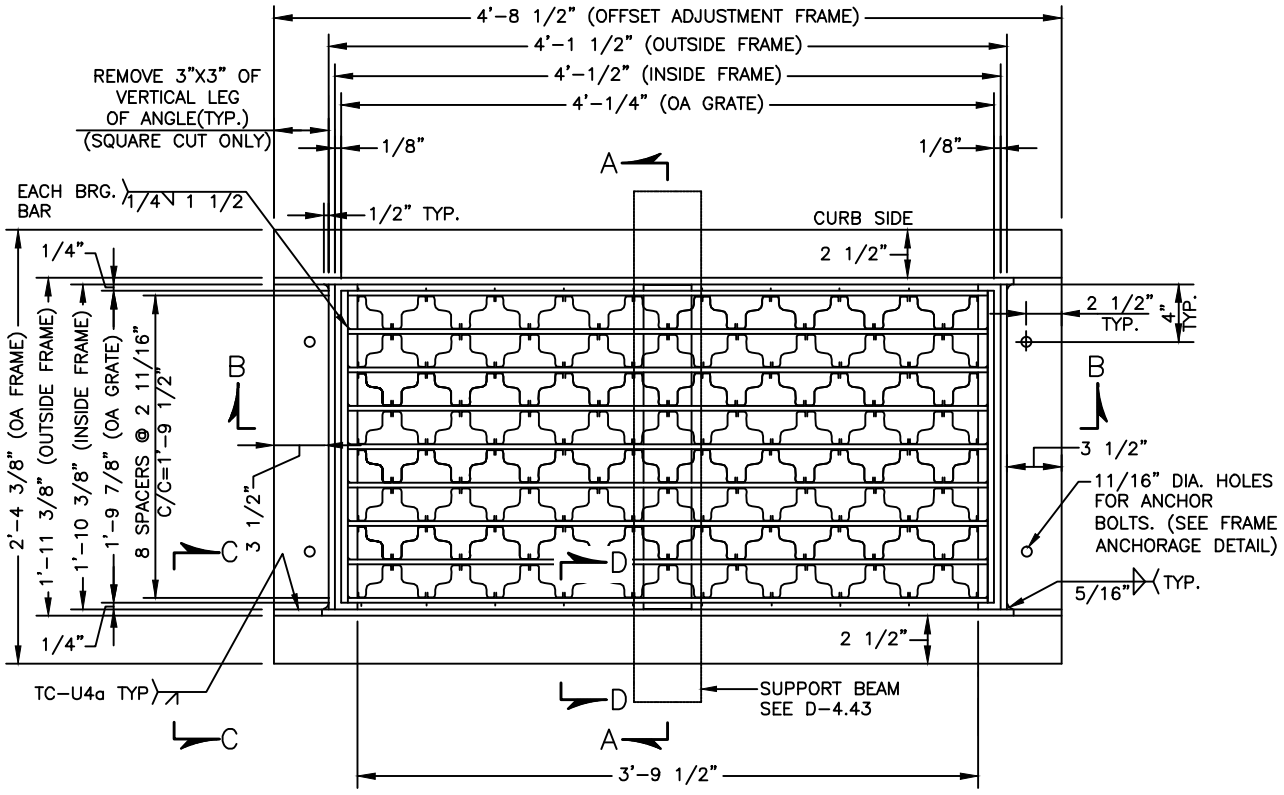
1 SECTION B-B

NOTES 1

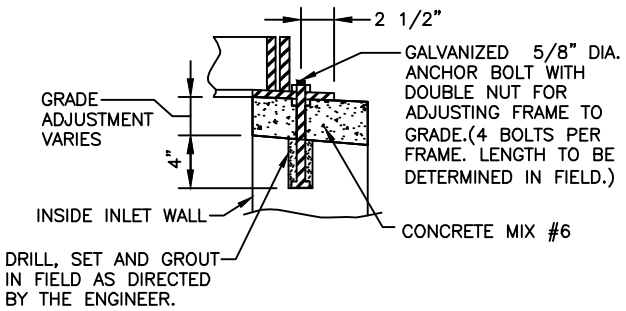
1. SEE DETAIL D-4.01 FOR GENERAL NOTES APPLICABLE TO ALL STORM DRAIN INLETS
2. CONCRETE TO BE MIX #6 (4500PSI).
3. REINFORCING: COVER SHALL BE 1 1/2" FROM BOTH SIDES.
   - WALL - 2 LAYERS OF 4X4-W4.0XW4.0 WELDED WIRE FABRIC.
   - BASE - 2 LAYERS OF 4X4-W6.0XW6.0 WELDED WIRE FABRIC.
4. THREADED PLASTIC INSERTS TO BE PROVIDED FOR HANDLING.
5. GRADE AND SLOPE ADJUSTMENTS COMPLETED IN THE FIELD USING CONCRETE MIX #6.
6. PIPE OPENINGS TO BE PROVIDED AS REQUIRED. FOR SIZE, LOCATION, AND INVERT ELEVATIONS REFER TO CONSTRUCTION PLANS. SEE DETAIL D-4.02 FOR THE KNOCKOUT DETAIL.
7. PLACEMENT OF SUBGRADE DRAINAGE WILL BE AS DIRECTED BY THE ENGINEER OR AS NOTED ON THE CONSTRUCTION PLAN.

7/17/2015 DRAFT

Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	NR INLET Precast	Detail 1 D-4.41



1 PLAN



FRAME ANCHORAGE DETAIL

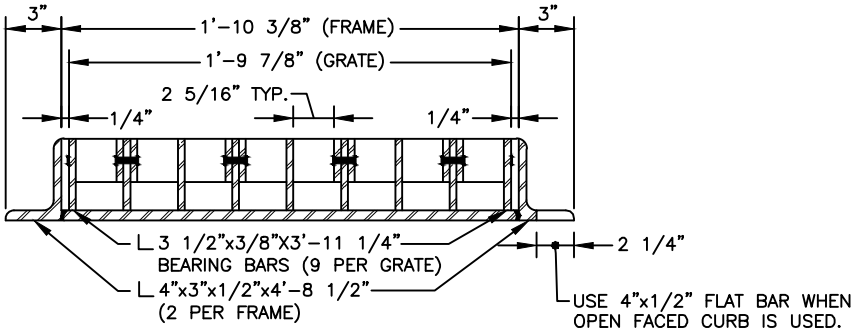
NOTES

1. FRAMES & GRATES TO BE SQUARE, FLAT AND TRUE.
2. STRUCTURAL STEEL SHALL BE ASTM A36.
3. FRAMES AND GRATES TO BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
4. SEE LATEST SHA SPECIFICATIONS
1 5. FOR SECTIONS SEE DETAIL D-4.43.

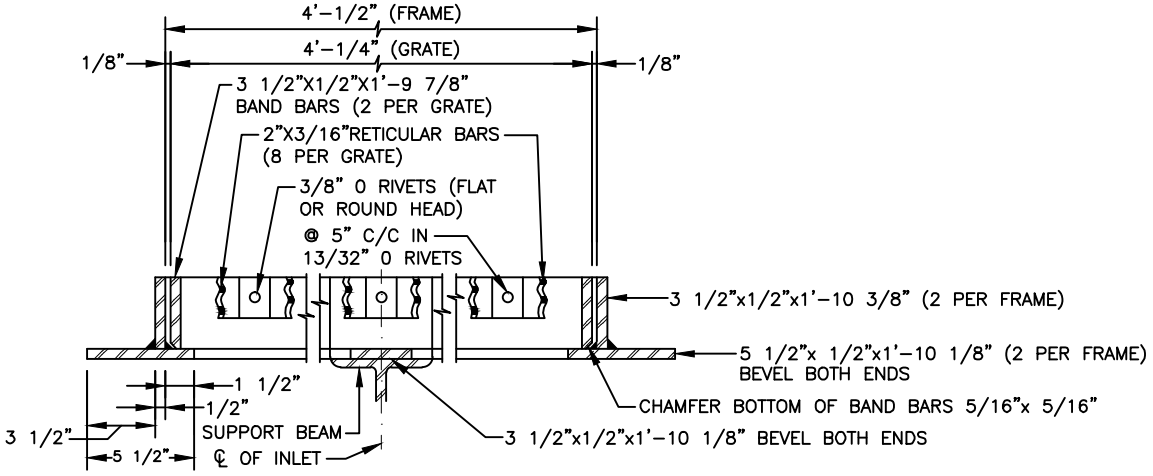
7/17/2015

DRAFT

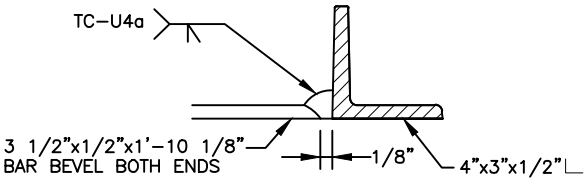
Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	NR INLET Frame, Grate & Anchorage	Detail 1 D-4.42



1 ENLARGED SECTION A–A

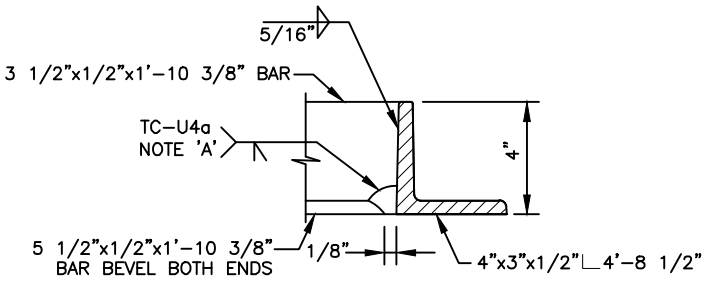


1 ENLARGED SECTION B–B



ENLARGED SECTION D–D

(SHOWN WITHOUT GRATE)

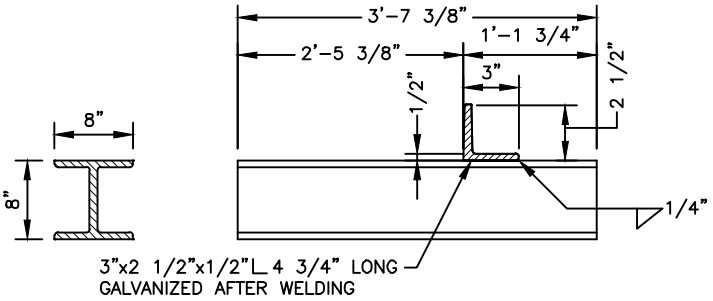


ENLARGED SECTION C–C

NOTE 'A': WELD 5 1/2"x1/2" BAR TO 4"x3"x1/2"L BEFORE WELDING 3 1/2"x1/2" BAR

MATERIAL: STRUCTURAL STEEL ASTM A36, GALVANIZED AFTER FABRICATION

WEIGHT (MIN.): APPROX. 165 LBS.



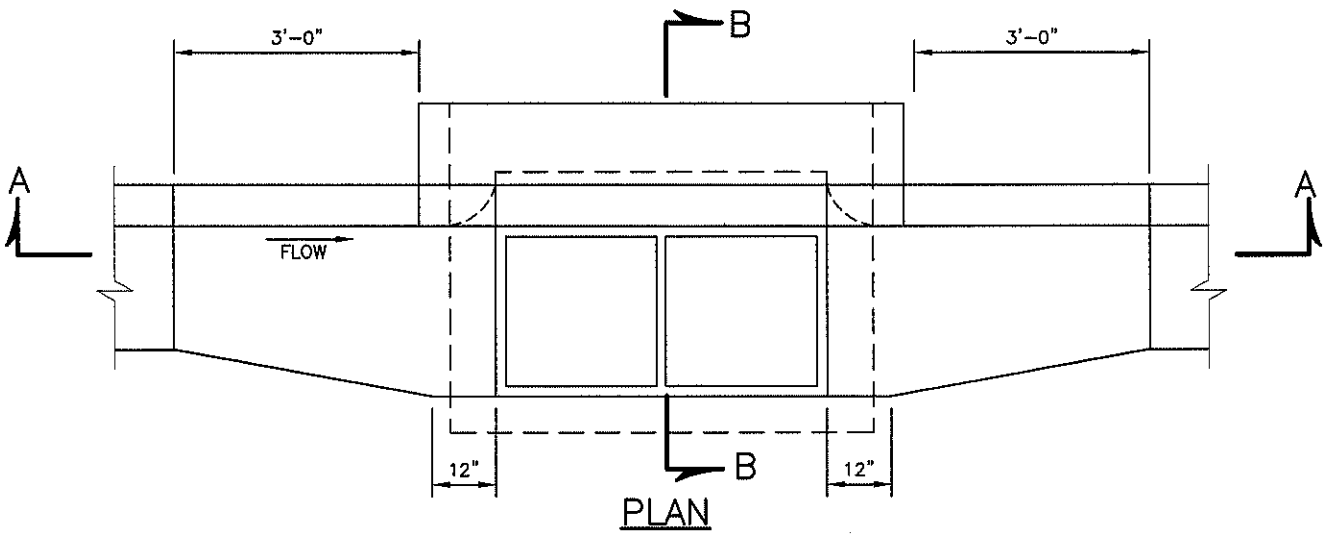
SUPPORT BEAM

W8X31 (GALVANIZED)

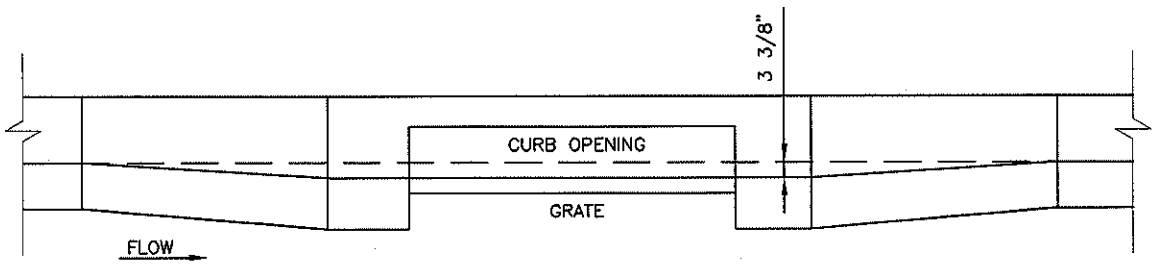
7/17/2015

DRAFT

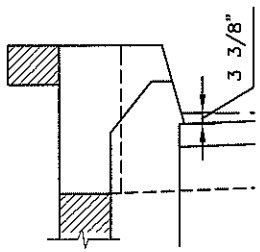
Revised 1 X/XX/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	NR INLET Frame, Grate & Support	Detail 1 D-4.43



PLAN



SECTION A–A



SECTION B–B

7/17/2015
DRAFT

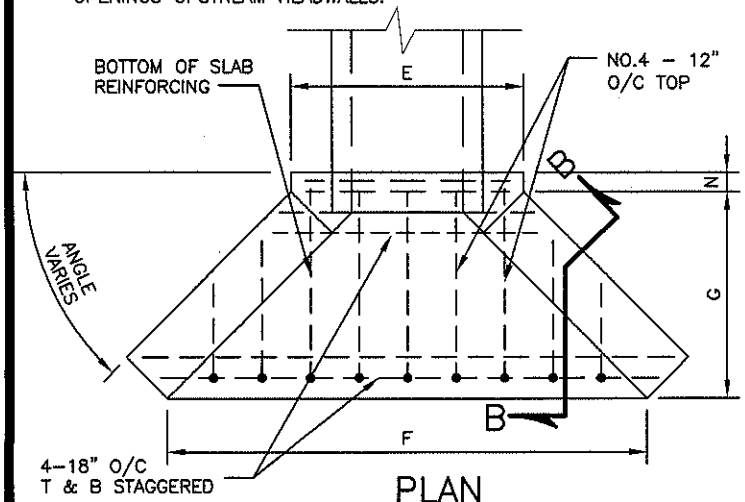
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Inlet Depression	Detail D-4.81

NOTES:

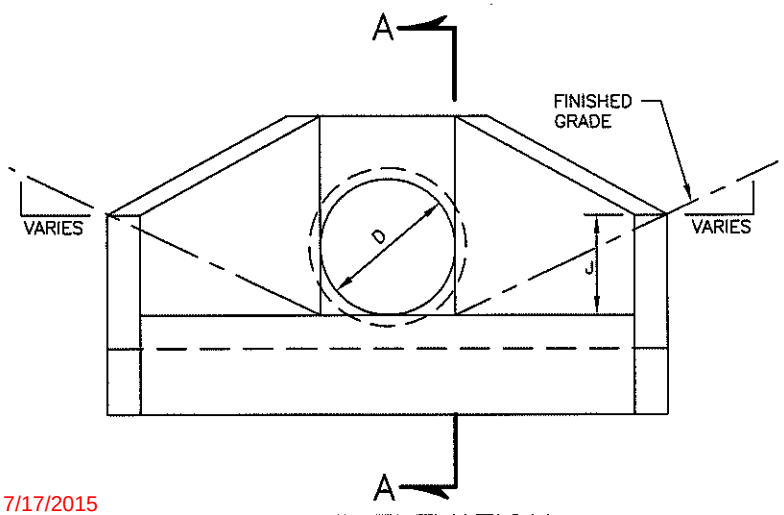
1. CONTRACTOR SHALL PROVIDE 3"–45° BEVEL AROUND PIPE OPENINGS UPSTREAM HEADWALLS.

D	E	F	G	H	J	K	L	N	R	Δ VOL. CY
12" 15"	2'–8" 2'–11"	7'–2" 7'–5"	3'–0" 3'–0"	2'–6" 2'–9"	2'–0" 2'–0"	8"	8"	8"	#5–12" O/C	1.50 1.60
18" 21"	3'–0" 3'–4"	7'–6" 7'–9"	3'–0"	3'–0" 3'–3"	2'–0" 2'–0"	8"	8"	8"	#5–12" O/C	1.70 1.80
24" 27"	3'–8" 3'–11"	8'–0" 8'–3"	3'–0"	3'–6" 3'–9"	2'–0" 2'–0"	8"	8"	8"	#5–12" O/C	1.90 2.00
30"	4'–2"	8'–6"	3'–0"	4'–0"	2'–1±"	8"	8"	10"	#5–12" O/C	2.85
36"	4'–8"	10'–0"	3'–6"	4'–6"	2'–3"	8"	10"	10"	#5–12" O/C	3.15
42"	5'–3"	11'–6"	4'–0"	5'–0"	2'–9"	8"	10"	10"	#5–12" O/C	3.87
48"	5'–10"	13'–0"	4'–6"	5'–6"	3'–0"	8"	10"	12"	#5–12" O/C	5.08
54"	6'–5"	14'–6"	5'–0"	6'–0"	3'–3"	9"	12"	12"	#6–8" O/C	6.50
60"	7'–0"	16'–0"	5'–6"	6'–6"	3'–6"	9"	12"	12"	#6–8" O/C	7.98
66"	7'–7"	17'–6"	6'–0"	7'–0"	3'–9"	9"	12"	14"	#6–8" O/C	9.14
72"	8'–2"	19'–0"	6'–6"	7'–6"	4'–3"	9"	12"	14"	#6–8" O/C	11.10

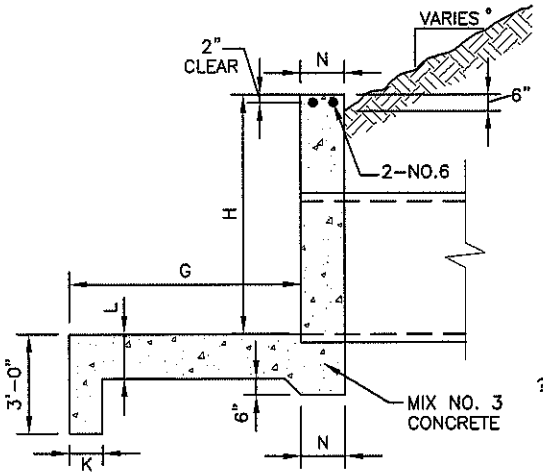
Δ – BASED ON 2:1 CHANNEL SIDE SLOPES AND 45 ANGLE



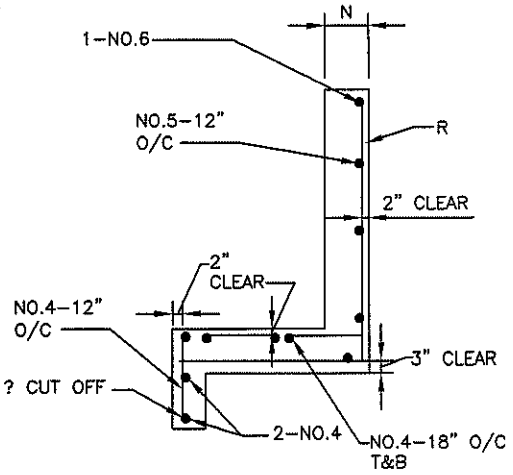
PLAN



FRONT ELEVATION



SECTION A–A



SECTION B–B

7/17/2015
DRAFT

Revised

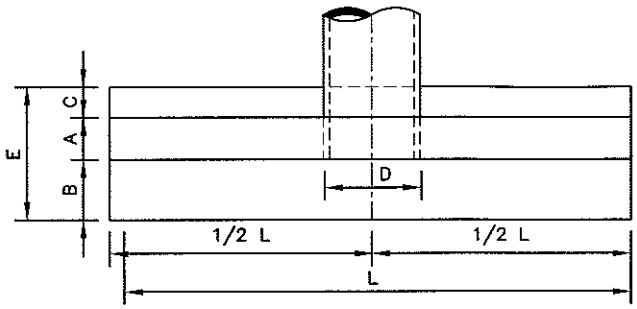
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

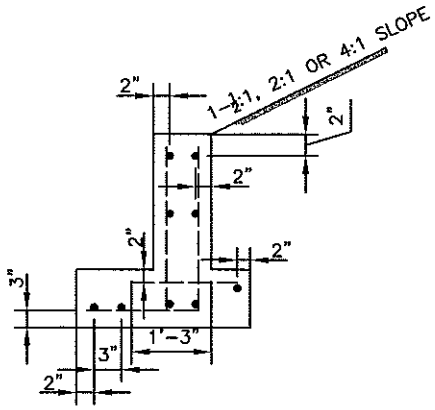
Approved: _____
Chief, Bureau of Engineering

TYPE 'A' Headwall
Circular Pipe

Detail
D–5.11



PLAN

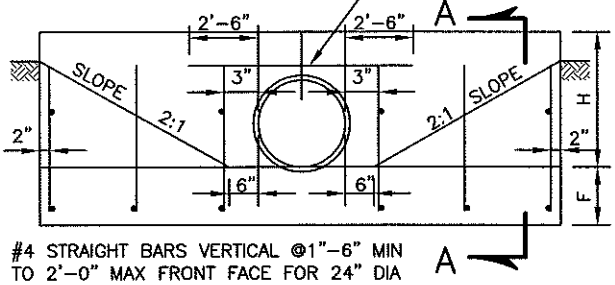


DISPOSITION OF BARS – DETAIL

REINFORCING: DEFORMED STEEL BARS (1/2" DIA)
CHAMFER: ALL EXPOSED EDGES 1"x1" OR AS DIRECTED
CONCRETE SHALL BE MIX NO. 2.

4 #4 STRIGHT BARS VERTICAL IN FRONT FACE FOR 12" DIA TO 18" DIA PIPE ENDWALLS INCLUSIVE.

2 #4 STRAIGHT BARS HORIZONTAL 1 EA FACE FOR 36" DIA TO 60" DIA PIPE ENDWALLS INCLUSIVE.



#4 STRAIGHT BARS VERTICAL @1"-6" MIN TO 2'-0" MAX FRONT FACE FOR 24" DIA TO 60" DIA PIPE ENDWALLS INCLUSIVE.

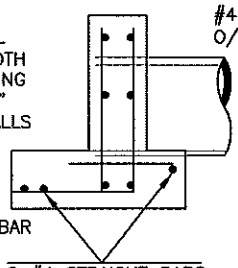
ELEVATION

'S' DISTANCES FROM INSIDE SURFACE OF PIPE TO VERTICAL BARS IN FRONT AND REAR FACE.
4" FOR 12" DIA TO 18" DIA PIPES INCLUSIVE
6" FOR 24" DIA TO 36" DIA PIPES INCLUSIVE
8" FOR 42" DIA TO 60" DIA PIPES INCLUSIVE

#4 STRAIGHT BARS HORIZONTAL @1'-7" O/C BOTH FACES-TOP AND BOTTOM BARS TO BE FULL LENGTH-ALL ENDWALLS.

#4 STRAIGHT BAR HORIZONTAL @1'-0" O/C BOTH SIDES OF OPENING FOR 36" TO 60" DIA PIPE ENDWALLS

#4 BENT BARS @ 1'-0" O/C ALL ENDWALLS



1 #4 STRAIGHT BAR HORIZONTAL-ALL ENDWALLS.

2 #4 STRAIGHT BARS HORIZONTAL FOR 36" TO 60" DIA PIPE ENDWALLS.

SECTION A-A

QUANTITIES FOR ESTIMATION PURPOSES ONLY

OPENING		DIMENSIONS							QUANTITIES	
D INCHES	AREA SQ FT	A	B	C	E	F	H	L	CONC. CY	STEEL LBS
12	0.79	9"	6"	6"	1'-9"	9"	1'-9"	6'-6"	0.61	41
15	1.23	9"	6"	6"	1'-9"	9"	2'-0"	7'-9"	0.77	47
18	1.77	9"	6"	6"	1'-9"	9"	2'-3"	9'-0"	0.95	54
21	2.40	9"	6"	6"	1'-9"	9"	2'-6"	10'-3"	1.14	70
24	3.14	9"	14"	6"	2'-5"	9"	2'-9"	11'-6"	1.56	80
27	3.98	9"	14"	6"	2'-5"	9"	3'-0"	12'10"	1.82	88
30	4.91	9"	14"	6"	2'-5"	12"	3'-6"	14'-2"	2.22	98
33	5.94	9"	14"	6"	2'-5"	12"	3'-9"	15'-5"	2.48	105
36	7.07	12"	16"	10"	3'-2"	12"	4'-0"	16'-8"	4.16	182
42	9.62	12"	16"	10"	3'-2"	12"	4'-6"	19'-2"	5.07	206
48	12.57	12"	16"	10"	3'-2"	12"	5'-0"	21'-8"	6.09	244
54	15.90	12"	20"	12"	3'-8"	12"	5'-6"	24'-2"	7.62	275
60	19.64	12"	20"	12"	3'-8"	12"	6'-0"	26'-8"	8.82	304
72	28.27	12"	20"	12"	3'-8"	12"	7'-0"	31'-8"	11.46	377

7/17/2015 DRAFT

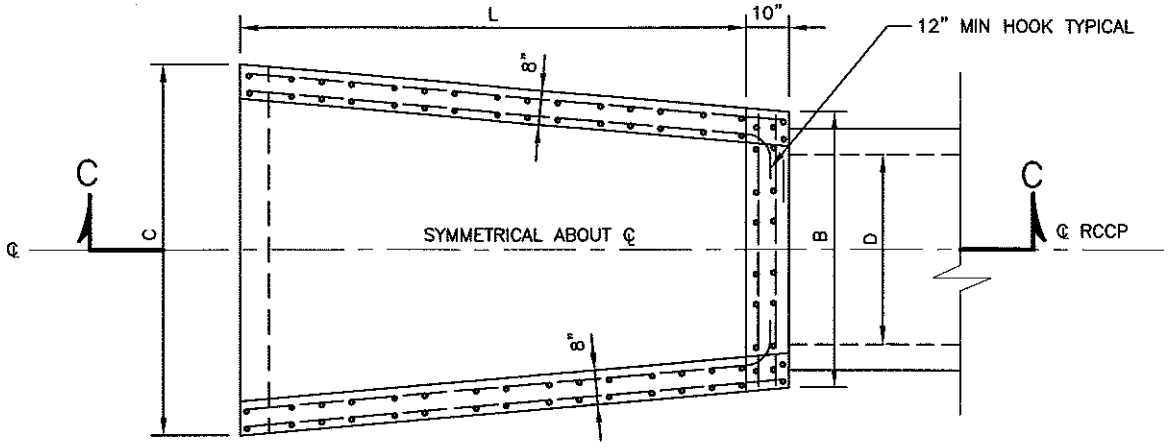
Revised

Revised 5/7/2007 Approved

Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

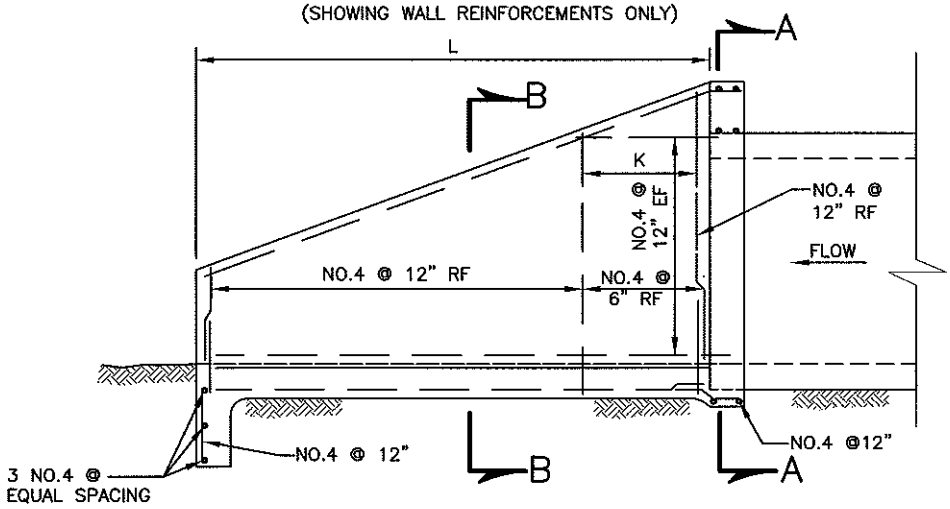
Type 'C' Endwall
Circular Pipe

Detail
D-5.21

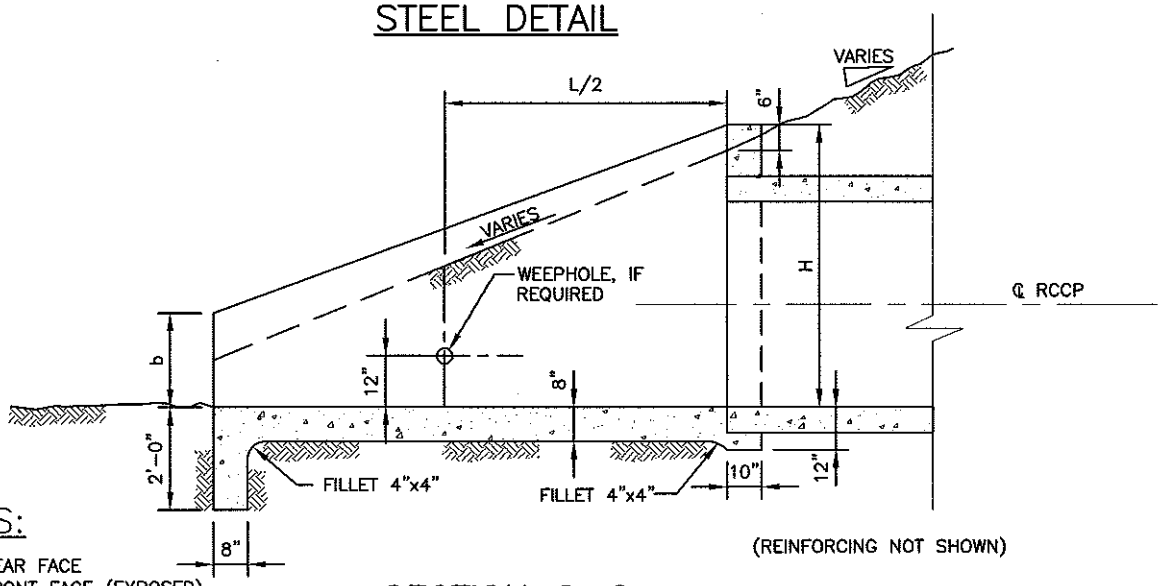


PLAN

(SHOWING WALL REINFORCEMENTS ONLY)



STEEL DETAIL



(REINFORCING NOT SHOWN)

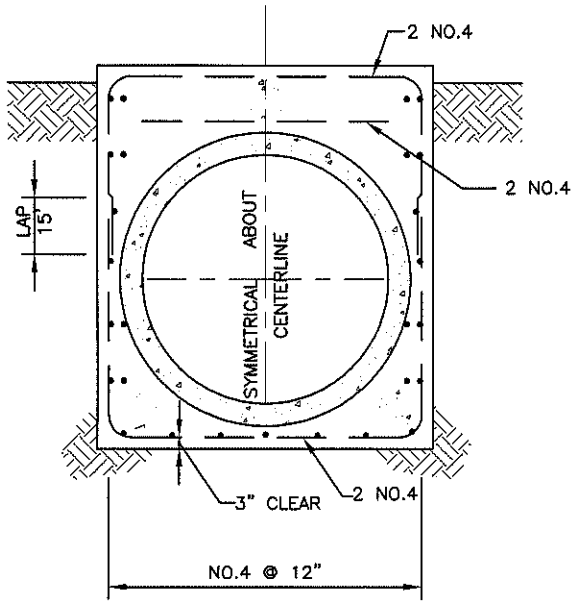
SECTION C–C

NOTES:

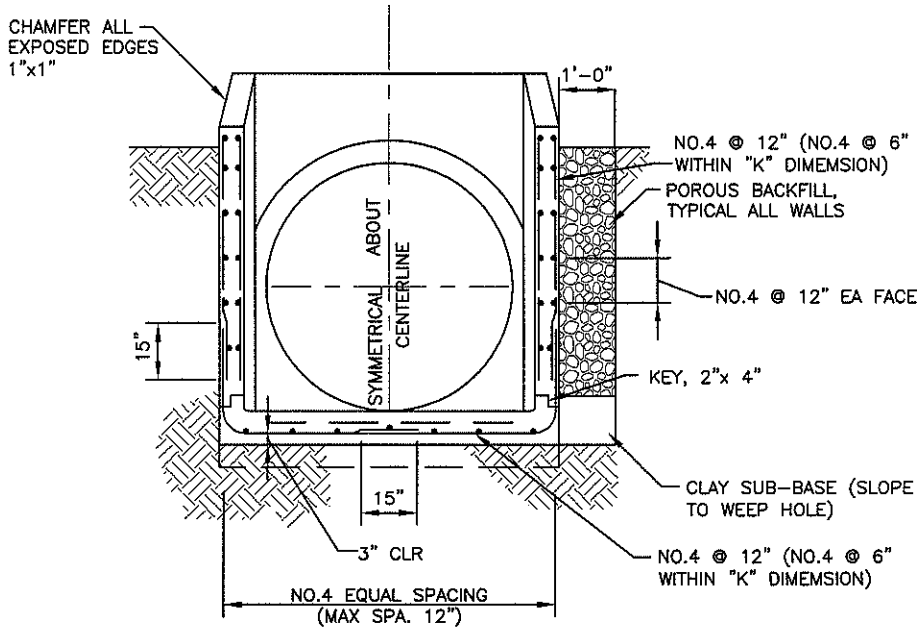
1. RF= REAR FACE
2. FF= FRONT FACE (EXPOSED)
3. EF= EACH FACE
4. USE ONLY WHERE OTHER HEADWALLS CANNOT BE USED.
5. HEADWALL TO BE PARALLEL TO ℄ OF ROADWAY.
6. CHAMFER ALL EXPOSED EDGES 1" x 1".
7. FOR SECTION A & B (SEE DETAIL D–5.42)

7/17/2015 DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	TYPE 'O' Headwall Circular Pipe Outfall	Detail D–5.41



SECTION A–A



SECTION B–B

HEADWALLS FOR CIRCULAR PIPE (RCCP)

DIMENSIONS	DIAMETER – (D)													
	12"	15"	18"	21"	24"	27"	30"	36"	42"	48"	54"	60"	66"	72"
B	2'–4"	2'–7"	2'–10"	3'–1"	3'–4"	3'–7"	4'–2"	4'–8"	5'–2"	5'–8"	6'–2"	6'–10"	7'–6"	8'–0"
C	1'–11"	2'–3"	2'–7"	2'–11"	3'–4"	3'–8"	4'–5"	5'–2"	5'–11"	6'–8"	7'–5"	8'–4"	9'–1"	9'–10"
H	2'–6"	2'–9"	3'–0"	3'–3"	3'–6"	3'–9"	4'–0"	4'–6"	5'–0"	5'–6"	6'–0"	6'–6"	7'–0"	7'–6"
h	1'–0"	1'–0"	1'–0"	1'–0"	1'–0"	1'–0"	1'–3"	1'–6"	1'–9"	2'–0"	2'–3"	2'–6"	2'–9"	3'–0"
L	4'–6"	5'–0"	5'–6"	6'–0"	6'–6"	7'–0"	8'–0"	9'–0"	10'–3"	11'–6"	12'–9"	14'–0"	15'–3"	16'–6"
K	—	—	—	—	—	—	—	—	—	—	1'–0"	2'–0"	3'–0"	4'–0"

NOTES:

1. STEEL TO BE 2" CLEAR UNLESS OTHERWISE SHOWN.
2. PROVIDE ONE 3" CAST IRON WEEP HOLE IN EACH WINGWALL AT CENTER, FOR PIPES OVER 36" DIAMETER PLACE WEEP HOLE AT TOP OF CLAY SUBBASE.
3. USE ONLY WHERE OTHER HEADWALLS CAN NOT BE USED.
4. HEADWALL TO BE PARALLEL TO ℄ OF ROADWAY.
5. SEE DETAIL D–5.41

7/17/2015 DRAFT

Revised

Revised 5/7/2007

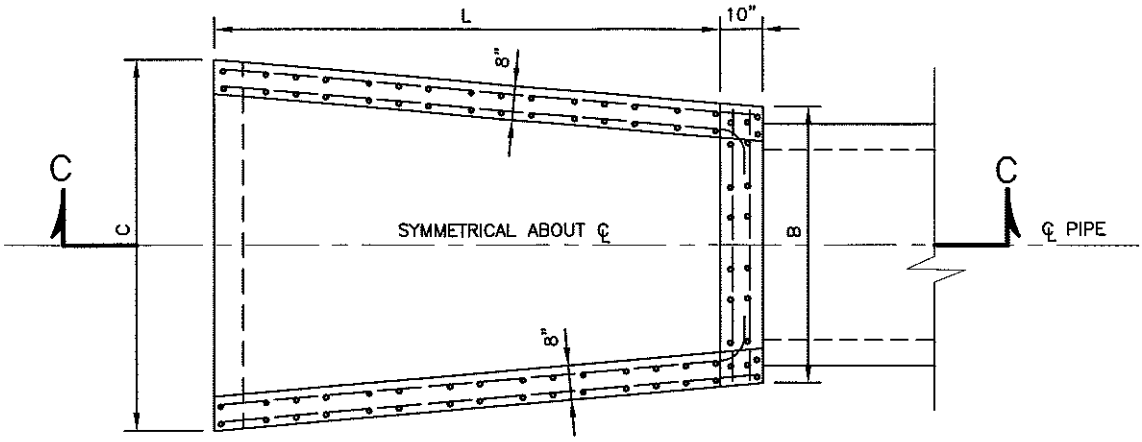
Approved

Howard County, Maryland
Department of Public Works

Approved: _____
Chief, Bureau of Engineering

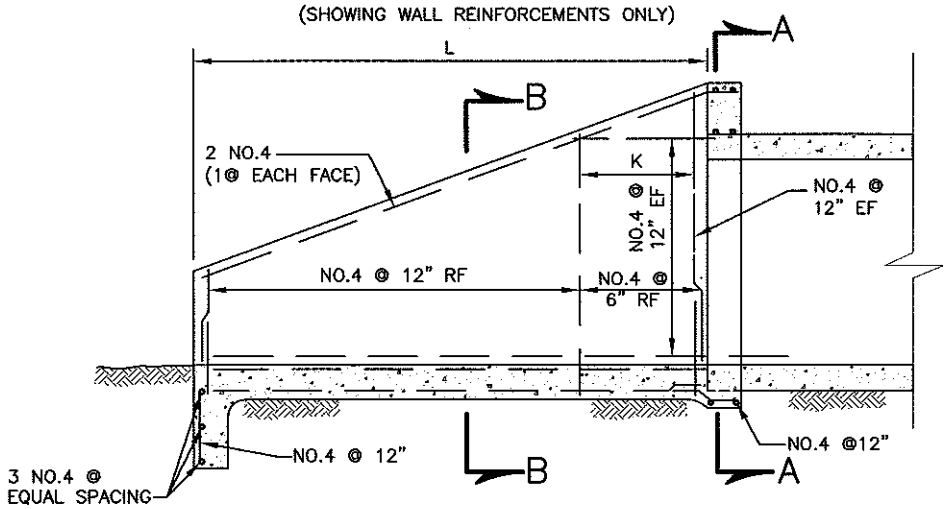
Type 'O' Headwall
Circular Pipe

Detail
D–5.42

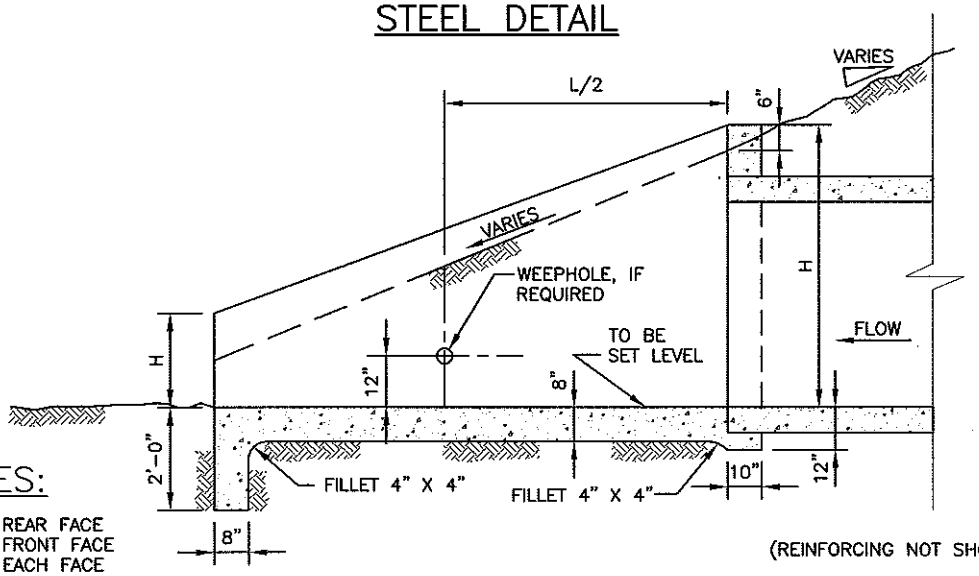


PLAN

(SHOWING WALL REINFORCEMENTS ONLY)



STEEL DETAIL



(REINFORCING NOT SHOWN)

SECTION C–C

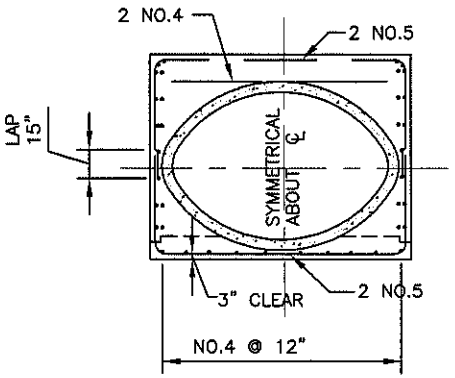
NOTES:

1. RF= REAR FACE
2. FF= FRONT FACE
3. EF= EACH FACE
4. STEEL TO BE 2" CLEAR UNLESS OTHERWISE SHOWN HEADWALL TO BE PARALLEL TO ℄ OF ROADWAY.
5. CHAMFER ALL EXPOSED EDGES 1" x 1".
6. FOR SECTION A–A AND B–B SEE DETAIL D–5.44

7/17/2015
DRAFT

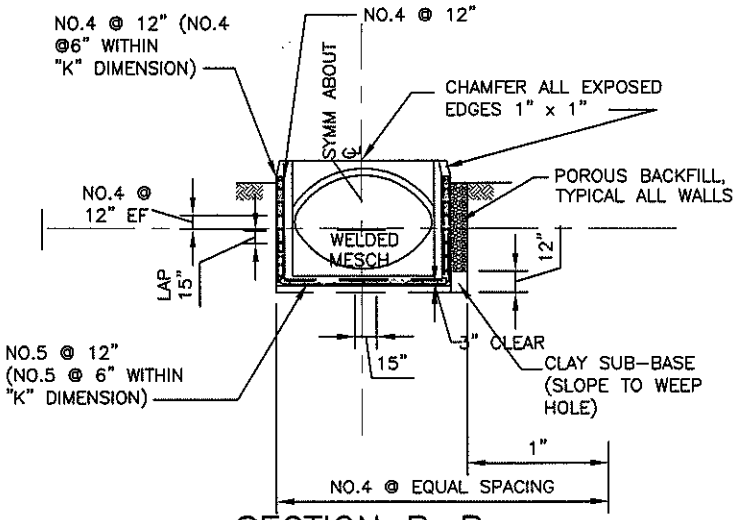
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Type 'O' Headwall Elliptical Pipe Outfall	Detail D-5.43

HEADWALLS FOR ELLIPTICAL PIPE (ERCCP)



SECTION A–A

SPAN	RISE	EQUIV. ROUND	B	C	H	h	L	K
23"	14"	18"	3'–5"	2'–11"	2'–5"	1'–0"	4'–3"	—
30"	19"	24"	4'–0"	3'–9"	2'–10"	1'–0"	5'–4"	—
38"	24"	30"	4'–8"	4'–8"	3'–4"	1'–0"	6'–6"	—
42"	27"	33"	5'–0"	5'–1"	3'–7"	1'–3"	7'–2"	—
45"	29"	36"	5'–3"	5'–5"	3'–10"	1'–4"	7'–8"	—
53"	34"	42"	6'–0"	6'–4"	4'–3"	1'–7"	8'–8"	—
60"	38"	48"	6'–8"	7'–1"	4'–8"	1'–9"	9'–6"	—
68"	43"	54"	7'–5"	7'–11"	5'–1"	2'–0"	10'–7"	—



SECTION B–B

NOTES:

1. PROVIDE ONE 3" CAST IRON PIPE WEEP HOLE IN EACH WINGWALL, AT CENTER, FOR PIPES OVER 60" SPAN. PLACE WEEP HOLE AT TOP OF CLAY SUB–BASE.
2. USE ONLY WHERE OTHER HEADWALLS CAN NOT BE USED.
3. HEADWALL TO BE PARRALLEL TO ℄ OF ROADWAY.
4. FOR CMPA DIMENSIONS B AND H SHALL BE BASED UPON HORIZONTAL AND VERTICAL DIMENSIONS OF ARCH.
5. SEE DETAIL D–5.43

7/17/2015
DRAFT

Revised

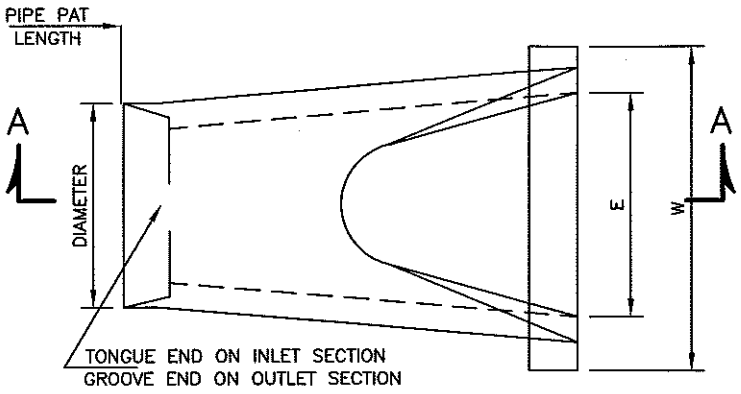
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

Approved: _____
Chief, Bureau of Engineering

Type 'O' Headwall
Elliptical Pipes

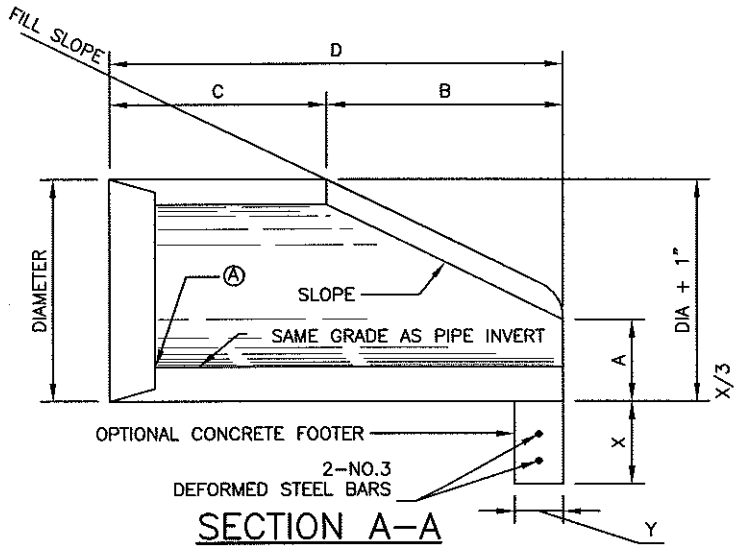
Detail
D–5.44



PLAN

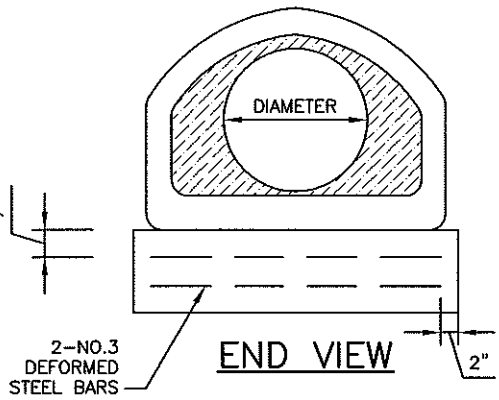
NOTES

1. END SECTIONS MUST BE REINFORCED TO CONFORM WITH CLASS IV PIPE.
2. CONCRETE FOOTER SHALL BE USED WHEN SPECIFIED ON THE PLANS, COST OF CONCRETE FOOTER TO BE INCLUDED IN PRICE OF END SECTION. CONCRETE TO BE MIX NO. 2. REINFORCEMENT TO BE NO. 3 BARS.



SECTION A–A

Ⓐ INVERT ELEVATION TO BE AT THE PIPE END OF THE STANDARD END SECTION. ELEVATIONS TO BE NOTED ON THE CONSTRUCTION PLANS.

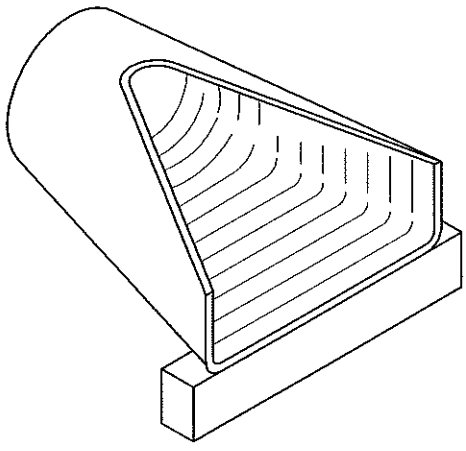


END VIEW

QUANTITIES FOR ESTIMATING PURPOSES ONLY

DIMENSIONS										QUANTITIES	
CONCRETE END SECTION							CONCRETE FOOTER				
DIA	SLOPE	A	B	C	D	E	W	X	Y	CONC CY	STEEL LBS
12"	3:1	4"	2'-0"	4'-0⅞"	6'-0⅞"	2'-0"	3'-0"	12"	9"	0.08	24.00
15"	3:1	6½"	2'-4"	3'-10"	6'-2"	2'-6"	3'-6"	12"	9"	0.10	28.50
18"	3:1	10¼"	2'-2"	4'-0"	6'-2"	3'-0"	4'-0"	12"	9"	0.11	33.00
21"	3:1	9"	3'-0"	3'-1½"	6'-1½"	3'-6"	4'-6"	12"	9"	0.13	37.50
24"	3:1	11"	3'-7"	2'-8"	6'-3"	4'-0"	5'-0"	15"	9"	0.17	42.00
27"	3:1	10½"	4'-1½"	2'-0"	6'-1½"	4'-6"	5'-6"	15"	9"	0.19	46.50
30"	3:1	1'-1"	4'-5"	1'-10"	6'-3"	5'-0"	6'-0"	15"	9"	0.21	51.00
33"	3:1	1'-2"	4'-7"	2'-2"	6'-9"	5'-6"	6'-6"	15"	9"	0.23	55.50
36"	3:1	1'-3½"	5'-3"	3'-1"	8'-1½"	6'-0"	7'-3"	15"	9"	0.25	62.25
42"	3:1	1'-9¼"	5'-5"	2'-10"	8'-3"	6'-6"	7'-9"	15"	9"	0.27	66.75
48"	3:1	2'-1"	6'-0"	2'-2"	8'-2"	7'-0"	8'-6"	18"	12"	0.47	73.50
54"	2.4:1	2'-5"	5'-2"	2'-10"	8'-0"	7'-6"	9'-0"	18"	12"	0.50	78.00
60"	3:1	2'-7"	4'-11"	3'-8½"	8'-7½"	8'-0"	9'-6"	18"	12"	0.53	82.50
66"	3:1	2'-4"	6'-6"	1'-9"	8'-3"	8'-6"	10'-0"	18"	12"	0.56	87.00
72"	3:1	2'-10"	6'-6"	1'-9"	8'-3"	9'-0"	10'-9"	18"	12"	0.60	93.75

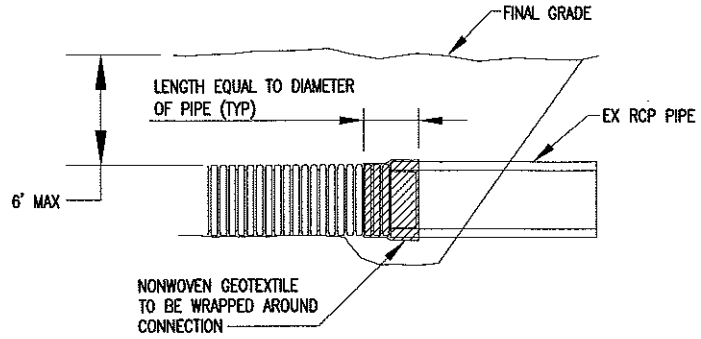
SEE NOTE 3 ABOVE FOR CONCRETE FOOTER



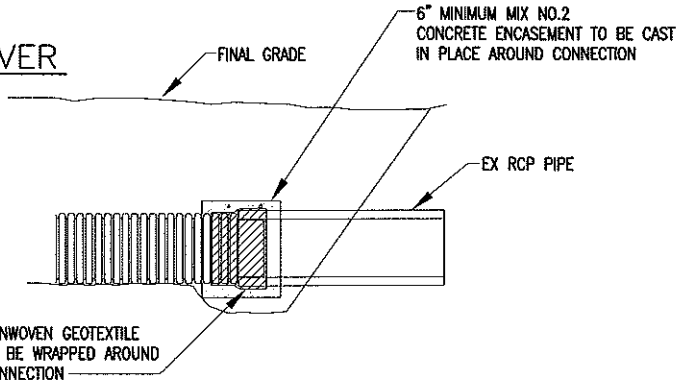
ISOMETRIC VIEW

7/17/2015
DRAFT

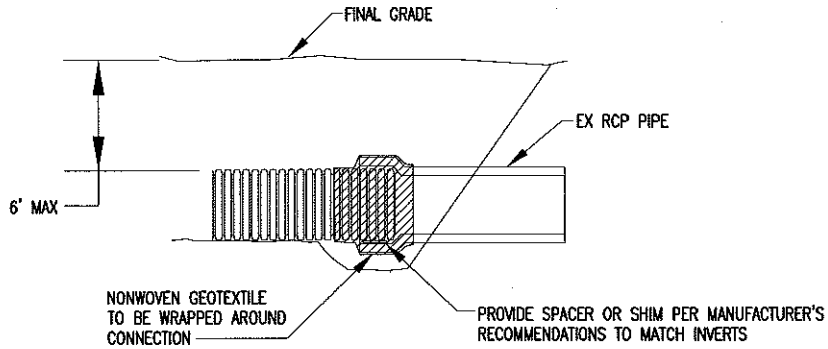
Revised	Howard County, Maryland Department of Public Works	Concrete End Section Circular Concrete Pipe	Detail D-5.51
Revised			
5/1/2007 Approved	Approved: _____ Chief, Bureau of Engineering		



HDPE TO RCP, SHALLOW COVER



HDPE TO RCP, COVER OVER 6'



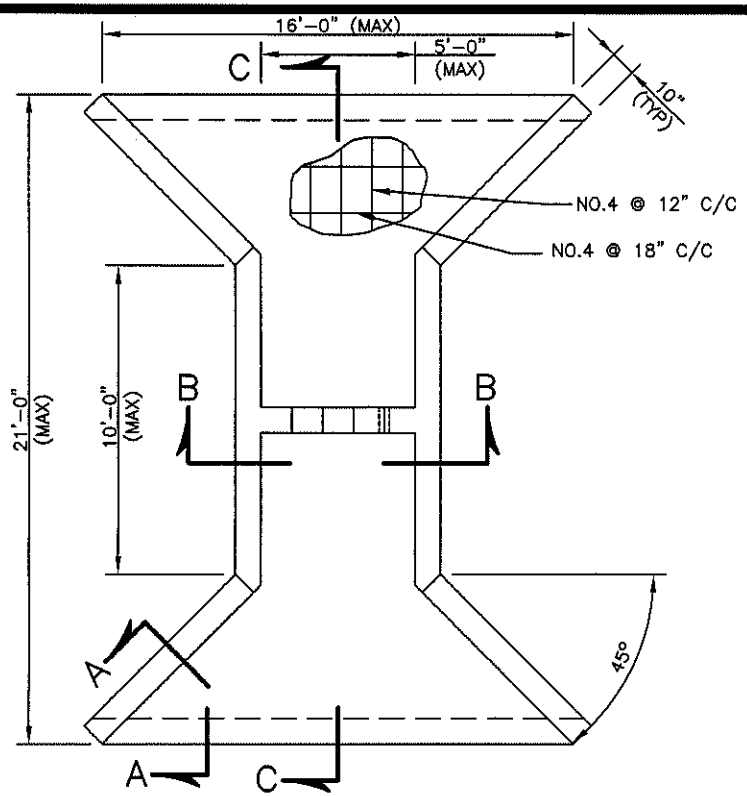
HDPE TO RCP BELL, SHALLOW COVER

NOTES:

1. EXISTING GRADE TO BE EXCAVATED IN SUCH A MANNER TO PROVIDE A SAFE WORK AREA.
2. INTERNAL CYLINDER ADAPTER OR WATERTIGHT REPAIR COUPLER, AS RECOMMENDED BY PIPE MANUFACTURER, TO BE WELDED TO HDPE PIPE, OUTSIDE DIAMETER TO BE INSERTED INTO INSIDE DIAMETER OF CONCRETE PIPE.
3. AREA UNDER CONNECTION MUST BE OVEREXCAVATED TO ALLOW AMPLE WORK AREA TO WRAP NON-WOVEN GEOTEXTILE.
4. SD TYPE I NON-WOVEN GEOTEXTILE TO BE WRAPPED AROUND CONNECTION WITH FULL SEAM OVERLAP (MINIMUM OVERLAP LENGTH = DIAMETER) TO PROVIDE FULL PROTECTION FROM SOIL INTRUSION.
5. CONNECTION AND PIPE TO BE BACKFILLED PER STANDARD SPECIFICATIONS.

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	HDPE To RCP Transition Connection	Detail D-5.52



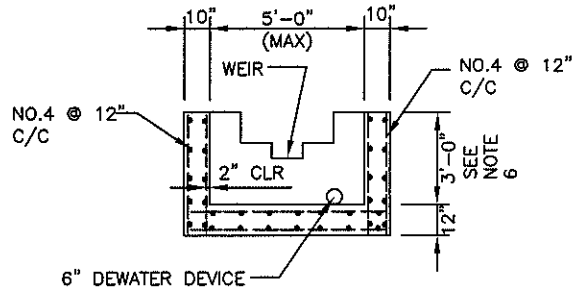
PLAN

NOTES:

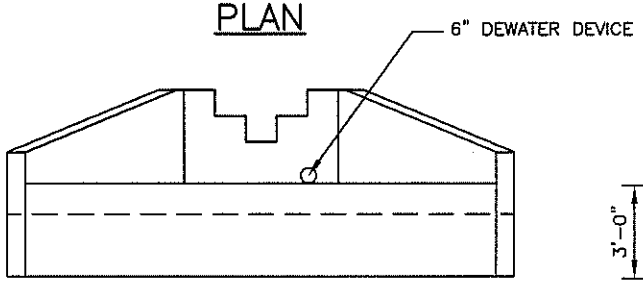
1. ALL EXPOSED EDGES TO HAVE 3/4" x 3/4" CHAMFER OR AS DIRECTED.
2. CONCRETE SHALL BE SHA MIX NO. 3 (fc'=3500 PSI @ 28 DAYS).
3. REINFORCING STEEL SHALL BE ASTM A615 GRADE 60.
4. QUANTITIES IN TABLE FOR ESTIMATING ONLY.
5. WEIR CONTROL SECTION SHALL BE SIZED FOR APPROPRIATE CONTROL OF DISCHARGE RATES (WEIR SHOWN IS FOR ILLUSTRATION PURPOSES ONLY.)
6. MAXIMUM WALL HEIGHT IS 3', HIGHER WALLS REQUIRE SPECIAL DESIGN.

VOL. CONC. (CY)	STEEL (LBS)
14.5	1100

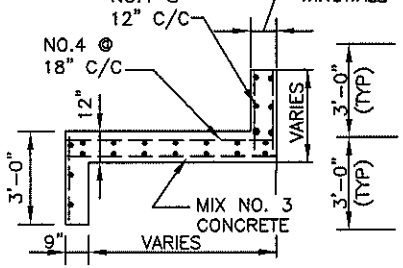
* VALUES SHOWN ARE APPROXIMATE FOR THE MAXIMUM SIZE OF THE STRUCTURE.



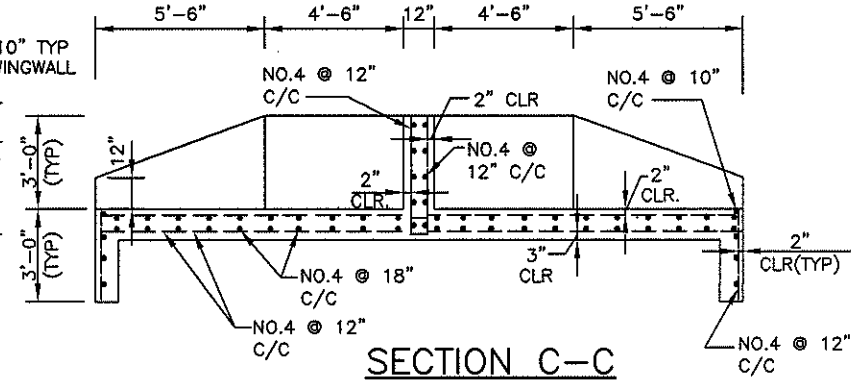
SECTION 'B-B'



FRONT ELEVATION



SECTION A-A

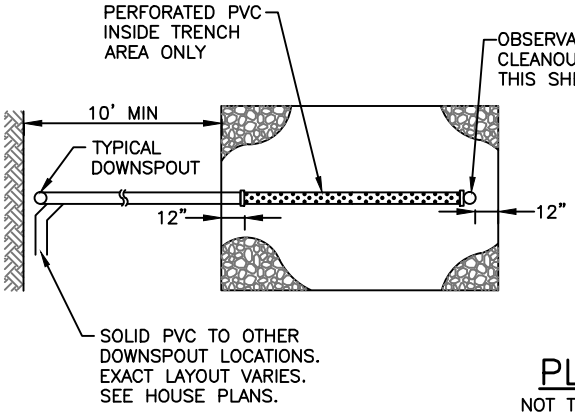


SECTION C-C

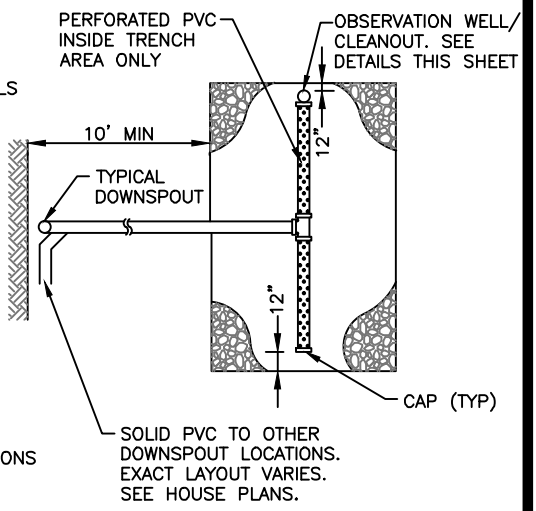
7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Low Rise SWM Control Structure	Detail D-6.01

LAYOUT OPTION 1



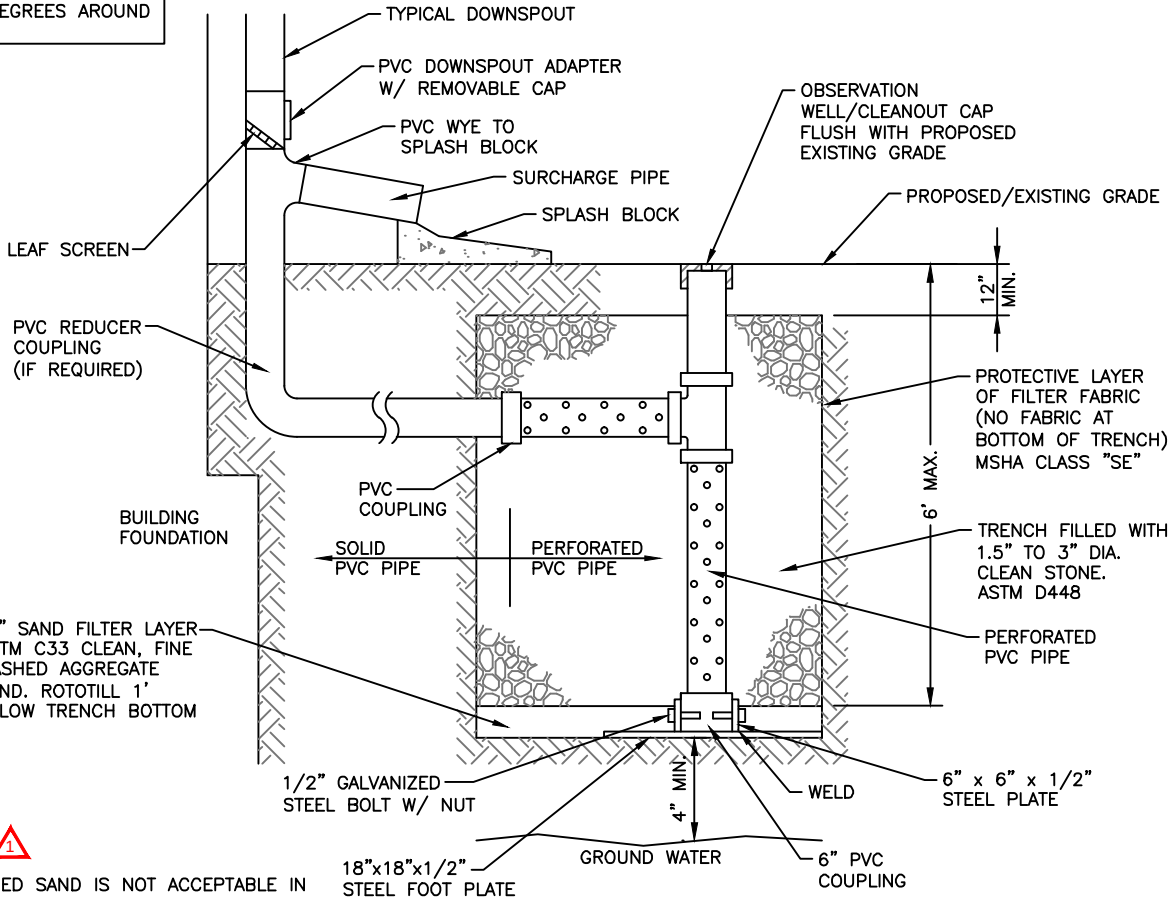
LAYOUT OPTION 2



PLAN

NOT TO SCALE
SEE PLAN FOR ALL DIMENSIONS

PERFORATED PIPE
PVC SCH 40 3/8" HOLES
4" O/C 90 DEGREES AROUND PIPE



TYPICAL SECTION

NOT TO SCALE

NOTES

1. MANUFACTURED SAND IS NOT ACCEPTABLE IN DRYWELLS.
2. ALL PIPES SHOULD BE SCH 40 PVC 4" MIN
3. DRYWELLS MUST BE A MINIMUM OF
   - 10' FROM BUILDING FOUNDATION
   - 30' FROM SEPTIC FIELD
   - 100' FROM WELL LOCATION

   AND SHOULD BE LOCATED TO MINIMIZE ANY BASEMENT SEEPAGE.
4. TRENCH MAY NOT BE INSTALLED IN FILL.

DRAFT
7/17/2015

Revised	Howard County, Maryland Department of Public Works	ROOF DRAIN DRYWELL Private	Detail D-9.01
1 X/XX/2015			
Approved 5/7/2007	Approved: N:\13767\Final Volume 4\signature.bmp		
Approved	Chief, Bureau of Engineering		

NOTES 1

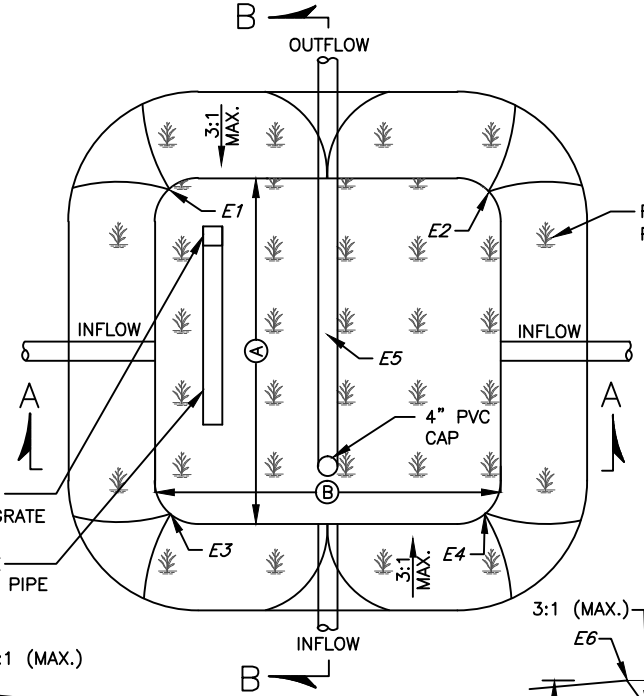
1. FACILITY SHALL BE A MINIMUM OF 10FT FROM ANY BUILDING.
2. FACILITY SHALL BE INSTALLED IN EXCAVATED VIRGIN SOIL (NOT FILL).
3. FACILITY SHALL BE MINIMUM 2' ABOVE THE SEASONAL HIGH WATER TABLE.
4. REGULAR INSPECTIONS SHALL BE REQUIRED DURING FOLLOWING STAGES OF THE CONSTRUCTION.
   - 4.1. DURING EXCAVATION TO SUBGRADE AND PLACEMENT AND BACKFILL OF UNDERDRAIN SYSTEMS.
   - 4.2. DURING PLACEMENT OF PLANTING MEDIA.
   - 4.3. DURING CONSTRUCTION OF APPURTENANT CONVEYANCE.
   - 4.4. UPON COMPLETION OF FINAL GRADING AND ESTABLISHMENT OF PERMANENT STABILIZATION.
5. E1 TO E12 AS-BUILT SPOT ELEVATION LOCATIONS.
6. THIS STANDARD IS A REFERENCE TO SHOW THE ELEMENTS AND MINIMUM DIMENSIONS FOR A RAIN GARDEN. EACH FACILITY SHALL BE DESIGNED AND APPROVED ON A SITE SPECIFIC BASIS. THIS DETAIL PROVIDES BLANK SPACES TO INFORM WHERE AS-BUILT INFORMATION IS REQUIRED FOR SWM CLOSEOUT.

AS-BUILT FACILITY DIMENSIONS 1

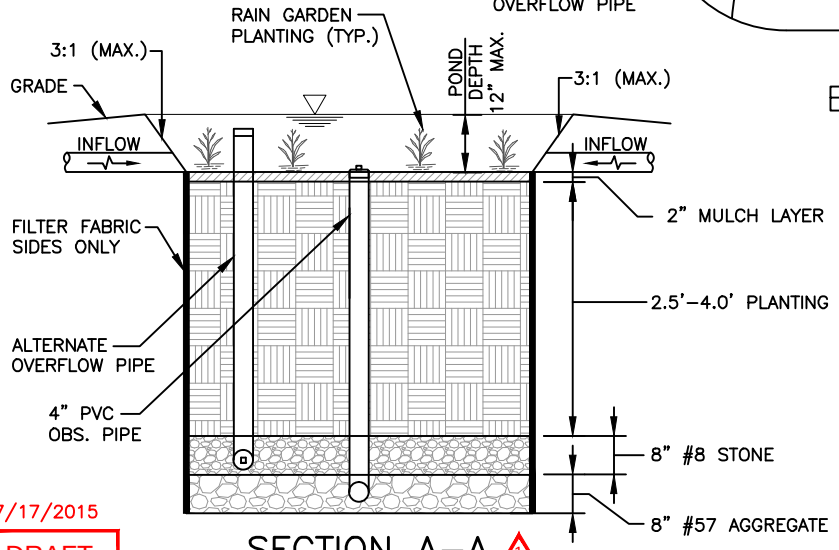
WIDTH	Ⓐ	____ FT
LENGTH	Ⓑ	____ FT
DEPTH	Ⓒ	____ FT

AS-BUILT FACILITY ELEVATIONS

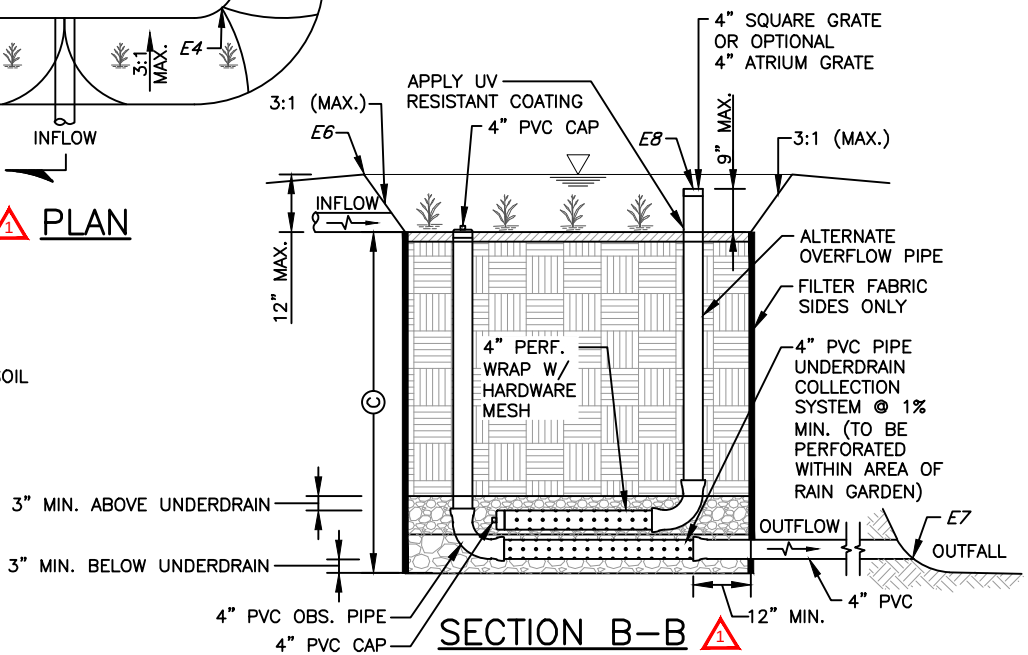
E1	____ FT	CORNER
E2	____ FT	CORNER
E3	____ FT	CORNER
E4	____ FT	CORNER
E5	____ FT	CENTER
E6	____ FT	LOW SIDE AT TOP OF THE SLOPE
E7	____ FT	OUTFALL
E8	____ FT	TOP OF INLET



1 PLAN



SECTION A-A 1



SECTION B-B 1

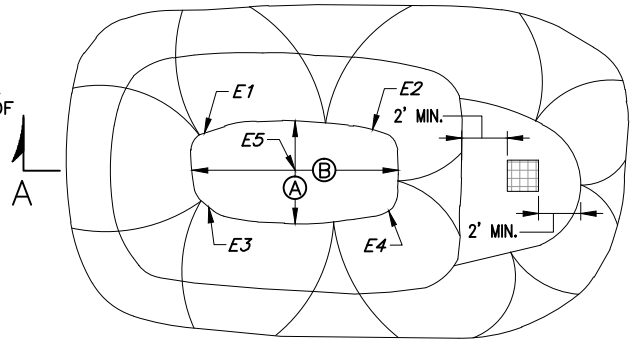
7/17/2015

DRAFT

Revised	Howard County, Maryland	RAIN GARDEN 1	Detail
1 X/XX/2015	Department of Public Works	Private For Reference	D-9.02
Revised 5/7/2007	Approved: N:\13767\Final Volume 4\signature.bmp		
Approved	Chief, Bureau of Engineering		

NOTES 1

1. FACILITY SHALL BE A MINIMUM OF 10FT FROM ANY BUILDING.
2. FACILITY SHALL BE INSTALLED IN EXCAVATED VIRGIN SOIL (NOT FILL).
3. FACILITY SHALL BE MINIMUM 4' ABOVE THE SEASONAL HIGH WATER TABLE.
4. REGULAR INSPECTIONS SHALL BE REQUIRED DURING FOLLOWING STAGES OF THE CONSTRUCTION.
   - 4.1. DURING EXCAVATION TO SUBGRADE AND PLACEMENT AND BACKFILL OF UNDERDRAIN SYSTEMS.
   - 4.2. DURING PLACEMENT OF PLANTING MEDIA.
   - 4.3. DURING CONSTRUCTION OF APPURTENANT CONVEYANCE.
   - 4.4. UPON COMPLETION OF FINAL GRADING AND ESTABLISHMENT OF PERMANENT STABILIZATION.
5. E1 TO E8 AS-BUILT SPOT ELEVATION LOCATIONS.
6. THIS STANDARD IS A REFERENCE TO SHOW THE ELEMENTS AND MINIMUM DIMENSIONS FOR A MICRO-BIORENTENTION FACILITY. EACH FACILITY SHALL BE DESIGNED AND APPROVED ON A SITE SPECIFIC BASIS. THIS DETAIL PROVIDES BLANK SPACES TO INFORM WHERE AS-BUILT INFORMATION IS REQUIRED FOR SWM CLOSEOUT.



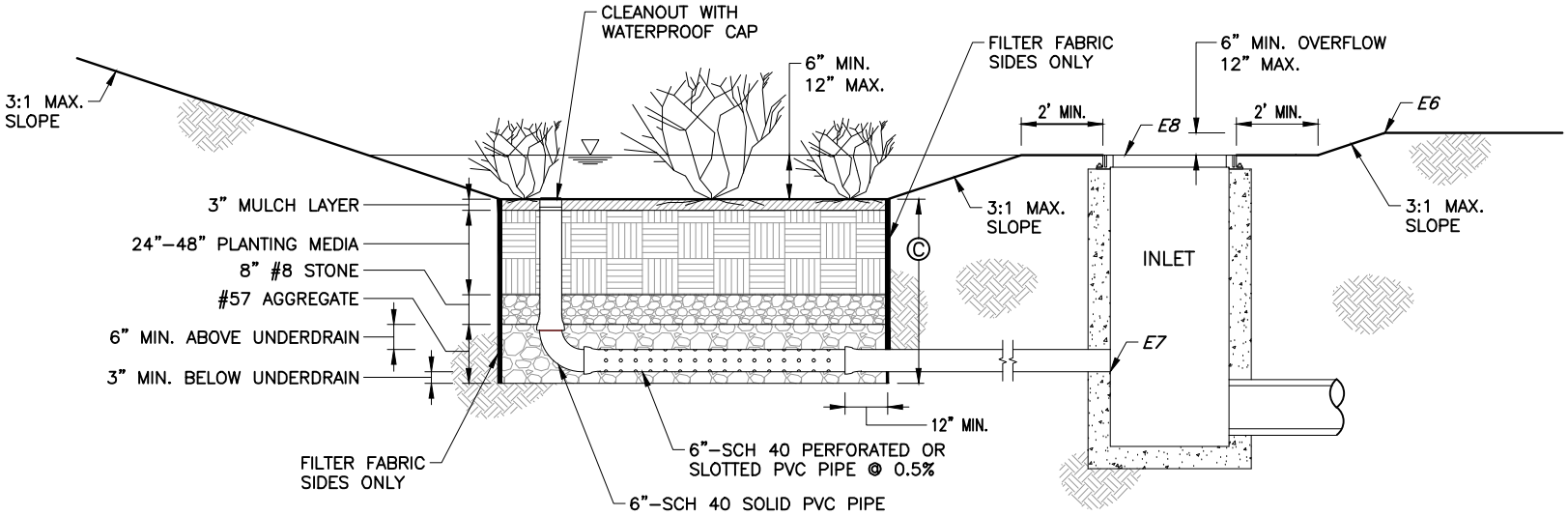
1 PLAN

AS-BUILT FACILITY DIMENSIONS 1

WIDTH	Ⓐ	____ *FT*
LENGTH	Ⓑ	____ *FT*
DEPTH	Ⓒ	____ *FT*

AS-BUILT FACILITY ELEVATIONS

E1	____	*FT*	*CORNER*
E2	____	*FT*	*CORNER*
E3	____	*FT*	*CORNER*
E4	____	*FT*	*CORNER*
E5	____	*FT*	*CENTER*
E6	____	*FT*	*LOW SIDE AT TOP OF THE SLOPE*
E7	____	*FT*	*OUTFALL*
E8	____	*FT*	*TOP OF INLET*

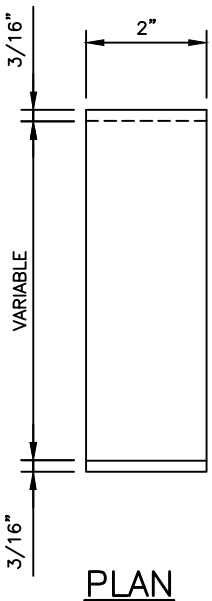


1 SECTION A-A

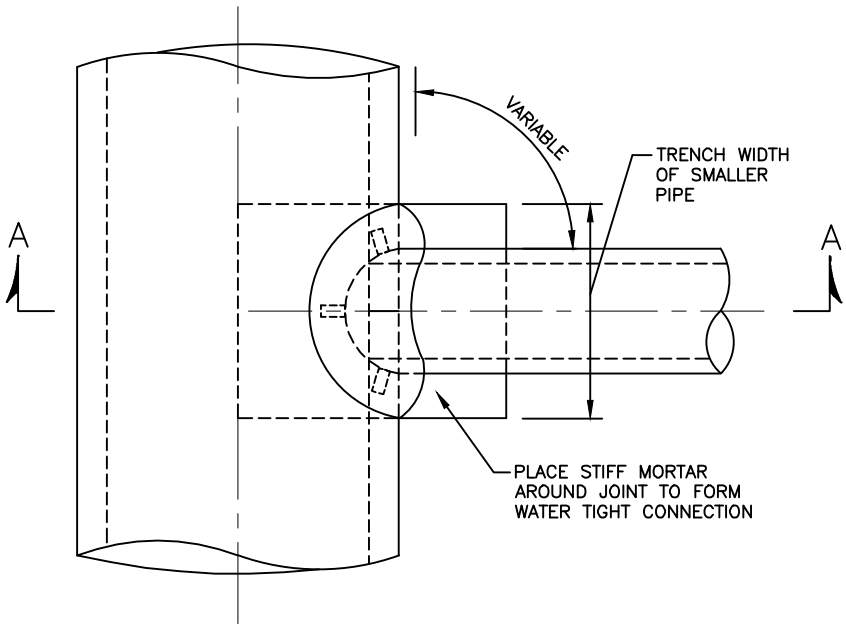
7/17/2015

DRAFT

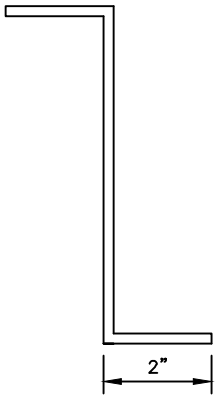
Revised	Howard County, Maryland	MICRO-BIORETENTION FACILITY 1	Detail
1 X/XX/2015	Department of Public Works	Private For Reference	D-9.03
Revised 5/7/2007	Approved: N:\13767\Final Volume 4\signature.bmp		
Approved	Chief, Bureau of Engineering		



PLAN

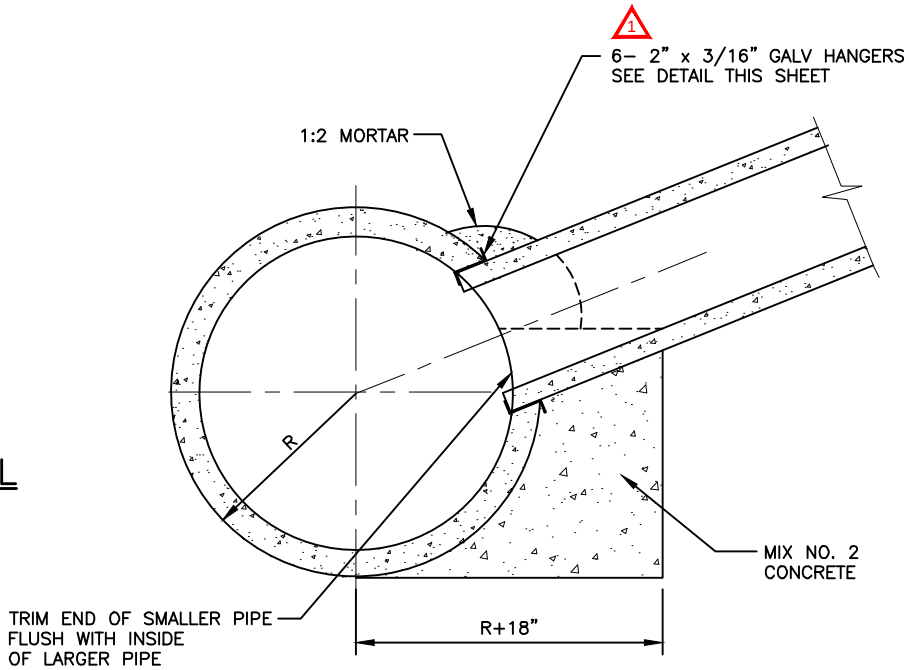


PLAN



PROFILE

GALVANIZED
HANGER DETAIL



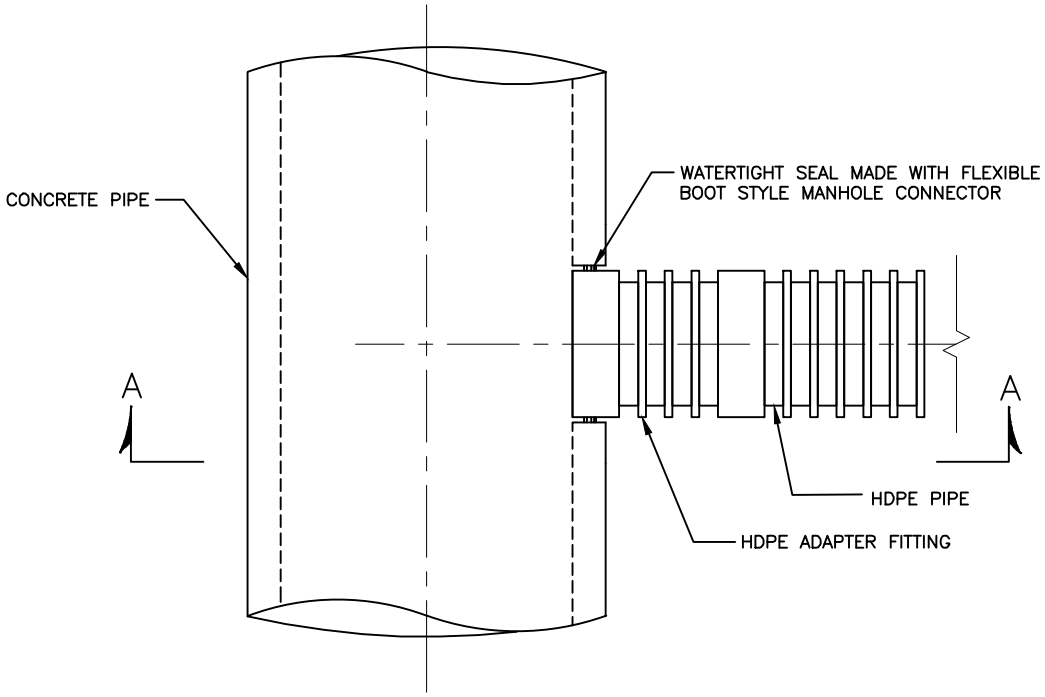
SECTION A–A

NOTES:

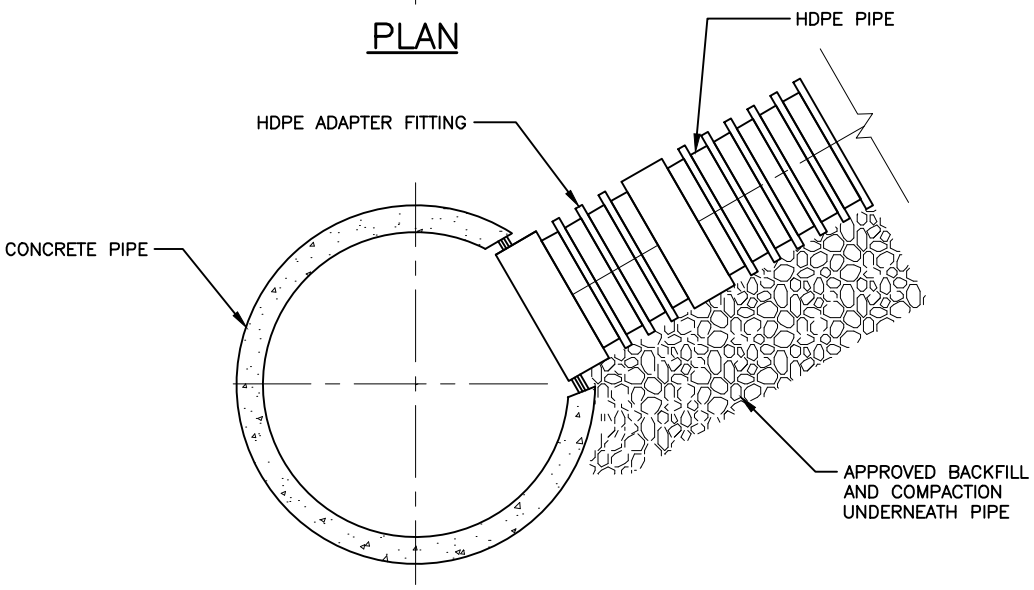
1. FOR USE WITH CONCRETE PIPE ONLY.
2. 36" MINIMUM DIAMETER OF LARGER PIPE.
3. 0.45 MINIMUM RATIO OF SMALLER PIPE DIAMETER TO LARGER PIPE DIAMETER.
4. ONLY ONE FIELD CONNECTION PERMITTED IN A SINGLE LENGTH OF LARGER PIPE.
5. NOT FOR USE WITHIN THE PUBLIC RIGHT–OF–WAY OR PUBLIC EASEMENT.

7/17/2015 DRAFT

Revised 1 6/17/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	CONCRETE PIPE FIELD CONNECTION Private	Detail 1 D–9.53



PLAN



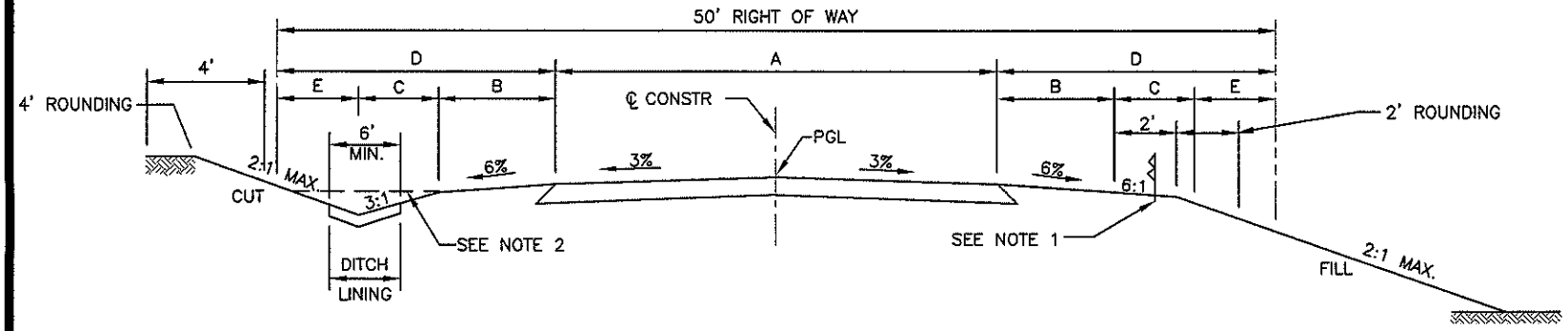
SECTION A–A

NOTES:

1. FOR USE WITH HDPE PIPE CONNECTION TO RCP PIPE ONLY.
2. 36" MINIMUM DIAMETER OF CONCRETE PIPE.
3. 0.45 MINIMUM RATIO OF SMALLER PIPE TO LARGER PIPE DIAMETER.
4. ONLY ONE FIELD CONNECTION PERMITTED IN A SINGLE LENGTH OF LARGER PIPE.
5. CORE DRILL OPENING IN CONCRETE PIPE TO SIZE SPECIFIED BY FLEXIBLE BOOT MANUFACTURER. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
6. CONNECT FLEXIBLE BOOT TO HDPE ADAPTER FITTING BEFORE CONNECTING TO HDPE PIPE. SEE HDPE MANUFACTURER INSTRUCTIONS.
7. PROVIDE WATERTIGHT GASKETS IN ACCORDANCE WITH HDPE MANUFACTURER INSTRUCTIONS.

7/17/2015 DRAFT

Revised 1 6/17/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	HDPE PIPE CONNECTION TO RCCP Private	Detail 1 D-9.54



OPEN SECTION

NOTES:

1. TRAFFIC BARRIER W-BEAM AS REQUIRED (SEE DESIGN MANUAL III).
2. DITCH CROSS SECTION SLOPE MAY BE FLATTENED TO PROVIDE A SWALE AT OR NEAR THE CREST OF VERTICAL CURVES WHERE QUANTITY OF SWALE FLOW IS SMALL, AS APPROVED BY DPW.
3. PROVIDE CURB AT INTERSECTIONS (SEE DESIGN MANUAL III).
4. NORMAL CROWN SECTIONS ARE SHOWN. SEE DESIGN MANUAL III FOR SUPERELEVATION REQUIREMENTS.
5. 4'-0" SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.01).

CLASSIFICATION	A	B	C	D	E	PAVING SECTION
MINOR COLLECTOR 1000 ADT	28'	4'	4'	11'	3'	P-3
ACCESS STREET 500 ADT	24'	4'	4'	13'	5'	P-2
ACCESS PLACE 200 ADT	22'	4'	4'	14'	6'	P-2

7/17/2015
DRAFT

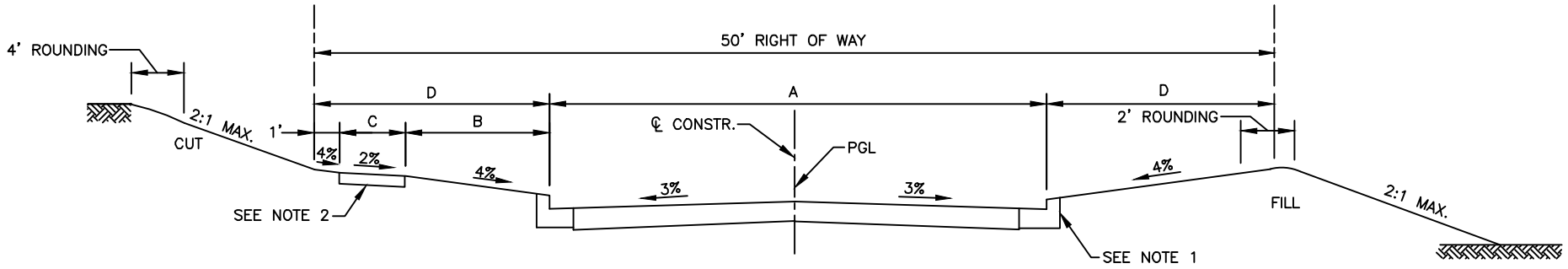
Revised

Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

TYPICAL SECTIONS-Residential Streets
Access Place, Access Street, Minor Collector
Open Section (Outside Planned Service Area Only)

Detail
R-1.01



CLOSED SECTION 1

NOTES:

1. TYPE OF CURB VARIES (MODIFIED COMBINATION CURB & GUTTER OR COMBINATION CURB & GUTTER – SEE DESIGN MANUAL VOLUME III FOR CRITERIA).
2. 4" CONCRETE SIDEWALK AS REQUIRED BY SUB–DIVISION REGULATIONS.
3. 4'–0" SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R–4.01).
4. SEE R–3.05 FOR WHERE SIDEWALK IS AGAINST CURB.

CLASSIFICATION	A	B	C	D	PAVING SECTION
MINOR COLLECTOR 2000 ADT	28'	6'	4'	11'	P–3
ACCESS STREET 1000 ADT	24'*	8'	4'	13'	P–2
ACCESS PLACE 200 ADT	24'*	8'	4'	13'	P–2

*TOWNHOUSES, CONDOMINIUM / APARTMENT DEVELOPMENTS REQUIRE 26' MINIMUM PAVING WIDTH (P–2 PAVING SECTION)

7/17/2015

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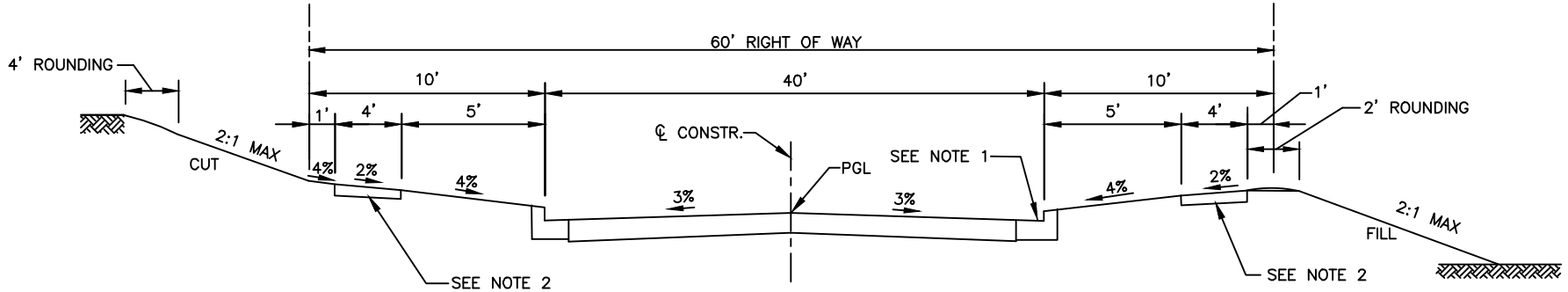
Revised
1 X/XX/2015
Revised
1/2/2007
Approved

Howard County, Maryland
Department of Public Works

Approved: N:\13767\Final Volume 4\signature.bmp
Chief, Bureau of Engineering

TYPICAL SECTIONS – RESIDENTIAL STREETS
Access Place, Access Streets, Minor Collector
(Closed Section)

Detail
R–1.02

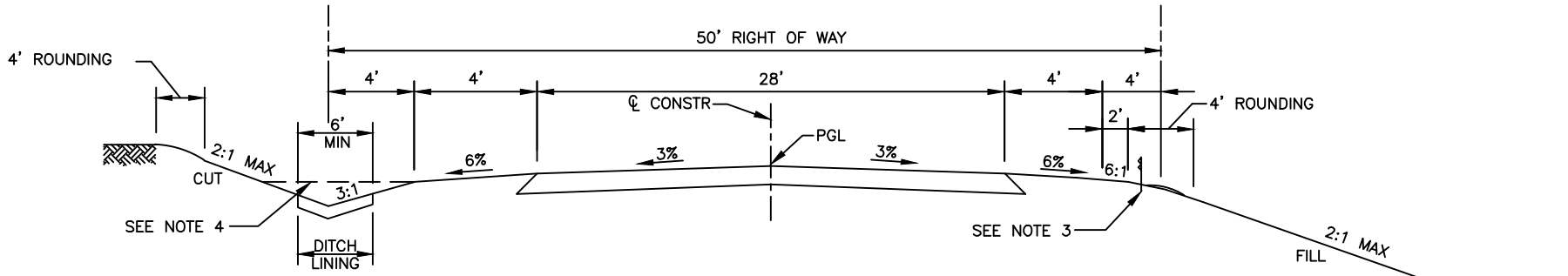


1 CLOSED SECTION

CLASSIFICATION	PAVING SECTION
MAJOR COLLECTOR	P-4
MINOR COLLECTOR 2000 ADT	P-4
LOCAL ROADS & CUL-DE-SACS 1000 ADT	P-3

NOTE:

1. TYPE OF CURB VARIES (MODIFIED COMBINATION CURB & GUTTER OR COMBINATION CURB & GUTTER-SEE DESIGN MANUAL III).
2. 4" CONCRETE SIDEWALK AS REQUIRED BY SUB-DIVISION REGULATIONS.
3. TRAFFIC BARRIER W-BEAM AS REQUIRED (SEE DESIGN MANUAL III).
4. DITCH CROSS SECTION SLOPE MAY BE FLATTENED TO PROVIDE A SWALE AT OR NEAR THE CREST OF VERTICAL CURVES WHERE QUANTITY OF SWALE FLOW IS SMALL, AS APPROVED BY DPW.
5. NORMAL CROWN SECTIONS ARE SHOWN. SEE DESIGN MANUAL FOR SUPER ELEVATION REQUIREMENTS.
6. 4'-0" CONCRETE SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.01)

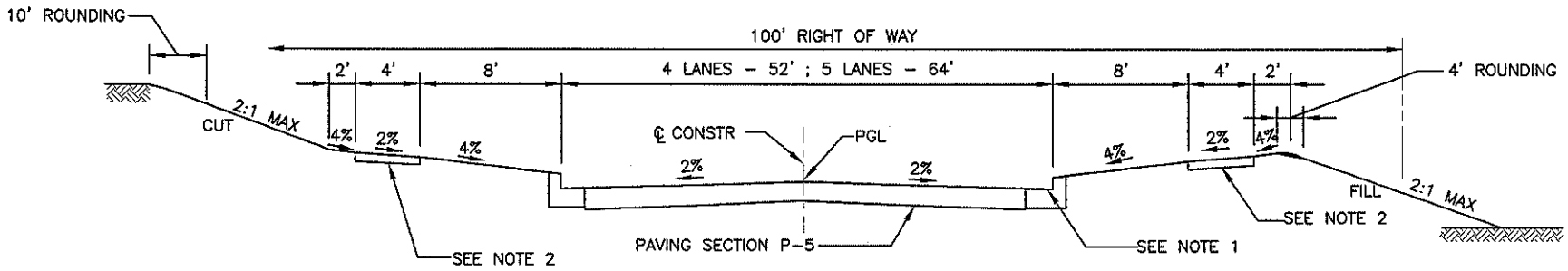


OPEN SECTION (OUTSIDE PLANNED SERVICE AREA ONLY)

7/17/2015

DRAFT

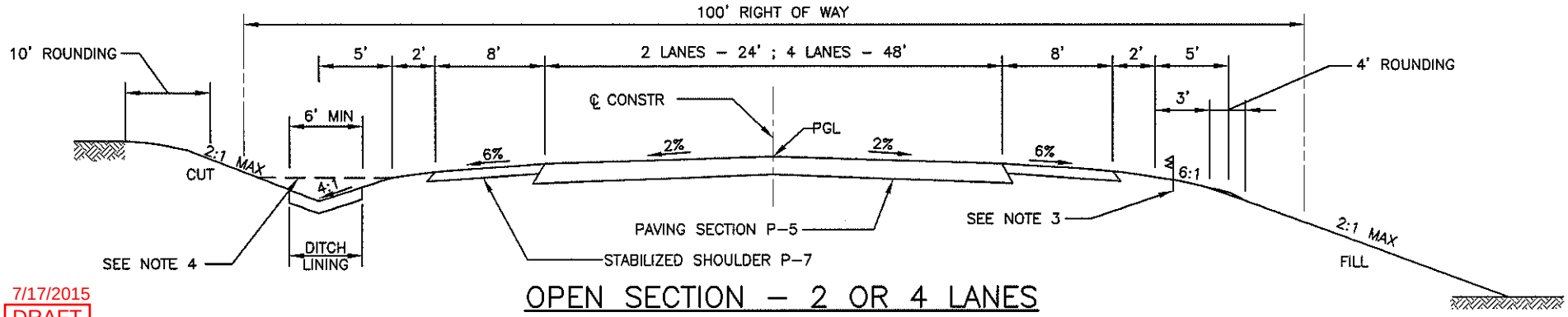
Revisions	Howard County, Maryland Department of Public Works	TYPICAL SECTIONS - NON-RESIDENTIAL STREETS Local Roads, Minor Collector, Major Collector	Detail
1 Revised X/XX/2015 Revised 5/7/2007 Approved	Approved: H:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering		R-1.03



CLOSED SECTION – 4 OR 5 LANES

NOTE:

1. 7" COMBINATION CURB & GUTTER.
2. 4" CONCRETE SIDEWALK AS REQUIRED BY SUB–DIVISION REGULATIONS.
3. TRAFFIC BARRIER W–BEAM AS REQUIRED (SEE DESIGN MANUAL III).
4. DITCH CROSS SECTION SLOPE MAY BE FLATTENED TO PROVIDE A SWALE AT OR NEAR THE CREST OF VERTICAL CURVES WHERE QUANTITY OF SWALE FLOW IS SMALL, AS APPROVED BY DPW.
5. NORMAL CROWN SECTIONS ARE SHOWN. SEE DESIGN MANUAL III FOR SUPERELEVATION REQUIREMENTS.
6. 4'–0" CONCRETE SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R–4.01).



OPEN SECTION – 2 OR 4 LANES

7/17/2015
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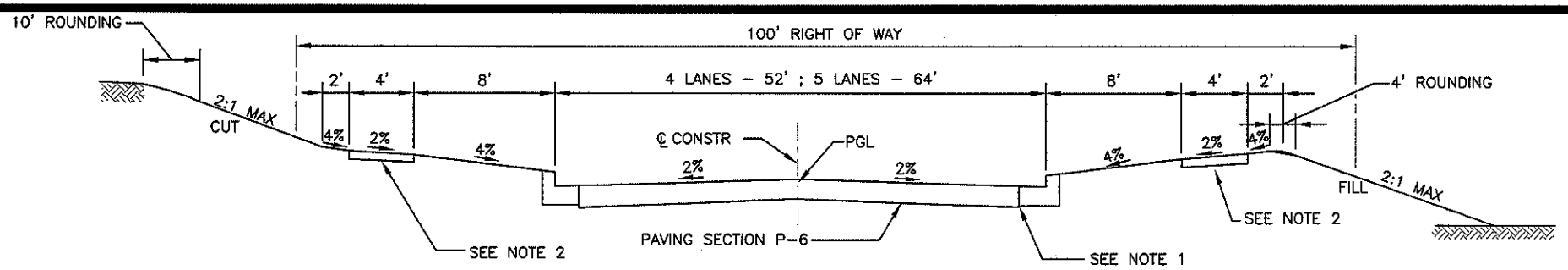
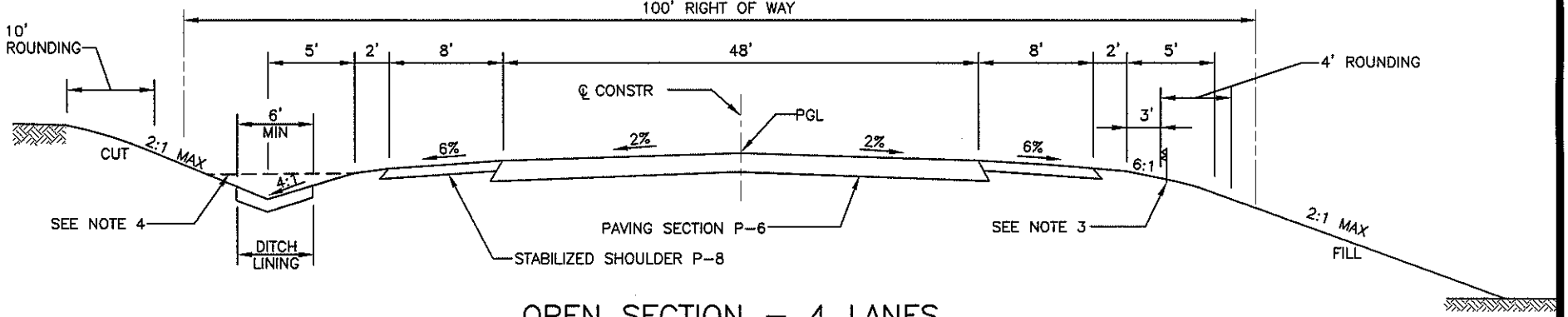
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	TYPICAL SECTIONS Minor Areterial Streets	Detail R–1.04



CLOSED SECTION – 4 OR 5 LANES

NOTE:

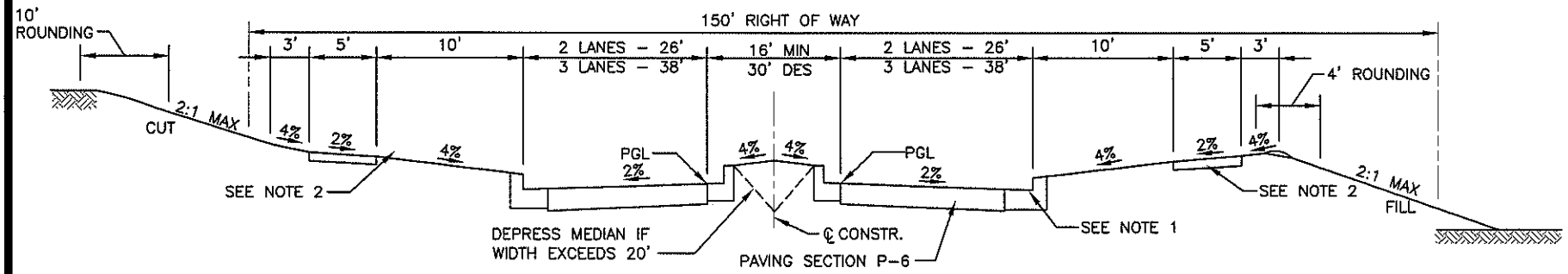
1. 7" COMBINATION CURB & GUTTER.
2. 4" CONCRETE SIDEWALK AS REQUIRED BY SUB-DIVISION REGULATIONS.
3. TRAFFIC BARRIER W-BEAM AS REQUIRED (SEE DESIGN MANUAL).
4. DITCH CROSS SECTION SLOPE MAY BE FLATTENED TO PROVIDE A SWALE AT OR NEAR THE CREST OF VERTICAL CURVES WHERE QUANTITY OF SWALE FLOW IS SMALL, AS APPROVED BY DPW.
5. NORMAL CROWN SECTIONS ARE SHOWN. SEE DESIGN MANUAL FOR SUPERELEVATION REQUIREMENTS.
6. 4'-0" CONCRETE SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.01).



OPEN SECTION – 4 LANES

7/17/2015
DRAFT

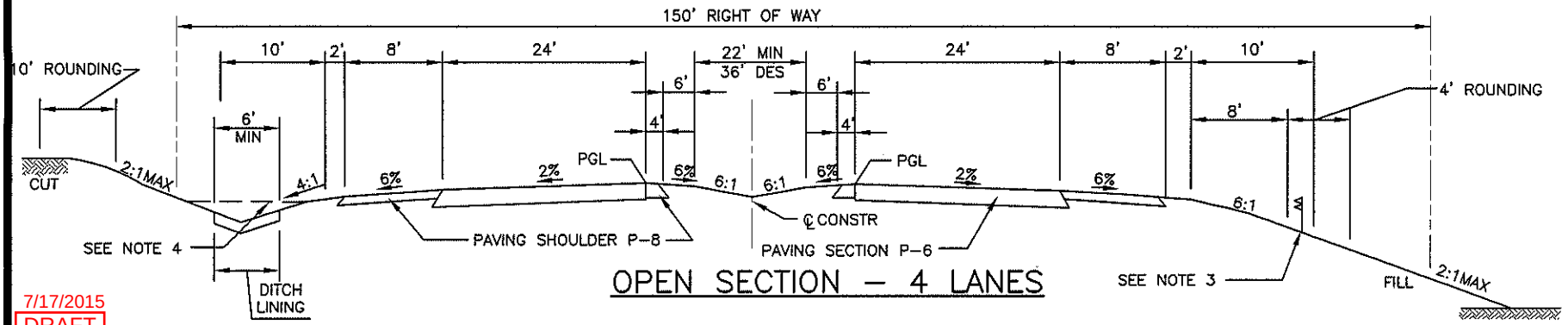
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	TYPICAL SECTIONS Undivided Intermediate Arterial Streets	Detail R-1.05



CLOSED SECTION – 4 OR 6 LANES

NOTES:

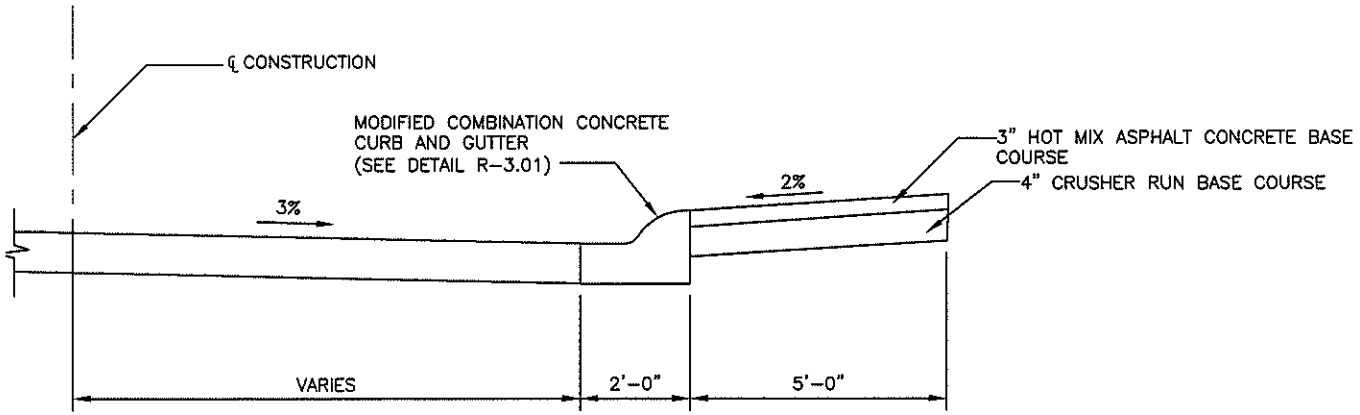
1. 7" COMBINATION CURB & GUTTER.
2. 4" CONCRETE SIDEWALK AS REQUIRED BY SUB-DIVISION REGULATIONS.
3. TRAFFIC BARRIER W-BEAM AS REQUIRED (SEE DESIGN MANUAL III.)
4. DITCH CROSS SECTION SLOPE MAY BE FLATTENED TO PROVIDE A SWALE AT OR NEAR THE CREST OF VERTICAL CURVES WHERE QUANTITY OF SWALE FLOW IS SMALL, AS APPROVED BY DPW.
5. NORMAL CROWN SECTIONS ARE SHOWN. SEE DESIGN MANUAL III FOR SUPERELEVATION REQUIREMENTS.
6. THE CURB AND GUTTER ALONG THE MEDIAN SHALL HAVE THE STANDARD GUTTER SLOPE. TO PREVENT SNOW MELT FROM DRAINING ONTO THE ROADWAY.



OPEN SECTION – 4 LANES

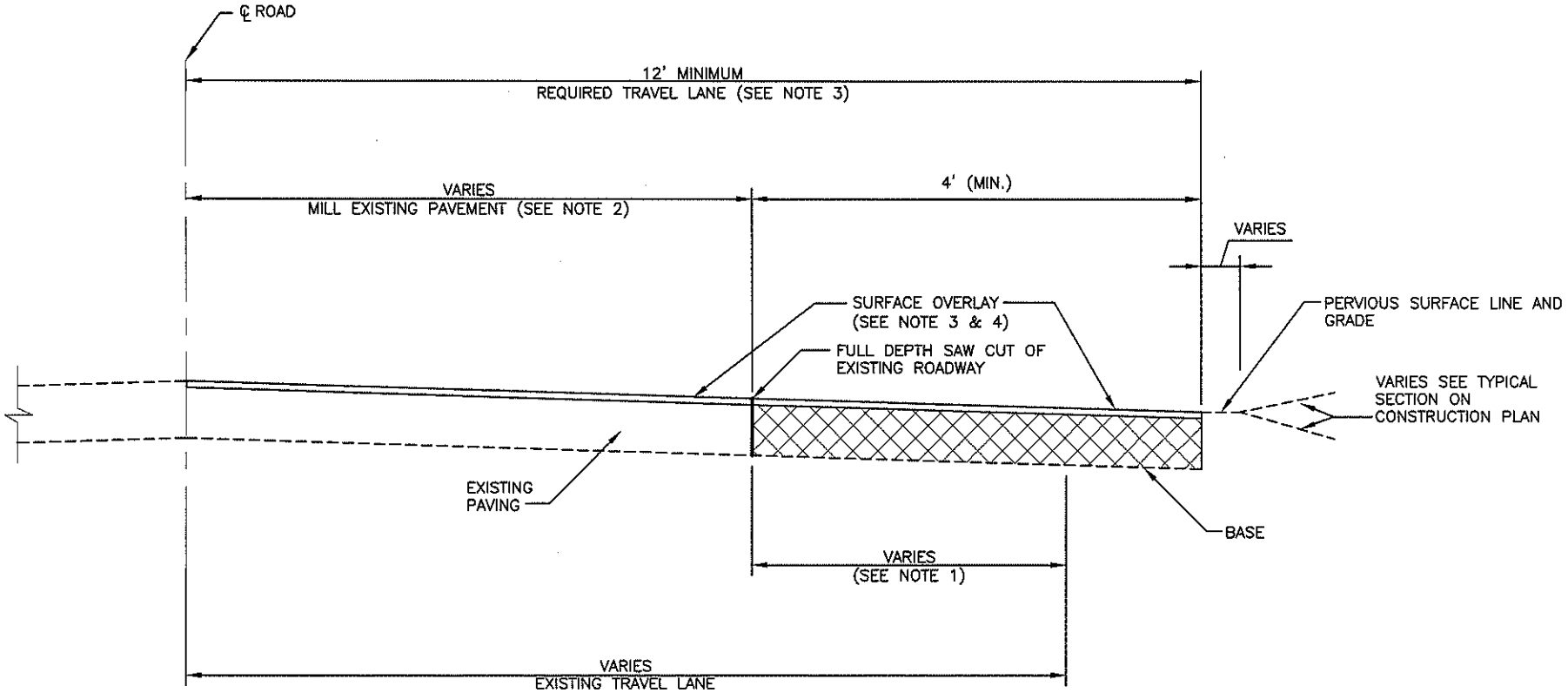
7/17/2015
DRAFT

Revised	Howard County, Maryland Department of Public Works	TYPICAL SECTIONS Divided Intermediate Arterial Streets	Detail R-1.06
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		



7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	TYPICAL SECTIONS Raised Shoulder	Detail R-1.07



NOTES:

1. WHEN EXISTING TRAVEL LANE IS LESS THAN THE REQUIRED 12' LANE CONTRACTOR SHALL REMOVE A MINIMUM OF 1' FULL DEPTH OF THE EXISTING ROADWAY. IF CURB AND GUTTER IS INSTALLED, PROVIDE A MINIMUM OF 4' OF WIDENING FROM FACE OF GUTTER PAN.
2. THE EXISTING PAVEMENT TO BE RESURFACED SHALL BE MILLED AT DEPTH OF 1 1/2" (MINIMUM).
3. THE RESURFACING SHALL BE PLACED TO THE CENTERLINE OF THE ROADWAY.
4. RESURFACING COURSE TO BE EQUAL TO THE SURFACE COURSE OF THE TYPICAL PAVEMENT SECTION.

7/17/2015
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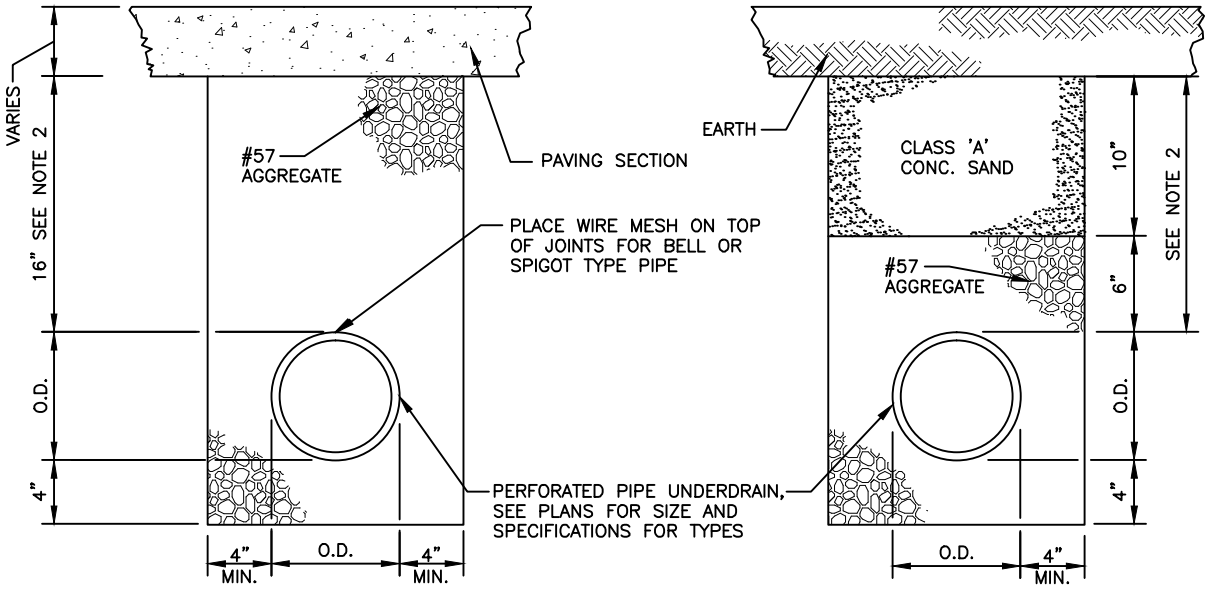
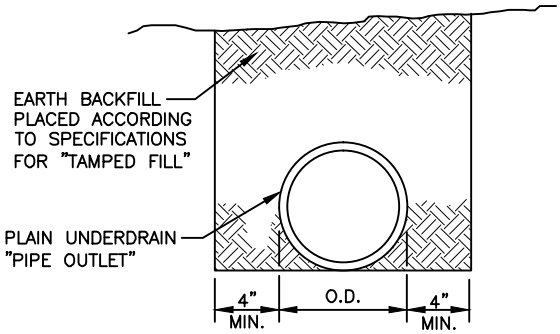
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Existing Roadway Widening Strip	Detail R-1.08

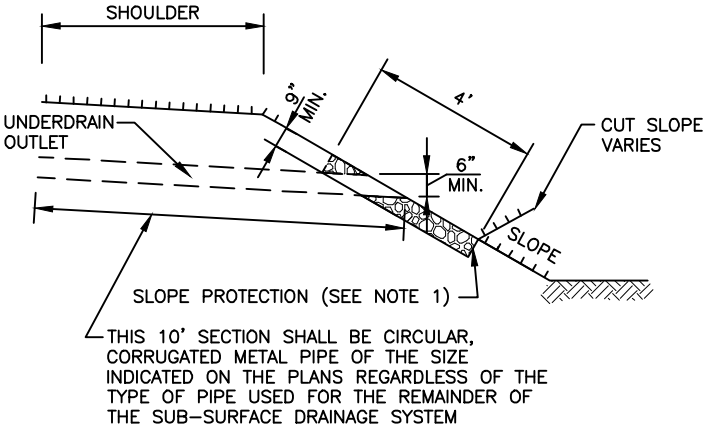


PAVEMENT SUB-BASE UNDERDRAIN DITCH TRENCH

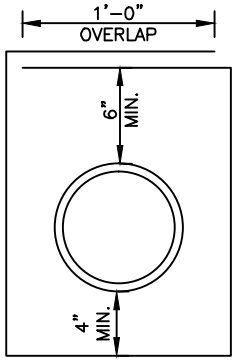
SUB-SURFACE UNDERDRAIN TRENCH SECTION



UNDERDRAIN OUTLET TRENCH SECTION



UNDERDRAIN OUTLET ON ROADWAY SLOPE



1 GEOTEXTILE FABRIC

NOTES

1. SLOPE PROTECTION USING 4" TO 7" STONE SHALL BE USED. THE WIDTH OF STONE PROTECTION TO BE 2'.
2. WITH THE APPROVAL OF THE ENGINEER, THE DIMENSIONS SHOWN MAY BE VARIED WHERE UNDERDRAIN DISCHARGED INTO AN INLET OR WHERE OTHER UNUSUAL CONDITIONS PREVAIL. SEE SPECIFICATIONS PERTAINING TO PAYMENT FOR EXTRA TRENCH DEPTH.
3. (1) UNDERDRAIN SHALL BE LAID ON A MINIMUM 1.0% GRADE UNLESS OTHERWISE APPROVED BY THE ENGINEER.
4. UNDERDRAINS SHALL BE DISCHARGED INTO INLETS AND MANHOLES WHERE POSSIBLE AND SHALL BE DISCHARGED ONTO THE ROADWAY SLOPES ONLY WHERE NO INLETS OR MANHOLES ARE AVAILABLE FOR CONNECTION.
5. FOR JOINTS, REFER TO SPECIFICATIONS.
6. (1) WRAP #57 AGGREGATE WITH GEOTEXTILE FABRIC. SEE DETAIL IN THIS SHEET. GEOTEXTILE CLASS SHALL BE SPECIFIED IN PLANS.

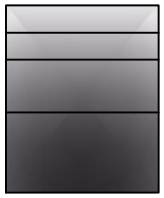
7/17/2015 DRAFT

Revised	Howard County, Maryland Department of Public Works		Detail
1 X/XX/2015		UNDERDRAIN	R-1.09
Approved 5/7/2007	Approved: N:\13767\Final Volume 4\signature.bmp		
Approved	Chief, Bureau of Engineering		

SECTION NUMBER	ROAD AND STREET CLASSIFICATION	CALIFORNIA BEARING RATIO (CBR)	3 TO <5	5 TO <7	≥ 7	3 TO <5	5 TO <7	≥ 7
		PAVEMENT MATERIAL (INCHES)	MIN. SUPERPAVE ASPHALT MIX WITH GAB			SUPERPAVE ASPHALT MIX WITH CONSTANT GAB		
P-1	PARKING BAYS: RESIDENTIAL AND NON-RESIDENTIAL PARKING DRIVE AISLES: RESIDENTIAL AND NON-RESIDENTIAL WITH NO MORE THAN 2 HEAVY TRUCKS PER DAY	SUPERPAVE ASPHALT MIX FINAL SURFACE 9.5 MM PG 64-22S, LEVEL 1 (ESAL)	1.5	1.5	1.5	1.5	1.5	1.5
		SUPERPAVE ASPHALT MIX INTERMEDIATE SURFACE (NA)	NA	NA	NA	NA	NA	NA
		SUPERPAVE ASPHALT MIX BASE 19.0 MM, PG 64-22S, LEVEL 1 (ESAL)	2.0	2.0	2.0	3.5	3.0	2.5
		GRADED AGGREGATE BASE (GAB)	8.5	7.0	5.0	4.0	4.0	4.0
P-2	PARKING DRIVE AISLES: RESIDENTIAL AND NON-RESIDENTIAL WITH NO MORE THAN 10 HEAVY TRUCKS PER DAY LOCAL ROADS: ACESS PLACE, ACCESS STREET CUL-DE-SACS: RESIDENTIAL	SUPERPAVE ASPHALT MIX FINAL SURFACE 9.5 MM, PG 64-22S, LEVEL 1 (ESAL)	1.5	1.5	1.5	1.5	1.5	1.5
		SUPERPAVE ASPHALT MIX INTERMEDIATE SURFACE 9.5 MM, PG 64-22S, LEVEL 1 (ESAL)	1.0	1.0	1.0	1.0	1.0	1.0
		SUPERPAVE ASPHALT MIX BASE 19.0 MM, PG 64-22S, LEVEL 1 (ESAL)	2.0	2.0	2.0	3.5	2.0	2.0
		GRADED AGGREGATE BASE (GAB)	8.0	4.0	3.0	4.0	4.0	4.0
P-3	PARKING DRIVE AISLES: RESIDENTIAL AND NON-RESIDENTIAL WITH NO MORE THAN 10 HEAVY TRUCKS PER DAY LOCAL ROADS: ACCESS PLACE, ACCESS STREET CUL-DE-SACS: NON-RESIDENTIAL MINOR COLLECTORS: RESIDENTIAL	SUPERPAVE ASPHALT MIX FINAL SURFACE 9.5 MM, PG 64-22S, LEVEL 1 (ESAL)	1.5	1.5	1.5	1.5	1.5	1.5
		SUPERPAVE ASPHALT MIX INTERMEDIATE SURFACE 9.5 MM, PG 64-22S, LEVEL 1 (ESAL)	1.0	1.0	1.0	1.0	1.0	1.0
		SUPERPAVE ASPHALT MIX BASE 19.0 MM, PG 64-22S, LEVEL 1 (ESAL)	3.0	3.0	3.0	4.5	3.0	2.0
		GRADED AGGREGATE BASE (GAB)	10.0	6.0	3.0	6.0	6.0	6.0
P-4	MINOR COLLECTORS: NON-RESIDENTIAL MAJOR COLLECTORS	SUPERPAVE ASPHALT MIX FINAL SURFACE 12.5 MM, PG 64-22S, LEVEL 2 (LOW ESAL)	2.0	2.0	2.0	2.0	2.0	2.0
		SUPERPAVE ASPHALT MIX INTERMEDIATE SURFACE 12.5 MM, PG 64-22S, LEVEL 2 (LOW ESAL)	2.0	2.0	2.0	2.0	2.0	2.0
		SUPERPAVE ASPHALT MIX BASE 19.0 MM, PG 64-22S, LEVEL 2 (LOW ESAL)	4.0	4.0	3.0	6.0	5.0	3.0
		GRADED AGGREGATE BASE (GAB)	13.0	7.0	4.0	6.0	6.0	6.0

NOTES

1. HEAVY TRUCKS ARE DEFINED AS THOSE WITH SIX (6) WHEELS OR MORE INCLUDING GARBAGE TRUCKS.
2. SUPERPAVE ASPHALT MIX LAYERS SHALL BE PLACED IN APPROPRIATE COMPACTED LIFT THICKNESS: 19.0 MM BASE (2.0" MIN. TO 4.0" MAX.), 12.5 MM SURFACE (1.5" MIN. TO 3.0" MAX.), AND 9.5 MM SURFACE (1.0" MIN. TO 2.0" MAX.)
3. GRADED AGGREGATE BASE (GAB) TO BE PLACED AND COMPACTED IN 6" MAX. COMPACTED THICKNESS LAYERS.
4. THE INTERMEDIATE SURFACE COURSE LAYER MUST BE PLACED WITHIN 2 WEEKS OF PLACEMENT OF BASE COURSE, AND IS REQUIRED PRIOR TO SUBSTANTIAL COMPLETION INSPECTION AND BOND REDUCTION.
5. IN LIEU OF PLACING THE INTERMEDIATE SURFACE COURSE LAYER FOR COMMERCIAL/INDUSTRIAL ENTRANCE APRONS WITHIN THE COUNTY RIGHT-OF-WAY WHERE AUXILIARY LANES ARE NOT REQUIRED, THE THICKNESS OF THE INTERMEDIATE PAVEMENT LAYER CAN BE ADDED TO THE REQUIRED THICKNESS OF THE BASE ASPHALT LAYER.
6. THE CONSTRUCTION DRAWINGS SHALL SHOW THE PAVING SECTION, ROAD CLASSIFICATION AND CBR VALUE FOR EACH ROADWAY.



SUPERPAVE ASPHALT MIX FINAL SURFACE
SUPERPAVE ASPHALT MIX INTERMEDIATE SURFACE
SUPERPAVE ASPHALT MIX BASE
GRADED AGGREGATE BASE (GAB)

DRAFT
7/17/2015

Revised

Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

Approved: N:\13767\Final Volume 4\signature.bmp
Chief, Bureau of Engineering

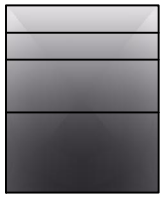
PAVING SECTIONS
P-1 to P-4

Detail
R-2.01

SECTION NUMBER	ROAD AND STREET CLASSIFICATION	CALIFORNIA BEARING RATIO (CBR)	3 TO <5	5 TO <7	≥ 7	3 TO <5	5 TO <7	≥ 7
		PAVEMENT MATERIAL (INCHES)	MIN. SUPERPAVE ASPHALT MIX WITH GAB			SUPERPAVE ASPHALT MIX WITH CONSTANT GAB		
P-5	MINOR ARTERIAL	SUPERPAVE ASPHALT MIX FINAL SURFACE 12.5 MM, PG 70-22, LEVEL 3 (HIGH ESAL)	2.0	2.0	2.0	2.0	2.0	2.0
		SUPERPAVE ASPHALT MIX INTERMEDIATE SURFACE 12.5 MM, PG 64-22S, LEVEL 3 (HIGH ESAL)	2.0	2.0	2.0	2.0	2.0	2.0
		SUPERPAVE ASPHALT MIX BASE 19.0 MM, PG 64-22S, LEVEL 3 (HIGH ESAL)	6.0	6.0	6.0	7.0	5.0	4.0
		GRADED AGGREGATE BASE (GAB)	11.0	5.0	4.0	8.0	8.0	8.0
P-6	UNDIVIDED INTERMEDIATE ARTERIAL DIVIDED INTERMEDIATE ARTERIAL	SUPERPAVE ASPHALT MIX FINAL SURFACE 12.5 MM, PG 70-22S, LEVEL 3 (HIGH ESAL)	2.0	2.0	2.0	2.0	2.0	2.0
		SUPERPAVE ASPHALT MIX INTERMEDIATE SURFACE 12.5 MM, PG 64-22S, LEVEL 3 (HIGH ESAL)	2.0	2.0	2.0	2.0	2.0	2.0
		SUPERPAVE ASPHALT MIX BASE 19.0 MM, PG 64-22S, LEVEL 3 (HIGH ESAL)	7.0	7.0	7.0	8.5	6.5	5.0
		GRADED AGGREGATE BASE (GAB)	13.0	6.0	4.0	8.0	8.0	8.0
P-7	STABILIZED SHOULDER: MINOR ARTERIAL	CHIP SEAL DOUBLE SURFACE TREATMENT	1.75	1.75	1.75	NA	NA	NA
		GRADED AGGREGATE BASE (GAB)	16.5	14.5	13.0	NA	NA	NA
P-8	PAVED SHOULDER: UNDIVIDED INTERMEDIATE ARTERIAL DIVIDED INTERMEDIATE ARTERIAL SIDEWALK AND PARKING AREAS (PRIVATE) (NOTE: THIS SECTION MAY BE USED IN LIEU OF CONCRETE SIDEWALK IN OFF SITE, PRIVATELY MAINTAINED AREAS ONLY.)	SUPERPAVE ASPHALT MIX FINAL SURFACE 12.5 MM, PG 64-22S, LEVEL 1 (LOW ESAL)	3.0	3.0	3.0	4.0	3.5	3.5
		GRADED AGGREGATE BASE (GAB)	9.5	8.0	5.5	6.0	6.0	6.0

NOTES

1. HEAVY TRUCKS ARE DEFINED AS THOSE WITH SIX (6) WHEELS OR MORE INCLUDING GARBAGE TRUCKS.
2. SUPERPAVE ASPHALT MIX LAYERS SHALL BE PLACED IN APPROPRIATE COMPACTED LIFT THICKNESS: 19.0 MM BASE (2.0" MIN. TO 4.0" MAX.), 12.5 MM SURFACE (1.5" MIN. TO 3.0" MAX.), AND 9.5 MM SURFACE (1.0" MIN. TO 2.0" MAX.)
3. GRADED AGGREGATE BASE (GAB) TO BE PLACED AND COMPACTED IN 6" MAX. COMPACTED THICKNESS LAYERS.
4. THE INTERMEDIATE SURFACE COURSE LAYER MUST BE PLACED WITHIN 2 WEEKS OF PLACEMENT OF BASE COURSE, AND IS REQUIRED PRIOR TO SUBSTANTIAL COMPLETION INSPECTION AND BOND REDUCTION.
5. IN LIEU OF PLACING THE INTERMEDIATE SURFACE COURSE LAYER FOR COMMERCIAL/INDUSTRIAL ENTRANCE APRONS WITHIN THE COUNTY RIGHT-OF-WAY WHERE AUXILIARY LANES ARE NOT REQUIRED, THE THICKNESS OF THE INTERMEDIATE PAVEMENT LAYER CAN BE ADDED TO THE REQUIRED THICKNESS OF THE BASE ASPHALT LAYER.
6. THE CONSTRUCTION DRAWINGS SHALL SHOW THE PAVING SECTION, ROAD CLASSIFICATION AND CBR VALUE FOR EACH ROADWAY.



SUPERPAVE ASPHALT MIX FINAL SURFACE
SUPERPAVE ASPHALT MIX INTERMEDIATE SURFACE
SUPERPAVE ASPHALT MIX BASE
GRADED AGGREGATE BASE (GAB)

DRAFT
7/17/2015

Revised

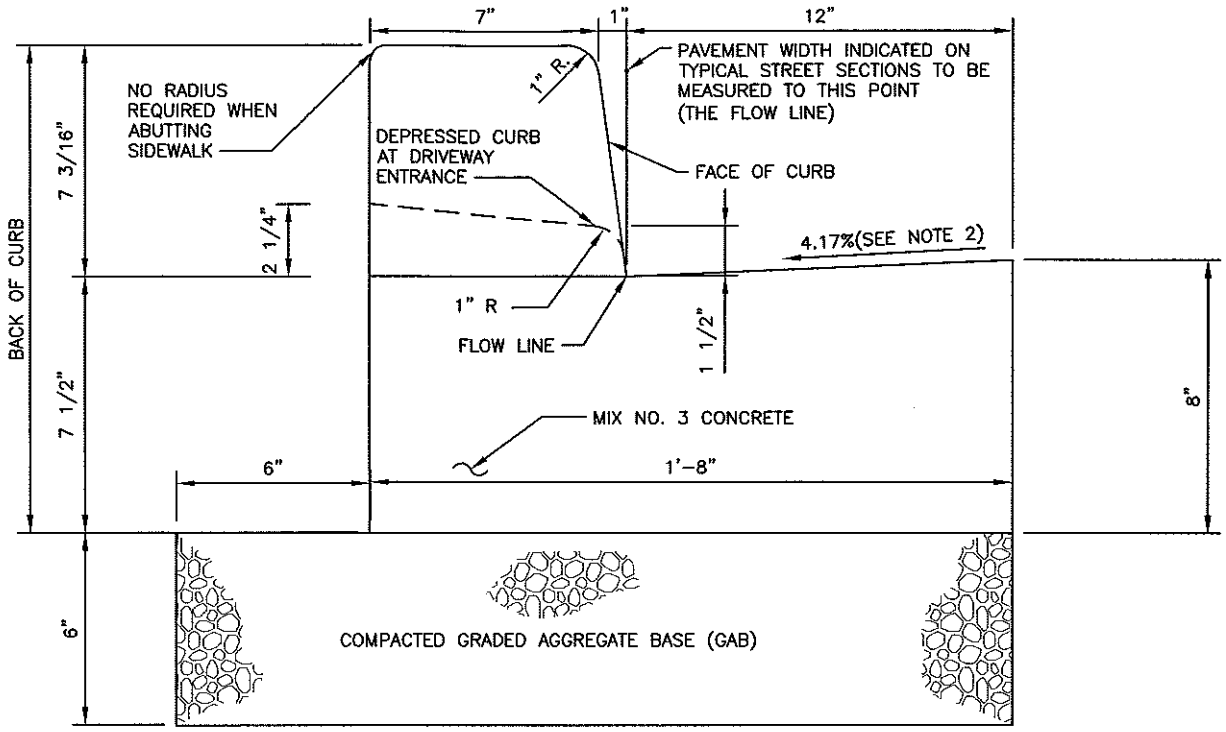
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

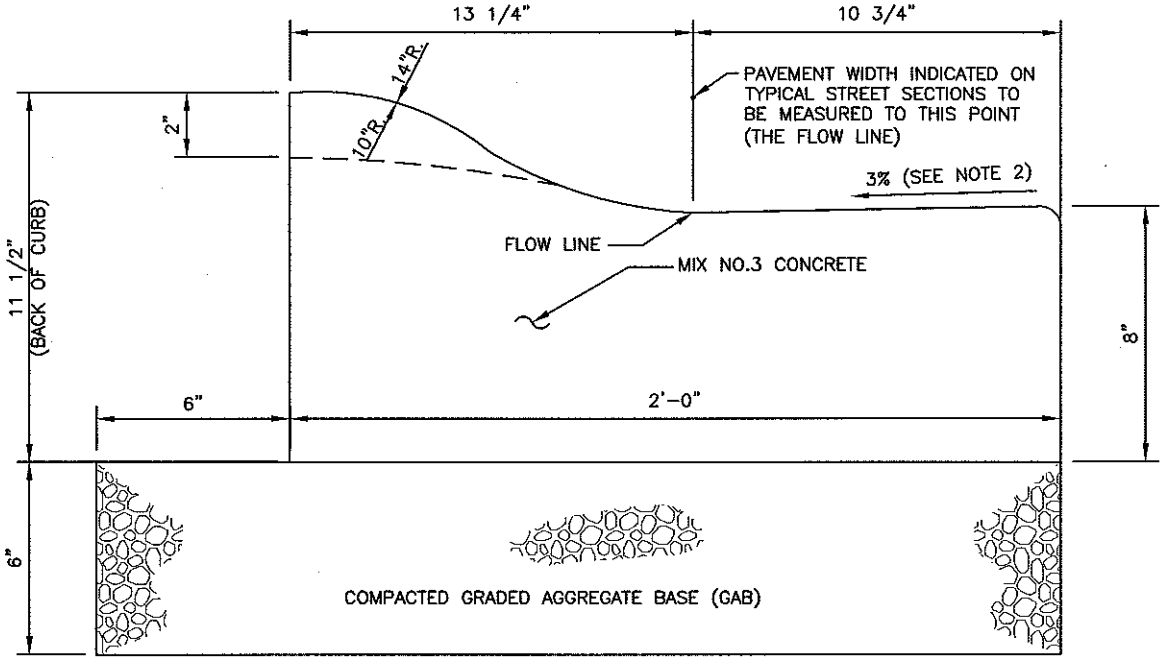
Approved: N:\\3767\Final Volume 4\signature.bmp
Chief, Bureau of Engineering

PAVING SECTIONS
P-5 to P-8

Detail
R-2.02



7" COMBINATION CURB AND GUTTER



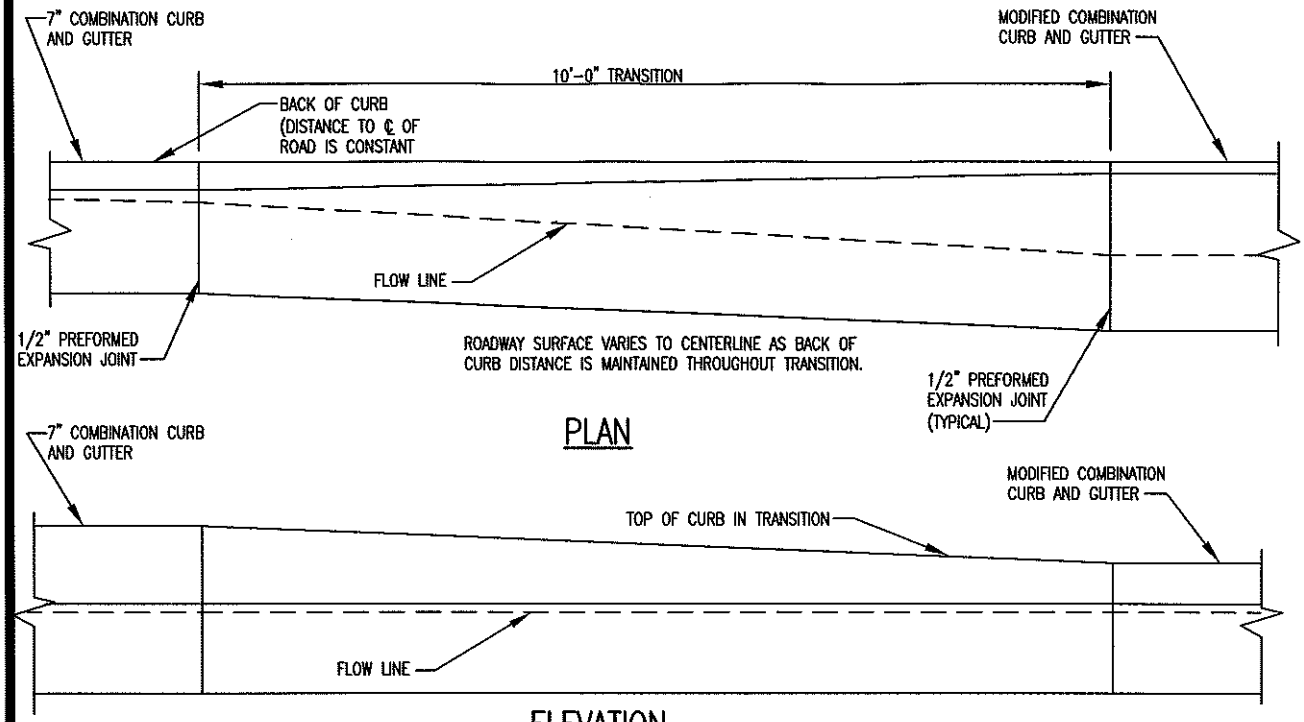
MODIFIED COMBINATION CURB AND GUTTER

NOTE:

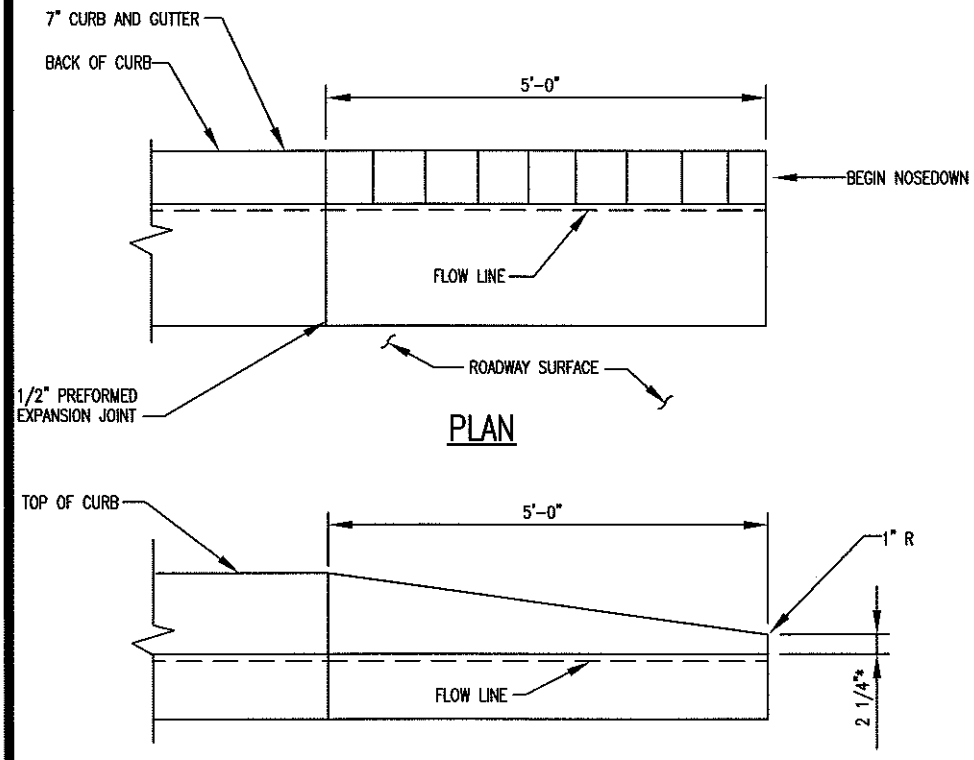
1. A REVERSE GUTTER PAN SHALL HAVE A GUTTER SLOPE OF 4.17% AWAY FROM THE FLOW LINE, AND SHALL NOT BE USED WHERE THIS DRAINAGE CREATES A HAZARDOUS CONDITION.
2. GUTTER PAN AT THE MEDIAN EDGE OF INTERMEDIATE ARTERIALS OR THE HIGH SIDE OF SUPERELEVATED SECTIONS SHALL BE SLOPED AT THE SAME RATE AND IN THE SAME DIRECTION AS THE PAVEMENT. MATCH PAVEMENT CROSS SLOPE WHEN CURB IS LOCATED ON THE LOW SIDE OF SUPERELEVATED SECTION AND THE RATE OF SUPERELEVATION IS GREATER THAN 3% FOR MODIFIED CURB & GUTTER.
3. A MINIMUM OF TWO (2) FEET OF COMPACTED STABILIZED EARTH, OR EQUIVALENT, SHALL SUPPORT THE ENTIRE BACK OF CURB.
4. POSITIVE DRAINAGE SHALL BE PROVIDED BOTH BEHIND THE CURB AND ALONG THE GUTTER AND FLOW LINE.

7/17/2015 DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	CURB AND GUTTER 7" & Modified	Detail R-3.01



7" C & G TO MODIFIED C & G DETAIL

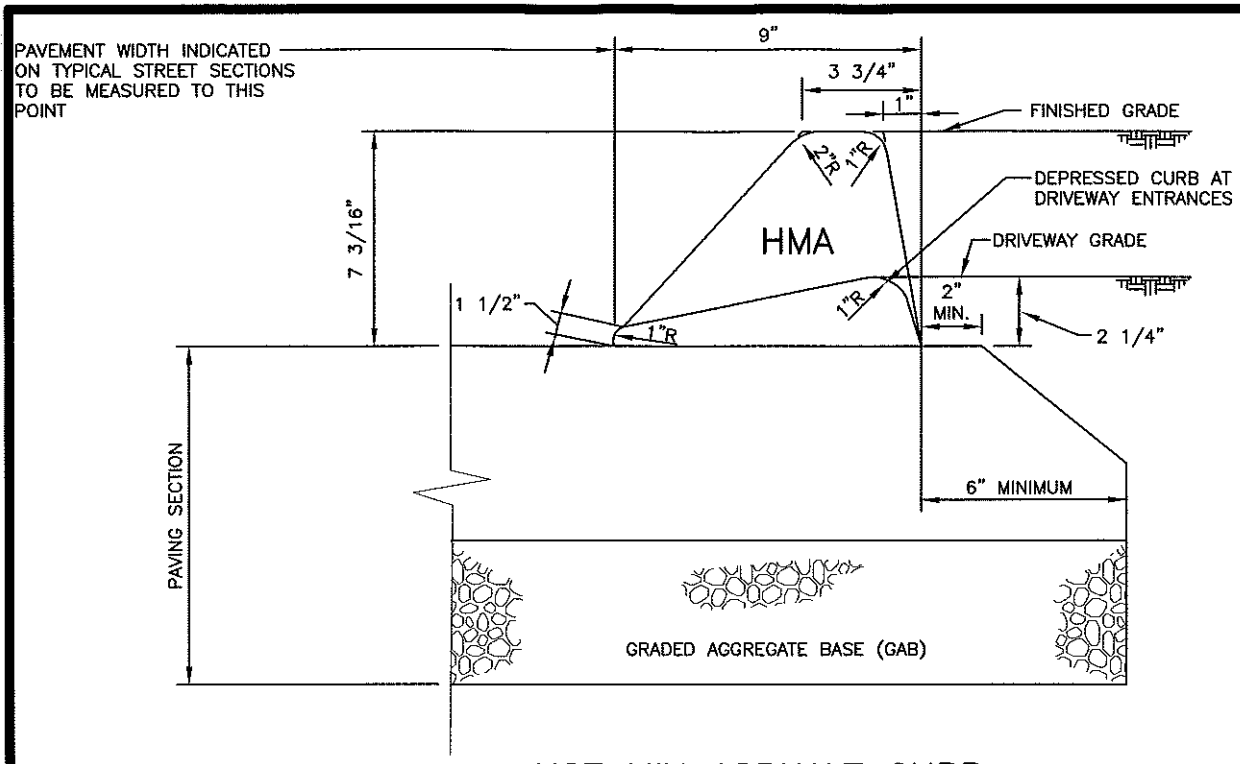


NOSE DOWN DETAIL

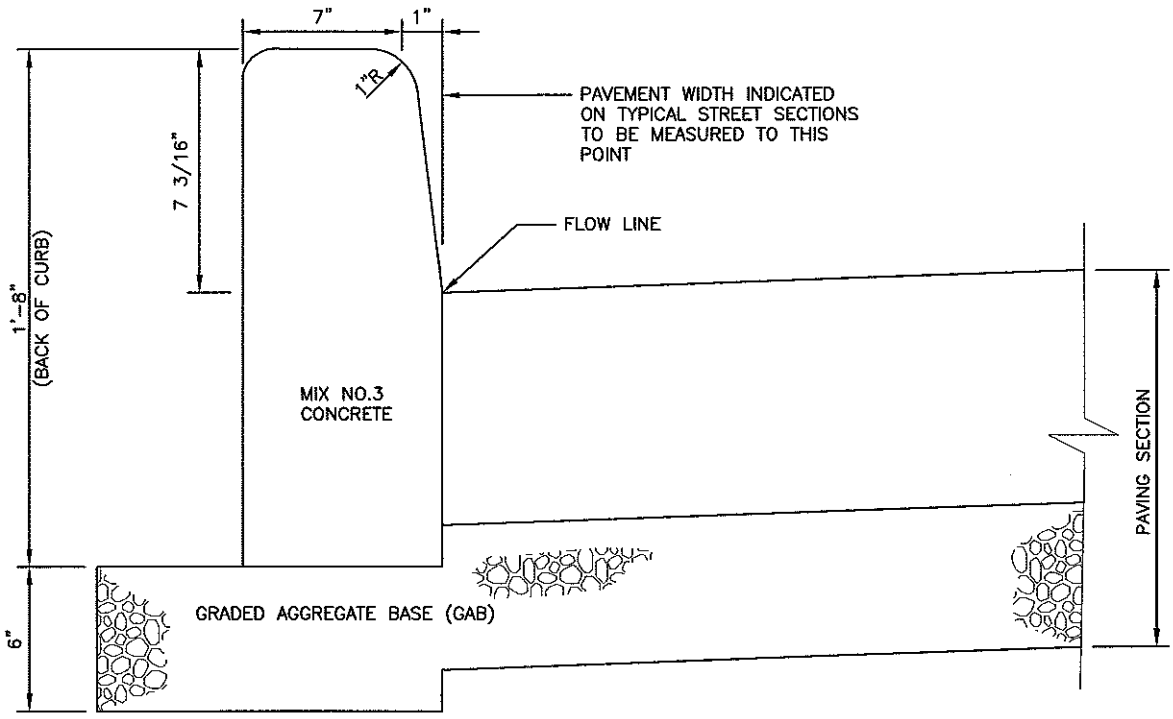
* DIMENSION SHALL BE 0" WHEN NOSE DOWN OCCURS FOR SIDEWALK RAMP (NO LIP AT RAMP)

7/17/2015
DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	CURB AND GUTTER 7" Transition to Modified & Nose Down	Detail R-3.02



HOT MIX ASPHALT CURB



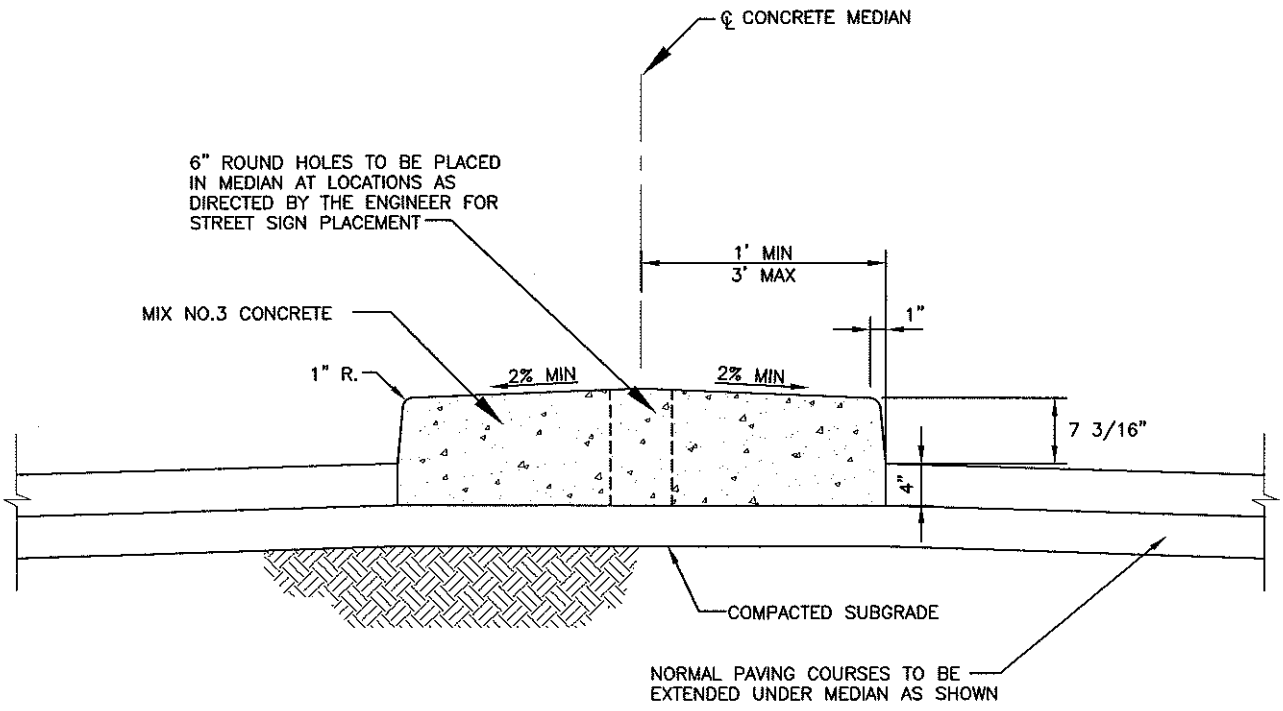
CONCRETE BARRIER CURB

NOTES:

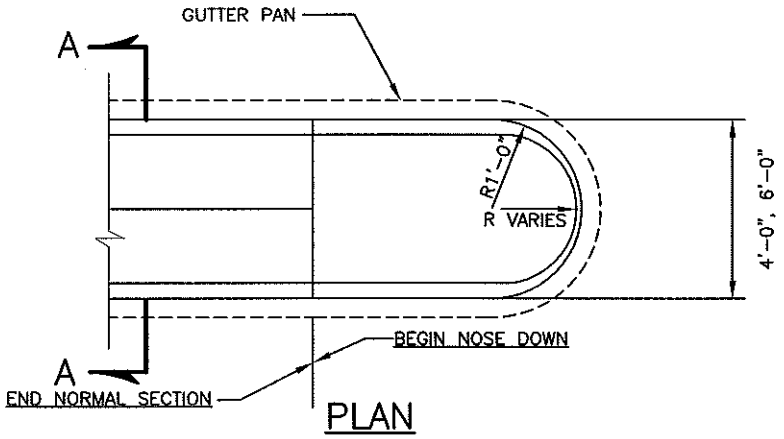
1. A MINIMUM OF TWO (2) FEET OF COMPACTED STABILIZED EARTH, OR EQUIVALENT, SHALL SUPPORT THE ENTIRE BACK OF CURB.
2. POSITIVE DRAINAGE SHALL BE PROVIDED BOTH BEHIND THE CURB AND ALONG THE GUTTER AND FLOW LINE.

7/17/2015 DRAFT

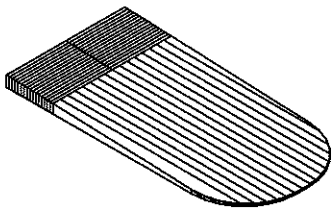
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	CURBS Hot Mix Asphalt & Concrete Barrier	Detail R-3.03



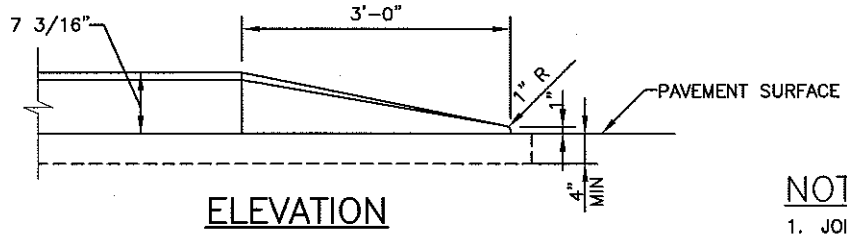
SECTION A–A
(SHOWN WITHOUT GUTTER PAN)



PLAN



ISOMETRIC–NOSE DOWN
(SHOWN WITHOUT GUTTER PAN)



ELEVATION

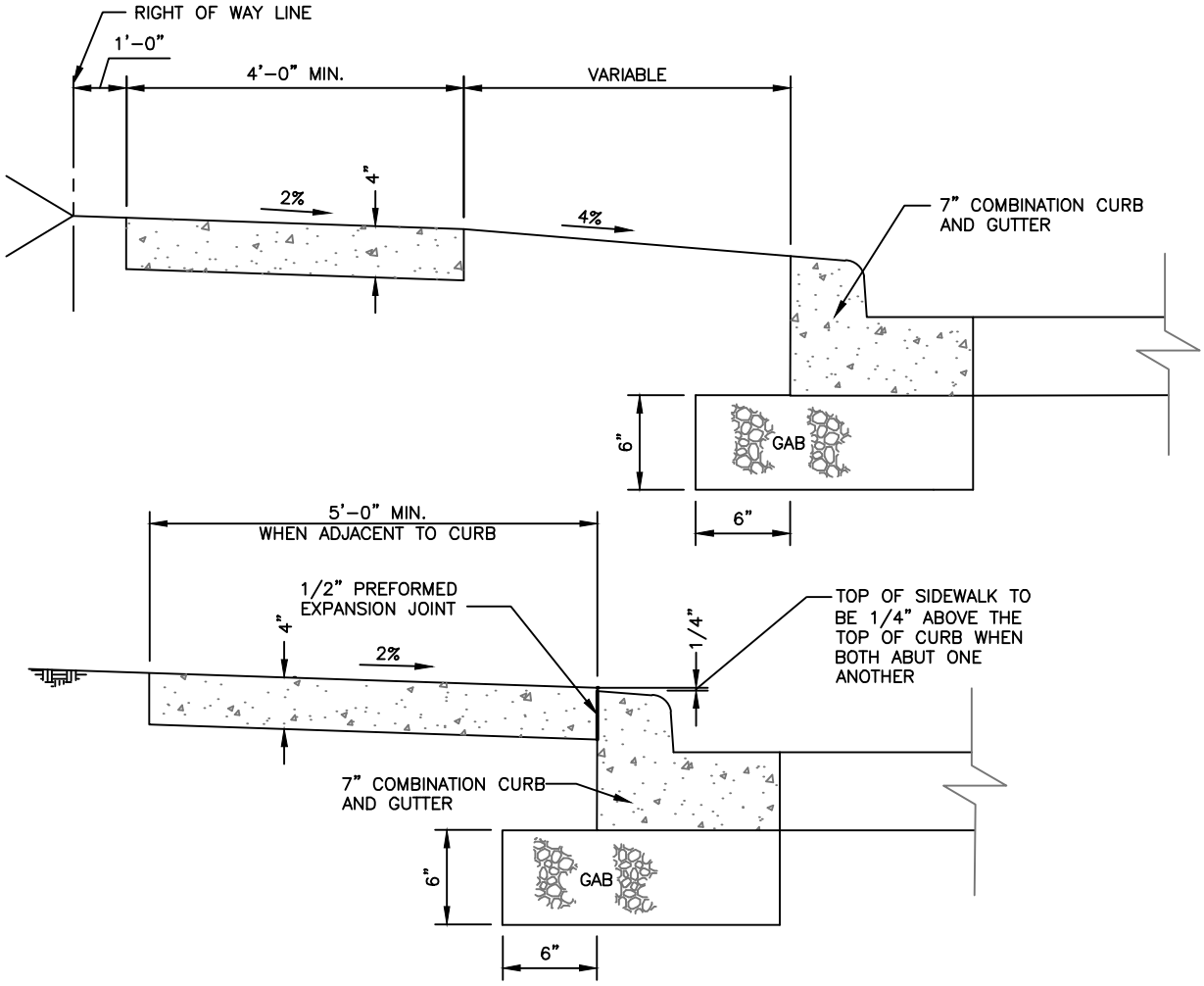
NOSE DOWN AT APPROACH END OF MEDIAN

NOTE:

1. JOINTS SHALL BE SPACED 10 FEET ON CENTERS IN ACCORDANCE WITH THE SPECIFICATIONS FOR CONCRETE COMBINATION CURB & GUTTER. WIDTH OF MEDIAN TO BE AS SPECIFIED ON THE PLANS.

7/17/2015
DRAFT

Revised	Howard County, Maryland Department of Public Works	Monolithic Concrete Median	Detail R-3.04
Revised 5/7/2007 Approved	Approved: Chief, Bureau of Engineering		

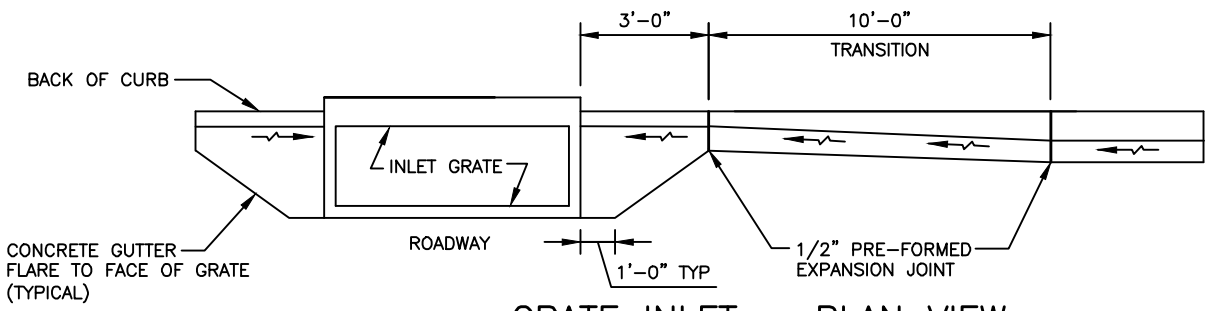


NOTES:

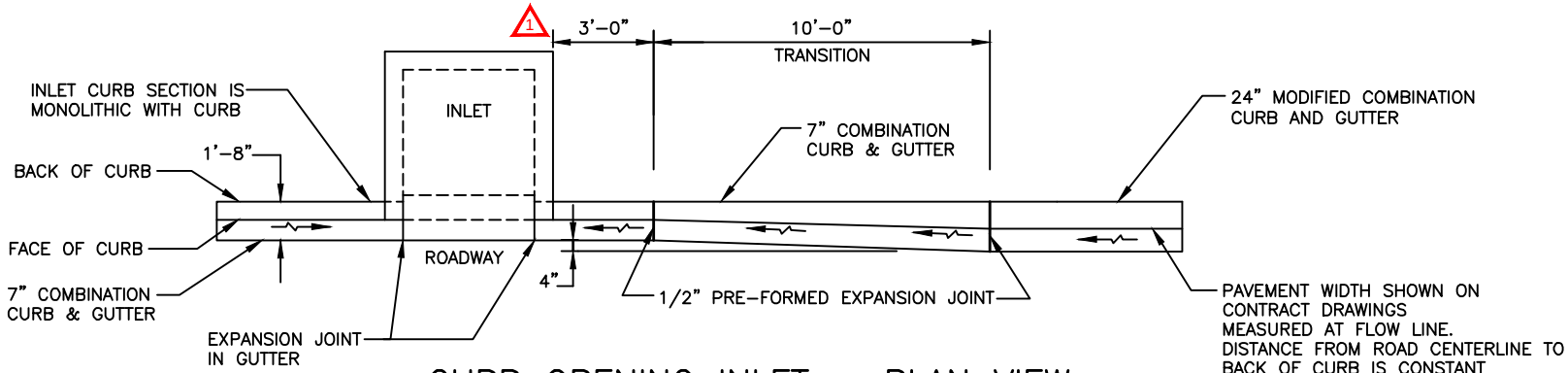
1. SIDEWALK TO BE SCRIBED IN 5'-0" MAXIMUM SQUARES.
2. EXPANSION JOINTS ACROSS THE SIDEWALK NOT TO BE MORE THAN 15' APART, OR 16' FOR 4' WIDE SIDEWALK.
3. 1/2" PREFORMED EXPANSION MATERIAL IN EXPANSION JOINTS TO BE KEPT 1/4" BELOW SURFACE OF SIDEWALK.
4. CONCRETE TO BE MIX #3.
5. WHEN SIDEWALK ABUTS CURB, SIDEWALK SHALL BE 1/4" ABOVE CURB WITH 1/2" PREFORMED EXPANSION JOINT BETWEEN SIDEWALK AND CURB.
6. ON LONGITUDINAL SIDEWALK GRADES OF 5% OR GREATER, A CONCRETE HEADER, 6" THICK AND 6" DEEP BELOW THE NORMAL 4" SIDEWALK THICKNESS SHALL BE CONSTRUCTED FOR THE FULL WIDTH OF THE SIDEWALK AT INTERVALS OF 48 FEET. THE HEADERS SHALL BE PLACED AT THE EXPANSION JOINT LOCATIONS AND SHALL BE MONOLITHIC WITH THE SIDEWALK.
7. SIDEWALK WIDTH ADJACENT TO CURB SHALL BE 5'-0" MINIMUM EXCEPT SIDEWALK ADJACENT TO CURB IN CUL-DE-SAC BULBS MAY BE 4'-0" WIDE.
8. SIDEWALK LOCATED 2' OR MORE FROM CURB MAY BE 4'-0" IN WIDTH WITH A 5'x5' PAVED SECTION PLACED 200' APART.
9. 4'-0" SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.01).

7/17/2015 DRAFT

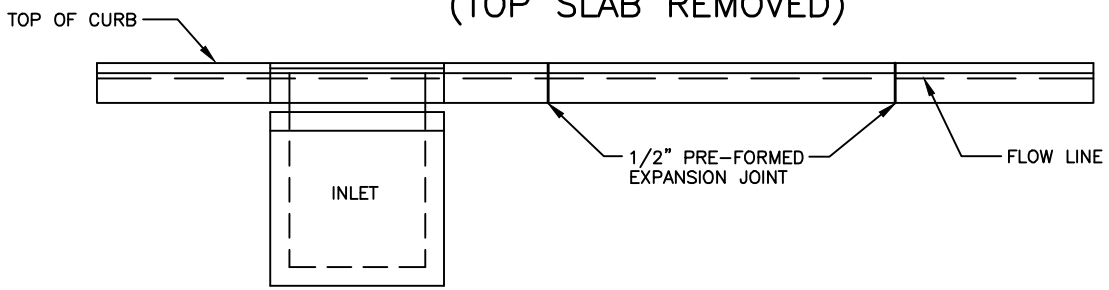
Revised	Howard County, Maryland	CONCRETE SIDEWALK	Detail
1 X/XX/2015	Department of Public Works		R-3.05
Approved 5/7/2007	Approved: N:\13767\Final Volume 4\signature.bmp		
Approved	Chief, Bureau of Engineering		



GRATE INLET – PLAN VIEW



CURB OPENING INLET – PLAN VIEW
(TOP SLAB REMOVED)

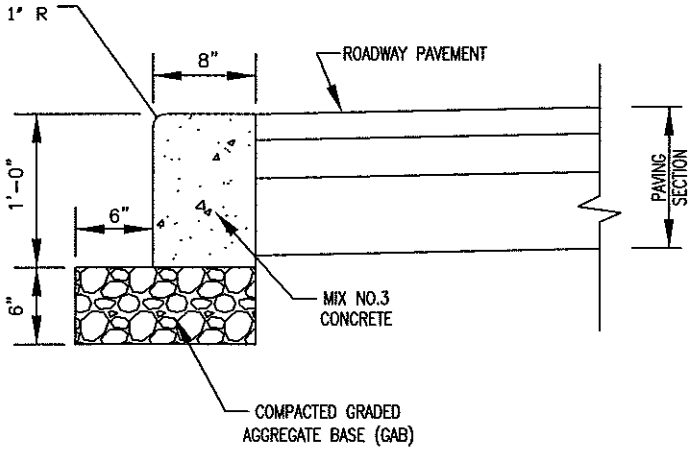


CURB OPENING INLET – ELEVATION VIEW

7/17/2015

DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13787\Final Volume 4\signature.bmp Chief, Bureau of Engineering	CURB AND GUTTER Modified Combination Transition for Inlets	Detail R-3.06

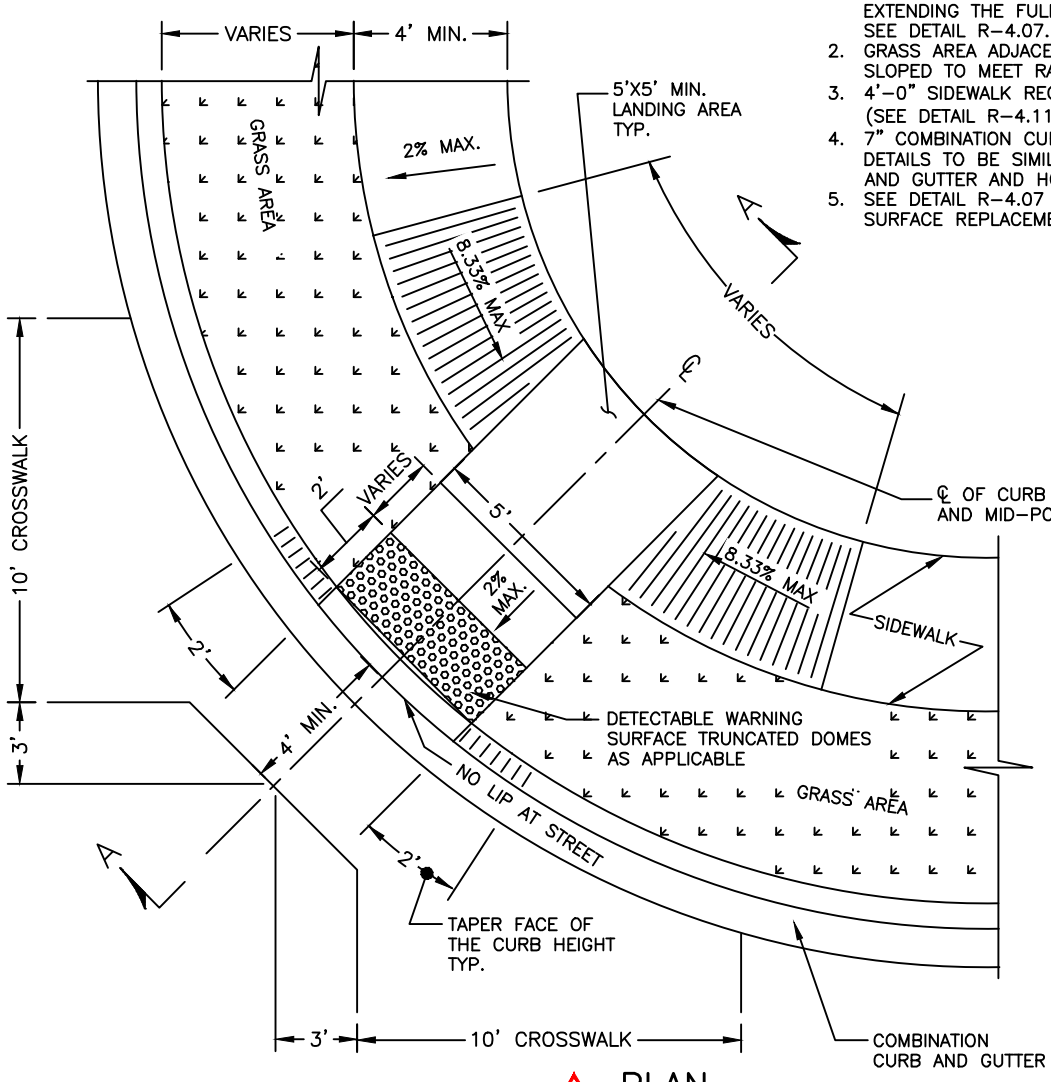


7/17/2015
DRAFT

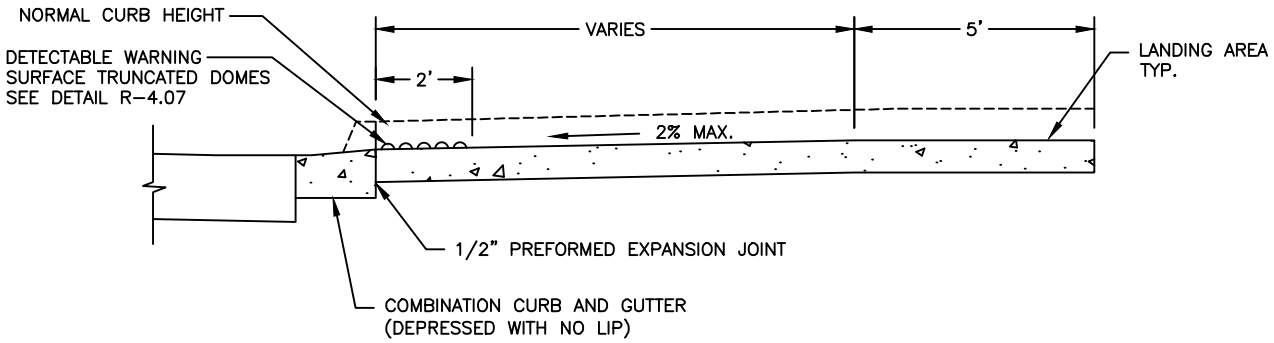
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Curb Flush	Detail R-3.07

NOTES:

1. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF THE RAMP. SEE DETAIL R-4.07.
2. GRASS AREA ADJACENT TO SIDEWALK MUST BE SLOPED TO MEET RAMP.
3. 4'-0" SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.11).
4. 7" COMBINATION CURB AND GUTTER IS SHOWN. DETAILS TO BE SIMILAR FOR MODIFIED CURB AND GUTTER AND HOT MIX ASPHALT CURB.
5. SEE DETAIL R-4.07 FOR DETECTABLE WARNING SURFACE REPLACEMENT GUIDELINES.



1 PLAN



1 SECTION A-A

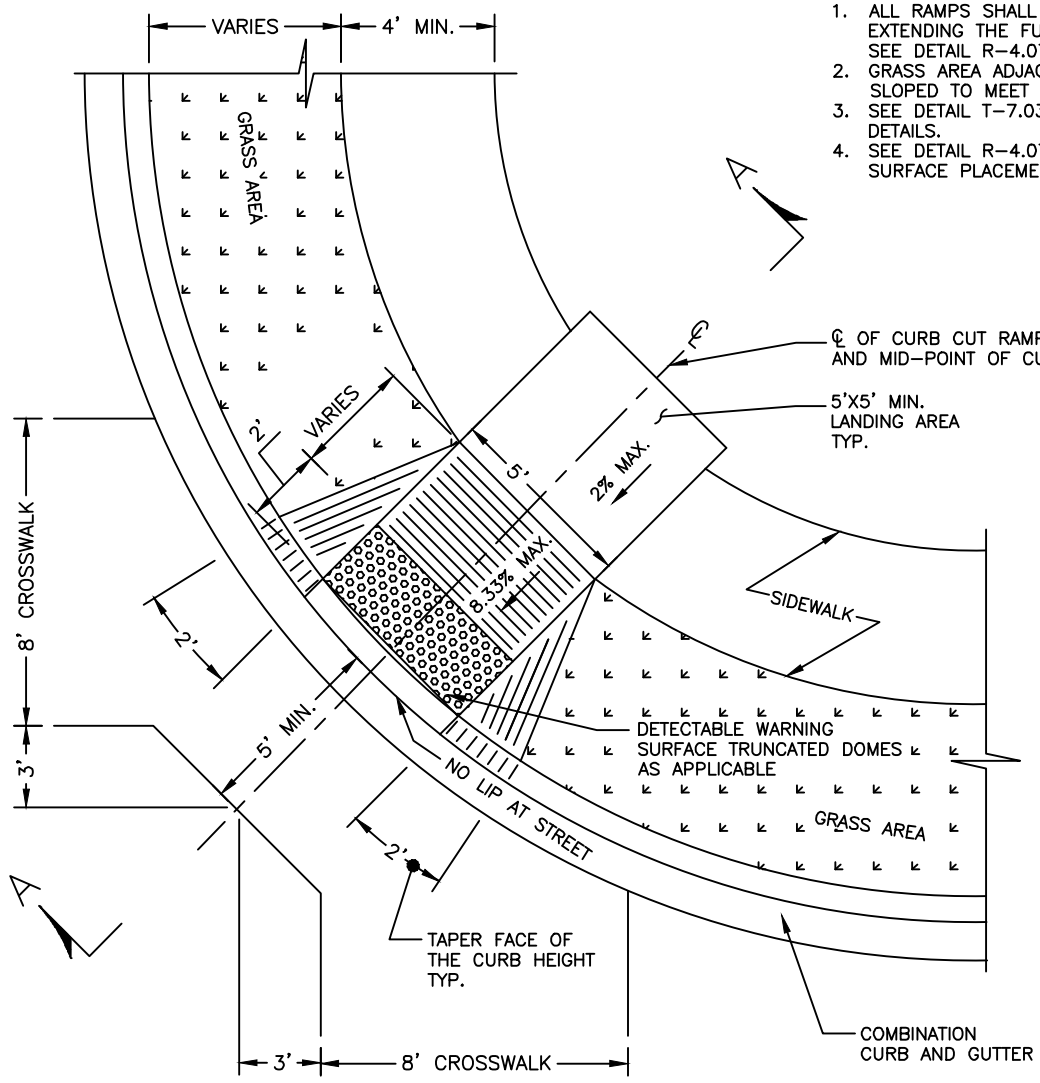
7/17/2015

DRAFT

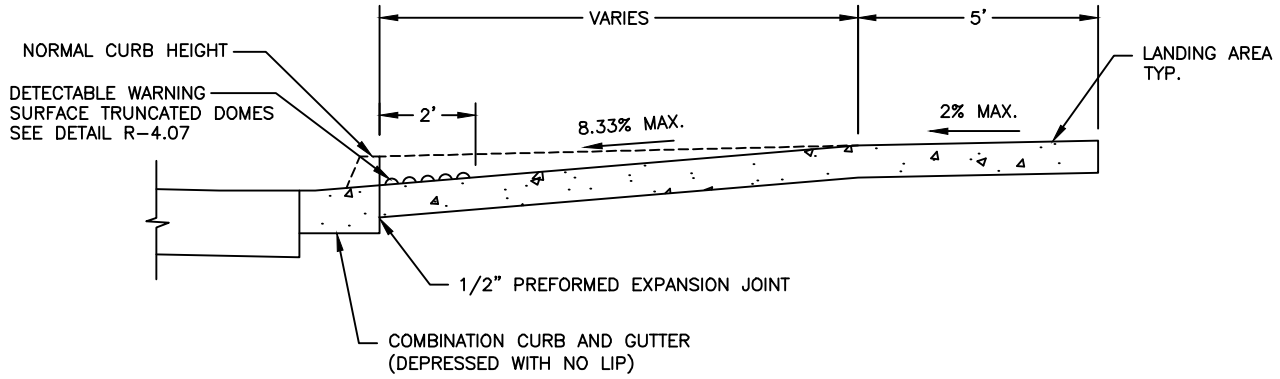
Revised 1 7/17/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	SIDEWALK RAMP Type A	Detail R-4.01

NOTES:

1. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF THE RAMP. SEE DETAIL R-4.07.
2. GRASS AREA ADJACENT TO SIDEWALK SHALL BE SLOPED TO MEET RAMP.
3. SEE DETAIL T-7.03 FOR CROSSWALK MARKING DETAILS.
4. SEE DETAIL R-4.07 FOR DETECTABLE WARNING SURFACE PLACEMENT GUIDELINES.



1 PLAN

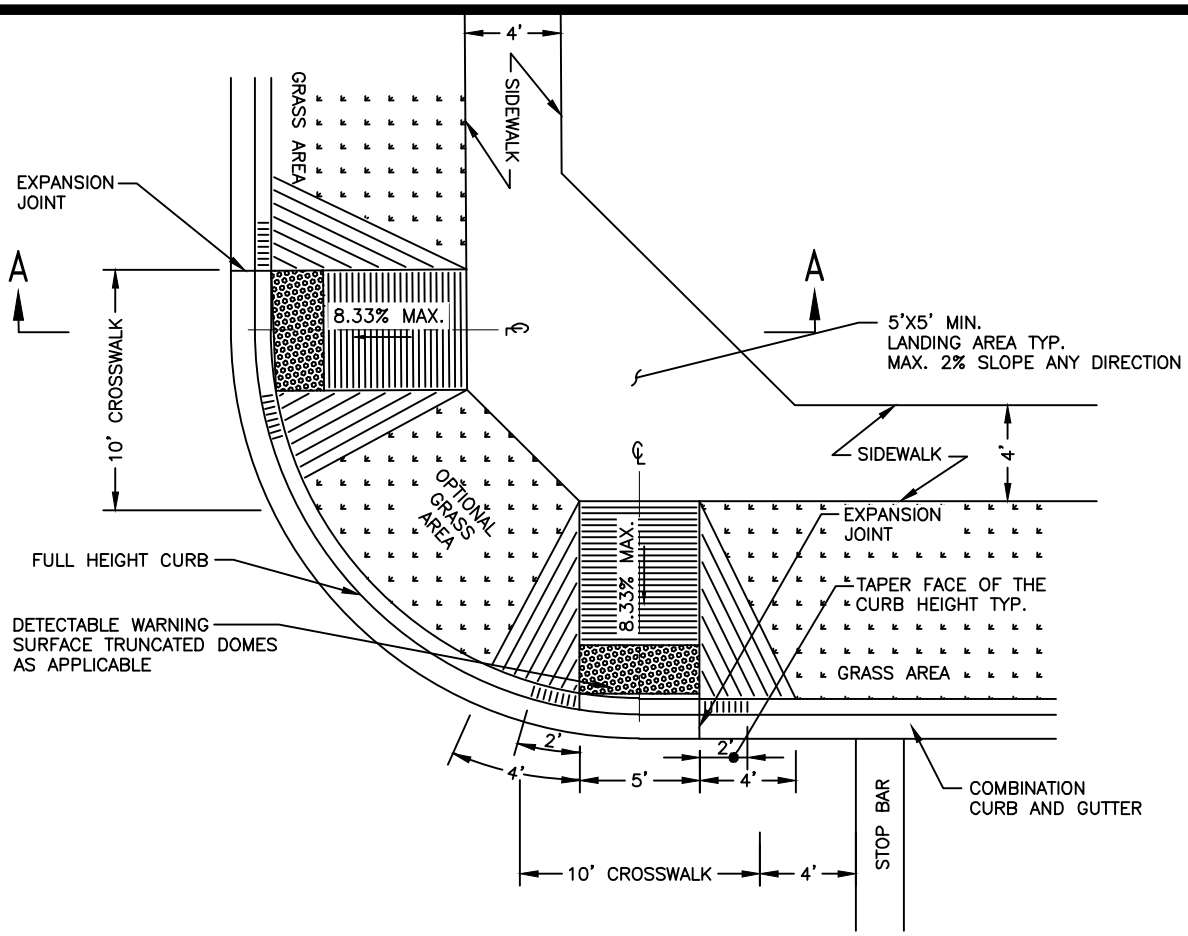


1 SECTION A-A

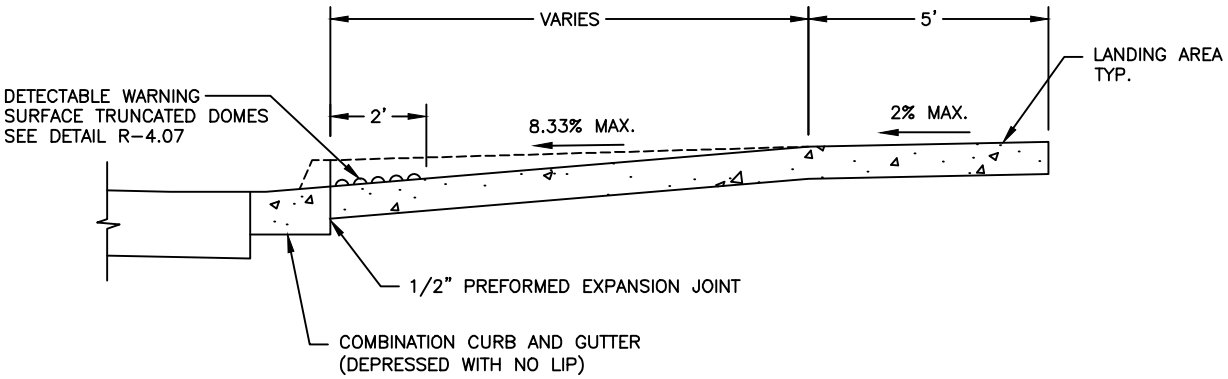
7/17/2015

DRAFT

Revised 1 7/17/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: [signature] Chief, Bureau of Engineering	SIDEWALK RAMP Type B Single Ramp	Detail R-4.02



1 PLAN

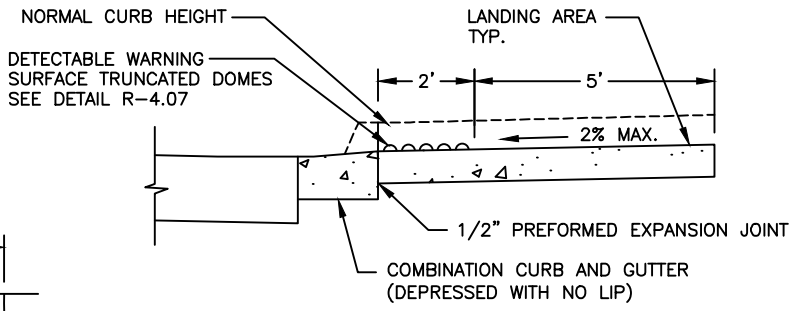


1 SECTION A–A

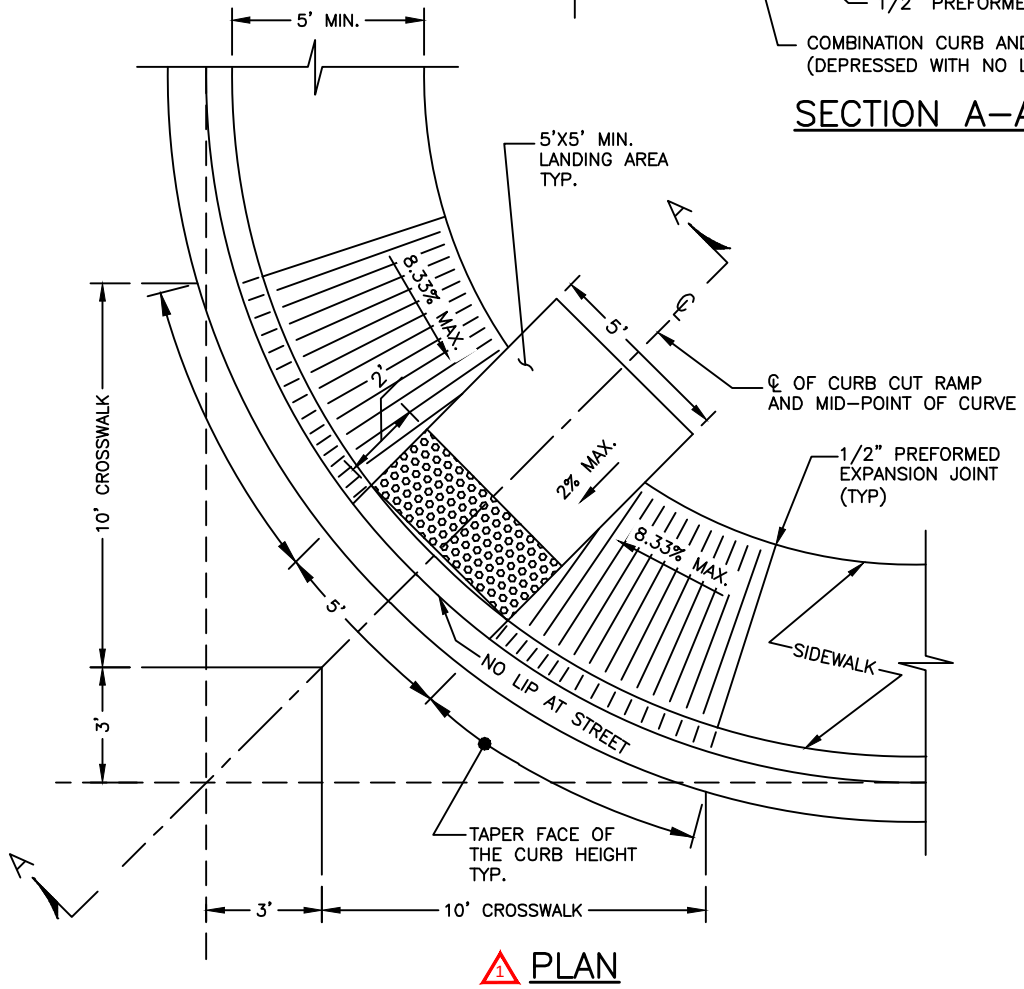
7/17/2015

DRAFT

Revised 1 7/17/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	SIDEWALK RAMP Type B Dual Ramp	Detail R-4.03



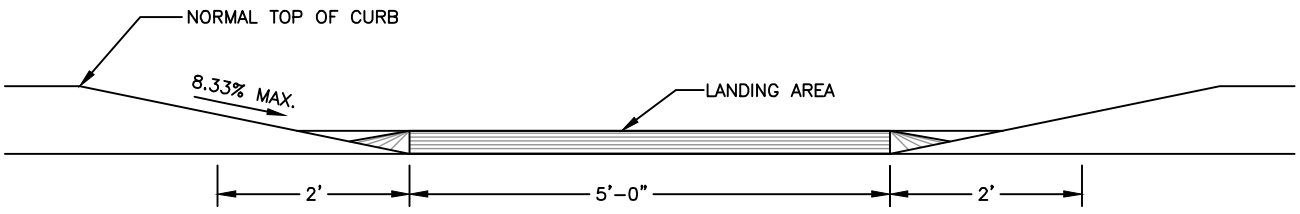
SECTION A-A ⚠1



⚠1 PLAN

NOTES:

1. TYPE C SIDEWALK RAMP IS TO BE USED AT LOCATIONS WHERE THE SIDEWALK MUST BE PLACED IMMEDIATELY ADJACENT TO THE BACK OF THE CURB. THE SIDEWALK SHALL BE AT LEAST 5'-0" IN WIDTH.
2. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF THE RAMP. SEE DETAIL R-4.07.
3. 7" COMB. CURB AND GUTTER IS SHOWN. DETAILS TO BE SIMILAR FOR MOD. CURB AND GUTTER AND BIT. CURB.
4. 4'-0" SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.01).
5. SEE DETAIL R-4.07 FOR DETECTABLE WARNING SURFACE PLACEMENT GUIDELINES.

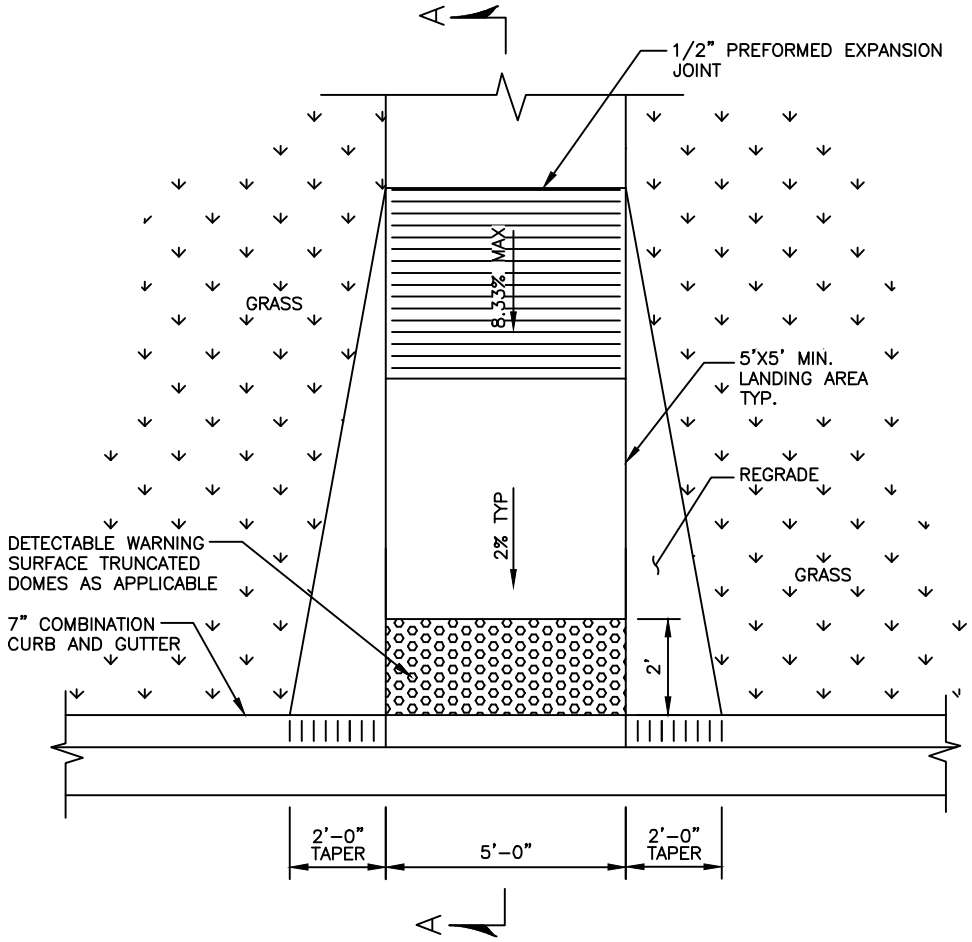


FRONT VIEW

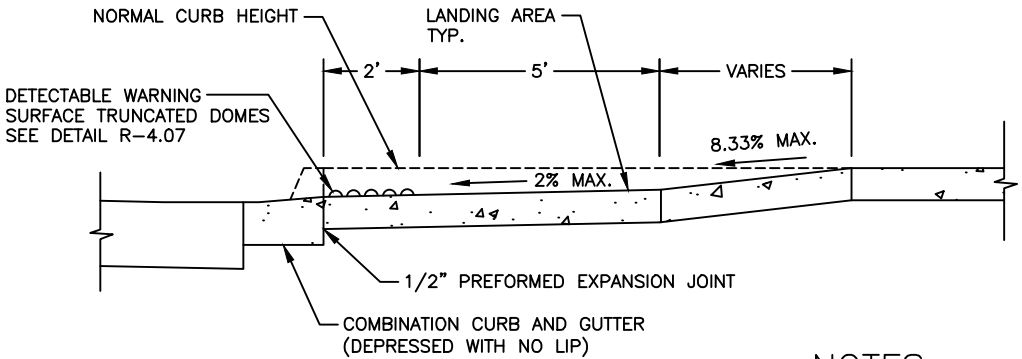
7/17/2015

DRAFT

Revised ⚠1 7/17/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signatures.bmp Chief, Bureau of Engineering	SIDEWALK RAMP Type C	Detail R-4.04



1 RAMP PERPENDICULAR TO CURB



1 SECTION A-A

NOTES:

1. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF RAMP. SEE DETAIL R-4.07.
2. GRASS AREA ADJACENT TO SIDEWALK MUST BE SLOPED TO MEET RAMP.
3. 4'-0" SIDEWALK REQUIRES PASSING AREA (SEE DETAIL R-4.01).

7/17/2015

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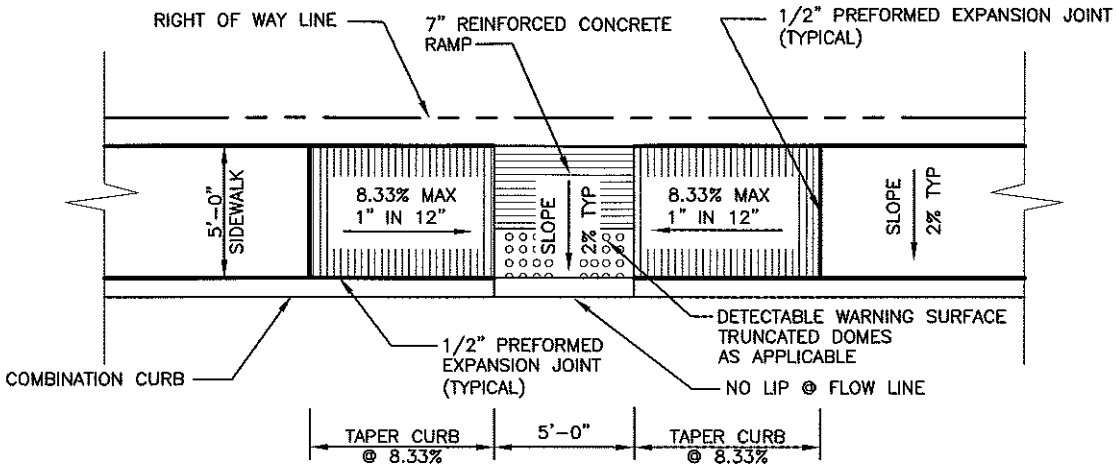
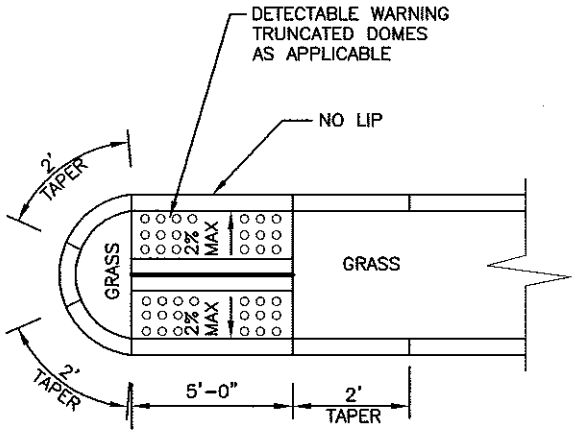
Revised 1 7/17/2015 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signatures.bmp Chief, Bureau of Engineering	SIDEWALK RAMP Layout & Grading Perpendicular to Curb	Detail R-4.05



RAMP PARALLEL TO CURB



RAMP THRU MEDIAN

NOTES:

1. ALL RAMPS SHALL HAVE DETECTABLE WARNING SURFACES. SEE DETAIL R-4.07.
2. GRASS AREA ADJACENT TO SIDEWALK MUST BE SLOPED TO MEET RAMP.

7/17/2015
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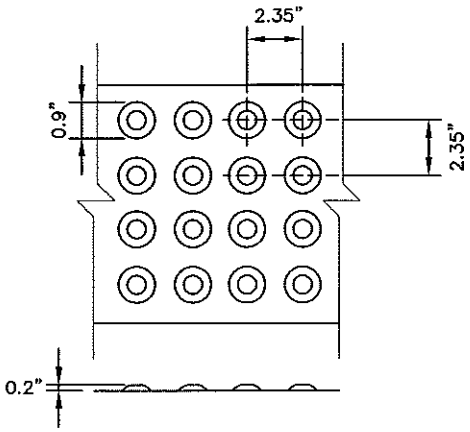
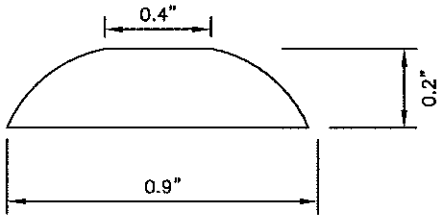
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	SIDEWALK RAMP Layout & Grading Parallel to Curb & Thru Median	Detail R-4.06

MAT DETAILS

SEE PLACEMENT GUIDELINES BELOW

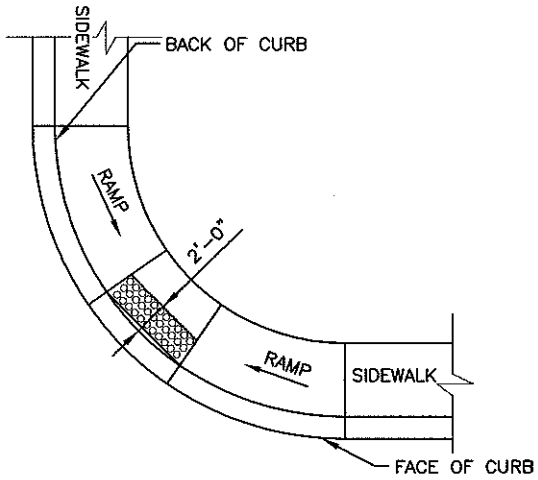


DOME SPACING



DOME SECTION

PLACEMENT GUIDELINES



RAMP RADIAL AND ADJACENT TO CURB

NOTES:

1. THE DETECTABLE WARNING SURFACE SHALL BE LOCATED SO THAT THE EDGE NEAREST THE CURB LINE IS 6 TO 8 INCHES FROM THE FACE OF THE CURB.
2. FOR SKEWED APPLICATIONS DETECTABLE WARNING SHALL BE PLACED SUCH THAT THE DOMES CLOSEST TO THE BACK OF THE CURB ARE NO LESS THAN 0.5" AND NO MORE 3.0" FROM THE BACK OF THE CURB. TRUNCATED DOME SURFACES SHALL BE FABRICATED TO PROVIDE FULL DOMES ONLY.

7/17/2015
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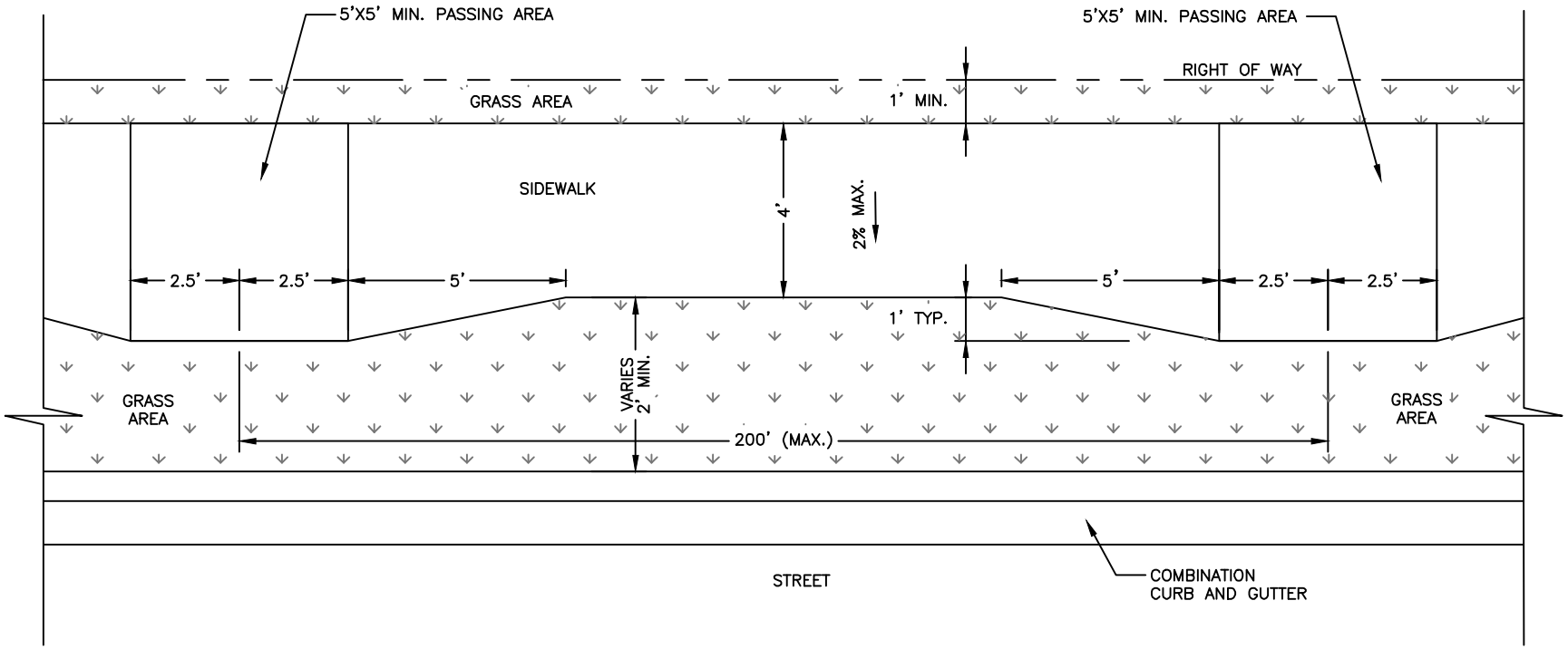
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	SIDEWALK RAMP Detectable Warning Truncated Domes	Detail R-4.07



PLAN

NOTES

1. REFER TO R-3.05 FOR NOTES
2. DRIVEWAY APRON MAY BE USED IN PLACE OF PASSING AREA IF DESIGN SHOWS ALL OF THE REQUIREMENTS ARE MET.

7/17/2015

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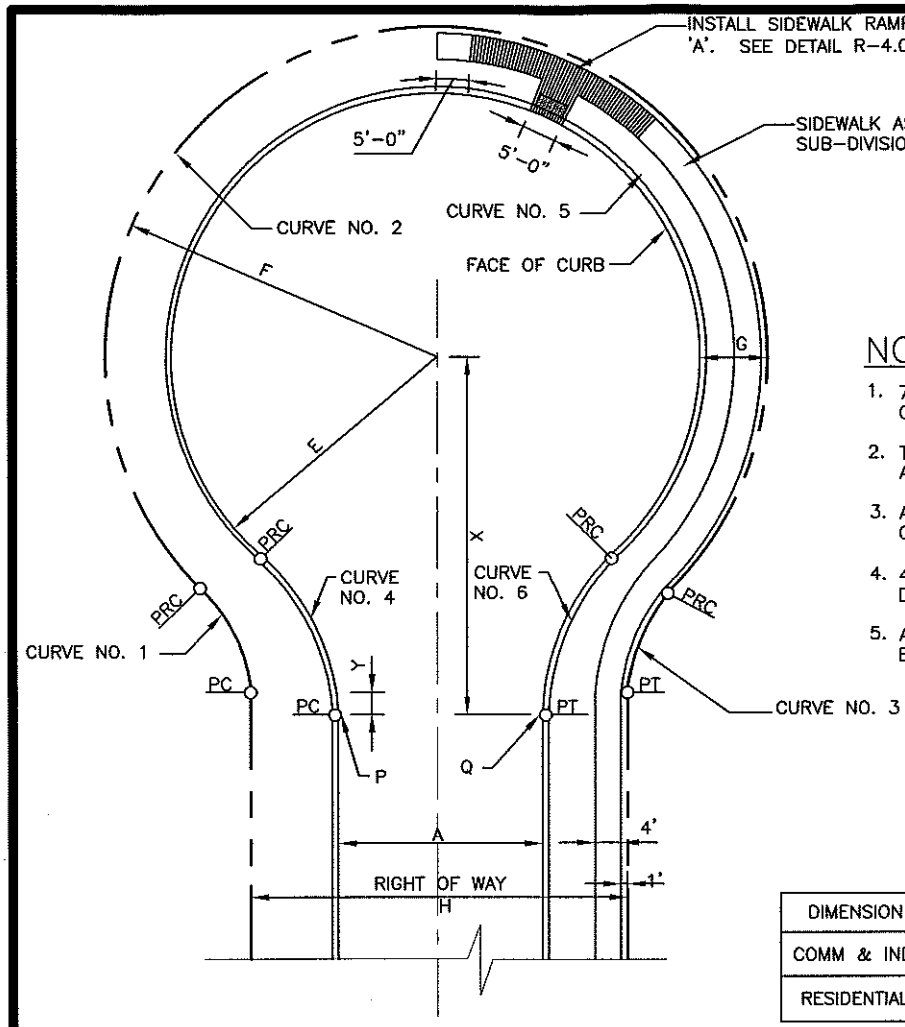
Revised Revised X/X/2015 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	SIDEWALK Passing Area	Detail R-4.11



NOTES:

1. 7"COMBINATION CURB & GUTTER SHALL BE USED ON DOWNGRADE CUL-DE-SACS.
2. THE MAXIMUM GRADE OF THE CIRCULAR AREA IN ANY DIRECTION SHALL NOT EXCEED 6%.
3. A PROFILE SHALL BE PROVIDED ALONG THE TOP OF CURB FROM POINT P TO POINT Q.
4. 4'-0" SIDEWALK REQUIRES A PASSING AREA, SEE DETAIL R-4.01.
5. ALL RAMPS SHALL HAVE A WARNING TEXTURE ENTENDING THE FULL WIDTH OF THE RAMP.

DIMENSION	A	E	F	G	H
COMM & IND.	40'	47'	60'	13'	60'
RESIDENTIAL	24',26',28'	45'	55'	10'	50'

CURVE DATA

COMMERICAL-INDUSTRIAL (40' APPROACH) X=61.70', Y=-3.11' L.P.=286.25'					RESIDENTIAL (24' APPROACH) X=64.74', Y=2.29' L.P.=292.23'				
	CURVE 1&3	CURVE 2	CURVE 4&6	CURVE 5		CURVE 1&3	CURVE 2	CURVE 4&6	CURVE 5
Δ	49° 40'47"	279° 21'34"	47° 16'04"	274° 32'09"	Δ	51° 19'04"	282° 38'08"	54° 01'03"	251° 57'35"
R	25.00'	60.00'	37.00'	47.00'	R	25.00'	55.00'	35.00'	45.00'
L	21.68'	292.54'	30.52'	225.20'	L	22.39'	271.31'	33.00'	226.33'
T	11.57'	—	16.19'	—	T	12.01'	—	17.84'	—
L.C.	21.00'	—	29.67'	—	L.C.	21.65'	—	31.79'	—

RESIDENTIAL (26' APPROACH) X=64.00', Y=3.64' L.P.=289.74'					RESIDENTIAL (28' APPROACH) X=63.24', Y=1.55' L.P.=287.22'				
	CURVE 1&3	CURVE 2	CURVE 4&6	CURVE 5		CURVE 1&3	CURVE 2	CURVE 4&6	CURVE 5
Δ	51° 19'04"	282° 38'08"	53° 07'48"	286° 15'37"	Δ	51° 19'04"	282° 38'08"	53° 13'46"	284° 27'32"
R	25.00'	55.00'	35.00'	45.00'	R	25.00'	55.00'	35.00'	45.00'
L	22.39'	271.31'	32.46'	224.83'	L	22.39'	271.31'	31.91'	223.41'
T	12.01'	—	17.50'	—	T	12.01'	—	17.16'	—
L.C.	21.65'	—	31.30'	—	L.C.	21.65'	—	30.81'	—

7/17/2015 DRAFT

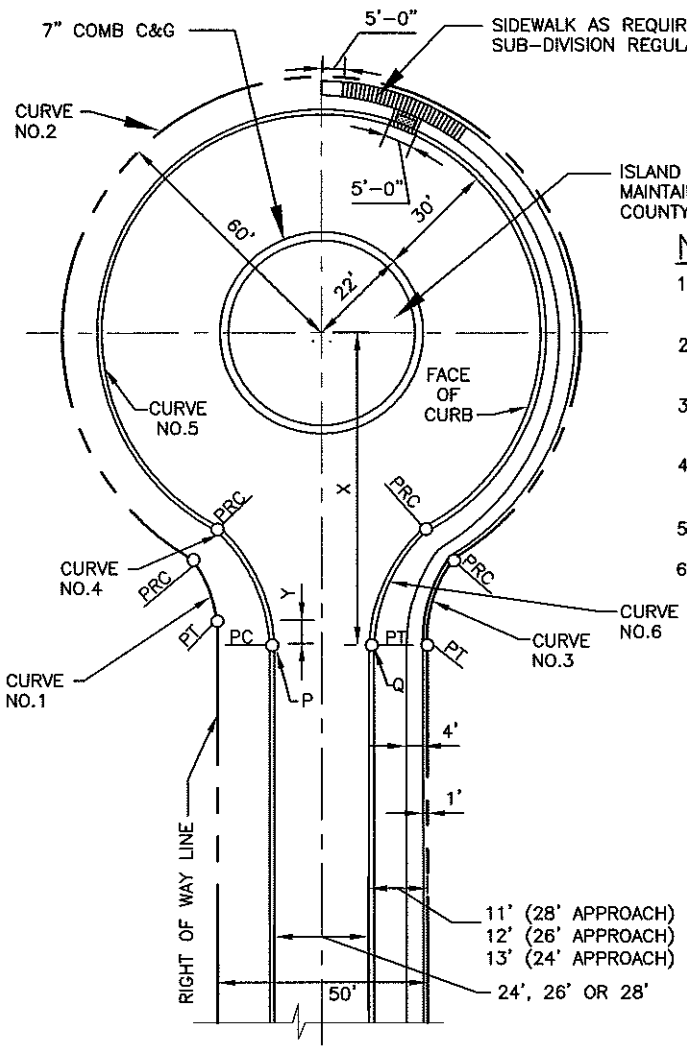
Revised

Revised 5/7/2007 Approved

Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

CUL-DE-SAC without Island

Detail
R-5.01



NOTES:

1. 7" COMBINATION CURB & GUTTER SHALL BE USED ON DOWN GRADE CUL-DE-SAC.
2. THE MAXIMUM GRADE OF THE CIRCULAR AREA IN ANY DIRECTION SHALL NOT EXCEED 6%.
3. A PROFILE SHALL BE PROVIDED ALONG THE TOP OF THE CURB FROM POINT P TO POINT Q.
4. THIS CUL-DE-SAC TO BE USED IN RESIDENTIAL AREAS ONLY.
5. 4'-0" SIDEWALK REQUIRES A PASSING AREA, SEE R-4.01.
6. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF THE RAMP.

RESIDENTIAL (24' APPROACH) X=73.21', Y=4.47' L.P.=337.38'				
	CURVE 1&3	CURVE 2	CURVE 4&6	CURVE 5
Δ	53° 58'05"	287° 56'10"	57° 18'03"	294° 36'05"
R	25.00'	60.00'	35.00'	52.00'
L	23.55'	301.53'	35.00'	267.37'
T	12.73'	——	19.12'	——
L.C.	22.69'	——	33.56'	——

RESIDENTIAL (26' APPROACH) X=72.56', Y=3.82' L.P.=334.99'				
	CURVE 1&3	CURVE 2	CURVE 4&6	CURVE 5
Δ	53° 58'05"	287° 56'10"	56° 30'53"	293° 01'45"
R	25.00'	60.00'	35.00'	52.00'
L	23.55'	301.53'	34.52'	265.94'
T	12.73'	——	18.81'	——
L.C.	22.69'	——	33.14'	——

RESIDENTIAL (28' APPROACH) X=71.89', Y=3.15' L.P.=332.58'				
	CURVE 1&3	CURVE 2	CURVE 4&6	CURVE 5
Δ	53° 58'05"	287° 56'10"	55° 43'17"	291° 26'34"
R	25.00'	60.00'	35.00'	52.00'
L	23.55'	301.53'	34.04'	264.50'
T	12.73'	——	18.50'	——
L.C.	22.69'	——	32.71'	——

7/17/2015 DRAFT

Revised

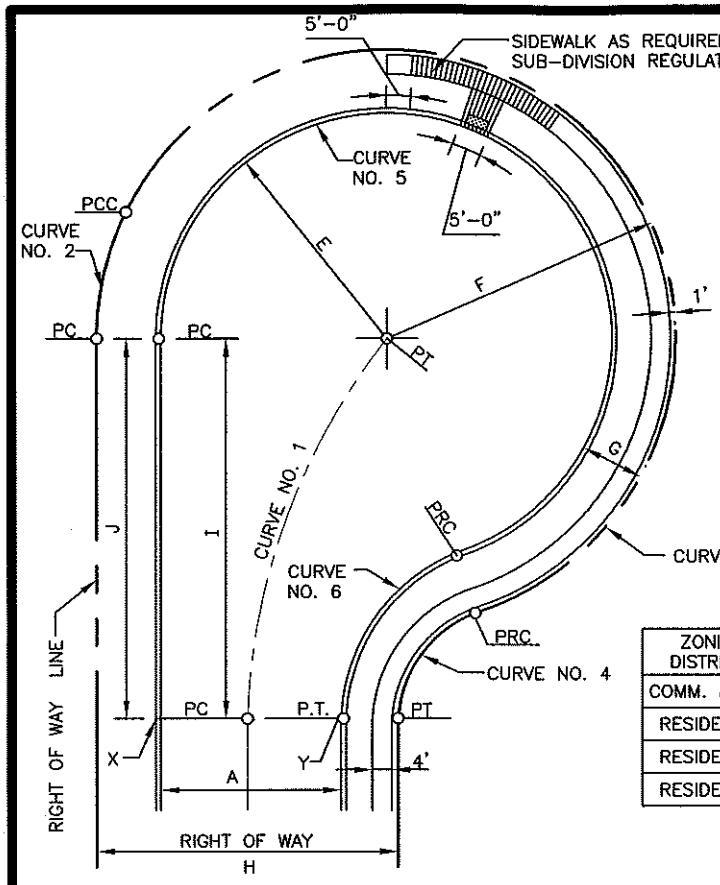
Revised 5/7/2007 Approved

Howard County, Maryland
Department of Public Works

Approved: _____
Chief, Bureau of Engineering

CUL-DE-SAC with Island

Detail
R-5.02



NOTES:

1. 7" COMBINATION CURB & GUTTER SHALL BE USED ON DOWNGRADE CUL-DE-SACS.
2. THE MAXIMUM GRADE OF THE CIRCULAR AREA IN ANY DIRECTION SHALL NOT EXCEED 6%.
3. A PROFILE SHALL BE PROVIDED ALONG THE TOP OF CURB FROM POINT X TO POINT Y.
4. 4'-0" SIDEWALK REQUIRES A PASSING AREA, SEE R-4.01.
5. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF THE RAMP.

ZONING DISTRICTS	A	E	F	G	I	J	H
COMM. & IND.	40'	47'	59'	12'	78.46'	84.12'	60'
RESIDENTIAL	28'	45'	55'	10'	77.95'	68.51'	50'
RESIDENTIAL	26'	45'	55'	10'	78.38'	65.12'	50'
RESIDENTIAL	24'	45'	55'	10'	78.77'	62.61'	50'

CURVE DATA

COMMERCIAL – INDUSTRIAL 40' APPROACH L.P.=327.39'							RESIDENTIAL 28' APPROACH L.P.=326.83'						
	CURVE 1	CURVE 2	CURVE 3	CURVE 4	CURVE 5	CURVE 6		CURVE 1	CURVE 2	CURVE 3	CURVE 4	CURVE 5	CURVE 6
Δ	37°58'45"	38°56'33"	211°35'11"	70°31'44"	249°04'31"	69°04'31"	Δ	43°22'31"	12°06'05"	244°09'34"	76°59'50"	256°59'50"	76°59'50"
R	127.50'	50.00'	59.00'	25.00'	47.00'	37.00'	R	113.50'	100.00'	55.00'	25.00'	45.00'	35.00'
L	84.51'	33.98'	217.88'	30.77'	204.32'	44.61'	L	85.92'	21.12'	234.38'	33.60'	201.85'	47.03'
T	43.88'	17.68'	—	17.68'	—	25.47'	T	45.14'	10.60'	—	19.88'	—	27.84'
L.C.	82.98'	33.33'	—	28.87'	—	41.95'	L.C.	83.89'	21.08'	—	31.12'	—	43.57'

RESIDENTIAL 26' APPROACH L.P.=329.31'							RESIDENTIAL 24' APPROACH L.P.=331.73'						
	CURVE 1	CURVE 2	CURVE 3	CURVE 4	CURVE 5	CURVE 6		CURVE 1	CURVE 2	CURVE 3	CURVE 4	CURVE 5	CURVE 6
Δ	44°24'55"	17°08'46"	239°51'03"	76°59'50"	258°27'47"	78°27'47"	Δ	**45°27'50"**	21°02'22"	236°41'30"	76°59'50"	259°55'17"	79°55'17"
R	112.00'	100.00'	55.00'	25.00'	45.00'	35.00'	R	110.50'	100.00'	55.00'	25.00'	45.00'	35.00'
L	86.82'	29.93'	230.24'	33.60'	203.00'	47.93'	L	87.68'	36.72'	227.21'	33.60'	204.14'	48.82'
T	45.72'	15.08'	—	19.88'	—	28.58'	T	46.30'	18.57'	—	19.88'	—	29.33'
L.C.	84.66'	29.81'	—	31.12'	—	44.27'	L.C.	85.40'	36.52'	—	31.12'	—	44.96'

7/17/2015
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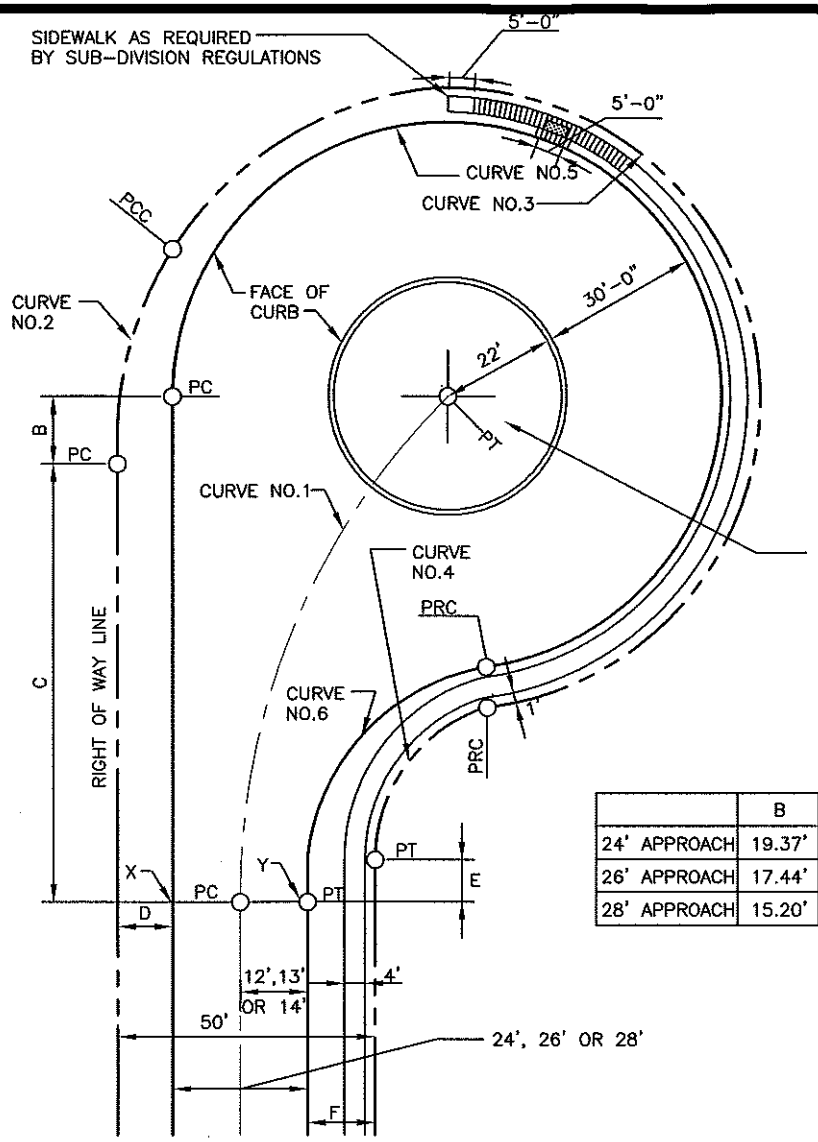
Revised	Howard County, Maryland Department of Public Works	CUL-DE-SAC Offset without Island	Detail R-5.03
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		



NOTES:

1. 7" COMBINATION CURB & GUTTER SHALL BE USED ON DOWN GRADE CUL-DE-SACS.
2. MAXIMUM GRADE OF THE CIRCULAR AREA IN ANY DIRECTION SHALL NOT EXCEED 6%.
3. A PROFILE SHALL BE PROVIDED ALONG THE TOP OF CURB FROM POINT X TO POINT Y.
4. THIS CUL-DE-SAC TO BE USED IN RESIDENTIAL AREAS ONLY.
5. 4'-0" SIDEWALK REQUIRES A PASSING AREA, SEE R-4.01.
6. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF THE RAMP.
7. BACK OF CURB NOT SHOWN HERE FOR CLARITY PURPOSES.

	B	C	D	E	F
24' APPROACH	19.37'	67.35'	13.00'	2.31'	13.00'
26' APPROACH	17.44'	69.10'	12.00'	2.25'	12.00'
28' APPROACH	15.20'	71.10'	11.00'	2.15'	11.00'

CURVE DATA

RESIDENTIAL 24' APPROACH L.P.=379.73'						
	CURVE 1	CURVE 2	CURVE 3	CURVE 4	CURVE 5	CURVE 6
Δ	49°31'28"	28°57'18"	234°17'19"	83°14'37"	265°23'06"	85°23'06"
R	114.00'	100.00'	60.00'	25.00'	52.00'	35.00'
L	98.54'	50.54'	245.35'	36.32'	240.86'	52.16'
T	52.58'	25.82'	—	22.21'	—	32.29'
L.C.	95.50'	50.00'	—	33.21'	—	47.46'

RESIDENTIAL 26' APPROACH L.P.=362.23'						
	CURVE 1	CURVE 2	CURVE 3	CURVE 4	CURVE 5	CURVE 6
Δ	48°31'18"	25°50'31"	236°43'21"	82°33'52"	264°03'44"	84°03'44"
R	115.00'	100.00'	60.00'	25.00'	52.00'	35.00'
L	97.81'	45.10'	247.90'	36.03'	239.66'	51.35'
T	52.06'	22.94'	—	21.95'	—	31.55'
L.C.	94.92'	44.72'	—	32.99'	—	46.87'

RESIDENTIAL 28' APPROACH L.P.=360.48'						
	CURVE 1	CURVE 2	CURVE 3	CURVE 4	CURVE 5	CURVE 6
Δ	47°31'45"	22°19'54"	239°33'09"	81°53'03"	262°44'11"	82°44'11"
R	117.00'	100.00'	60.00'	25.00'	52.00'	35.00'
L	97.06'	38.98'	250.86'	35.73'	238.45'	50.54'
T	51.52'	19.74'	—	21.69'	—	30.82'
L.C.	94.30'	38.73'	—	32.76'	—	46.26'

7/17/2015
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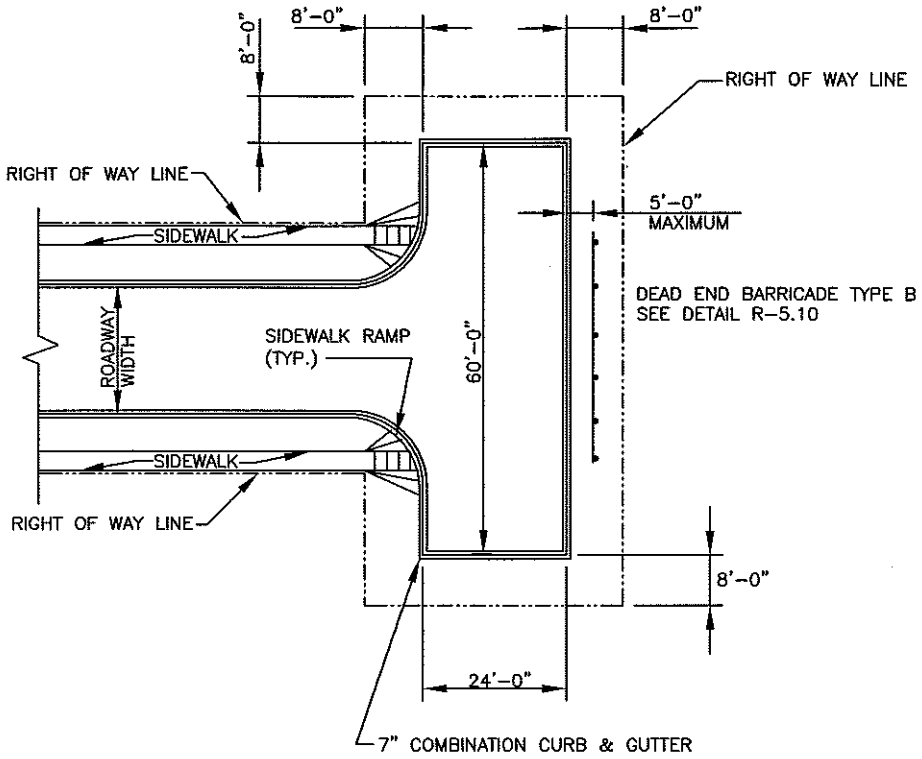
Revised

Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

CUL-DE-SAC
Offset
with Island

Detail
R-5.04



NOTES:

1. PERMANENT TEE SHALL ONLY BE INSTALLED ON RESIDENTIAL STREETS WITH LESS THAN 200 ADT.
2. THE LENGTH OF THE BARRICADE IS TO EQUAL THE WIDTH OF THE ROADWAY.
3. INSTALL SIGNS R7-1 (1) "NO PARKING", R7-4 "NO STANDING", R7-4 (1) "NO STOPPING" AS DIRECTED BY DPW.
4. INSTALL SIGNS OM-1 (2) "END OF ROAD BARRIER" BEHIND BARRICADE. SIGNS TO BE INSTALLED 12' APART. MINIMUM 2 SIGNS PER TEE TURN-AROUND.
5. THERE SHALL BE NO DRIVEWAYS ALONG THE TEE TURN-AROUND.

7/17/2015
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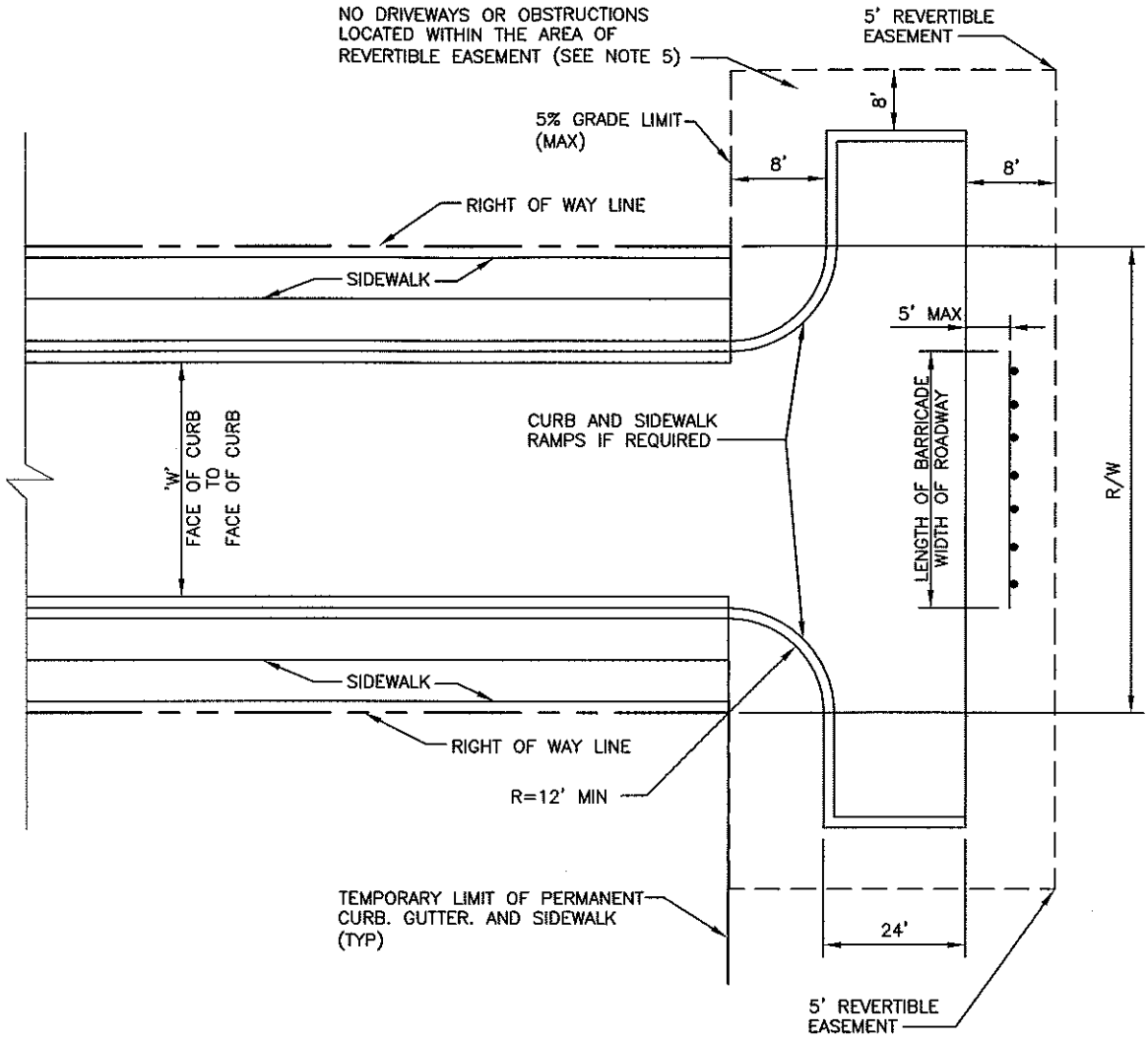
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	TEE TURN-AROUND Permanent (<200 ADT)	Detail R-5.05



NOTES:

1. A TEE TURN-AROUND SHALL BE USED IN LIEU OF A CUL-DE-SAC ONLY IF THE STREET IS TO BE EXTENDED IN THE FUTURE.
2. HMA CURB SHALL EXTEND AROUND THE TEE TURN-AROUND IF AND AS REQUIRED TO CONTROL CURB DRAINAGE FROM THE ROADWAY SECTION.
3. REFER TO DETAIL R-5.08 FOR TYPICAL ROADWAY PROFILE TEMPORARY LIMIT OF PAVING.
4. PROVIDE REVERTIBLE EASEMENT FOR CONSTRUCTION AND RESTRICTED AREA (INCLUDING PLACEMENT OF DEAD END BARRICADE).
5. GRADING WITHIN 5' OF PERIMETER OF THE CURB AND PAVEMENT SHALL NOT EXCEED 3% IN ANY DIRECTION AND NO OBSTRUCTIONS (FENCE, PLANTINGS) ARE PERMITTED IN REVERTIBLE EASEMENT.
6. PROVIDE POSITIVE DRAINAGE FOR THE TEMPORARY TEE TURN-AROUND INTO A SUITABLE OUTFALL.
7. INSTALL SIGNS R7-1 "NO PARKING", R7-4 "NO STANDING", R7-4(1) "NO STOPPING" AS PER DIRECTED BY DPW
8. INSTALL SIGNS OM-1(2) "END OF ROAD MARKED" BEHIND BARRICADE. SIGN TO BE INSTALLED 12' APART. MINIMUM 2 SIGNS PER TEE-TURN-AROUND.
9. DEAD END BARRICADE (TYPE A OR B AS DIRECTED BY DPW) SEE DETAIL R-5.09 FOR PLACEMENT OF BARRICADE.
10. 4'-0" SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.01).
11. THERE SHALL BE NO DRIVEWAYS ALONG THE TEE TURN-AROUND

7/17/2015
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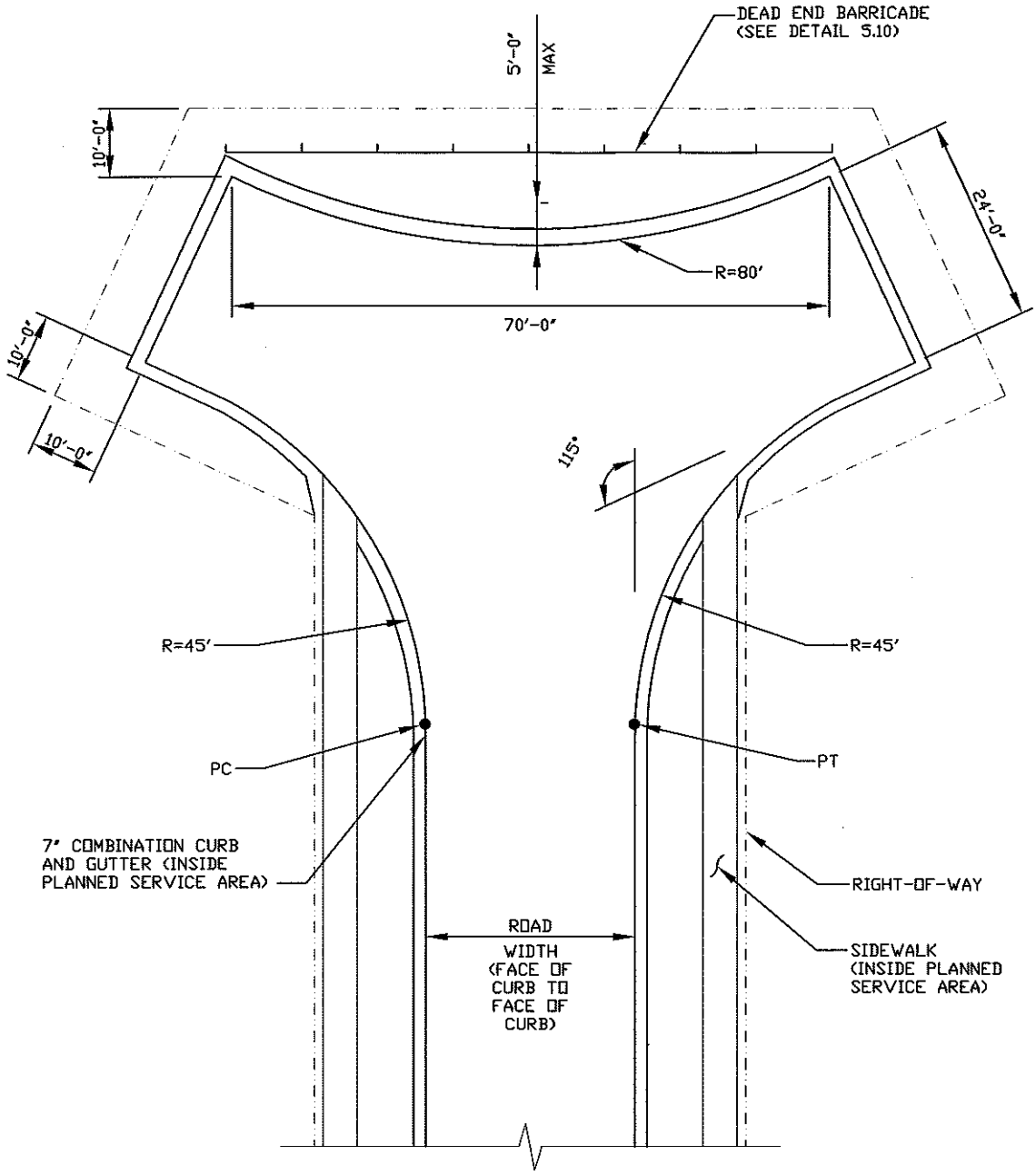
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	TEE TURN-AROUND Temporary	Detail R-5.06



NOTES:

1. PERMANENT Y TURN-AROUND SHOULD ONLY BE INSTALLED ON RESIDENTIAL STREETS WITH LESS THAN 200 ADT.
2. THE LENGTH OF THE BARRICADE IS TO EQUAL THE WIDTH OF THE END OF THE ROADWAY PAVING.
3. INSTALL SIGNS R7-1(1) "NO PARKING", R7-4(1) "NO STOPPING" AS DIRECTED BY DPW.
4. INSTALL SIGNS OM-1(2) "END OF ROAD BARRIER" BEHIND BARRICADE. SIGNS TO BE INSTALLED 12' APART. MINIMUM 2 SIGNS PER Y TURN-AROUND.
5. DEAD END BARRICADE (TYP A OR B AS DIRECTED BY DPW) SEE DETAIL R-5.09 FOR PLACEMENT OF BARRICADE.
6. SEE DETAIL R-4.05 FOR SIDEWALK RAMP LAYOUT. 4' SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.01).

7/17/2015
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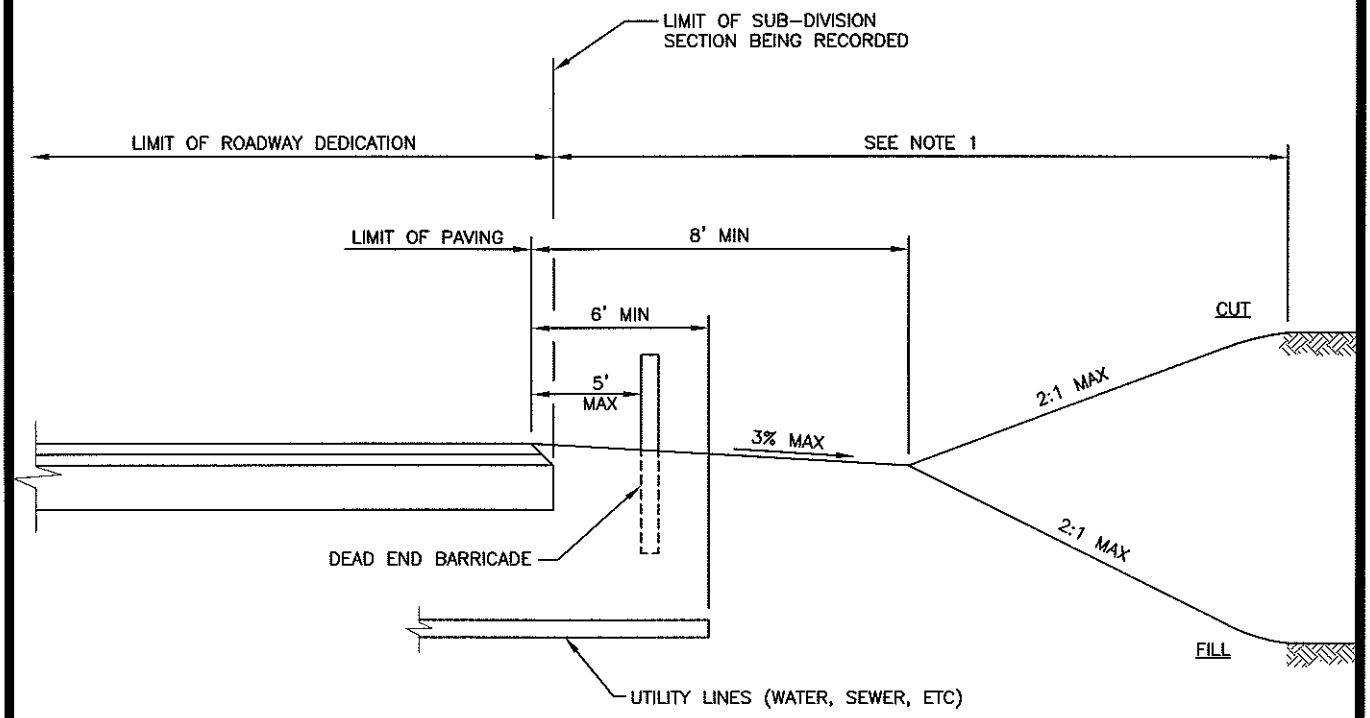
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Y TURN-AROUND Permanent (<200 ADT)	Detail R-5.07



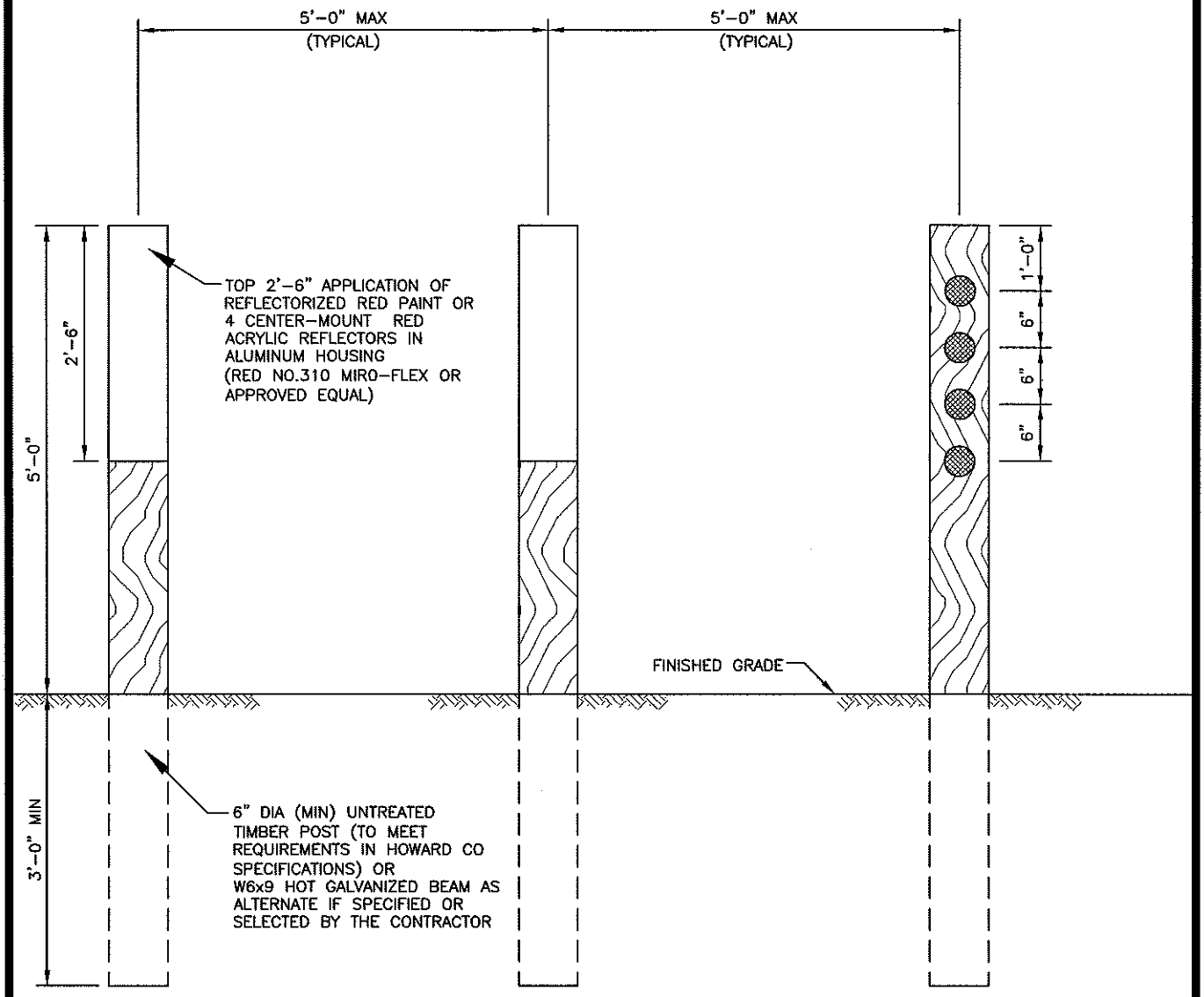
NOTES:

1. GRADING, UTILITY EXTENSIONS, BARRICADE AND OTHER FACILITIES BEYOND THE PAVEMENT LIMIT SHALL BE PLACED ON THE LAND WHICH IS PART OF THE NEXT SECTION OF THE SAME SUB-DIVISION OR ON THE NEIGHBORING PROPERTY WHERE A MUTUAL AGREEMENT WITH THE OWNER THEREOF CAN BE OBTAINED.

2. PROVISIONS FOR HANDLING DRAINAGE, INCLUDING EROSION CONTROL FACILITIES, SHALL BE PLACED AT THE LIMIT OF WORK AS REQUIRED. POSITIVE DRAINAGE SHALL BE PROVIDED INTO A SUITABLE OUTFALL FOR THE ROADWAY, EASEMENTS, AND RIGHT-OF-WAY AREAS.

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Roadway Profile Temporary Limit of Paving	Detail R-5.08

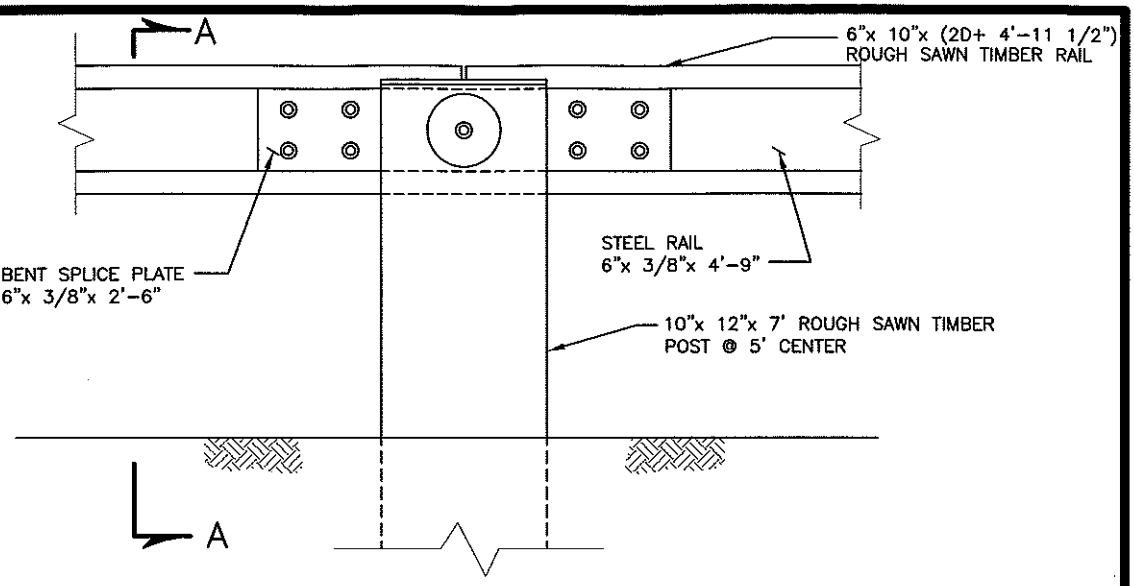


NOTES:

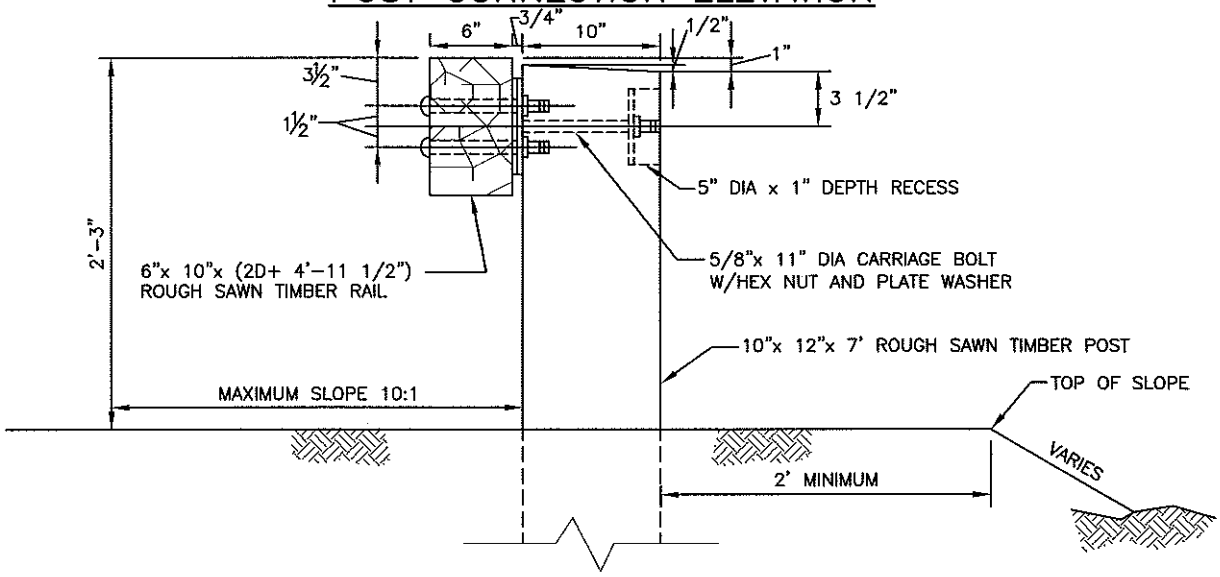
1. TYPE A BARRICADE TO BE UTILIZED WHEN ANTICIPATED TIME OF USE IS LESS THAN ONE YEAR.
2. BARRICADE IS TO EXTEND THE FULL WIDTH OF ROADWAY UNLESS OTHERWISE NOTED ON THE CONTRACT DOCUMENTS.

7/17/2015
DRAFT

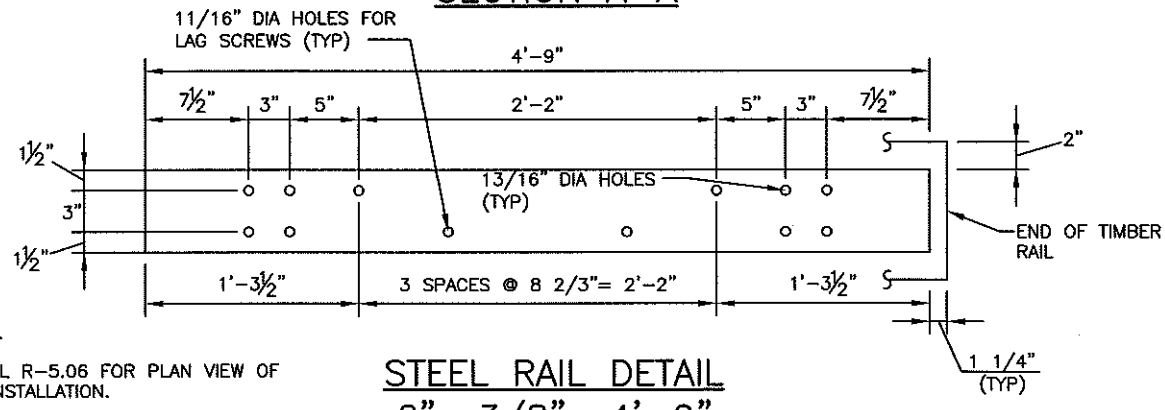
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	DEAD END BARRICADE Type A	Detail R-5.09



POST CONNECTION ELEVATION



SECTION A–A



NOTES:

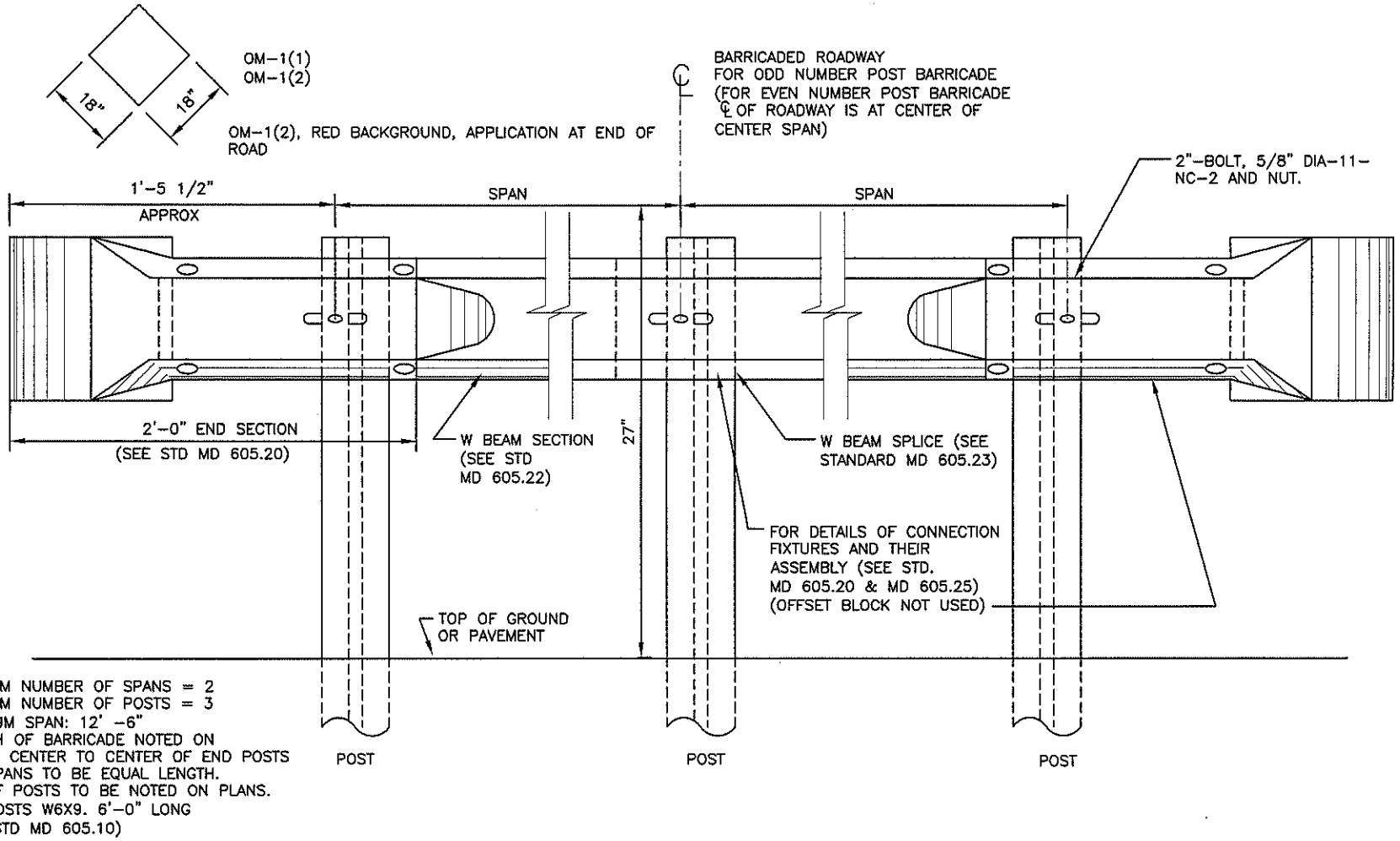
1. SEE DETAIL R-5.06 FOR PLAN VIEW OF BARRICADE INSTALLATION.

2. INSTALL SIGNS (OM-1(2)) "END OF ROAD MARKER" BEHIND BARRICADE. SIGNS TO BE INSTALLED 12' APART MINIMUM 2 SIGNS PER LOCATION.

STEEL RAIL DETAIL
6"x 3/8"x 4'-9"

7/17/2015 DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	DEAD END BARRICADE Type B	Detail R-5.10



MINIMUM NUMBER OF SPANS = 2
MINIMUM NUMBER OF POSTS = 3
MAXIMUM SPAN: 12' -6"
LENGTH OF BARRICADE NOTED ON PLANS: CENTER TO CENTER OF END POSTS
ALL SPANS TO BE EQUAL LENGTH.
NO. OF POSTS TO BE NOTED ON PLANS.
ALL POSTS W6X9. 6'-0" LONG
(SEE STD MD 605.10)

NOTE:

1. INSTALL SIGNS OM-1(2) " END OF ROAD MARKER" BEHIND BARRICADE. SIGNS TO BE INSTALLED 12' APART. MINIMUM 2 SIGNS PER LOCATION

7/17/2015 DRAFT

Revised

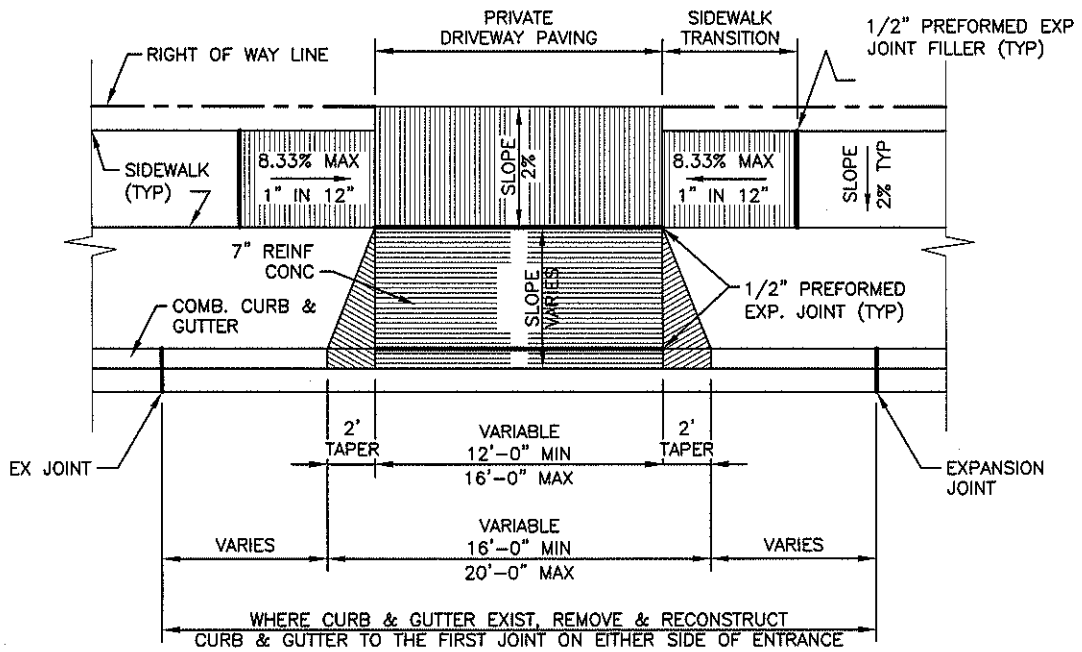
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

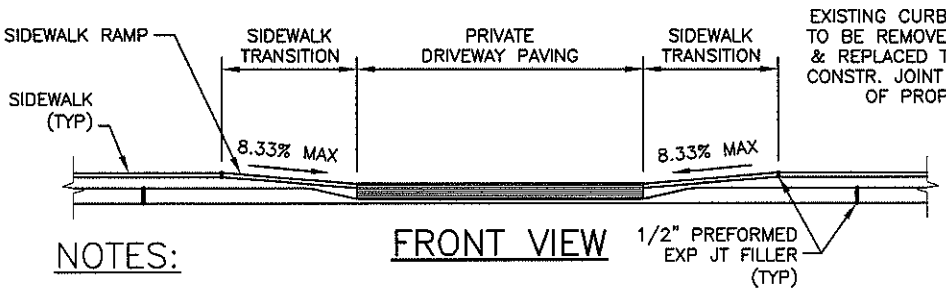
Approved: _____
Chief, Bureau of Engineering

DEAD END BARRICADE
Type C

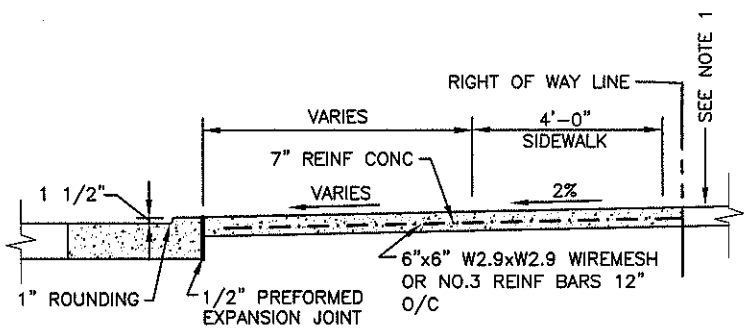
Detail
R-5.11



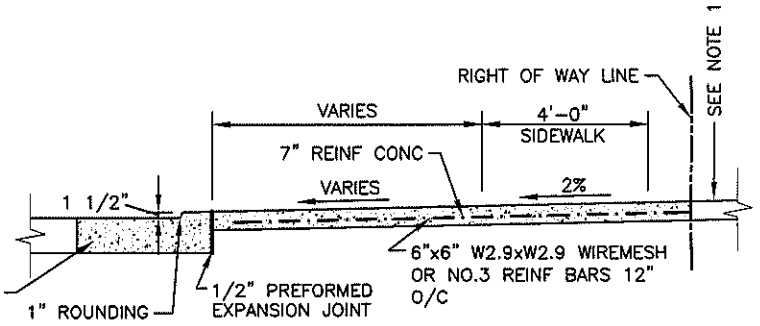
PLAN



FRONT VIEW



SECTION
DRIVEWAY IN NEW CURB



SECTION
DRIVEWAY IN EXISTING CURB

NOTES:

1. PRIVATE DRIVEWAY (IF CONC, 1/2" PREFORMED EXP JT IS TO BE PROVIDED AT R/W LINE.)
2. TIE-IN GRADE OF PRIVATE DRIVEWAY SHALL NOT EXCEED 15%.
3. ALL RAMPS SHALL HAVE A TEXTURE EXTENDING THE FULL WIDTH AND DEPTH OF THE RAMP. GRASS AREA ADJACENT TO SIDEWALK MUST BE SLOPED TO MEET RAMP.
4. 4'-0" SIDEWALK REQUIRES A PASSING AREA, SEE DETAIL R-4.01.

7/17/2015
DRAFT

Revised

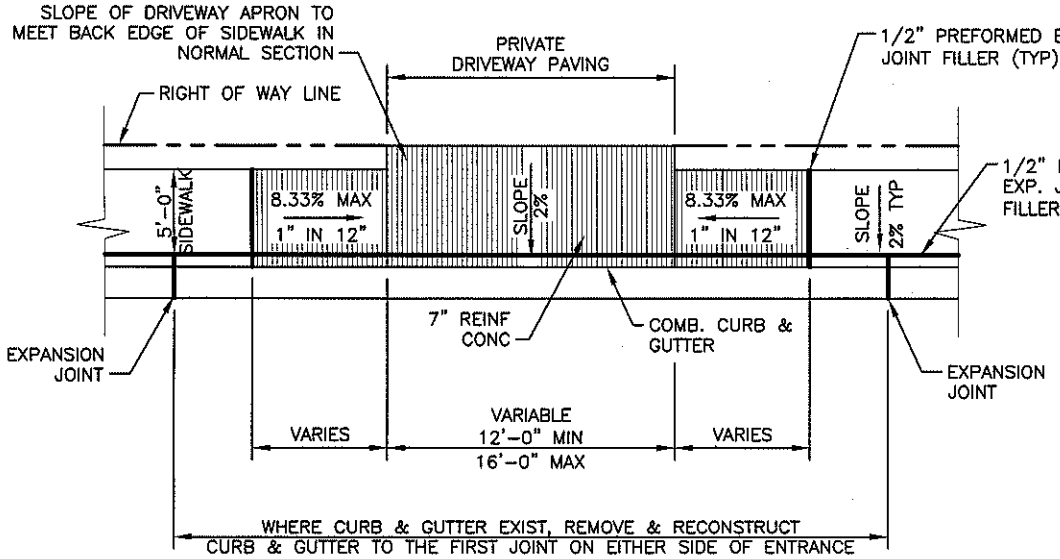
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

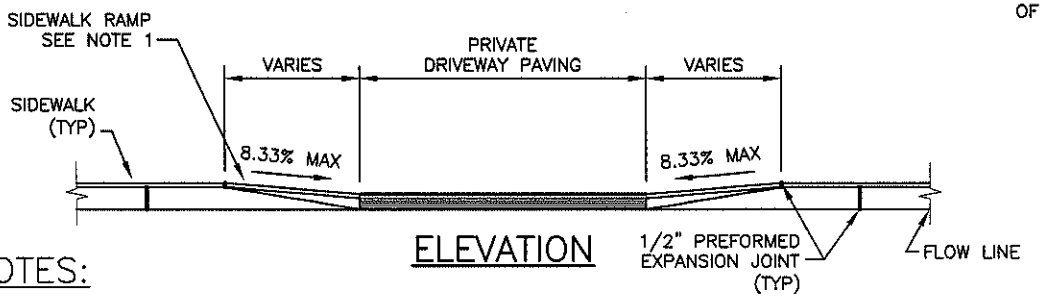
Approved: _____
Chief, Bureau of Engineering

RESIDENTIAL DRIVEWAY ENTRANCE
7" Combination Curb and Gutter
Sidewalk Setback from Curb

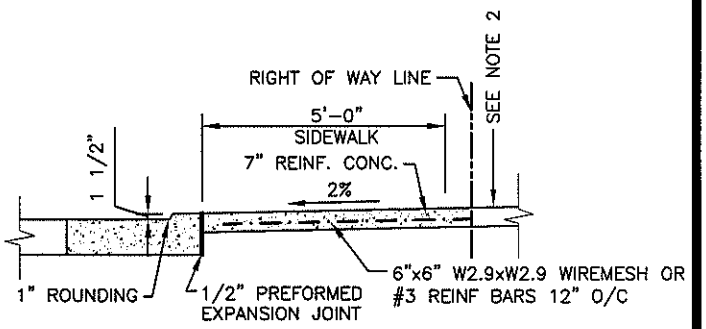
Detail
R-6.01



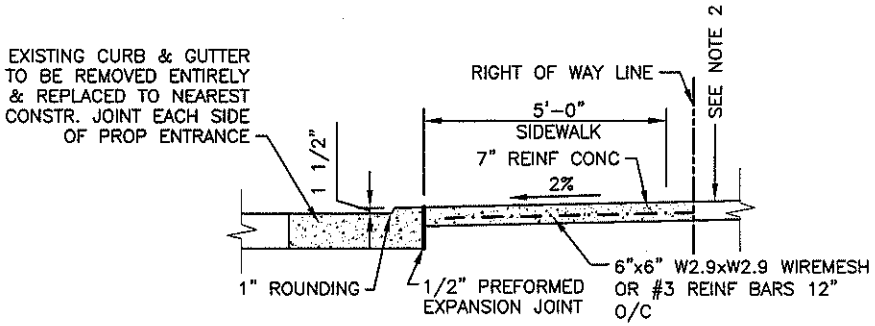
PLAN



ELEVATION



SECTION
DRIVEWAY IN NEW CURB



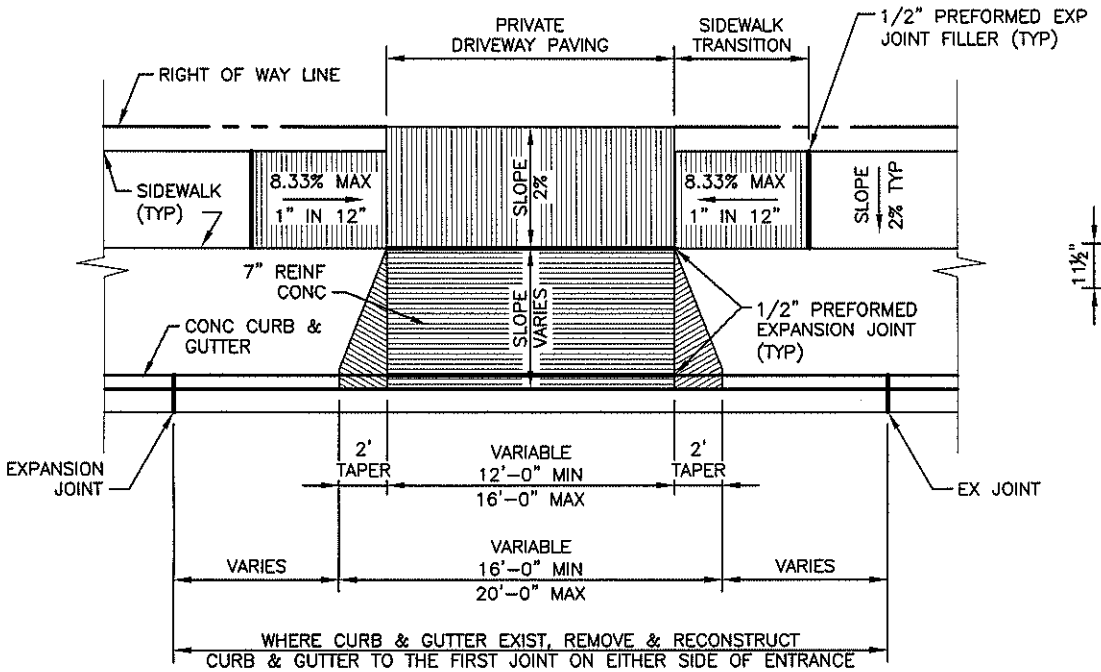
SECTION
DRIVEWAY IN EXISTING CURB

NOTES:

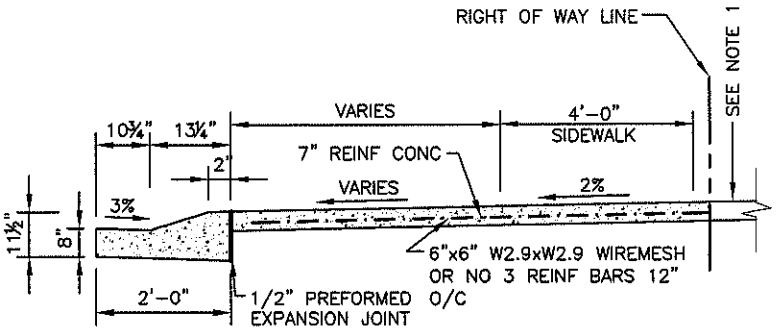
1. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF THE RAMP.
2. TIE-IN GRADE OF PRIVATE DRIVEWAY SHALL NOT EXCEED 15%.
3. PRIVATAE DRIVEWAY PAVING (IF CONC, 1/2" PREFOMRED EXP JT IS TO BE PROVIDED AT R/W LINE.)
4. GRASS AREA ADJACENT TO SIDEWALK MUST BE SLOPED TO MEET RAMP.

7/17/2015 DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	RESIDENTIAL DRIVEWAY ENTRANCE 7" Combination Curb and Gutter Sidewalk Abutting Curb	Detail R-6.02



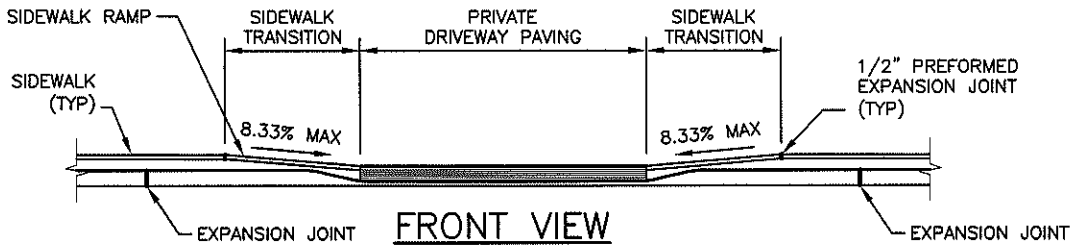
PLAN



SECTION

NOTES:

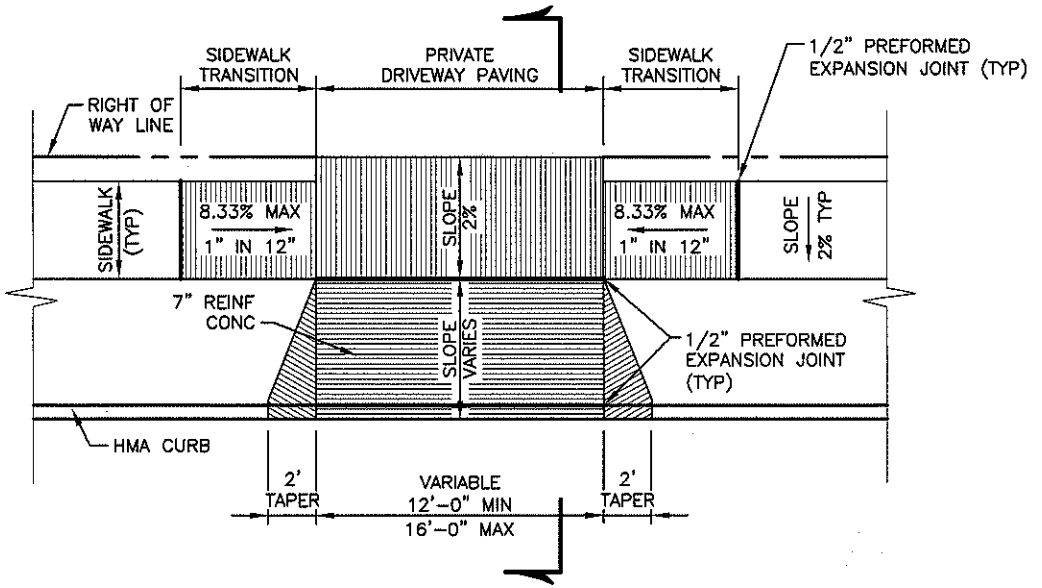
1. ALL RAMPS SHALL HAVE A TEXTURE EXTENDING THE FULL WIDTH AND DEPTH OF THE RAMP.
2. PRIVATE DRIVEWAY (IF CONC, 1/2" PREFORMED EXPANSION JOINT IS TO BE PROVIDED AT THE RIGHT OF WAY LINE.)
3. TIE-IN GRADE OF PRIVATE DRIVEWAY SHALL NOT EXCEED 15%.
4. GRASS AREA ADJACENT TO SIDEWALK MUST BE SLOPED TO MEET RAMP.
5. 4'-0" SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.01).



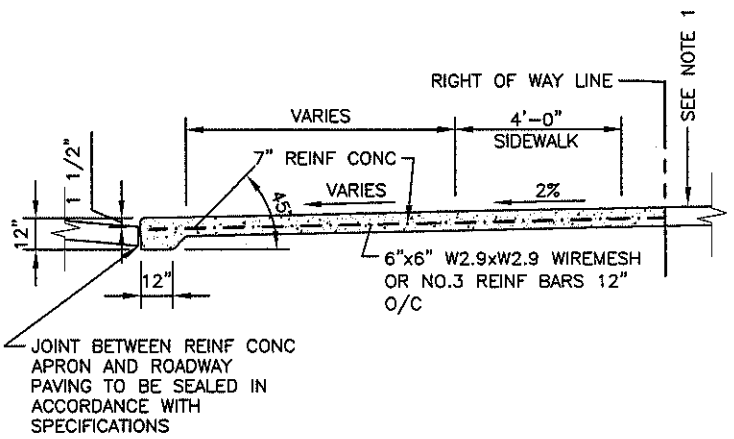
FRONT VIEW

7/17/2015
DRAFT

Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	RESIDENTIAL DRIVEWAY ENTRANCE Modified Combination Curb and Gutter Sidewalk Setback from Curb	Detail R-6.03



PLAN



SECTION

NOTES:

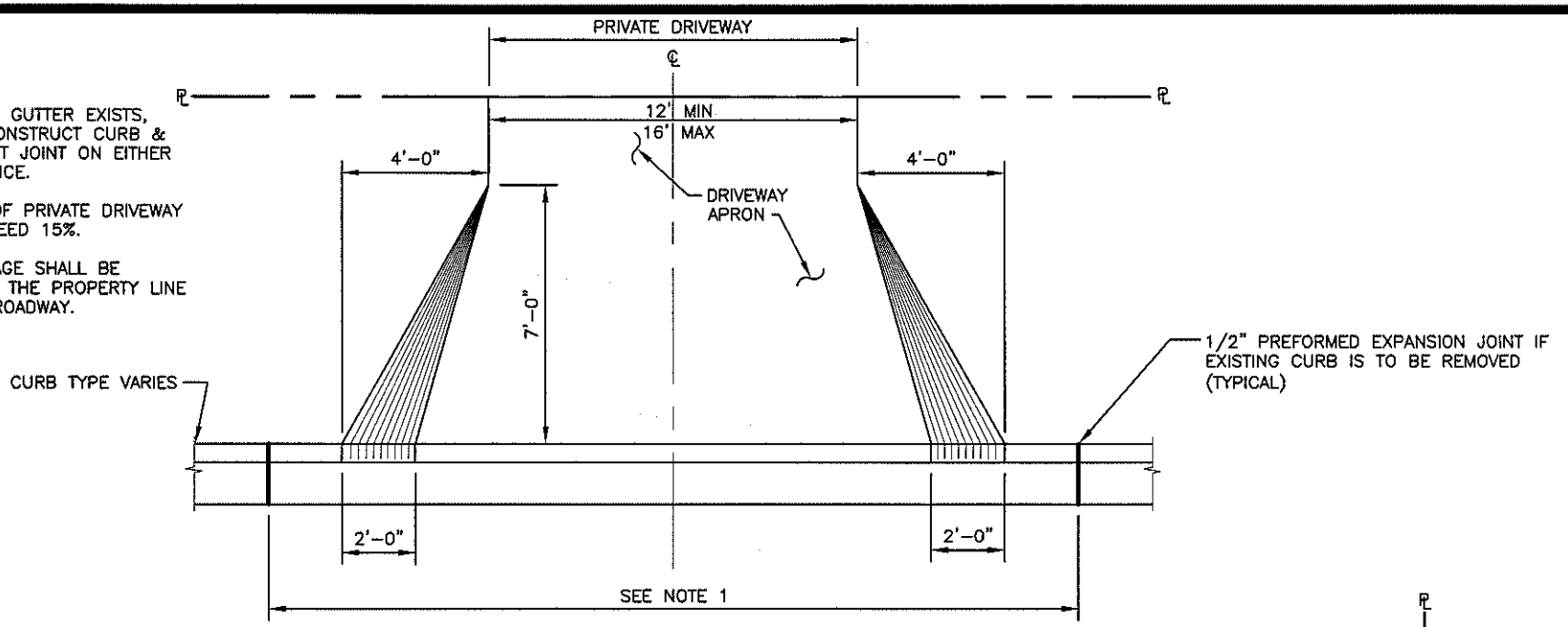
1. ALL RAMPS SHALL HAVE A TEXTURE EXTENDING THE FULL WIDTH AND DEPTH OF THE RAMP.
2. PRIVATE DRIVEWAY (IF CONC., 1/2" PREFORMED EXP. JOINT FILLER IS TO BE PROVIDED AT THE RIGHT OF WAY LINE.)
3. TIE-IN GRADE OF PRIVATE DRIVEWAY SHALL NOT EXCEED 15%.
4. GRASS AREA ADJACENT TO SIDEWALK MUST BE SLOPED TO MEET RAMP.
5. 4'-0" SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.01).

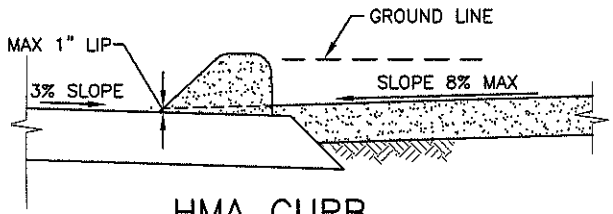
7/17/2015
DRAFT

Revised	Howard County, Maryland Department of Public Works	RESIDENTIAL DRIVEWAY ENTRANCE Hot Mix Asphalt Curb Sidewalk Setback from Curb	Detail
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		R-6.04

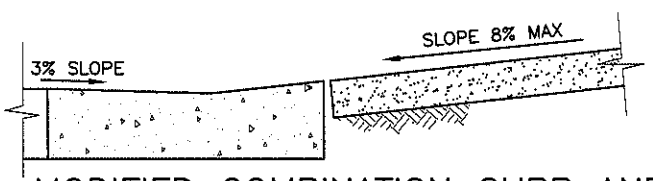
NOTES:

1. WHERE CURB & GUTTER EXISTS, REMOVE & RECONSTRUCT CURB & GUTTER TO FIRST JOINT ON EITHER SIDE OF ENTRANCE.
2. TIE-IN GRADE OF PRIVATE DRIVEWAY SHALL NOT EXCEED 15%.
3. POSITIVE DRAINAGE SHALL BE PROVIDED FROM THE PROPERTY LINE DOWN TO THE ROADWAY.

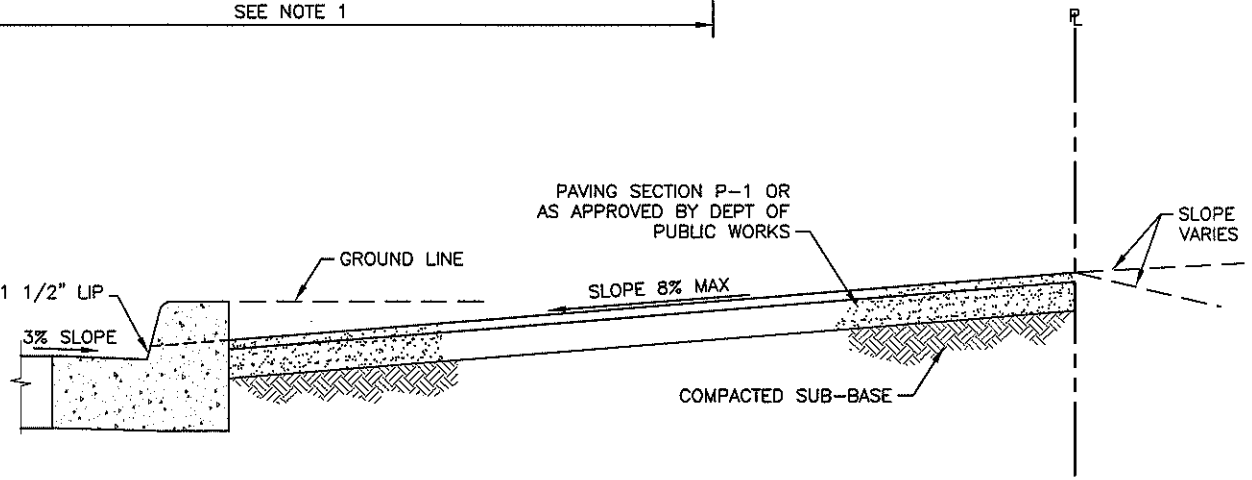




HMA CURB



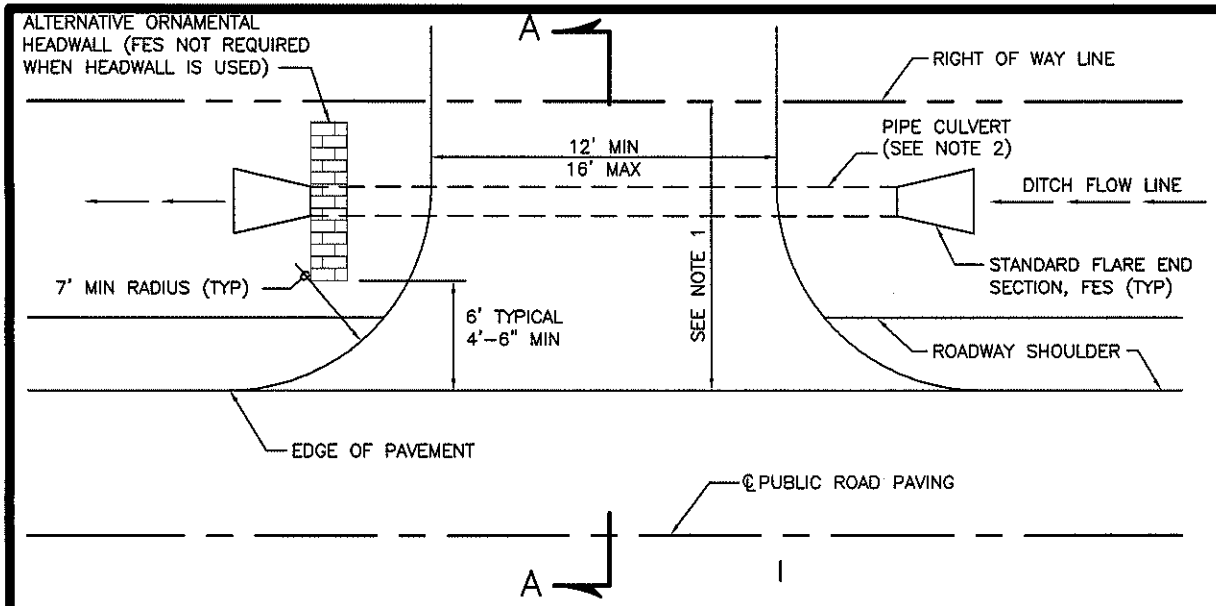
MODIFIED COMBINATION CURB AND GUTTER



7" COMBINATION CURB AND GUTTER

7/17/2015 DRAFT

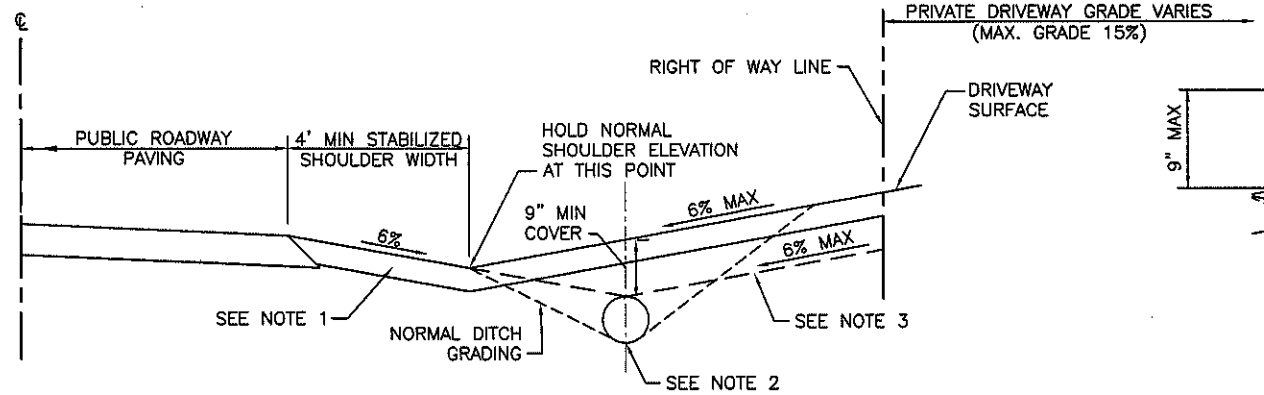
Revised	Howard County, Maryland Department of Public Works	RESIDENTIAL DRIVEWAY ENTRANCE Closed Section Roadway without Sidewalk	Detail R-6.05
Revised 5/7/2007	Approved: _____ Chief, Bureau of Engineering		
Approved			



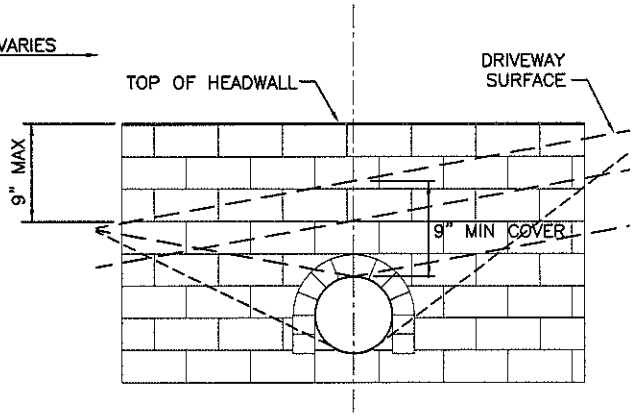
PLAN

NOTES:

1. DRIVEWAY MUST BE PAVED FROM EDGE OF PUBLIC ROAD TO RIGHT OF WAY LINE USING STANDARD PAVING SECTION P-1 OR ALTERNATE SECTION EQUAL TO OR BETTER THAN P-1, AS APPROVED BY DPW.
2. DRAINAGE CULVERT SHALL BE SIZED FOR A 10 YEAR FREQUENCY STORM AND THE MINIMUM SIZE SHALL BE 12" DIA ROUND OR 14"x9" ARCH PIPE IF LARGER PIPE IS REQUIRED, DITCH INVERT SHALL BE LOWERED TO PROVIDE MIN DITCH GRADIENT OF 0.5% AND CLEARANCE SHOWN.
3. SWALE FLOW MAY BE PROVIDED OVER DRIVEWAY LOCATED AT OR NEAR THE CREST OF VERTICAL CURVES ON THE PUBLIC ROAD WHERE QUANTITY OF FLOW IS SMALL, AS APPROVED BY DPW.
4. TIE-IN GRADE OF PRIVATE DRIVEWAY SHALL NOT EXCEED 15%.
5. SEE TYPICAL SECTIONS FOR LAYOUT AND GRADING OF DITCH AND PIPE CULVERT.
6. USE OF THE ALTERNATIVE ORNAMENTAL HEADWALL SHALL REQUIRE APPROVAL BY THE DPW DIRECTOR. HOWARD COUNTY WILL NOT MAINTAIN ORNAMENTAL HEADWALLS. AN HOA AGREEMENT IS REQUIRED.



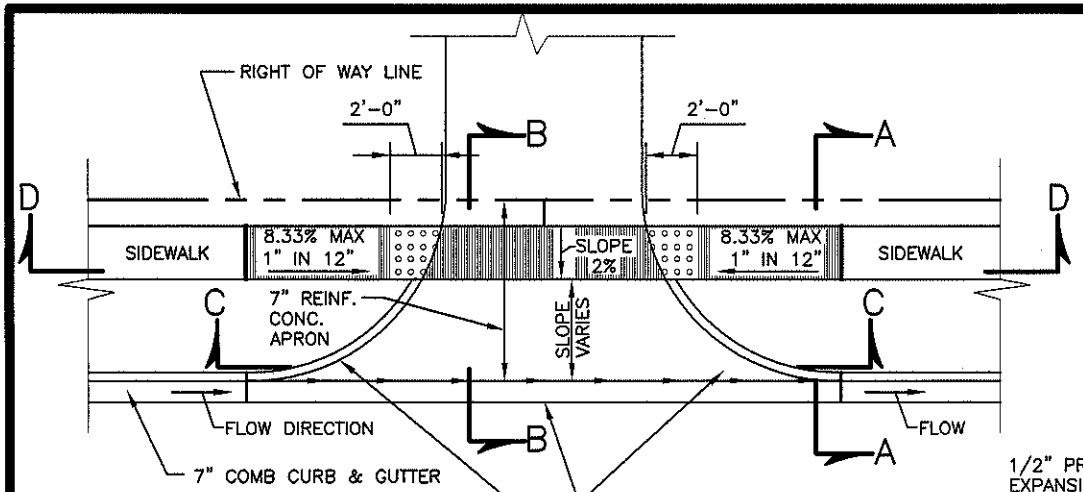
SECTION A-A



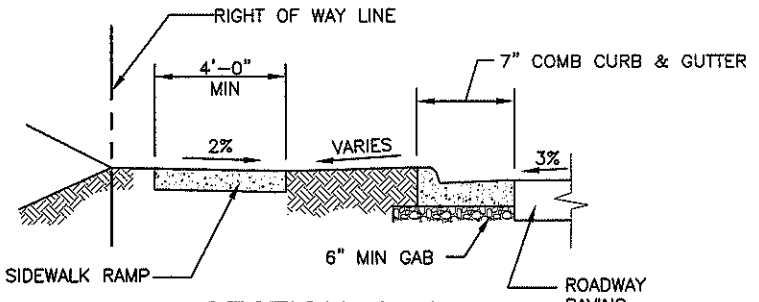
ALTERNATIVE ORNAMENTAL HEADWALL DETAIL

7/17/2015
DRAFT

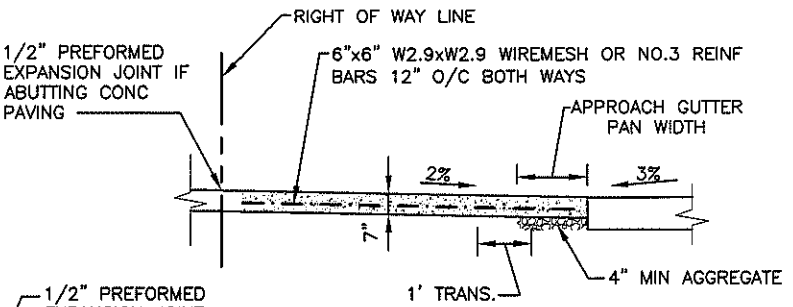
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	RESIDENTIAL DRIVEWAY ENTRANCE Open Section Roadway	Detail R-6.06



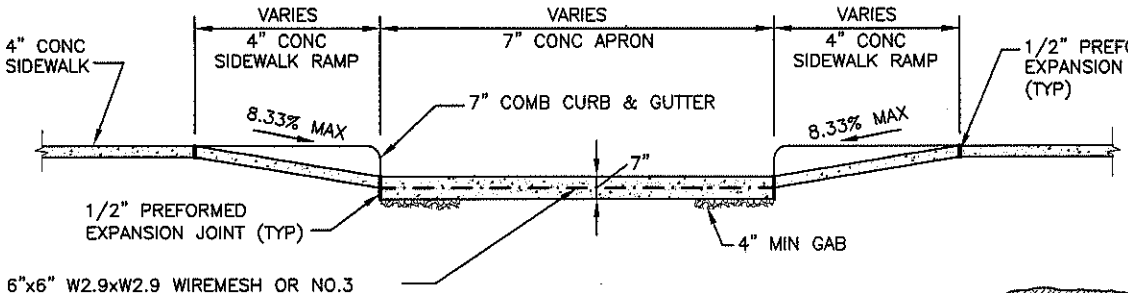
PLAN



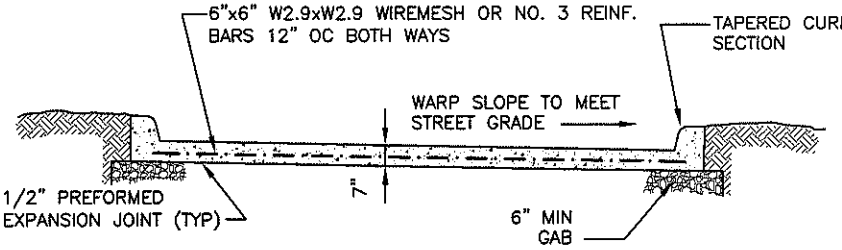
SECTION A–A



SECTION B–B



SECTION D–D



SECTION C–C

NOTES:

1. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF THE RAMP.
2. GRASS AREA ADJACENT TO SIDEWALK MUST BE SLOPED TO MEET RAMP.
3. 4'–0" SIDEWALK REQUIRES PASSING AREA (SEE DETAIL R–4.01).

7/17/2015
DRAFT

Revised

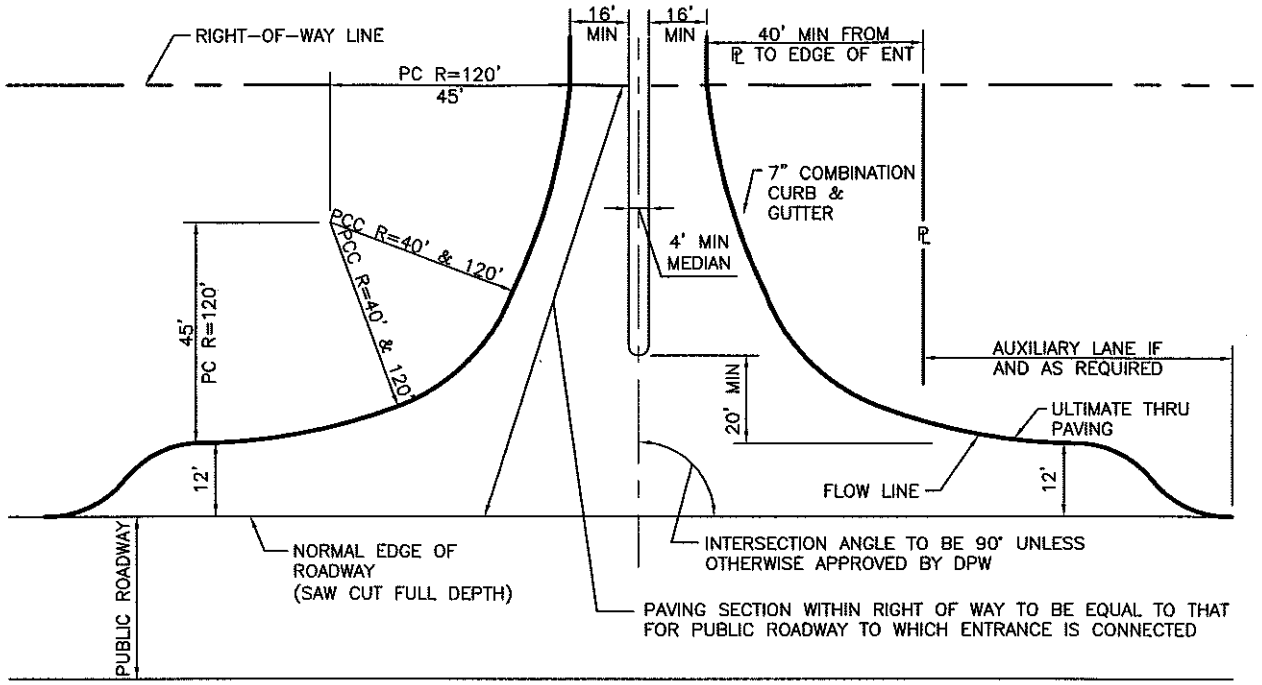
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

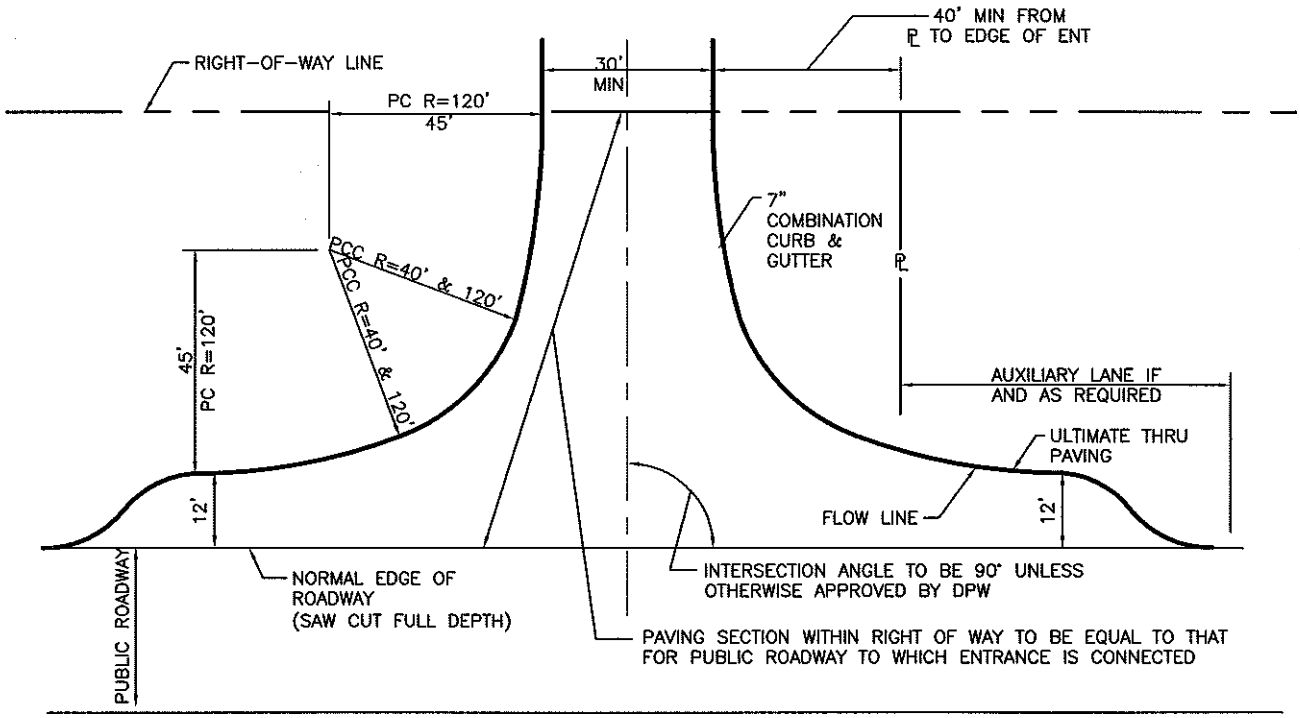
Approved: _____
Chief, Bureau of Engineering

COMMERICAL–INDUSTRIAL–APARTMENT
Entrance Concrete Apron

Detail
R–6.07



DIVIDED ROADWAY ENTRANCE



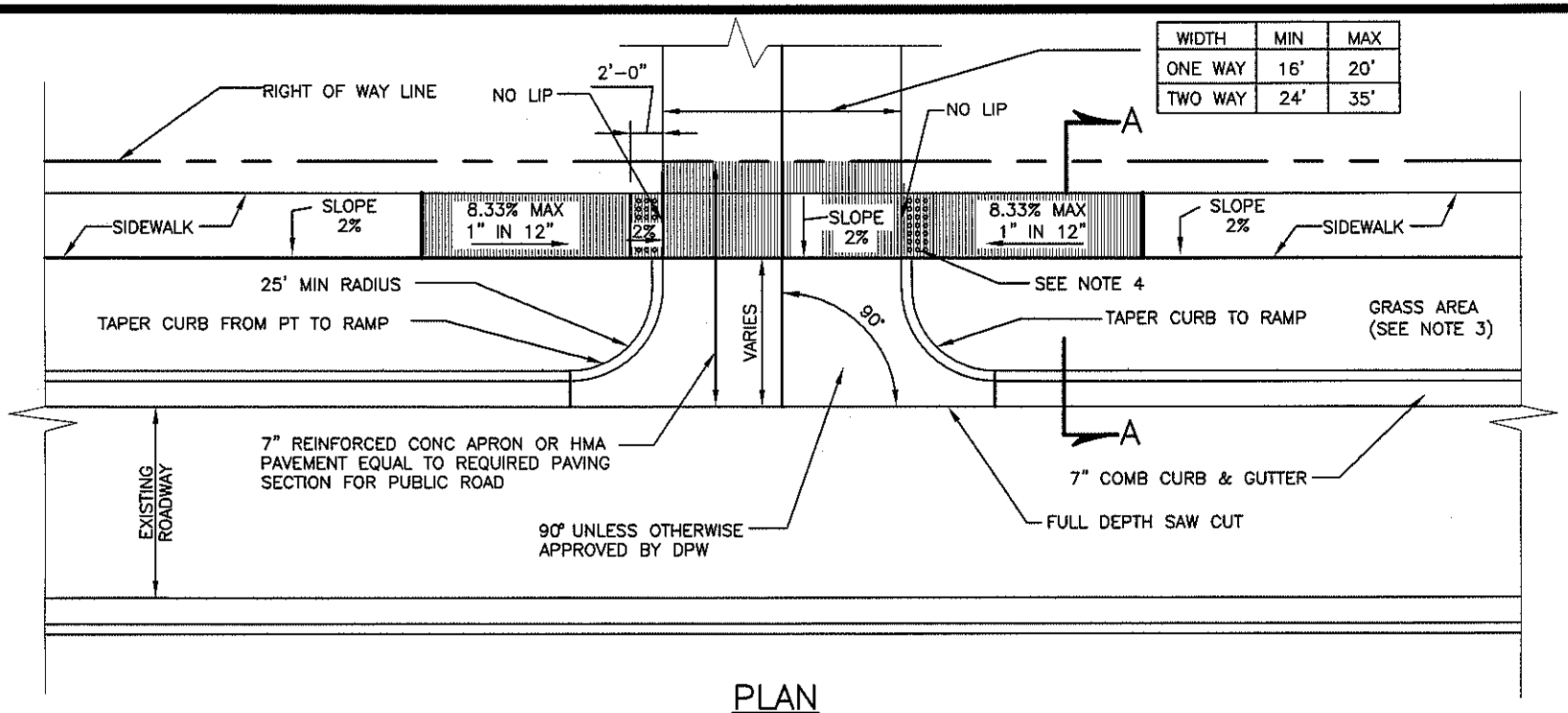
UNDIVIDED ROADWAY ENTRANCE

NOTES:

1. ALL HIGH VOLUME DRIVEWAYS SHALL BE DESIGNED IN ACCORDANCE WITH THE INTERSECTION DESIGN CRITERIA IN DESIGN MANUAL III.
2. HIGH VOLUME DRIVEWAYS DESIGNED FOR WB-40 VEHICLES.
3. NOSE OF MEDIAN SHALL BE A MINIMUM OF 20' BACK FROM THE EDGE OF THRU PAVING AS SHOWN.

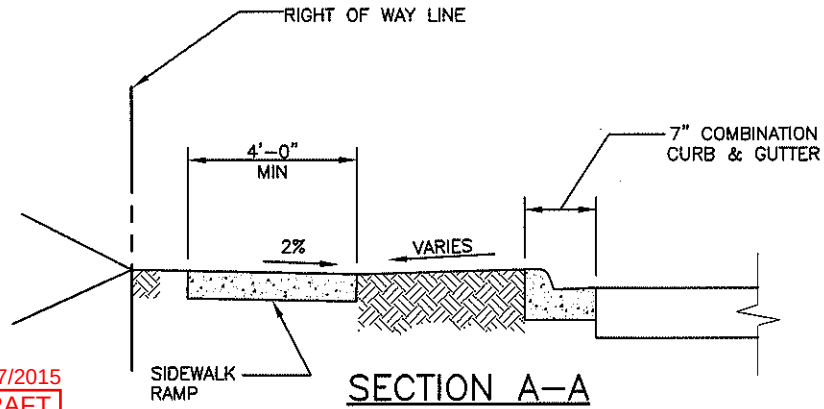
7/17/2015 DRAFT

Revised / Revised 5/7/2007 / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	COMMERCIAL-INDUSTRIAL-APARTMENT High Traffic Volume (>200 V.P.H.)	Detail R-6.08



WIDTH	MIN	MAX
ONE WAY	16'	20'
TWO WAY	24'	35'

PLAN



SECTION A–A

NOTES:

1. ENTRANCE TO BE USED ONLY IF AUXILIARY LANES ARE NOT REQUIRED IN ACCORDANCE WITH DESIGN MANUAL VOL. III SECTION 2.5.B.5 AND SECTION 2.6.G.
2. WHEN PROPOSED ENTRANCE IS CONSTRUCTED ON AN EXISTING STREET WITH COMBINATION CURB OR CURB & GUTTER, THE CURB OR CURB & GUTTER SHALL BE REMOVED TO THE FIRST EXISTING JOINT ON EITHER SIDE OF THE PROPOSED ENTRANCE AND REPLACED BY NEW CONSTRUCTION.
3. GRASS AREA ADJACENT TO SIDEWALK MUST BE SLOPED TO MEET RAMP.
4. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF THE CURB RAMP.

7/17/2015
DRAFT

Revised

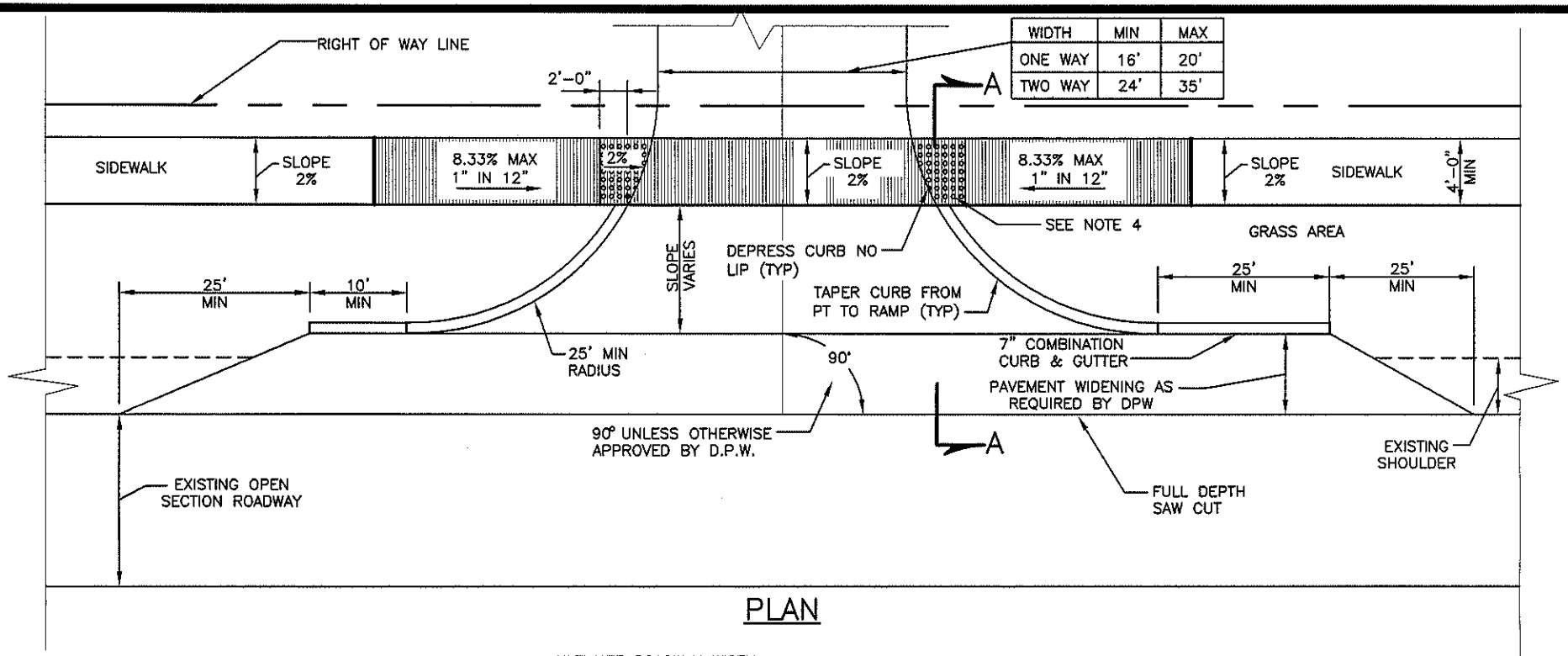
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

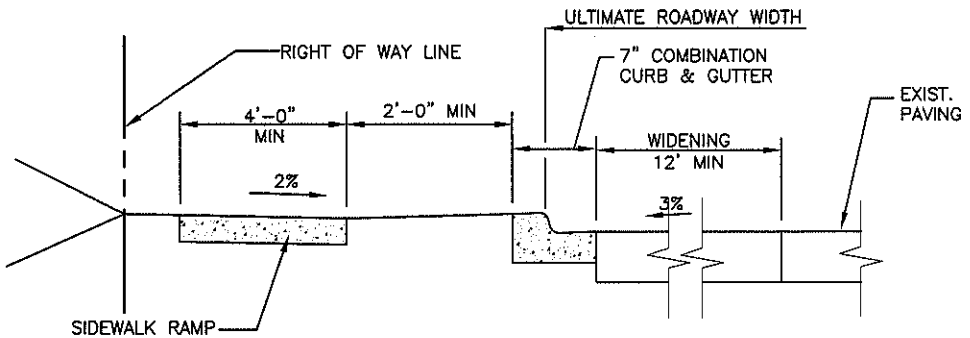
Approved: _____
Chief, Bureau of Engineering

COMMERCIAL–INDUSTRIAL–APARTMENT
Entrance on Closed Section Roadway (<200 V.P.H.)

Detail
R-6.09



PLAN



SECTION A–A

NOTES:

1. ENTRANCE TO BE USED ONLY IF AUXILIARY LANES ARE NOT REQUIRED IN ACCORDANCE WITH DESIGN MANUAL VOL III SECTION 2.5.B.5 AND SECTION 2.6.G.
2. PAVING SECTION FOR ENTRANCE WITHIN THE PUBLIC RIGHT OF WAY WILL BE AS REQUIRED FOR PUBLIC ROAD.
3. GRASS AREA ADJACENT TO SIDEWALK MUST BE SLOPED TO MEET RAMP.
4. ALL RAMPS SHALL HAVE A WARNING TEXTURE EXTENDING THE FULL WIDTH OF THE RAMP.

7/17/2015
DRAFT

Revised

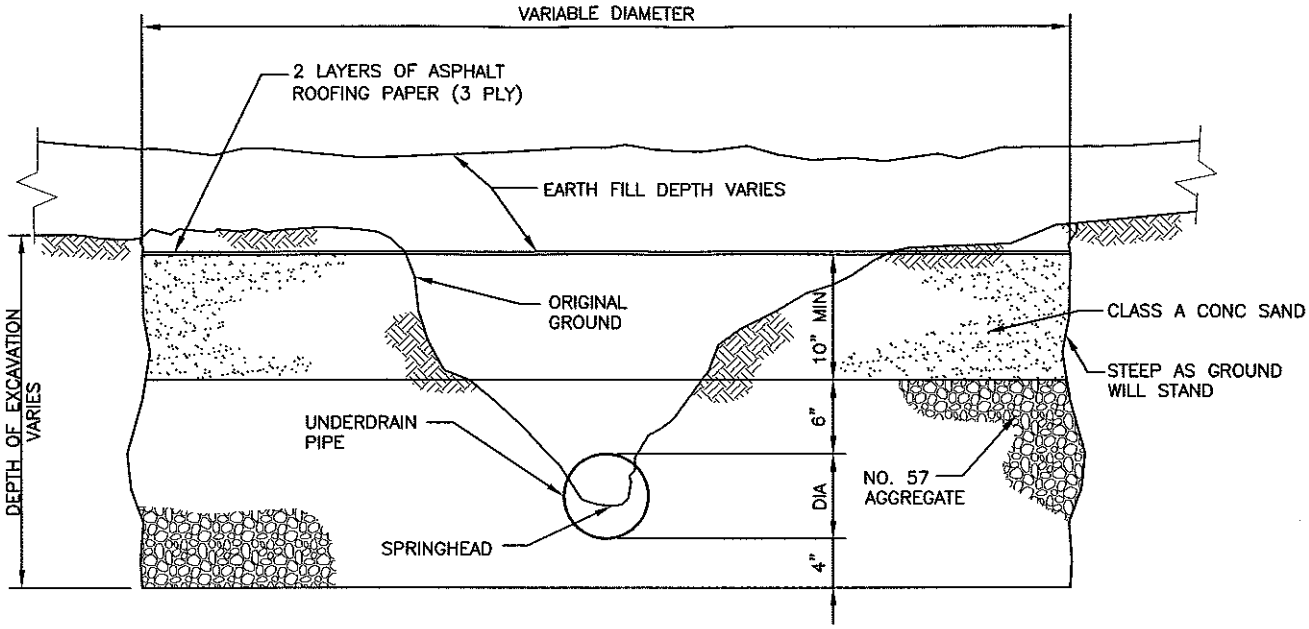
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works

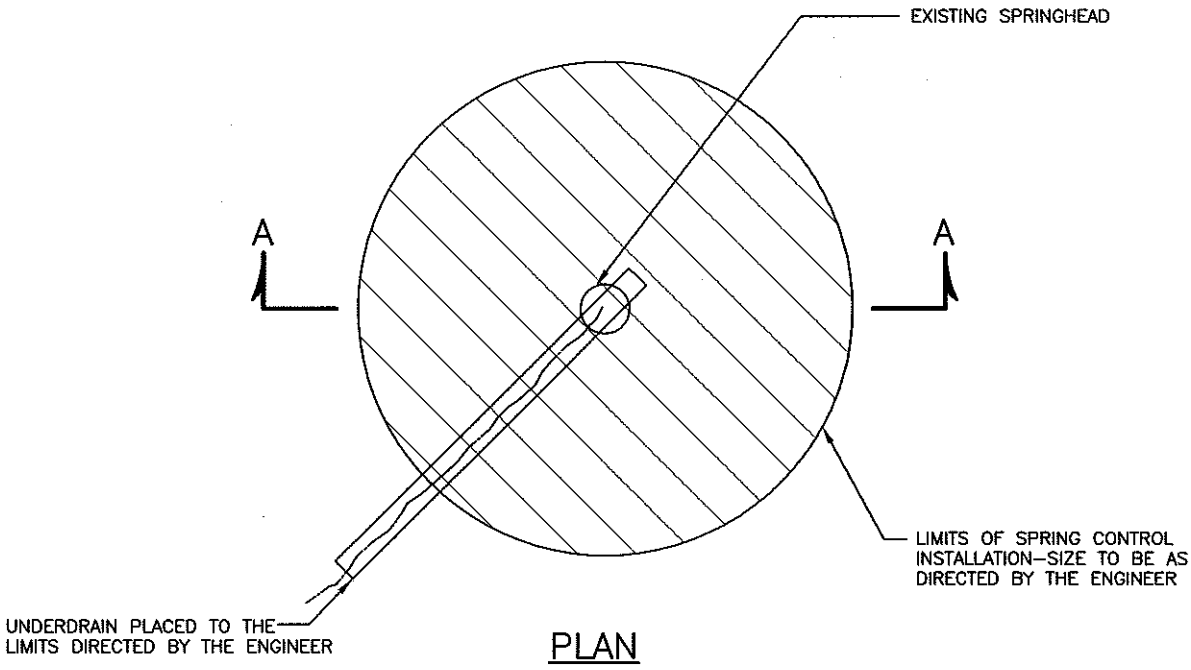
Approved: _____
Chief, Bureau of Engineering

COMMERCIAL–INDUSTRIAL–APARTMENT
Entrance on Open Section Roadway
(<200 V.P.H.)

Detail
R-6.10



SECTION A–A



PLAN

NOTES:

1. SPRING CONTROL TO BE CONSTRUCTED WHERE NOTED ON THE PLANS OR WHERE DIRECTED BY ENGINEER.
2. THE COST OF FURNISHING AND INSTALLING 3 PLY ROOFING PAPER SHALL BE INCLUDED IN THE CONTRACT UNIT PRICE FOR AGGREGATE BACKFILL FOR UNDERDRAIN.

7/17/2015
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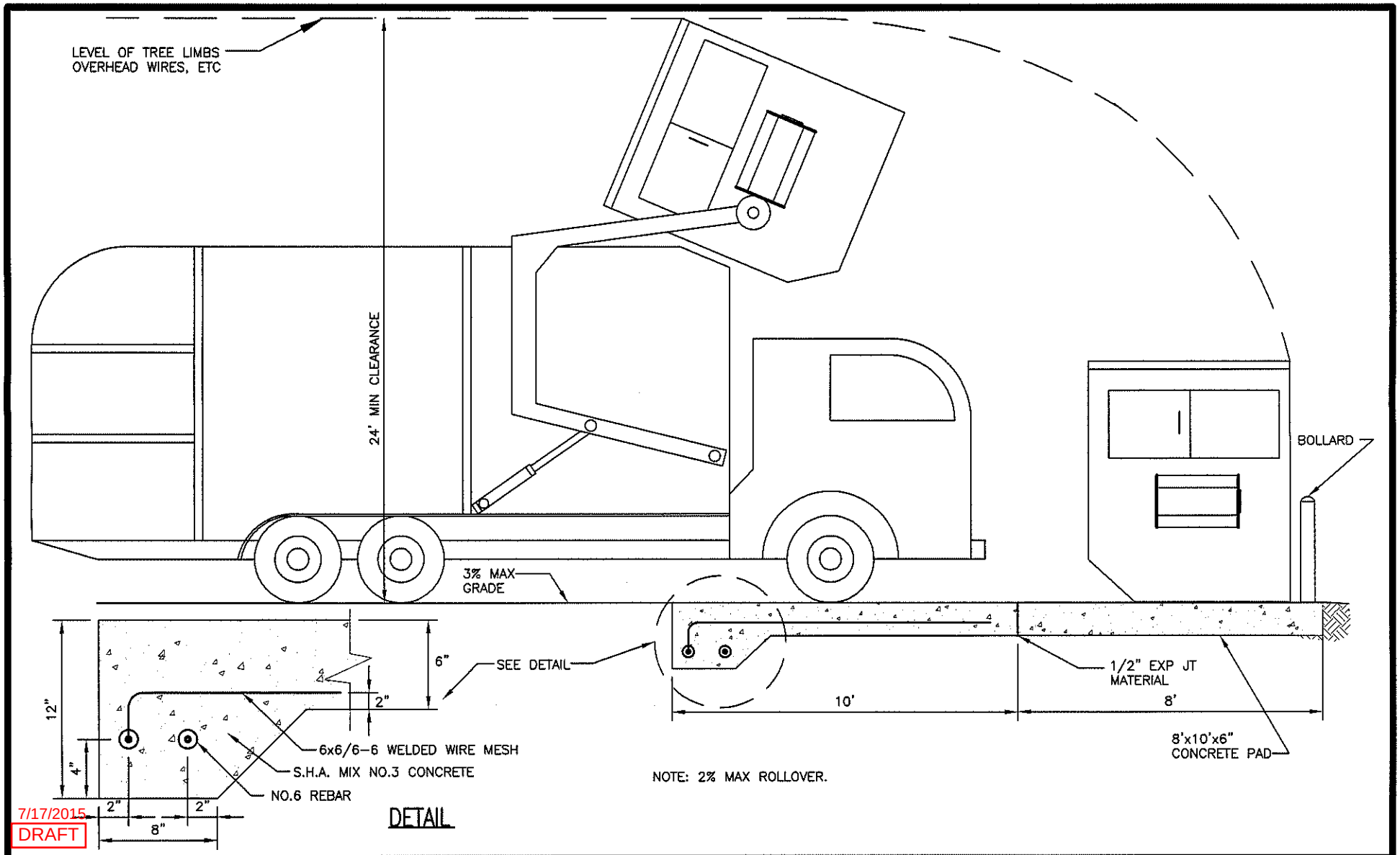
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Spring Control	Detail R–8.02



7/17/2015
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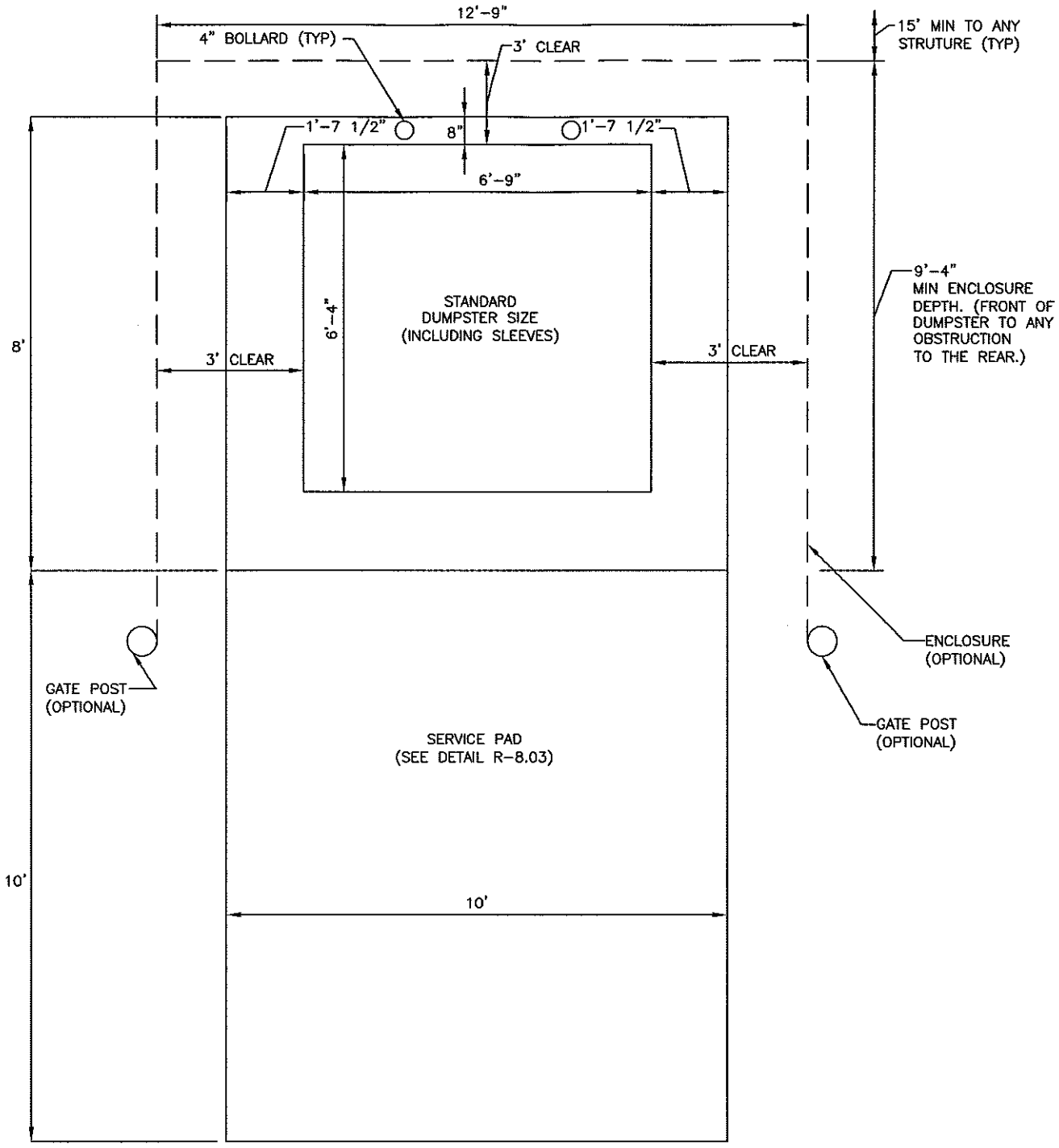
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	SOLID WASTE Service Pad	Detail R-8.03



NOTES:

1. ENCLOSURE GATES ARE NOT RECOMMENDED.
2. IF ENCLOSURE GATES ARE INSTALLED, MINIMUM OPENING OF 12'-9" MUST BE MAINTAINED WHEN GATES ARE SECURED OPEN.
3. A MINIMUM OF 15' CLEAR SPACE SHALL BE PROVIDED FROM THE ENCLOSURE TO ANY STRUCTURE.

7/17/2015
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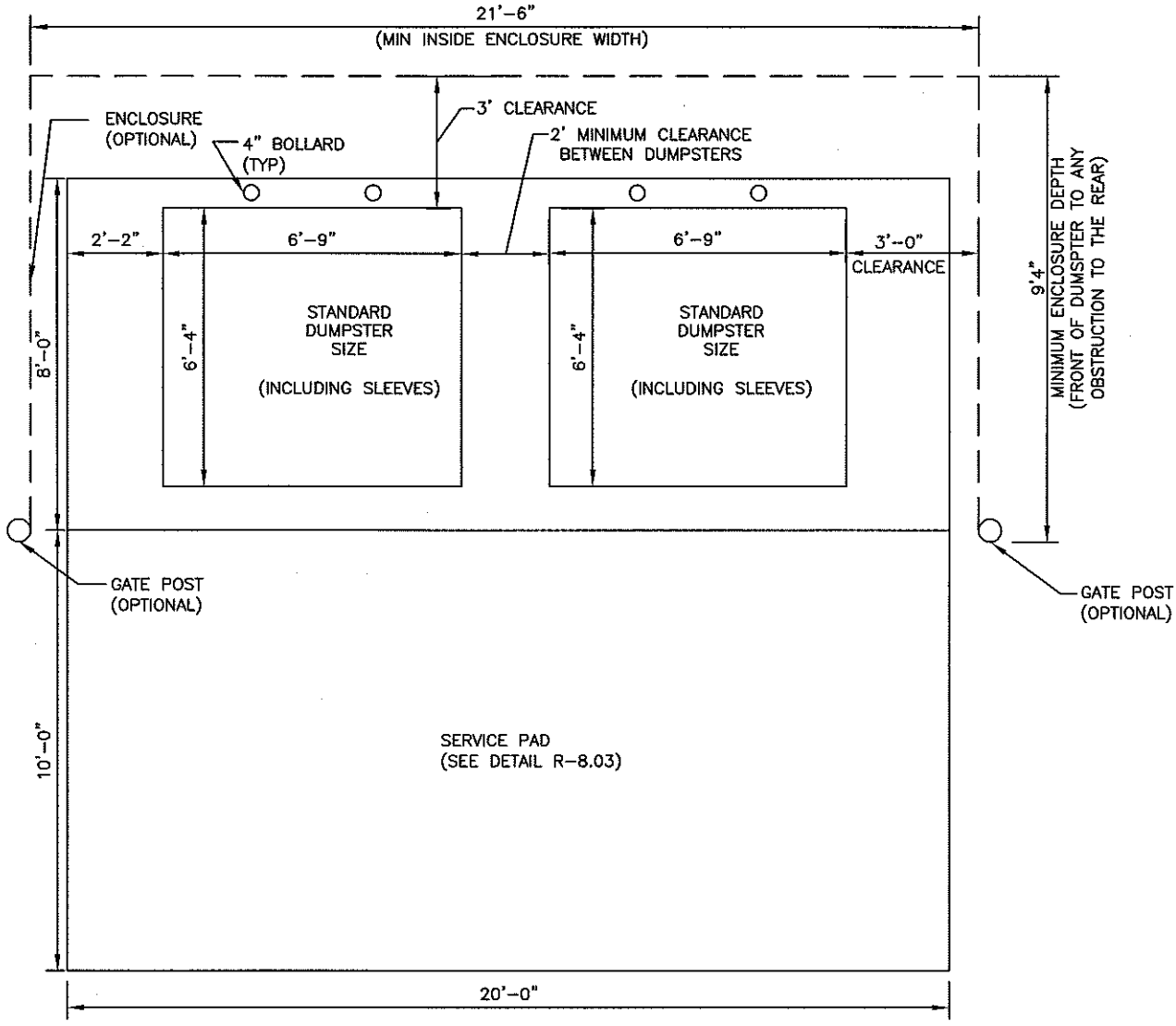
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	SOLID WASTE Single Container Enclosure	Detail R-8.04



NOTES:

1. ENCLOSURE GATES ARE NOT RECOMMENDED.
2. IF ENCLOSURE GATES ARE INSTALLED, MINIMUM OPENING OF 21'–6" MUST BE PROVIDED WHEN GATES ARE OPENED. ONLY 2 GATE SYSTEMS WITH NO CENTER POST ARE ALLOWED.
3. A MINIMUM OF 15' CLEAR SPACE SHALL BE PROVIDED FROM THE ENCLOUSURE TO ANY STRUCTURE.

7/17/2015
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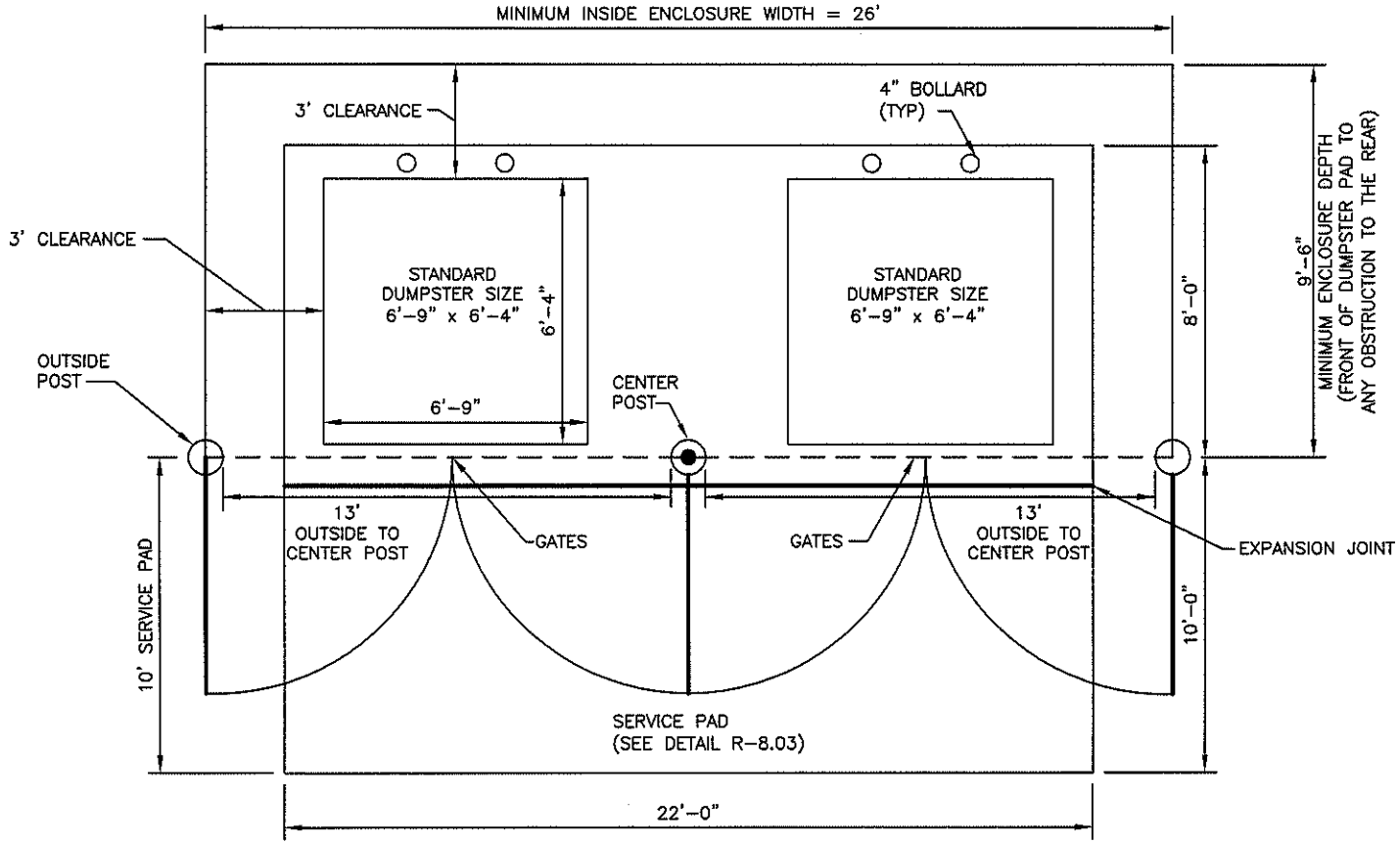
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	SOLID WASTE Double Container Enclosure 2 Gate System	Detail R–8.05

NOTES:

1. ENCLOSURE GATES ARE NOT RECOMMENDED.
2. IF ENCLOSURE GATES ARE INSTALLED, A MINIMUM OF 12'–9" CLEAR SPACE IS REQUIRED. THE GATES SHALL SECURE IN THE OPEN POSITION.
3. A MINIMUM OF 15' CLEAR SPACE SHALL BE PROVIDED FROM THE ENCLOUSURE TO ANY STRUCTURE.



7/17/2015
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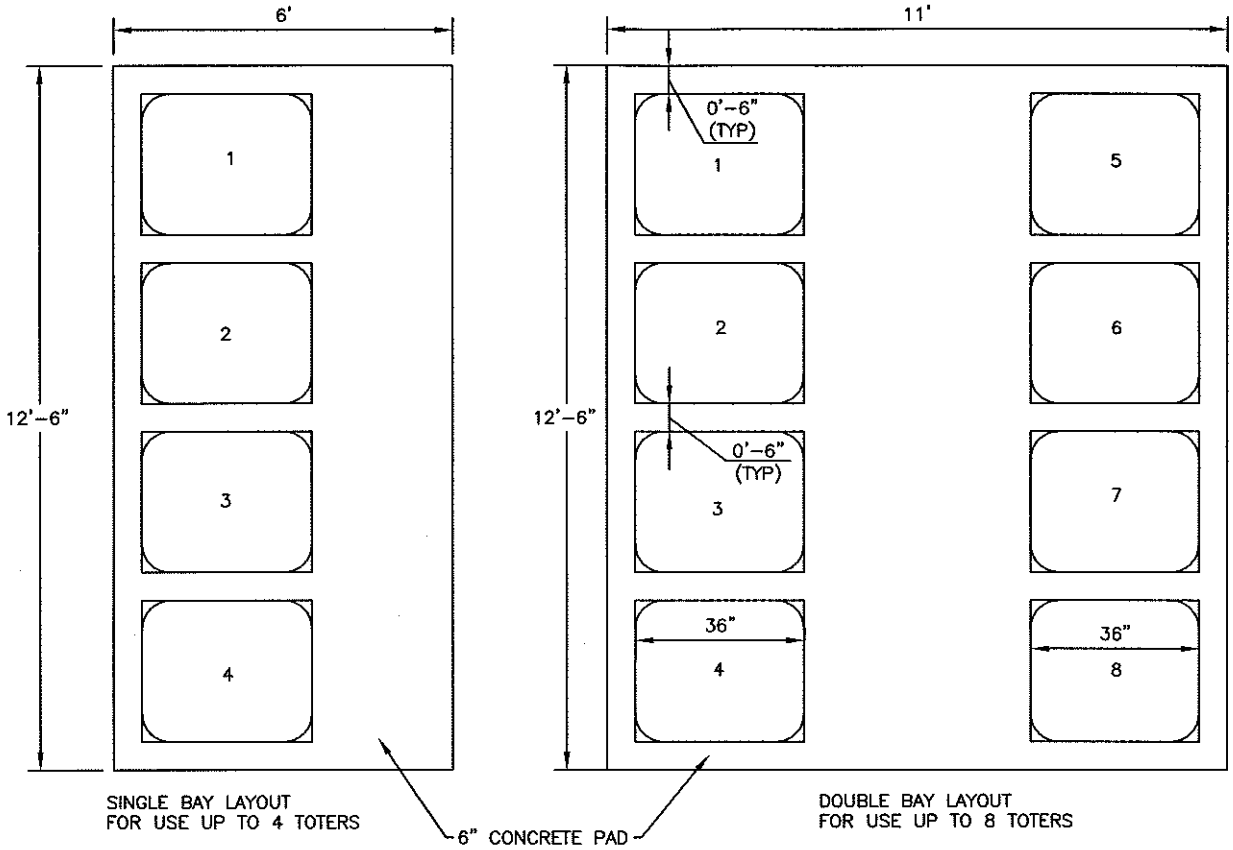
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	SOLID WASTE Double Container Enclosure 4 Gate System	Detail R–8.06



NOTES:

1. NORMAL TOTER SIZE IS 30" WIDE x 36" DEEP.
2. THESE OPTIONAL TOTER STORAGE AREAS MAY BE ATTACHED OR PLACED NEXT TO THE DUMPSTER AREA.
3. THE PAD SHALL BE ON THE SAME GRADE AS THE ROADWAY OR HANDICAP TYPE CURB USED.
4. IF ENCLOSURE IS USED, AT LEAST A 4' OPENING IS NECESSARY TO REMOVE AND REPLACE TOTERS.
5. INSTALL EXPANSION JOINTS AS APPLICABLE.

7/17/2015
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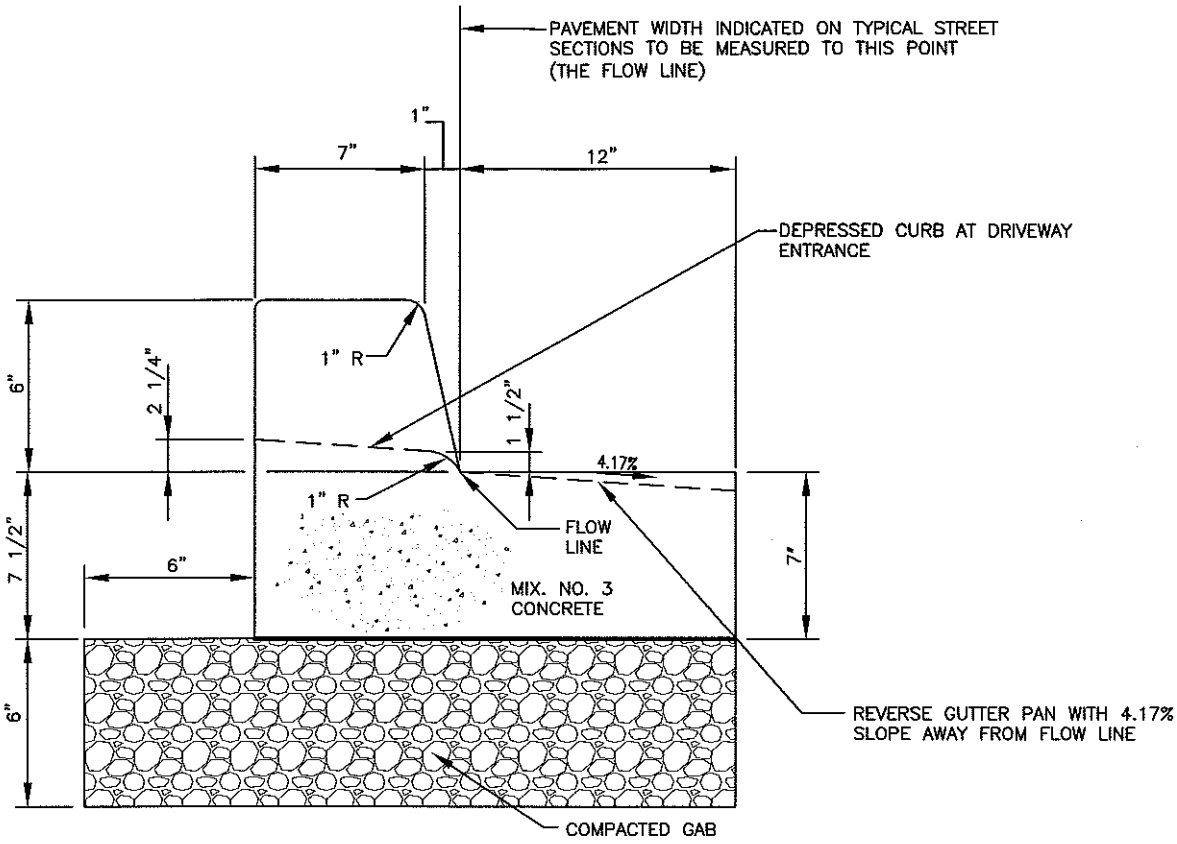
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	SOLID WASTE Recycling Toter Storage Area Layouts	Detail R-8.07



6" COMBINATION CURB AND GUTTER

NOTE:

1. GUTTER PAN AT THE MEDIAN EDGE OF INTERMEDIATE ARTERIALS OR THE HIGH SIDE OF SUPERELEVATED SECTIONS SHALL BE SLOPED AT THE SAME RATE AND IN THE SAME DIRECTION AS THE PAVEMENT. MATCH PAVEMENT CROSS SLOPE WHEN CURB IS LOCATED ON THE LOW SIDE OF SUPERELEVATED SECTION AND THE RATE OF SUPERELEVATION IS GREATER THAN 3% FOR MODIFIED CURB AND GUTTER.

7/17/2015
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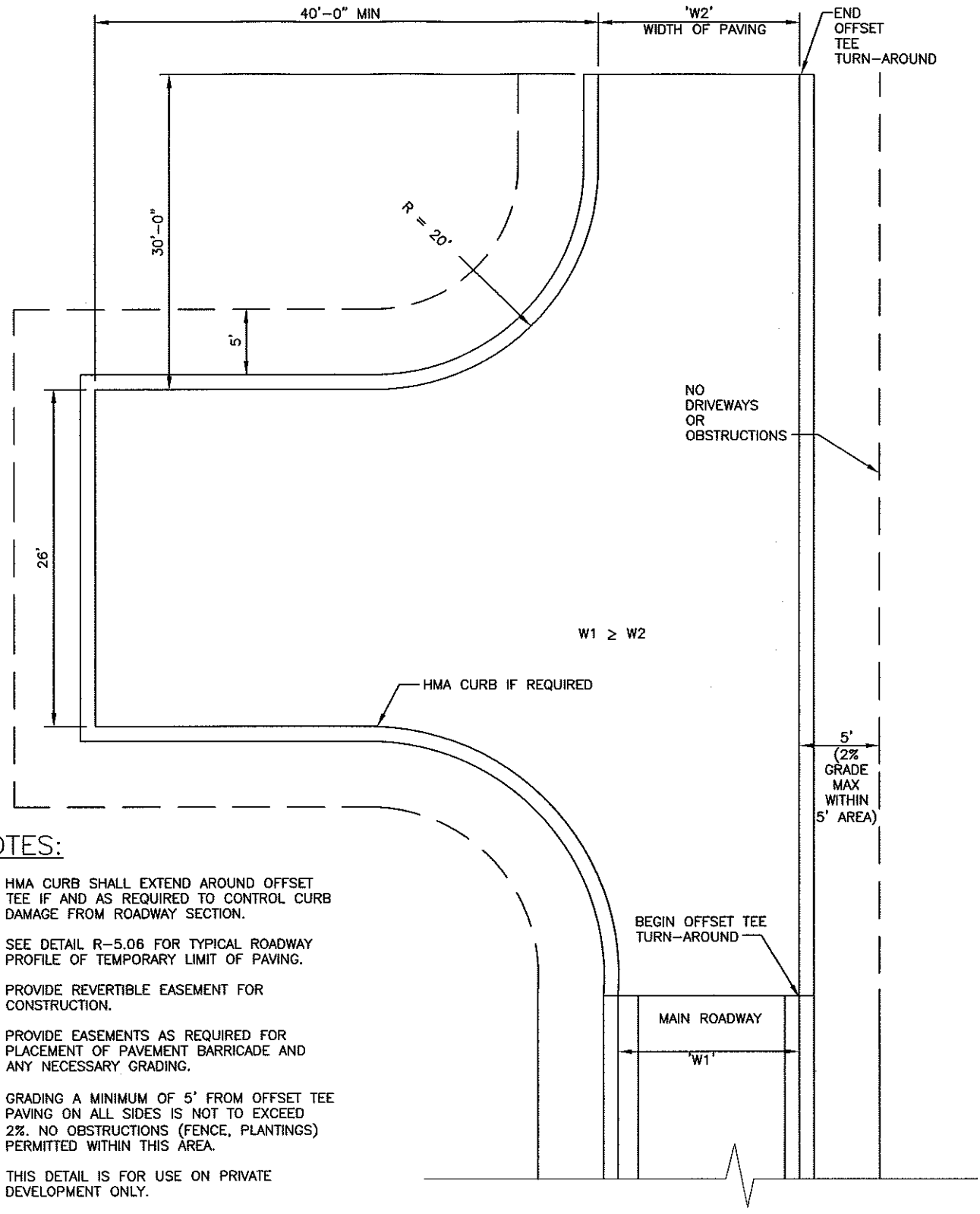
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	CURB AND GUTTER 6" Combination Curb and Gutter Private	Detail R-9.01

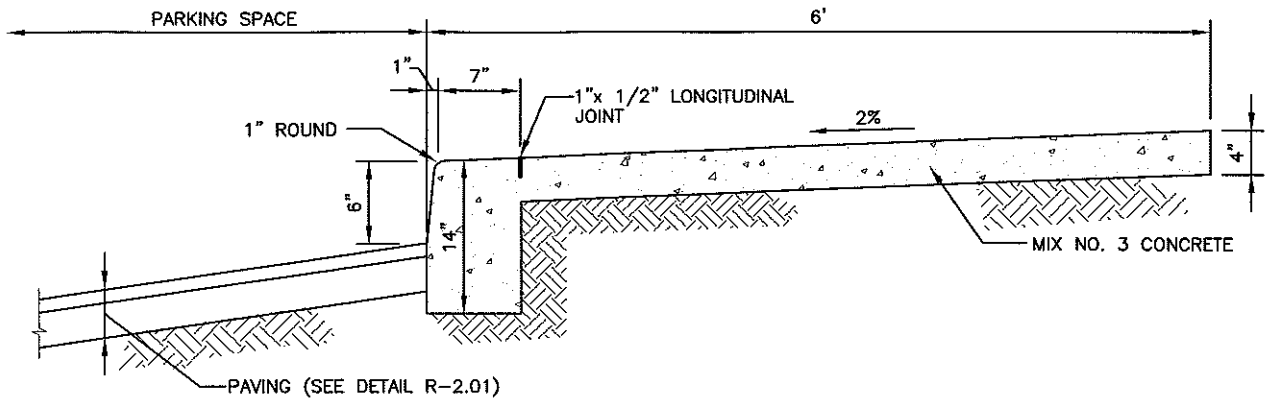


NOTES:

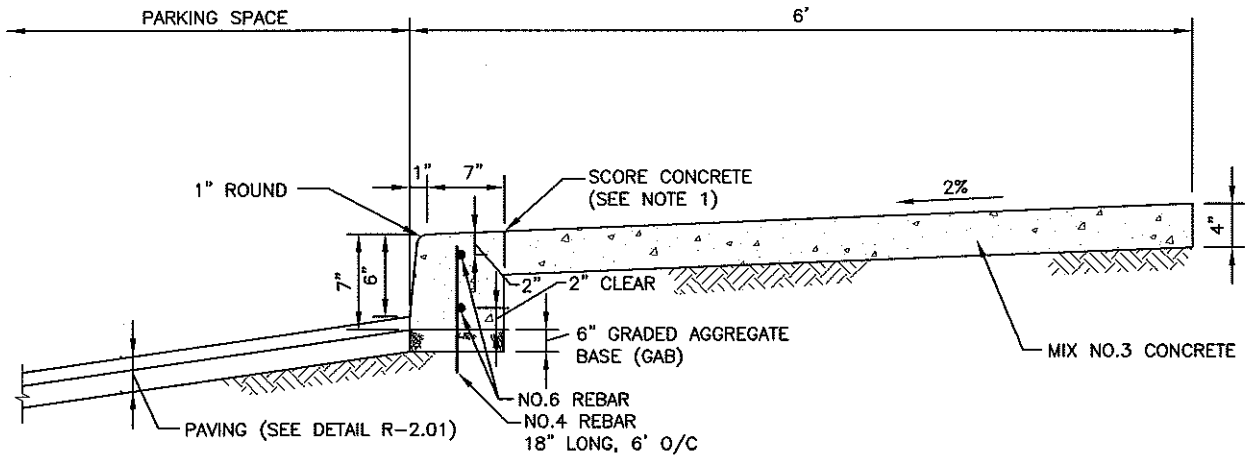
1. HMA CURB SHALL EXTEND AROUND OFFSET TEE IF AND AS REQUIRED TO CONTROL CURB DAMAGE FROM ROADWAY SECTION.
2. SEE DETAIL R-5.06 FOR TYPICAL ROADWAY PROFILE OF TEMPORARY LIMIT OF PAVING.
3. PROVIDE REVERTIBLE EASEMENT FOR CONSTRUCTION.
4. PROVIDE EASEMENTS AS REQUIRED FOR PLACEMENT OF PAVEMENT BARRICADE AND ANY NECESSARY GRADING.
5. GRADING A MINIMUM OF 5' FROM OFFSET TEE PAVING ON ALL SIDES IS NOT TO EXCEED 2%. NO OBSTRUCTIONS (FENCE, PLANTINGS) PERMITTED WITHIN THIS AREA.
6. THIS DETAIL IS FOR USE ON PRIVATE DEVELOPMENT ONLY.

7/17/2015 DRAFT

Revised	Howard County, Maryland Department of Public Works	TEE TURN-AROUND Offset Private	Detail R-9.02
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		



SECTION



ALTERNATE SECTION

NOTES:

1. LONGITUDINAL JOINT BETWEEN SIDEWALK AND CURB SHALL BE CONTINUOUS AND TO A DEPTH OF 1/4 THE SIDEWALK OR 1" MAX. LATITUDINAL JOINTS SHALL RUN FROM BACK EDGE OF SIDEWALK, CONTINUOUS TO THE BOTTOM FACE OF CURB TO A DEPTH OF 1/4' AND SPACED 5' APART.
2. PROVIDE 1/2" EXPANSION JOINTS AT 15' INTERVALS IN LATITUDINAL JOINTS TO FULL CROSS-SECTION.
3. 4'-0" SIDEWALK REQUIRES A PASSING AREA (SEE DETAIL R-4.01).

7/17/2015
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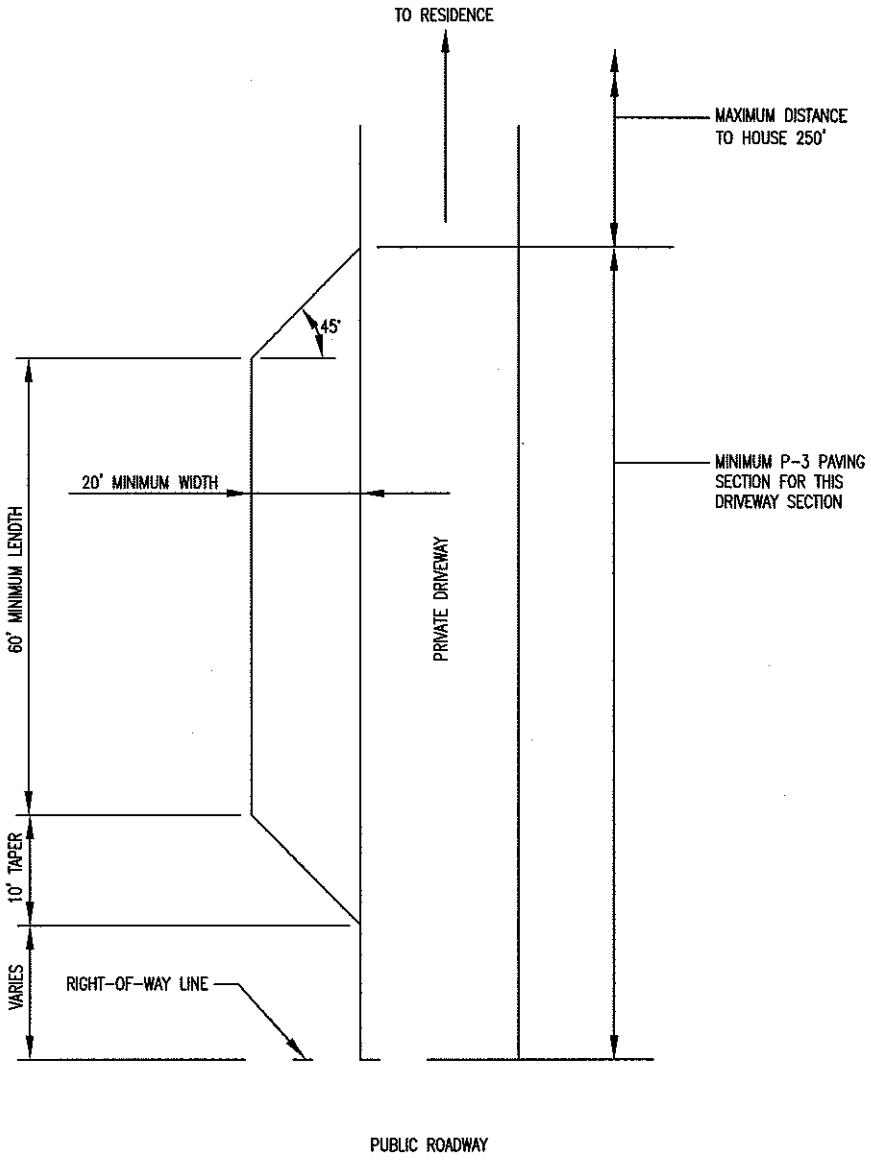
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Monolithic Curb and Sidewalk Private Parking Area	Detail R-9.03



NOTES:

1. EMERGENCY PULL-OFF FOR DRIVEWAYS GREATER THAN 800 FEET LONG.
2. MAXIMUM SLOPE IN ANY DIRECTION WITHIN PULL-OFF SHALL BE 4%.

7/17/2015

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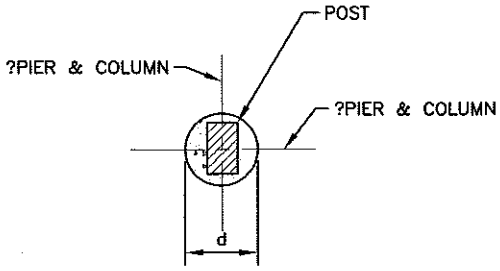
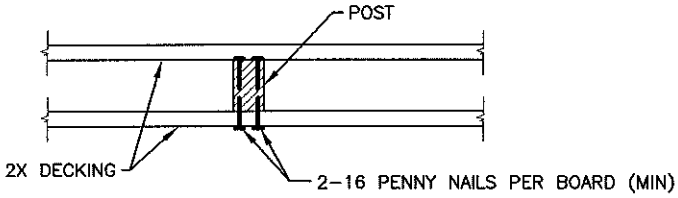
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	DRIVEWAY Emergency Pull-off Private	Detail R-9.04

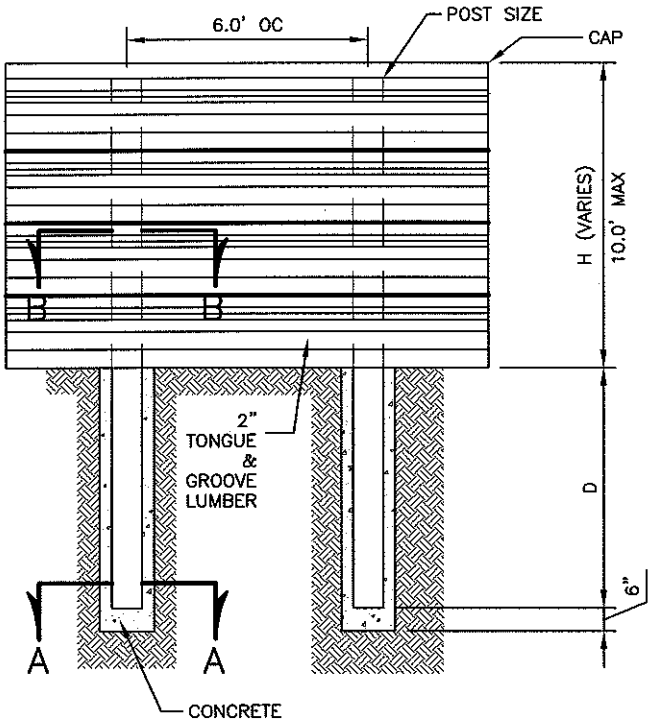


H	D	d	POST SIZE
5'	6'	12"	4"X8"
8'	6'	16"	8"X8"
10'	8'	18"	6"X12"

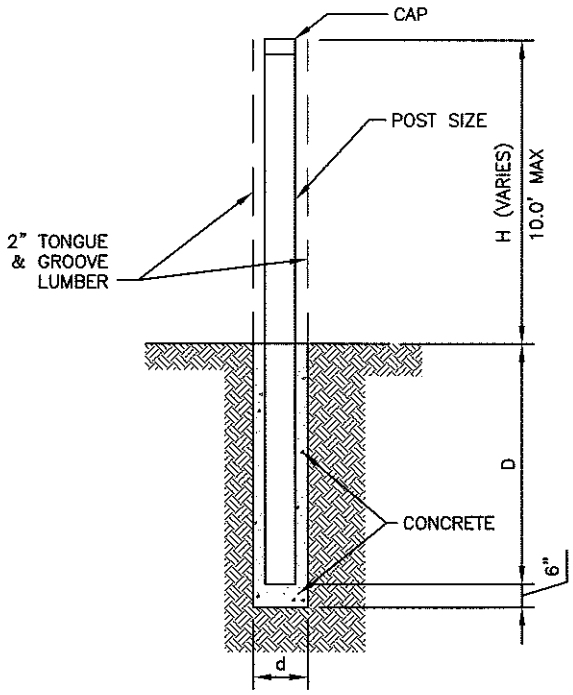
SECTION A–A



SECTION B–B



ELEVATION



SECTION

NOTES:

1. SEE DETAIL R-9.06.

7/17/2015
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Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Noise Wall Private	Detail R-9.05

NOTES:

1. GENERAL:
   - A. HEIGHT OF BARRIER SHALL BE BASED ON ACOUSTIC REQUIREMENTS.
   - B. BARRIER WALLS HAVING A HEIGHT (H) NOT INDICATED IN THE TABLES SHALL BE CONSTRUCTED AS SHOWN IN THE HIGHER HEIGHT CATEGORY.
2. SIDING:
   - A. 2 INCH WOOD DECKING MATERIAL SHALL BE UTILIZED TO SPAN HORIZONTALLY BETWEEN POSTS. DESIGN CRITERIA IS BASED ON AN ALLOWABLE BENDING STRESS OF 1400 LBS PER SQ IN. AND A 33⅓% INCREASE IN STRESS FOR FOR WIND LOADS AS CONSIDERED APPROPRIATE. DECKING SHALL BE MC15.
   - B. SIDING IN CONTACT WITH THE GROUND AND FOR A DISTANCE OF 6" ABOVE GRADE SHALL BE TREATED WITH WOOD PRESERVATIVE.
3. POST:
   - A. WOOD POST SHALL BE UTILIZED AT THE SPACING INDICATED ON THE SCHEDULE. DESIGN CRITERIA IS BASED ON AN ALLOWABLE BENDING STRESS OF 1400 LBS PER SQ IN. AND A 33⅓% INCREASE FOR WIND LOAD.
   - B. POST EMBEDDED IN CONCRETE SHALL BE TREATED WITH A WOOD PRESERVATIVE IN THE AREA OF EMBEDMENT AND 12" ABOVE GRADE.
4. CONCRETE:
   - A. CONCRETE IN THE PIERS HAVE A 28 DAY COMPRESSIVE STRENGTH OF 2500 LBS PER SQ FT.
   - B. CONCRETE SHALL BE PLACED IN DRILLED PIERS UTILIZING THE EARTH AS FORMS.
5. FOUNDATIONS:
   - A. THE DRILLED PIERS HAVE BEEN DESIGNED UTILIZING AN ALLOWABLE PASSIVE PRESSURE OF 300 LBS PER SQ FT AND THE FOLLOWING FORMULA:

     $D=(14.52M/(Pd))^{0.333}$

     M= MOMENT AT TOP OF DRILLED PIER (FT/LBS)

     P= ALLOWABLE PASSIVE PRESSURE (300 LBS PER SQ FT)

     d= DIAMETER OF PIER (FT)

     D= DEPTH OF PIER (FT)
6. ALTERNATIVE #1 (PRESERVATIVE TREATMENT):

   ALTERNATIVE #1 REPRESENTS THE ADDITIONAL COST FACTOR FOR TREATING THE BASIC WOOD STRUCTURE INDICATED ON THIS REFERENCE PLAN. THE NECESSITY FOR TREATMENT AND THE TYPE OF THE PRESERVATIVE WILL BE SUBJECT TO LOCAL CONDITIONS. ALL TREATMENTS SHALL CONFORM TO AWPA STD C-14.
7. ALTERNATIVE #2 (PAINTING):

   ALTERNATIVE #2 REPRESENTS THE ADDITIONAL COST FACTOR REQUIRED TO PAINT ONE SIDE OF THE BASIC WOOD STRUCTURE SHOWN ON THIS REFERENCE PLAN. PAINTING SHALL CONSIST OF 3 APPLICATIONS OF PAINT. 2 COATS OF LATEX BASE PAINT CONFORMING TO FEDERAL SPECIFICATION TT-P-009966 SHALL BE APPLIED OVER PRIMER COAT CONFORMING TO FEDERAL SPECIFICATION TT-P-00250.
8. ALTERNATIVE #3 (STAINING);

   ALTERNATIVE #3 REPRESENTS THE ADDITIONAL COST FACTOR REQUIRED TO STAIN ONE SIDE OF BASIC WWOOD STRUCTURE. STAIN SHALL CONSIST OF 2 COATS OF SEMI-TRANSPARENT SEALER STAIN APPLIED IN ACCORDANCE WITH MANUFACTURERS WRITTEN INSTRUCTIONS.
9. SPECIAL SITE SPECIFIC DESIGN BY A STRUCTURAL ENGINEER IS REQUIRED FOR WALL HEIGHT (H) GREATED THAN 10 FT.

7/17/2015
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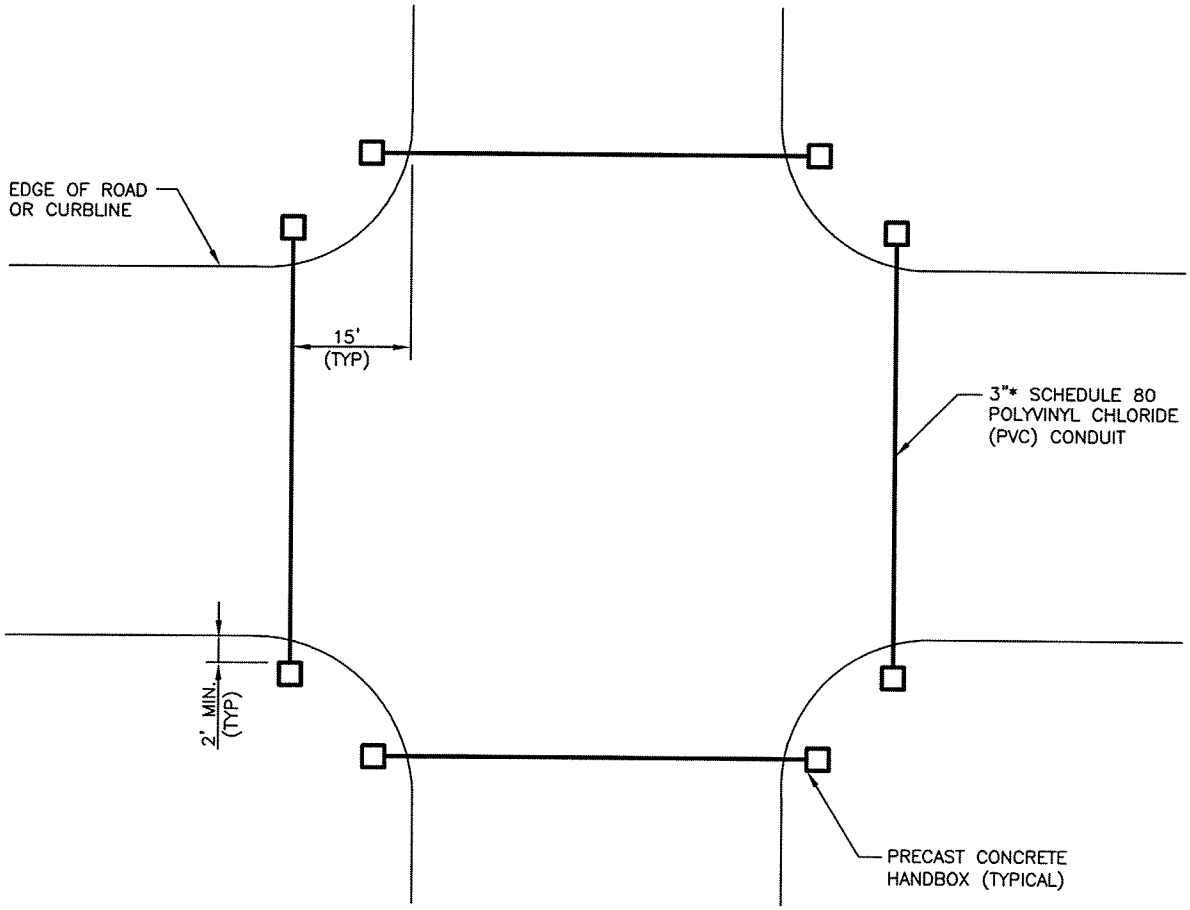
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Noise Wall Notes Private	Detail R-9.06



* LARGER CONDUITS SHALL BE INSTALLED WHEN SO DIRECTED BY THE DEPARTMENT OF PUBLIC WORKS.

NOTES:

1. CONDUITS SHALL BE INSTALLED WHEN DIRECTED BY THE DEPARTMENT OF PUBLIC WORKS.
2. CONDUITS SHALL BE LAID AT A DEPTH OF 24", WITH PRECAST CONCRETE HANDBOX ON EACH END.

7/17/2015
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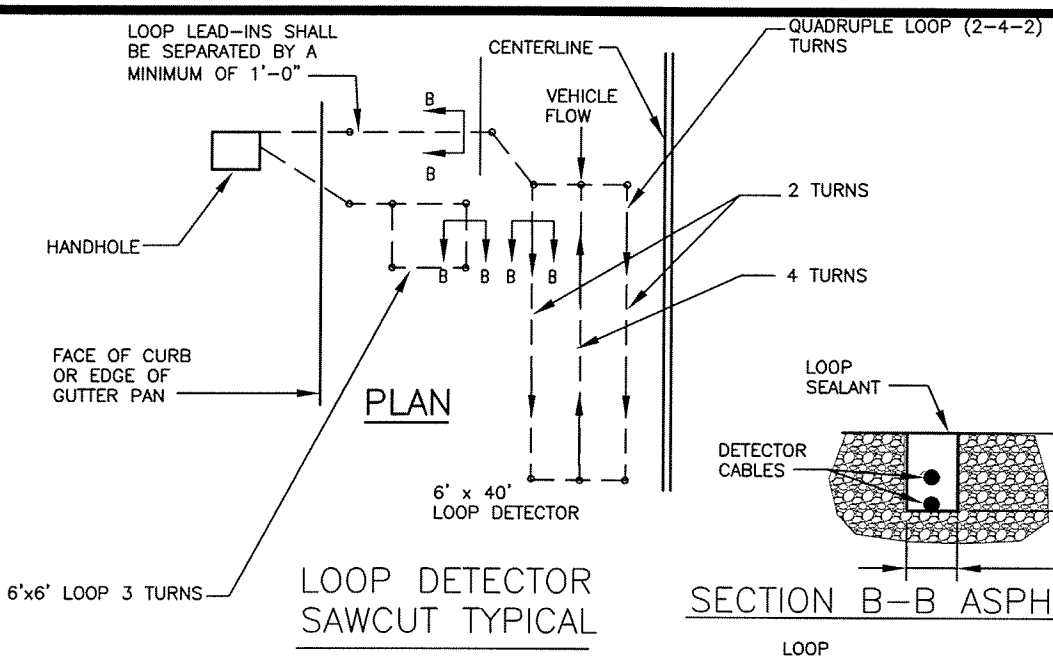
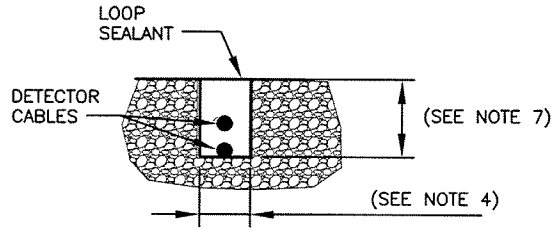
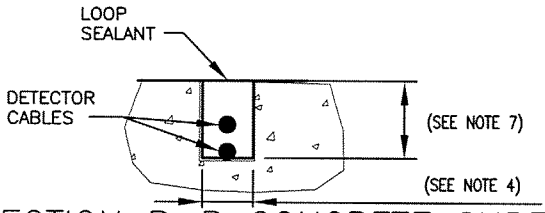
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Conduit Layout for Future Signalization	Detail T-1.01



LOOP DETECTOR SAWCUT TYPICAL



SECTION B-B ASPHALT SURFACE



SECTION B-B CONCRETE SURFACE

NOTES:

1. WHEN A PROPOSED LOOP DETECTOR SAWCUT CROSSES A LATERAL ROADWAY JOINT OR VALVE COVER (i.e. MANHOLE, HANDHOLE, ETC.) LOOP DETECTOR INSTALLATION SHALL BE MODIFIED INTO TWO SEPARATE LOOP DETECTORS WHICH SHALL NOT TRAVERSE JOINTS OR VALVE COVERS.
2. THE LOOPS SHALL BE PLACED IN THE CENTER OF THE LANE UNLESS OTHERWISE NOTED ON PLANS.
3. PRESENCE LOOP DETECTORS ARE TO BE PLACED 10' IN FRONT OF THE EXISTING OR PROPOSED STOP LINE.
4. LOOP DETECTOR SAWCUTS SHALL BE 5/8" LEAD-INS FROM THE LOOP DETECTOR TO THE EDGE OF PAVEMENT/CURB AND GUTTER SHALL BE 5/8".
5. 1 1/2" DRILL HOLES SHALL BE USED AT ALL CHANGES IN SAWCUT DIRECTIONS.
6. SEPARATE 1" ELECTRICAL CONDUIT SLEEVES SHALL BE REQUIRED FOR EACH LOOP SPACED 1'-0" MINIMUM APART IN ROADWAY.
7. 2" DEPTH FOR CONCRETE ROAD SURFACE OR 4 1/2" DEPTH FOR ASPHALT ROAD SURFACE.
8. LOOP DETECTORS INSTALLED AS PART OF A RESURFACING PROJECT, SHALL BE PLACED IN THE PAVING COURSE PRIOR TO THE FINAL SURFACE COURSE.
9. WHEN INDICATED ON THE PLANS FOR A LOOP DETECTOR TO BE INSTALLED IN A HOT ASPHALT PATCH, THE ROADWAY SHALL BE PATCHED TO CONFORM TO MSHA STD. SPECIFICATIONS SECTION 505 PRIOR TO THE INSTALLATION OF THE LOOP DETECTOR. THE PATCH SIZE SHALL BE AS SHOWN ON THE PLANS.
10. DETECTOR TO BE INSTALLED IN PORTLAND CEMENT CONCRETE PAVEMENT REPAIRS SHALL CONFORM TO MSHA STD. SPECIFICATIONS SECTION 522 PRIOR TO THE INSTALLATION OF THE LOOP DETECTOR. MINIMUM LONGITUDINAL ROADWAY REPAIR SHALL BE 8' FOR 6'x6' LOOP DETECTORS AND 42' FOR 6'x40' LOOP DETECTORS.
11. FOR SPLICE KIT FOR LOOP DETECTOR WIRE AND LOOP DETECTOR LEAD-IN, REFER TO SHA STANDARD NO. MD 810.01.
12. FOR LOOP DETECTOR LEAD-IN INSTALLATION, REFER TO SHA STANDARD NOS. MD 810.02 AND MD 810.03.

7/17/2015
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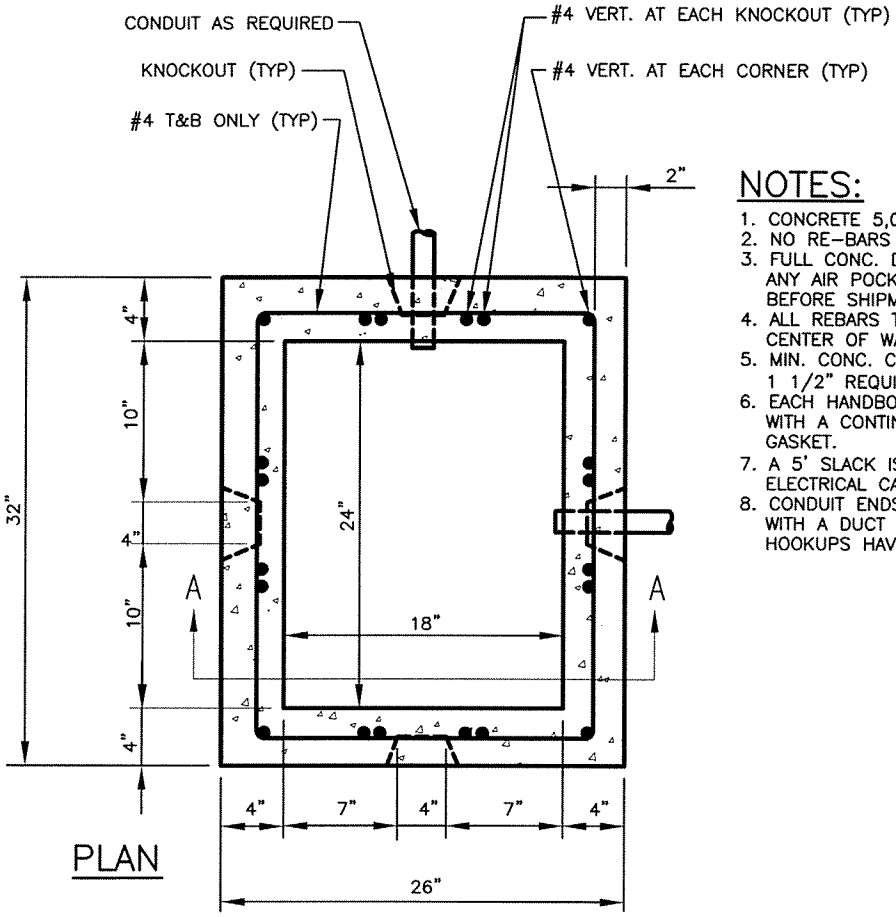
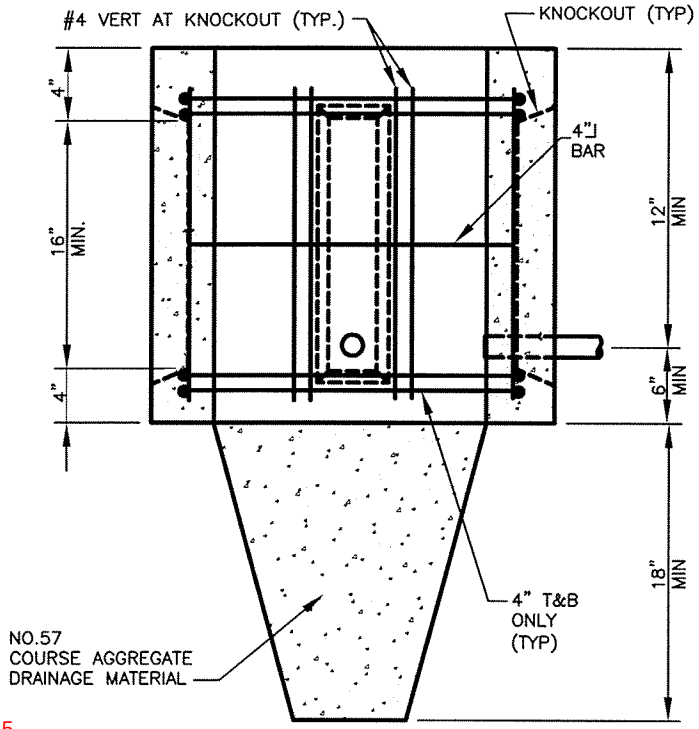
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Loop Detector Installation	Detail T-2.01



PLAN

NOTES:

1. CONCRETE 5,000 PSI
2. NO RE-BARS AT KNOCKOUT
3. FULL CONC. DIMENSIONS REQUIRED. ANY AIR POCKETS MUST BE PATCHED BEFORE SHIPMENT.
4. ALL REBARS TO BE PLACED AT CENTER OF WALLS.
5. MIN. CONC. COVER FOR REBARS 1 1/2" REQUIRED.
6. EACH HANDBOX SHALL BE PROVIDED WITH A CONTINUOUS ONE-PIECE PVC GASKET.
7. A 5' SLACK IS REQUIRED FOR ALL ELECTRICAL CABLE IN HANDBOX.
8. CONDUIT ENDS SHALL BE SEALED WITH A DUCT SEALER AFTER ELECTRICAL HOOKUPS HAVE BEEN COMPLETED



7/17/2015
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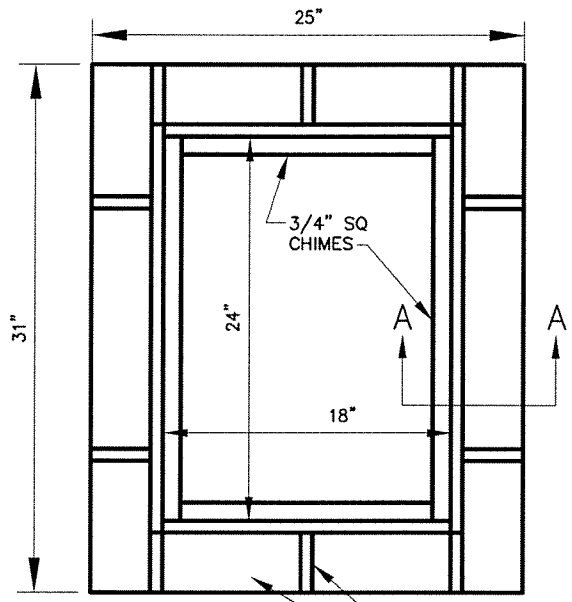
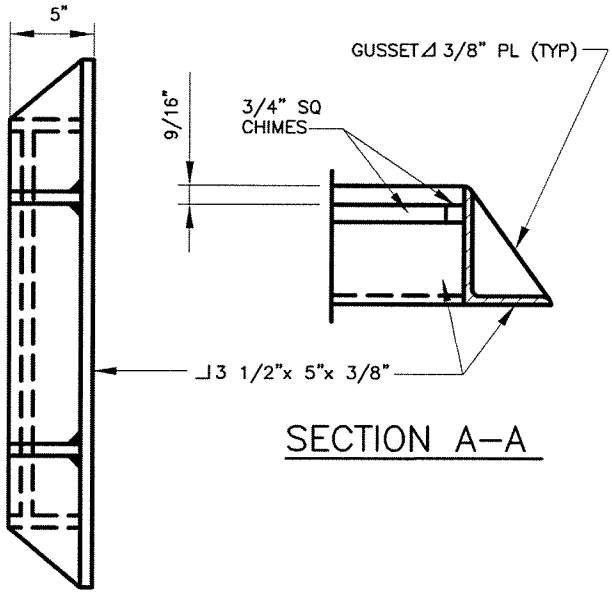
SECTION A-A

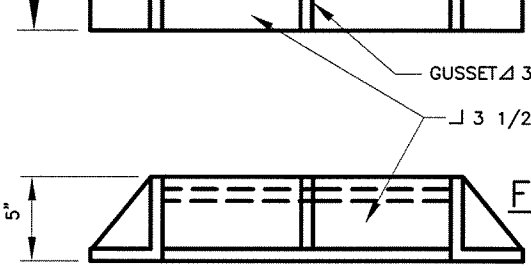
12"

Revised	Howard County, Maryland Department of Public Works	Precast Concrete Handbox	Detail T-3.01
Revised 5/7/2007	Approved: _____ Chief, Bureau of Engineering		
Approved			

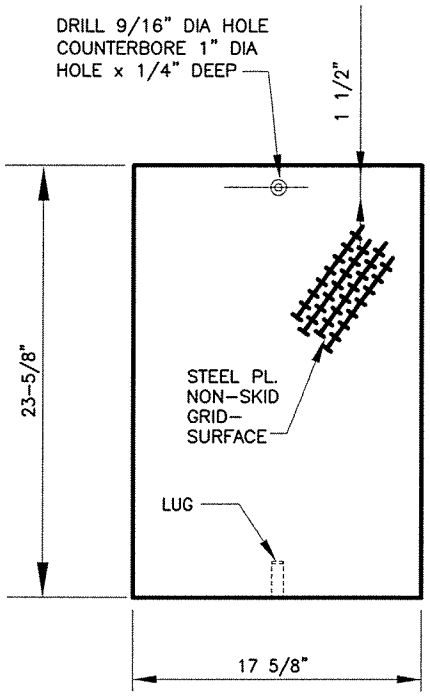


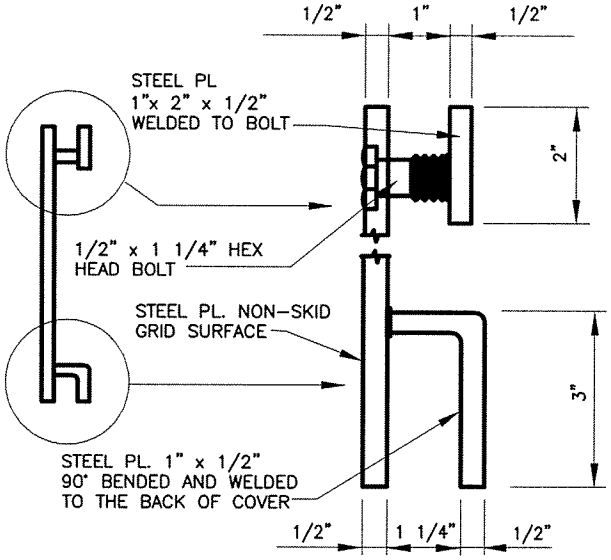


SECTION A–A



FRAME DETAILS





COVER DETAILS

7/17/2015
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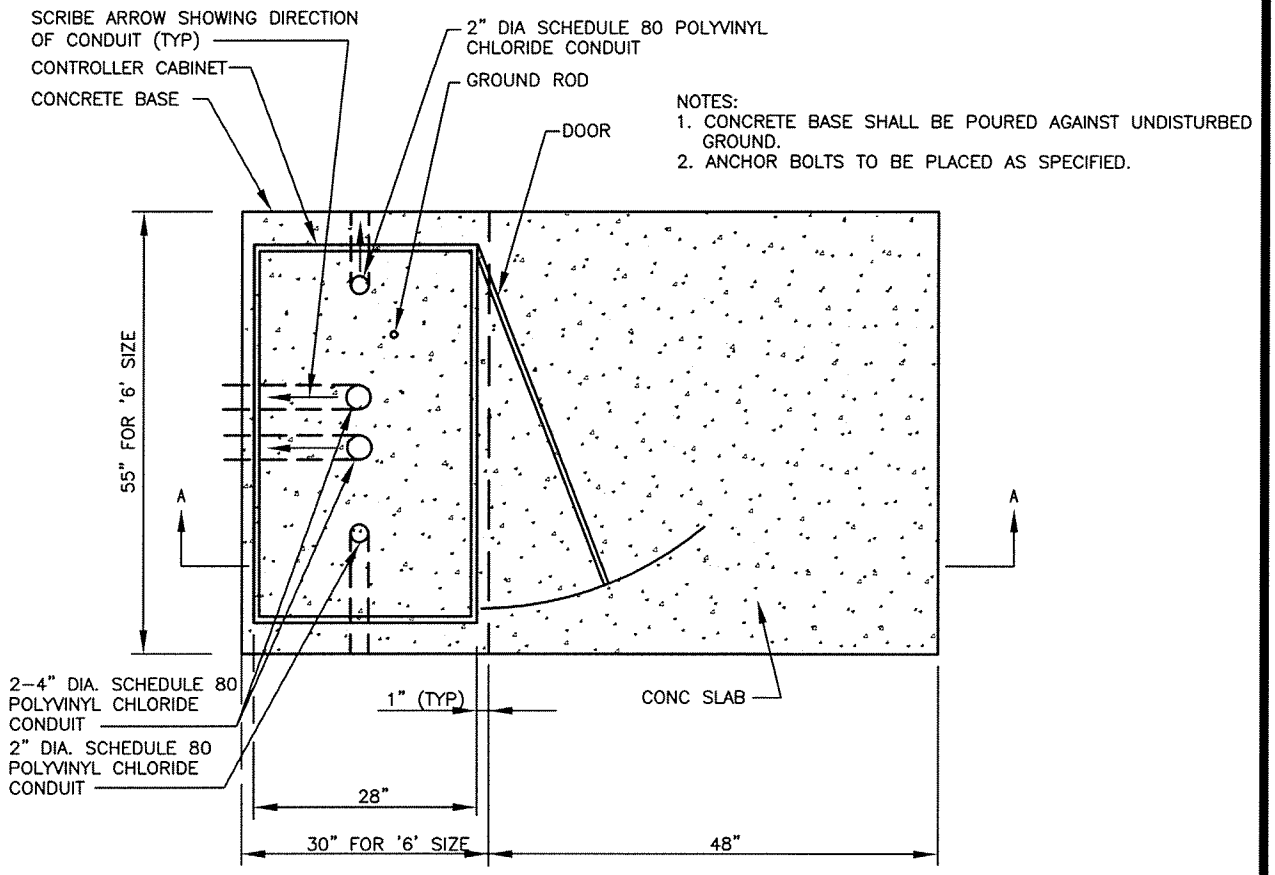
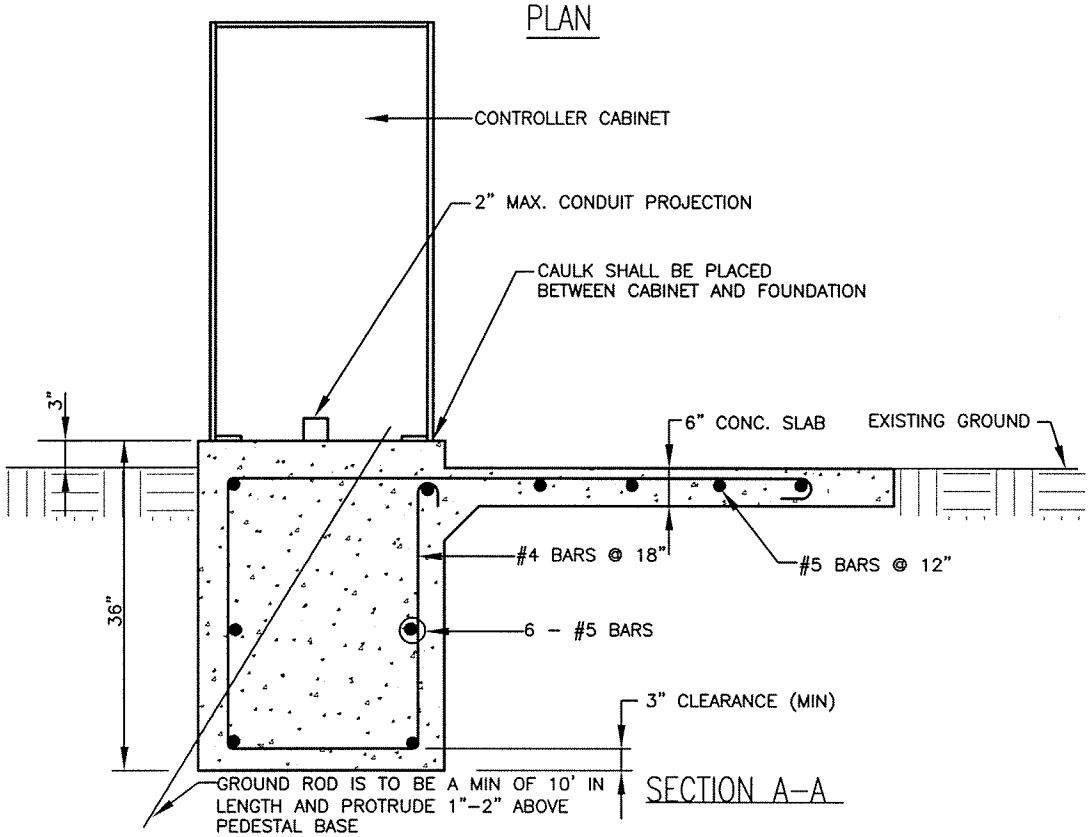
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Typical Handbox Frame And Cover	Detail T-3.02



PLAN



SECTION A-A

7/17/2015
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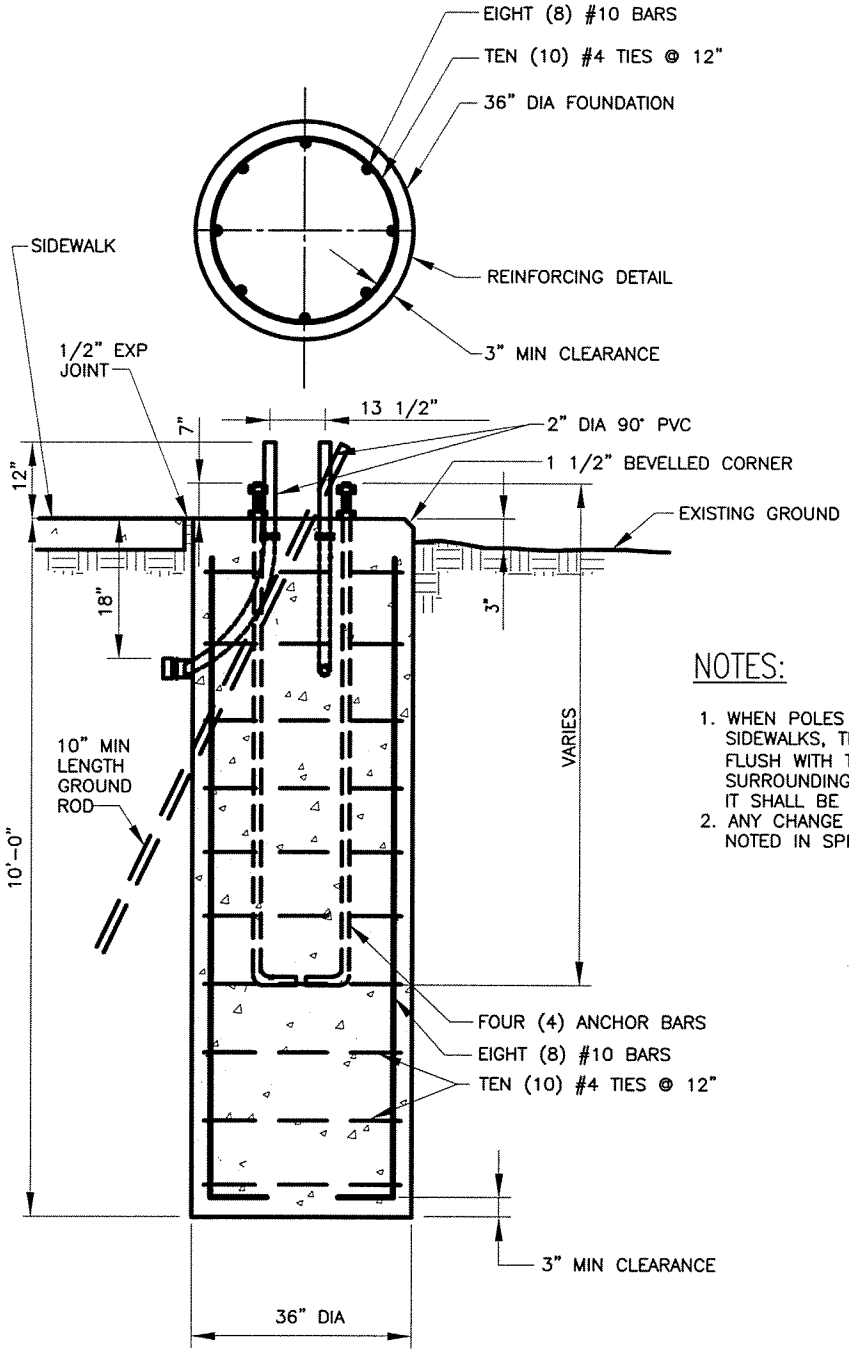
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Ground Mount Controller Cabinet	Detail T-4.01



NOTES:

1. WHEN POLES ARE IN PLACED IN SIDEWALKS, THE FOUNDATION SHALL BE FLUSH WITH THE CURB AND/OR SURROUNDING AREA, IN OTHER AREAS IT SHALL BE FILLED WITH GROUT.
2. ANY CHANGE IN PVC CONDUIT WILL BE NOTED IN SPECIAL PROVISIONS.

7/17/2015
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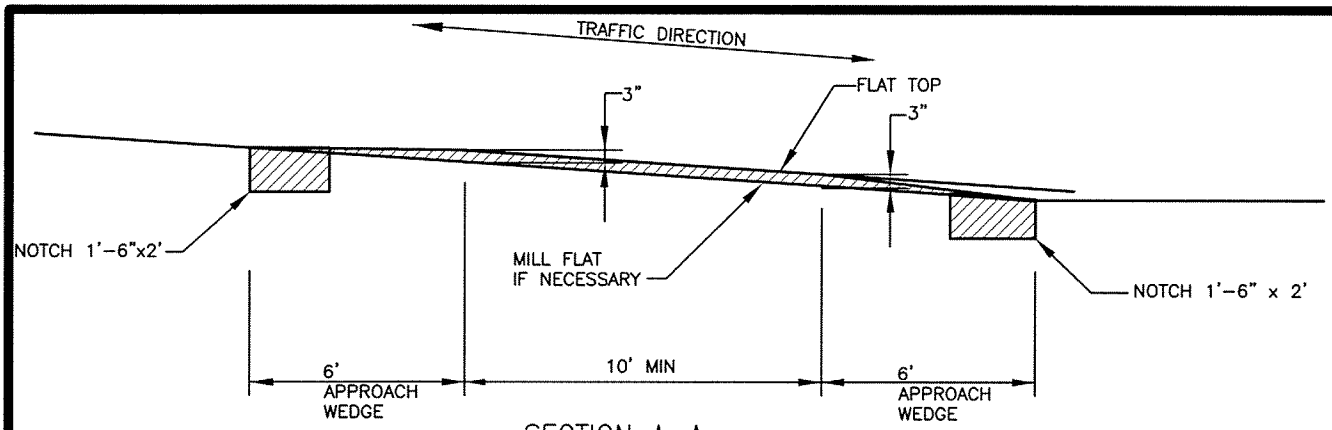
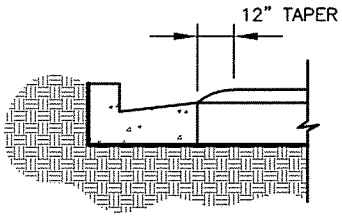
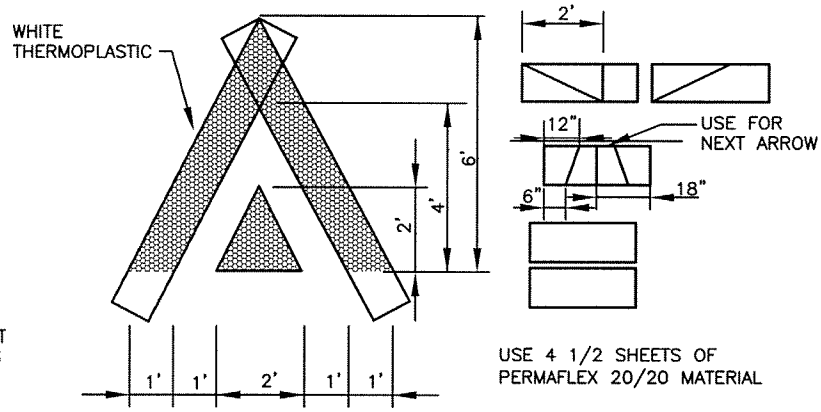
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Traffic Signal Pole Foundation Detail	Detail T-5.01



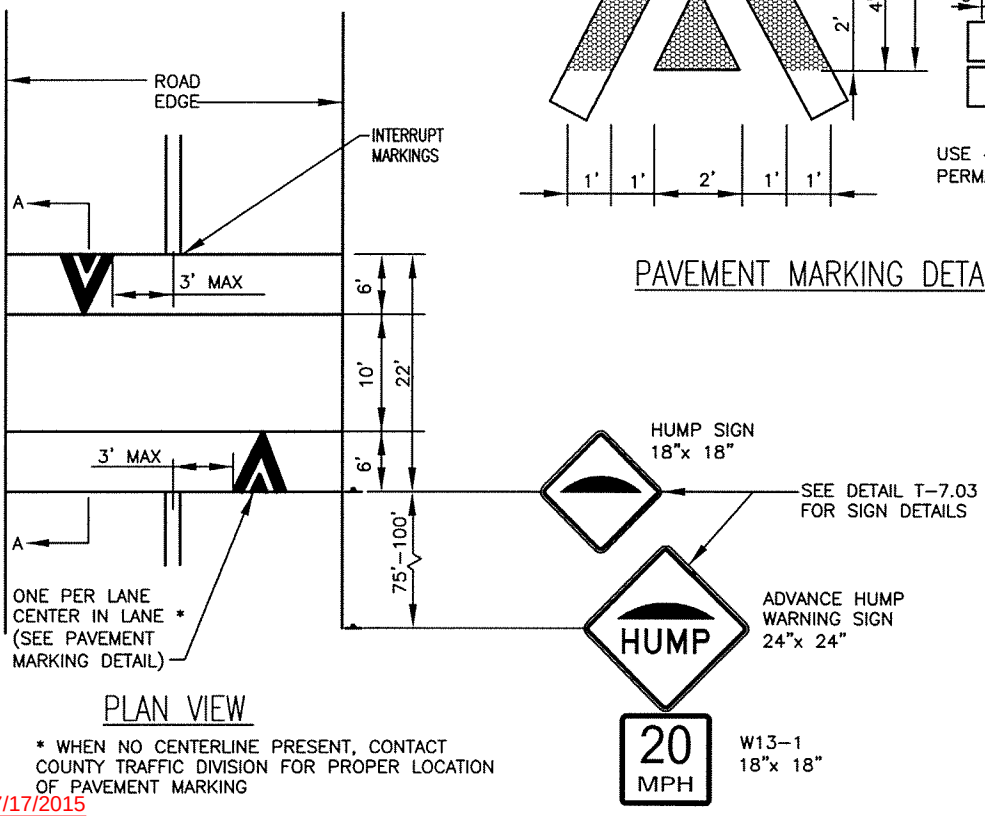
SECTION A-A



CURB TREATMENT



PAVEMENT MARKING DETAIL



PLAN VIEW

* WHEN NO CENTERLINE PRESENT, CONTACT COUNTY TRAFFIC DIVISION FOR PROPER LOCATION OF PAVEMENT MARKING

7/17/2015
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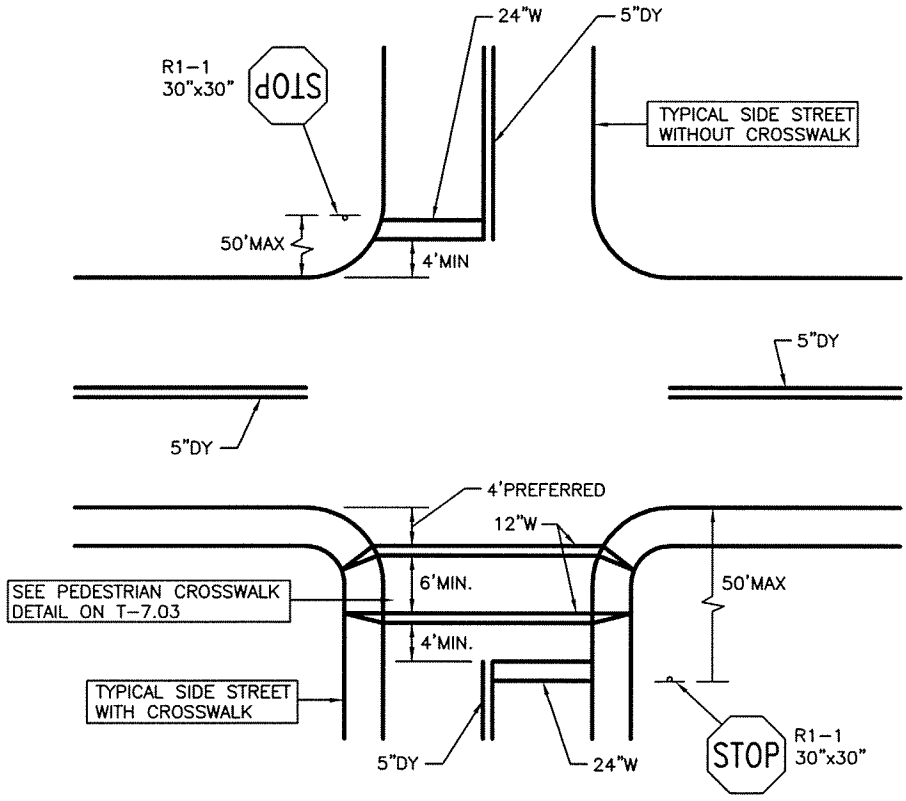
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Flat Top Profile Speed Table (Speed Hump)	Detail T-6.01



LEGEND

	TRAFFIC SIGN
5"DY	5" DOUBLE YELLOW LINE – PAINT
12"W	12" SOLID WHITE LINE (CROSSWALK) THERMOPLASTIC PAVEMENT MARKING
24"W	24" SOLID WHITE LINE (STOP LINE) THERMOPLASTIC PAVEMENT MARKING

7/17/2015
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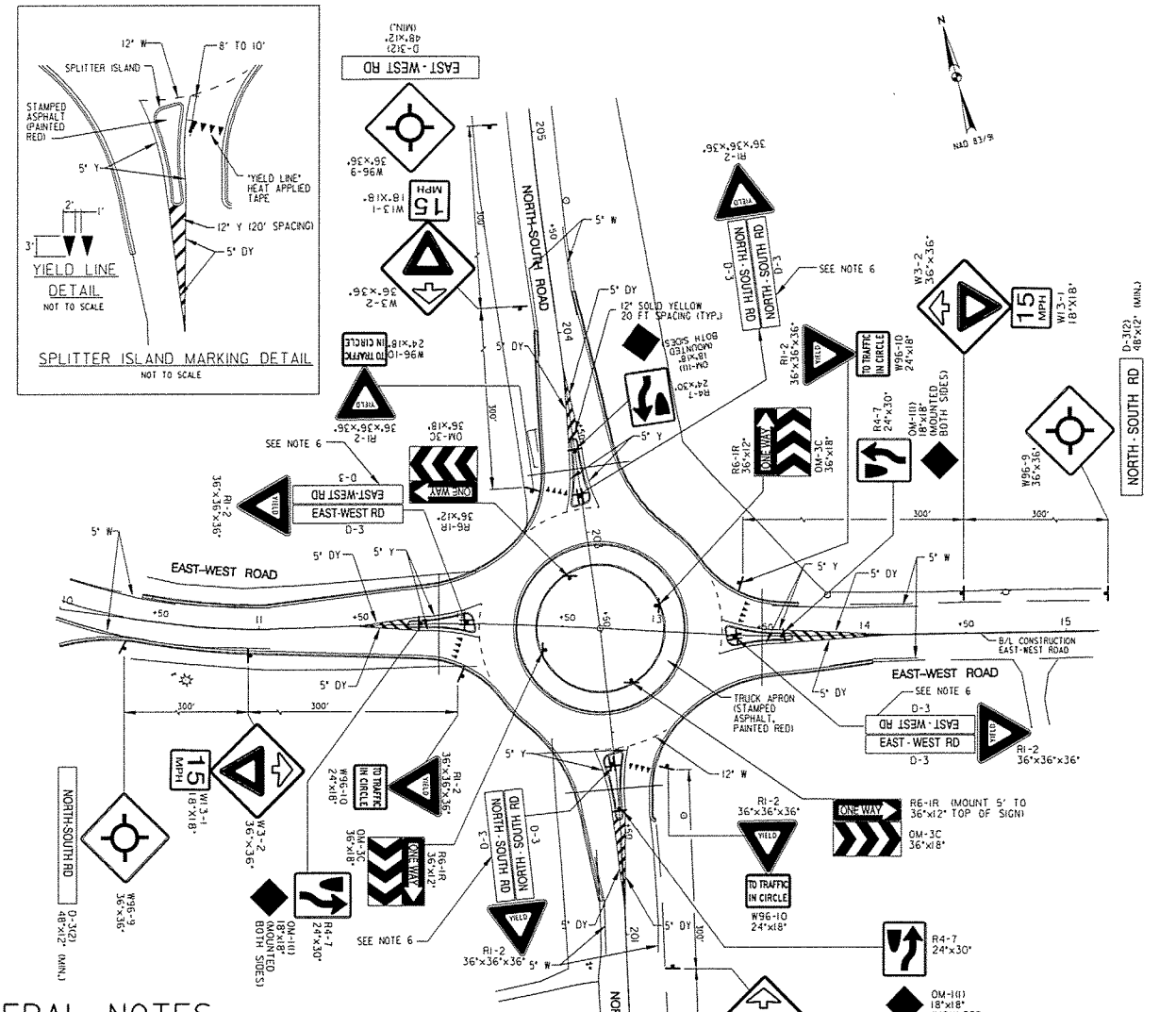
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Typical Intersection Signing And Marking Layout	Detail T-7.01



GENERAL NOTES

1. ALL SIGNS SHALL BE MOUNTED ON 2" SQUARE GALVANIZED METAL TUBE POSTS (14 GAUGE) INSERTED INTO A 2½" SQUARE GALVANIZED METAL TUBE SLEEVE, 3' LONG (12 GAUGE). A GALVANIZED POLE CAP SHALL BE MOUNTED ON TOP.
2. ALL SIGN LOCATIONS ARE APPROXIMATE. EXACT LOCATIONS WILL BE FIELD MARKED BY TRAFFIC ENGINEER.
3. ALL MARKINGS WILL BE MARKED AND APPROVED BY TRAFFIC ENGINEER, PRIOR TO INSTALLATION.
4. THE "YIELD LINE" AND 3' WHITE SKIP MARKINGS SHALL BE HEAT APPLIED TAPE.
5. SINGLE SIGN ON POST - 5' TO BOTTOM OF SIGN; TWO SIGNS/PANELS - 4' TO BOTTOM OF SIGN; HEIGHT MEASURED FROM ROAD SURFACE, EXCEPT WHERE THERE ARE SIDEWALKS.
6. THE STREET NAME (D-3) SIGNS MOUNTED AT 90 DEGREE ANGLE ABOVE THE YIELD (RI-2) SIGNS LOCATED IN THE SPLITTER ISLANDS WILL BE FABRICATED BY HOWARD COUNTY AND INSTALLED BY THE CONTRACTOR.
7. TIE EDGE LINE (5" W) MARKINGS INTO EXISTING PAVEMENT MARKINGS.
8. TRUCK APRON AND SPLITTER ISLANDS - USE STAMPED ASPHALT, PAINTED RED.
9. WHERE CROSSWALKS ARE REQUIRED - WILL PASS THROUGH CENTER OF SPLITTER ISLAND.
10. SEE DETAIL T-7.03 FOR W96-9, W96-10, AND OM-3C SIGN DETAILS.

LEGEND

	TRAFFIC SIGN
5" W	5" SOLID WHITE LINE - PAINT
5" Y	5" SOLID YELLOW LINE - PAINT
5" DY	5" DOUBLE YELLOW LINE - PAINT
12" W	12" WHITE DASHED LINE (3' SEGMENT, 3' GAP) - HEAT APPLIED TAPE
12" Y	12" YELLOW PAINT
▼▼▼▼	YIELD LINE PAVEMENT MARKING - HEAT APPLIED TAPE
——	4" PVC (MARKED AT ENDS) FOR STREET LIGHT CABLE PULLS

7/17/2015
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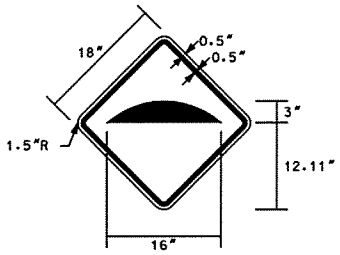
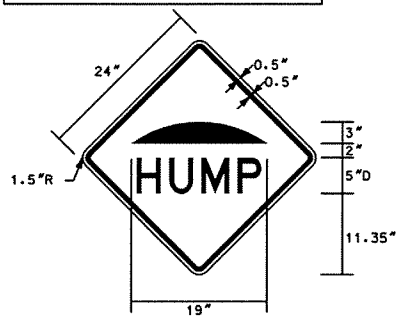
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Typical Roundabout Signing and Marking Layout

Detail
T-7.02

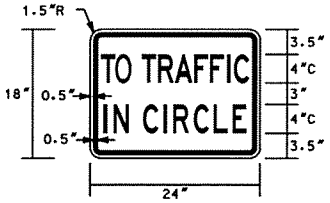
SIGN DETAILS



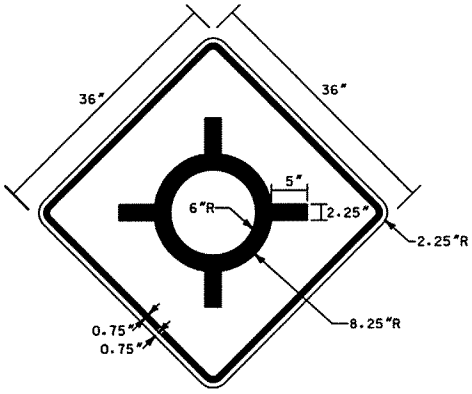
SPEED
HUMP SIGN
18"x18"



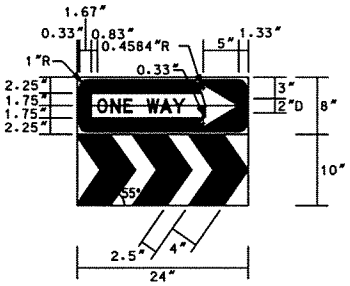
ADVANCE HUMP
WARNING SIGN
24"x24"



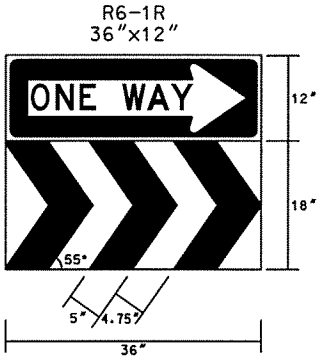
W96-10
24"x18"



W96-9
36"x36"



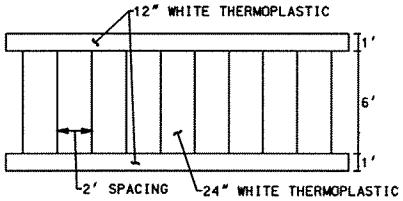
COMBINED R6-1R/OM-3C
FOR RESIDENTIAL STREETS*
24"x18"
(25 MPH)



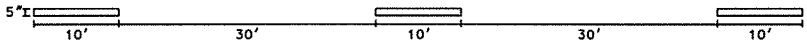
OM-3C
36"x18"
(>25 MPH)

* NOTE: MUST BE FABRICATED AS ONE SIGN (ONE PIECE OF SHEET ALUMINUM)

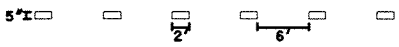
PAVEMENT MARKING DETAILS



PEDESTRIAN CROSSWALK DETAIL



BROKEN WHITE LINE (10' SEGMENT/30' GAP)



DOTTED WHITE LINE (2' SEGMENT/6' GAP)

7/17/2015
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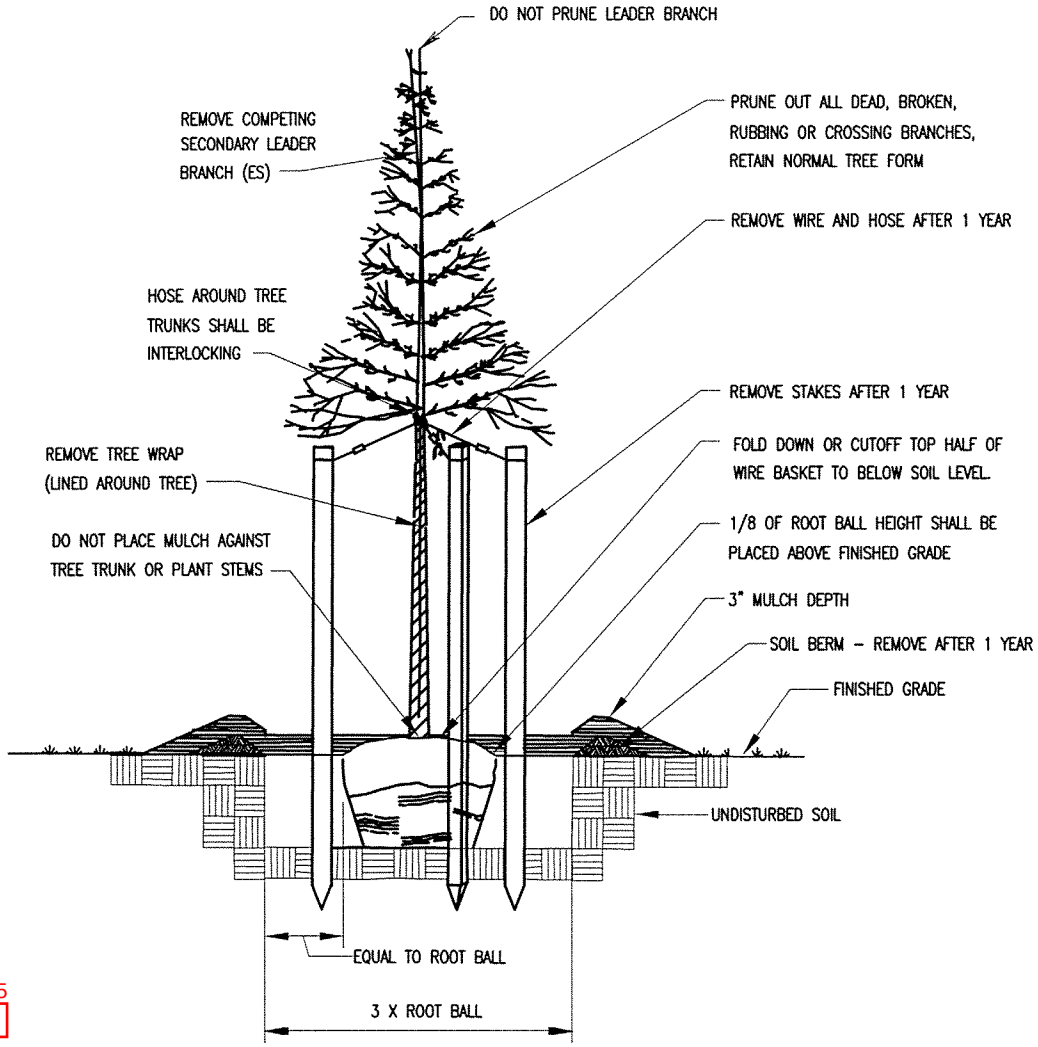
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Signing and Marking Details	Detail T-7.03

GENERAL NOTES AAPLICABLE TO ALL LANDSCAPING DETAILS;

1. HOSE FOR USE AROUND TREE TRUNKS SHALL BE INTERLOCKING.
2. TREE SUPPORTS INCLUDING WIRES, STAKES AND HOSE SHALL BE REMOVED AFTER 1 YEAR TO ALLOW TREES TO SWAY.
3. FOLD DOWN OR CUT OFF HALF OF WIRE BASKET TO BELOW SOIL LEVEL.
4. PIT DIAMETER SHALL BE THREE TIMES THE DIAMETER OF THE ROOT BALL.
5. ROOT BALLS SHALL HAVE 1/8" OF HEIGHT ABOVE GRADE.
6. SOIL BERMS SHALL BE REMOVED AFTER 1 YEAR.
7. MULCH SHALL NOT BE DIRECTLY PLACED AGAINST TREE TRUNKS OR PLANT STEMS.
8. PRUNING PATTERNS SHALL BE AS FOLLOWS:

   PRUNE TO REMOVE BROKEN, DEAD AND DAMAGED BRANCHES. ON TREES WITH DOMINANT LEADERS, REMOVE COMPETING SECONDARY LEADERS. ALL PRUNING SHALL BE AS APPROVED BY THE ENGINEER.

9. SHA ROOT COLLAR HEIGHT DETAIL FOR PLANTING IN WELL-DRAINED SOIL SHALL NOT BE USED. ONLY ROOT HEIGHT DETAILS FOR COMPACTED SOIL OR POORLY DRAINED SOIL SHALL BE USED.



7/17/2015
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Revised	Howard County, Maryland Department of Public Works	Landscaping General Notes	Detail L-1.01
Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		

1. CONTRACTOR IS RESPONSIBLE FOR ALL TRAFFIC CONTROL MEASURES AND SHALL WORK WITH THE COUNTY ON THE BEST TIME FOR WORK TO TAKE PLACE.
2. LANDSCAPE MATERIAL SHALL BE PLANTED BETWEEN APRIL AND MAY OR SEPTEMBER AND OCTOBER.
3. ALL EXISTING PLANT MATERIAL SHALL BE REMOVED FROM ISLAND.
4. THE OUTER SIX FEET OF THE ISLAND SHALL BE DUG TO THE DEPTH OF THREE INCHES BELOW CURB AND SOIL REMOVED.
5. THE DUG OUT AREA SHALL BE COMPACTED USING A SMALL VIBRATOR.
6. LANDSCAPE FABRIC SHALL COVER THE COMPACTED AREA AND GO UP THE INNER SOIL EDGE JOINTS IN FABRIC SHALL OVERLAP BY A FOOT.
7. "BARN RED STONE" (3–4 INCHES IN DIA) SHALL BE ADDED TO THE COMPACTED AREA AND BROUGHT UP TO JUST ABOVE THE TOP OF THE CURB AND INNER CIRCLE OF SOIL.
8. THE INNER CIRCLE OF SOIL SHALL BE LOOSEN TO A ONE–FOOT DEPTH.
9. 3 INCHES THICK OF LEAFGRO OVER TOTAL PLANTING AREA SHALL BE TILLED INTO TOP 6 INCHES.
10. CREATE A SLIGHT CROWN IN THE CENTER OF THE ISLAND.
11. SHREDDED HARDWOOD MULCH SHALL BE ADDED TO THE DEPTH OF 2–3 INCHES WITH IT NOT TOUCHING THE BASE OF PLANTS.
12. PLANTS SHALL MEET MARYLAND NURSERYMEN SPECIFICATIONS.
13. A CENTER TREE (6–8 FT IN HEIGHT AND 1.5 INCH CALIBER) SHALL BE SELECTED FROM THE FOLLOWING LIST:

ACER GINNALA	AMUR MAPLE
ACER BUERGERANUM	TRIDENT MAPLE
AMERLANCHIER LAEVIS 'CUMULUS'	CUMULUS SERVICEBERRY
CERCIS CANADENSIS 'OKLAHOMA'	OKLAHOMA REDBUD
CORNUS MAS	CORNELIANCHERRY DOGWOOD
HAMMELIS VIRGINIANA	WITCHHAZEL
LAGERSTROEMIA INDICA	CRAPEMYRTLE

(A CULTIVAR MATURING AT 18 FEET, MILDEW RESISTANT AND FOR THIS HARDINESS ZONE)

MALUS SPP. (ANY HIGHLY DISEASE RESISTANT CULTIVAR)	CRABAPPLE
SYRINGA RETICULATA	JAPANESE TREE LILAC
VIBURNUM LENTAGO	NANNYBERRY (TREE FORM) VIBURMUM

14. A RING OF SHORE JUNIPER (JUNIPERUS CONFERTA) SHALL BE PLANTED AT A THREE FOOT SPACING ON CENTER AND TWO–FEET FROM THE STONE RING (1 PER NINE SQ FT). PLANTS SHALL BE OF A 3 GALLON SIZE.
15. A SELECTION OF FOUR PERENNIALS FROM THE FOLLOWING LIST SHALL BE PLANTED AT 18" ON CENTER (1 PER 2.25 SQ FT) IN 4 LARGE GROUP CLUSTERS BETWEEN THE CENTER TREE AND SHORE JUNIPER. DO NOT PLANT PERENNIALS CLOSER THAN 2 FT FROM THE CENTER TREE OR SHORE JUNIPER. PLANTS SHALL BE A 1–GALLON SIZE. (N–NATIVE)

AMSONIA TABERNAEMONTANA 'BLUE ICE'	DWARF BLUESTAR	N
ASCLEPIAS TUBEROSA	BUTTERFLYWEED	N
CHRYSOPIS MARIANA	MARYLAND GOLDENASTER	N
COREOPSIS VERTICILLATA 'ZAGREB'	THREADLEAF COREOPSIS	N
ECHINACEA PUPUREA 'KIM'S KNEE HIGH'	DWARF PURPLE CONEFLOWER	

7/17/2015
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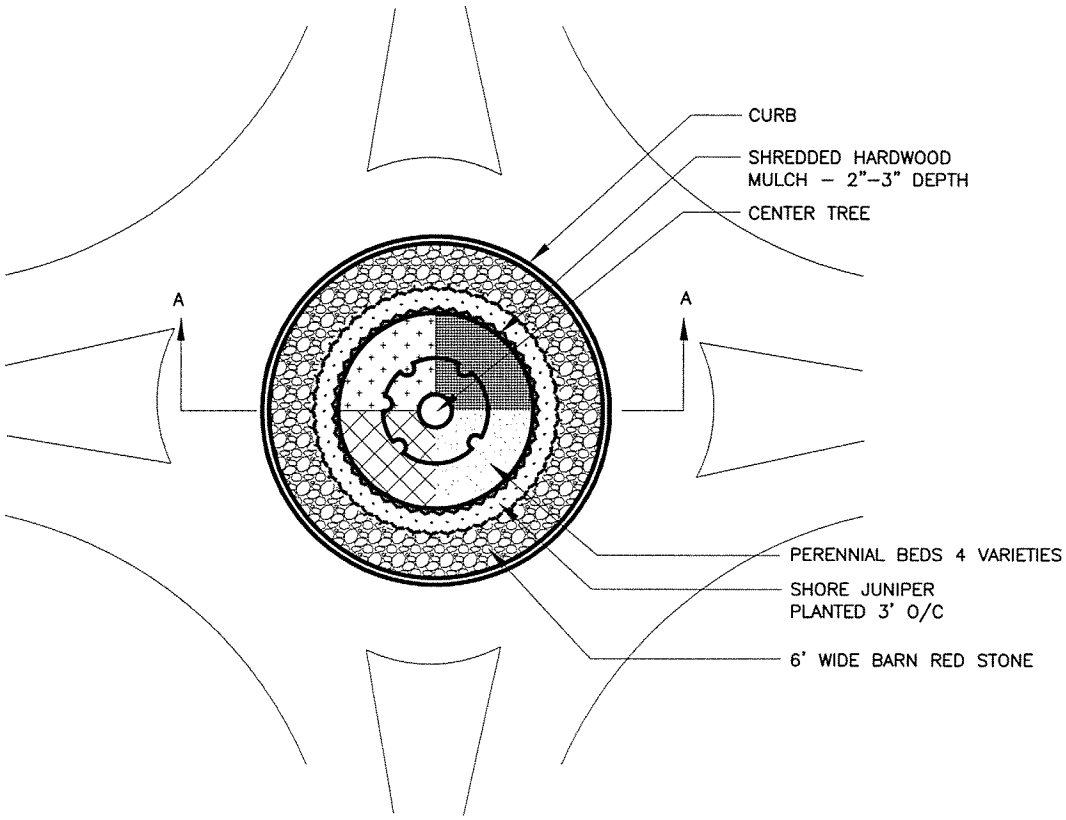
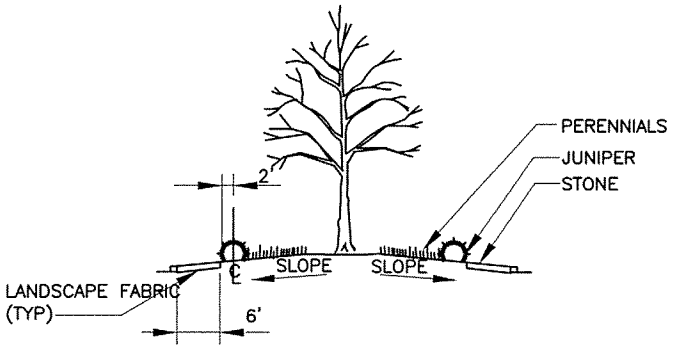
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Traffic Circle Generic Landscape Design Information	Detail L–1.02



PLAN



SECTION A–A

7/17/2015
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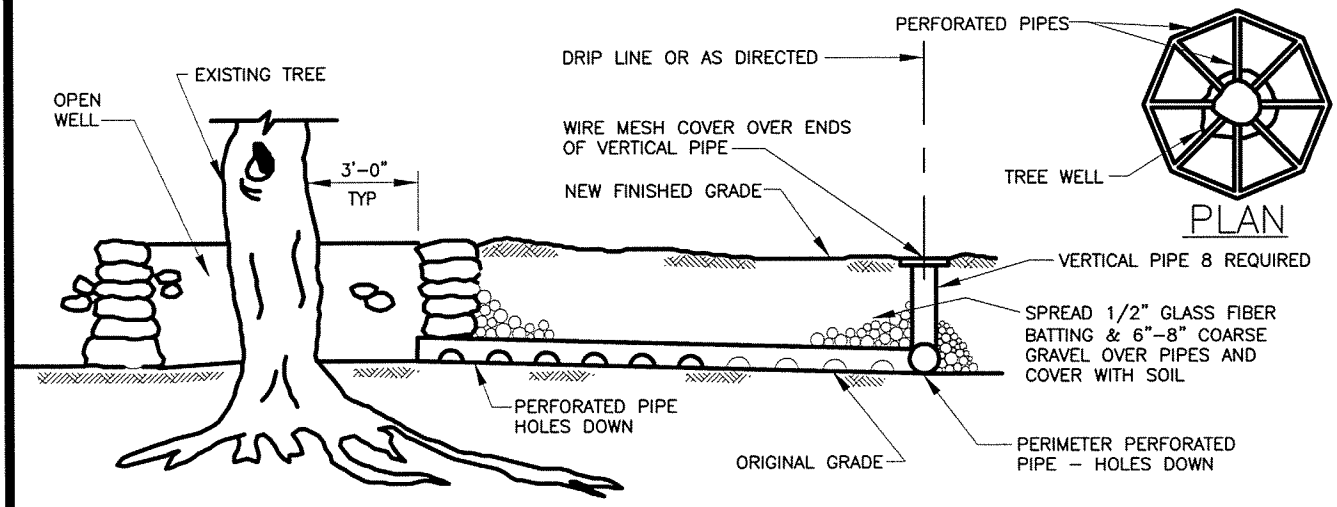
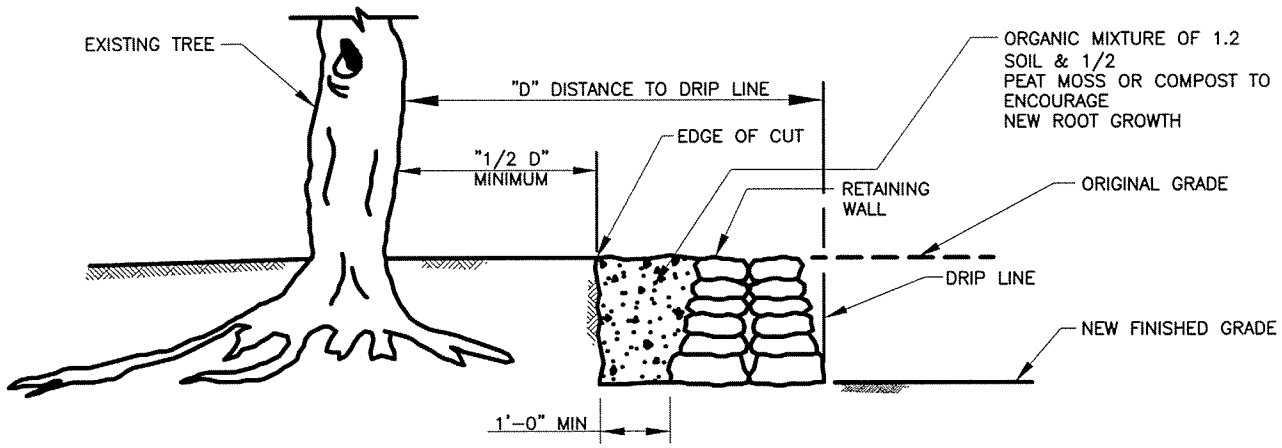
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Traffic Circle Generic Landscape Design Layout	Detail L-1.03



PERMANENT TREE PROTECTION DETAIL (TREE WELL)

(WHEN FINISHED GRADE IS 1'-0" OR MORE ABOVE EXISTING GRADE)
NOTE: WELL TO BE CONSTRUCTED OF STONE OR BRICK (ALL HEADERS). IF BRICK IS USED, VERTICAL JOINTS TO BE LEFT OPEN FOR DRAINAGE 1/2" MAXIMUM INSIDE FACE OF WALL.



PERMANENT TREE PROTECTION DETAIL (GROUND LOWERING)

(WHEN FINISHED GRADE IS GREATER THAN 6" BELOW EXISTING GRADE)
NOTE:
1. PRUNE BRANCHES OF TREE AS REQUIRED TO COMPENSATE FOR LOST ROOTS.
2. IF MORTAR USED IN WALL CONSTRUCTION PROVIDE 1" DIA WEEP HOLES 2'-0" OC BASE OF WALL

7/17/2015
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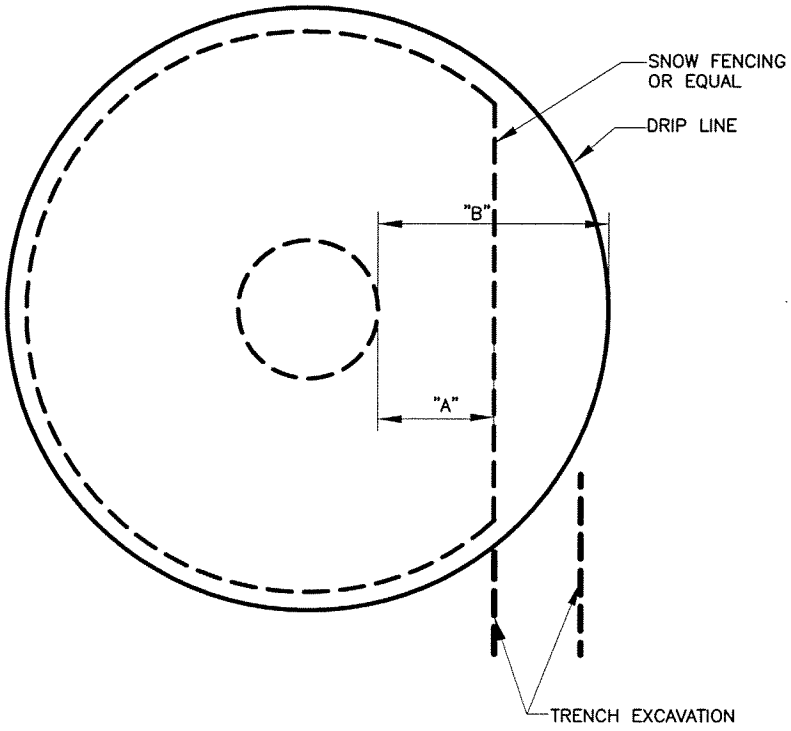
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	Tree Protection Tree Well and Ground Lowering Private	Detail L-9.01

"B" = DISTANCE OF DRIP LINE EDGE FROM TRUNK OF TREE

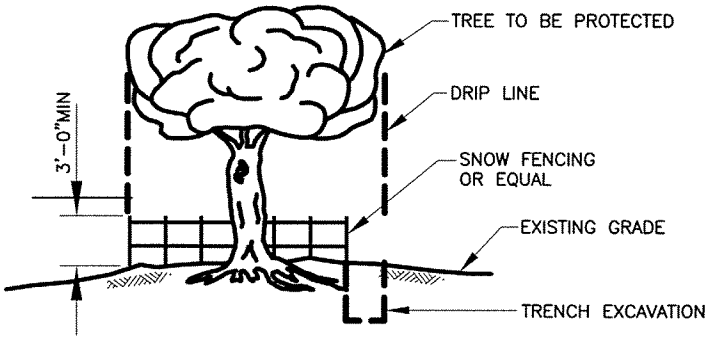
"A" = 1/2 OF "B"



TEMPORARY TREE PROTECTION(PLAN)

NOTES:

FENCING SHALL BE PLACED AT THE DRIP LINE OF TREES TO BE PROTECTED DURING CONSTRUCTION EXCEPT ON THE SIDE OF THE UTILITY TRENCHING. FENCING SHALL NOT BE PLACED CLOSER TO THE TREE THAN 1/2 THE TOTAL DISTANCE FROM THE TREE TO THE LIMITS OF THE TREE'S DRIP LINE. THIS SPACE IS TO ACCOMMODATE TRENCHING ONLY AND NOT TO ALLOW ADDITIONAL WORKING SPACE.



TEMPORARY TREE PROTECTION

NOTES:

1. GROUPS OF TREES MAY BE FENCED AS ONE.

7/17/2015
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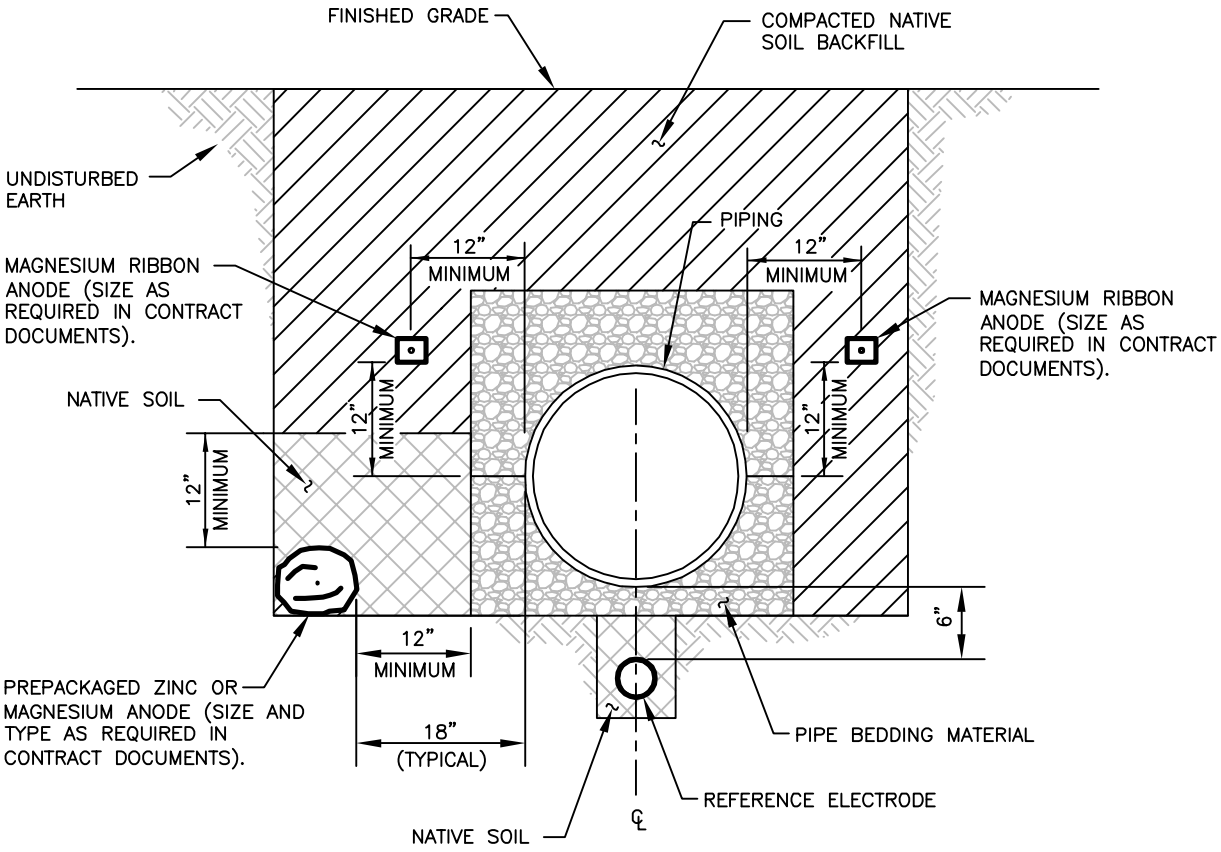
Revised Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	Temporary Tree Protection Fencing Private	Detail L-9.02



NOTES:

1. INSTALL ANODES AND REFERENCE ELECTRODE IN NATIVE SOIL. DO NOT BACKFILL PREPACKAGED OR RIBBON ANODES OR REFERENCE ELECTRODE WITH SAND OR STONE.
2. POSITION MAGNESIUM RIBBON ANODES SO THAT THEY ARE LOCATED IN NATIVE SOIL 12 INCHES ABOVE STONE BACKFILL OF PIPELINE.
3. BACKFILL PREPACKAGED MAGNESIUM ANODES WITH A MINIMUM OF 12 INCHES NATIVE SOIL ON ALL SIDES.

7/17/2015
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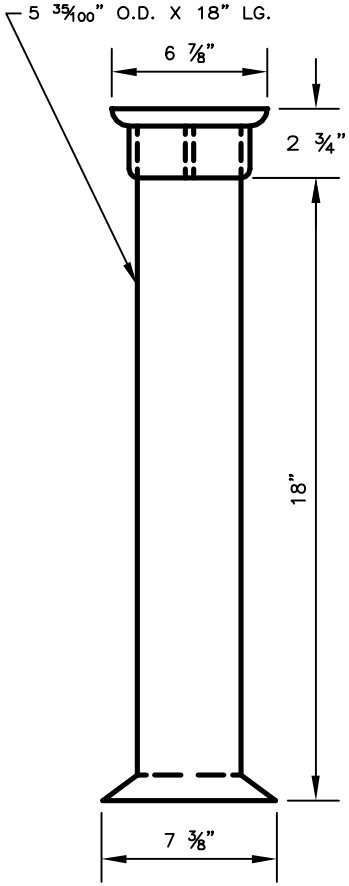
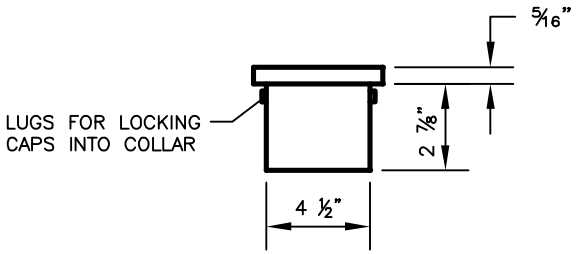
Revised	Howard County, Maryland	PIPE TRENCH	Detail
⚠ 6/30/2011 Revised	Department of Public Works	Anode and Reference Electrode Placement	C-1.01
5/7/2007 Approved	Approved: Chief, Bureau of Engineering		

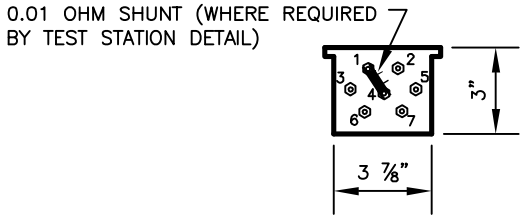


ELEVATION
TEST BOX BODY

PLAN



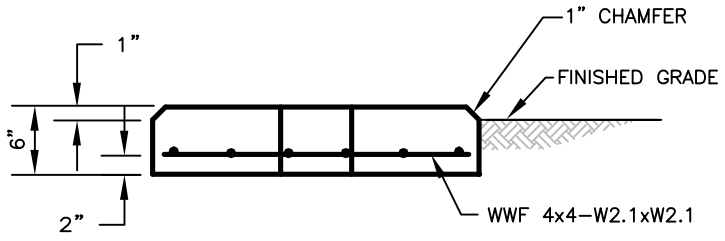
SIDE VIEW
TEST BOX LID



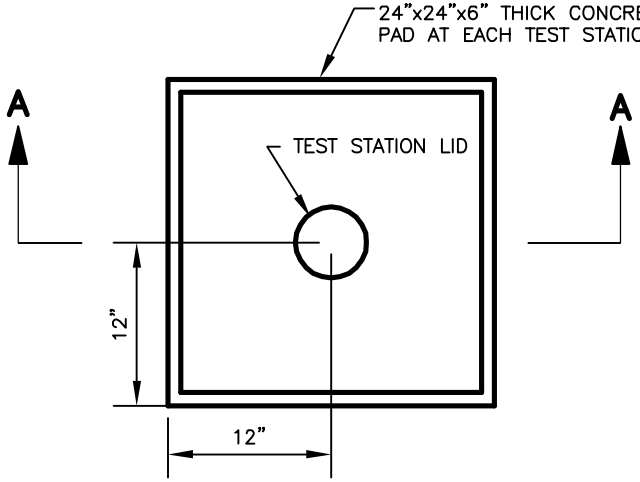
NOTES:

INSTALL COPPER SHORTING STRAP ON TERMINAL BOARD WHERE REQUIRED BY TEST STATION DETAIL.

TERMINAL BOARD



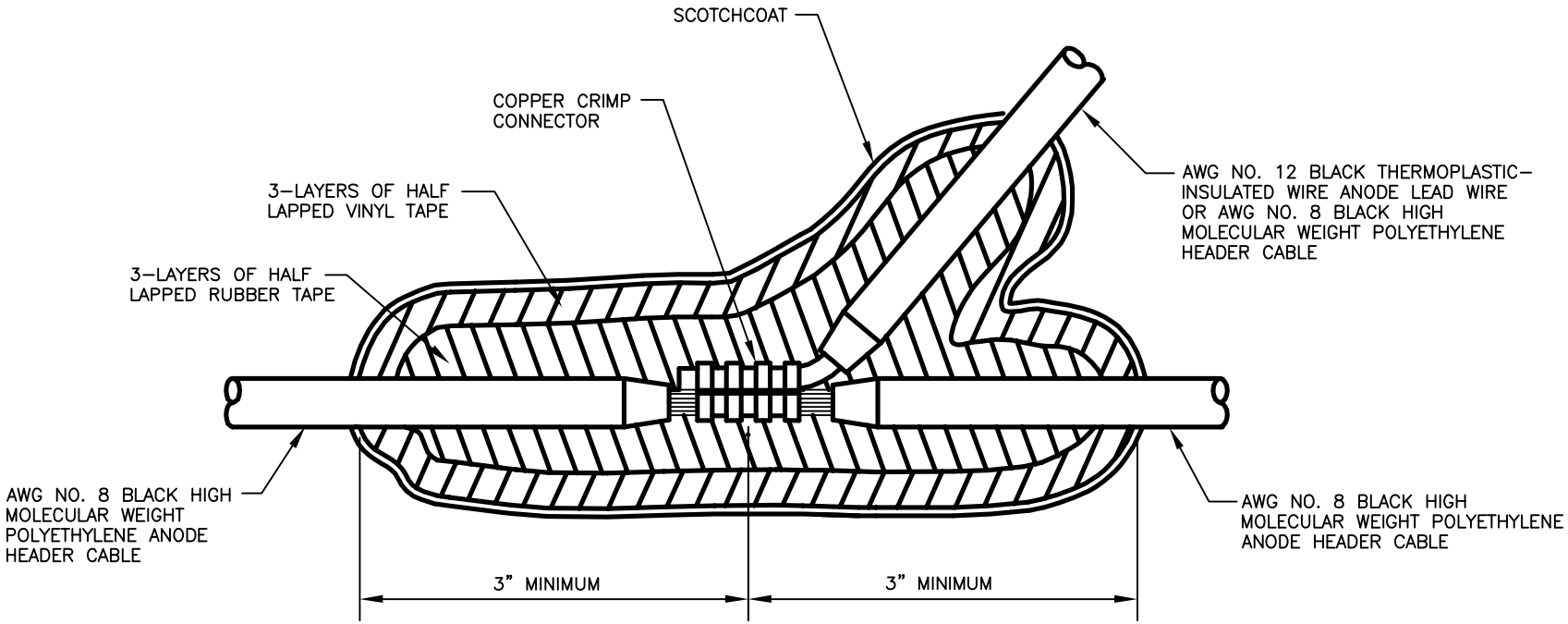
SECTION "A–A"



PLAN
TEST STATION PAD

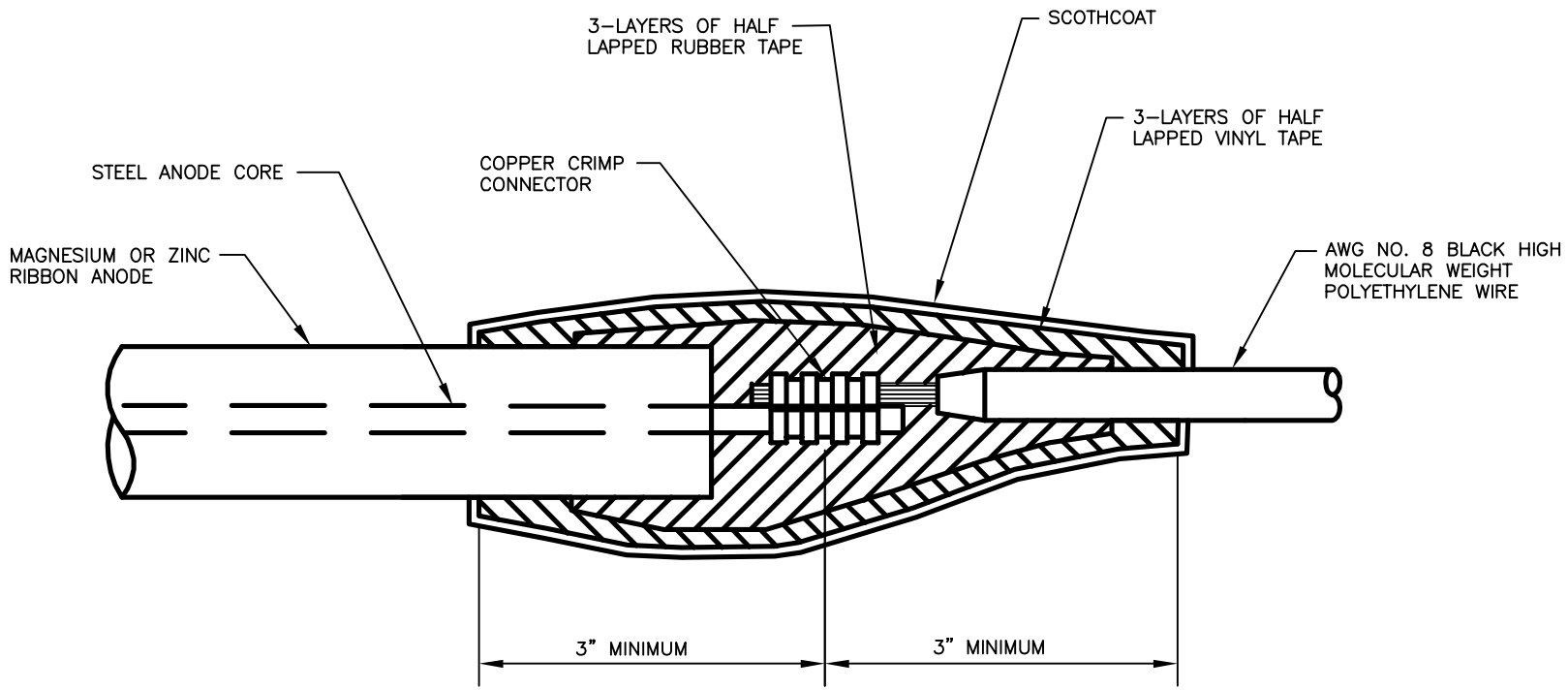
7/17/2015
DRAFT

Revised ⚠6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	TEST STATION Flush to Grade Test Box and Pad	Detail C–1.02



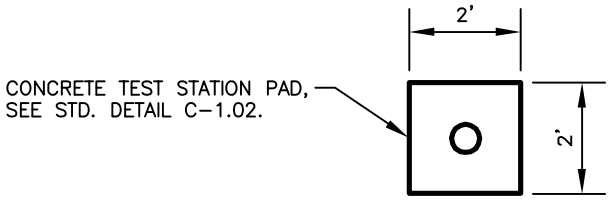
7/17/2015
DRAFT

Revised / Revised / Approved	Howard County, Maryland Department of Public Works Approved: _____ Chief, Bureau of Engineering	SPLICE Header Cable	Detail C–1.03
6/30/2011 5/7/2007			

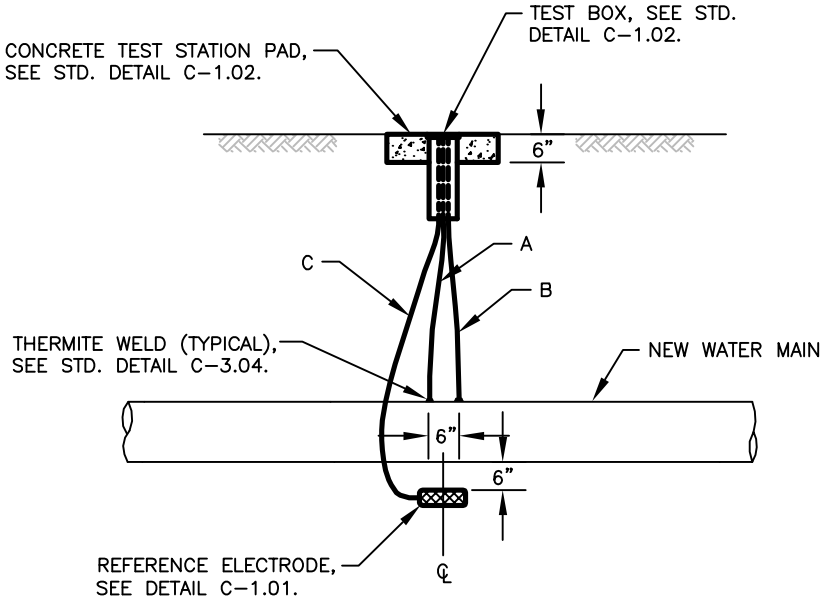


7/17/2015
DRAFT

Revised ⚠6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	SPLICE Ribbon Anode to Header Cable	Detail C–1.04



PLAN



ELEVATION

WIRING SCHEDULE

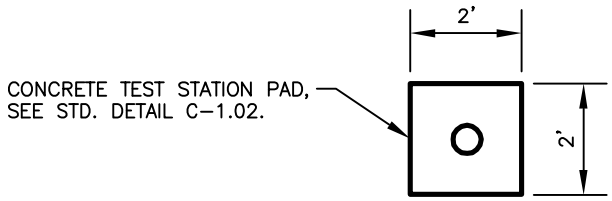
DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK

NOTES:

1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.

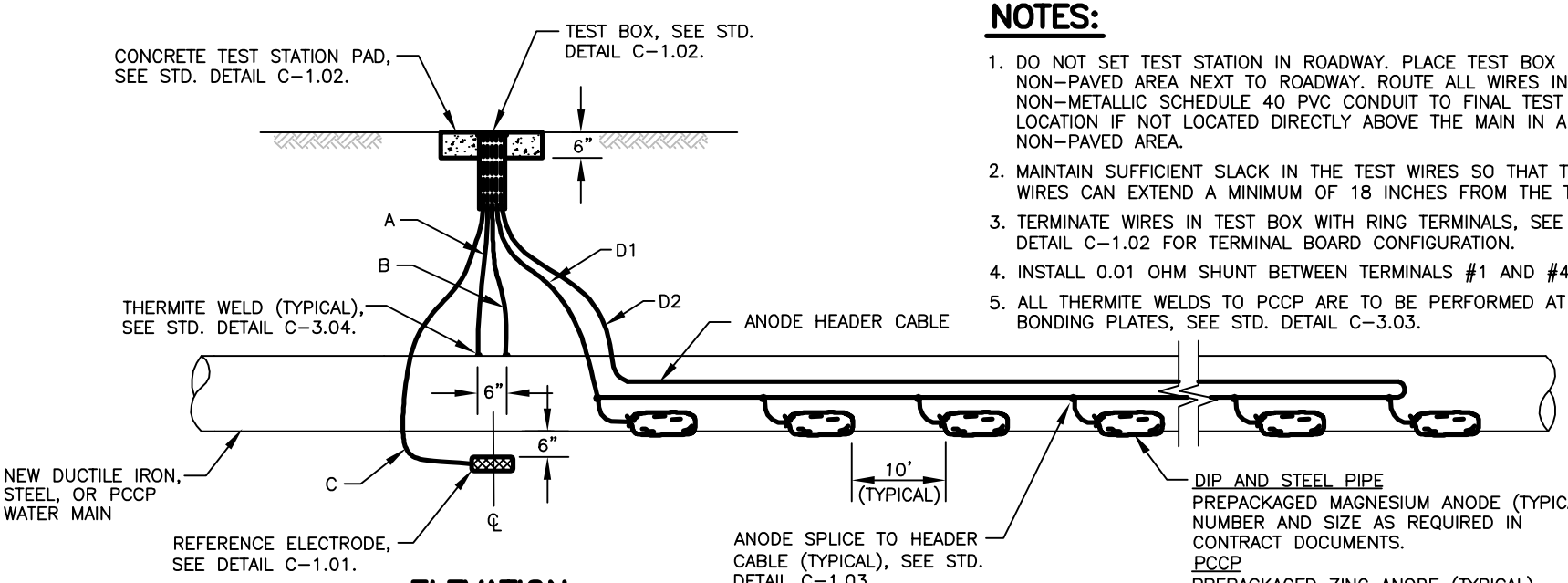
7/17/2015
DRAFT

Revised ⚠6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	TEST STATION Monitoring	Detail C-2.01



PLAN

WIRING SCHEDULE					
DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
ANODE HEADER CABLE	D1 D2	4 7	#8 #8	HMWPE HMWPE	BLACK BLACK



ELEVATION

NOTES:

1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. INSTALL 0.01 OHM SHUNT BETWEEN TERMINALS #1 AND #4.
5. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.

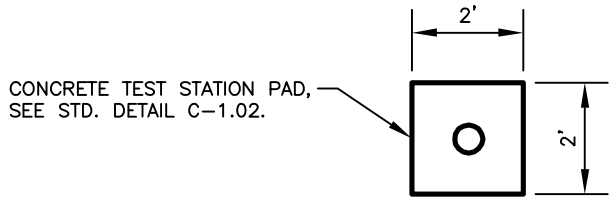
7/17/2015
DRAFT

Revised
⚠6/30/2011
Revised
5/7/2007
Approved

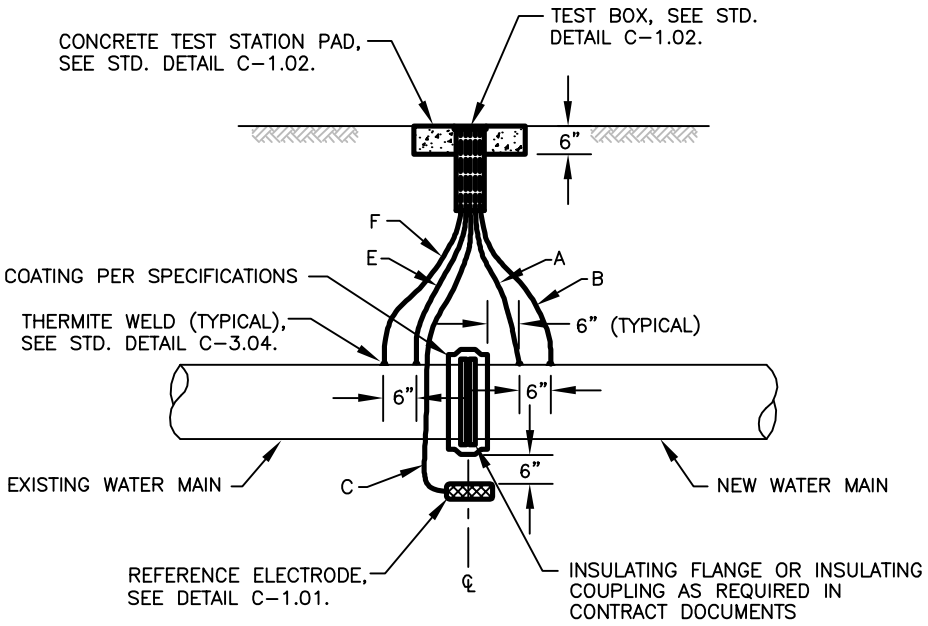
Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

TEST STATION
Prepackaged Anodes

Detail
C-2.02



PLAN



ELEVATION

WIRING SCHEDULE

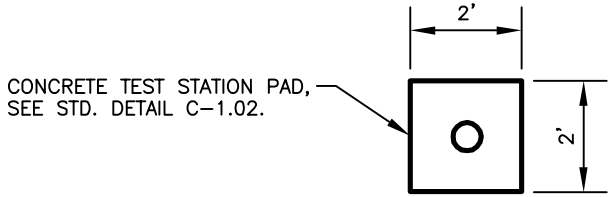
DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
EXISTING WATER MAIN	E F	2 5	#8 #10	THWN THWN	WHITE WHITE

NOTES:

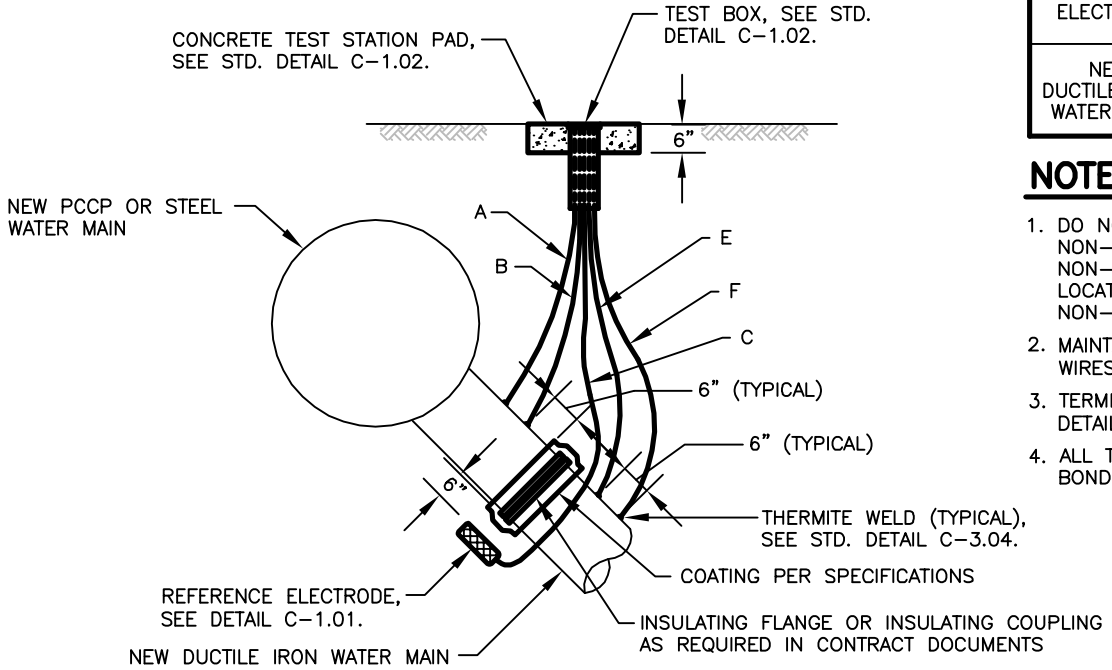
1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.

7/17/2015
DRAFT

Revised ⚠6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	TEST STATION Insulating Joint	Detail C-2.03



PLAN



ELEVATION

WIRING SCHEDULE					
DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW PCCP OR STEEL WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
NEW DUCTILE IRON WATER MAIN	E F	2 5	#8 #10	THWN THWN	WHITE WHITE

NOTES:

1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.

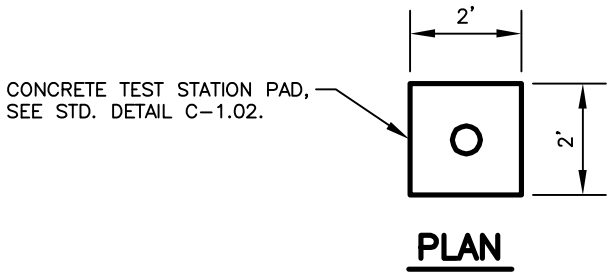
7/17/2015
DRAFT

Revised
⚠6/30/2011
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

TEST STATION
Insulating Joint
DIP Connection to Main

Detail
C-2.04



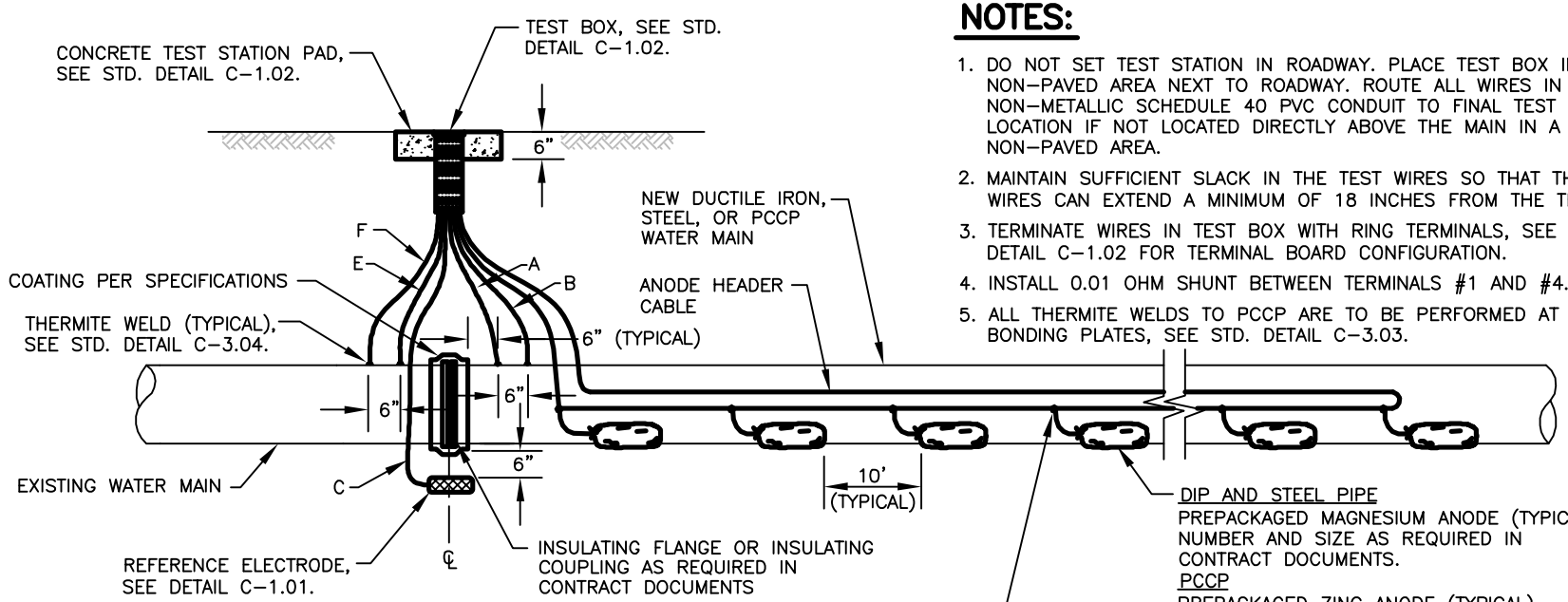
PLAN

WIRING SCHEDULE

DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
ANODE HEADER CABLE	D1 D2	4 7	#8 #8	HMWPE HMWPE	BLACK BLACK
EXISTING WATER MAIN	E F	2 5	#8 #10	THWN THWN	WHITE WHITE

NOTES:

1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. INSTALL 0.01 OHM SHUNT BETWEEN TERMINALS #1 AND #4.
5. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.



ELEVATION

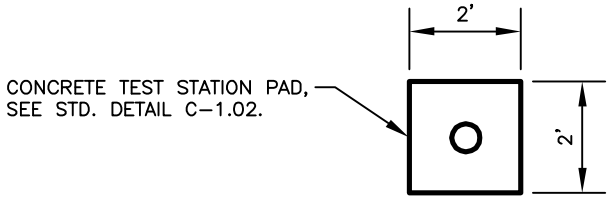
7/17/2015
DRAFT

Revised
⚠6/30/2011
Revised
5/7/2007
Approved

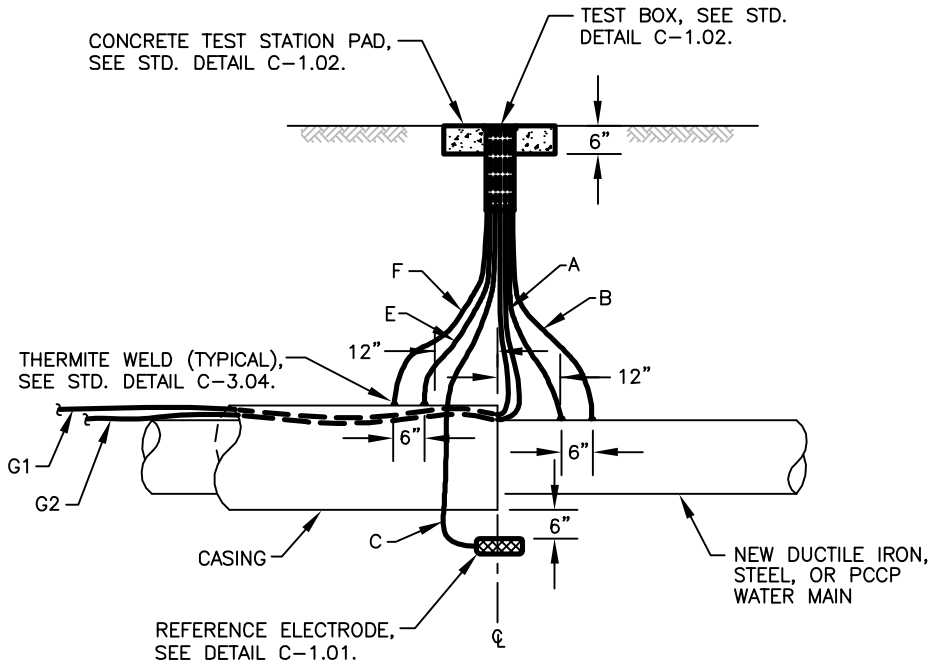
Howard County, Maryland
Department of Public Works
Approved: _____
Chief, Bureau of Engineering

TEST STATION
Insulating Joint and Anodes

Detail
C-2.05



PLAN



ELEVATION

WIRING SCHEDULE					
DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
CASING	E F	2 5	#8 #10	THWN THWN	WHITE WHITE
CASING TEST WIRES	G1 G2	4 4	#8 #10	THWN THWN	RED RED

NOTES:

1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. INSTALL 0.01 OHM SHUNT BETWEEN TERMINALS #1 AND #4.
5. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.

7/17/2015
DRAFT

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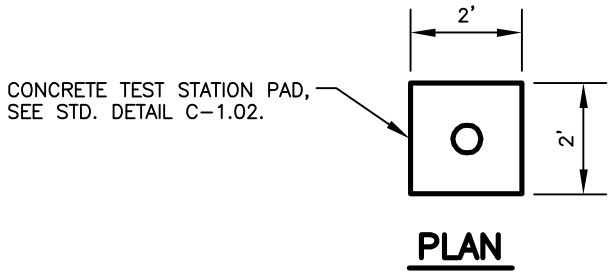
⚠6/30/2011
Revised
5/7/2007
Approved

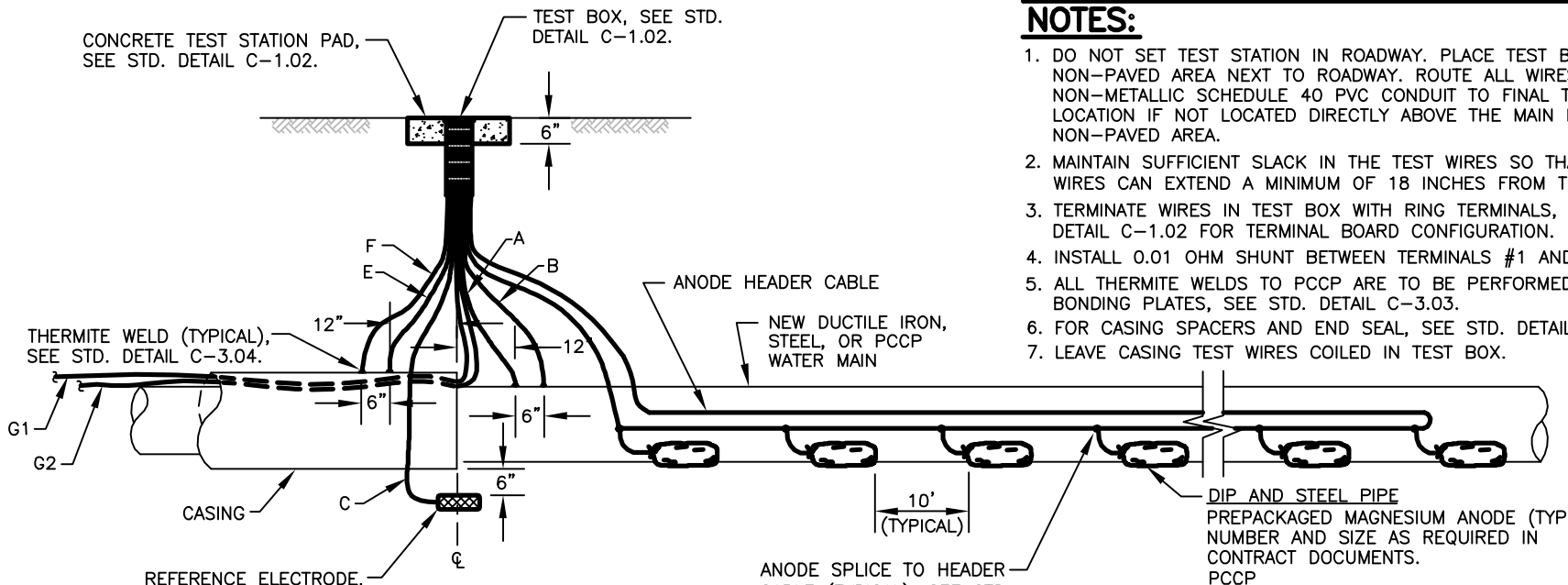
Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

TEST STATION
Casing

Detail
C-2.06



PLAN



ELEVATION

WIRING SCHEDULE

DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
ANODE HEADER CABLE	D1 D2	4 7	#8 #8	HMWPE HMWPE	BLACK BLACK
CASING	E F	2 5	#8 #10	THWN THWN	WHITE WHITE
CASING TEST WIRES	G1 G2	– –	#8 #10	THWN THWN	RED RED

NOTES:

1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. INSTALL 0.01 OHM SHUNT BETWEEN TERMINALS #1 AND #4.
5. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.
6. FOR CASING SPACERS AND END SEAL, SEE STD. DETAIL C-4.07.
7. LEAVE CASING TEST WIRES COILED IN TEST BOX.

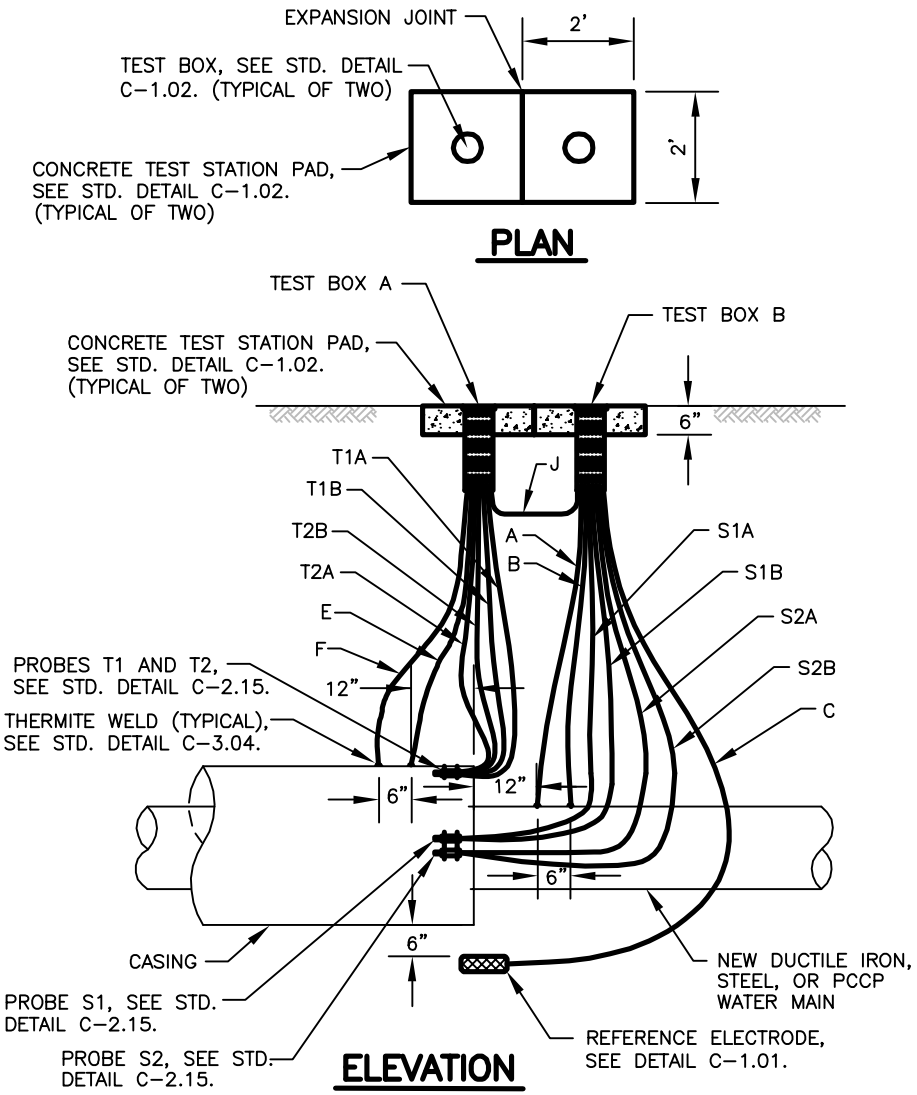
7/17/2015
DRAFT

Revised
6/30/2011
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

TEST STATION
Casing and Anodes

Detail
C-2.07



7/17/2015
DRAFT

WIRING SCHEDULE – TEST BOX A

DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
PROBE T1	T1A T1B	4 4	#14 #14	THWN THWN	BLACK BLACK
PROBE T2	T2A T2B	7 7	#14 #14	THWN THWN	BLACK BLACK
CASING	E F	2 5	#8 #10	THWN THWN	WHITE WHITE
JUMPER	J	1	#8	HMWPE	BLACK

WIRING SCHEDULE – TEST BOX B

DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLACK BLACK
PROBE S1	S1A S1B	4 4	#14 #14	THWN THWN	BLACK BLACK
PROBE S2	S2A S2B	7 7	#14 #14	THWN THWN	BLACK BLACK
REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
JUMPER	J	2	#8	HMWPE	BLACK

NOTES:

SEE NOTES ON STD. DETAIL C-2.07.

Revised
⚠6/30/2011
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

TEST STATION
Casing with Corrosion Rate Probes

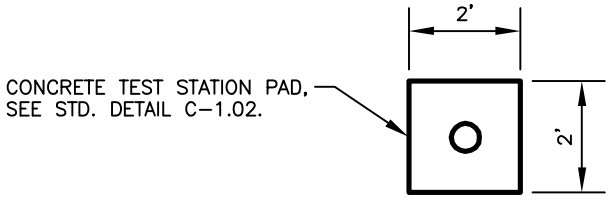
Detail
C-2.08

WIRING SCHEDULE

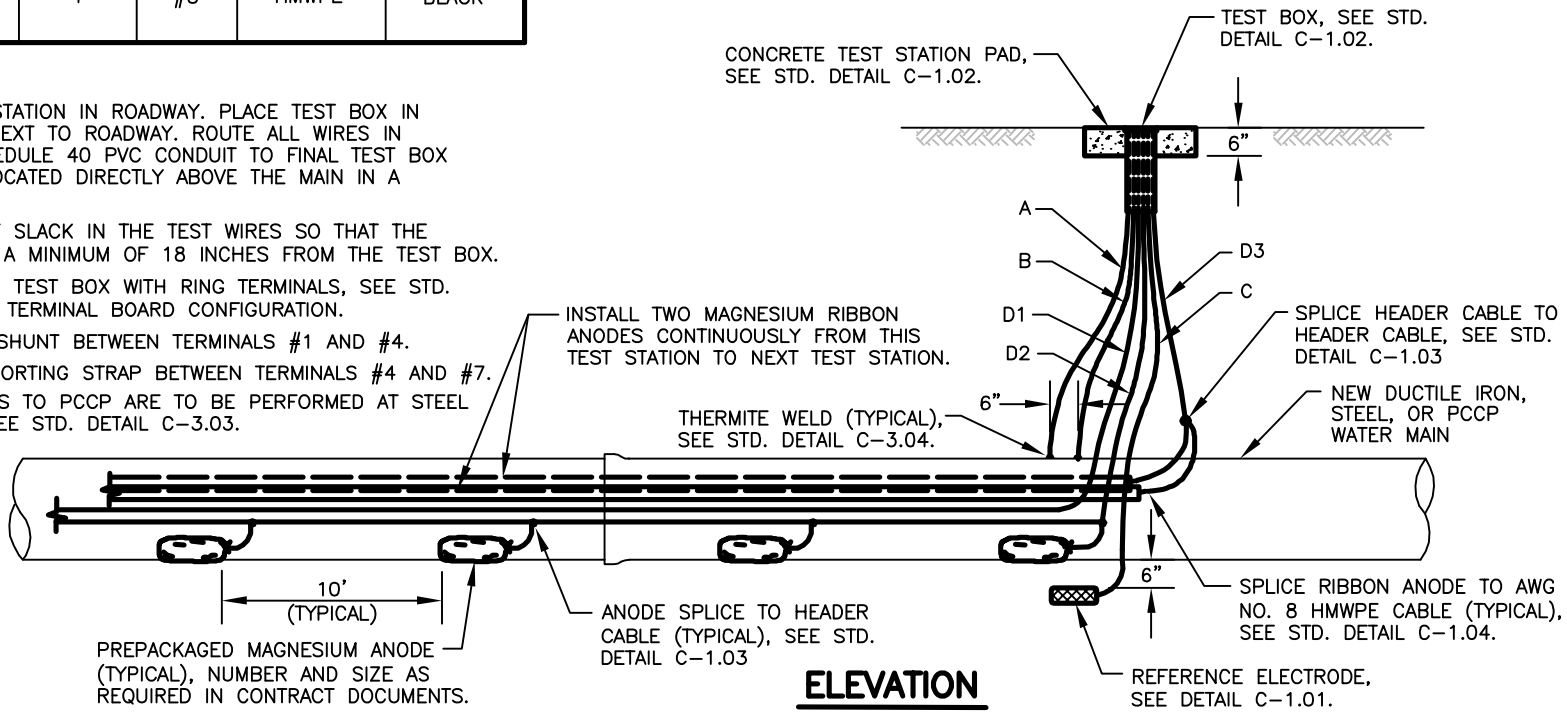
DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
PREPACKAGED MAGNESIUM ANODE HEADER CABLE	D1 D2	5 7	#8 #8	HMWPE HMWPE	BLACK BLACK
MAGNESIUM RIBBON ANODE HEADER CABLE	D3	4	#8	HMWPE	BLACK

NOTES:

1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. INSTALL 0.01 OHM SHUNT BETWEEN TERMINALS #1 AND #4.
5. INSTALL COPPER SHORTING STRAP BETWEEN TERMINALS #4 AND #7.
6. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.



PLAN



ELEVATION

7/17/2015
DRAFT

Revised
6/30/2011
Revised
5/7/2007
Approved

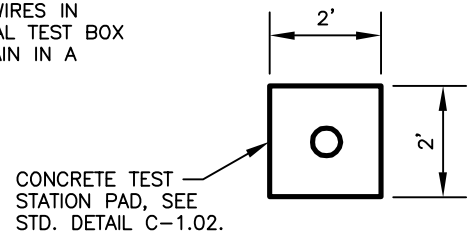
Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

TEST STATION
Type-A Anode (Both Ends of Each Section of Anode Ribbon)

Detail
C-2.09

NOTES:

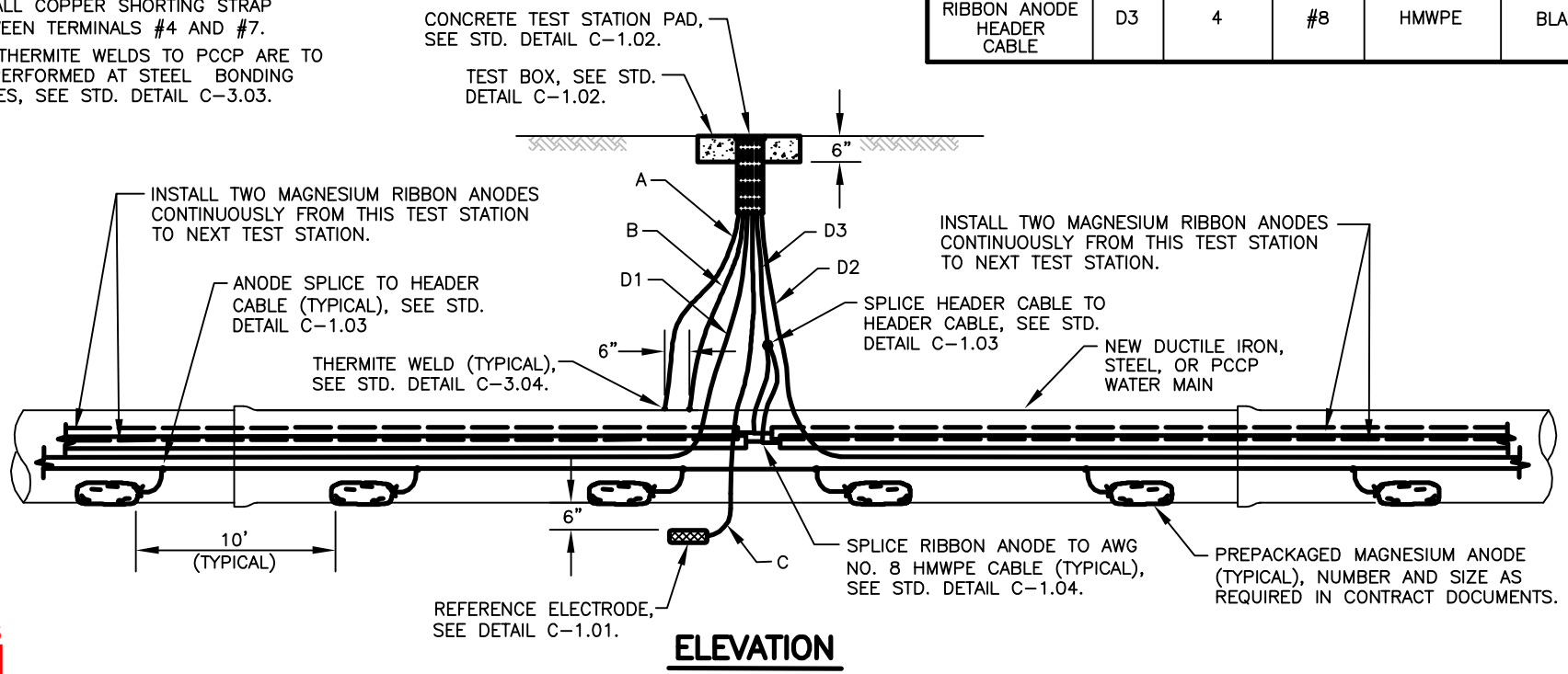
1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. INSTALL 0.01 OHM SHUNT BETWEEN TERMINALS #1 AND #4.
5. INSTALL COPPER SHORTING STRAP BETWEEN TERMINALS #4 AND #7.
6. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.



PLAN

WIRING SCHEDULE

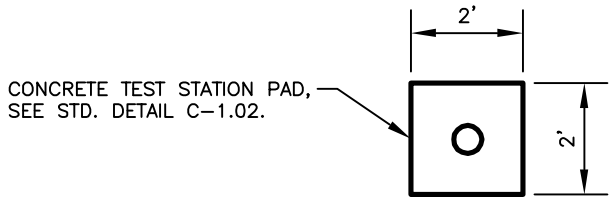
DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
PREPACKAGED MAGNESIUM ANODE HEADER CABLE	D1 D2	5 7	#8 #8	HMWPE HMWPE	BLACK BLACK
MAGNESIUM RIBBON ANODE HEADER CABLE	D3	4	#8	HMWPE	BLACK



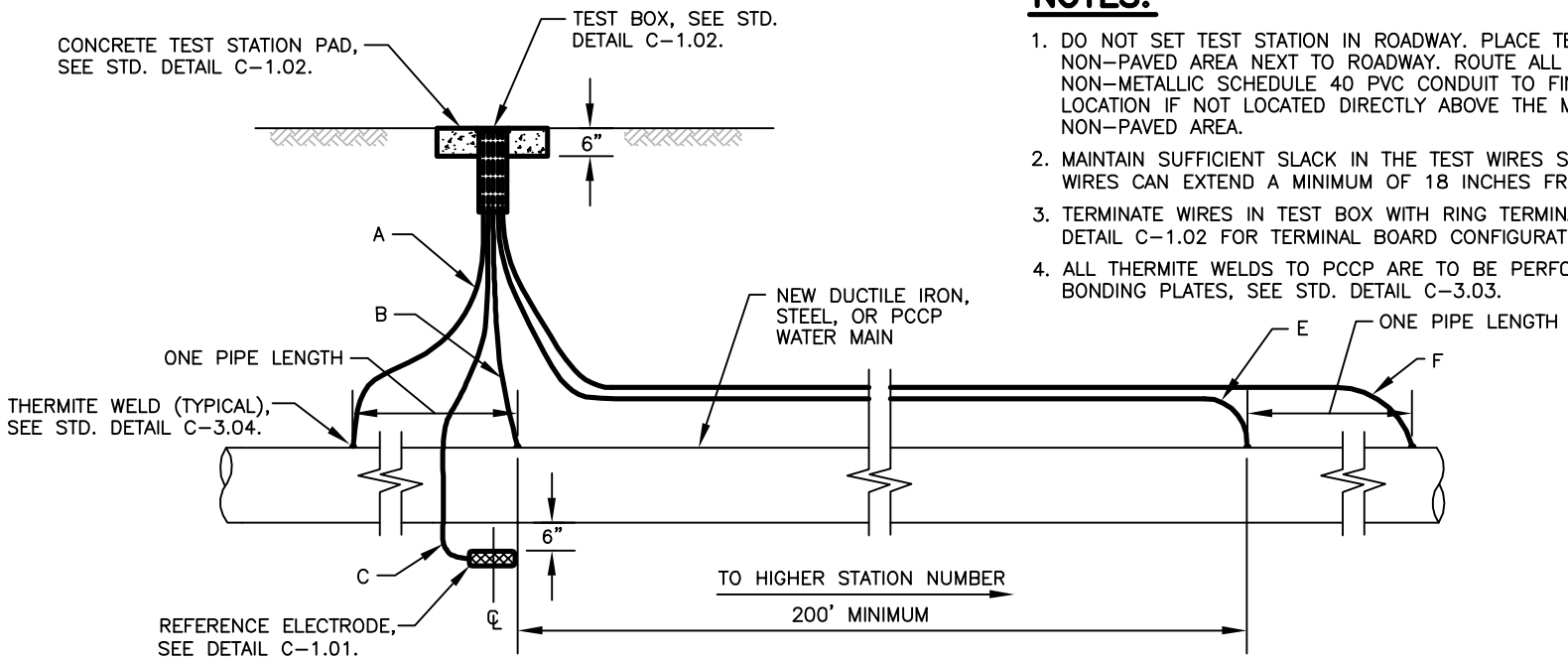
ELEVATION

7/17/2015
DRAFT

Revised	Howard County, Maryland Department of Public Works	TEST STATION Type-B Anode (Intermediate Anode Ribbon)	Detail C-2.10
⚠6/30/2011 Revised 5/7/2007 Approved	Approved: _____ Chief, Bureau of Engineering		



PLAN



ELEVATION

WIRING SCHEDULE

DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW PIPE AT TEST STATION	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
NEW PIPE AT HIGHER STATION NO.	E F	2 5	#10 #8	THWN THWN	GREEN GREEN

NOTES:

1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.

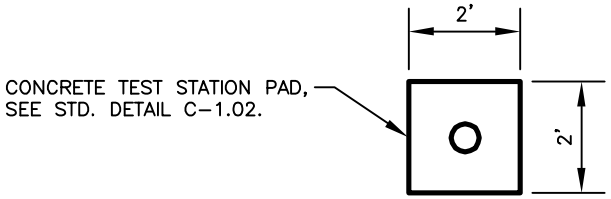
7/17/2015
DRAFT

Revised
⚠6/30/2011
Revised
5/7/2007
Approved

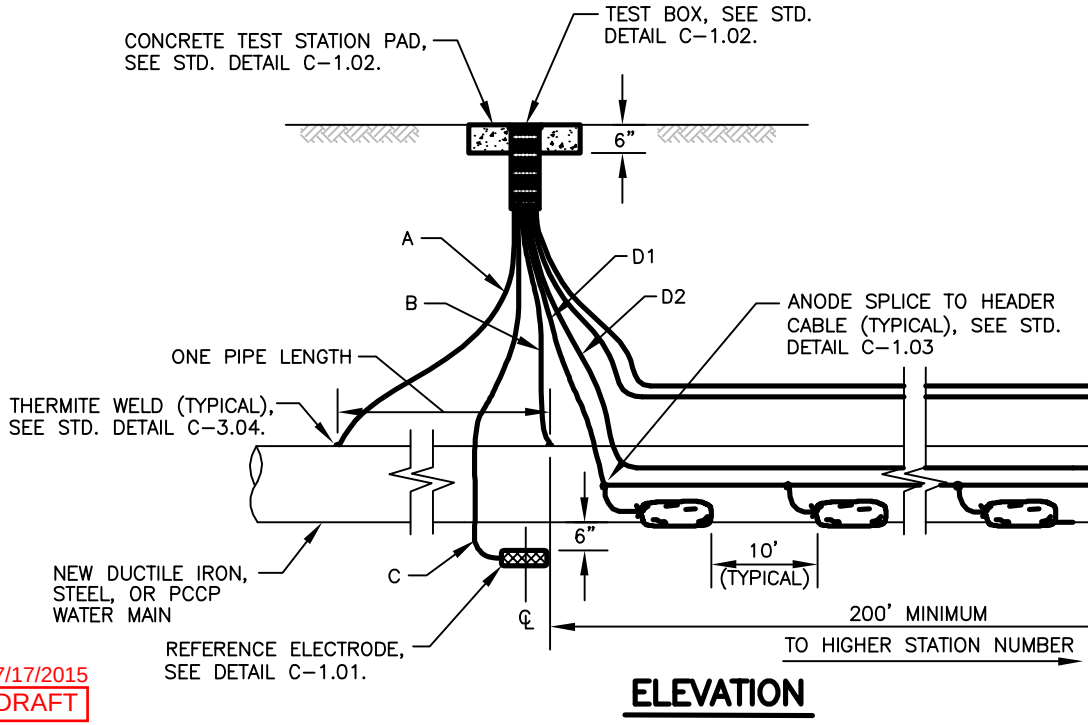
Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

TEST STATION
IR Drop

Detail
C-2.11



PLAN



ELEVATION

WIRING SCHEDULE

DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW PIPE AT TEST STATION	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
PERMANENT REFERENCE ELECTRODE	C	6	#14	HMWPE	BLACK
ANODE HEADER CABLE	D1 D2	4 7	#8 #8	HMWPE HMWPE	BLACK BLACK
NEW PIPE AT HIGHER STATION NO.	E F	2 5	#10 #8	THWN THWN	GREEN GREEN

NOTES:

1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. INSTALL 0.01 OHM SHUNT BETWEEN TERMINALS #1 AND #4.
5. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.

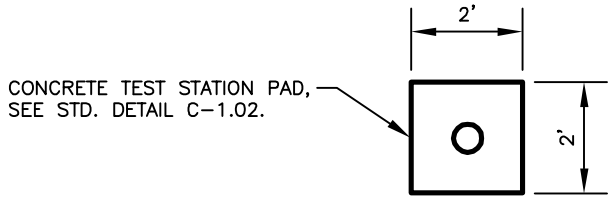
7/17/2015
DRAFT

Revised
⚠6/30/2011
Revised
5/7/2007
Approved

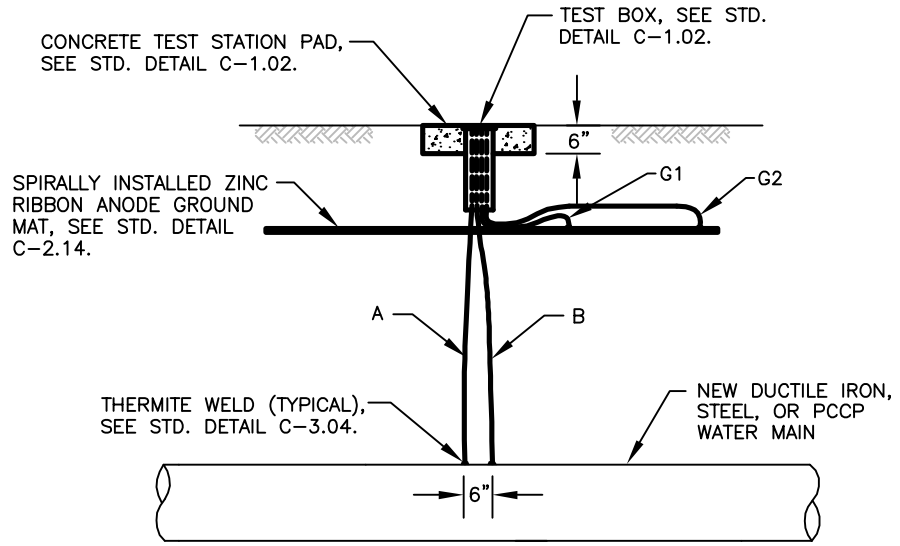
Howard County, Maryland
Department of Public Works
Approved: _____
Chief, Bureau of Engineering

TEST STATION
IR Drop and Anodes

Detail
C-2.12



PLAN



ELEVATION

WIRING SCHEDULE

DESCRIPTION	WIRE	TEST STATION TERMINAL	AWG WIRE SIZE	TYPE OF INSULATION	COLOR OF INSULATION
NEW WATER MAIN	A B	1 3	#8 #10	THWN THWN	BLUE BLUE
HEADER CABLE FOR ZINC RIBBON ANODE	G1 G2	4 4	#8 #8	HMWPE HMWPE	BLACK BLACK

NOTES:

1. DO NOT SET TEST STATION IN ROADWAY. PLACE TEST BOX IN NON-PAVED AREA NEXT TO ROADWAY. ROUTE ALL WIRES IN NON-METALLIC SCHEDULE 40 PVC CONDUIT TO FINAL TEST BOX LOCATION IF NOT LOCATED DIRECTLY ABOVE THE MAIN IN A NON-PAVED AREA.
2. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
3. TERMINATE WIRES IN TEST BOX WITH RING TERMINALS, SEE STD. DETAIL C-1.02 FOR TERMINAL BOARD CONFIGURATION.
4. INSTALL 0.01 OHM SHUNT BETWEEN TERMINALS #1 AND #4.
5. ALL THERMITE WELDS TO PCCP ARE TO BE PERFORMED AT STEEL BONDING PLATES, SEE STD. DETAIL C-3.03.
6. FOR AC GROUND MAT INSTALLATION, SEE STD. DETAIL C-2.14.

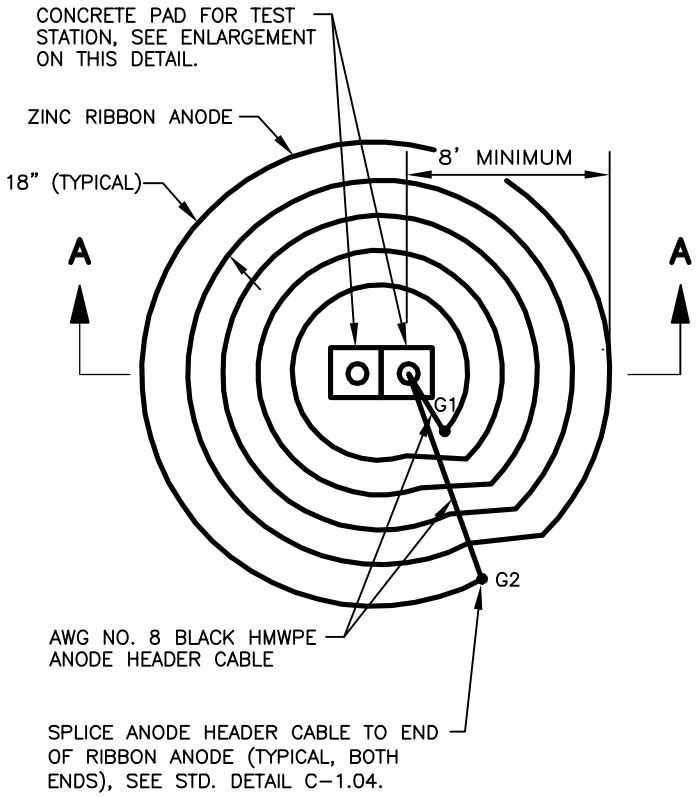
7/17/2015
DRAFT

Revised
⚠6/30/2011
Revised
5/7/2007
Approved

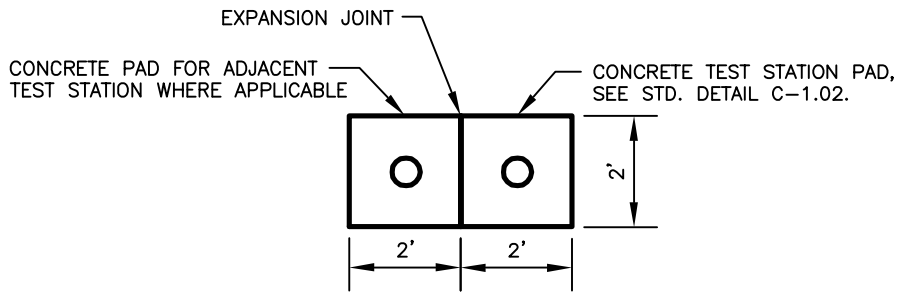
Howard County, Maryland
Department of Public Works
Approved:
Chief, Bureau of Engineering

TEST STATION
AC Ground Mat

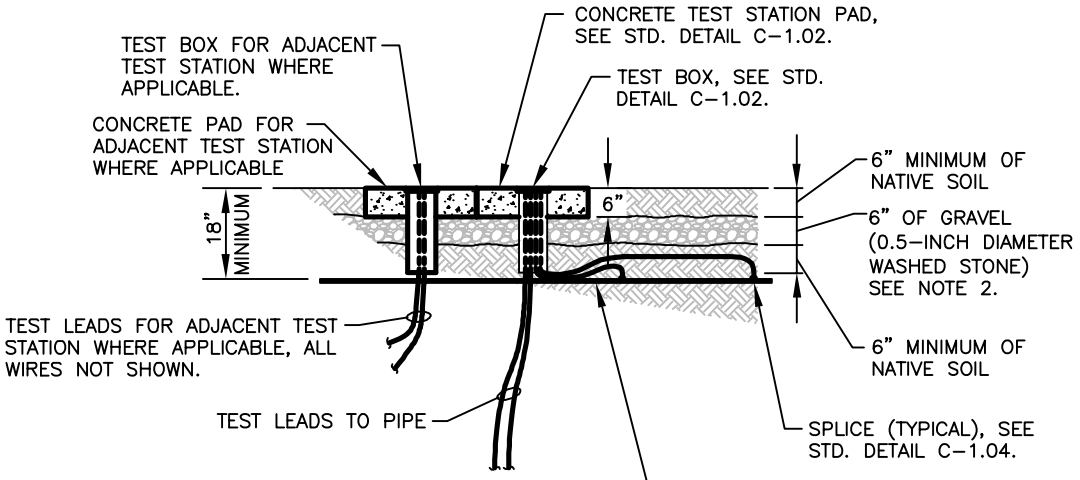
Detail
C-2.13



PLAN



ENLARGEMENT



SECTION "A-A"

NOTES:

1. FOR AC GROUND MAT TEST STATION INSTALLATION, SEE SD. DETAIL C-2.13.
2. WASHED STONE TO BE PLACED ABOVE ENTIRE AREA OF ZINC RIBBON ANODE.

7/17/2015
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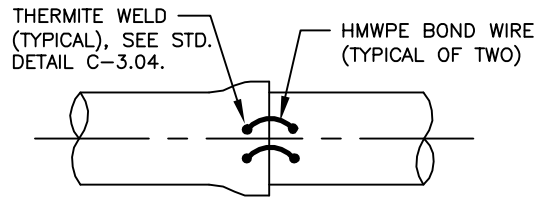
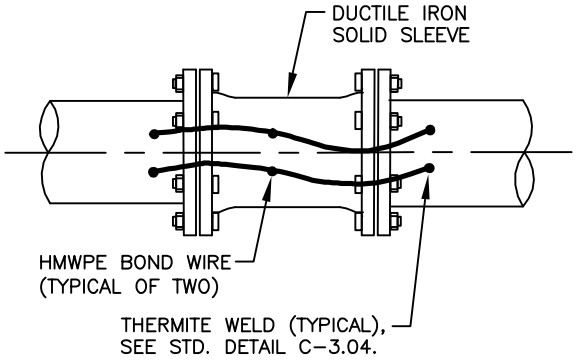
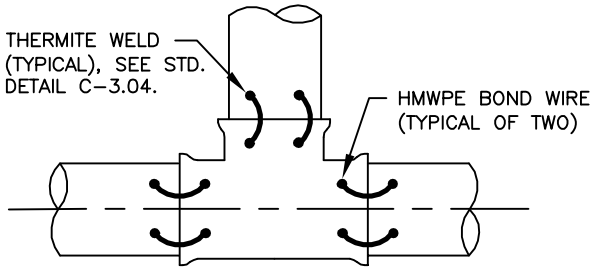
Revised ⚠6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	TEST STATION AC Ground Mat Installation	Detail C-2.14



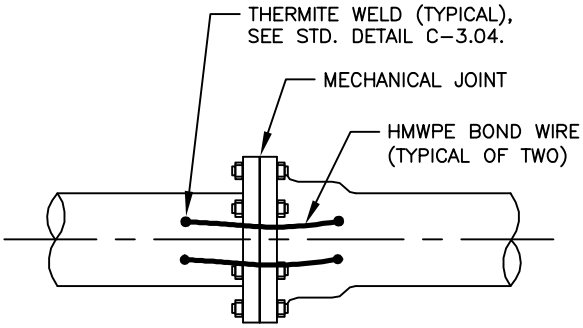
TYPICAL PIPE JOINT BOND



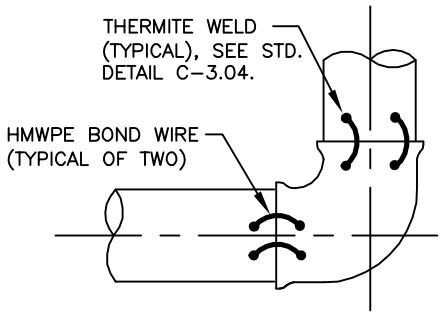
TYPICAL BONDING OF SOLID SLEEVE



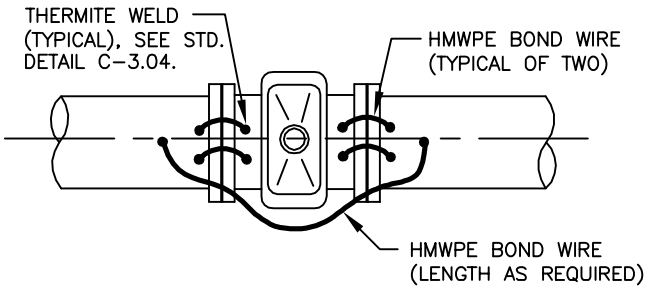
TYPICAL BONDING OF TEE



TYPICAL MECHANICAL JOINT BOND



TYPICAL BONDING OF BEND, REDUCER OR SOLID SLEEVE



TYPICAL BONDING OF VALVE

NOTES:

1. BOND ALL JOINTS ON UNDERGROUND DUCTILE IRON PIPING ASSOCIATED WITH THE WATER MAIN.
2. THERMITE WELD BONDING WIRES TO TOP OF PIPE OR FITTINGS, SEE STD. DETAIL C-3.04.
3. WIRE SIZE FOR BONDING JOINTS SHALL BE AS FOLLOWS:

PIPE SIZE	WIRE SIZE
LARGER THAN 36"	AWG NO. 2 HMWPE
16" TO 36"	AWG NO. 4 HMWPE
12" AND SMALLER	AWG NO. 6 HMWPE

4. DO NOT THERMITE WELD TO PVC PIPE.
5. EACH BOND WIRE SHALL BE A MAXIMUM OF 18" IN LENGTH.

7/17/2015
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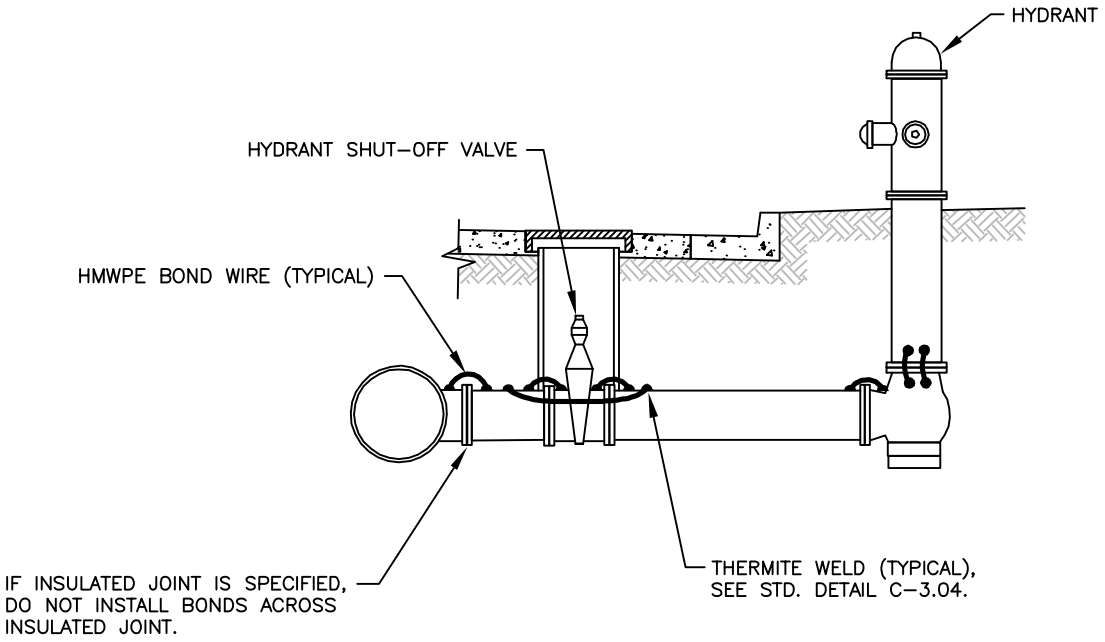
Revised	Howard County, Maryland	BONDING	Detail
⚠ 6/30/2011 Revised	Department of Public Works	Joints	C-3.01
5/7/2007 Approved	Approved: Chief, Bureau of Engineering		

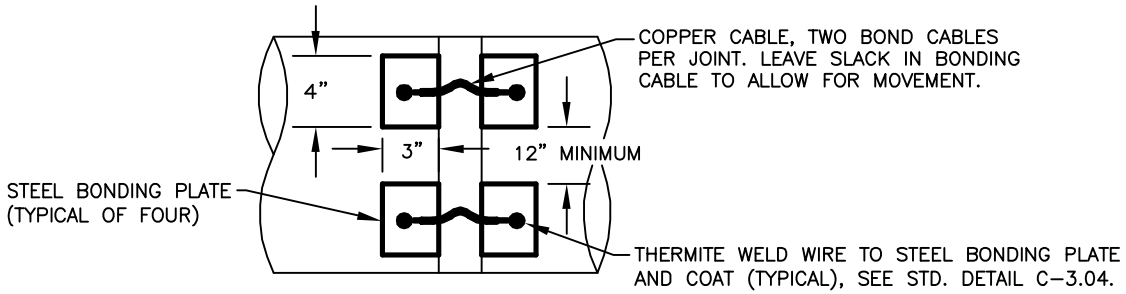


NOTES:

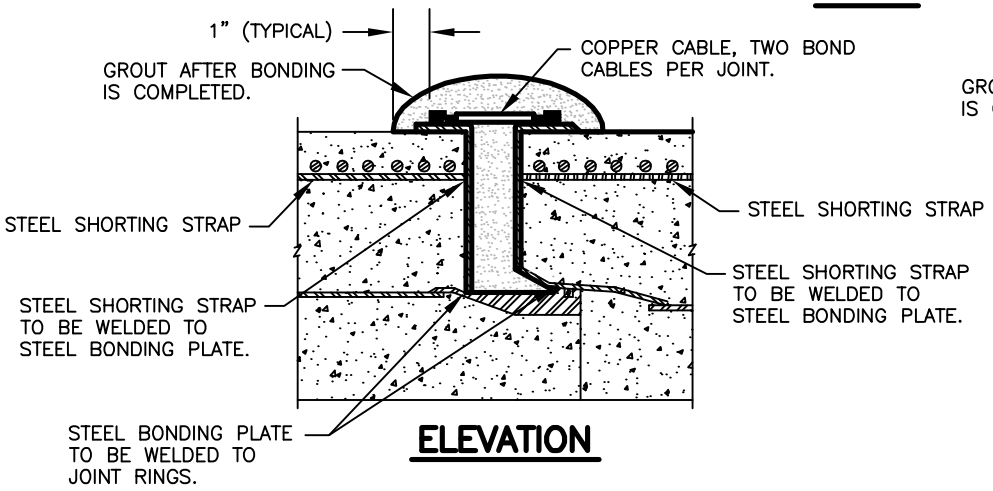
1. BOND ALL DUCTILE IRON COMPONENTS TOGETHER WITH AWG NO. 6 HMWPE WIRES.
2. INSTALL BOND WIRES ON TOP OF PIPE OR FITTING WHERE POSSIBLE.
3. INSTALL A MINIMUM OF TWO BOND CABLES ACROSS EACH PIPE JOINT.
4. SEE STD. DETAIL C–3.01 FOR BONDING OF JOINTS.

7/17/2015
DRAFT

Revised ⚠6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	BONDING Fire Hydrant Piping	Detail C–3.02

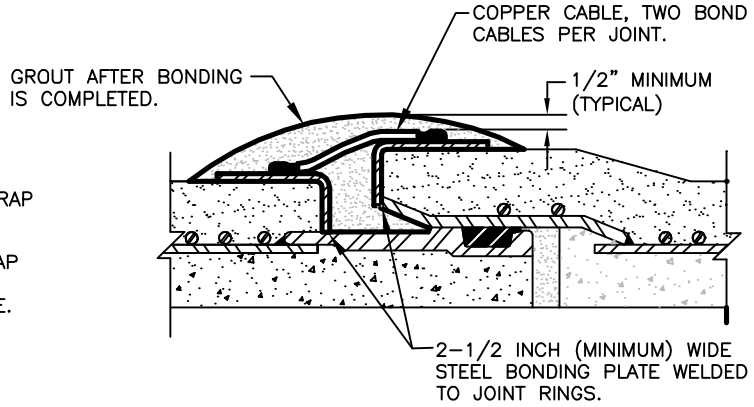


PLAN



ELEVATION

EMBEDDED PCCP JOINT



ELEVATION

LINED PCCP JOINT

NOTES:

1. TWO STEEL SHORTING STRAPS REQUIRED PER PIPE SECTION FOR EMBEDDED CYLINDER PIPE. NO SHORTING STRAPS REQUIRED FOR LINED CYLINDER PIPE.
2. STEEL BONDING PLATES AND STEEL SHORTING STRAPS (IF REQUIRED) TO BE INSTALLED BY PIPE MANUFACTURER DURING PIPE FABRICATION.
3. WIRE SIZE FOR BONDING JOINTS SHALL BE AS FOLLOWS:

PIPE SIZE	WIRE SIZE
LARGER THAN 36"	AWG NO. 2 HMWPE
16" TO 36"	AWG NO. 4 HMWPE
12" AND SMALLER	AWG NO. 6 HMWPE

7/17/2015
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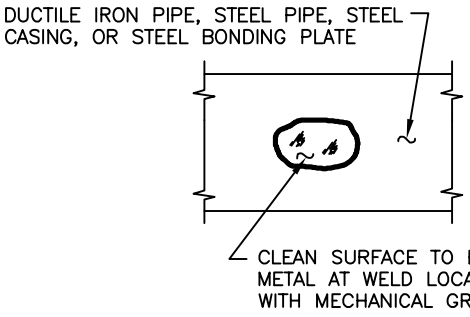
Revised
⚠6/30/2011
Revised
5/7/2007
Approved

Howard County, Maryland
Department of Public Works
Approved: _____
Chief, Bureau of Engineering

BONDING
PCCP Joint

Detail
C-3.03



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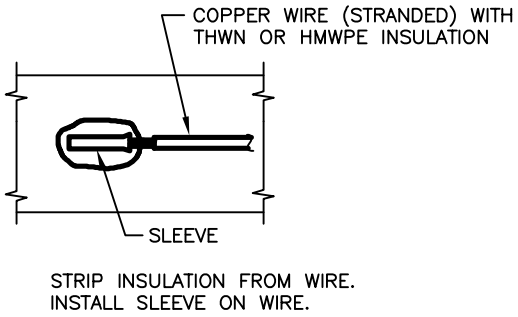

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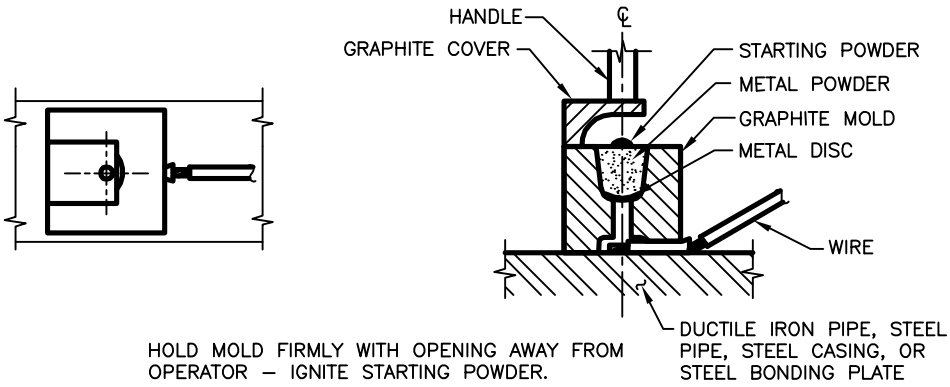

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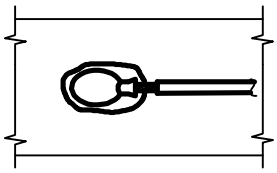

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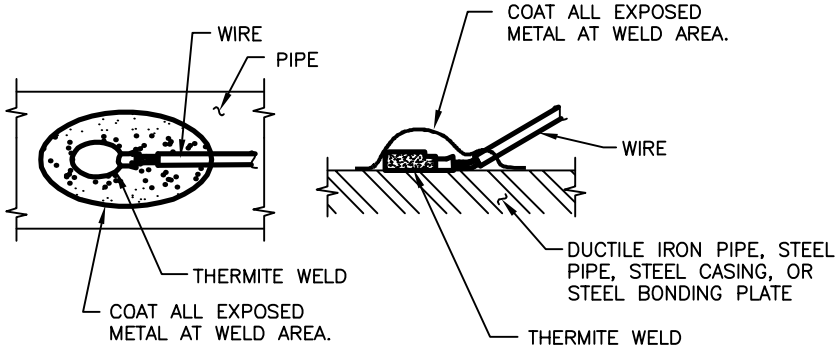


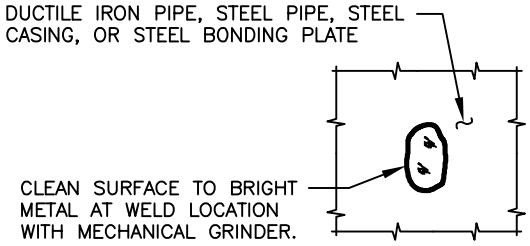
STEP 5:

NOTES:

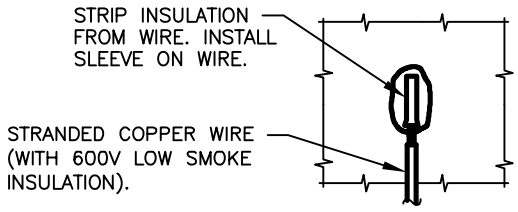
1. THERMITE WELDS MADE TO DUCTILE IRON PIPE, STEEL PIPE, OR STEEL CASING SHALL BE COATED WITH A PREFABRICATED ONE PIECE PLASTIC CAP FILLED WITH ELASTOMERIC MATERIAL.
2. THERMITE WELDS MADE TO THE STEEL BONDING PLATES OF PCCP PIPING SHALL BE COATED WITH BRUSH APPLIED MASTIC (10 MILS MINIMUM THICKNESS). MASTIC SHALL BE DRY BEFORE THERMITE WELDS ARE COVERED OVER WITH GROUT.

7/17/2015
DRAFT

Revised ⚠ 6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	BONDING Horizontal Thermite Weld	Detail C-3.04



STEP 1:



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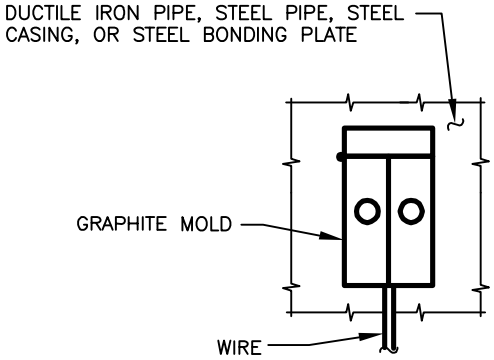

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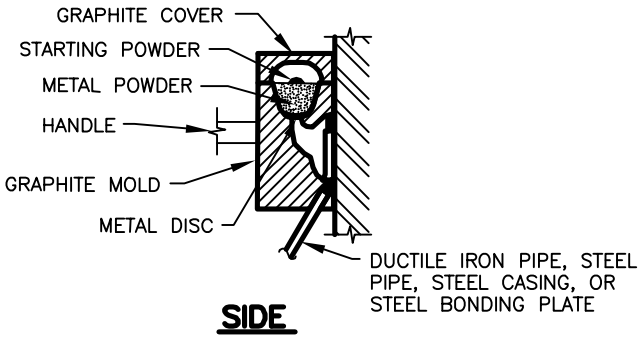
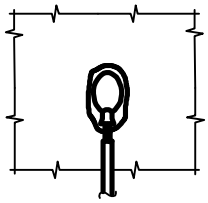


SIDE

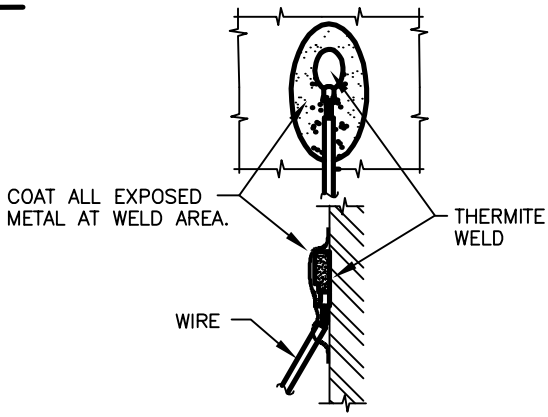
HOLD GRAPHITE MOLD FIRMLY OVER WIRE WITH OPENING AWAY FROM OPERATOR – IGNITE STARTING POWDER.

STEP 3:



REMOVE SLAG FROM CONNECTION. THOROUGHLY CLEAN WELD AREA.

STEP 4:



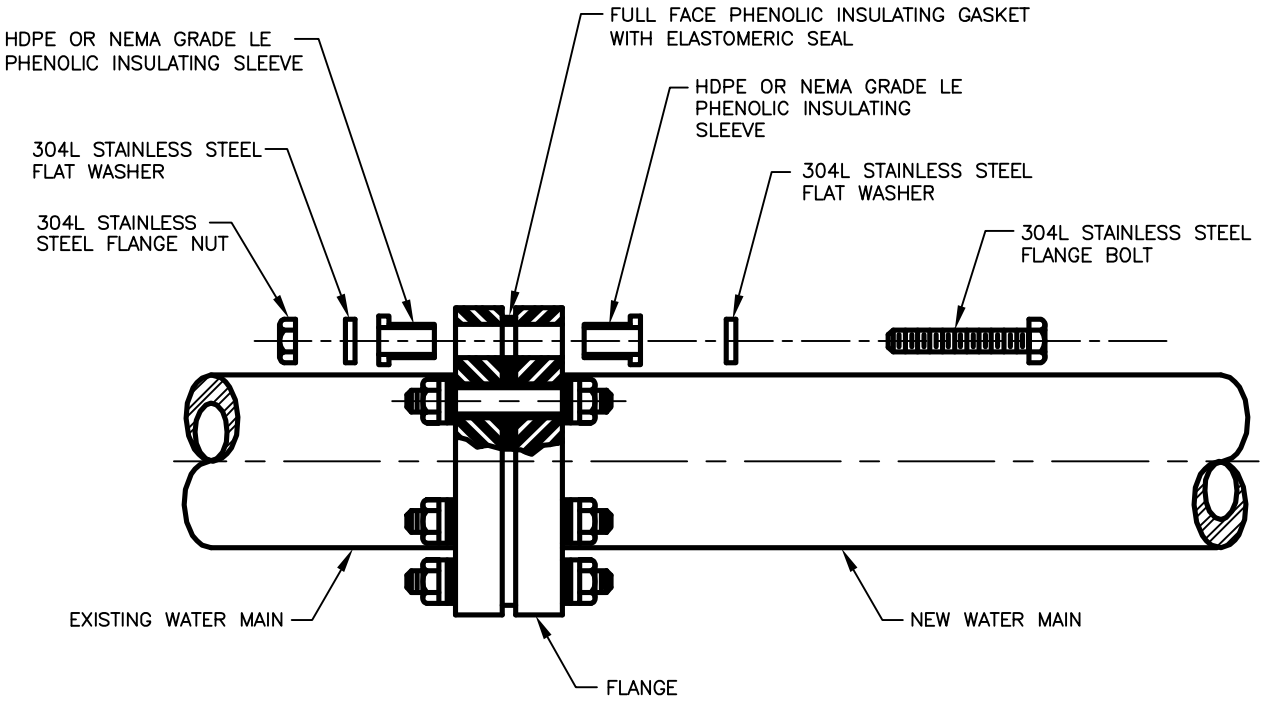
STEP 5:

NOTES:

1. THERMITE WELDS MADE TO DUCTILE IRON PIPE, STEEL PIPE, OR STEEL CASING SHALL BE COATED WITH A PREFABRICATED ONE PIECE PLASTIC CAP FILLED WITH ELASTOMERIC MATERIAL.
2. THERMITE WELDS MADE TO THE STEEL BONDING PLATES OF PCCP PIPING SHALL BE COATED WITH BRUSH APPLIED MASTIC (10 MILS MINIMUM THICKNESS). MASTIC SHALL BE DRY BEFORE THERMITE WELDS ARE COVERED OVER WITH GROUT.

7/17/2015
DRAFT

Revised	Howard County, Maryland	BONDING	Detail
⚠ 6/30/2011 Revised	Department of Public Works	Vertical Thermite Weld	C-3.05
5/7/2007 Approved	Approved: Chief, Bureau of Engineering		



NOTE:

FOR EXTERNAL COATING OF INSULATING FLANGE, SEE INSULATING FLANGE STD. DETAIL C-4.02 AND AS REQUIRED IN CONTRACT DOCUMENTS.

7/17/2015
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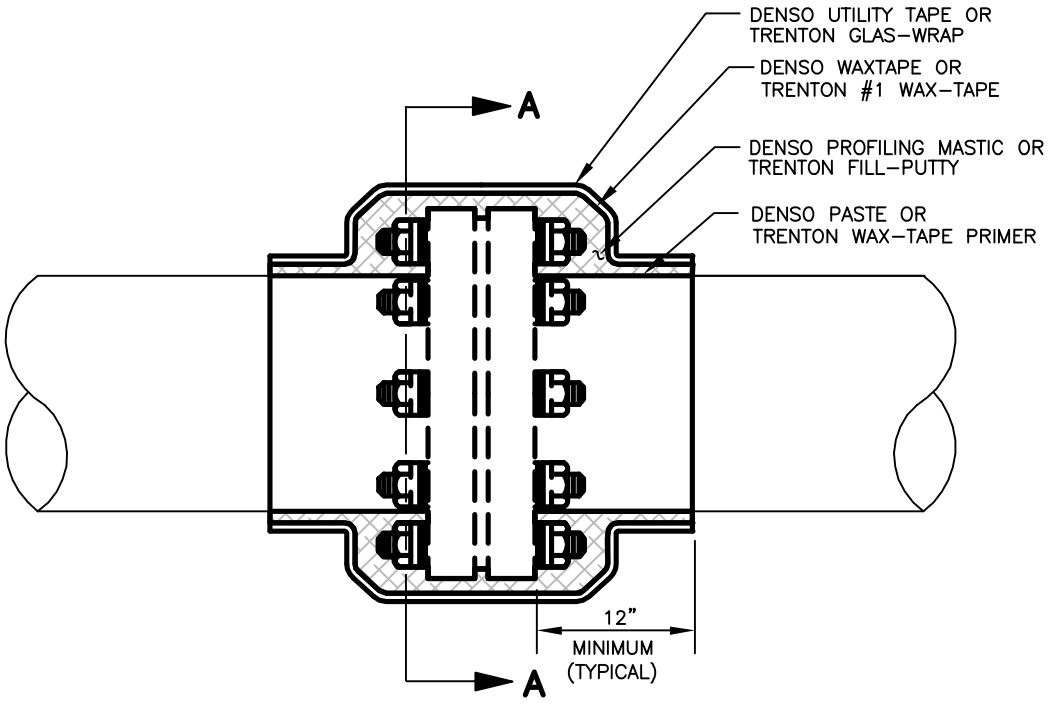
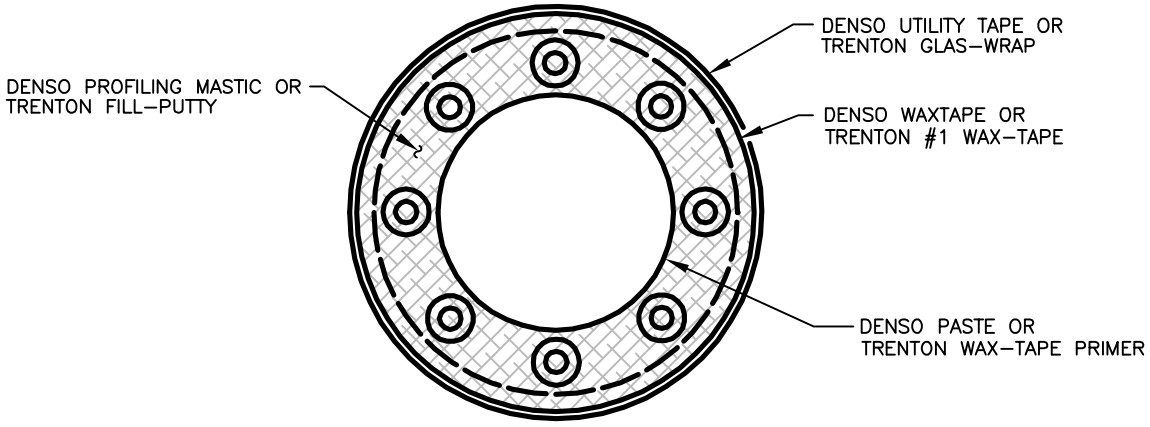
Revised ⚠ 6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	INSULATOR Flange	Detail C-4.01



ELEVATION



SECTION "A–A"

NOTE:

USE ALL DENSO OR ALL TRENTON COMPONENTS. DO NOT MIX COMPONENTS.

7/17/2015
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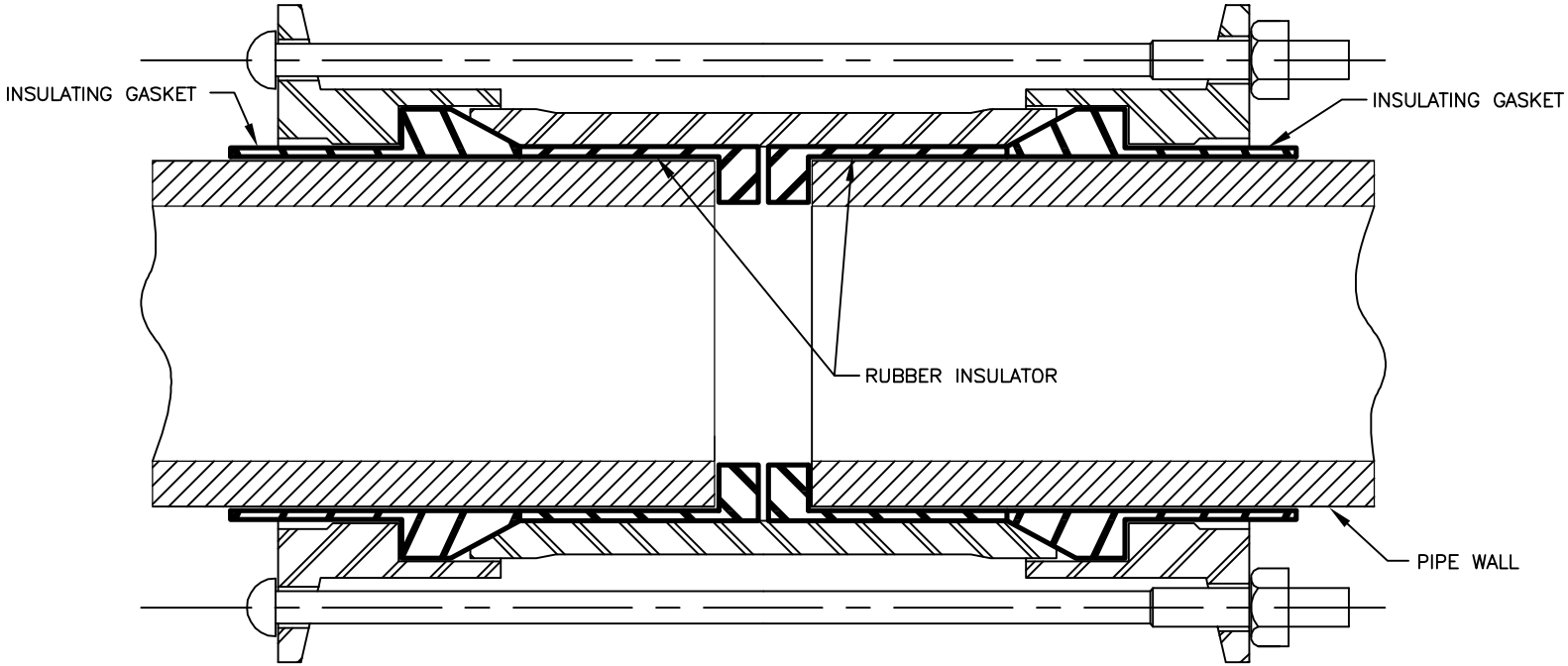
Revised ⚠ 6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	INSULATOR Coating Insulating Flange	Detail C–4.02



NOTES:

1. THE INSULATING MATERIALS SHALL INCLUDE AN INSULATING GASKET AND A "FULL BOOT" PLASTIC TUBULAR INSULATOR INSIDE THE MIDDLE RING TO PREVENT CONTACT BETWEEN PIPE ENDS THAT ARE ISOLATED FROM ONE ANOTHER. INSULATION SHALL BE PROVIDED TO BOTH ENDS OF COUPLING.
2. FOR EXTERNAL COATING OF INSULATING COUPLING, SEE INSULATING COUPLING STD. DETAIL C-4.04 AND AS REQUIRED IN CONTRACT DOCUMENTS.

7/17/2015
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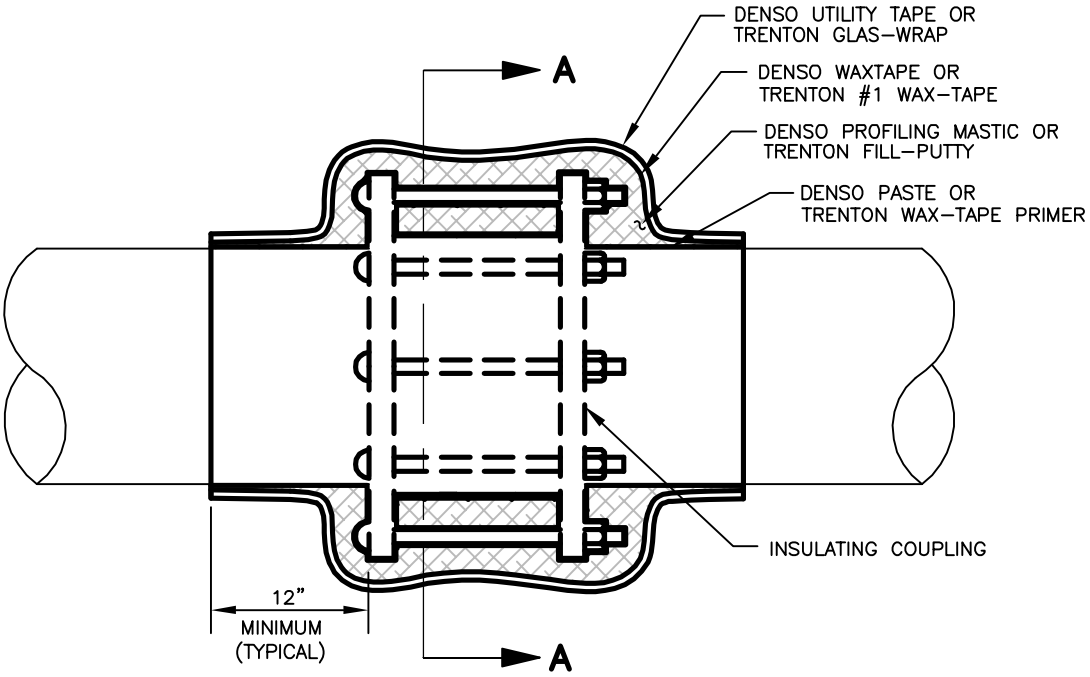
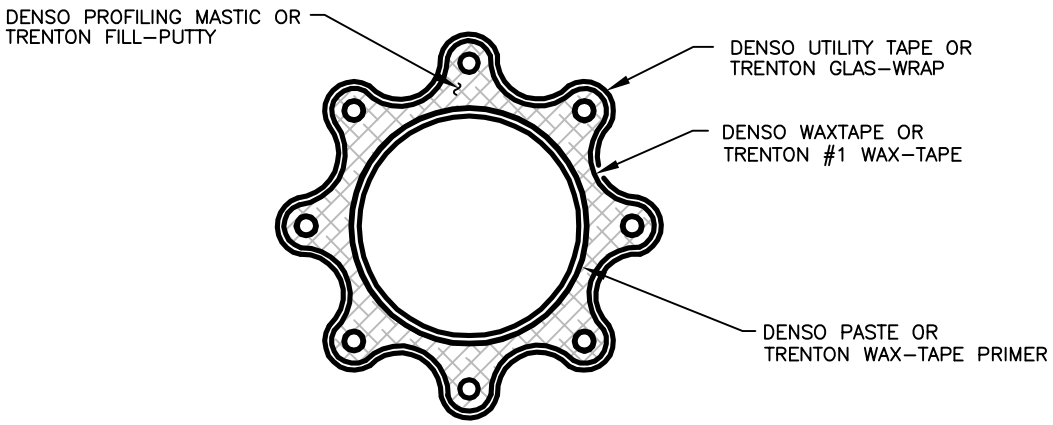
Revised ⚠6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	INSULATOR Coupling	Detail C-4.03



ELEVATION



SECTION "A–A"

NOTE:

USE ALL DENSO OR ALL TRENTON COMPONENTS. DO NOT MIX COMPONENTS.

7/17/2015
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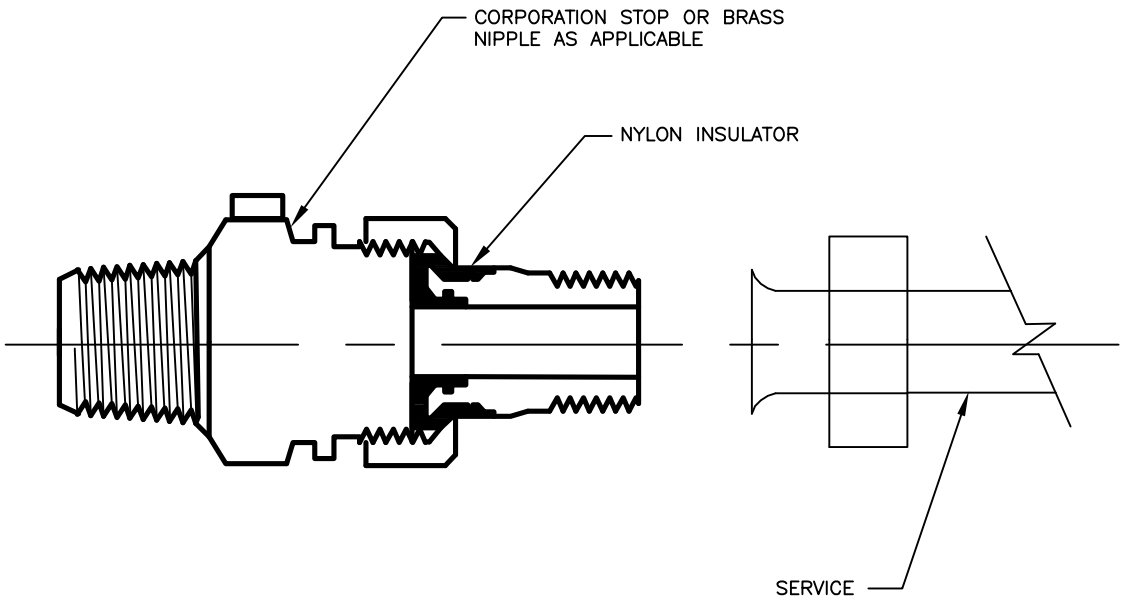
Revised ⚠ 6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	INSULATOR Coating Insulating Coupling	Detail C–4.04



NOTE:

SEE CONTRACT DOCUMENTS FOR EXTERNAL COATING OF INSULATING CORPORATION STOP.

7/17/2015
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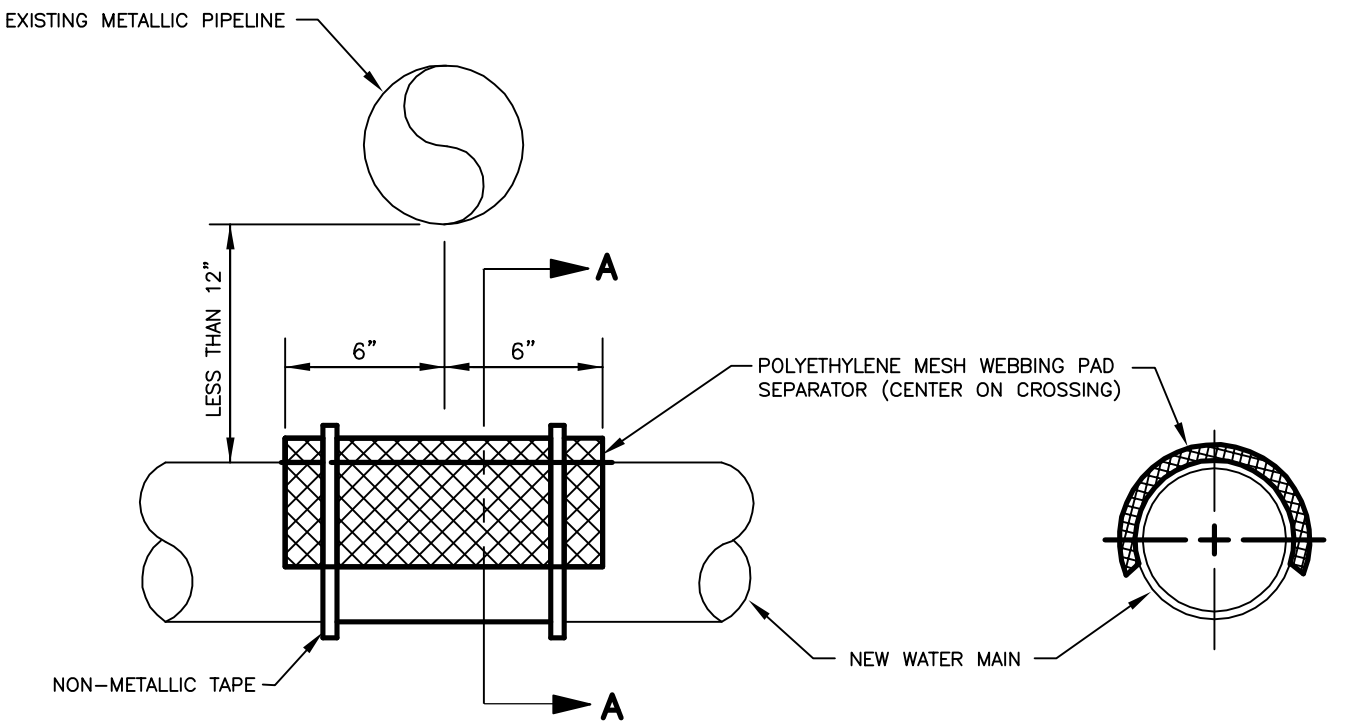
Revised ⚠6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	INSULATOR Corporation Stop	Detail C-4.05



ELEVATION

SECTION "A–A"

NOTES:

1. INSTALL SEPARATOR WHEN PIPES ARE LESS THAN 12" APART.
2. INSTALL SEPARATOR BETWEEN NEW AND EXISTING PIPE IF EXISTING PIPE IS WITHIN 12" OF NEW MAIN IN ANY DIRECTION.

7/17/2015
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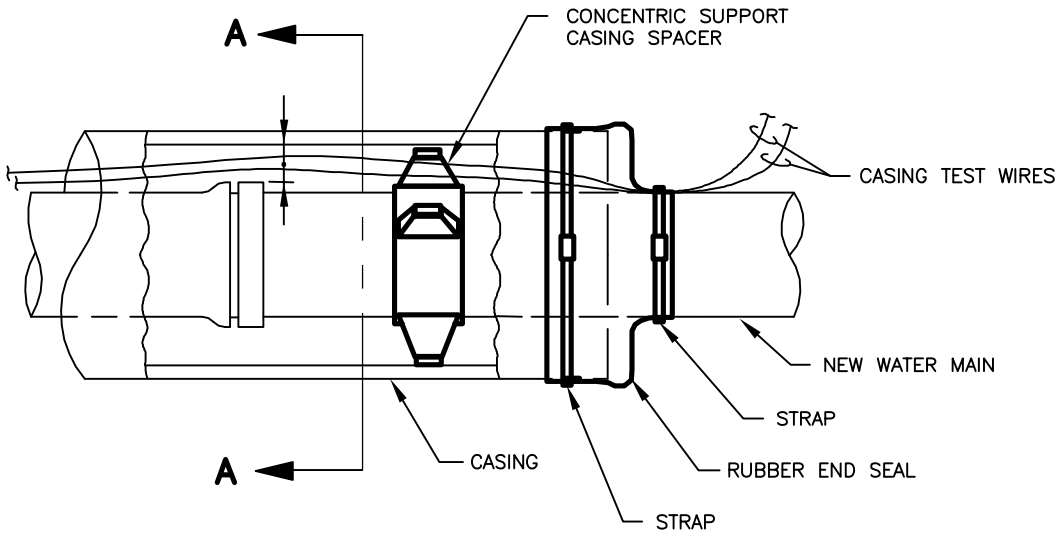
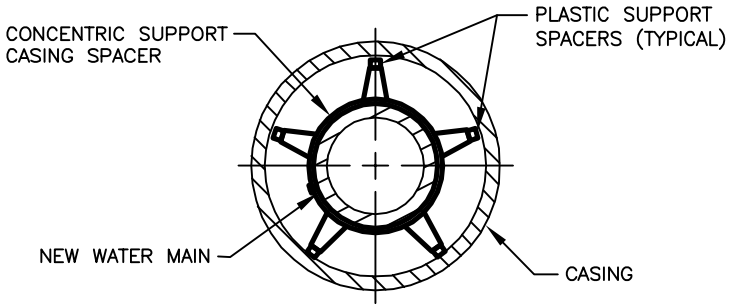
Revised ⚠6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	INSULATOR Separator Mesh	Detail C-4.06



ELEVATION



SECTION "A–A"

NOTE:

INSTALL CASING SPACERS AND RUBBER END SEALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND CONTRACT DOCUMENTS.

7/17/2015
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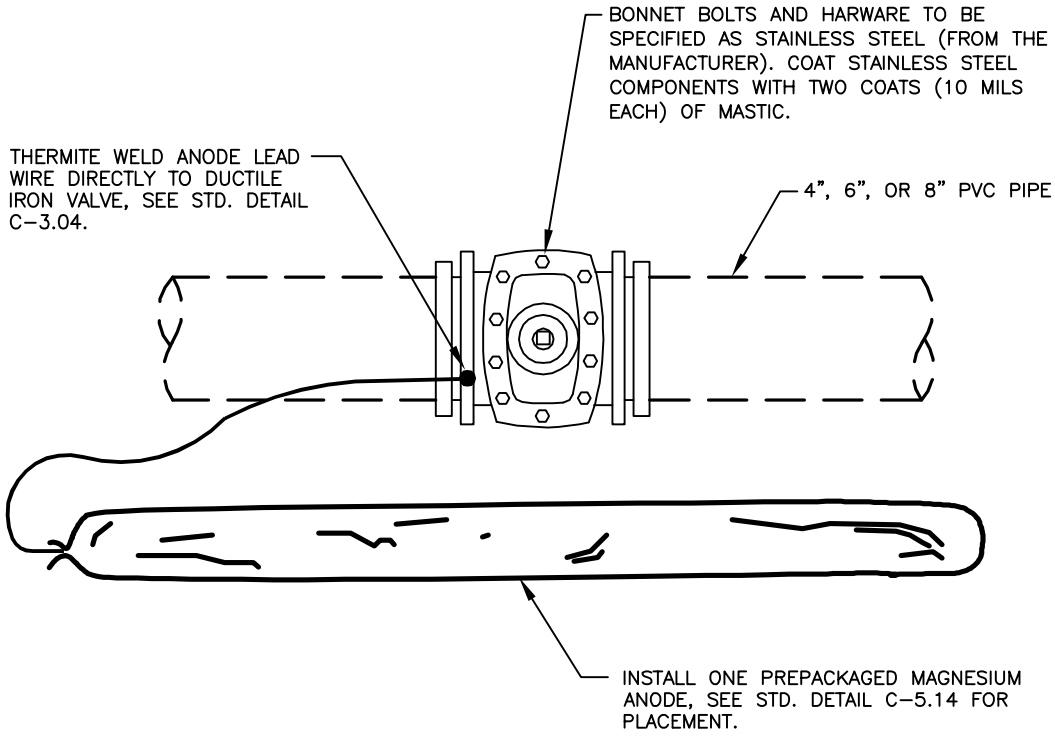
Revised ⚠ 6/30/2011 Revised 5/7/2007 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	INSULATOR Casing Spacers and End Seal	Detail C–4.07



NOTES:

1. BONNET BOLTS AND HARWARE TO BE SPECIFIED AS STAINLESS STEEL (FROM THE MANUFACTURER). COAT STAINLESS STEEL COMPONENTS WITH TWO COATS (10 MILS EACH) OF MASTIC.
2. ANODE PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.14.
3. DO NOT THERMITE WELD TO PVC PIPE.
4. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.

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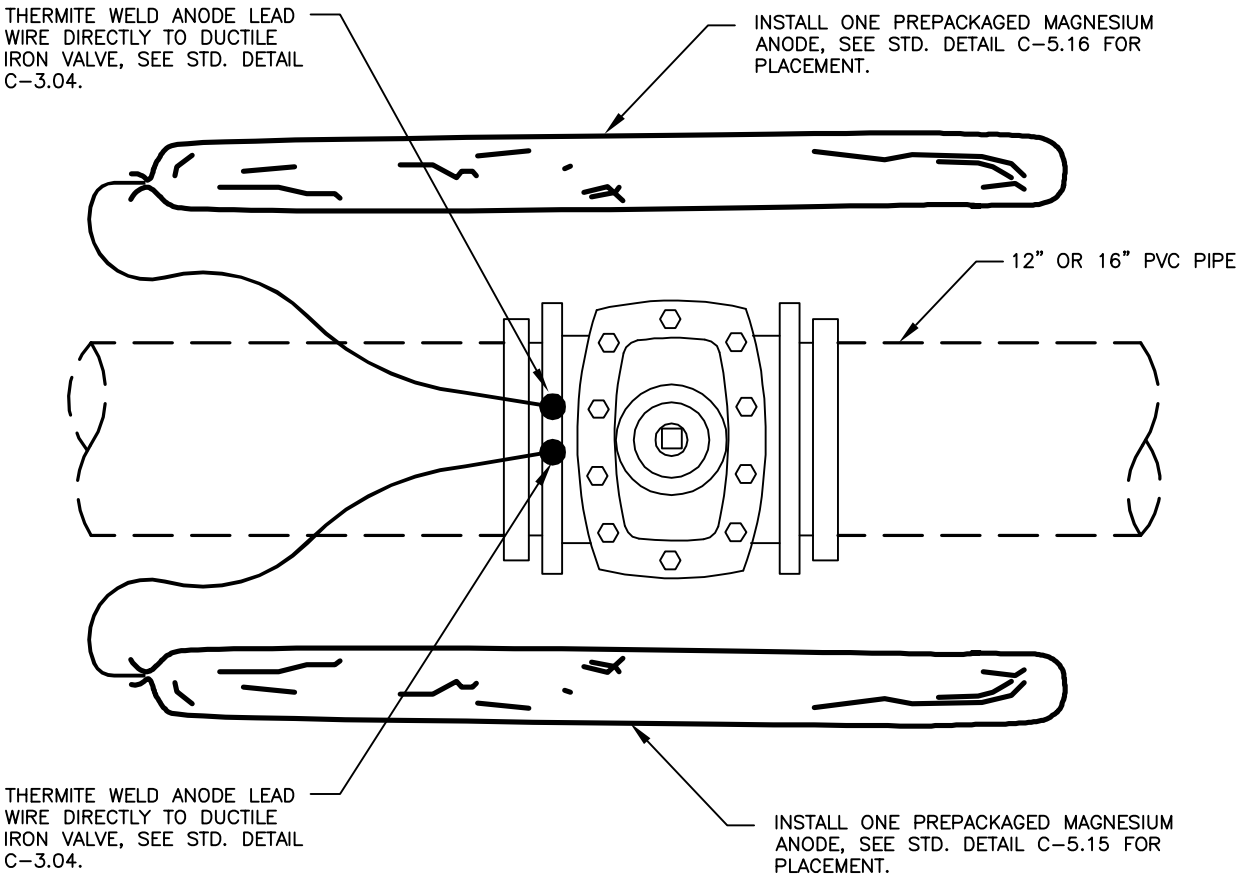
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN 4-Inch, 6-Inch, or 8-Inch Ductile Iron Valve	Detail C-5.01



NOTES:

1. BONNET BOLTS AND HARWARE TO BE SPECIFIED AS STAINLESS STEEL (FROM THE MANUFACTURER). COAT STAINLESS STEEL COMPONENTS WITH TWO COATS (10 MILS EACH) OF MASTIC.
2. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.15.
3. DO NOT THERMITE WELD TO PVC PIPE.
4. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.

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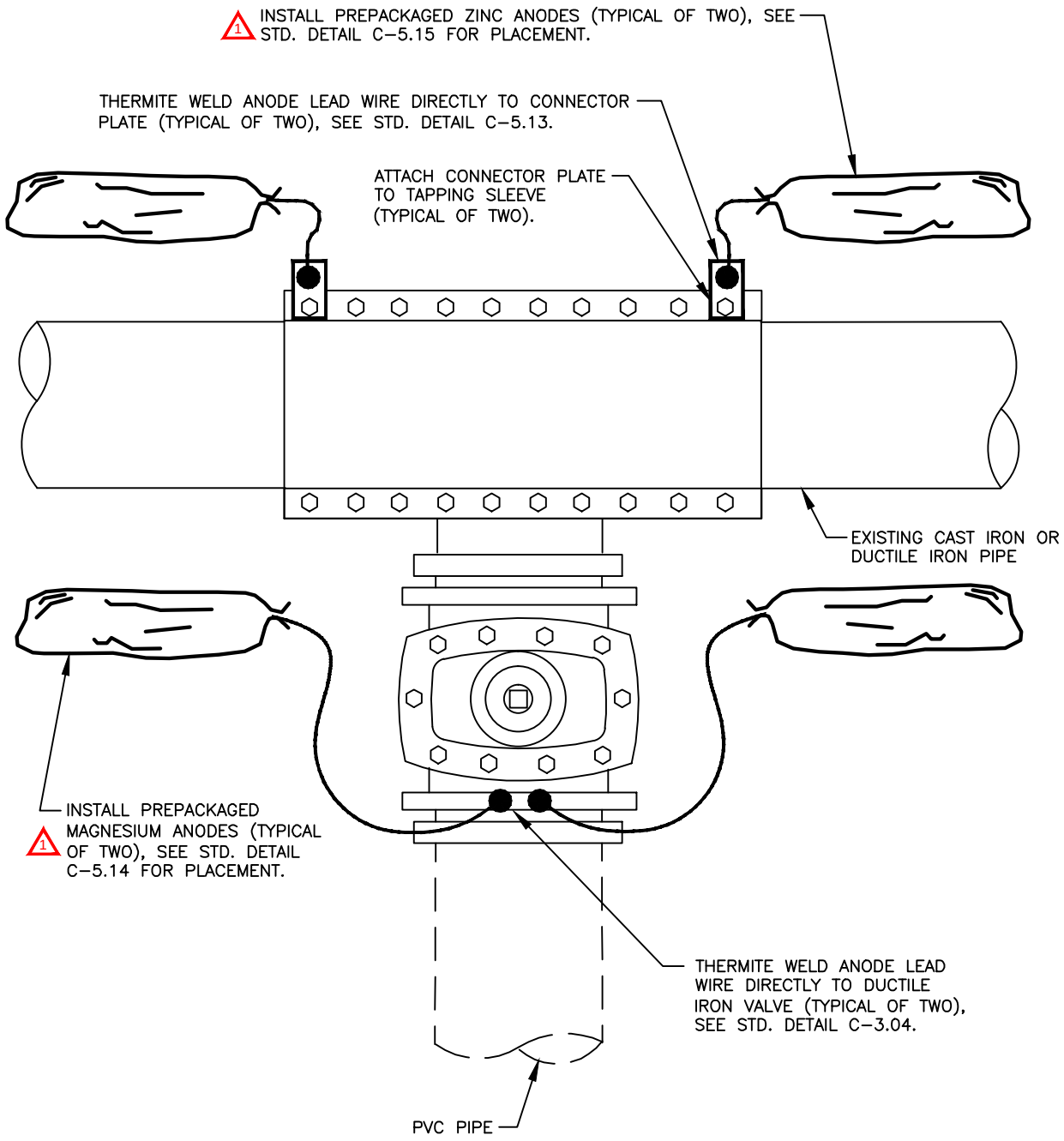
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN 10-Inch or 12-Inch Ductile Iron Valve	Detail C-5.02

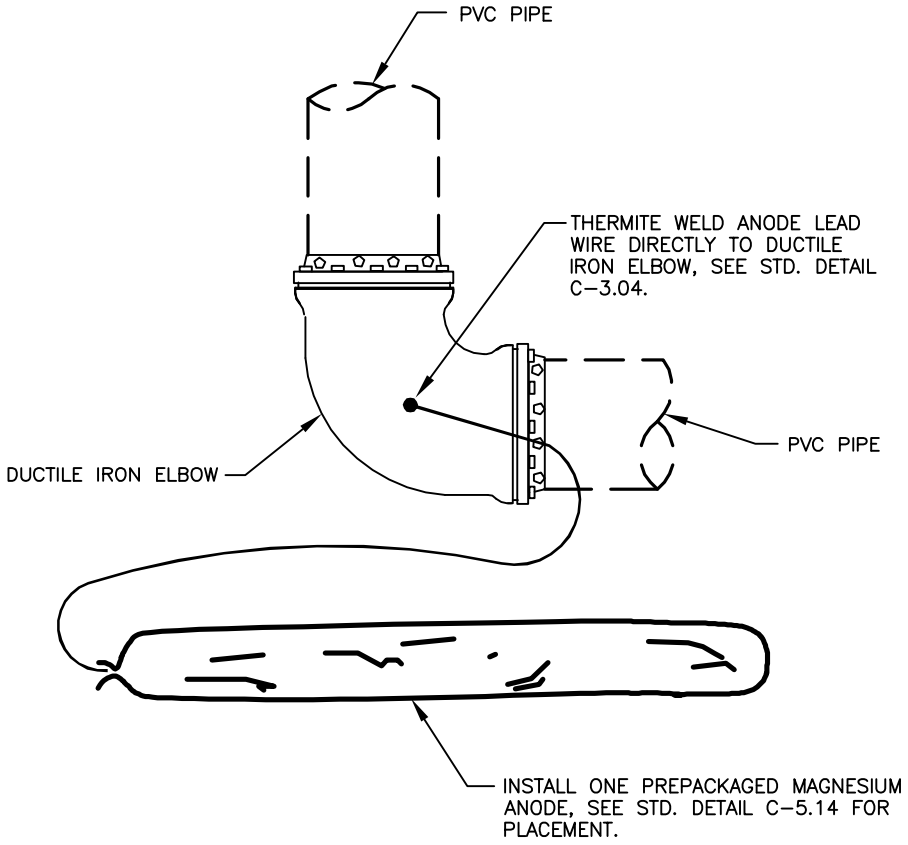


NOTES:

1. BONNET BOLTS AND HARWARE TO BE SPECIFIED AS STAINLESS STEEL (FROM THE MANUFACTURER). COAT STAINLESS STEEL COMPONENTS WITH TWO COATS (10 MILS EACH) OF MASTIC.
2. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.15.
3. DO NOT THERMITE WELD TO PVC PIPE.
4. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.

7/17/2015 DRAFT

1 Revised X/XX/2015 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: N:\13767\Final Volume 4\signature.bmp Chief, Bureau of Engineering	PVC MAIN Tapping Sleeve and Valve	Detail C-5.03



NOTES:

1. ANODES REQUIRED ONLY IF ELBOW IS DUCTILE IRON.
2. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.14.
3. DO NOT THERMITE WELD TO PVC PIPE.
4. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.

7/17/2015
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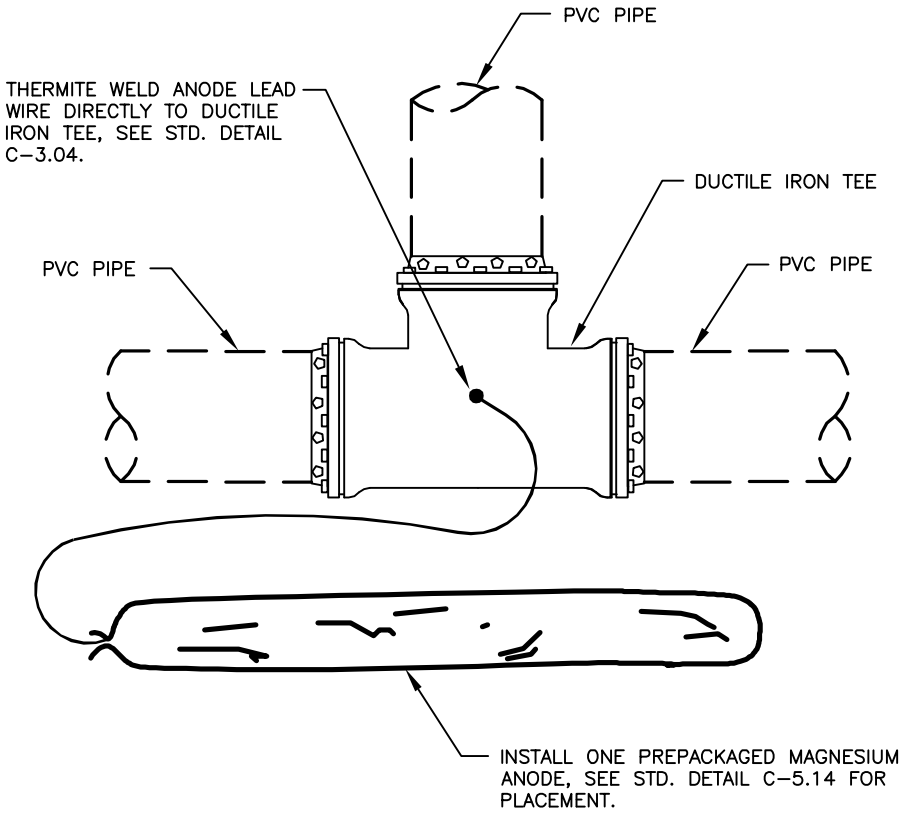
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN Ductile Iron Elbow	Detail C-5.04



NOTES:

1. ANODES REQUIRED ONLY IF TEE IS DUCTILE IRON.
2. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.14.
3. DO NOT THERMITE WELD TO PVC PIPE.
4. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.

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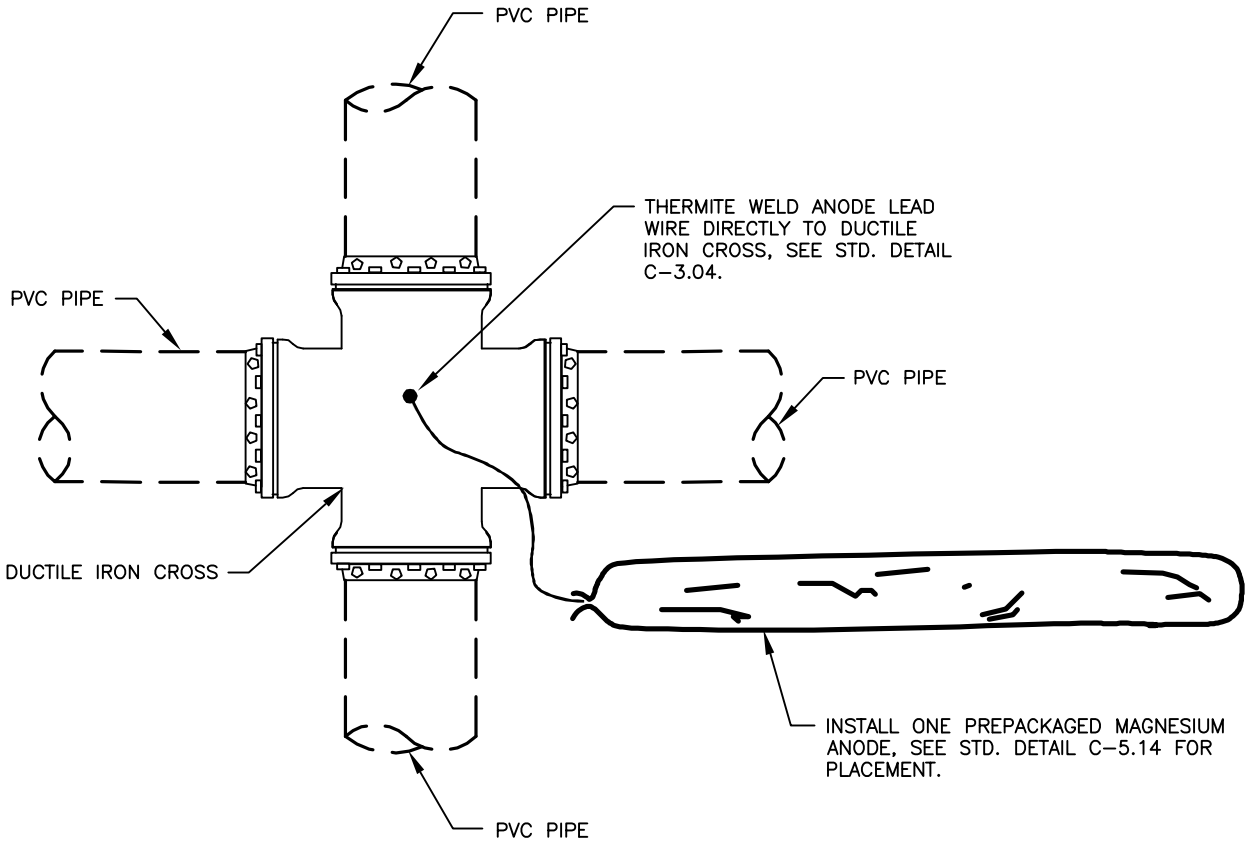
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN Ductile Iron Tee	Detail C-5.05



NOTES:

1. ANODES REQUIRED ONLY IF CROSS IS DUCTILE IRON.
2. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.14.
3. DO NOT THERMITE WELD TO PVC PIPE.
4. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.

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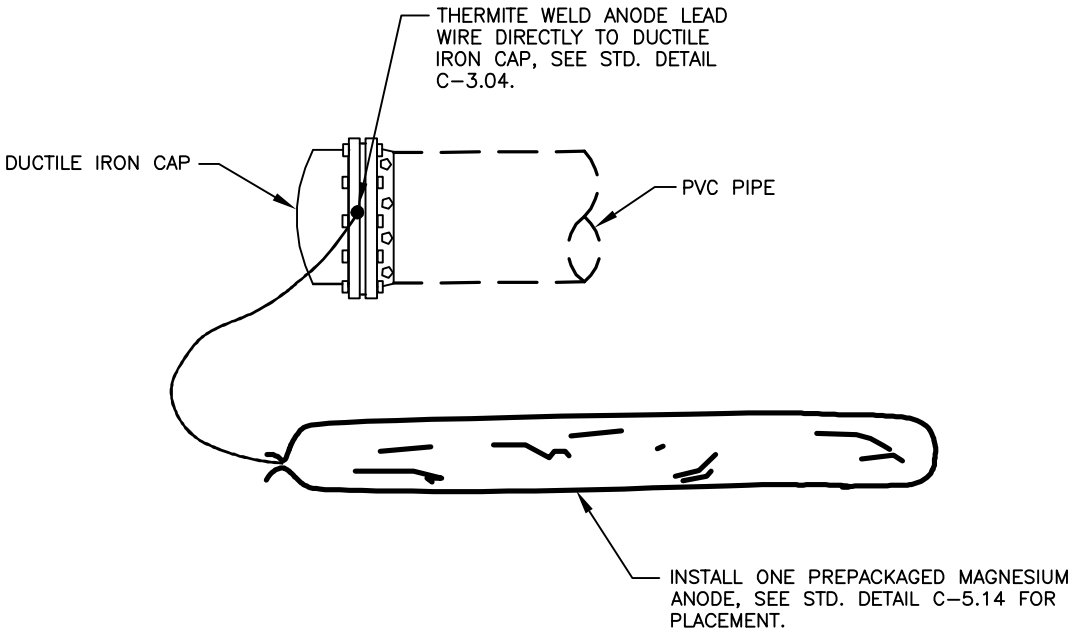
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN Ductile Iron Cross	Detail C-5.06



NOTES:

1. ANODES REQUIRED ONLY IF CAP IS DUCTILE IRON.
2. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.14.
3. DO NOT THERMITE WELD TO PVC PIPE.
4. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.

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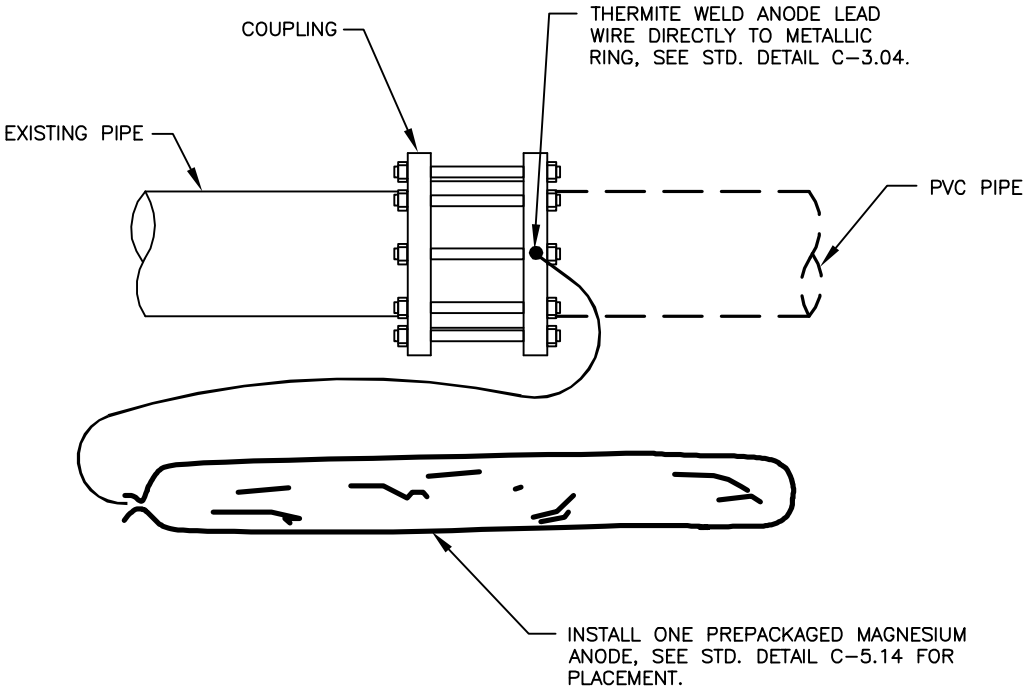
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN Ductile Iron Cap	Detail C-5.07



NOTES:

1. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.14.
2. DO NOT THERMITE WELD TO PVC PIPE.
3. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.
4. IF COUPLING IS EPOXY COATED, REMOVE COATING FROM COUPLING RING WHERE BOLTS ARE MOVED.

7/17/2015
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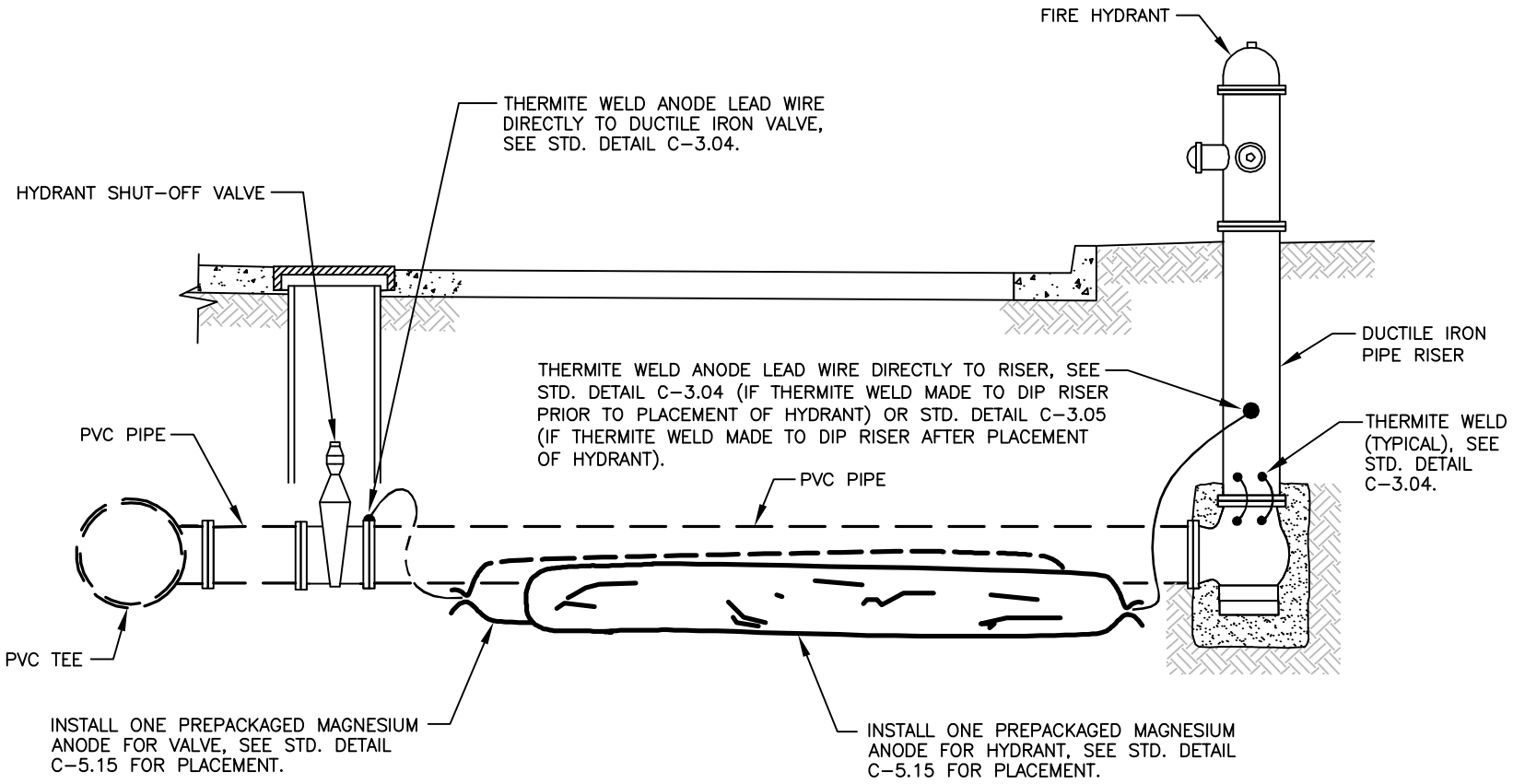
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN Ductile Iron Coupling	Detail C-5.08



NOTES:

1. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.15.
2. DO NOT THERMITE WELD TO PVC PIPE.
3. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.

7/17/2015
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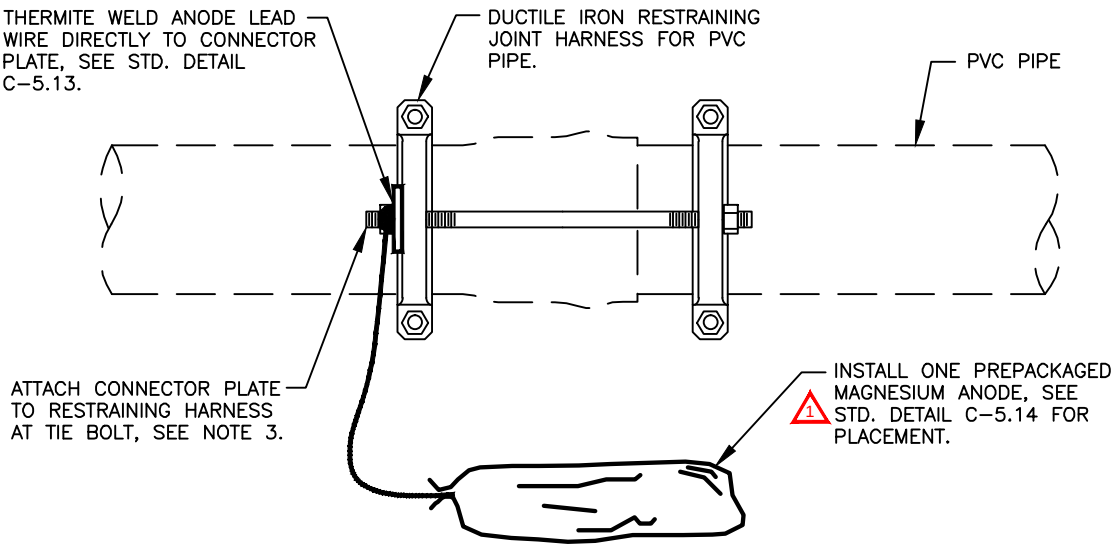
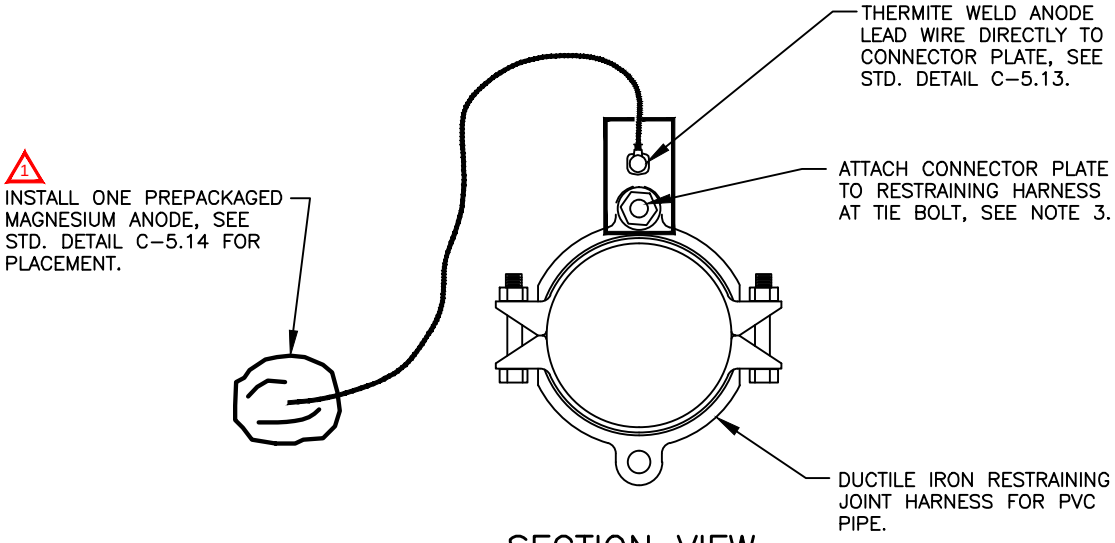
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN Fire Hydrant with PVC Lateral	Detail C-5.09



PLAN



SECTION VIEW

NOTES

1. CONNECTOR PLATE TO BE THERMITE WELDED TO ANODE LEAD WIRE PRIOR TO ATTACHING CONNECTOR PLATE TO RESTRAINING HARNESS.
2. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.14.
3. REMOVE COATING FROM RESTRAINING HARNESS WHERE CONNECTOR PLATE IS TO BE MOUNTED. REMOVE COATING IMMEDIATELY PRIOR TO ATTACHING THE CONNECTOR PLATE.
4. DO NOT THERMITE WELD TO PVC PIPE.
5. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.
6. COAT BOLTS WITH 20 MILS (TWO COATS 10 MILS EACH) OF BRUSH APPLIED MASTIC.

7/17/2015 DRAFT

Revised
1 X/XX/2015

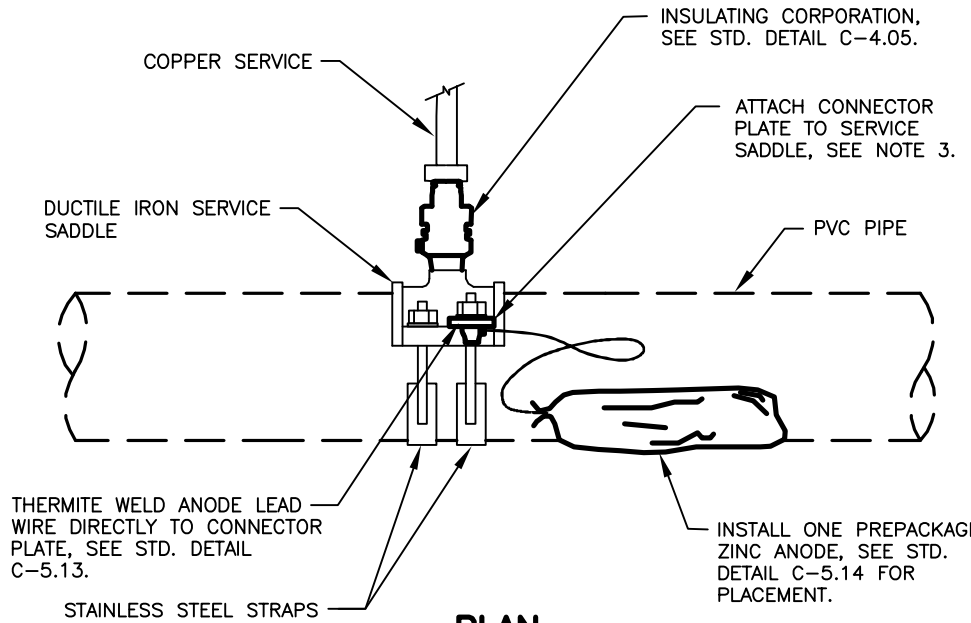
6/30/2011
Approved

Howard County, Maryland
Department of Public Works

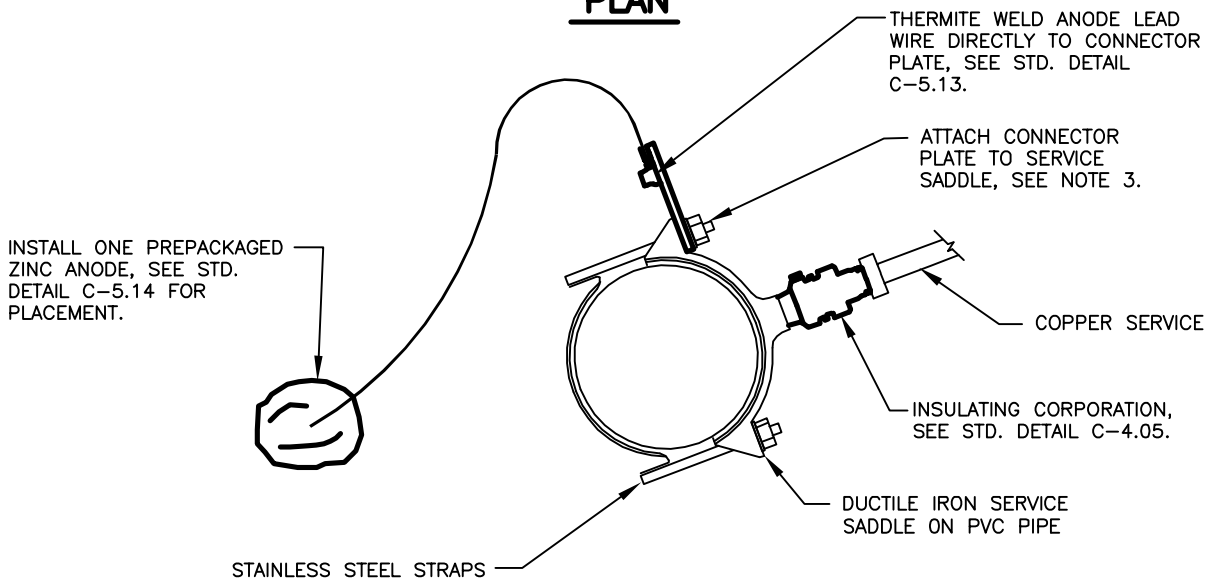
Approved: _____
N:\13767\Final Volume 4\signature.bmp
Chief, Bureau of Engineering

PVC MAIN
Restraining Harness

Detail
C-5.10



PLAN



SECTION VIEW

NOTES:

1. CONNECTOR PLATE TO BE THERMITE WELDED TO ANODE LEAD WIRE PRIOR TO ATTACHING CONNECTOR PLATE TO SERVICE SADDLE.
2. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.14.
3. REMOVE COATING FROM SERVICE SADDLE WHERE CONNECTOR PLATE IS TO BE MOUNTED. REMOVE COATING IMMEDIATELY PRIOR TO ATTACHING THE CONNECTOR PLATE.
4. PLASTIC SERVICE PIPING DOES NOT REQUIRE AN INSULATING CORPORATION, A NON-INSULATING CORPORATION MAY BE USED.
5. DO NOT THERMITE WELD TO PVC PIPE.
5. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.

7/17/2015
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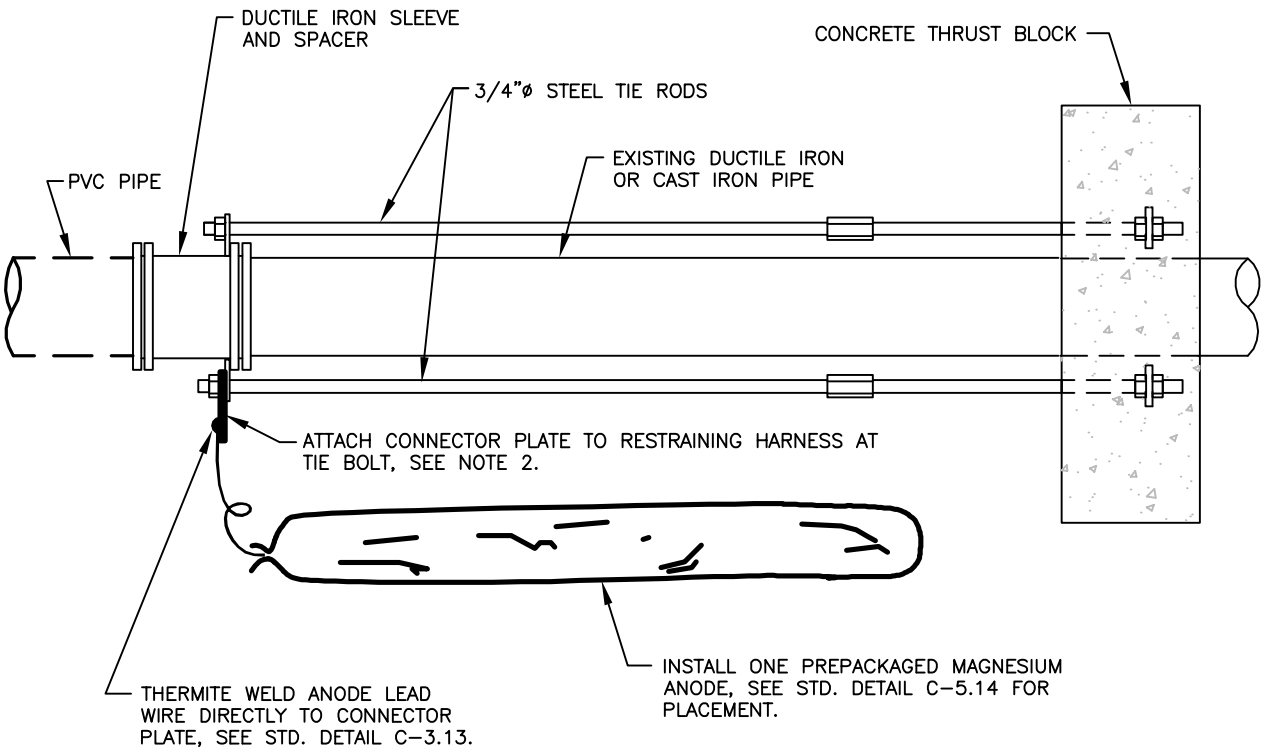
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN Service Saddle	Detail C-5.11



NOTES:

1. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 12" FROM EDGE OF PIPE, SEE STD. DETAIL C-5.14.
2. REMOVE COATING FROM RESTRAINING HARNESS WHERE CONNECTOR PLATE IS TO BE MOUNTED. REMOVE COATING IMMEDIATELY PRIOR TO ATTACHING THE CONNECTOR PLATE.
3. DO NOT THERMITE WELD TO PVC PIPE.
4. ANODE SIZE TO BE DETERMINED IN CONTRACT DOCUMENTS.

7/17/2015
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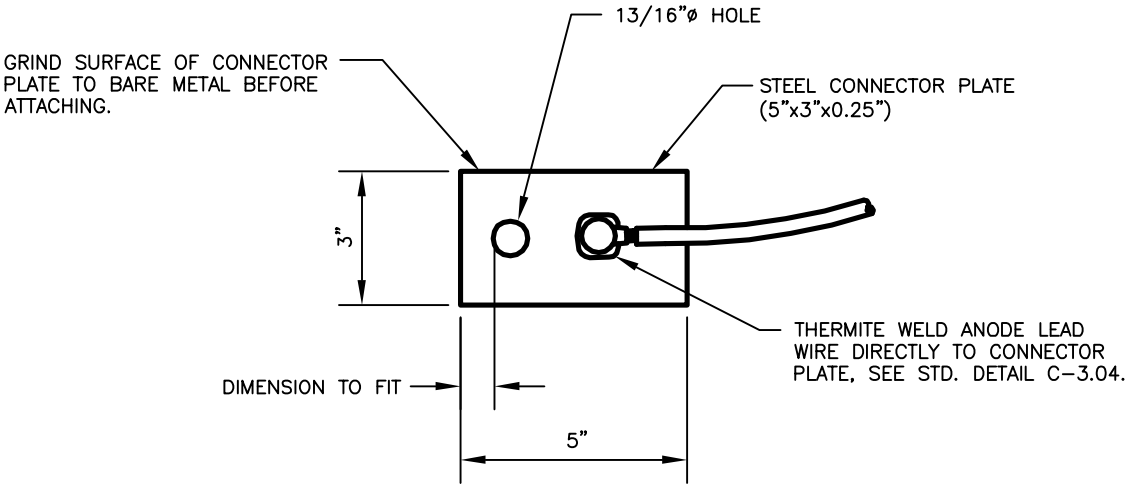
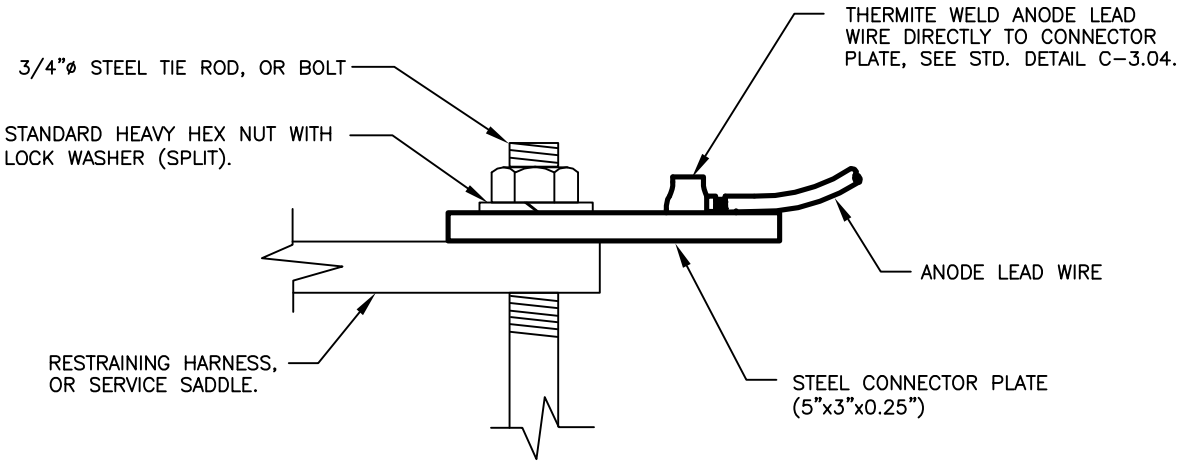
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN In-Line Thrust Block	Detail C-5.12



PLAN



SIDE VIEW

NOTES:

1. CONNECTOR PLATE TO BE THERMITE WELDED TO ANODE LEAD WIRE PRIOR TO ATTACHING CONNECTOR PLATE TO RESTRAINING HARNESS, TAPPING SADDLE, OR SERVICE SADDLE.
2. THERMITE WELDS SHALL BE COATED WITH A PREFABRICATED ONE PIECE PLASTIC CAP FILLED WITH ELASTOMERIC MATERIAL, ROYSTON HANDY-CAP OR APPROVED EQUAL.

7/17/2015
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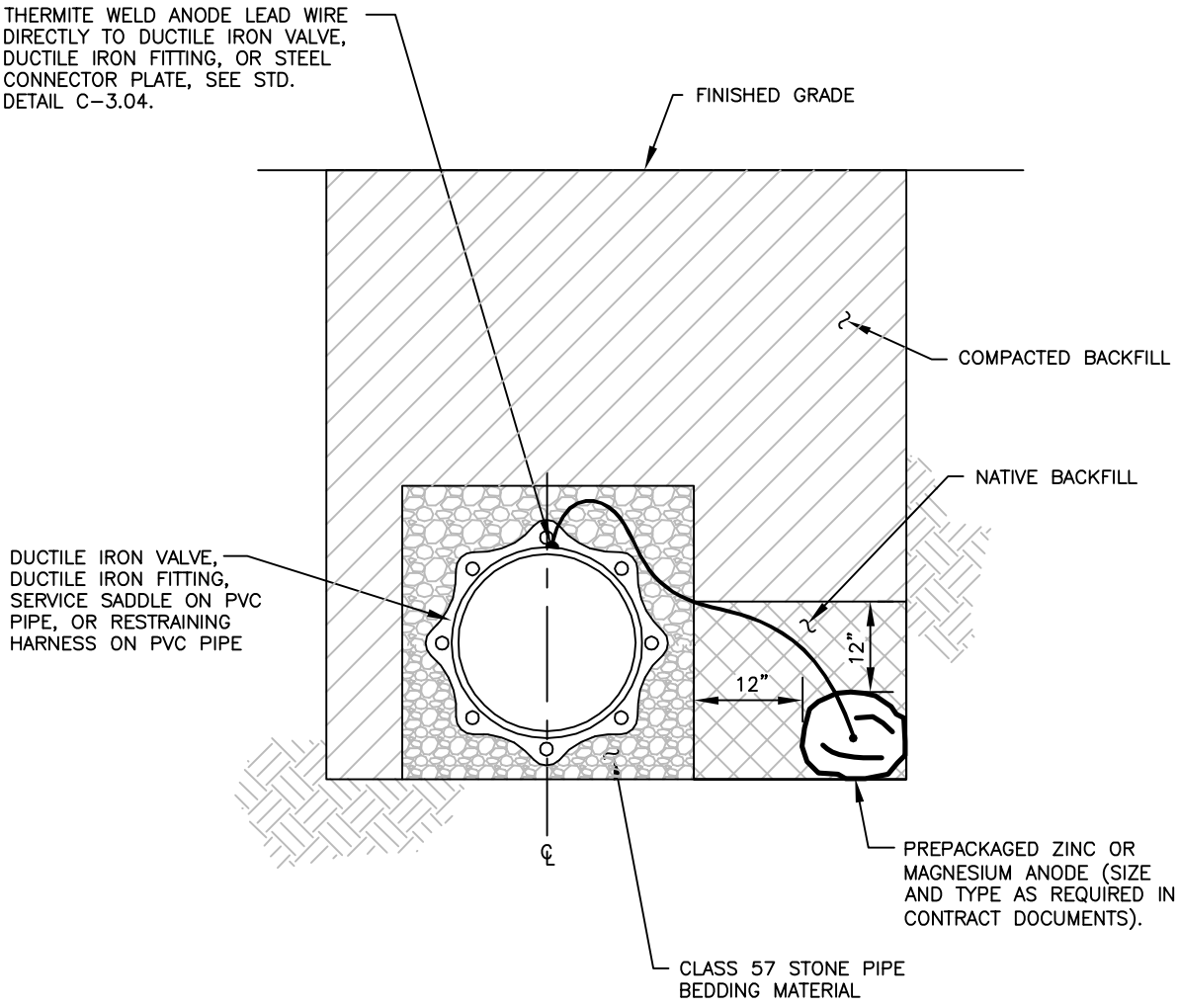
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN Connector Plate	Detail C-5.13



NOTES:

1. INSTALL ANODES A MINIMUM OF 12 INCHES FROM PIPE.
2. BACKFILL ANODES WITH NATIVE SOIL FOR A MINIMUM OF 12 INCHES ON ALL SIDES. DO NOT BACKFILL ANODES WITH SAND OR STONE.
3. DO NOT THERMITE WELD TO PVC PIPE.

7/17/2015
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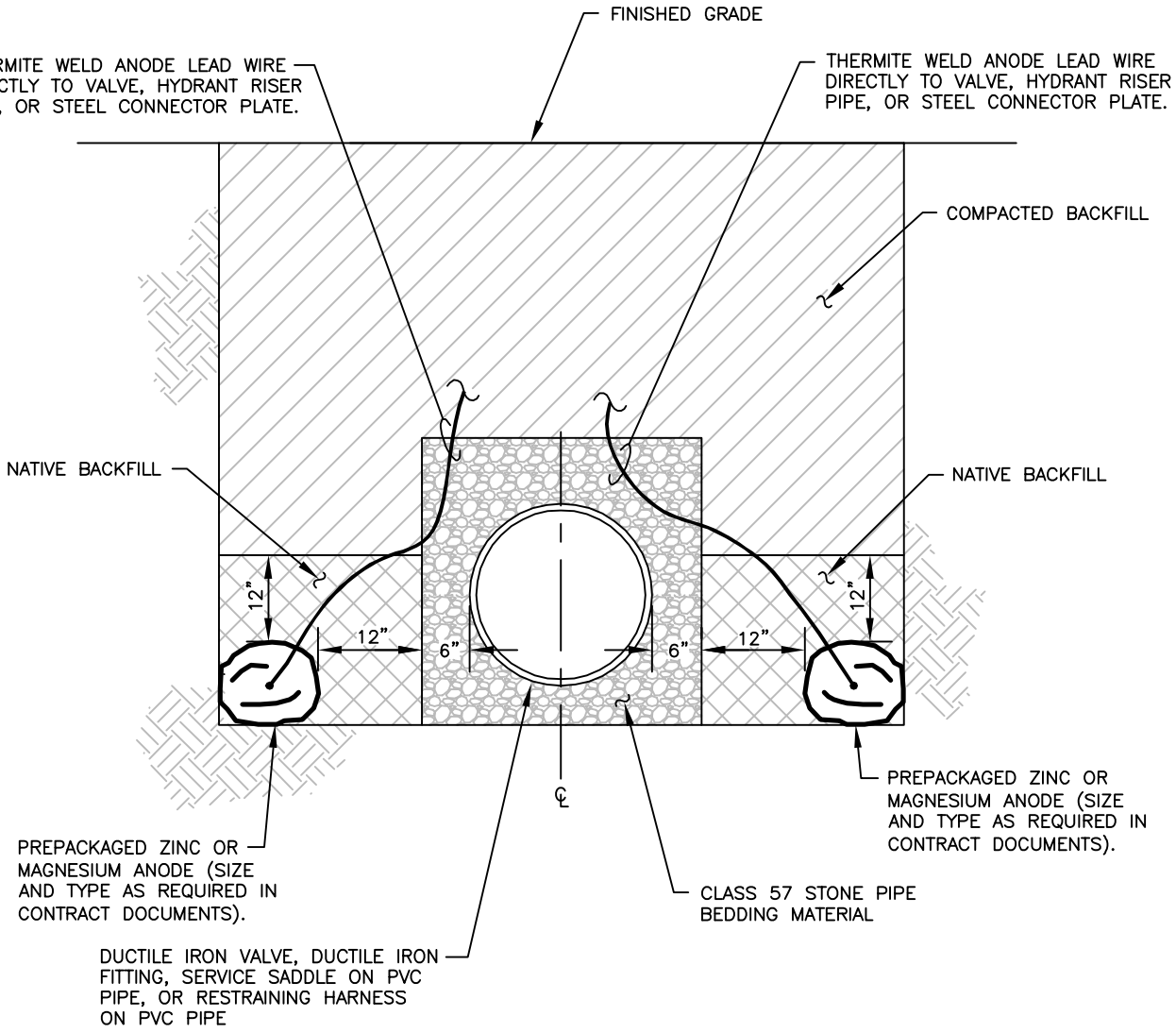
Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN Single Anode Placement	Detail C-5.14



NOTES:

1. WHEN INSTALLING ANODES AT HYDRANTS, ATTACH ONE ANODE LEAD TO SHUT-OFF VALVE, AND ONE ANODE LEAD TO HYDRANT RISER PIPE, SEE STD. DETAIL C-5.09.
2. INSTALL ANODES A MINIMUM OF 12 INCHES FROM PIPE.
3. BACKFILL ANODES WITH NATIVE SOIL FOR A MINIMUM OF 12 INCHES ON ALL SIDES. DO NOT BACKFILL ANODES WITH SAND OR STONE.
4. DO NOT THERMITE WELD TO PVC PIPE.

7/17/2015
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Revised Revised 6/30/2011 Approved	Howard County, Maryland Department of Public Works Approved: Chief, Bureau of Engineering	PVC MAIN Multiple Anode Placement	Detail C-5.15